WILLIAMSON
WATER & LAND ADVISORY

188 Beaumont Street, Wynyard Quarter

Detailed Site Investigation

WESTHAVEN RESIDENTIAL LIMITED PARTNERSHIP

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Cover image from Warren and Mahoney

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1. Introduction

Williamson Water & Land Advisory Ltd (WWLA) has been commissioned to undertake an assessment of the potential contamination effects of the proposed development by Westhaven Residential Limited Partnership at 188 Beaumont Street, Wynyard Quarter (the 'Project' or 'site'). The Project is a residential-led mixed use building comprising 210 residential apartments, ground floor retail and ancillary car parking. This assessment has been prepared for the purpose of a substantive application under the Fast-track Approvals Act 2024 (FTAA).

The site is described in **Table 1** and shown in **Figure 1**.

Table 1. Site identification details

Address	Legal description	Record of Title	Area (m^2)
188 Beaumont Street, Auckland Central 1010	Lot 1 DP 541270	909263	5,215



Figure 1. Site location (Aerial source: LINZ)
Approximate site extent shown by red outline

1.1 Objective and scope of work

The objective of this assessment is to provide a summary of the current contamination conditions at the site and evaluate these in the context of the project with respect to the consenting implications for the FTAA process. This report evaluates relevant data from previous site investigations in the context of the project to:

- Confirm potential effects on human health and/or the environment.
- Determine consent requirements under the:

  - Resource Management (National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NESCS); and
  - Chapter E30 of the Auckland Unitary Plan (AUP).
- Outline the proposed mitigations and recommended conditions of consent.

Collectively this assessment and supporting information fulfils the requirement for a Preliminary Site Investigation (PSI), Detailed Site Investigation (DSI) and SMP (or RAP). It has been prepared in general accordance with the requirements of:

- Ministry for the Environment (MfE). Contaminated Land Management Guideline No. 1: Reporting on Contaminated Sites in New Zealand (Revised 2021), (CLMG1); and
- MfE. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Revised 2011).

1.2 Qualifications and experience

This report has been prepared, reviewed, and certified by a SQEP as described in the NESCS and NESCS Users' Guide[1]. CVs confirming the SQEP status of our contaminated land specialists are available on request but in summary the author of this report (Shane Moore) has 30 years of experience in the assessment, remediation and management of contaminated land and groundwater in the New Zealand context. This experience has included providing technical contamination related advice in support of redevelopment of Wynyard Quarter, including the subject site, since 1999. Representative projects include:

- Providing support to BP and Shell's lease exit processes from the Wynyard Quarter. This included design and implementation of field investigation programmes, remedial design, stakeholder consultation, consent support, peer review and presentation of expert evidence including to the High Court;
- Preparing technical assessments for the Sea+City Projects Ltd (Auckland Council's development entity at the time) to obtain resource consent for the first phases of public space redevelopment including North Wharf, Silo Park and adjoining roadways (Jellicoe Street etc.);
- Peer review and presentation of expert evidence, including to the High Court, to support the case Auckland Waterfront Development Agency's took against Mobil to attempt to recover remedial costs relating to development of the subject site; and
- Investigating the subject site as part of the resource consent application BUN60330464.

Shane Moore records that he has read and agrees to comply with the Environment Court Practice Note 2023 (Code of Conduct for Expert Witnesses). Shane Moore confirms that this report is in its area of expertise, except where it states that it relies upon the evidence or reports of other expert witnesses lodged forming part of the Project's application material. Shane Moore has not omitted to consider any material facts known to it at the time that might alter or detract from the opinions expressed in this assessment.

1.3 Abbreviations

The abbreviations are used in this report are set out in **Table 2**.

Table 2. Abbreviations

Abbreviation	Description
1.1.2-TCA	1.1.2-Trichloroethane
AFFF	Aqueous film forming foam
ASPT	Mobil Oil Auckland Special Products Terminal

[1] Ministry for the Environment (MfE), April 2012. NESCS Users' Guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.

AUP	Auckland Unitary Plan
DSI	Detailed Site Investigation
ECBF	East Coast Bays Formation
FTAA	Fast-track Approvals Act 2024
HAIL	Hazardous Activities and Industries List
NESCS	Resource Management (National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011
PAHs	Polycyclic aromatic hydrocarbons
PFHxS	Perfluorohexane sulfonic acid
PFAS	Per- and polyfluoroalkyl substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
PPE	Personal protective equipment
PSI	Preliminary Site Investigation
RDA	Restricted Discretionary Activity
RAP	Remediation Action Plan
Site	Site or subject site relates to 188 Beaumont Street
SMP	Site Management Plan
SPH	Separate phase hydrocarbons
SQEP	Suitably qualified and experienced contaminated land practitioner
TPH	Total petroleum hydrocarbons
T+T	Tonkin & Taylor Ltd
VAM	Vinyl acetate monomer
Wider site	Relates to the previous extent of the ASPT site, including part of Orams Marine facilities to the south
WWLA	Williamson Water & Land Advisory Ltd

2. Proposed development

As described in **Section 1**, the proposed development comprises a residential-led mixed use building with the ground floor comprising retail spaces and car parking with apartments on the floors above. Selected design drawings are provided for reference in **Appendix A**.

The site is known to be contaminated as a result of its use as part of the former Mobil Oil Auckland Special Products Terminal (ASPT), a bulk petrochemical storage facility that operated between the 1920s and early 2000s. The ASPT site was previously investigated to support an application for resource consent to redevelop the site and extend the existing Orams marine village and servicing facilities (T+T, 2018[2]). The resource consent application (BUN60330464) included concept designs for a residential apartment building on the subject site (188 Beaumont Street). While the previous residential concept for the subject site was not consented as part of BUN60330464 the previous investigations included assessments of effects under residential land use for the subject site and therefore remain relevant to current consent application.

From a ground contamination perspective, the key elements of the development are:

- The site will be entirely covered with new buildings, pavements or raised landscaped areas. There will be no exposed soil or potential for users of the site to contact soil (other than imported growing media) when the site has been developed.
- The ground floor of the development will comprise retail spaces around its street and harbourside frontages. The central portion of the ground floor will comprise car parking, lobbies and supporting infrastructure (loading areas, mechanical and electrical services areas etc.). Residential activities will only occur on the first floor and levels above.
- The ground floor slab is proposed to be suspended above existing ground level. At the time of preparing this assessment it had not been confirmed whether a void would be retained beneath the suspended floor slab of this area backfilled. The implications of this are discussed further in **Section 5.2**.
- Reinforced bored concrete piles embedded into the underlying East Coast Bays Formation rock are expected to be the preferred foundation solution (although driven steel piles could also be considered for more lightly loaded areas). The piles will be interconnected by a grillage of ground beams.
- Excavation will be required:
    - To remove obstructions for piling;
    - To construct building cores (lift pits etc.) to approximately 4 m below ground level (mbgl);
    - To install ground beams beneath parts, noting that suspending the floor slab will eliminate the need to excavate significantly below existing grade over large parts of the site; and
    - To install some deeper service connections.

The development will also include a boundary adjustment between the site and the adjoining Orams site, and a unit title subdivision of the new building.

For completeness, we note that there are ongoing passive discharges of historical contaminants from the site due to natural groundwater movement which are authorised by BUN60330464 (which includes the subject site). These passive, historical discharges were assessed in detail as part of the application for BUN60330464 and the effects, which primarily relate to contaminated groundwater or entrained SPH discharging into the marine environment (refer to **Appendix E** for further detail), were determined to be less than minor once mitigation measures were implemented. The effects are mitigated by the new seawall and diversion structures installed around the perimeter to the wider site (former ASPT), which includes the subject site. As the proposed development will not materially change the passive discharges of contaminants from the subject site nor will it give rise to any additional discharges that result in adverse effects arising from the development and require

[2] Tonkin & Taylor (T+T), November 2018. Preliminary and Detailed Site Investigations (Ground Contamination), 142-188 Beaumont Street, Wynyard Quarter. Prepared for Orams Marine. Ref. 30881.20000.2 Rev 4.

further mitigation, we understand no additional discharge consents are required and are not sought as part of this application.

3. Site condition

This section provides a summary of the site history, sources of contamination and current contamination conditions. The information presented in this section is primarily derived from T+T's PSI/DSI report which was undertaken in 2018 to assess the site conditions in relation to a resource consent for the redevelopment and extension of the existing Orams marine village and servicing facilities (BUN60330464) and which in WWLA's view remains relevant for the proposed development. The information is supplemented by WWLA's knowledge of the site and surrounds obtained from more recent investigations (refer to **Section 3.3**). The reader is referred to T+T's original report (**Appendix E**) for further detail if needed.

3.1 Site setting

The site setting is summarised in **Table 3**.

Table 3. Site setting

Current site use	The site is currently used primarily as carparking for local businesses but with portions of its southern extent used as a temporary construction yard associated with development work that is occurring on the adjoining marine precinct.
Surrounding land use	*Surrounding land use can indicate potential sources of contamination, and also receptors of contamination sourced from the site (if any).* The site is located within a commercial and industrial area on the western side of Beaumont Street in Wynyard Quarter. To the north of the site lies Silo Park, a public open space area. To the east lies Beaumont Street and with a car park and other commercial activities currently beyond. Orams Marine Precinct borders the site to the south. This area, which was part of the wider ASPT site, has recently undergone redevelopment including resurfacing, installation of an 850 tonne travel lift, new boat work sheds and seawall strengthening works. To the west lies the recently strengthened seawall with Westhaven Marina and St Marys Bay located beyond.
Topography and drainage	*The topography of the site impacts where contaminants might migrate to if present and surface water features are potential receiving environments for contaminants (if any) derived from the site.* The site and surrounds are mostly level at around 3m RL. Auckland Council's GeoMaps shows that stormwater is reticulated along Jellicoe Street to outfalls at the western end of the road. However, in most sites also have private outfalls to the harbour
Geology	*Geological conditions are considered in the context of describing the conceptual site model (CSM) (Section 2.3) should a potential for contamination be identified. For example, more porous soils can enable contaminants (if present) to move more quickly and potentially further than clay-rich soils that retain/ bind or prevent penetration of contaminants.* The published geology[3] indicates the site is underlain by Reclamation fill which is described as *"re-worked clay to gravel sized materials including some demolition debris".* Previous investigation show that reclamation fill is underlain by marine sediments, alluvial sediments and weather competent rock of the East Coast Bays Formation (ECBF) at depth. The materials used to reclaim Wynyard Quarter are also known to include pockets of demolition debris, timbers and gasworks, incinerator and other process-related wastes.
Hydrogeology	*Hydrogeological conditions affect potential risk of contaminant (if present) entering and being transported in groundwater*. The groundwater table is at sea level and is tidally affected, the greatest response closest to the wharf structure and adjacent seawall. Groundwater flows generally east to west, to the Waitemata Harbour, with a southwest component to the flow also evident.
Sensitive receptors	*Sensitive environmental receptors could include aquatic or terrestrial ecosystems. This is not an ecological assessment but is instead an initial review of the surrounding environment to assess where contaminants (if present) on the site could migrate to and whether the receiving ecosystem could be vulnerable to contaminants*. The ecosystem of the Waitemata Harbour which includes habitat for marine mammals, shorebirds and fisheries, is the nearest environmental receptor to the site.

[3] Kermode, L.O., 1992. Geology of the Auckland urban area. Scale 1:50,000. Institute of Geological and Nuclear Sciences.

	Sensitive human receptors could for example be children at a school or kindergarten on or adjacent to a site. Workers on industrial land (including or adjacent to a site) would be considered less sensitive. The Wynyard Quarter Playground and Silo Park are both situated <50m northeast and north of the site respectively. Members of the public, including children, using these spaces would be considered sensitive human receptors.

3.2 Site history

The site was reclaimed from the sea in approximately 1912. Materials typically used in the reclamation works in the local area include dredged sediments (referred to as hydraulic fill), fill materials from nearby foreshore headland excavations, demolition materials, gasworks waste and incinerator ash.

Following reclamation, the site was occupied by Mobil Oil (and its precursor companies) from the late 1920s until 2006. Historical plans for the Mobil ASPT show that bulk storage of petroleum fuels, solvents, vinyl acetate monomer (VAM), transformer oil and lube oil was undertaken on the site. A fire suppression system, that included aqueous film forming foam (AFFF), was formerly located in the northeast corner of the site.

Mobil ASPT was decommissioned circa 2006. Since the decommissioning the property has been associated with marine industry activities, including use as a base for the Emirates Team NZ Americas Cup syndicate. More recently, the site has been partially repaved and operated principally as a car park for local businesses.

3.3 Contamination conditions

HAIL[4] activities, those with the potential to cause ground contamination, have been confirmed as historically being undertaken on the site. The historic HAIL activities, principally being bulk fuel and petroleum chemical storage by Mobil, but also potential inclusion of contaminants in the original reclamation fill, have contributed contaminants (including metals, hydrocarbons and solvents) to ground. A summary of the contamination conditions is provided in **Table 4** with excerpts of the relevant results provided for reference in **Appendix B**.

The contamination testing results are discussed in the context of protection of human health and environmental (ecosystem) receptors under a commercial /industrial land use since the site will be entirely paved and residential uses will only occur in levels 1 and above. However, consideration of residential use is given in relation to volatile contaminants which under some circumstances have the potential to migrate into higher levels of a structure. The relevant standards for contaminants in soils to protect human health are provided in Section 9.1 of T+T's report (**Appendix E**).

Table 4. Summary of contamination conditions

Soil contamination	In summary the available data shows: • Granular fill occurs across the entire site, thickening behind the seawall, while hydraulic fill (dredged marine sediments, i.e. silts, clay and shell) thins towards the seawall thickening to the east. Together these two reclamation fill units contain the bulk of contamination. • The majority of samples tested (refer to location plan provided in **Appendix B**) from both granular and hydraulic fill materials contain one or more contaminants above published background ranges (i.e. not suitable as cleanfill). • The highest concentrations of contaminants are encountered at depth in the soil profile, generally at >1.5 m depth with surficial granular fill materials complying with the standards for protection of human health under commercial / industrial land use (a conservative proxy for assessing potential effects on construction workers). • Some soils at greater depths, corresponding to the groundwater table and capillary fringe, contain concentrations of hydrocarbons that exceed the standards for protection of maintenance / excavation workers. • Consistent with use of the site for petrochemical storage the contamination is dominated by petroleum hydrocarbon compounds represented by total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs) and various aromatic hydrocarbons. • Asbestos was identified at trace levels in two of six locations sampled by previous investigations. A further five samples collected by WWLA during installation of additional soil vapour monitoring wells (refer to **Further**

[4] Ministry for the Environment's Hazardous Activities and Industries List.

	Investigations discussion tabulated below) were tested for asbestos. Asbestos was not detected in these samples (refer to laboratory reports provided in **Appendix B**). • Metals occasionally exceed the relevant standards for protection of environmental receptors but comply with the criteria for protection of human health under commercial / industrial land use. • Owing to the previous identification of per- and polyfluoroalkyl substances (PFAS) in groundwater, WWLA also tested three soil samples for the presence of these compounds. One sample contained low concentrations of perfluorooctane sulfonic acid (PFOS) and perfluorohexane sulfonic acid (PFHxS), refer to laboratory reports provided in **Appendix B**. The concentrations comply with the criteria for protection of human health under commercial/ industrial land use[5] but will have implications for disposal of PFAS impacted surplus spoil and discharges of surface and groundwater from the site. The implications of the presence of PFAS are discussed further in **Section 4**.
Groundwater contamination	In summary the available data shows: • Consistent with soil results dissolved hydrocarbons are present in groundwater samples collected across the site. However, monitoring conducted by WWLA since completion of the Orams Marine redevelopment works indicates that concentrations have reduced, at least at the downgradient boundaries of the site (refer to **Appendix B**). • Cyanide is present in groundwater beneath the site. Cyanide is a regional contaminant due to the widespread inclusion of gasworks waste in the reclamation of Wynyard Quarter. However, associated metal contamination generally complies with the relevant standards for the protection of the environment. Exposure to human receptors is not relevant for this contamination (there is no beneficial use of groundwater and swimming does not occur in the marina). • Low concentrations of PFAS compounds are present in groundwater across the site. The concentrations comply with the relevant standards for 99% level of species protection for PFOS[6] and PFOA[5]. • No measured contaminants are present in groundwater at concentrations that present a risk to the health of construction workers, or future users or occupiers of the site. However, as separate phase hydrocarbons (SPH) have previously been encountered at monitoring locations near the southern boundary of the site, the potential to encounter localised areas of SPH within the site cannot be excluded. The potential health effects associated with these materials can be mitigated by appropriate monitoring, and if necessary personal protective equipment (PPE). However, the potential to generate objectionable odours also needs to be considered during excavation, particularly works that extend near or below groundwater level.
Soil vapour contamination	In summary the available data shows: • Sampling has identified the presence of petroleum hydrocarbon related compounds and chlorinated solvents in soil vapour beneath the site. However, concentrations generally comply with the relevant criteria for the protection of human health under both commercial / industrial and residential land use. • The exception being 1.1.2-Trichloroethane (1.1.2-TCA), which is present at concentrations exceeding all land use standards by approximately 5-fold at one sampling location. However, 1.1.2-TCA was only detected at a single location and average concentrations that could enter a new structure are therefore expected to be much lower than reported at that single location. Even without considering dilution in the subsurface, the concentration only needs to be reduced by 5-fold to meet the commercial/ industrial acceptance criteria. It is expected that far greater attenuation will be available for a new building with a suspended floor slab. Greater attenuation (~20-fold) is required for the measured 1.1.2-TCA concentrations to comply with the acceptance criteria for residential land use. However, this level of attenuation is expected to be achieved for a new building with a suspended floor slab in combination with residences not being developed on the ground floor. The implications are discussed further in **Section 4**. • It should be noted that soil vapour sampling provides a more accurate assessment of the vapour risk to site users (relative to groundwater or soil concentrations) as it measures the actual soil gas concentrations rather than being calculated from groundwater or soil data, which is modelled using a range of assumptions.
Further investigations	As noted above, soil vapour concentrations locally exceed default exposure standards, while a low residual risk is anticipated under the proposed development WWLA is currently undertaking further testing to clarify this risk. The

[5] PFAS National Environmental Management Plan, Version 3.0, 2025, National Chemicals Working Group of the Heads of EPA (HEPA) Australia and New Zealand (PFAS NEMP)
[6] ANZG 2023, Toxicant default guideline values for aquatic ecosystem protection: Perfluorooctane sulfonate (PFOS) in freshwater. Australian and New Zealand Guidelines for Fresh and Marine Water Quality

	testing comprises installation of four new soil vapour monitoring locations, and integrity testing and sampling of both the new and four existing monitoring locations, as shown on **Figure 2** (overpage). This monitoring is expected to confirm the need for vapour mitigation (if required) and will inform an updated vapour risk assessment to be provided to Council for approval. We note that this process is consistent with that required by Condition 17 of the existing consent for the Orams Marine redevelopment and extension (BUN60330464). In addition to additional vapour monitoring it is recommended that further testing be undertaken prior to works commencing to inform PFAS concentrations in surplus spoil that will be generated during earthworks required for construction of foundations. It is appropriate to undertake this testing as part of the detailed design process, i.e. after issue of resource consent. The options for mitigating both PFAS and vapour risks are discussed further in **Sections 4.2** and **5.2** respectively.



Figure 2. Soil vapour monitoring locations (Aerial source: LINZ)
Approximate site extent shown by red outline

4. Assessment of effects

Review of the contamination conditions in the context of the proposed development and associated construction works indicates that the primary ground contamination risks relate to:

1. Deep excavations (extending beneath surficial engineered subbase and hardfill) - generation of odours, release of vapours and contact with contaminated soils or water during these works could result in effects on site workers. If not appropriately controlled odours or vapours could also impact the users or occupiers of neighbouring properties.
2. Offsite disposal of surplus soil or fill - inappropriate management or disposal of surplus spoil containing contaminants (principally petrochemicals) could cause health or environmental effects at receiving sites.
3. Surface water and groundwater dewatering discharges containing contaminants (principally petrochemicals) and SPH - management of these discharges is required to ensure that unacceptable effects do not occur in the adjacent marine environment or to users of the harbour.
4. Vapour intrusion into the new building - if not appropriately mitigated the migration of petrochemical vapours (vapour intrusion) could result in long-term effects on the health of users or occupants of the new building.

These risks and implications for design and construction are discussed further below. The conceptual site model (an analysis of the contamination source, routes of exposure and effect on receptors or source-pathway-receptor model) is further detailed in Section 10 of T+T's previous assessment (refer to **Appendix E**).

4.1 Deep excavations

Where excavations extend beneath surficial engineered subbase and hardfill construction workers could be exposed to hydrocarbons in soil (or as SPH) that could present a nuisance through generation of odours that maybe unpleasant or cause discomfort (dizziness, nausea or headaches). The short duration and limited open area of these works, e.g. during piling or localised excavations for ground beams, will mitigate potential effects on health. However, this will be confirmed and controlled by appropriate real-time monitoring of vapour concentrations and odours during soil disturbance. This monitoring is expected to be implemented via a Site Management Plan (SMP, refer to draft provided as **Appendix D**) which is recommended as a condition of consent. A hierarchy of controls, which are contained within the SMP, can be implemented if monitoring trigger levels are exceeded, the controls are summarised below.

For excavations of longer duration, for example for building cores, controls such as sheet piling or cement stabilisation, that will be required to facilitate safe entry of workers into these deep excavations. These controls, supplemented with those described below (and the in the SMP, **Appendix D**), will mitigate potential exposures to contaminants during deeper/ longer duration excavations.

The hierarchy of controls that can be implemented if monitoring trigger levels are exceeded, could include:

- Pausing works until odours / vapours abate.
- Active ventilation of excavations.
- Limiting open areas and/or progressively stabilising excavations as works progress.
- Using deodorising solutions.
- Additional PPE (e.g. half-face respirators with cartridges for volatile organic compounds).

Advice will be sought from the SQEP overseeing the project to ensure that the controls selected appropriately address the any potential effects. The controls outlined above, which will be implemented to mitigate exposures to site workers, will also address potential effects on the users of neighbouring sites, and the general public.

4.2 Offsite disposal of surplus soil or fill

Surplus soils or fill generated by the development works are unlikely to be suitable for disposal as cleanfill. As a minimum surplus spoil will need to be disposed of to managed fill but soils between approximately 1.5 and 5 m

depth (that cannot be reused onsite) are expected to require disposal to a Class 1 landfill (Redvale or Hampton Downs) due to the potential generation of odour from these materials. If they can be separated from the overlying contaminated materials (e.g. by casing the holes) deeper natural soils encountered during piling works are expected to be suitable for disposal as cleanfill.

The presence of PFAS in some site soils imposes some additional constraints on offsite disposal as landfills in the Auckland region are not currently willing to receive PFAS impacted soils or fill. While landfill operators already receive PFAS in municipal and other waste streams they have been unwilling to date to accept relatively small quantities of low level PFAS contaminated soils, but it remains the landfill operator's right to determine whether they accept these materials.

The primary options to address PFAS impacted materials are by:

- Minimising the generation of surplus spoil through the design process, for example use of driven or screw rather than bored piles.
- Retaining PFAS impacted materials onsite, for example beneath the suspended slab.
- Engaging with landfill operators to assess if there are circumstances under which they will accept PFAS contaminated materials, for example with prior treatment.

To support this process, and as specified in the SMP, we recommend that additional testing of soils for PFAS is conducted once foundation designs and site levels are better understood. As this presents a commercial risk, i.e. cost of spoil disposal, rather than health or environmental risk, it is appropriate to undertake this testing as part of the detailed design process.

4.3 Surface water and groundwater discharges

Surface water generated by rain falling into deep excavations or discharges from groundwater dewatering are likely to include low concentrations of PFAS, cyanide and dissolved hydrocarbons. Surface water may also locally include SPH, which as indicated above can generate odours and vapours. Surface water can also generate oily sheens and slicks which may affect both humans and environmental receptors that contact them. The options for disposal of water that does not soak to ground onsite will therefore comprise:

1. Temporary storage and testing for acceptability prior to discharging to stormwater; or
2. Treatment to remove contaminants to acceptable levels prior to discharging to stormwater. Treatment will require a multistage process to remove SPH (oil/water separation) and suspended sediment (settling and/or chemical separation/ flocculation) finally PFAS and/or cyanide as necessary (e.g. via absorption on granular activated carbon). Such systems are commercially available and variants of them have been implemented previously during development of other sites in Wynyard Quarter; or
3. Removal of suspended sediment and, subject to Watercare approval, discharging to trade waste.

These controls are expected to be implemented via the SMP (**Appendix D**) which will be required as a condition of consent.

4.4 Vapour intrusion

As described in **Section 3.3**, a low residual risk to human health associated with vapour intrusion into the new building remains. The potential for discharges of vapour into the new building will be ongoing throughout the operation of the building. This risk is currently being confirmed by additional soil vapour testing as required by the conditions of consent. If the additional testing being undertaken shows that an unacceptable risk remains it can be mitigated by incorporation of appropriate vapour protection measures in the building design. The mitigation options are discussed further in **Section 5** and conditions of consent are recommended to address this residual risk.

5. Proposed mitigation

The mitigation measures proposed to ensure that less than minor adverse effects arise from both construction of, and ongoing vapour discharges from, the proposed development are set out in this section. It should be noted that the proposed mitigation measures are consistent with those consented for (under BUN60330464), and implemented during, development of the wider site (former ASPT) which have proven to be effective for managing adverse effects on the environment and the protection of human health.

5.1 Construction related effects

As described in **Section 4**, there is potential for effects to arise during construction related ground disturbance works at the site, specifically relating to deep excavations, disposal of surplus soil or fill, and from surface water and groundwater dewatering discharges associated with these activities. The effects associated with these activities will be mitigated by implementation of an SMP, which will also be required as a condition of consent (refer to discussion in **Section 6**).

In summary, the controls proposed in the SMP principally comprise:

- Confirming suitable disposal locations for surplus spoil prior to works commencing.
- That a vapour risk assessment, which confirms the required vapour mitigation measures (if any), is provided to Council for approval prior to construction commencing (refer to further discussion in **Section** Error! Reference source not found.).
- Ensuring the construction workers wear suitable protective equipment and the workspaces are appropriately monitored.
- That discharges (dust, stormwater runoff, odour) are either contained within the site or appropriately treated prior to discharge offsite.

5.2 Long-term effects

Potential vapour mitigation options are summarised in **Table 5**. It should be noted that there is a spectrum of options available and depending on the monitoring results and the final building design the optimal solution may comprise a combination of these options. It is intended that the final mitigation solution will be informed by a vapour risk assessment based on the monitoring data currently being collected. This process is consistent with Condition 17 approved in BUN60330464.

Table 5. Vapour intrusion mitigation options

Vapour monitoring programme results	Vapour mitigation option	Overview of design solution
Vapour concentrations acceptable or exposure pathways incomplete	No mitigation	No vapour mitigation measures will be required.
Vapour concentrations unacceptable or exposure pathways complete	Ventilated subfloor void	If a suspended floor with an underlying void space is pursued as the foundation solution for the development, it should be able to be sufficiently ventilated via external openings through the perimeter ground beams and a limited ventilation network. An indicative design for the void ventilation network is provided in **Appendix C**. We note that the car park area is proposed to be mechanically ventilated (likely using jet fans) to remove vehicle exhaust fumes. Assuming the ventilation meets Building Code requirements the subfloor beneath the car park will not need to be ventilated. Spaces that are only accessed for short periods of time, such as plantrooms and storage areas, are also unlikely to require sub-slab ventilation since risk is proportional to the duration of

		exposure and these areas will not normally be occupied. However, this would be confirmed as part of the vapour risk assessment.
	Vapour barrier with ventilation network	If slab-on-grade construction is pursued, a taped barrier system is likely to provide adequate protection. An indicative design for the ventilation barrier is provided in **Appendix C**. Approval for a similar system has recently been obtained for new commercial buildings (Building 1a and 1b) being constructed on the adjoining Orams Marine site. This will still require a ventilation network beneath it, the nature of which depends on what level it is installed at.

6. Consenting implications

Contaminated land related consenting requirements are summarised below and discussed in detail in the following sections (**Section 6.1** and **6.2**). Colour coding is used to indicate where we consider the relevant requirements:

- Can be met or are not applicable.
- Applicable and cannot be met and therefore consent is required.

Table 6. Summary of contamination consent requirements

Regulatory Framework	Rule	Consent required (Y/N and type)
NESCS	8(1) – Removal of a fuel storage system	No – not applicable
	8(2) – Soil sampling	No – not applicable
	8(3) – Disturbing soil	Yes – it is expected that the permitted soil disturbance volumes and durations will be exceeded requiring consent as a Restricted Discretionary Activity under Regulation 10
	8(4) Subdivision	Yes – the permitted activity requirements cannot be met, and contamination is present above the applicable standards requiring consent as a Restricted Discretionary Activity under Regulation 10
	8(4) Change in land use	
AUP	E30.6.1.2 Discharges of contaminants from soil disturbance activities	Yes – consent required on a controlled activity basis under Rule E30.6.2.1

6.1 NESCS

The NESCS sets out nationally consistent planning controls appropriate to district and city councils for assessing potential human health effects related to contaminants in soil. The regulations apply to specific activities on land (soil disturbance and removal, subdivision, bulk soil sampling and land use change) where an activity included on the HAIL has occurred.

Our assessment of the proposed works relative to the soil disturbance and land use change rules in the NESCS shows:

- The NESCS applies to the site because HAIL activities (bulk fuel and petroleum chemical storage and contaminants in reclamation fill) have occurred, related contaminants remain in soil above background levels, and soil disturbance and a change in use is required to facilitate the proposed development.
- It is expected that the following permitted activity thresholds will be exceeded:
  - Earthworks volumes and/or duration (refer to **Table 7**).
  - Change of use and subdivision of a piece of land (refer to **Table 8**).
- The proposed earthworks (soil disturbance), and subdivision and changing use following construction of the new building, will require consent as a Restricted Discretionary Activity under Regulation 10 of the NESCS because contaminants are present above the applicable standards for the protection of human health (refer to **Table 9**).
- Council will require that an SMP is submitted in support of the consent application, an SMP included as **Appendix D**.

Table 7. Soil disturbance as a Permitted Activity under Regulation 8(3) of the NESCS

Reg. 8(3)	Permitted activity requirements	Evaluation
(a)	Implementation of controls to minimise exposure of humans to mobilised contaminants.	Will be met if the SMP provided as **Appendix D** to this report is implemented.
(b)	The soil must be reinstated to an erosion free state within one month of completing the land disturbance.	Expected to be able to be met as the site will be progressively stabilised as construction works progress.
(c)	The volume of the disturbance of the piece of land must be no more than 25 m^3 per 500 m^2.	The site-specific permitted activity volume for disturbance based on the HAIL area covering the entire site (5,215 m^2) is ~261 m^3. The scale of the development will require earthworks that exceed this threshold.
(d)	Soil must not be taken away unless it is for laboratory testing or, for all other purposes combined, a maximum of 5 m^3 per 500 m^2 of soil may be taken away per year.	Based on the HAIL area covering the entire site (5,215 m^2) the site-specific permitted activity volume for soil removal is ~52 m^3 per year. The scale of the development will require earthworks that exceed this threshold.
(e)	Soil taken away must be disposed of at an appropriately licensed facility.	Expected to be met as required by conditions of consent.
(f)	The duration of land disturbance must be no longer than two months.	This requirement will be exceeded with the piling and substructure works alone proposed to take 6 – 8 months.
(g)	The integrity of a structure designed to contain contaminated soil or other contaminated materials must not be compromised.	Not applicable.

Table 8. Permitted Activity provisions for subdivision and change in land use under Regulation 8(4) of the NESCS

Reg. 8(4)	Permitted activity requirements	Evaluation
(a)	A preliminary site investigation of the land or piece of land must exist.	This report fulfils the requirements for a PSI.
(b)	The PSI must state that it is highly unlikely that there will be a risk to human health if the activity is done to the piece of land.	This combined PSI and DSI shows that soils, or more specifically the vapour generated from them, have the potential to pose an unacceptable risk to human health under the proposed use.
(c)	The report must be accompanied by a relevant site plan to which the report is referenced.	The figures provided in this report fulfil this requirement.
(d)	The consent authority must have the report and the plan.	The report and plan will be provided to Auckland Council as part of the consenting process.

Table 9. Soil disturbance, subdivision and changing use as an RDA under Regulation 10 of the NESCS

Reg. 10	RDA requirements	Evaluation
(a)	A detailed site investigation of the piece of land must exist.	This report fulfils the requirement for a DSI.
(b)	The report on the detailed site investigation must state that the soil contamination exceeds the applicable standard in regulation 7.	This report confirms that the applicable standards are exceeded.
(c)	The consent authority must have the report	The report will be provided to Auckland Council as part of the consenting process.
(d)	Conditions arising from the application of subclause (3), if there are any, must be complied with	Subclause (3) sets out the matters over which council has discretion. We do not expect any matters arising that cannot be agreed with council and/or addressed by suitable conditions of consent.

6.2 Auckland Unitary Plan

Section E30 of the AUP contains rules that address discharges to the environment, both during works and in the long term. The contaminated land rules of the AUP apply to soils that contain 'elevated levels of contaminants', which is defined as contaminants exceeding the permitted activity discharge criteria set out in Rule E30.6.1.4, and where either soil disturbance of greater than 200 m^3, or longer than 2 months, is proposed (amongst other requirements).

As described in **Section 3.3**, contaminants exceed the permitted activity discharge criteria and SPH is expected to be present at the site. As earthworks will exceed 200 m^3 and take longer than 2 months, the relevant permitted activity rules of Section E30 of the AUP cannot be met. Consent will therefore be required to authorise short-term discharges during the works. As set out in **Table 10**, we consider that the requirements of Rule E30.6.2.1 can be met and consent can therefore be granted on a Controlled Activity basis.

As described in **Section 2**, passive historical discharges via groundwater are already authorised by BUN60330464.

Table 10. Discharge of contaminants into air, or into water or onto or into land not meeting permitted activity standards under Rule E30.6.2.1 of the AUP

E30.6.2.1	Controlled Activity requirements	Evaluation
(1)	A detailed site investigation (contaminated land) must be prepared and submitted to Council for consideration.	This report fulfils the requirement for a DSI. The report will be provided to Auckland Council as part of the consenting process.
(2)	A site management plan (contaminated land) must be prepared and submitted to Council for consideration.	An SMP is provided as **Appendix D** to this report.
(3)	A remedial action plan (contaminated land), relevant to the site and the proposed disturbance or remediation must be prepared and submitted to Council for consideration.	The content of the SMP provided as **Appendix D** to this report fulfils the requirement for a RAP.
(4)	The report on the detailed site investigation (contaminated land) must state either that: (a) … (b) discharges from the land are highly unlikely to cause significant adverse effects on the environment; or (c) …	Construction related effects (short-term) will be mitigated by implementation of the SMP (as described in **Section 5.1** and provided as **Appendix D**). Implementation of the SMP will ensure that effects are highly unlikely cause significant adverse effects on the environment, thereby fulfilling the requirement of Rule E30.6.2.1(4)(b).

6.3 Proposed conditions of consent

The proposed conditions of consent set out in **Table 11** are considered to be appropriate to manage the potential effects of the project. These conditions have been adopted, with minor project specific amendments and some consolidation to avoid repetition, from existing consent BUN60330464. Cross reference to the relevant conditions of BUN60330464 are provided for clarification.

For avoidance of doubt, it is proposed that the following ground contamination related documents would be provided to Council for certification prior to commencement of works:

1. An SMP updated to address the final design to fulfil proposed Condition 2. This document will interface with the Erosion and Sediment Control Plan expected to be required by other conditions of consent;
2. A project specific health and safety plan that incorporates the requirements of the SMP to fulfil proposed Condition 1; and
3. A vapour risk assessment to fulfil proposed Condition 5.

Table 11. Proposed conditions of consent

Proposed condition	Requirement	BUN60330464 Condition No.
1	A site-specific health and safety plan, which includes details of the proposed mitigation of the effects associated with the contaminated material shall be prepared prior to the commencement of any land disturbance works and be available on site during the works.	12
2	At least 10 days prior to the commencement of the land disturbance activity on site an updated Site Management Plan (SMP) for the work shall be prepared by a suitably qualified and experienced contaminated land practitioner (SQEP) and provided to the Council (Team Leader Compliance Monitoring) for review. The SMP shall incorporate the relevant content of the draft SMP submitted in support of the application.	14, 68, 75
3	All land disturbance and associated procedures aimed to mitigate any adverse effects on human health and the environment and relevant sampling and monitoring shall be undertaken in accordance with the SMP, referenced in Condition 2 above. Any subsequent variations to the SMP shall be submitted to the Council (Team Leader Compliance monitoring) for review prior to the implementation of any changed procedures. *Advice Note: The Council acknowledges that the Site Management Plan is intended to provide flexibility of the management of the works and contaminant discharges. Accordingly, the SMP may need to be updated over the duration of the project. Any updates should be limited to the scope of this consent and be consistent with the conditions of this consent. If you would like to confirm that any proposed updates are within scope, please contact the Team Leader.*	15
4	All land-disturbance activity authorised by this consent shall be overseen by a SQEP to ensure that all management and mitigation procedures set out in the SMP, referenced in Condition 2, and conditions of this consent have been adhered to.	16
5	At least 10 days prior to the construction of buildings on site either of the requirements of 5a or 5b shall be met: a. A vapour risk assessment report shall be submitted Council for certification. Based on the outcome of the vapour risk assessment suitable building protection measures shall be incorporated into the design and construction of each building as outlined in the SMP, referenced in Condition 2; or b. Building protection measures shall be incorporated into the design and construction of each building. The design of the building protection measures shall be undertaken by a suitably qualified and experienced professional in vapour protection design and the relevant supporting documentation shall be in the form of: ▪ A Design Report specific to each protection measure or building structure (as appropriate); ▪ An Installation Plan specific to each protection measure; and ▪ A Verification Plan specific to each protection measure.	17

6	If Condition 5b is implemented, installation of the building protection measures shall be undertaken in accordance with the Design Report, Installation Plan and Verification Plan under the oversight of a suitably qualified and experienced professional. The suitably qualified and experienced professional shall provide verification records, and coordinate the supply of as-built plans, for inclusion in the SVR (Condition 13).	New, replaces the last paragraph of 17b, which was ambiguous
7	In the event an incidental discovery of contamination the unexpected contamination procedure in the SMP shall be implemented, including applicable isolation and mitigation measures. In the event that the contamination identified is outside the scope of this consent, the Council (Team Leader Compliance Monitoring) shall be notified and a remedial action proposal provided and approved by Council prior to implementation.	31
8	Excavated material that is not re-used on site shall be disposed of at a facility consented to accept the levels of the identified contamination. Excavated soil shall not be disposed of as 'cleanfill' unless it has been appropriately tested and characterised by a SQEP as meeting the 'Cleanfill material' definition set out in the Auckland Unitary Plan (Operative in Part) (AUP(OP)).	32
9	The contamination status of any soil imported to the site shall comply with the definition of 'Cleanfill material', as set out in the AUP(OP).	33
10	All sampling and testing of contamination on the site, as required, shall be overseen by a SQEP. All sampling and testing shall be undertaken in accordance with the Contaminated Land Management Guidelines, No.5: Site Investigation and Analysis of Soils (Ministry for the Environment, revised 2011).	34
11	Within three months of the completion of earthworks on the site, a Site Validation Report (SVR) shall be submitted to the Team Leader for certification. The SVR shall be prepared by a SQEP in accordance with the Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand (Ministry for the Environment, revised 2011) and contain sufficient detail to address the following matters: a. A summary of the works undertaken, including the location and dimensions of the excavations carried out and the volume of soil excavated. b. Details and results of any testing, including validation testing, undertaken and interpretation of the results in the context of the NES:CS and the AUP(OP). c. Records/evidence of the appropriate disposal for any material removed from the site. d. Records of any unexpected contamination encountered during the works and response actions, if applicable. e. Conditions of the final site ground surface and details of any validation sampling undertaken on materials re-used on site or imported to site. f. Reports of any complaints, health and safety incidents or pollution incidents, spills and discharges related to contamination, and/or contingency actions during the earthworks. g. A statement certifying whether all works have been carried out in accordance with the requirements of the consent, otherwise providing details of relevant breaches, if applicable. h. Verification records and as-built drawings for all building vapour protection measures installed.	45
13	Any perched groundwater, or surface run-off water encountered within the excavation area requiring removal shall be considered potentially contaminated, and shall either: a. Be disposed of by a licenced liquid waste contractor; or b. Pumped to sewer, providing the relevant permits are obtained; or c. Discharged to the stormwater system or to the marine water environment provided testing demonstrates compliance following reasonable mixing with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality for the protection of 80 percent of marine water species, with the exception of benzene and per- and polyfluoroalkyl substances where the 95 percent protection level shall apply, and that it is free from petroleum hydrocarbon sheen and separate phase hydrocarbons.	71

7. Summary and conclusions

The assessment considers the current contamination on the site, and the anticipated effects relating to this contamination, in the context of the Project and associated construction works. This assessment indicates that the primary ground contamination risks relate to:

- Generation of odours, release of vapours and contact with contaminated soils or water during deep excavations (extending beneath surficial engineered subbase and hardfill). These effects relate principally to site workers but if not appropriately controlled odours or vapours could also impact the users or occupiers of neighbouring properties;
- Offsite disposal of surplus soil or fill containing contaminants (principally petrochemicals). Inappropriate management or disposal of surplus spoil could cause health or environmental effects at receiving sites;
- Management of surface water and groundwater dewatering discharges containing contaminants (principally petrochemicals) and SPH is required to ensure that unacceptable effects do not occur in the adjacent marine environment or to users of the harbour; and
- If not appropriately mitigated the migration of petrochemical vapours could result in long-term effects on the health of users or occupants of the new building.

The assessment concludes that consent is required:

- On a Restricted Discretionary Activity (RDA) basis under Regulation 10 of the NESCS; and
- On a Controlled Activity (CA) basis under Rule E30.6.2.1 of the AUP.

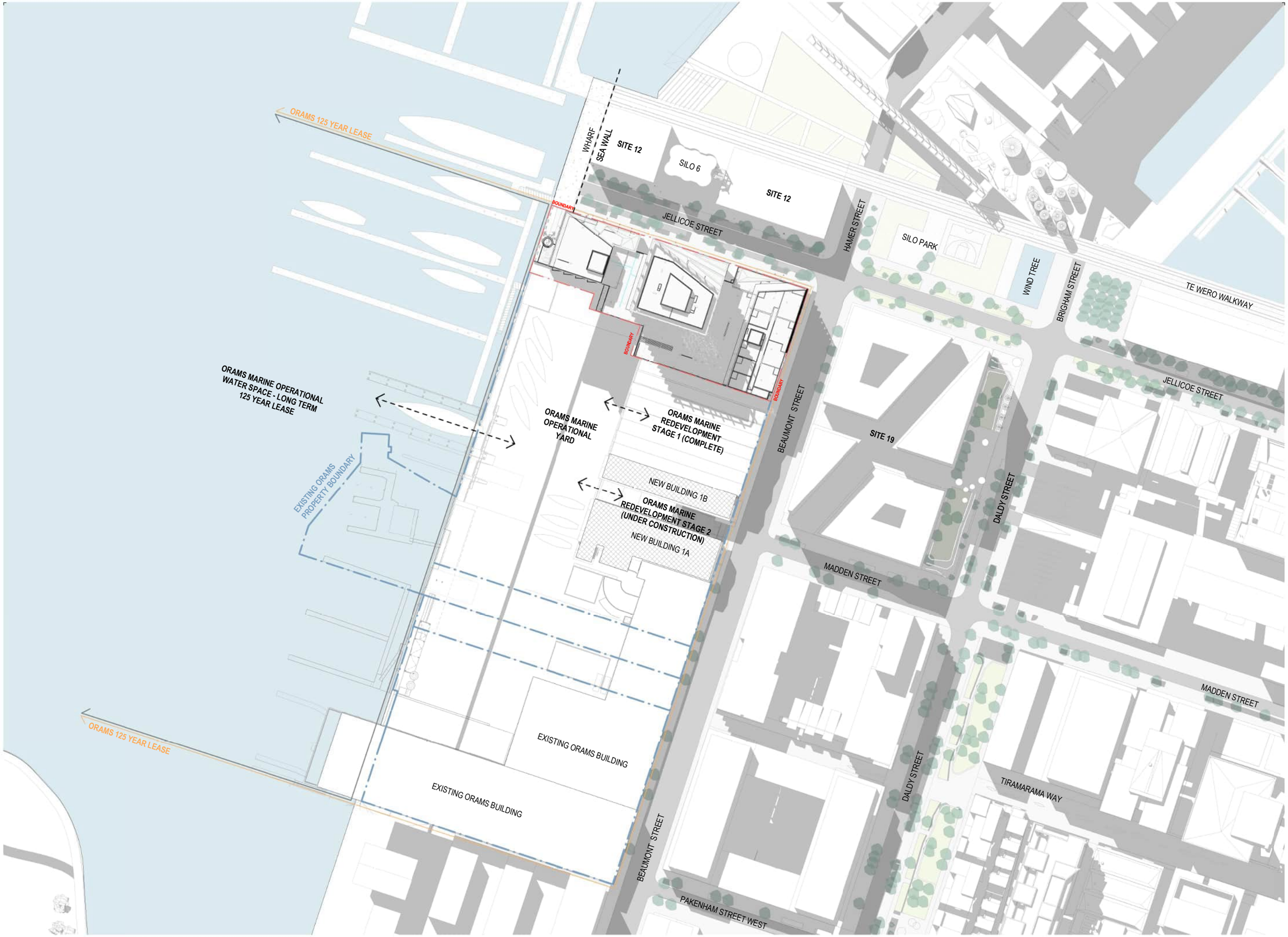
An SMP is provided (**Appendix D**) that sets out how these potential risks can be mitigated so that effects on human health or the environment will be less than minor. In summary, the proposed controls principally comprise:

- Confirming suitable disposal locations for surplus spoil prior to works commencing.
- That a vapour risk assessment, which confirms the required vapour mitigation measures (if any), is provided to Council for approval prior to construction commencing.
- Ensuring the construction workers wear suitable protective equipment and the workspaces are appropriately monitored.
- That discharges (dust, stormwater runoff, odour) are either contained within the site or appropriately treated prior to discharge offsite.

The recommended conditions of this consent are appropriate to mitigate the effects of the current development proposal.

This report has been prepared, reviewed, and certified by a SQEP. This assessment and supporting information collectively fulfil the requirement for a PSI, DSI and SMP (or RAP) for the purpose of the substantive application for the Proposal.

Appendix A. Selected design drawings



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Project Title

188 BEAUMONT STREET

WYNYARD QUARTER

Drawing Title

SITE PLAN

Drawing Status

PRELIMINARY DESIGN

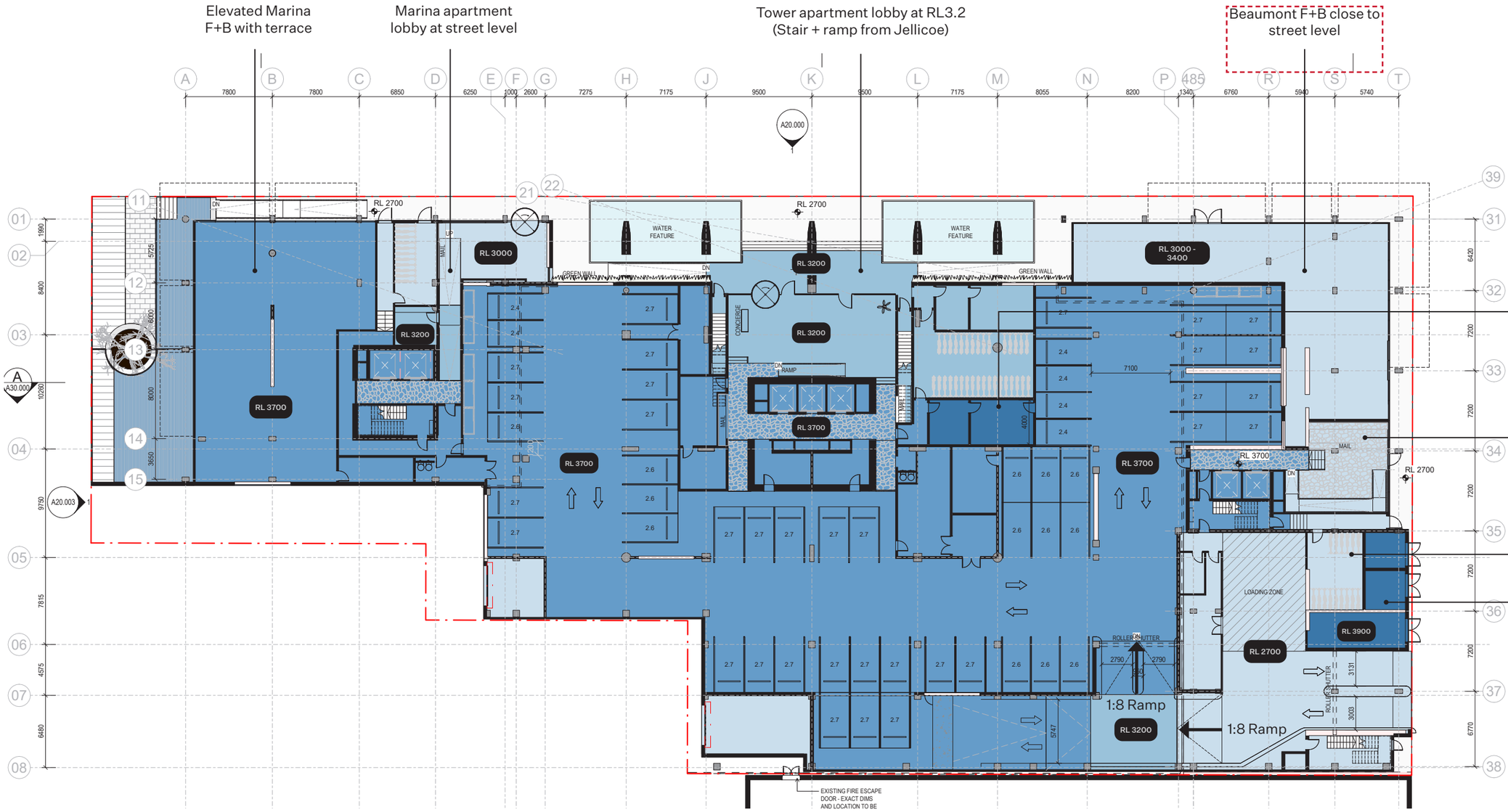
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Drawing No A03.001 **Revision** A

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188 Beaumont Street
Current - Slab Levels | Zoning Summary



Equipment at RL3.9. Slab can potentially remain at 3.7

Beaumont apartment lobby at street level

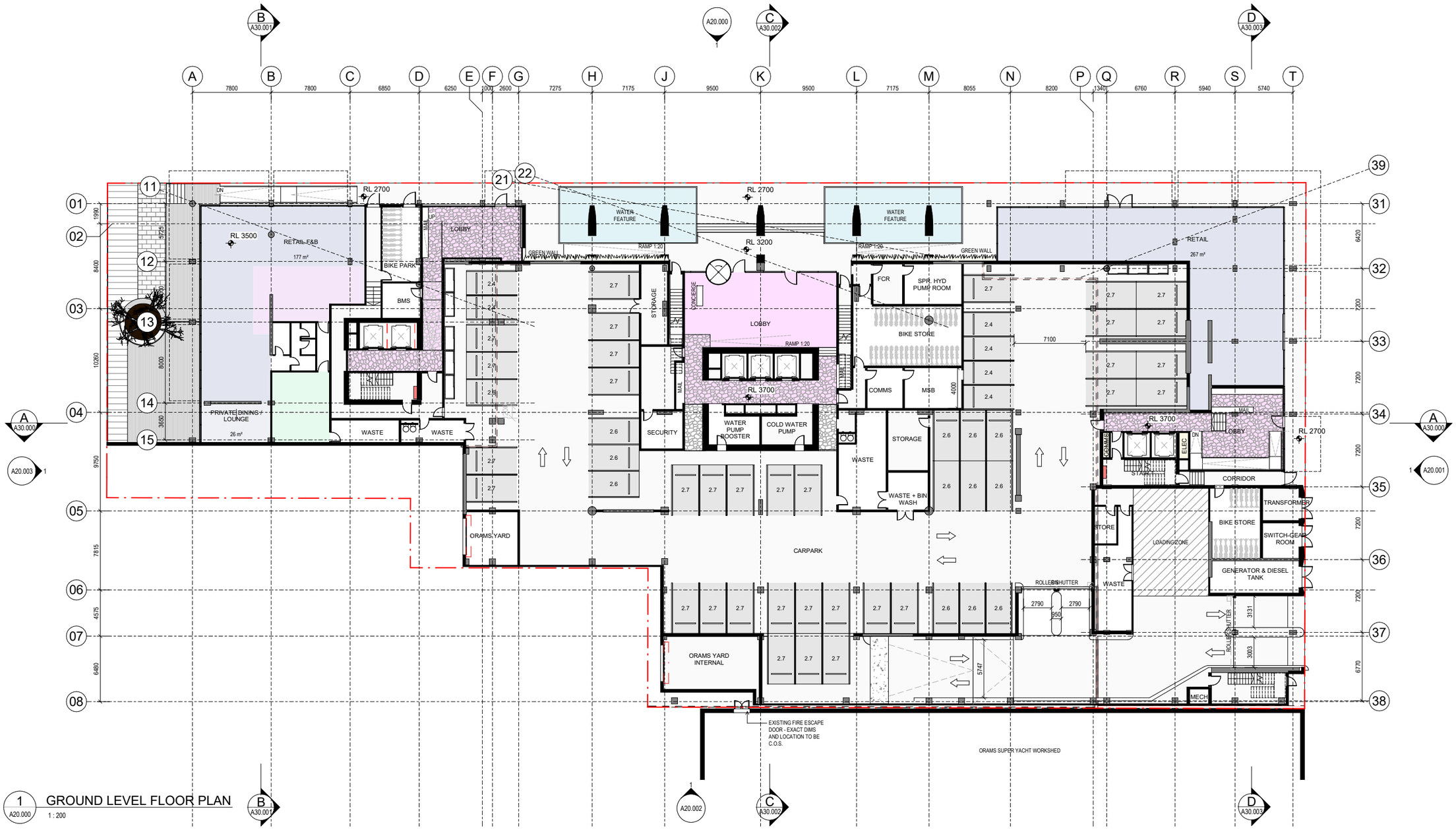
Bike store at street level

Transformers at RL 3.9 with elevated street-side access

Key

	RL 2.7
	RL 3.2
	RL 3.7
	RL 3.9

- Above plan illustrates slab level demarcations at a high level
- Further detailed study and coordination with the wider consultant team is required to ensure all technical considerations have been accounted for



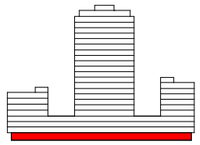
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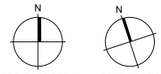
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KEY ELEVATION

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GROUND LEVEL FLOOR PLAN

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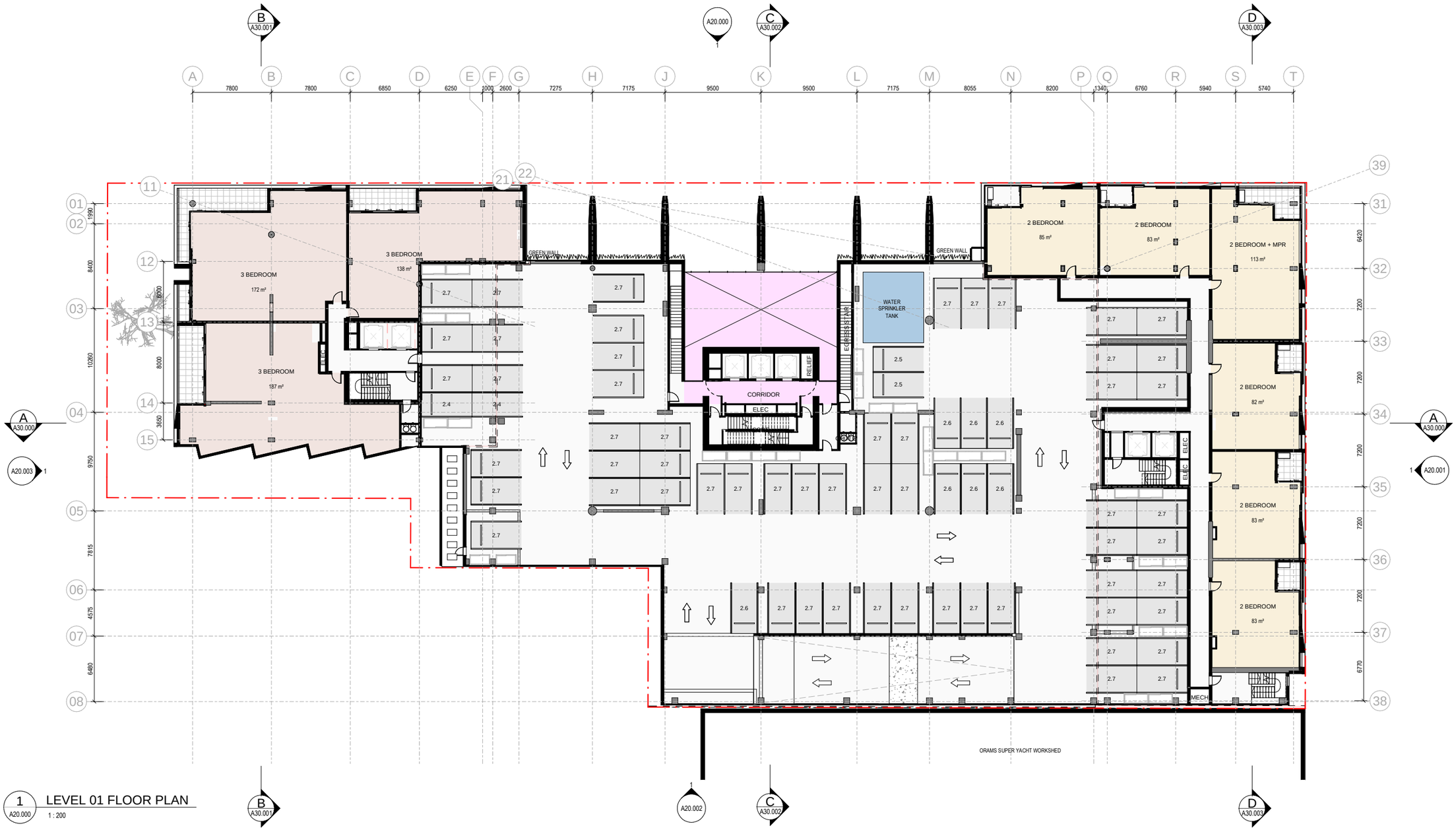
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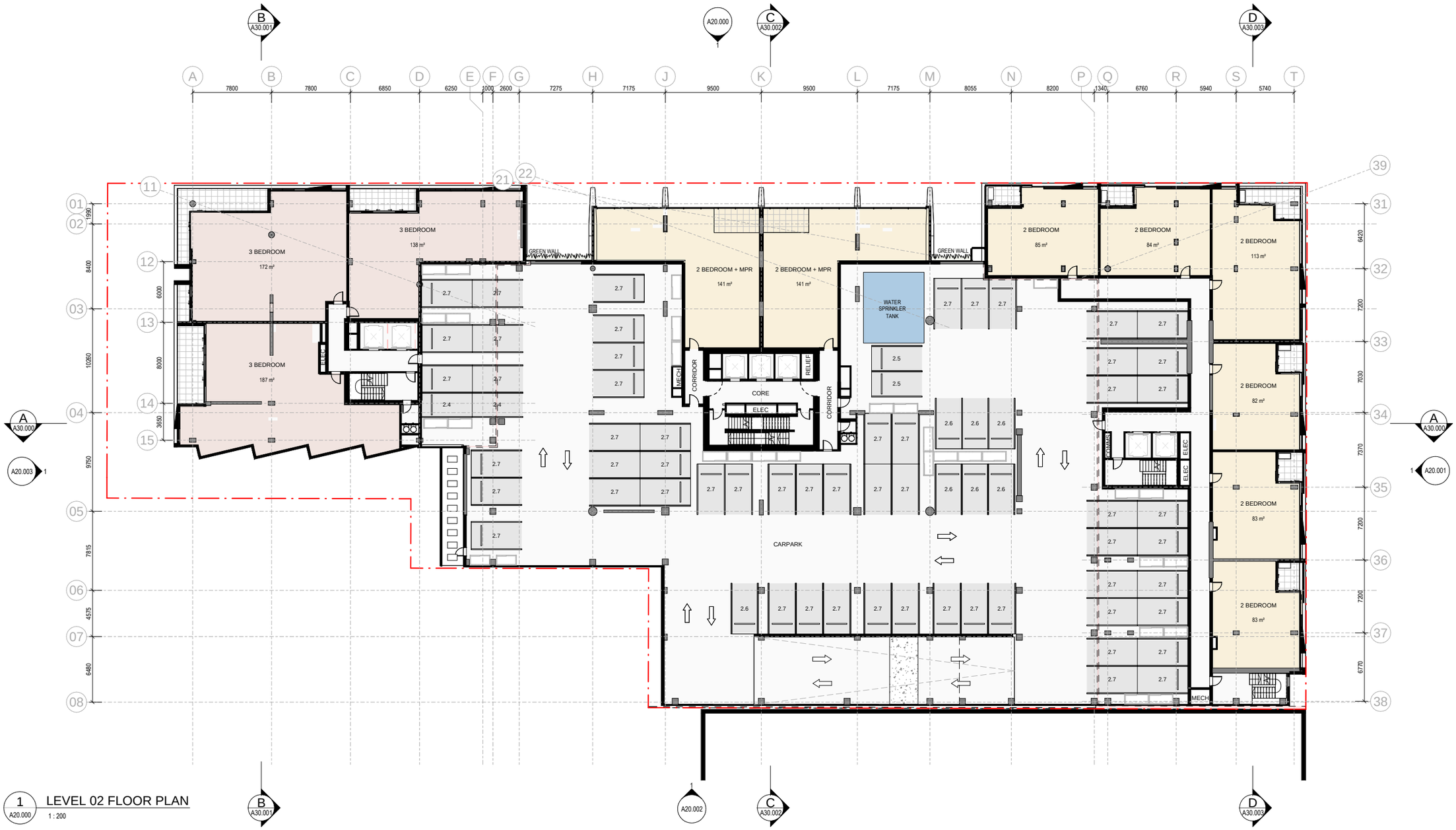
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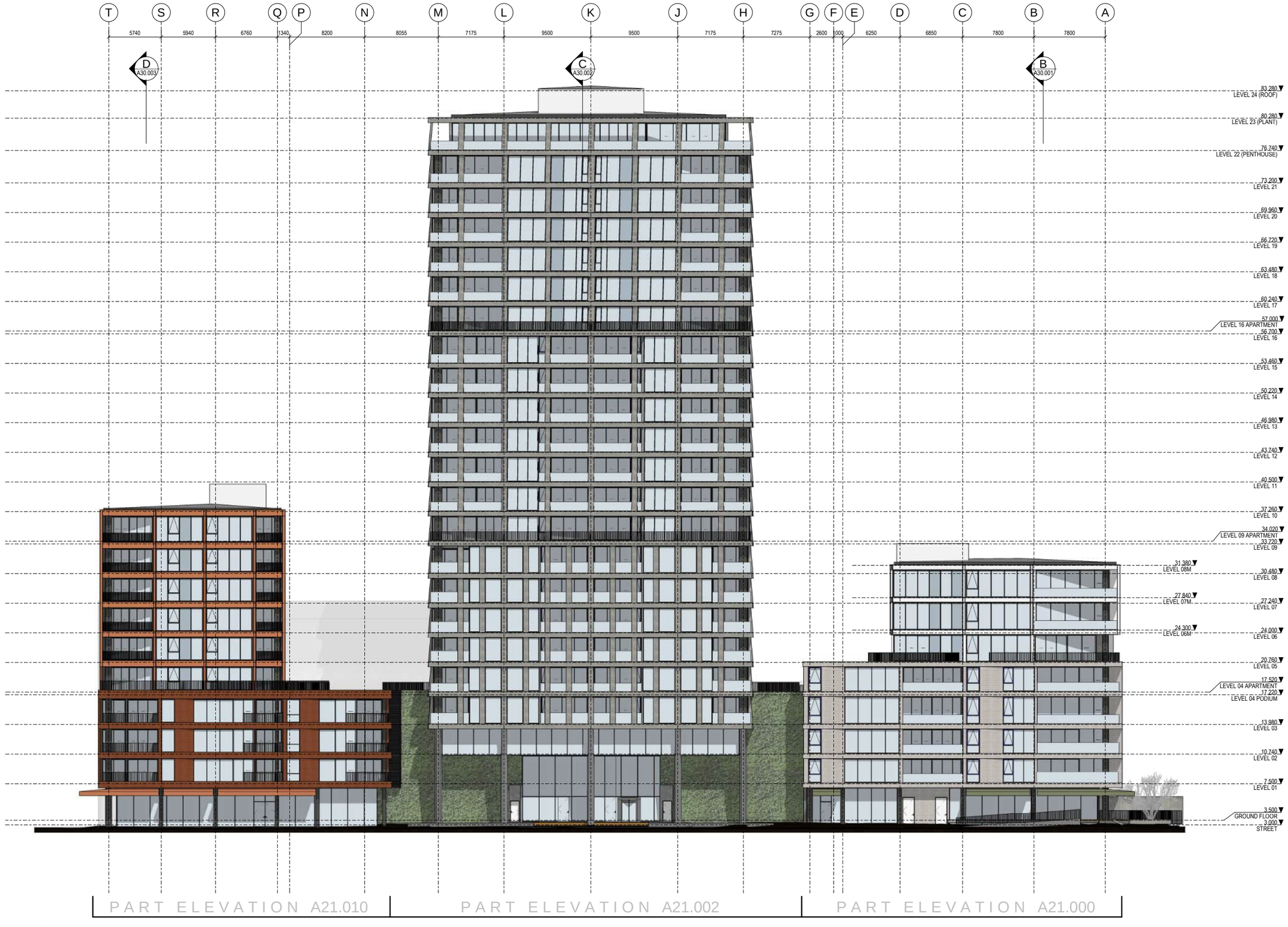
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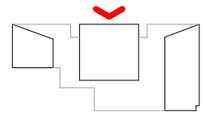
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GLAZING PANEL LEGEND
- VISION PANEL
- SPANDREL PANEL



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WYNYARD QUARTER

Drawing Title

NORTH ELEVATION

Drawing Status

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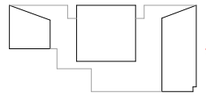
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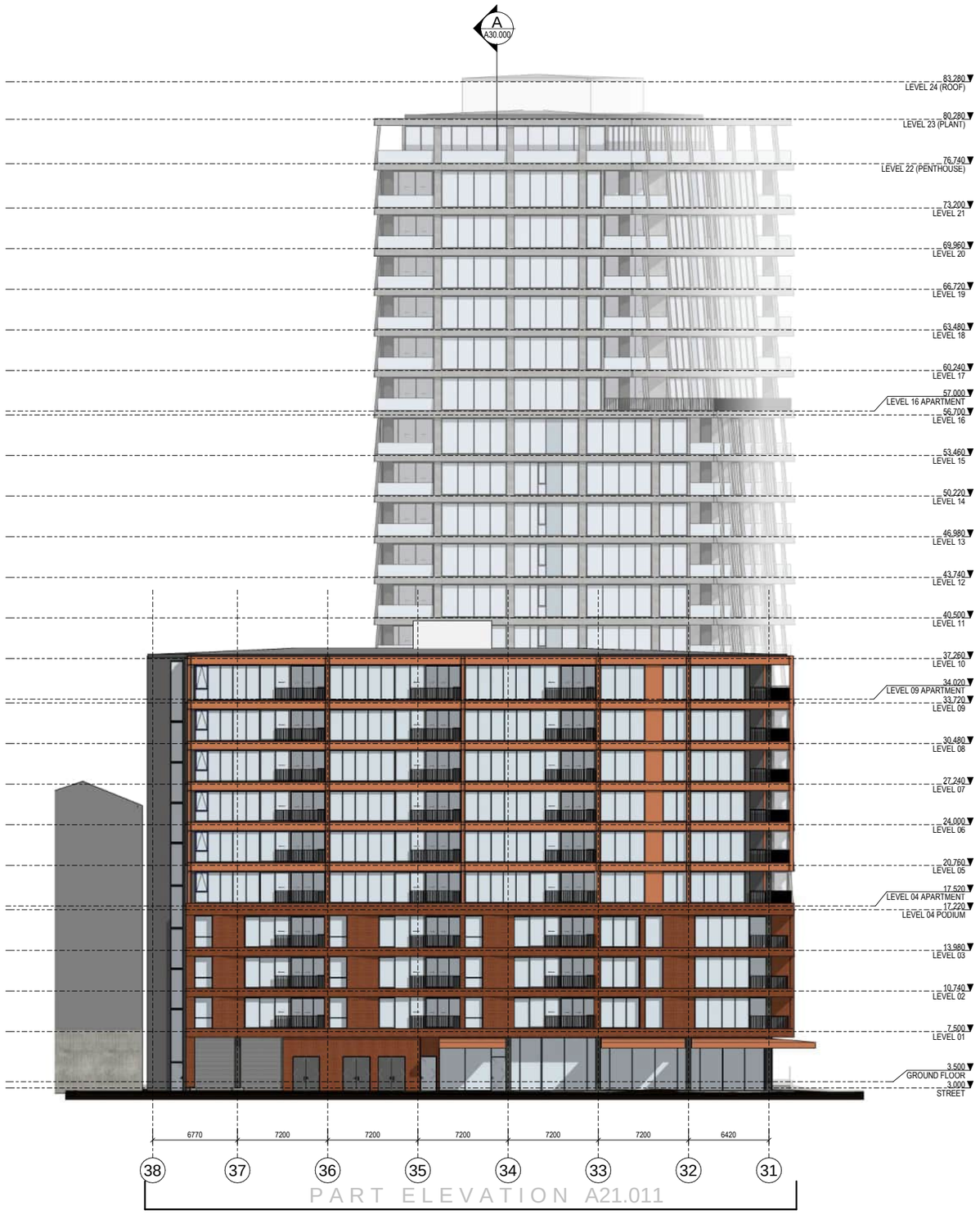
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GLAZING PANEL LEGEND
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- SPANDREL PANEL



KEY ELEVATION



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Fire Engineer

NDY
Electrical Engineer

Client

WESTHAVEN RESIDENTIAL LIMITED PARTNERSHIP

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Registered Architects and Designers
www.warrenandmahoney.com

Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

EAST ELEVATION

Drawing Status

50% PRELIMINARY DESIGN

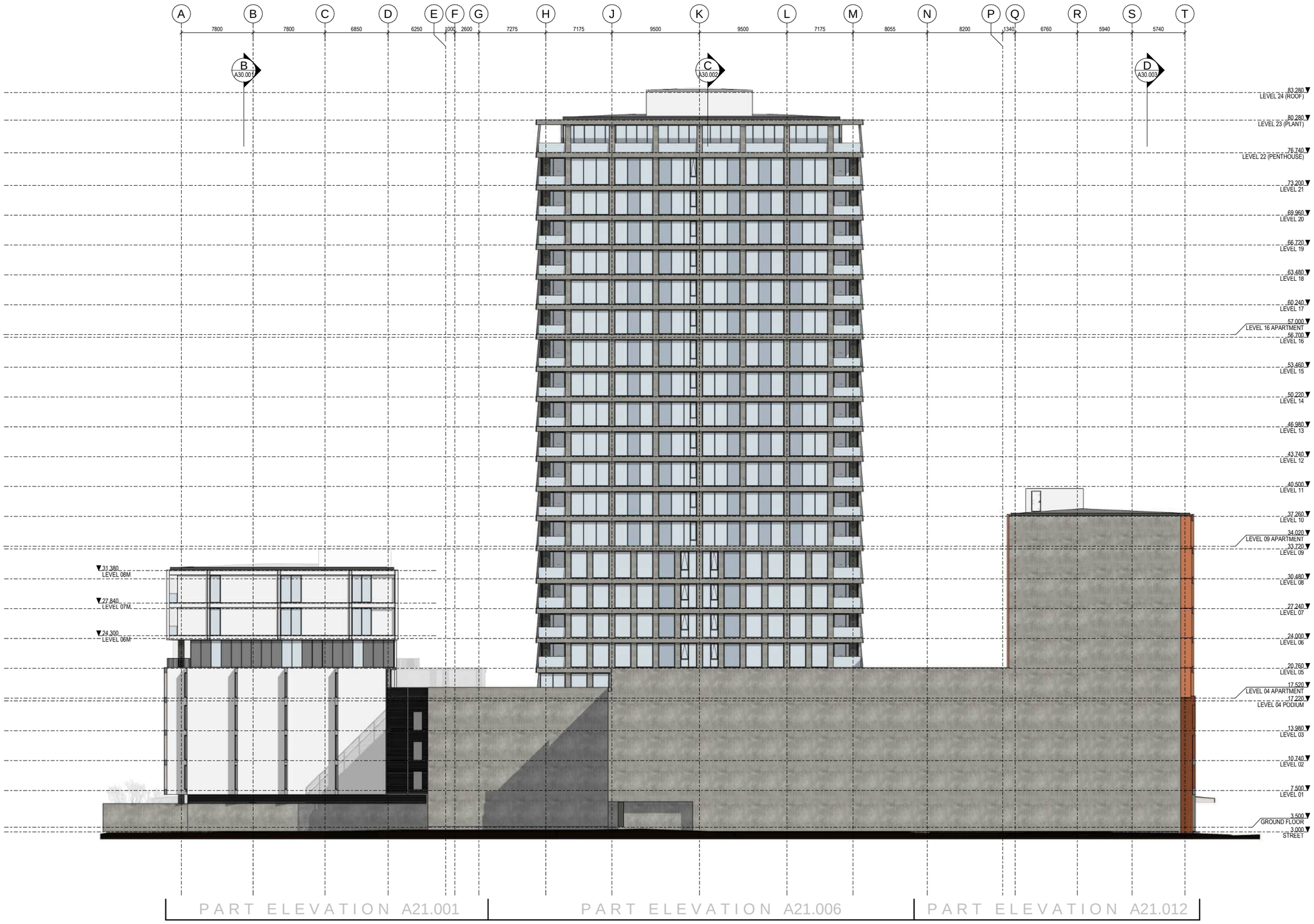
Drawing Details

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Date	10/17/2025 2:37:56 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A20.001

Revision A

WARREN AND MAHONEY



1 A10.000 SOUTH ELEVATION
1 : 200

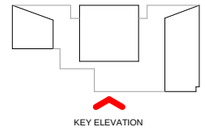
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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes

GLAZING PANEL LEGEND
VISION PANEL
SPANDREL PANEL


KEY ELEVATION

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

SOUTH ELEVATION

Drawing Status

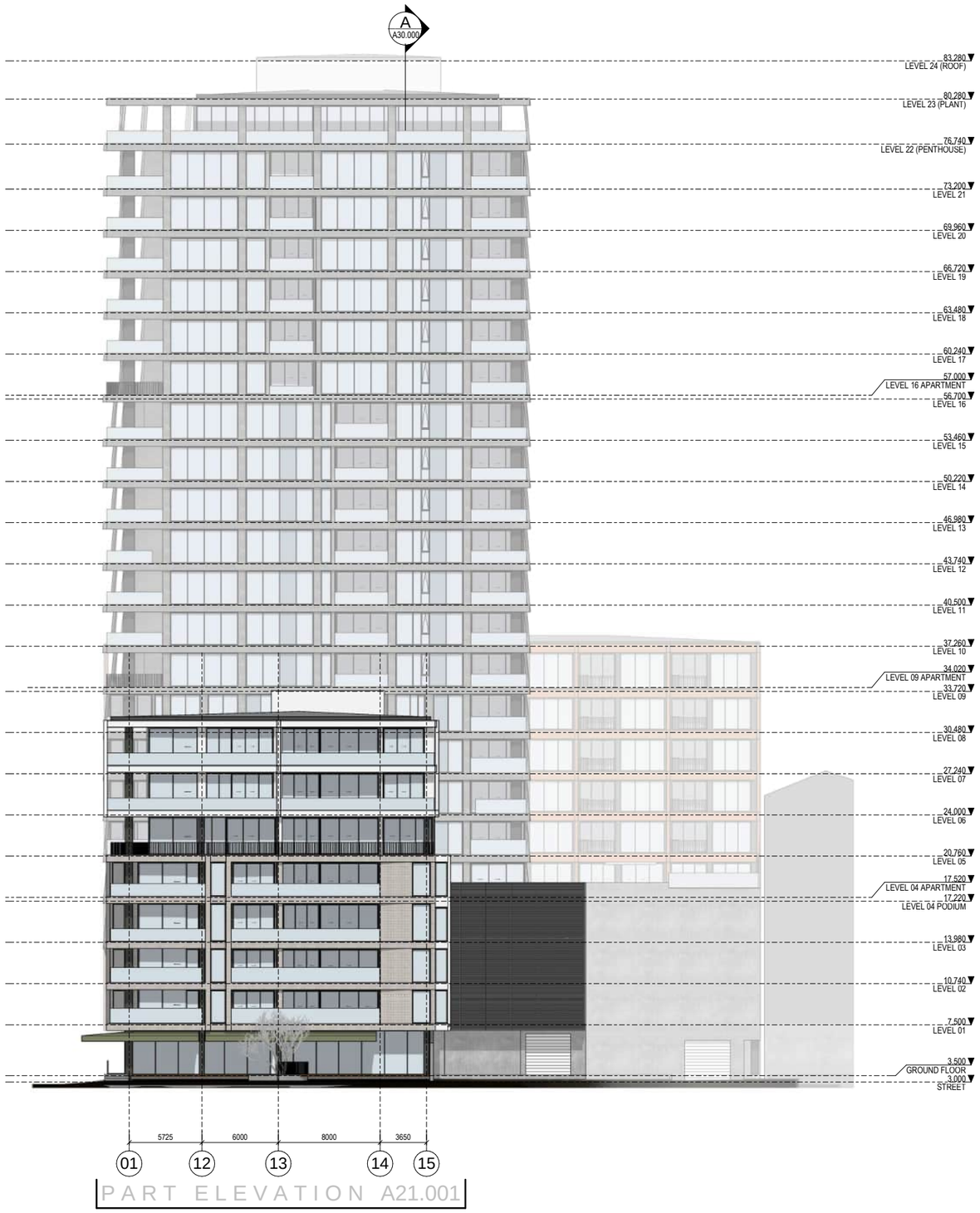
50% PRELIMINARY DESIGN

Drawing Details

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Date	10/17/2025 2:38:11 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A20.002 **Revision** A

WARREN AND MAHONEY



PART ELEVATION A21.001

1 / A10.000 WEST ELEVATION

1 : 200

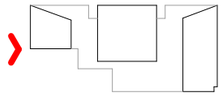
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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes

GLAZING PANEL LEGEND
- VISION PANEL
- SPANDREL PANEL



KEY ELEVATION

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

WEST ELEVATION

Drawing Status

50% PRELIMINARY DESIGN

Drawing Details

Scale	As indicated@ A1
Date	10/17/2025 2:38:22 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A20.003

Revision A

WARREN AND MAHONEY

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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

T S R Q P N M L K J H G F E D C B A

5740 5940 6760 1340 8200 8055 7175 9500 9500 7175 7275 2600 1000 6250 6850 7800 7800

D A30.003 C A30.002 B A30.001

1 A31.002 1 A31.003 1 A31.001 1 A31.000

BOUNDARY LINE BOUNDARY LINE

83.280	LEVEL 24 (ROOF)	3000
80.280	LEVEL 23 (PLANT)	3540
76.740	LEVEL 22 (PENTHOUSE)	3540
73.200	LEVEL 21	3240
69.960	LEVEL 20	3240
66.720	LEVEL 19	3240
63.480	LEVEL 18	3240
60.240	LEVEL 17	3240
57.000	LEVEL 16 APARTMENT	300
56.700	LEVEL 16	3240
53.460	LEVEL 15	3240
50.220	LEVEL 14	3240
46.980	LEVEL 13	3240
43.740	LEVEL 12	3240
40.500	LEVEL 11	3240
37.260	LEVEL 10	3240
34.020	LEVEL 09 APARTMENT	300
33.720	LEVEL 09	3240
30.480	LEVEL 08	3240
27.240	LEVEL 07	3240
24.000	LEVEL 06	3240
20.760	LEVEL 05	3240
17.520	LEVEL 04 APARTMENT	300
17.220	LEVEL 04 PODIUM	3240
13.980	LEVEL 03	3240
10.740	LEVEL 02	3240
7.500	LEVEL 01	4000
3.500	GROUND FLOOR	
3.000	STREET	
1.100	LIFT PIT - TOWER	

31.380	LEVEL 08M	3540
27.840	LEVEL 07M	3540
24.300	LEVEL 06M	3240

A A

KEY ELEVATION

A A10.000 Section A-A - GRID 4 LOOKING SOUTH
1 : 200

Notes

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET

WYNYARD QUARTER

Drawing Title

SECTION A-A

Drawing Status

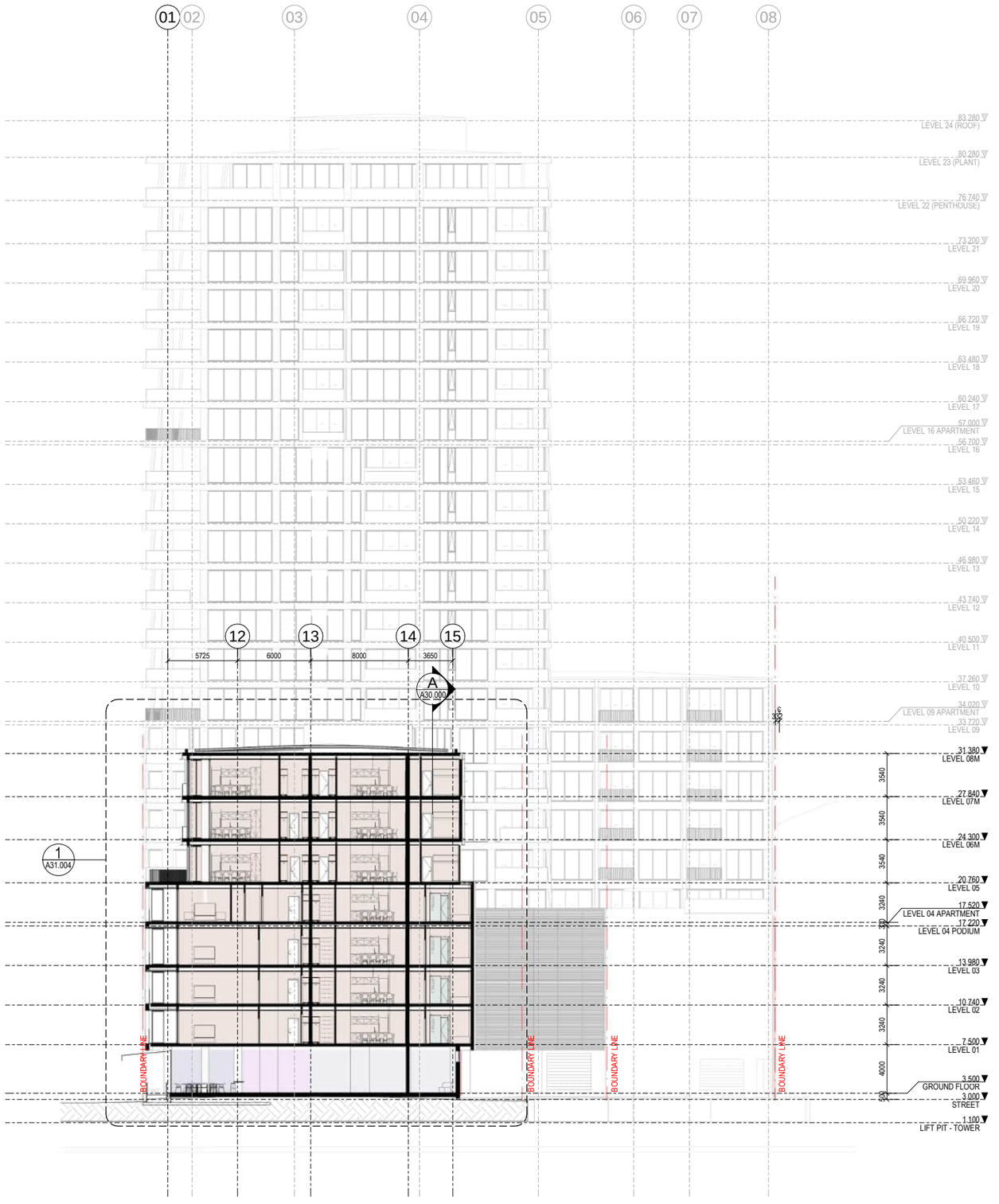
50% PRELIMINARY DESIGN

Drawing Details

Scale	1 : 200@ A1
Date	10/17/2025 12:17:16 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A30.000 **Revision** A

WARREN AND MAHONEY



B
A10.000 Section B-B - GRID B LOOKING EAST

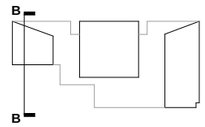
1 : 200

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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes



KEY ELEVATION

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

SECTION B-B

Drawing Status

50% PRELIMINARY DESIGN

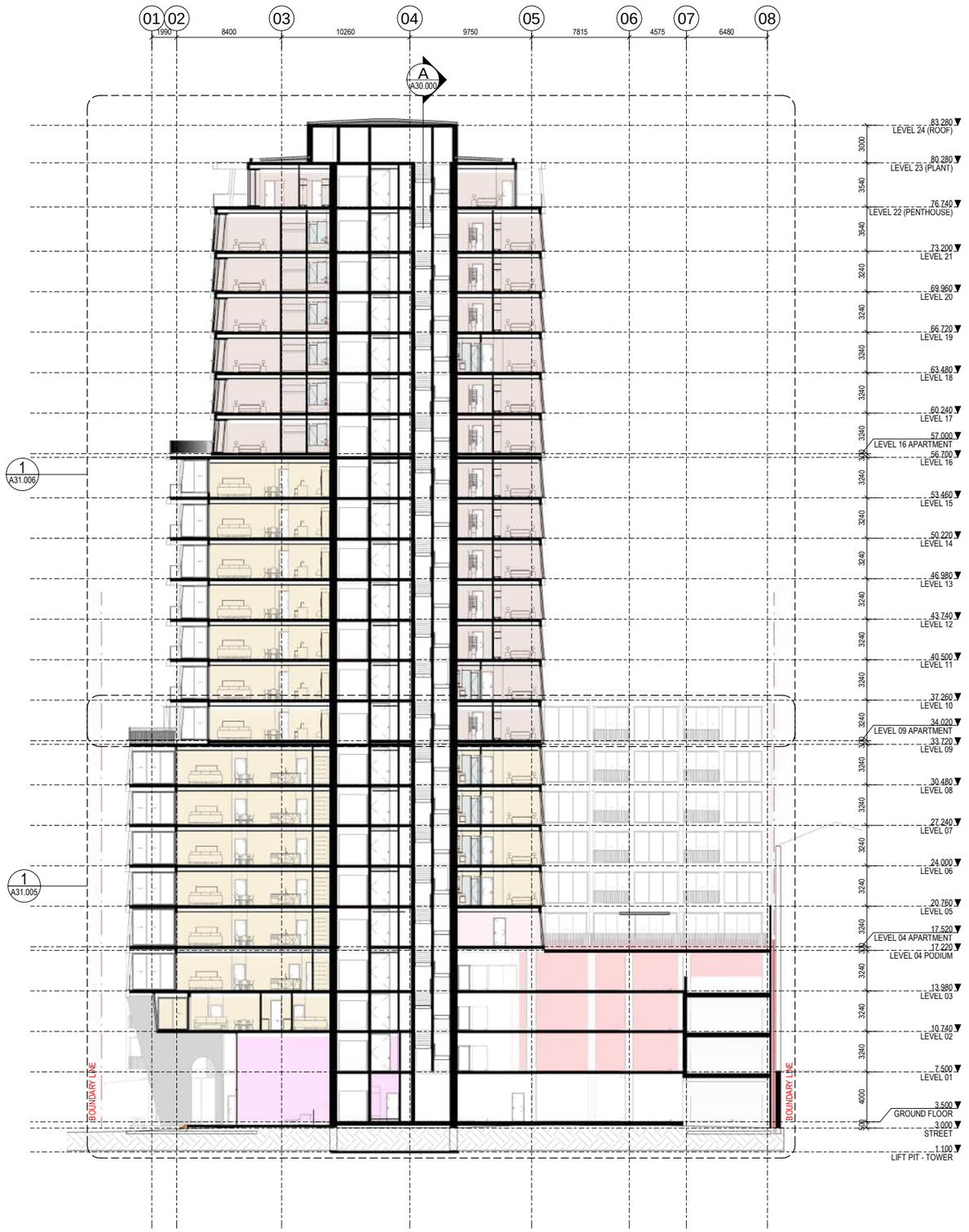
Drawing Details

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Date	10/17/2025 12:17:34 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A30.001

Revision A

WARREN AND MAHONEY



C
A10.000 Section C-C - GRID K LOOKING EAST

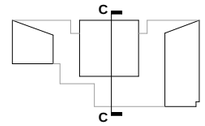
1 : 200

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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes



KEY ELEVATION

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

SECTION C-C

Drawing Status

50% PRELIMINARY DESIGN

Drawing Details

Scale	1 : 200@ A1
Date	10/17/2025 12:17:45 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A30.002 **Revision** A

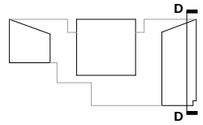
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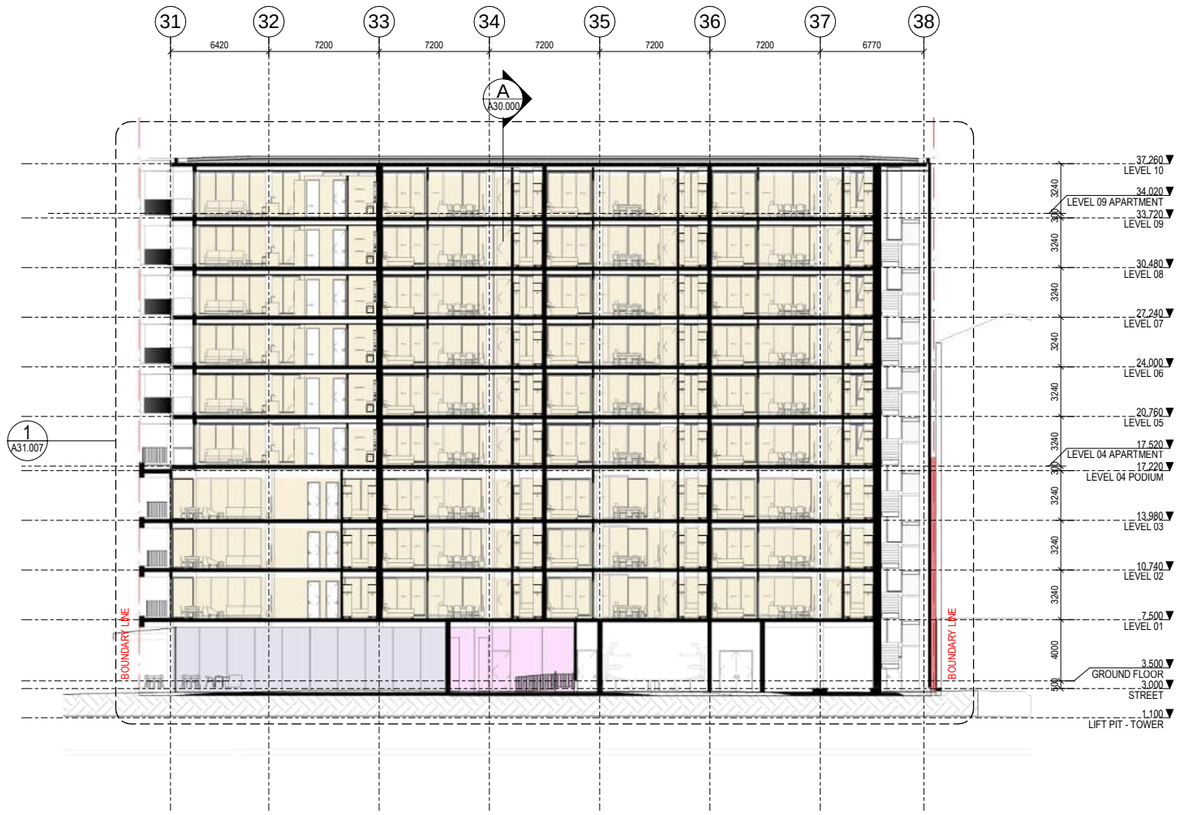
Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes



KEY ELEVATION



D
A10.000 Section D-D - GRID S LOOKING EAST

1 : 200

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

SECTION D-D

Drawing Status

50% PRELIMINARY DESIGN

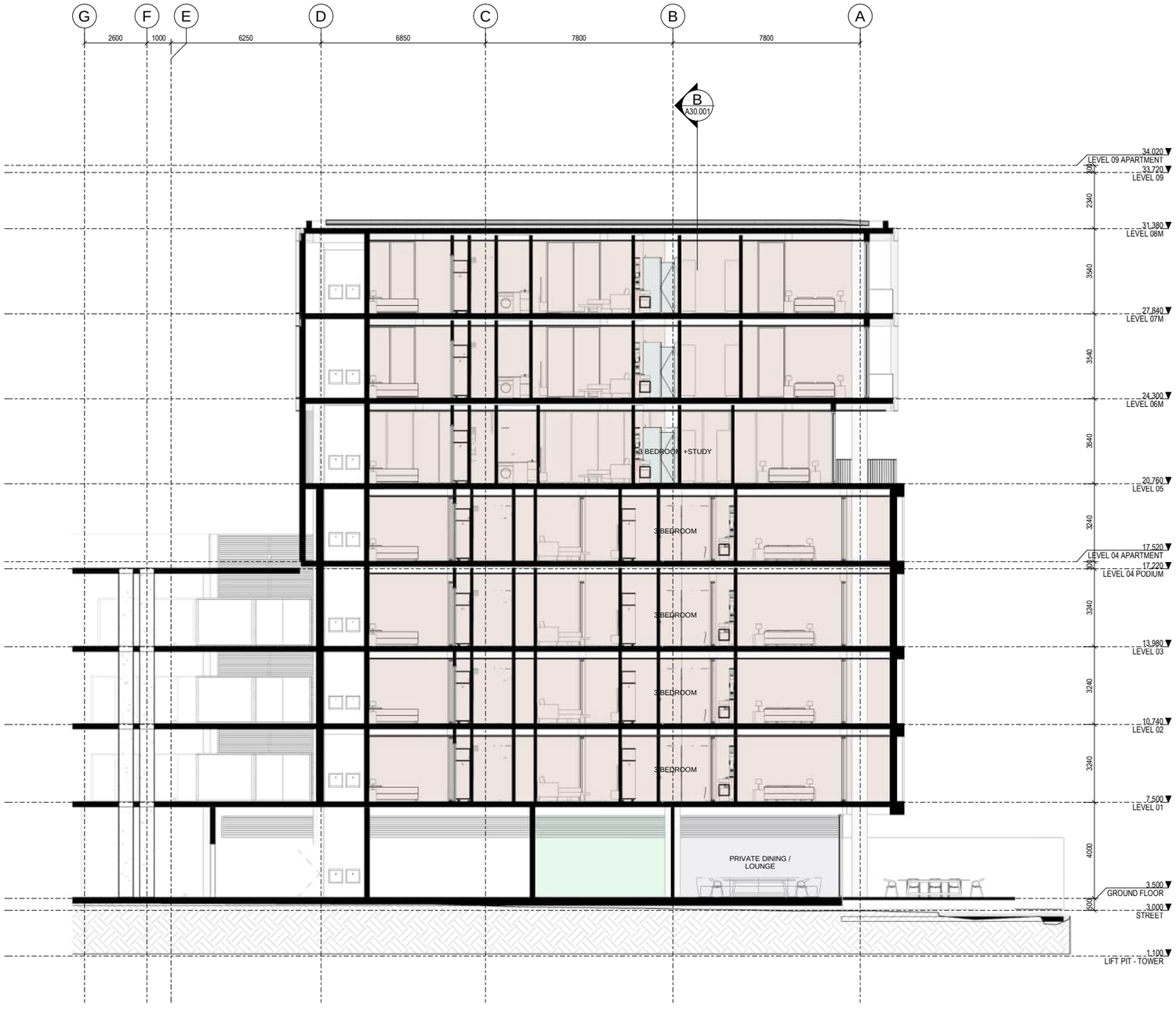
Drawing Details

Scale	1 : 200@ A1
Date	10/17/2025 12:17:50 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A30.003

Revision A

WARREN AND MAHONEY



1 A30.000 MARINA PART SECTION - GRID 4 LOOKING SOUTH

1 : 100

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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

PART SECTION 01

Drawing Status

50% PRELIMINARY DESIGN

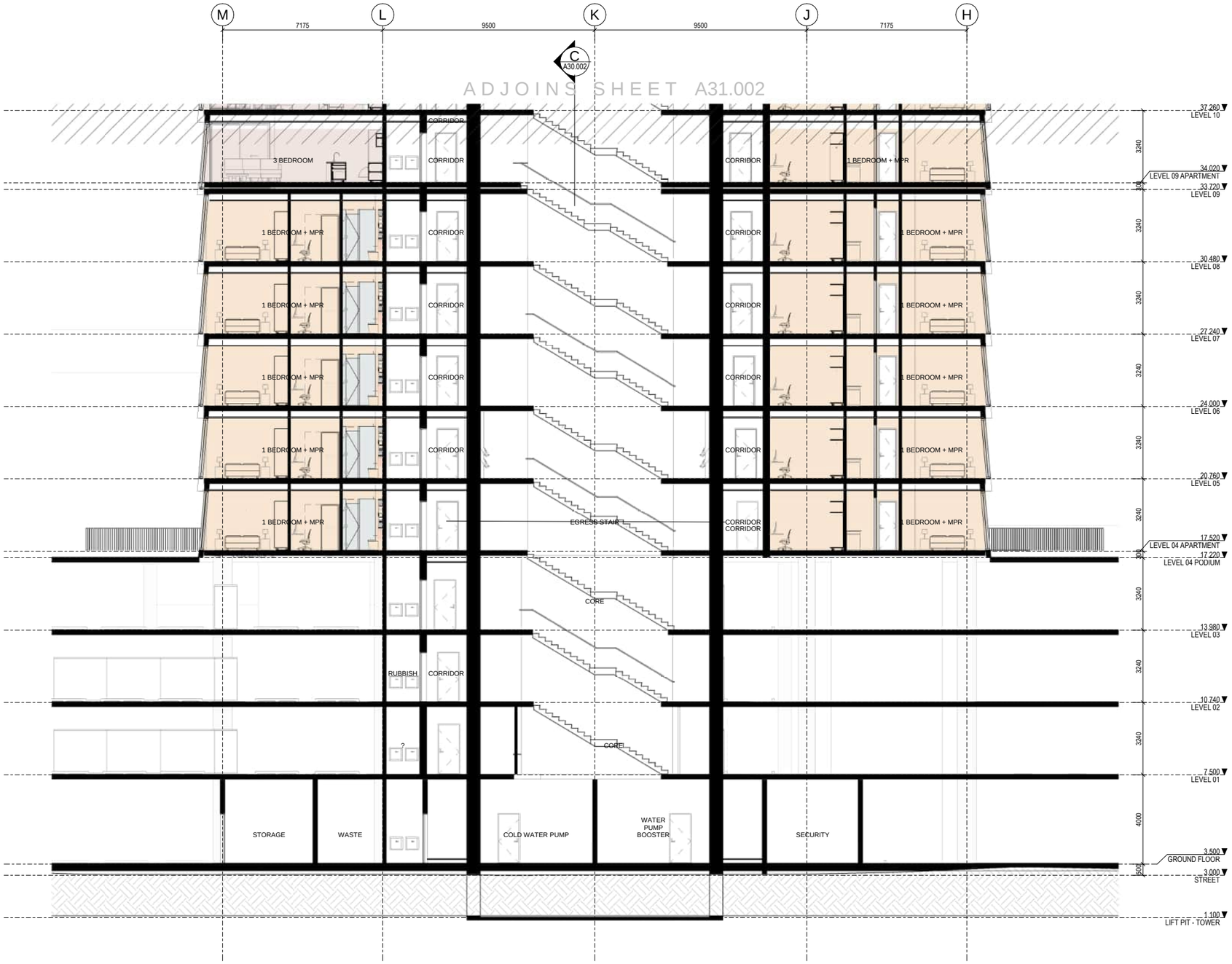
Drawing Details

Scale	1 : 100@ A1
Date	10/17/2025 12:18:08 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A31.000

Revision A

WARREN AND MAHONEY



1 A30.000 TOWER PART SECTION - GRID 4 LOOKING SOUTH (LEVEL G-8)

1 : 100

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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

PART SECTION 02

Drawing Status

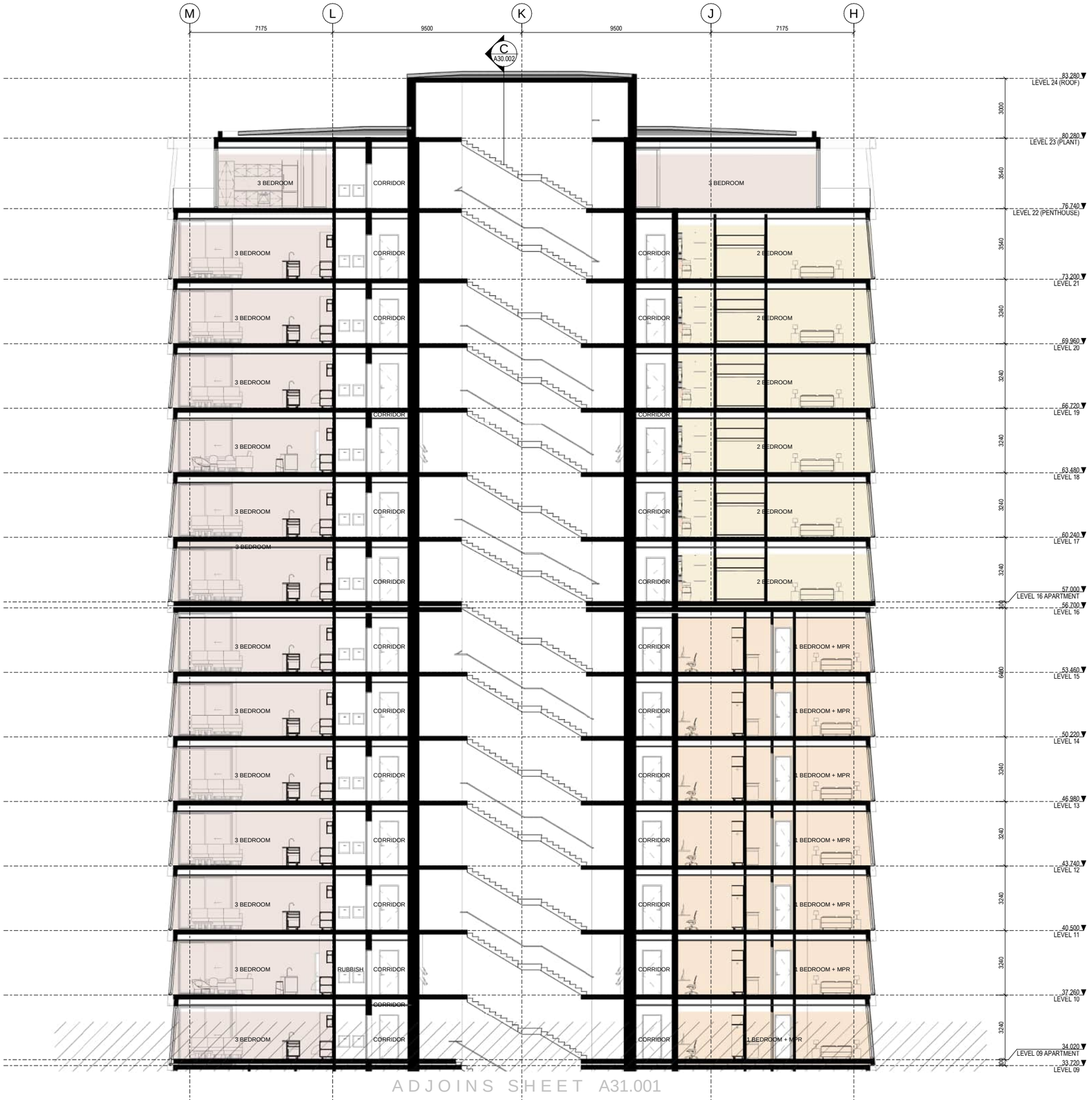
50% PRELIMINARY DESIGN

Drawing Details

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Date	10/17/2025 12:18:29 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A31.001 **Revision** A

WARREN AND MAHONEY



1 / A30.000 TOWER PART SECTION - GRID 4 LOOKING SOUTH (LEVEL 9-24)

1 : 100

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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

PART SECTION 03

Drawing Status

50% PRELIMINARY DESIGN

Drawing Details

Scale	1 : 100@ A1
Date	10/17/2025 12:18:56 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A31.002 **Revision** A

WARREN AND MAHONEY



1 BEUMONT PART SECTION - GRID 4 LOOKING SOUTH
A30.000 1 : 100

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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

PART SECTION 04

Drawing Status

50% PRELIMINARY DESIGN

Drawing Details

Scale	1 : 100@ A1
Date	17/10/2025 2:31:39 pm
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A31.003 **Revision** A

WARREN AND MAHONEY



1 A30.001 MARINA PART SECTION - GRID B LOOKING EAST

1 : 100

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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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New Zealand
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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

PART SECTION 05

Drawing Status

50% PRELIMINARY DESIGN

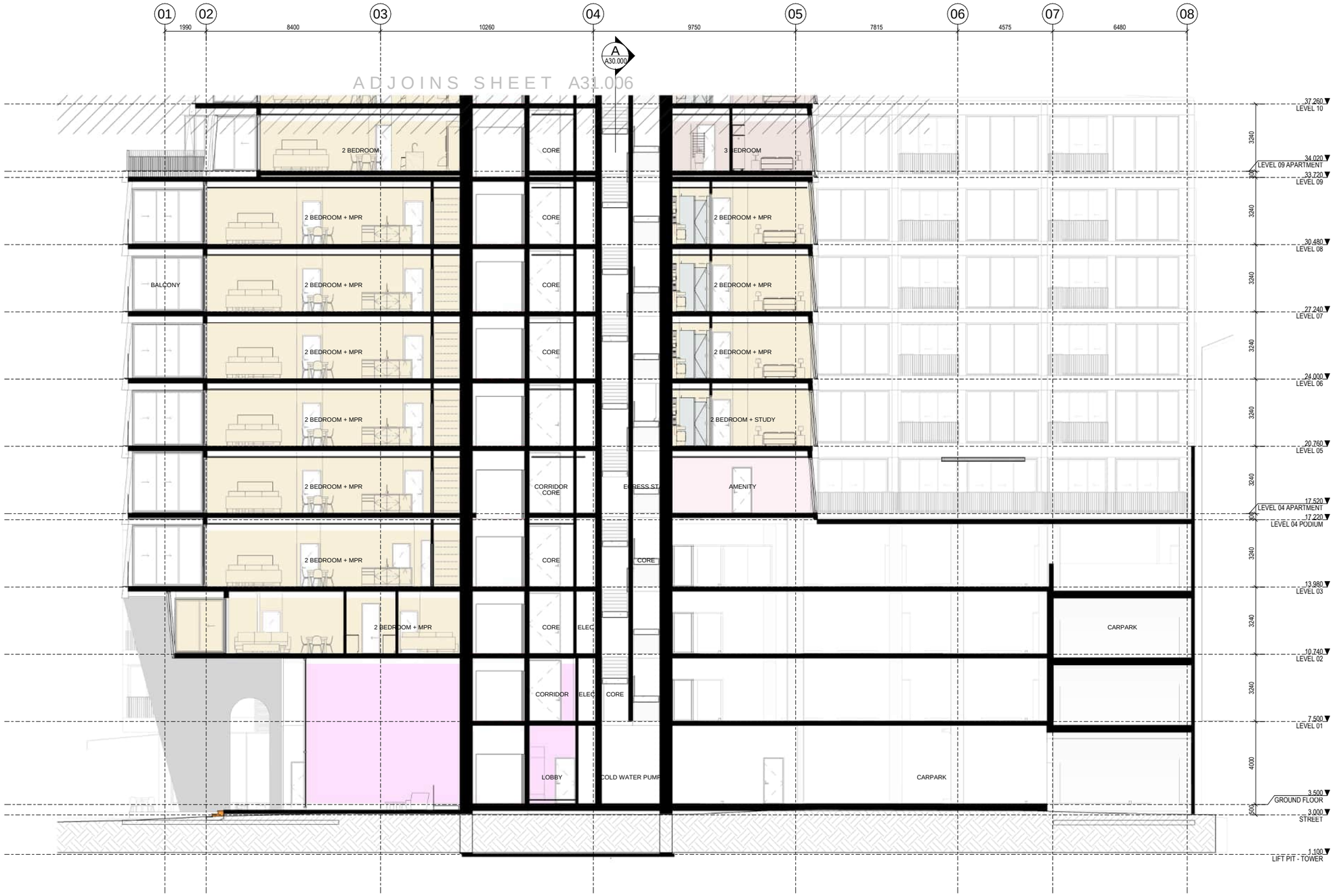
Drawing Details

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Date	10/17/2025 12:19:38 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A31.004

Revision A

WARREN AND MAHONEY



1
A30.002

TOWER PART SECTION - GRID K LOOKING EAST (LEVEL G-8)

1 : 100

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Revisions

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Notes

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

PART SECTION 06

Drawing Status

50% PRELIMINARY DESIGN

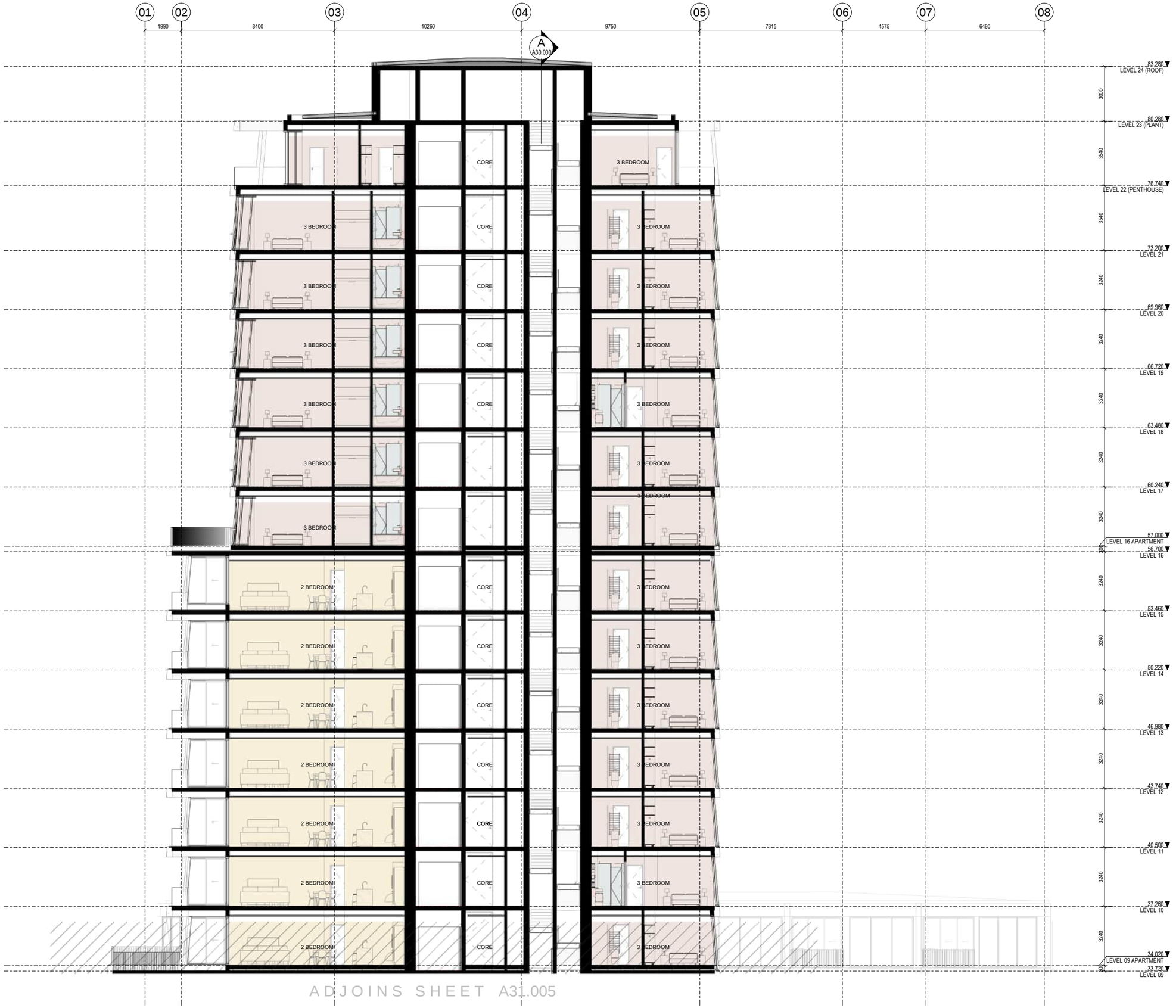
Drawing Details

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Date	10/17/2025 12:19:55 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A31.005

Revision A

WARREN AND MAHONEY



1
A30.002

TOWER PART SECTION - GRID K LOOKING EAST (LEVEL 9-24)

1 : 100

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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

PART SECTION 07

Drawing Status

50% PRELIMINARY DESIGN

Drawing Details

Scale	1 : 100@ A1
Date	10/17/2025 12:20:08 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A31.006

Revision A

WARREN AND MAHONEY



1 A30.003 BEAUMONT PART SECTION - GRID S LOOKING EAST

1 : 100

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Revisions

A	17/10/2025	50% PRELIMINARY DESIGN

Notes

Consultants

AECOM
Project Manager

ROBERT BIRD GROUP
Structural Engineer

NDY
Mechanical Engineer

JENSEN HUGHES
Fire Engineer

NDY
Electrical Engineer

Client

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New Zealand
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Registered Architects and Designers
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Project Title

188 BEAUMONT STREET
WYNYARD QUARTER

Drawing Title

PART SECTION 08

Drawing Status

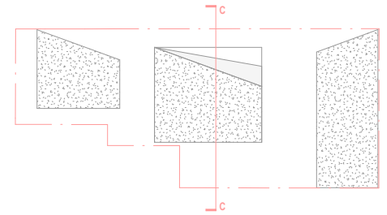
50% PRELIMINARY DESIGN

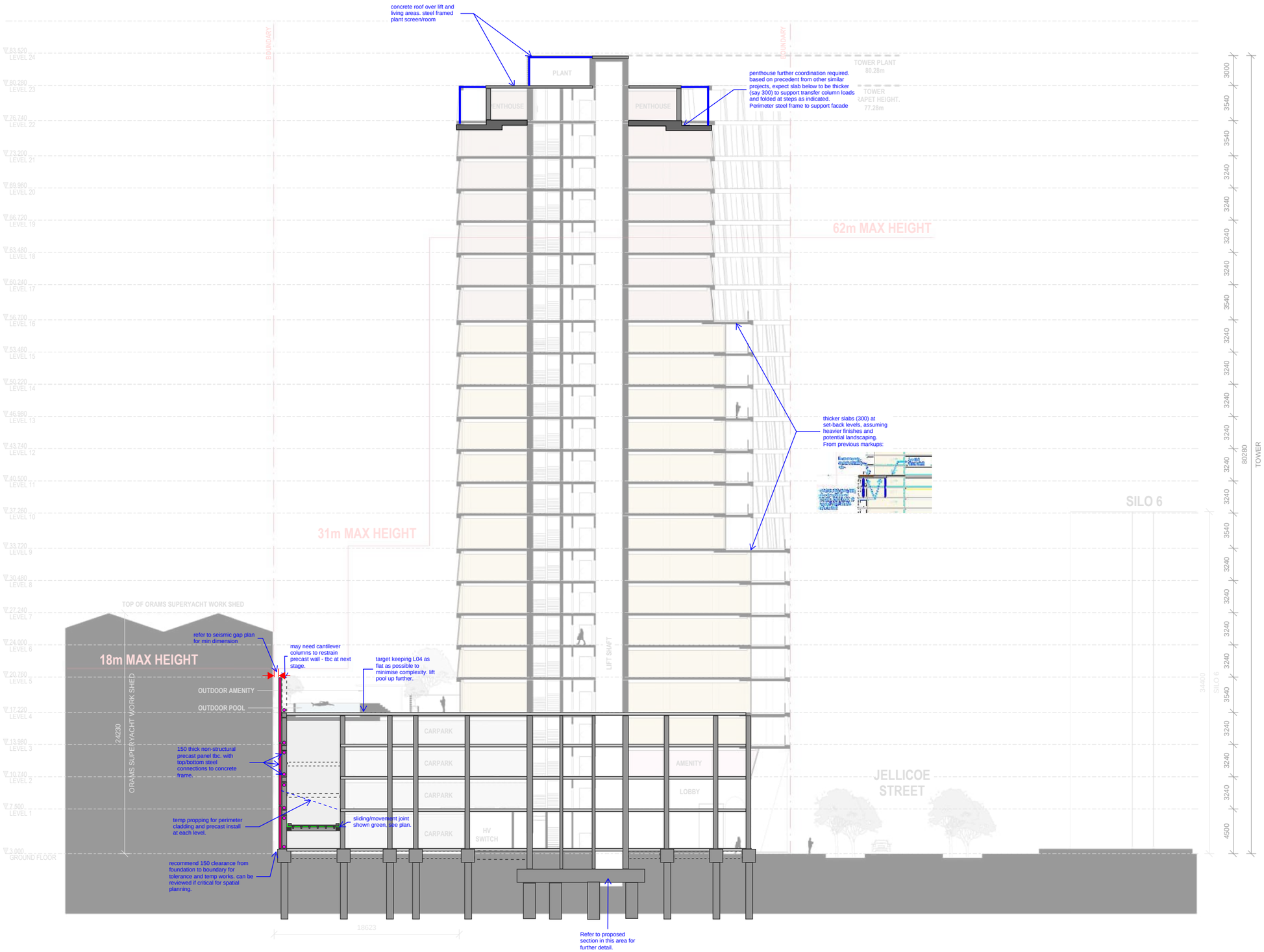
Drawing Details

Scale	1 : 100@ A1
Date	10/17/2025 12:20:19 PM
Job No	10442
Drawn	WAM
Checked	WAM

Drawing No A31.007 **Revision** A

WARREN AND MAHONEY





LEGEND

- 1 BEDROOM
- 2 BEDROOM
- 3 BEDROOM

Do not scale. The copyright of this drawing remains with Warren and Mahoney Architects New Zealand Ltd.

Drawing Status

—

Drawing Details

—

Scale	As indicated@ A1
Date	
Job No	10442
Drawn	Author
Checked	Checker
Drawing No	Revision

RobertBirdGroup
Member of the Surbana Jurong Group

WARREN AND MAHONEY

Typical Section

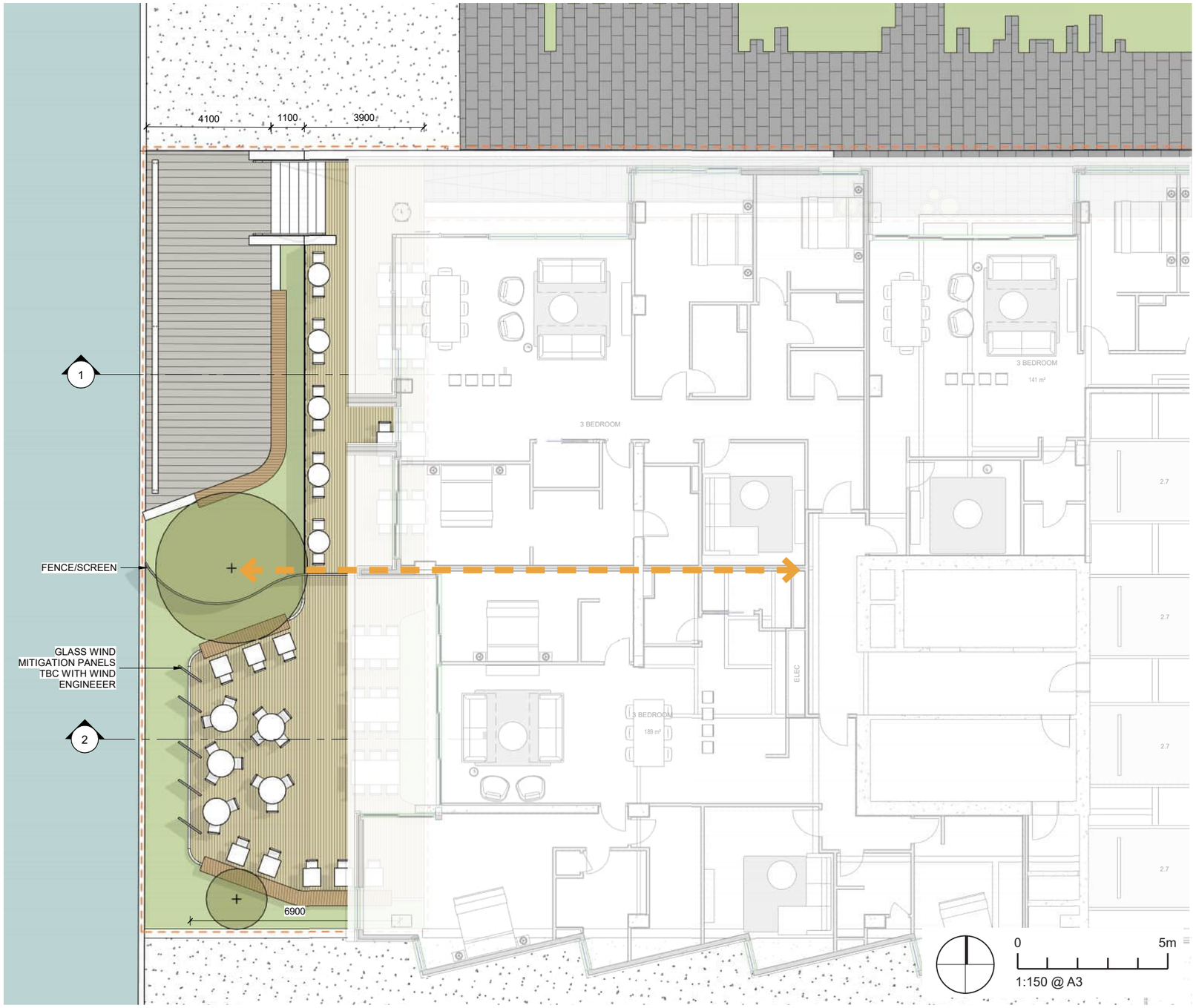
MARINA PLAN - LEVEL 01

DRAFT

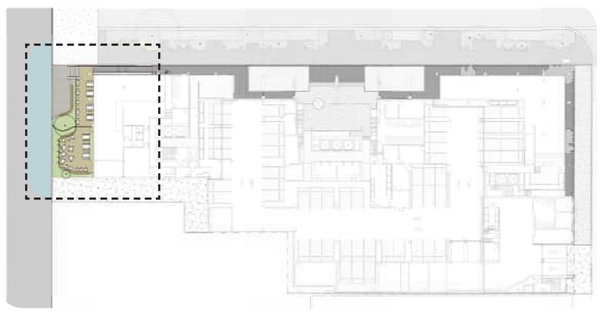
PŌHUTUKAWA ANCHOR TREE

The central feature tree serves as an anchor to the coastal edge, acting as a focal point for the public realm while providing a natural divider between the public waterfront and the private dining space. Its position aligns with the internal architectural layout and sits on the wall that separates the two apartments, enabling both residences to enjoy clear views toward the marina.

The tree will be trained to maintain a low height and compact form. Periodic pruning of internal branches will reduce canopy density, allowing dappled light to reach the planting below while preserving sightlines and maintaining a tidy, sculpted structure.



KEYPLAN

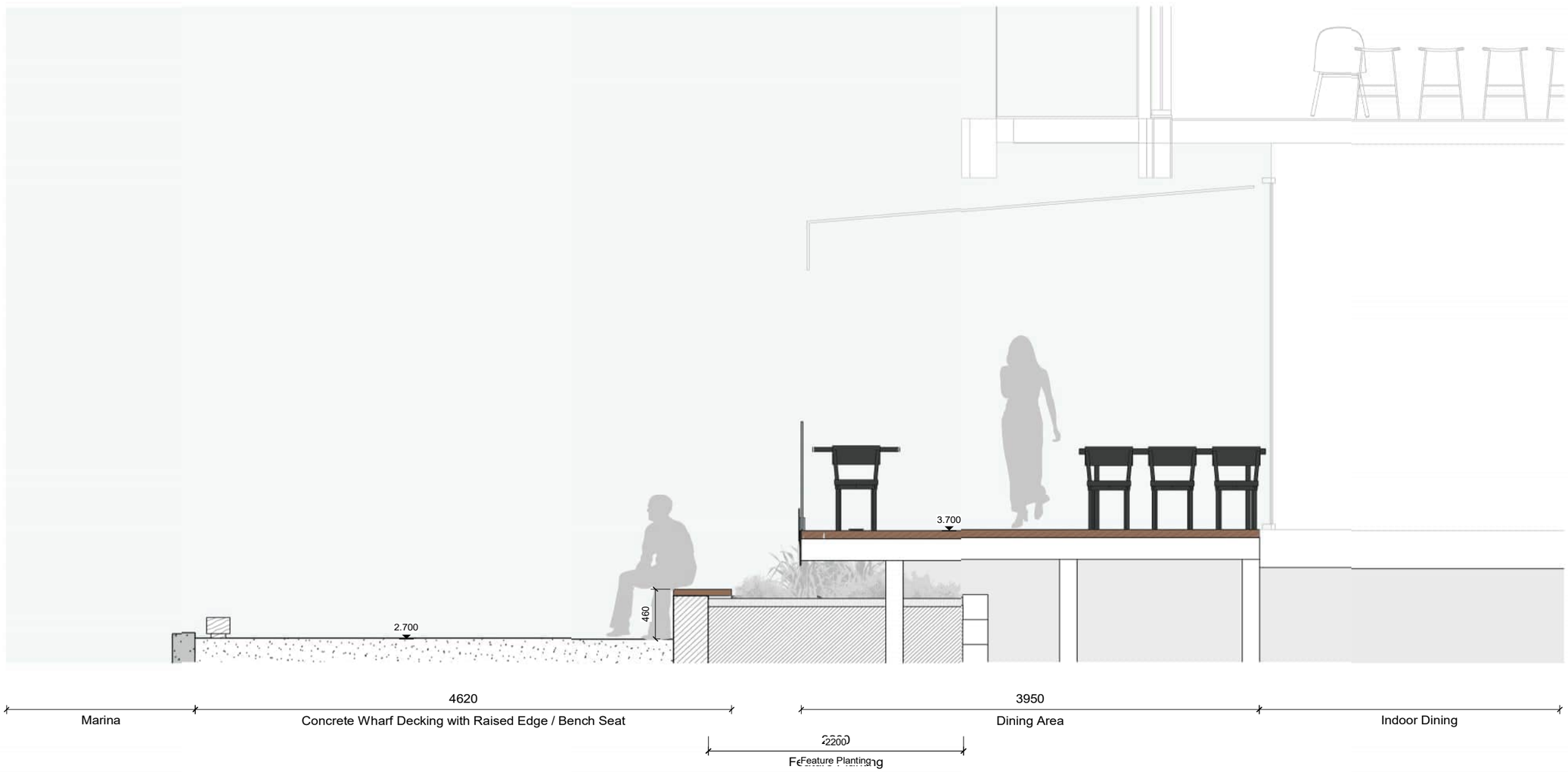


DRAFT

MARINA SECTION 01

0 1m

1:40 @ A3

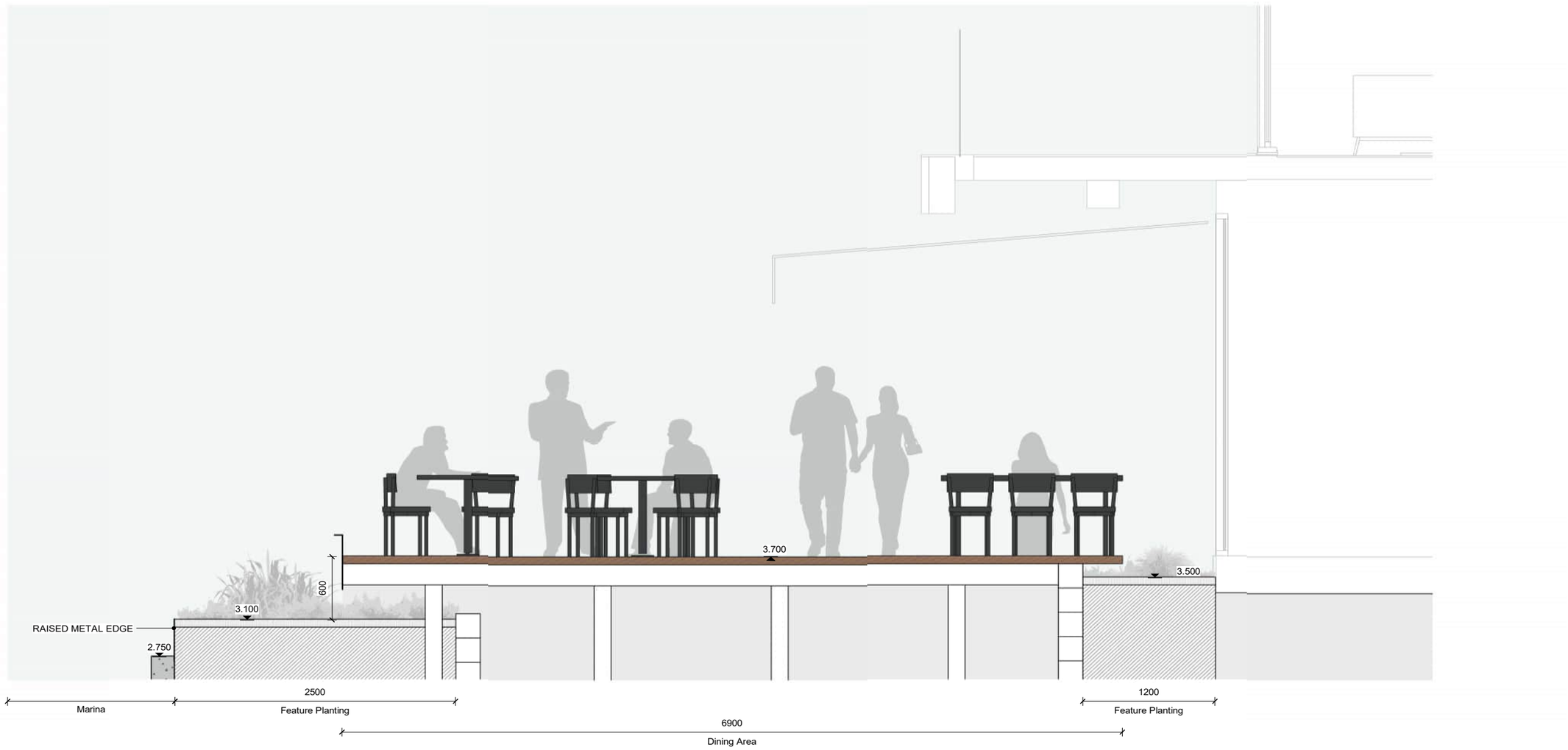


MASTERPLAN | TITLE OF PROJECT | DATE

MARINA SECTION 02

0 1m

1:40 @ A3



MASTERPLAN | TITLE OF PROJECT | DATE

Appendix B. Existing contamination data

COPYRIGHT ON THIS FIGURE IS RESERVED DO NOT SCALE FROM THIS FIGURE - IF IN DOUBT, ASK.

C:\12dSynergy\data\ALBTCAD\Orams Expansion Facility_166\CAD\FIG\30881-CONT-F11A.dwg 2018-Nov-02 3:31:48 PM Plotted By: MARK ENNION

GBH109P	mg/L
CN	0.03
1,2 DCE	18.8
TETRACHLOROETHENE PCE	7.6
TCE	9.2
VC	5.4*
CUMENE	0.042

CBH204P	mg/L
CN	0.029
ETHYLBENZENE	0.007
CUMENE	0.29

CBH203P	mg/L
CN	0.025

GBH111	mg/L
CN	0.03

MW4 (AUG.2018)	mg/L
Cu	0.098
Zn	0.141

CBH206P	mg/L
CN	0.154
BENZENE	0.87
1,2 DCE	11.047
VC	3.7
CUMENE	0.87
NAPTHALENE	0.125
ETHYLBENZENE	0.39
TOLUENE	0.76
M&P XYLENE	0.28
ANTHRACENE	0.00051
PHENANTHRENE	0.0027

EXISTING WELL 1	mg/L
CUMENE	0.058

CBH205P	mg/L
CN	0.015
ANTHRACENE	0.00029
PHENANTHRENE	0.0012

CBH202P	mg/L
CN	0.2
ANTHRACENE	0.0005
BAP	0.0004
PHENANTHRENE	0.007

GBH104P	mg/L
ANTHRACENE	0.0008
FLUORANTHENE	0.00159
PHENANTHRENE	0.0041

MW2 (AUG.2018)	mg/L
Cu	0.65
Zn	5.4

CBH208P	mg/L
CN	0.015

CBH207P	mg/L
CUMENE	0.082

GBH106P	mg/L
ANTHRACENE	0.00016
PHENANTHRENE	0.0013

CBH209P	mg/L
CN	0.095
CUMENE	0.164
ANTHRACENE	0.00064
FLUORANTHENE	0.00123
PHENANTHRENE	0.0024

GBH103P	mg/L
CUMENE	0.134

GBH107P	mg/L
CN	0.023

SS01, SS02, SS03, SS04, SS05, SS06, GBH303, GBH304, GBH302, GBH301, GBH101, GBH109P, BH03, BH02, BH01, BH3/MW3, MW1, BH4, BH6/MW4, BH5, BH2/MW2, BH1, BH7, BH8, BH10, BH9/MW1, TP103, TP102, TP101, VMP10, VMP14, VMP23, VMP29, CBH206P, CBH205P, CBH204P, CBH203P, CBH202P, CBH201P, CBH208P, CBH207P, CBH209P, GBH104P, GBH106P, GBH108P, GBH110P, GBH107P, GBH105, GBH103P, GBH102P, VP2, VP3, VP4, VP5, VP6, SITE 18, CURRENT ORAMS FACILITY, NEW BUILDING 1A, NEW BUILDING 1B, NEW BUILDING 2, JELLICOE STREET, BEAUMONT STREET

A3 SCALE 1:1000

0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

LEGEND

- SITE EXTENT
- BOUNDARY
- SHALLOW PIEZOMETER
- 6-8m PIEZOMETER
- VP — 2018 VAPOUR MONITORING POINT
- VMP — 2012 VAPOUR MONITORING POINT

GEOTECHNICAL INVESTIGATION:

- GBH302 — BOREHOLE LOCATION
- GBH102P — BOREHOLE WITH PIEZOMETER
- TP102 — TEST PIT LOCATION

CONTAMINATION INVESTIGATION:

- CBH206P — BOREHOLE WITH PIEZOMETER LOCATION
- SS01 — SURFACE SAMPLE

PREVIOUS INVESTIGATION:

- 90-BH1 — BOREHOLE LOCATION BY T+T
- BH03 — BOREHOLE LOCATION BY OTHERS

RESULTS EXCEEDS THE AUSTRALIAN AND NEW ZEALAND WATER QUALITY GUIDELINES

NOTES:

1. AERIAL PHOTO SOURCED FROM AUCKLAND COUNCIL GEOMAPS, LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 3.0 NEW ZEALAND LICENCE (CC BY 3.0).
2. ALL SEABED ARE IN CHART DATUM UNLESS NOTED OTHERWISE.
3. ALL LEVELS ON THE LAND ARE IN COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. NEW ZEALAND VERTICAL 2016.
4. PROPOSED BUILDING OUTLINE PROVIDED BY RTA STUDIO, REF. "18122 - Site 18_RC01_SK-010 - SITE PLAN_WIP.dwg" DATED 2/07/2018.

Tonkin+Taylor

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PROJECT No.	30881.2000	
DESIGNED	LKH	Aug. 18
DRAWN	JC	Aug. 18
CHECKED	AMM	Nov.18
APPROVED	WMW	Nov.18

CLIENT **ORAMS MARINE**

PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
CONCENTRATIONS IN GROUNDWATER - EXCEEDANCES OF WATER QUALTY GUIDELINES

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 11A REV 2

All samples pertain to current site area

Table 9.5 **Soil sampling results - Site 18 (area of proposed apartment only) (mg/kg)**

Sample ID	AUP Discharge Criteria [0]	NES Soil human health criteria for commercial / industrial land use [1]	NES Soil human health criteria for high-density residential land use [1b]	Inhalation pathway [7] (outdoor)	Inhalation pathway [7] (indoor)	Non-volcanic Background [3]	Max	CBH201	CBH201	CBH201	CBH209	CBH209	GBH102	GBH102	GBH102	GBH103	GBH103	GBH103	GBH103	Beca BH1	Beca BH1	Beca BH1	Beca BH1	Beca BH1	Beca BH1	Beca BH1
Depth (m)								0.7 - 1.0	2.1 - 2.6	5.0 - 5.2	0.2 - 0.6	1.4 - 1.9	0.8 - 1.0	2.4 - 2.5	5.0 - 5.1	0.15-0.25	1.3 - 1.55	4.1 - 4.5	5.45 - 5.7	0.3	2.5-2.75	4	4 (dup)	5.2	7	9
Date								6/07/2018	6/07/2018	6/07/2018	3/07/2018	3/07/2018	11/07/2018	11/07/2018	11/07/2018	4/07/2018	4/07/2018	4/07/2018	4/07/2018	15/12/2011	15/12/2011	15/12/2011	16/12/2011	15/12/2011	15/12/2011	15/12/2011
Lab ID								2011994.3	2011994.9	2011994.14	2009906.1	2009906.3	2013973.23	2013973.18	2013973.2	2010645.3	2010644.26	2010644.23	2010644.22	-	-	-	-	-	-	-
Geological unit								Fill - silty gravel	Fill - sand with minor gravel	Fill - clayey silt	Fill - silty gravel	Fill - gravelly sand	Fill - gravelly sand	Fill - Sandy silt, shells	Tauranga Group Clay	Fill - sandy gravel	Fill - sandy silt	Fill - sandy silt, gravel, shells	Fill - sandy silt, gravel, shells	-	-	-	-	-	-	-
Metals and metaloids (totals)																										
Arsenic	100	70	45	-	-	12	13	< 2	6	-	6	6	7	5	-	-	6	6	-	5	6	10	13	7	10	< 2
Cadmium	7.5	1,300	230	-	-	0.65	4.2	< 0.10	< 0.10	-	0.12	< 0.10	0.26	< 0.2	-	-	< 0.10	< 0.10	-	0.21	0.21	4.2	1.0	0.36	< 0.10	< 0.10
Chromium	400	NL	NL	-	-	55	57	34	10	-	23	5	23	5	-	-	4	16	-	19	29	57	57	19	20	7
Copper	325	NL	NL	-	-	45	**480**	44	17	-	41	5	69	< 4	-	-	2	15	-	64	66	220	480	29	4	5
Lead	250	3,300	500	-	-	65	**400**	4.2	88	-	135	23	**400**	12.9	-	-	32	19.8	-	146	97	97	112	42	6.7	5
Mercury	0.75	4,200	1,000	-	-	0.45	0.59	< 0.10	0.1	-	0.26	< 0.10	0.59	< 0.2	-	-	< 0.10	0.55	-	-	-	-	-	-	-	-
Nickel	105	6,000 [4]	1,200 [4b]	-	-	35	**143**	**143**	19	-	67	6	58	< 4	-	-	5	12	-	48	29	132	101	45	7	3
Zinc	400	400,000 [4]	60,000 [4b]	-	-	180	280	38	76	-	137	25	280	21	-	-	20	58	-	270	87	260	260	79	34	9
Total Cyanide	0.9 [10]	1,500 [4]	300 [4b]	-	-	<LOR	0.19	-	-	-	-	-	-	-	-	-	-	-	-	0.19	0.19	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Tributyltin																										
Dibutyltin	-	250 [5]	19 [5b]	-	-	<LOR	0	< 0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monobutyltin	-	-	-	-	-	<LOR	0	< 0.007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tributyltin	-	250 [5]	19 [5b]	-	-	<LOR	0	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triphenyltin	-	-	-	-	-	<LOR	0	< 0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos																										
FA/AF % (weight/weight)	-	0.001% [6]	0.001% [6b]	-	-	<LOR	0	ND	-	-	<0.001	-	<0.001	-	-	ND	-	-	-	-	-	-	-	-	-	-
ACM % (weight/weight)	-	0.05% [6]	0.04% [6b]	-	-	<LOR	0	ND	-	-	ND	-	ND	-	-	ND	-	-	-	-	-	-	-	-	-	-
Asbestos form	-	-	-	-	-	-		ND	-	-	Chrysotile, loose fibres	-	Chrysotile, loose fibres	-	-	ND	-	-	-	-	-	-	-	-	-	-
Polyaromatic Hydrocarbons																										
1-Methylnaphthalene	-	730 [5]	180 [5b]	-	-	<LOR	23	< 0.011	8.6	-	0.081	22	0.071	7.7	-	-	23	0.02	-							
2-Methylnaphthalene	-	3000 [5]	240 [5b]	-	-	<LOR	12.2	< 0.011	12.2	-	0.104	1.69	0.075	7.9	-	-	7.1	< 0.013	-	< 0.7	< 0.9	< 1.0	5.7	< 0.9	< 0.9	< 0.8
Perylene						<LOR	0.07	< 0.011	< 0.012	-	0.069	0.06	0.034	< 0.013	-	-	0.03	0.07	-							
Benzo[a]pyrene Potency Equivaler	-	-	-	-	-	<LOR	340.9	< 0.03	0.08	-	0.22	0.19	0.22	0.03	-	-	0.26	0.23	-	< 3.3	< 8.5	< 22.5	340.9	< 3.2	< 3.2	< 3
Benzo[a]pyrene Toxic Equivalence	-	35	24	-	-	<LOR	0.26	< 0.03	0.08	-	0.22	0.19	0.22	0.03	-	-	0.26	0.23	-							
Acenaphthylene	-	-	-	-	-	<LOR	4.4	< 0.011	0.187	-	0.034	0.41	0.021	< 0.013	-	-	0.53	< 0.013	-	< 0.7	< 0.9	4.4	1.4	< 0.9	< 0.9	< 0.8
Acenaphthene	-	-	-	-	-	<LOR	43	< 0.011	0.43	-	< 0.012	1.07	< 0.014	0.158	-	-	1.56	< 0.013	-	< 0.7	< 0.9	< 1.0	43	< 0.9	< 0.9	< 0.8
Anthracene	-	-	-	-	-	<LOR	166	< 0.011	0.058	-	0.016	0.24	0.03	< 0.013	-	-	0.4	0.018	-	< 0.7	1.3	12.7	166	< 0.9	< 0.9	< 0.8
Benzo[a]anthracene	-	-	-	-	-	<LOR	200	< 0.011	0.038	-	0.098	0.125	0.102	0.014	-	-	0.22	0.129	-	0.9	4.3	13.3	200	< 0.9	< 0.9	< 0.8
Benzo[a]pyrene (BAP)	20	35	24	NL	1000 (surface); NL (1-4m); NL (>4m)	<LOR	**132**	< 0.011	0.058	-	0.162	0.132	0.148	0.027	-	-	0.192	0.179	-	< 1.4	3.7	8.7	**132**	< 1.7	< 1.7	< 1.6
Benzo[b]fluoranthene + Benzo[j]fl	-	-	-	-	-	<LOR	126	< 0.011	0.054	-	0.21	0.157	0.139	0.019	-	-	0.22	0.196	-	< 1.4	3.4	8.3	126	< 1.7	< 1.7	< 1.6
Benzo[e]pyrene		-	-	-	-		0.166	< 0.011	0.025	-	0.157	0.166	0.091	< 0.013	-	-	0.165	0.126	-							
Benzo[g,h,i]perylene	-	-	-	-	-	<LOR	75	< 0.011	0.033	-	0.188	0.188	0.153	0.013	-	-	0.126	0.104	-	< 1.4	2.6	6.1	75	< 1.7	< 1.7	< 1.6
Benzo[k]fluoranthene	-	-	-	-	-	<LOR	60	< 0.011	0.019	-	0.059	0.045	0.055	< 0.013	-	-	0.08	0.055	-	< 1.4	2	5.1	60	< 1.7	< 1.7	< 1.6
Chrysene	-	-	-	-	-	<LOR	156	< 0.011	0.02	-	0.107	0.07	0.1	< 0.013	-	-	0.137	0.129	-	1	3.5	10.2	156	< 0.9	< 0.9	< 0.8
Dibenzo[a,h]anthracene	-	-	-	-	-	<LOR	20	< 0.011	< 0.012	-	< 0.012	< 0.013	0.02	< 0.013	-	-	< 0.012	< 0.013	-	< 1.4	< 1.7	< 1.9	20	< 1.7	< 1.7	< 1.6
Fluoranthene	-	-	-	-	-	<LOR	480	< 0.011	0.134	-	0.2	0.5	0.22	0.064	-	-	0.79	0.27	-	2.3	9.1	34	480	< 0.9	< 0.9	< 0.8
Fluorene	-	-	-	-	-	<LOR	53	< 0.011	0.74	-	< 0.012	1.36	0.016	0.45	-	-	1.92	< 0.013	-	< 0.7	< 0.9	5.3	53	< 0.9	< 0.9	< 0.8
Indeno(1,2,3-c,d)pyrene	-	-	-	-	-	<LOR	72	< 0.011	0.029	-	0.157	0.13	0.148	0.015	-	-	0.108	0.112	-	< 1.4	1.8	4.1	72	< 1.7	< 1.7	< 1.6
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [8]	63 (surface); 83 (1-4m); (130) (>4m) [8]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LOR	**11.3**	< 0.06	**0.85**	-	< 0.06	**2.4**	< 0.07	0.32	-	-	< 0.06	< 0.07	-	< 0.7	< 0.9	1.3	**11.3**	< 0.9	< 0.9	< 0.8
Phenanthrene	-	-	-	-	-	<LOR	370	< 0.011	0.64	-	0.072	1.47	0.108	0.48	-	-	2.1	0.059	-	1.4	2.8	31	370	< 0.9	< 0.9	< 0.8
Pyrene	7.9 [7]	NL [8]	(1,600) (surface); NL (1-4m); NL (>4m) [9]	NL	NL	<LOR	**420**	< 0.011	0.16	-	0.24	0.65	0.22	0.078	-	-	1.15	0.39	-	2.6	10.4	31	**420**	< 0.9	< 0.9	< 0.8
Polychlorinated Biphenyls							0																			
Total PCB (Sum of 35 congeners)	1.2 [1]	1.2	0.33	-	-	<LOR	0	< 0.4	-	-	-	-	-	-	-	-	< 0.4	-	-							
Total Petroleum Hydrocarbons																										
C7 - C9	(5,200) [7]	(500) (surface); (500) (1-4m); (12,000) (>4m) [8]	(500) (surface); (500) (1-4m); (3,800) (>4m) [9]	5,200 (surface); 9,800 (1-4m); 12,000 (>4m)	NL	<LOR	2200	< 8	670	< 10	< 8	2,200	< 8	1,500	< 9	-	510	< 8	-	< 9	< 11	750	400	< 19	< 11	< 10
C10 - C14	(9,200) [7]	(1,700) (surface); (2,200) (1-4m); (3,400) (>4m) [8]	(510) (surface); (670) (1-4m); (1,000 (>4m) [9]	7,800 (surface); 10,000 (1-4m); 16,000 (>4m)	NL	<LOR	6200	< 20	1,690	< 20	58	5,500	35	1,500	< 20	-	6,200	< 20	-	< 20	< 30	2,100	2,100	< 40	< 30	< 20
C15 - C36	NL [7]	NL [8]	NL [9]	NL	NL	<LOR	17100	< 40	1,010	< 40	360	2,900	780	790	< 40	-	3,800	< 40	-	45	< 50	17,100	5,800	< 80	< 50	< 40
Total hydrocarbons (C7 - C36)	-	-	-	-	-	<LOR	20000	< 70	3,400	< 70	420	10,600	810	3,800	< 70	-	10,500	< 70	-	< 70	< 80	20,000	8,800	< 140	< 80	< 70
Suspected Product									Weathered Diesel and Mono aromatic hydrocarbons		Weathered Diesel/Heavy End	Weathered Turpentine/Petrol/Kerosene	Weathered Fuel Oil/Lube Oil	Weathered Petrol/Turpentine		-	Weathered Turpentine/Diesel/Heavy End									
BTEX in VOC																										
Benzene	0.029 [7]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m) [8]	1.1 (surface); 1.9 (1-4m); 2.4 (>4m) [9]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m)	480 (surface); 610 (1-4m); 860 (>4m)	<LOR	**0.6**	-	**0.6**	< 0.3	-	< 0.19	< 0.3	< 0.19	< 0.3	-	-	< 0.19	< 0.4	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
Ethylbenzene	7.2 [7]	(200) (surface); (300) (1-4m); (450) (>4m) [8]	(59) (surface); (92) (1-4m); (140) (>4m) [9]	200 (surface); 300 (1-4m); 450 (>4m)	6,200 (surface); NL (1-4m); NL (>4m)	<LOR	0.4	-	0.4	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 0.8	< 1.1	< 12	< 10	< 1.1	< 1.1	< 1.0
Toluene	6.0 [7]	(270) (surface); (480) (1-4m); (790) (>4m) [8]	(82) (surface); (170) (1-4m); (240) (>4m) [9]	270 (surface); 550 (1-4m); 790 (>4m)	NL	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
m&p-Xylene	3.7 [7]	(200) (surface); (420) (1-4m); (590) (>4m) [8]	(59) (surface); (130) (1-4m); (180) (>4m) [9]	200 (surface); 420 (1-4m); 590 (>4m)	NL	<LOR	0.6	-	0.6	< 0.6	-	< 0.4	< 0.5	< 0.4	< 0.5	-	-	< 0.4	< 0.7	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
o-Xylene						<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
Halogenated Aliphatics																										
cis-1,2-Dichloroethene	5 [10]	20 [5]	31 [5b]	-	-	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
Tetrachloroethene (tetrachloroeth	0.2 [10]	400 [5]	81 [5b]	-	-	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 1.0	< 1.0	< 6	< 5	< 1.0	< 1.0	< 1.0
Trichloroethene (trichloroethylene	5 [10]	19 [5]	4.1 [5b]	-	-	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
Vinyl chloride	-	175	0.59 [5b]	-	-	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 1.0	< 1.0	< 6	< 5	< 1.0	< 1.0	< 1.0
Monoaromatic Hydrocarbons																										
n-Butylbenzene	-	58,000 [5]	3,900 [5b]	-	-	<LOR	14.7	-	4.4	< 0.3	-	14.7	< 0.3	2	< 0.3	-	-	< 0.3	< 0.4							
tert-Butylbenzene	-	120,000 [5]	7,800 [5b]	-	-	<LOR	0.5	-	0.3	< 0.3	-	0.5	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4							
Isopropylbenzene (Cumene)	-	9,900 [5]	1,900 [5b]	-	-	<LOR	20	-	8.4	< 0.3	-	20	< 0.3	3.6	< 0.3	-	-	< 0.3	< 0.4							
4-Isopropyltoluene (p-Cymene)	-	-	-	-	-	<LOR	0.9	-	0.9	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4							
n-Propylbenzene	-	24,000 [5]	3,800 [5b]	-	-	<LOR	62	-	21	< 0.3	-	62	< 0.3	7.1	< 0.3	-	-	< 0.3	< 0.4							
sec-Butylbenzene	-	-	-	-	-	<LOR	10	-	3.3	< 0.3	-	10	< 0.3	1.8	< 0.3	-	-	< 0.3	< 0.4							
1,2,4-Trimethylbenzene	-	1,800 [5]	300 [5b]	-	-	<LOR	0.6	-	0.6	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4							
1,3,5-Trimethylbenzene	-	1,500 [5]	270 [5b]	-	-	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4							
Other VOC																										
Carbon disulphide		3,500 [5]	770 [5b]	-	-	<LOR	0	-	< 0.14	< 0.3	-	< 0.05	< 0.3	< 0.19	< 0.3	-	-	< 0.05	< 0.07							
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [8]	63 (surface); 83 (1-4m); (130) (>4m) [9]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LOR	0	-	< 0.6	< 0.6	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4							
Other SVOC (Beca BHs only)																										
4,4'-DDD	1,000 [1 (total DDT)]	1,000 [1 (total DDT)]	240 [1 (total DDT)]	-	-	<LOR	0	-	-	-	-	-	-	-	-	-	-	-	-	< 1.4	< 1.7	< 1.9	< 1.6	< 1.7	< 1.7	< 1.6
Carbazole	-	-	-	-	-	<LOR	36	-	-	-	-	-	-	-	-	-	-	-	-	< 1.4	< 1.7	3	36	< 1.7	< 1.7	< 1.6
Dibenzofuran	-	1,000 [5]	73 [5b]	-	-	<LOR	32	-	-	-	-	-	-	-	-	-	-	-	-	< 1.4	< 1.7	3.4	32	< 1.7	< 1.7	< 1.6

Notes:
All results in mg/kg (except where otherwise stated)
NL = no limit
<LOR = below level of laboratory detection
NC = not calculated due to insufficient values above laboratory detection

Assessment:
Human Health (COMMERCIAL) criteria exceeded
red text Human Health (HIGH DENSITY RESIDENTIAL) criteria exceeded
bold text AUP criteria exceeded
highlighted - above lab detection limit (excluding metals)
non-volcanic background exceeded

0. Auckland Unitary Plan Permitted Activity Standards, Chapter E.30
1.National Environmental Standard - Soil Contamination Standard - commerical land use
1b. National Environmental Standard - Soil Contamination Standard - high density residential land use
2. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* INHALATION PATHWAY, sandy silt, various depths
3. Background concentrations of trace elements in Auckland soils (non-volcanic soils) Table E30.6.1.4.2 the AUP.
4.National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *Commercial/Industrial land use*
4b. National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *High density residential land use*
5. USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, composite worker, chronic effects
5b. USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, resident, chronic effects
6. BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *commercial land use*
6b. BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *high density residential land use*
7. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Protection of Groundwater Quality,* sandy silt, contamination at <1m depth, groundwater at 2m depth.
8. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* ALL PATHWAYs, sandy silt, various depths
9. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Residential use* ALL PATHWAYs, sandy silt, various depths
10. Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines for the protection of the environment and human health (residential values)

Samples outlined in red pertain to current site area

Table 9.4 **Soil sampling results - Site 18 (not including the area of proposed apartment) (mg/kg)**

Sample ID	AUP Discharge Criteria [0]	NES Soil human health criteria for commercial / industrial land use [1]	Inhalation pathway [2] (outdoor)	Inhalation pathway [2] (indoor)	Non-volcanic Background [3]	Max	GBH101	GBH101	GBH104	GBH104	GBH104	GBH105	GBH105	GBH105	GBH106	GBH106	GBH107	GBH107	GBH108	GBH108	GBH108	GBH109	GBH109	GBH109	GBH109	GBH110	GBH110
Depth (m)							0.9 - 1.0	6.5 - 7.05	0.3 - 0.7	1.2 - 1.7	4.5 - 5.0	0.15 - 0.25	1.55 - 1.65	2.7 - 3.0	0.5 - 0.8	2.7 - 3.0	0.13 - 0.2	3.0 - 3.5	0.45 - 0.6	1.9 - 2.1	5.1 - 5.3	1.0-1.1	2.5 - 2.9	5.0 - 5.5	6.85 - 7.05	0.6-0.8	2.4-2.65
Date							23/07/2018	24/07/2018	2/07/2018	2/07/2018	2/07/2018	6/07/2018	6/07/2018	6/07/2018	24/07/2018	25/07/2018	10/07/2018	10/07/2018	6/07/2018	6/07/2018	6/07/2018	12/07/2018	13/07/2018	13/07/2018	16/07/2018	12/07/2018	18/07/2018
Lab ID							2019525.3	2020257.4	2009174.15	2009174.17	2009174.18	2012478.2	2012478.4	2012478.5	2020257.5	2021090.5	2013217.1	2013217.5	2011994.16	2011994.2	2011994.25	2014707.3 / 2014713	2015346.3	2015346.8	2016128.1	2014707.5/ 2014713	2017470.1
Geological unit							Fill - sandy gravel	Marine sediment - silt	Fill - sandy gravel	Fill - sandy gravel	Fill - clayey silt	Fill - sandy gravel	Fill - silty sand, with gravel	Fill - silty sand, shells	Fill - sandy gravel	Fill - gravelly silt	Fill - sand and gravel	Fill - marine sediments	Fill - gravelly silt	Fill - marine sediments	Fill - marine sediments	Fill - silty gravel	Fill - silt, gasworks waste	Fill - marine sediments	Fill - marine sediments	Fill - clayey silt with sand	Fill - sandy silt with gravel
TOC (g/100g dry weight)							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.18	0.53	-	-
Metals and metaloids (totals)																											
Arsenic	100	70	-	-	12	36	36	-	3	3	-	< 2	5	6	< 2	-	16	7	6	3	-	10	11	-	-	5	< 2
Cadmium	7.5	1,300	-	-	0.65	0.57	0.42	-	0.22	< 0.10	-	< 0.10	< 0.10	< 0.10	< 0.10	-	< 0.10	< 0.10	0.23	< 0.10	-	0.36	< 0.10	-	-	< 0.10	< 0.10
Chromium	400	NL	-	-	55	300	28	-	27	17	-	50	5	6	23	-	300	15	23	18	-	30	19	-	-	13	13
Copper	325	NL	-	-	45	240	44	-	113	27	-	63	3	3	46	-	39	22	240	20	-	94	72	-	-	12	12
Lead	250	3,300	-	-	65	**1620**	74	-	47	135	-	2	26	9.8	28	-	**850**	11.1 #1	**320**	11.1	-	**1,620**	**280**	-	-	54	7.4
Mercury	0.75	4,200	-	-	0.45	**4.3**	< 0.10	-	0.1	0.34	-	< 0.10	< 0.10	0.6	< 0.10	-	-	-	0.39	< 0.10	-	**1.41**	0.62	-	-	< 0.10	< 0.10
Nickel	105	6,000 [4]	-	-	35	**210**	78	-	**133**	11	-	**210**	5	4	**109**	-	28	56 #1	41	10	-	44	47	-	-	9	16
Zinc	400	400,000 [4]	-	-	180	**560**	74	-	191	74	-	55	28	28	92	-	80	60	**560**	46	-	330	200	-	-	31	46
Total Cyanide	1,500 [4]	1,500 [4]	-	-	<LD	40	-	-	-	1.05	-	-	0.6	-	-	-	-	-	-	-	-	-	0.25	-	-		
Tributyltin																											
Dibutyltin	250 [5]	250 [5]	-	-	<LD	0.033	-	-	-	-	-	< 0.005	-	-	-	-	-	-	0.033	-	-	-	-	-	-		-
Monobutyltin	-	-	-	-	<LD	0.077	-	-	-	-	-	< 0.007	-	-	-	-	-	-	0.077	-	-	-	-	-	-		-
Tributyltin	250 [5]	250 [5]	-	-	<LD	0.025	-	-	-	-	-	< 0.004	-	-	-	-	-	-	0.025	-	-	-	-	-	-		-
Triphenyltin	-	-	-	-	<LD	0	-	-	-	-	-	< 0.003	-	-	-	-	-	-	< 0.003	-	-	-	-	-	-		-
Asbestos																											
FA/AF % (weight/weight)	-	0.001% [6]	-	-	<LD	0.001	ND	-	<0.001	-	-	ND	-	-	<0.001	-	ND	-	<0.001	-	-	0.001	-	-	-	ND	
ACM % (weight/weight)	-	0.05% [6]	-	-	<LD	0	ND	-	ND	-	-	ND	-	-	ND	-	ND	-	ND	-	-	ND	-	-	-	ND	
Asbestos form	-	-	-	-	-	0	ND	-	Chrysotile, loose fibres	-	-	ND	-	-	Chrysotile, loose fibres	-	ND	-	Chrysotile, loose fibres	-	-	Chrysotile, loose fibres	-	-	-	ND	
Polyaromatic Hydrocarbons																											
1-Methylnaphthalene	730 [5]	730 [5]	-	-	<LD	9.3	1.11	-	0.036	< 0.014	-	< 0.011	9.3	-	< 0.012	-	2.6	< 0.013	0.024	3	-	0.58	3.6	-	-	0.018	0.176
2-Methylnaphthalene	3000 [5]	3000 [5]	-	-	<LD	3.4	1.34	-	0.036	< 0.014	-	< 0.011	2.2	-	< 0.012	-	1.57	< 0.013	0.029	3.4	-	0.81	0.57	-	-	< 0.014	< 0.015
Perylene	-	-	-	-	<LD	5.8	5	-	0.014	0.024	-	< 0.011	0.017	-	0.027	-	5.8	0.027	0.013	0.018	-	2.7	0.107	-	-	< 0.014	< 0.015
Benzo[a]pyrene Potency Equivalency Factor	-	35	-	-	<LD	48	23	-	< 0.03	0.08	-	< 0.03	0.09	-	0.08	-	48	< 0.04	< 0.03	< 0.04	-	23	0.76	-	-	0.04	< 0.04
Acenaphthylene	-	-	-	-	<LD	3.1	1.14	-	< 0.012	< 0.014	-	< 0.011	0.134	-	< 0.012	-	3.1	< 0.013	< 0.012	0.062	-	0.067	< 0.015	-	-	< 0.014	< 0.015
Acenaphthene	-	-	-	-	<LD	6.8	0.29	-	< 0.012	< 0.014	-	< 0.011	0.44	-	< 0.012	-	4.1	< 0.013	< 0.012	0.22	-	1.07	0.52	-	-	< 0.014	< 0.015
Anthracene	-	-	-	-	<LD	11.3	2.6	-	< 0.012	0.02	-	< 0.011	0.096	-	0.019	-	7.1	< 0.013	< 0.012	< 0.013	-	2.7	0.22	-	-	< 0.014	< 0.015
Benzo[a]anthracene	-	-	-	-	<LD	65	10.1	-	0.032	0.07	-	< 0.011	0.064	-	0.065	-	65	0.016	< 0.012	< 0.013	-	9.5	0.57	-	-	0.024	< 0.015
Benzo[a]pyrene (BAP)	20	35	NL	1000 (surface); NL (1-4m); NL (>4m)	<LD	20	15	-	0.013	0.051	-	< 0.011	0.063	-	0.061	-	10.6	< 0.013	0.02	< 0.013	-	17.8	0.48	-	-	0.031	< 0.015
Benzo[b]fluoranthene + Benzo[j]fluoranthe	-	-	-	-	<LD	89	20	-	0.019	0.067	-	< 0.011	0.074	-	0.074	-	89	0.021	0.023	0.027	-	11	0.62	-	-	0.041	< 0.015
Benzo[e]pyrene	-	-	-	-	-	48	12	-	0.021	0.044	-	< 0.011	0.045	-	0.042	-	48	< 0.013	0.03	0.024	-	12.6	0.31	-	-	0.035	< 0.015
Benzo[g,h,i]perylene	-	-	-	-	<LD	48	16.3	-	0.013	0.047	-	< 0.011	0.049	-	0.037	-	48	0.021	0.043	< 0.013	-	12	0.31	-	-	< 0.014	< 0.015
Benzo[k]fluoranthene	-	-	-	-	<LD	35	8.4	-	0.012	0.042	-	< 0.011	0.036	-	0.017	-	35	< 0.013	< 0.012	< 0.013	-	3.2	0.27	-	-	< 0.014	< 0.015
Chrysene	-	-	-	-	<LD	77	13.1	-	0.027	0.077	-	< 0.011	< 0.013	-	0.055	-	77	< 0.013	< 0.012	< 0.013	-	8.6	0.44	-	-	0.014	< 0.015
Dibenzo[a,h]anthracene	-	-	-	-	<LD	10.7	2.5	-	< 0.012	< 0.014	-	< 0.011	< 0.013	-	< 0.012	-	10.7	< 0.013	< 0.012	< 0.013	-	1.89	0.068	-	-	< 0.014	< 0.015
Fluoranthene	-	-	-	-	<LD	260	20	-	0.016	0.196	-	< 0.011	0.25	-	0.154	-	260	0.074	0.018	0.063	-	6.1	1.72	-	-	0.029	< 0.015
Fluorene	-	-	-	-	<LD	7.1	0.59	-	0.022	< 0.014	-	< 0.011	0.57	-	< 0.012	-	1.13	< 0.013	< 0.012	< 0.013	-	0.72	0.78	-	-	< 0.014	< 0.015
Indeno(1,2,3-c,d)pyrene	-	-	-	-	<LD	45	18.7	-	< 0.012	0.043	-	< 0.011	0.053	-	0.03	-	45	0.017	0.026	< 0.013	-	8.4	0.4	-	-	< 0.014	< 0.015
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [4]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	**5.5**	**1.42**	-	< 0.06	< 0.07	-	< 0.06	**1.03**	-	< 0.06	-	**5.5**	< 0.07	< 0.06	**0.46**	-	**1.88**	**1.07**	-	-	< 0.07	< 0.08
Phenanthrene	-	-	-	-	<LD	280	10.7	-	0.046	0.041	-	< 0.011	0.75	-	0.045	-	280	0.071	< 0.012	0.128	-	9	1.67	-	-	< 0.014	< 0.015
Pyrene	7.9 [7]	NL [8]	NL	NL	<LD	**210**	**23**	-	0.063	0.21	-	< 0.011	0.43	-	0.161	-	**210**	0.053	0.026	0.088	-	**16.5**	1.56	-	-	0.044	< 0.015
Polychlorinated Biphenyls																											
Total PCB (Sum of 35 congeners)	1.2 [1]	1.2	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	< 0.4	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons																											
C7 - C9	(5,200) [7]	(500) (surface); (500) (1-4m); (12,000) (>4m) [8]	5,200 (surface); 9,800 (1-4m); 12,000 (>4m)	NL	<LD	1030	-	< 9	29	< 8	12	-	1,030	520	< 8	133	270	< 8	< 8	84	< 9	< 8	104	< 8	< 9	< 9	< 9
C10 - C14	(9,200) [7]	(1,700) (surface); (2,200) (1-4m); (3,400) (>4m) [8]	7,800 (surface); 10,000 (1-4m); 16,000 (>4m)	NL	<LD	5600	-	< 20	200	< 20	158	-	2,600	740	< 20	1,490	840	< 20	< 20	1,820	< 20	< 20	**2,800**	< 20	< 20	< 20	35
C15 - C36	NL [7]	NL [8]	NL	NL	<LD	10100	-	< 40	430	< 40	99	-	1,170	105	75	1,430	3,600	< 40	1,000	880	< 40	440	1,730	< 40	< 40	< 40	< 40
Total hydrocarbons (C7 - C36)	-	-	-	-	<LD	15700	-	< 70	660	< 70	270	-	4,800	1,370	75	3,100	4,700	< 70	1,000	2,800	< 70	440	4,700	< 70	< 70	< 70	< 70
Suspected Product									Weathered all ranges		Weathered Diesel		Weathered Petrol/Kerosene/ Diesel/Light Fuel Oil	Weathered Petrol/Kerosene/ Diesel/Light Fuel Oil		Weathered Diesel	Weathered Lube Oil/Heavy End		Weathered Light Fuel Oil/Lube Oil	Weathered Diesel		Weathered Lube Oil/Heavy End	Weathered Kerosene				
BTEX in VOC																											
Benzene	0.029 [7]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m) [8]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m)	480 (surface); 610 (1-4m); 860 (>4m)	<LD	**0.9**	-	< 0.3	< 0.17	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.18	< 0.3	< 0.3	< 0.3
Ethylbenzene	7.2 [7]	(200) (surface); (300) (1-4m); (450) (>4m) [8]	200 (surface); 300 (1-4m); 450 (>4m)	6,200 (surface); NL (1-4m); NL (>4m)	<LD	4.8	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	0.3	< 0.3	< 0.3	< 0.3	< 0.3
Toluene	6.0 [7]	(270) (surface); (480) (1-4m); (790) (>4m) [8]	270 (surface); 550 (1-4m); 790 (>4m)	NL	<LD	0.4	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
m&p-Xylene	3.7 [7]	(200) (surface); (420) (1-4m); (590) (>4m) [8]	200 (surface); 420 (1-4m); 590 (>4m)	NL	<LD	2	-	< 0.5	< 0.4	< 0.5	< 0.6	-	< 0.5	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	< 0.5	< 0.5	< 0.6	< 0.4	< 0.6	< 0.5	< 0.5
o-Xylene					<LD	0.6	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Halogenated Aliphatics																											
cis-1,2-Dichloroethene	20 [5]	20 [5]	-	-	<LD	5.1	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	1.1	< 0.3	< 0.3	< 0.3
Tetrachloroethene (tetrachloroethylene)	400 [5]	400 [5]	-	-	<LD	37	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	17.4	< 0.3	< 0.3	< 0.3
Trichloroethene (trichloroethylene)	19 [5]	19 [5]	-	-	<LD	4.8	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	**2.4**	< 0.3	< 0.3	< 0.3
Vinyl chloride	175	175	-	-	<LD	**1.4**	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	**1.4**	< 0.3	< 0.3
Monoaromatic Hydrocarbons																											
n-Butylbenzene	58,000 [5]	58,000 [5]	-	-	<LD	22	-	< 0.3	< 0.3	< 0.3	< 0.3	-	9	4.6	-	1.1	-	< 0.3	-	2.6	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
tert-Butylbenzene	120,000 [5]	120,000 [5]	-	-	<LD	0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	0.3	0.3	-	< 0.3	-	< 0.3	-	0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Isopropylbenzene (Cumene)	9,900 [5]	9,900 [5]	-	-	<LD	44	-	< 0.3	< 0.3	< 0.3	< 0.3	-	7.9	5.2	-	1.3	-	< 0.3	-	4.5	< 0.3	< 0.3	10.4	< 0.3	< 0.3	< 0.3	0.3
4-Isopropyltoluene (p-Cymene)	-	-	-	-	<LD	0.8	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
n-Propylbenzene	24,000 [5]	24,000 [5]	-	-	<LD	117	-	< 0.3	0.3	< 0.3	< 0.3	-	25	14.5	-	2	-	< 0.3	-	12.7	< 0.3	< 0.3	5.5	< 0.3	< 0.3	< 0.3	0.9
sec-Butylbenzene	-	-	-	-	<LD	5.1	-	< 0.3	< 0.3	< 0.3	< 0.3	-	5.1	3.1	-	1.1	-	< 0.3	-	3.7	< 0.3	< 0.3	2.2	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trimethylbenzene	1,800 [5]	1,800 [5]	-	-	<LD	48	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trimethylbenzene	1,500 [5]	1,500 [5]	-	-	<LD	17.8	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	0.3	< 0.3	< 0.3	< 0.3	< 0.3
Other VOC																											
Carbon disulphide	3,500 [5]	3,500 [5]	-	-	<LD	0	-	< 0.3	< 0.05	< 0.05	< 0.06	-	< 0.05	< 0.05	-	< 0.3	-	< 0.17	-	< 0.17	< 0.19	< 0.3	< 0.3	< 0.18	< 0.3	< 0.3	< 0.3
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [2]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	**3.3**	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.6	< 0.6	< 0.3	< 0.4	< 0.3	< 0.3	< 0.3	< 0.3
Other SVOC (Beca BHs only)																											
4,4'-DDD	1,000 [1 (total DDT)]	1,000 [1 (total DDT)]	-	-	<LD	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	-	-	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	1,000 [5]	1,000 [5]	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

All results in mg/kg (except where otherwise stated)
NL = no limit
<LD = below level of laboratory detection
NC = not calculated due to insufficient values above laboratory detection

Assessment

Red text Human Health (COMMERCIAL) criteria exceeded
Bold text AUP criteria exceeded
Highlighted - above lab detection limit (excluding metals)
Non-volcanic background exceeded

0. Auckland Unitary Plan Permitted Activity Standards, Chapter E.30
1. National Environmental Standard - Soil Contamination Standard - commerical land use
2. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* INHALATION PATHWAY, sandy silt, various depths
3. Background concentrations of trace elements in Auckland soils (non-volcanic soils) Table E30.6.1.4.2 the AUP.
4. National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *Commercial/Industrial land use*
5. USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, composite worker, chronic effects
6. BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *commercial land use*
7. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Protection of Groundwater Quality*, sandy silt, contamination at <1m depth, groundwater at 2m depth.
8. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* ALL PATHWAYs, sandy silt, various depths
9. Duplicate soil sample recorded in table as analytical results provide useful vinyl chloride information.

Samples outlined in red pertain to current site area. Samples outlined in orange were collected directly adjacent to the site and provide relevant context

Table 9.7 **Groundwater sampling results - Site 18 (mg/L)**

Sample ID	Assessment Criteria				Max	GBH102	GBH103	GBH104	GBH106	GBH107	GBH108	GBH109	GBH110	GBH111	CBH201	CBH202	CBH203	CBH204	CBH205	CBH206	CBH207	CBH208	CBH209	Existing MW1
Date	A&NZ Guidelines marine water 80% protection of species [1]	Groundwater acceptance criteria inhalation pathway [2]	Maximum of background range: Auckland non-volcanic aquifers [3]	Corrosivity for classification of chemical attack of concrete [4]		3/08/2018	6/08/2018	3/08/2018	1/08/2018	6/08/2018	26/07/2018	6/08/2018	3/08/2018	6/08/2018	25/07/2018	6/08/2018	26/07/2018	25/07/2018	30/07/2018	1/08/2018	26/07/2018	30/07/2018	3/08/2018	14/08/2018
Lab ID						2026369.2	2027205.4	2026369.3	2024974.2	2027205.1	2021746.3	2027205.3	2026369.1	2027205.5	2021090.9	2027205.2	2021746.1	2021090.10	2023317.1	2024974.1	2021746.20	2023317.20	2026369.4	2031679.4
pH				6.5	8	7.6	7.2	7.3	7.4	6.6	7.1	7.7	7.8	8	7.6	7.6	7.6	7.4	7.2	6.9	7	7.3	7.2	7.5
Electrical Conductivity (EC)	-	-	-	-	3380	1,566	167.3	321	110.2	115.3	89.5	849	1,651	629	183.9	2,120	3,380	139.4	99.9	414	80.6	142.2	87.1	2,880
Total Dissolved Solids (TDS)	-	-	-	-	23000	9,000	1,060	1,950	690	890	520	5,200	9,700	3,600	1,030	13,500	23,000	820	620	2,900	480	920	560	19,100
Chloride		-	-	-	10600	5,200	169	680	105	55	44	2,700	5,400	1,650	300	6,600	10,600	145	50	1,000	44	66	30	9,600
Sulphate	-	-	-	XA1 200-600 XA2 600-3000	1220	96	67	64	2.5	420	< 0.5	126	129	58	4.5	780	1,220	1.8	1.1	32	< 0.5	< 0.5	0.8	-
Metals and metaloids																								
Dissolved Arsenic	0.270 [UR]	-	0.0101	-	0.006	0.006	< 0.004	< 0.004	0.0012	< 0.0010	< 0.0010	< 0.004	0.005	< 0.004	0.0013	< 0.004	< 0.02	< 0.0010	< 0.0010	< 0.005	< 0.0010	0.0013	< 0.0010	< 0.004
Dissolved Cadmium	0.036	-	-	-	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.00005	< 0.00005	< 0.00005	< 0.0002	0.0002	< 0.0002	< 0.00005	< 0.0002	< 0.0010	< 0.00005	< 0.00005	< 0.00010	< 0.00005	< 0.00005	< 0.00005	< 0.0002
Dissolved Chromium	0.0906/ 0.085	-	<0.0005	-	0.0014	0.0014	< 0.0010	< 0.0010	< 0.0005	< 0.0005	< 0.0005	< 0.0010	< 0.0010	< 0.0010	< 0.0005	< 0.0010	< 0.010	< 0.0005	< 0.0005	0.0012	< 0.0005	< 0.0005	< 0.0005	< 0.0010
Dissolved Copper	0.008	-	0.001	-	0.003	0.003	< 0.0010	< 0.0010	< 0.0005	< 0.0005	< 0.0005	< 0.0010	0.0014	< 0.0010	< 0.0005	< 0.0010	< 0.010	0.0021	< 0.0005	< 0.0010	< 0.0005	< 0.0005	< 0.0005	< 0.0010
Dissolved Lead	0.012	-	0.0008	-	0.0035	< 0.0010	0.0035	< 0.0010	0.00012	< 0.00010	< 0.00010	< 0.0010	< 0.0010	< 0.0010	0.00061	< 0.0010	< 0.002	< 0.00010	0.00019	0.0006	0.00016	0.00012	0.00142	< 0.0010
Dissolved Mercury	0.0014	-	-	-	0	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008
Dissolved Nickel	0.56 [A]	-	0.03	-	0.014	0.014	< 0.007	< 0.007	< 0.0005	0.0016	< 0.0005	< 0.007	< 0.007	< 0.007	< 0.0005	< 0.007	< 0.010	< 0.0005	< 0.0005	< 0.0010	< 0.0005	< 0.0005	< 0.0005	<0.007
Dissolved Zinc	0.043	-	0.055	-	0.008	0.008	< 0.004	0.007	< 0.0010	0.0017	< 0.0010	< 0.004	< 0.004	< 0.004	< 0.0010	< 0.004	< 0.02	0.0058	< 0.0010	< 0.002	< 0.0010	0.0015	< 0.0010	< 0.004
Total Cyanide	0.014	-	-	-	0.154	< 0.02	0.08	0.06	0.004	**0.023**	0.0084	**0.03**	< 0.02	**0.03**	0.0062	**0.02**	**0.025 #1**	**0.029**	**0.015**	**0.154**	0.0084	**0.015**	**0.095**	< 0.02
Polycyclic Aromatic Hydrocarbons																								
Acenaphthene	-	-	-	-	0.00165	< 0.00010	0.00045	0.00151	0.00141	< 0.00010	0.00013	< 0.00010	< 0.00010	< 0.00010	0.00035	0.00056	< 0.00010	0.00014	0.00165	0.00105	0.00023	0.00027	0.0007	0.00014
Acenaphthylene	-	-	-	-	0.00024	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0001	0.00018	0.00024	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Anthracene	0.0001 [UR]	-	-	-	0.0008	< 0.00010	< 0.00010	**0.0008**	**0.00016**	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	**0.00015**	< 0.00010	< 0.00010	**0.00029**	**0.00051**	< 0.00010	< 0.00010	**0.00064**	< 0.00010
Benzo[a]anthracene	-	-	-	-	0.00026	< 0.00010	< 0.00010	0.00023	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00017	< 0.00010	< 0.00010	< 0.00010	0.00011	< 0.00010	< 0.00010	0.00026	< 0.00010
Benzo[a]pyrene (BAP)	0.0001 [UR]	S / S	-	-	0.00014	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	**0.00014**	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	-	-	-	0.0002	< 0.00010	< 0.00010	0.00014	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0002	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00015	0.00018
Benzo[g,h,i]perylene	-	-	-	-	0.00015	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00015
Benzo[k]fluoranthene	-	-	-	-	0.00012	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00012	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Chrysene	-	-	-	-	0.00021	< 0.00010	< 0.00010	0.00019	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00021	< 0.00010
Dibenzo[a,h]anthracene	-	-	-	-	0	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Fluoranthene	0.001 [UR]	-	-	-	0.00159	< 0.00010	< 0.00010	**0.00159**	0.00012	0.00018	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00068	< 0.00010	0.00012	0.00042	0.00081	< 0.00010	< 0.00010	**0.00123**	0.00021
Fluorene	-	-	-	-	0.0026	< 0.0002	0.0006	0.0024	0.0026	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0007	0.0008	< 0.0002	0.0002	0.002	0.0014	0.0006	0.0004	0.0012	< 0.0002
Indeno(1,2,3-c,d)pyrene	-	-	-	-	0.00013	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00011	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00013
Naphthalene	0.12	S / S	-	-	0.097	< 0.0005	< 0.0010	< 0.0005	< 0.0005	< 0.0010	< 0.0005	< 0.0010	< 0.0005	< 0.0010	0.0007	< 0.0010	< 0.0005	0.0017	0.0012	0.097	< 0.0005	0.0015	< 0.0005	< 0.0005
Phenanthrene	0.0006 [UR]	-	-	-	0.0041	< 0.0004	< 0.0004	**0.0041**	**0.0013**	0.0008	< 0.0004	< 0.0004	< 0.0004	< 0.0004	< 0.0004	**0.0007**	< 0.0004	< 0.0004	**0.0012**	**0.0027**	< 0.0004	< 0.0004	**0.0024**	< 0.0004
Pyrene	-	S / S	-	-	0.0011	< 0.0002	< 0.0002	0.0011	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0007	< 0.0002	< 0.0002	0.0004	0.0006	< 0.0002	< 0.0002	0.0007	0.0002
Polychlorinated Biphenyls Screening in Water, By Liq/Liq																								
Total PCB (Sum of 35 congeners)	0.0001 [A]		-		0	-	-	-	-	-	-	< 0.005	-	< 0.005	-	-	< 0.005	< 0.005	-	-	-	-	-	-
Total Petroleum Hydrocarbons in Water																								
C7 - C9	-	S / S	-	-	9.9	< 0.06	0.46	0.11	0.25	< 0.06	< 0.06	9.9	< 0.06	< 0.06	1.05	0.24	< 0.06	0.06	< 0.06	2	0.13	0.15	1.4	0.24
C10 - C14	-	S / S	-	-	12.2	< 0.2	2	1.9	0.9	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.4	2.9	< 0.2	1.2	1.1	5.9	0.5	1.5	1.5	12.2
C15 - C36	-	S / S	-	-	11.9	< 0.4	1.2	3.1	1.1	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	2.3	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.5	< 0.4	11.9
Total hydrocarbons (C7 - C36)	-	-	-	-	24	< 0.7	3.6	5.1	2.3	< 0.7	< 0.7	9.9	< 0.7	< 0.7	1.4	5.4	< 0.7	1.3	1.1	7.9	< 0.7	2.1	2.9	24
Suspected product						-	Weathered Jet Fuel	Weathered Diesel	Could not be identified	-	-	No chromatogram	-	-	Could not be identified	Weathered Diesel	-	Weathered Petrol	Weathered Petrol	Weathered Turpentine	Weathered Petrol	Weathered Kerosene	Weathered Mineral Turpentine	Weathered Jet and Lub Oil
BTEX																								
Benzene	0.7 [B]	5.2 / 330	-	-	0.87	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.008	< 0.003	< 0.003	0.029	< 0.003	< 0.003	< 0.003	< 0.003	**0.87**	< 0.003	< 0.003	< 0.003	< 0.003
Ethylbenzene	0.005 [UR]	110 / S	-	-	0.39	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	**0.007**	< 0.005	**0.39**	< 0.005	< 0.005	< 0.005	< 0.005
Toluene	0.180 [UR]	450 / S	-	-	0.76	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.021	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**0.76**	< 0.003	< 0.003	< 0.003	< 0.003
m&p-Xylene	0.275 [UR]	S/S	-	-	0.28	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	**0.28**	< 0.005	< 0.005	< 0.005	< 0.005
o-Xylene	0.350 [UR]		-	-	0.13	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.004	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.13	< 0.003	< 0.003	< 0.003	< 0.003
Halogenated Aliphatics																								
1,1-Dichloroethene	0.7 [UR]	-	-	-	0.014	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.013	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.014	< 0.003	< 0.003	< 0.003	< 0.003
cis-1,2-Dichloroethene	0.010 [a]	-	-	-	18.4	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**18.4**	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**11**	< 0.003	< 0.003	< 0.003	< 0.003
trans-1,2-Dichloroethene		-	-	-	0.4	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**0.4**	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**0.047**	< 0.003	< 0.003	< 0.003	< 0.003
Tetrachloroethene (tetrachloroethylene)	0.07 [UR]	-	-	-	7.6	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**7.6**	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.005	< 0.003	< 0.003	< 0.003	< 0.003
Trichloroethene (trichloroethylene)	0.33 [UR]	-	-	-	9.2	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**9.2**	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.004	< 0.003	< 0.003	< 0.003	< 0.003
Vinyl chloride	0.1 [UR]	-	-	-	5.4	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**5.4**	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**3.7**	< 0.003	< 0.003	< 0.003	< 0.003
Monoaromatic Hydrocarbons																								
n-Butylbenzene	-	-	-	-	0.103	< 0.005	0.019	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.026	0.021	0.103	0.006	< 0.005	0.021	< 0.005
tert-Butylbenzene	-	-	-	-	0.004	< 0.003	0.003	< 0.003	< 0.003	< 0.003	0.004	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
4-Isopropyltoluene (p-Cymene)	-	-	-	-	0.007	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.007	< 0.005	< 0.005	< 0.005	< 0.005
Isopropylbenzene (Cumene)	0.03 [UR]	-	-	-	0.87	< 0.003	**0.134**	0.023	< 0.003	< 0.003	0.028	**0.042**	< 0.003	< 0.003	0.014	< 0.003	< 0.003	**0.29**	0.007	**0.87**	**0.082**	0.009	**0.164**	**0.058**
n-Propylbenzene	-	-	-	-	1.68	< 0.005	0.28	0.022	< 0.005	< 0.005	0.027	0.024	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.32	< 0.005	1.68	0.157	< 0.005	0.34	0.008
sec-Butylbenzene	-	-	-	-	0.026	< 0.003	0.017	< 0.003	< 0.003	< 0.003	0.01	< 0.003	< 0.003	< 0.003	0.003	< 0.003	< 0.003	0.009	< 0.003	0.026	0.014	0.006	0.02	0.004
1,2,4-Trimethylbenzene	-	-	-	-	1.61	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	1.61	< 0.003	< 0.003	< 0.003	< 0.003
1,3,5-Trimethylbenzene	-	-	-	-	0.64	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.64	< 0.003	< 0.003	< 0.003	< 0.003
Trihalomethanes																								
Bromodichloromethane	-	-	-	-	0.107	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.107	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Chloroform (Trichloromethane)	0.37 [UR]	-	-	-	0.004	0.004	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Other VOC																								
Naphthalene	0.12				0.125	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	**0.125**	< 0.005	< 0.005	< 0.005	< 0.005
Poly- and Perfluorinated Alkyl Substances in Water (presented in PPT)																								
Total Perfluorohexanesulfonic acid (T-PFHxS)	-	-	-	-	2.8	-	1.6	-	1	0.16	-	-	-	2.8	1.7	-	-	0.1	-	-	-	-	-	-
Total Perfluorooctanesulfonic acid (T-PFOS)	-	-	-	-	5.6	-	4.4	-	5.6	<0.10	-	-	-	4.5	4.7	-	-	0.049	-	-	-	-	-	-
Sum of Total PFOS & PFHxS	31 [5,6]	-	-	-	7.3	-	6	-	6.6	0.16	-	-	-	7.3	6.4	-	-	0.15	-	-	-	-	-	-
Perfluorooctanoic acid (PFOA)	1,824 [5,6]	-	-	-	0.17	-	<0.10	-	<0.10	<0.10	-	-	-	0.17	<0.10	-	-	0.017	-	-	-	-	-	-

Notes:

1 - Australian and New Zealand Water Quality Guidelines (2018).

2 - Ministy for the Environment, 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand: Groundwater acceptance criteria for gravels; commercial/ industrial use; groundwater at 2 m depth; (indoor air / outdoor air).

3 - Auckland Regional Council (2007), State of the Environment Monitoring: Groundwater Quality Data Report 1998-2005. ARC Technical Publication 352.

4 - NZS 3101: Part 1 2006 Amendment 2 - less stringent of the ranges provided. See relevant section in report for details.

5 - Heads of EPAs Australia and New Zealand (HEPA, 2018) PFAS National Environmental Management Plan.

6- Draft ANZECC Australian and New Zealand Water Quality Guidelines reported in Government of Western Australia Department of Environmental Regulation (WA DER, updated 2017) Interim Guideline on the Assessment and Management of Perfluoroalkly and Polyfluoroalkyl Substances (PFAS) Contaminated Sites Guidelines.

UR - unknown reliability value .

A - indicatesthat trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure.

B - 95% protection value adopted, as per AUP Chapter E.30 rules.

S - Calculated water criteria exceeds solubility limit for pure compound in water.

a - ANZECC water quality guideline for recreational purposes.

b - ANZECC Guidelines for chemical compounds in water found to cause tainting of fish flesh and other aquatic organisms.

	Exceeds limit of detection
red bold	Exceeds ANZECC 80% criteria
green bold	Inhalation pathway criteria exceeded
	Sulphate concentations within the XA1 classification
	Sulphate concentations within the XA2 classification

Orams post-works groundwater monitoring data summary

Sample ID	Assessment Criteria		MW1						MW3								GBH102		GBH102P	GBH109			GBH110		GBH111		GBH111S	GBH111D
Date	A&NZ Guidelines marine water 80% protection of species [1]	Maximum of background range: Auckland non-volcanic aquifers [3]	20-Jan-08	7-Mar-08	11-Jul-11	15-Oct-12	10-Jan-14	17-Jun-19	24-Oct-24	20-Jan-08	7-Mar-08	11-Jul-11	15-Oct-12	10-Jan-14	23-Aug-18	18-Jun-19	24-Oct-24	30-Aug-18	18-Jun-19	18-Nov-24 and 12-Dec-24	6-Aug-18	17-Jun-19	24-Oct-24	3-Aug-18	17-Jun-19	6-Aug-18	19-Jun-19	18-Nov-24 and 12-Dec-24	18-Nov-24 and 12 Dec 24
Dissolved Metals and metaloids																												
Arsenic	0.270 UR	0.0101	< 0.0040	< 0.0040	< 0.005	< 0.002	< 0.004	0.0027	0.0008	< 0.0040	< 0.0040	< 0.005	< 0.02	< 0.004	< 0.004	<0.005	<0.0050	0.006	<0.0050	0.0011	< 0.004	0.0028	<0.0050	0.005	0.0460	< 0.004	<0.00050	0.00082	0.0019
Cadmium	0.036	-	< 0.00020	< 0.00020	< 0.0003	< 0.00010	< 0.0002	0.00002	0.00003	< 0.00020	< 0.00020	< 0.0003	< 0.0010	< 0.0010	< 0.0002	<0.0001	<0.00020	< 0.0002	<0.00010	0.00003	< 0.0002	0.000014	<0.00020	0.0002	0.00004	< 0.0002	<0.000010	0.00008	0.000049
Chromium	0.0906/ 0.085	<0.0005	< 0.0010	< 0.0010	< 0.003	< 0.0010	< 0.0010	0.00032	<0.00020	< 0.0010	0.0043	< 0.003	< 0.010	< 0.0010	0.0011	<0.002	<0.0020	0.0014	<0.0020	0.00051	< 0.0010	0.00098	<0.0020	< 0.0010	0.0110	< 0.0010	0.00026	<0.00020	<0.00020
Dissolved Copper	0.008	0.001	< 0.0010	< 0.0010	< 0.003	< 0.0010	< 0.0010	0.010	0.002	< 0.0010	< 0.0010	< 0.003	< 0.010	< 0.0010	< 0.0010	0.013	0.0053	0.003	<0.0020	0.00044	< 0.0010	0.0054	<0.0020	0.0014	0.0900	< 0.0010	<0.00020	<0.00020	<0.00020
Dissolved Lead	0.012	0.0008	0.0056	< 0.0010	< 0.0005	< 0.0002	< 0.0010	0.0005	<0.000050	< 0.0010	< 0.0010	< 0.0005	< 0.002	< 0.005	< 0.0010	0.00973	<0.00050	< 0.0010	<0.00050	<0.000050	< 0.0010	0.00059	<0.00050	< 0.0010	0.0038	< 0.0010	<0.000050	0.00029	<0.000050
Dissolved Nickel	0.56 A	0.03	< 0.0060	< 0.0060	< 0.003	< 0.0010	< 0.006	0.0005	0.0021	< 0.0060	< 0.0060	< 0.003	< 0.010	< 0.03	< 0.007	<0.002	<0.0020	0.014	0.002	0.0007	< 0.007	0.0064	0.0031	< 0.007	0.0038	< 0.007	0.00026	0.0014	0.0029
Dissolved Zinc	0.043	0.055	< 0.0040	0.0085	< 0.005	< 0.002	< 0.004	0.0081	0.0042	< 0.0040	< 0.0040	< 0.005	< 0.02	< 0.004	< 0.004	0.042	<0.010	0.008	<0.010	<0.0010	< 0.004	0.0062	<0.010	< 0.004	0.0530	< 0.004	<0.0010	0.0018	0.039
Total Cyanide	0.014	-	0.0029	0.0042	0.0048	0.004	0.005	0.0060	-	0.004	0.065	0.0164	0.0172	0.26	< 0.02	0.031	-	< 0.02	0.032	-	0.03	0.02	-	< 0.02	<0.0025	0.03	0.029	-	-
Total Petroleum Hydrocarbons in Water																												
C7 - C9	-	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	<0.2	<0.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.06	<0.2	<0.2	< 0.06	<0.2	<0.2	9.9	3.1	<0.2	< 0.06	<0.2	< 0.06	<0.2	<0.2	<0.2
C10 - C14	-	-	0.27	0.26	< 0.2	0.3	0.3	<0.2	<0.2	1	0.33	< 0.2	< 0.2	< 0.2	< 0.2	<0.2	<0.2	< 0.2	<0.2	<0.2	< 0.2	0.2	<0.2	< 0.2	<0.2	< 0.2	<0.2	<0.2	<0.2
C15 - C36	-	-	< 0.40	< 0.40	< 0.4	< 0.4	< 0.4	<0.3	<0.3	< 0.40	< 0.40	< 0.4	< 0.4	< 0.4	< 0.4	<0.3	<0.3	< 0.4	<0.3	<0.3	< 0.4	<0.3	<0.3	< 0.4	2	< 0.4	<0.3	<0.3	<0.3
Total hydrocarbons (C7 - C36)	-	-	< 0.70	< 0.70	< 0.7	< 0.7	< 0.7	<0.5	<0.5	1	< 0.70	< 0.7	< 0.7	< 0.7	< 0.7	<0.5	<0.5	< 0.7	<0.5	<0.5	9.9	3.3	<0.5	< 0.7	2	< 0.7	<0.5	<0.5	<0.5
Polycyclic Aromatic Hydrocarbons																												
1-Methylnaphthalene			-	-	-	-	-	-	<0.00010	-	-	-	-	-	-	-	<0.00010	-	-	<0.00010	-	-	<0.00010	-	-	-	-	0.0001	<0.00010
Acenaphthene	-	-	-	-	-	-	-	-	<0.00010	-	-	-	-	-	-	-	<0.00010	< 0.00010	<0.00002	<0.00010	< 0.00010	0.00008	<0.00010	< 0.00010	0.0001	< 0.00010	<0.00002	<0.00010	<0.00010
Acenaphthylene	-	-	-	-	-	-	-	-	<0.00010	-	-	-	-	-	-	-	<0.00010	< 0.00010	<0.00002	<0.00010	< 0.00010	<0.00002	<0.00010	< 0.00010	<0.00002	< 0.00010	<0.00002	0.00018	<0.00010
Fluoranthene	0.001 UR	-	-	-	-	-	-	0.00004	0.00014	-	-	-	-	-	< 0.00010	<0.00002	<0.00010	< 0.00010	<0.00002	<0.00010	< 0.00010	<0.00002	<0.00010	< 0.00010	<0.00002	< 0.00010	<0.00002	<0.00010	<0.00010
Fluorene	-	-	-	-	-	-	-	-	0.00011	-	-	-	-	-	-	-	<0.00010	< 0.0002	<0.00002	<0.00010	< 0.0002	0.00002	<0.00010	< 0.0002	0.0004	< 0.0002	<0.00002	0.00025	<0.00010
Naphthalene	0.12	-	-	-	-	-	-	-	<0.00010	-	-	-	-	-	-	-	<0.00010	< 0.0005	<0.00006	<0.00010	< 0.0010	0.00095	0.00013	< 0.0005	<0.00006	< 0.0010	<0.00006	0.00028	<0.00010
Phenanthrene	0.0006 UR	-	-	-	-	-	-	-	<0.00010	-	-	-	-	-	-	-	<0.00010	< 0.0004	<0.00003	<0.00010	< 0.0004	<0.00003	<0.00010	< 0.0004	0.0009	< 0.0004	<0.00003	0.00057	<0.00010
Pyrene	-	-	-	-	-	-	-	-	0.00018	-	-	-	-	-	-	-	<0.00010	< 0.0002	<0.00002	<0.00010	< 0.0002	<0.00002	<0.00010	< 0.0002	0.0015	< 0.0002	<0.00002	<0.00010	<0.00010
BTEX																												
Benzene	0.7 B	-	< 0.0050	< 0.0050	< 0.0010	< 0.0010	< 0.0010	<0.001	<0.0010	0.0066	0.01	< 0.0010	< 0.0010	< 0.0010	< 0.003	<0.001	<0.0010	< 0.003	<0.001	<0.0010	0.008	0.004	0.0048	< 0.003	<0.001	< 0.003	<0.001	<0.0010	<0.0010
Ethylbenzene	0.005 UR	-	< 0.010	< 0.010	< 0.0010	< 0.0010	< 0.0010	<0.001	<0.0010	< 0.010	< 0.010	< 0.0010	< 0.0010	< 0.0010	< 0.005	<0.001	<0.0010	< 0.005	<0.001	<0.0010	< 0.005	0.007	0.0011	< 0.005	<0.001	< 0.005	<0.001	<0.0010	<0.0010
Toluene	0.180 UR	-	0.0098	< 0.0050	< 0.0010	< 0.0010	< 0.0010	<0.001	<0.0010	0.0082	< 0.0050	< 0.0010	< 0.0010	< 0.0010	< 0.003	<0.001	<0.0010	< 0.003	<0.001	<0.0010	0.021	0.02	0.032	< 0.003	<0.001	< 0.003	<0.001	<0.0010	<0.0010
m&p-Xylene	0.275 UR	-	0.013	< 0.0050	< 0.002	< 0.002	< 0.002	<0.001	<0.0010	0.0062	< 0.0050	< 0.002	< 0.002	< 0.002	< 0.005	<0.001	<0.0010	< 0.005	<0.001	<0.0010	< 0.005	0.002	0.0036	< 0.005	<0.001	< 0.005	<0.001	<0.0010	<0.0010
o-Xylene	0.350 UR	-	< 0.0050	< 0.0050	< 0.0010	< 0.0010	< 0.0010	<0.001	<0.0010	< 0.0050	< 0.0050	< 0.0010	< 0.0010	< 0.0010	< 0.003	<0.001	<0.0010	< 0.003	<0.001	<0.0010	0.004	0.004	0.0053	< 0.003	<0.001	< 0.003	<0.001	<0.0010	<0.0010
Halogenated Aliphatics																												
1,1-Dichloroethene	0.7 UR	-	-	-	-	-	-	-	<0.0010	-	-	-	-	-	-	-	<0.0010	< 0.003	0.0005	<0.0010	0.013	<0.001	<0.0010	< 0.003	<0.001	< 0.003	<0.0005	<0.0010	<0.0010
cis-1,2-Dichloroethene	0.010 a	-	-	-	-	-	-	-	<0.0010	-	-	-	-	-	-	-	<0.0010	< 0.003	0.001	<0.0010	18.4	7.4	<0.0010	< 0.003	<0.001	< 0.003	<0.001	<0.0010	<0.0010
trans-1,2-Dichloroethene		-	-	-	-	-	-	-	<0.0010	-	-	-	-	-	-	-	<0.0010	< 0.003	0.001	<0.0010	0.4	0.4	<0.0010	< 0.003	<0.001	< 0.003	<0.001	<0.0010	<0.0010
Tetrachloroethene (tetrachloroethylene)	0.07 UR	-	-	-	-	-	-	-	<0.0010	-	-	-	-	-	-	-	<0.0010	< 0.003	0.001	<0.0010	7.6	0.7	<0.0010	< 0.003	<0.001	< 0.003	<0.001	<0.0010	<0.0010
Trichloroethene (trichloroethylene)	0.33 UR	-	-	-	-	-	-	-	<0.0010	-	-	-	-	-	-	-	<0.0010	< 0.003	0.0005	<0.0010	9.2	4.4	<0.0010	< 0.003	<0.0005	< 0.003	<0.001	<0.0010	<0.0010
Vinyl chloride	0.1 UR	-	-	-	-	-	-	-	<0.00030	-	-	-	-	-	-	-	<0.00030	< 0.003	0.001	0.001	5.4	3.9	<0.00030	< 0.003	<0.001	< 0.003	<0.001	<0.0030	<0.0030
Monoaromatic Hydrocarbons																												
Isopropylbenzene (Cumene)	0.03 UR	-	0.019	0.025	-	-	-	<0.001	<0.0010	0.17	0.14	-	-	-	< 0.0050	<0.001	<0.0010	< 0.003	<0.001	<0.0010	0.042	0.019	<0.0010	< 0.003	<0.001	< 0.003	<0.001	<0.0010	<0.0010
n-Propylbenzene	-	-	0.041	0.059	-	-	-	<0.001	<0.0010	0.22	0.094	-	-	-	< 0.0050	<0.001	<0.0010	< 0.005	<0.001	<0.0010	0.024	0.021	<0.0010	< 0.005	<0.001	< 0.005	<0.001	<0.0010	<0.0010
Styrene	0.25 b	-	< 0.0050	0.012	-	-	-	<0.001	<0.0010	< 0.0050	< 0.0050	-	-	-	< 0.0050	<0.001	<0.0010	-	-	<0.0010	-	-	-	-	-	< 0.003	<0.001	<0.0010	<0.0010
sec-Butylbenzene	-	-	-	-	-	-	-	-	<0.0010	-	-	-	-	-	-	-	<0.0010	< 0.003	<0.001	<0.0010	< 0.003	0.001	<0.0010	< 0.003	<0.001	< 0.003	<0.001	<0.0010	<0.0010
1,2,4-Trimethylbenzene	-	-	< 0.0050	<0.0050	-	-	-	<0.001	<0.0010	< 0.0050	< 0.0050	-	-	-	< 0.003	<0.001	<0.0010	< 0.003	<0.002	<0.0010	< 0.003	0.005	<0.0010	< 0.003	<0.001	< 0.003	<0.002	<0.0010	<0.0010
1,3,5-Trimethylbenzene	-	-	-	-	-	-	-	-	<0.0010	-	-	-	-	-	-	-	<0.0010	< 0.003	<0.001	<0.0010	< 0.003	0.002	<0.0010	< 0.003	<0.001	< 0.003	<0.001	<0.0010	<0.0010
Trihalomethanes																												
Bromodichloromethane	-	-	-	-	-	-	-	-	<0.0010	-	-	-	-	-	-	-	<0.0010	< 0.003	<0.0005	<0.0010	0.107	<0.0005	<0.0010	< 0.003	<0.0005	< 0.003	<0.0005	<0.0010	<0.0010
Chloroform (Trichloromethane)	0.37 UR	-	-	-	-	-	-	-	<0.0010	-	-	-	-	-	-	-	<0.0010	0.004	<0.001	<0.0010	< 0.003	<0.001	0.0045	< 0.003	<0.001	< 0.003	<0.001	<0.0010	0.0017
PFAS																												
PFHxS (total)	-	-	-	-	-	-	-	-	0.00059	-	-	-	-	-	-	-	0.000017	-	-	0.00042	-	-	0.00000015	-	-	0.0028	0.0026	0.00008	<0.0000010
PFOS (total)	-	-	-	-	-	-	-	-	0.0016	-	-	-	-	-	-	-	0.000019	-	-	0.00011	-	-	0.0000024	-	-	0.0045	0.0042	0.00017	<0.0000010
Sum PFOS + PFHxS	0.031 4	-	-	-	-	-	-	-	0.0022	-	-	-	-	-	-	-	0.000036	-	-	0.00054	-	-	0.0000026	-	-	0.0073	0.0068	0.00025	<0.0000020
PFOA	1.824 4	-	-	-	-	-	-	-	0.000026	-	-	-	-	-	-	-	0.0000012	-	-	0.000053	-	-	0.0000012	-	-	0.0002	0.0002	0.000079	<0.0000010
Total PFAS (n=30)	-	-	-	-	-	-	-	-	0.0025	-	-	-	-	-	-	-	0.000057	-	-	0.0021	-	-	0.000011	-	-	0.0002	0.0002	0.00035	-

Notes:

2024 post-works monitoring data

All results in g/m^3

Only compounds detected in one or more samples are shown

1 - Australian and New Zealand Water Quality Guidelines (2018).

2 - Ministy for the Environment, 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand: Groundwater acceptance criteria for gravels; commercial/ industrial use; groundwater at 2 m depth; (indoor air / outdoor air).

3 - Auckland Regional Council (2007), State of the Environment Monitoring: Groundwater Quality Data Report 1998-2005. ARC Technical Publication 352.

4 - Heads of EPAs Australia and New Zealand (HEPA, 2020) PFAS National Environmental Management Plan.

UR - unknown reliability value .

A - indicatesthat trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure.

B - 95% protection value adopted, as per AUP Chapter E.30 rules.

a - ANZECC water quality guideline for recreational purposes.

b - ANZECC Guidelines for chemical compounds in water found to cause tainting of fish flesh and other aquatic organisms.

Exceeds limit of reporting

red bold — Exceeds ANZECC 80% criteria

All samples pertain to current site area

Table A2: Summary vapour monitoring data

Sample information	VMP29s	VMP23s	VP2	GBH102P	GBH103P	CBH209P	CBH201P	Workplace Exposure Standards [1]		MfE target soil-air concentrations at 1 m depth [2]		NEPM HSLs [3]		USEPA target subslab concentrations [4]	
Year	2012	2012	2018	2024				Time weighted average	Short term exposure limit	Commercial / industrial	Residential	Commercial / industrial	Residential	Commercial / industrial	Residential
1.2.4-Trimethylbenzene	-	-	-	< 0.1	< 0.1	0.9	< 0.1	123,000	-	-	-	-	-	8,760	2,090
2.2.4 Trimethylpentane	<6	89	25,000	-	-	-	-	-	-	-	-	-	-	-	-
1.3.5-Trimethylbenzene	-	-	-	< 0.1	1.3	1.7	< 0.1	-	-	-	-	-	-	8,760	2,090
n-Propylbenzene	<LOR	<LOR	27	98	8.4	3.5	< 0.1	-	-	-	-	-	-	146,000	34,800
p-Isopropyltoluene	-	-	-	< 0.1	1.1	0.2	< 0.1	-	-	-	-	-	-	-	-
sec-Butylbenzene	-	-	-	< 0.1	6.1	1.4	< 0.1	-	-	-	-	-	-	-	-
tert-Butylbenzene	-	-	-	< 0.1	1.9	0.2	< 0.1	-	-	-	-	-	-	-	-
1.1.2-Trichloroethane	-	-	-	< 0.1	< 0.1	**130**	< 0.1	5,500	1,100	-	-	-	-	29.2	6.95
1.2.4-Trichlorobenzene	-	-	-	3.8	< 0.1	< 0.1	< 0.1	-	37,000 [1A]	-	-	-	-	292	69.5
1.3-Dichlorobenzene	-	-	-	< 0.1	< 0.1	0.1	< 0.1	-	-	-	-	-	-	-	-
Benzene	<LOR	<LOR	<8	< 0.05	< 0.05	0.11	0.13	160	-	745	149	4,400	1,100	524	120
Cyclohexane	<4	10	2,200	-	-	-	-	350,000	1,050,000	-	-	-	-	876,000	209,000
Ethylbenzene	-	-	-	< 0.1	< 0.1	0.7	< 0.1	88,000	176,000	21,700	6,550	1,500,000	380,000	1,640	374
Isopropyl benzene (Cumene)	<LOR	<LOR	21	< 0.1	7.4	6.7	< 0.1	125,000	375,000	-	-	-	-	58,400	13,900
m.p-Xylene	-	-	-	< 0.1	< 0.1	3.1	1.7	217,000	-	71,100	21,700	1,000,000	260,000	14,600	3,480
Naphthalene	-	-	-	< 0.1	1.2	< 0.1	< 0.1	2,600	10,000	3,180	936	3,700	900	120	27.5
o-Xylene	-	-	-	< 0.1	< 0.1	0.9	0.3	217,000	-	71,100	21,700	1,000,000	260,000	14,600	3,480
Styrene	<LOR	<LOR	12	< 0.1	< 0.1	0.1	< 0.1	85,000	170,000	-	-	-	-	146,000	34,800
Tetrachloroethene	74	7	72	< 0.1	< 0.1	0.4	< 0.1	136,000	271,000	-	-	8,000	2,000	5,840	1,390
Toluene	<LOR	<LOR	110	< 0.1	< 0.1	5.6	< 0.1	75,000	377,000	75,300	22,600	5,700,000	1,400,00	730,000	174,000
C5 TPH referenced to n-heptane	<400	<400	14,300	-	-	-	-	-	-	-	-	-	-	-	-
C6 TPH referenced to n-heptane	<800	<800	51,000	-	-	-	-	-	-	-	-	-	-	-	-
C7-C9 TPH referenced to n-heptane	<5,000	<5,000	178,000	< 100*	110	< 100*	110	-	-	4,710,000	1,420,000	850,000 [3A]	210,000 [3A]	-	-
C10-C12 TPH referenced to n-heptane	<3,000	<3,000	62,000	< 100#	< 100#	< 100#	< 100#	-	-	406,000 [2A]	127,000 [2A]	670,000[3A]	160,000[3A]	-	-

Notes:
All results in µg/m3
2012 and 2018 data repoduced from Tonkin & Taylor Ltd
*Values relate to fractions C6-C10 fraction
#Values relate to fractions C10-C12 fraction
Black values indicate detected concentrations
BOLD exceeds residential guidelines
Red shaded exceeds commercial / industrial guidelines
1.Worksafe, Workplace Exposure Standards and Biological Exposure Indices (9th edition) November 2107, updated 2018. Uses WES TWA and WES STEL
1A.Worksafe, Workplace Exposure Standards and Biological Exposure Indices (9th edition) November 2107, updated 2018. Uses WES CEILING
2. Target soil-air concentration data at 1 m for silty sand for commercial / industrial land use. Appendix 4J of the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Ministry for the Environment 1999, Revised 2011.
2A. Values relate to C10-C14 fraction
3. NEPM Health Investigation Levels for Soil Gas with CRC CARE screening levels for hydrocarbons (Technical Report 10) for silt at 0 to <1m for commercial/industrial (HSL D) and high density residential land (HSL B) use values.
3A. Values relate to C6-C10 and C10-C16 fractions
4. USEPA Target sub-slab and Near-Source Soil Gas Concentration - industrial/commercial and residential (assuming Hazard Quotient = 1, Target Risk-10^{-5}, Groundwater temperature= 20C and RfC = Chronic)

CERTIFICATE OF ANALYSIS

Work Order	:	**NH2501820**			
Client	:	**Williamson Water & Land Advisory**	Laboratory	:	Environmental Hamilton
Contact	:	Shane Moore	Contact	:	Customer Services NH
Address	:	10/1 Putaki Drive Kumeū Auckland New Zealand 0810	Address	:	Ruakura Research Centre, 10 Bisley Rd Hamilton WKO New Zealand 3214
Telephone	:	----	Telephone	:	+64 7 974 4740
Project	:	WWLA1615	Date Samples Received	:	15-Oct-2025 07:55
Order number	:	----	Date Analysis Commenced	:	17-Oct-2025
C-O-C number	:	----	Issue Date	:	23-Oct-2025 15:51
Sampler	:	Cherise Martin			
Site	:	----			
Quote number	:	EN/444			
No. of samples received	:	5			
No. of samples analysed	:	3			

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below.

Signatories	*Position*	*Accreditation Category*
Huub Jong	Laboratory Technician	Organics, Hamilton, Waikato

General Comments

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key: CAS Number: CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	Percent
mg/kg dry weight	mg/kg dry weight

>: greater than.
<: less than.
ø: ALS is not IANZ accredited for these tests.
^: This result is computed from individual analyte detections at or above the level of reporting.
~: Indicates an estimated value.
Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Samples were collected by yourselves (or your agent) and analysed as received at ALS NZ (or at the subcontracted laboratories, when applicable). Samples were in acceptable condition unless otherwise noted on this report.

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Client Sample ID	SV1 Depth: 1-1.5	SV2 Depth: 1-1.5	SV3 Depth: 1-1.5	----	----
				Client Sampling date / time	13-Oct-2025 00:00	13-Oct-2025 00:00	13-Oct-2025 00:00	----	----
					NH2501820-001	NH2501820-002	NH2501820-003	----	----
					Result	Result	Result	----	----
Perfluorinated Sulfonic Acids (PFSA)									
Perfluoropropane sulfonic acid (PFPrS)	423-41-6	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorohexane sulfonic acid (PFHxS) - Linear	355-46-4-L	0.0010	mg/kg dry weight		**0.0013**	<0.0010	<0.0010	----	----
Perfluorohexane sulfonic acid (PFHxS) - Mono-branched	355-46-4_MONO	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorohexane sulfonic acid (PFHxS) - Di-branched	355-46-4_DI	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0010	mg/kg dry weight		**0.0013**	<0.0010	<0.0010	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
PFOS - Linear	2795-39-3	0.0010	mg/kg dry weight		**0.0017**	<0.0010	<0.0010	----	----
Perfluorooctane sulfonic acid (PFOS) - Mono-branched	1763-23-1_MONO	0.0010	mg/kg dry weight		**0.0013**	<0.0010	<0.0010	----	----
Perfluorooctane sulfonic acid (PFOS) - Di-branched	1763-23-1_DI	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0010	mg/kg dry weight		**0.0030**	<0.0010	<0.0010	----	----
Perfluorononane sulfonic acid (PFNS)	68259-12-1	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluoroalkyl carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Client Sample ID	SV1 Depth: 1-1.5	SV2 Depth: 1-1.5	SV3 Depth: 1-1.5	----	----
				Client Sampling date / time	13-Oct-2025 00:00	13-Oct-2025 00:00	13-Oct-2025 00:00	----	----
					NH2501820-001	NH2501820-002	NH2501820-003	----	----
					Result	Result	Result	----	----
Perfluorinated Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluorinated sulfonamidoacetic acids									
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluoroalkyl sulfonamidoethanols									
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Fluorotelomer Sulfonates									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0050	mg/kg dry weight		<0.0050	<0.0050	<0.0050	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
Perfluoroalkyl Ether Carboxylic Acids (PFECA)									
Hexafluoropropylene oxide dimer acid (HFPO-DA)	13252-13-6	0.0010	mg/kg dry weight		<0.0010	<0.0010	<0.0010	----	----
PFAS_S: PFAS Summations									
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0010	mg/kg dry weight		**0.0043**	<0.0010	<0.0010	----	----
Sum of US EPA PFAS (PFOS + PFOA)	----	0.0010	mg/kg dry weight		**0.0030**	<0.0010	<0.0010	----	----
Sum (PFHxS + PFOS + PFOA)	PFHXS_PFOS_PFOA	0.0010	mg/kg dry weight		**0.0043**	<0.0010	<0.0010	----	----
Sum of PFAS (n=10)	PFAS_SUM10	0.0010	mg/kg dry weight		**0.0043**	<0.0010	<0.0010	----	----
Sum of PFAS (n=30)	PFAS_SUM31	0.0010	mg/kg dry weight		**0.0043**	<0.0010	<0.0010	----	----
PFAS_S: PFAS Surrogates									
13C4-PFOA	----	0.001	%		**97.2**	**101**	**107**	----	----
13C4-PFOS-Na	----	0.001	%		**113**	**109**	**108**	----	----

Surrogate Control Limits

Sub-Matrix : SOIL

Compound	CAS Number	Recovery Limits (%) Low	Recovery Limits (%) High
PFAS_S: PFAS Surrogates			
13C4-PFOA		70.0	130
13C4-PFOA		70.0	130
13C4-PFOA		70.0	130
13C4-PFOS-Na		70.0	130
13C4-PFOS-Na		70.0	130
13C4-PFOS-Na		70.0	130

Brief Method Summaries

Analytical Methods	Method	Matrix	Method Descriptions
PFAS in Soil	PFAS_S	SOIL	Final analysis of the extracts is performed by LCMSMS. In accordance with in-house procedure based on ASTM Method D7968-17a (2017). Perfluorooctane sulfonic acid (PFOS) - Reported as total of PFOS(Linear) + PFOS(mono-branched) + PFOS(di-branched) Perfluorooctane sulfonic acid (PFHxS) - Reported as total of PFHxS(Linear) + PFHxS(mono-branched) + PFHxS(di-branched) Sum of PFAS (N=10) - PFBA + PFPeA + PFHxA + PFHpA + PFOA + PFBS + PFHxS + PFOS + 6:2 FTS + 8:2 FTS Sum of PFAS (N=30) - PFPrS + PFBS + PFPeS + PFHxS + PFHpS + PFOS + PFNS + PFDS + PFBA + PFPeA + PFHxA + PFHpA + PFOA + PFNA + PFDA + PFUnDA + PFDoDA + PFTrDA + PFTeDA + PFOSA + N-EtFOSA + N-MeFOSA + N-EtFOSAA + N-MeFOSAA + N-EtFOSE + N-MeFOSE + 4:2 FTS + 6:2FTS + 8:2 FTS + HFPO-DA

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ANALYTICAL REPORT

IDENTIFICATION OF ASBESTOS IN SOIL SAMPLES (SEMI QUANTITATIVE ANALYSIS)

Client / Company name	ALS Food & Environmental NZ	Sample address	NH2501820
Client / Company address	10 Bisley Road, Enderley, Hamilton, 3214		
Client contact	Prianshu Chawla	Lab reference code	Q-00270
Sampler's name	Client	Client reference code	NH2501820
Sampler's contact number	07 974 4740	Date of sample reception	20-Oct-25
Email address	alsenviro.hamilton@alsglobal.com	Date of Analysis	22 and 23-Oct-25
Date of sampling	13-Oct-25	Date of Reporting	23-Oct-25

RESULTS

ANALYTICAL SUMMARY

Lab sample no.	Client sample no.	Sampling area details	Sample Weight as received (g)	Sample dry weight (g)	Moisture content (%)	Fibres identified
001	001	NH2501820-001;SV1	414.6	281.6	32.08	NAD, ORG
002	002	NH2501820-002;SV2	920.9	689.5	25.13	NAD, ORG
003	003	NH2501820-003;SV3	741.6	528.9	28.68	NAD, ORG
004	004	NH2501820-004;SV4	1080	1014	6.11	NAD, ORG
005	005	NH2501820-005;MBH01	912.3	855.4	6.24	NAD, ORG

Analytical Personnel: Meryn Tomson



Key Technical Personnel: Meryn Tomson



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SEMI-QUANTITATIVE ANALYSIS - SIZE FRACTION BREAKDOWN

Lab sample no	Client code / sampling area	Fraction size	Fraction Wt (g)	Asbestos product wt. *	Asbestos matrix	Asbestos content in matrix (%) *	Asbestos wt.(g) *	Total wt. (g) *	W/W % Asbestos*	
									ACM	AF/FA
001	001	>10mm	207.6	-	-	-	-	-	<0.001	<0.001
		10 – 2mm	47.3	-	-	-	-			
		<2mm	26.7	-	-	-	-			
002	002	>10mm	509.3	-	-	-	-	-	<0.001	<0.001
		10 – 2mm	106.6	-	-	-	-			
		<2mm	73.6	-	-	-	-			
003	003	>10mm	355.9	-	-	-	-	-	<0.001	<0.001
		10 – 2mm	102.4	-	-	-	-			
		<2mm	70.6	-	-	-	-			
004	004	>10mm	931.5	-	-	-	-	-	<0.001	<0.001
		10 – 2mm	67.2	-	-	-	-			
		<2mm	15.3	-	-	-	-			
005	005	>10mm	855.4	-	-	-	-	-	<0.001	<0.001
		10 – 2mm	0	-	-	-	-			
		<2mm	0	-	-	-	-			

Analytical Personnel: Meryn Tomson



Key Technical Personnel: Meryn Tomson



Notes

Method Summary: The sample analysis was conducted using stereo microscopic analysis followed by polarised light microscopy (PLM) with dispersion staining, following the AS 4964-2004 standard for the qualitative identification of asbestos in soil and bulk samples, and in accordance with BRANZ, New Zealand Guidelines for Assessing and Managing Asbestos in Soils (2017)

Disclaimers:

1.Alpha Analytics solely performs the analysis of submitted samples and does not partake in the sampling process. The company does not provide clients with sampling advice for asbestos-containing materials, and the results provided pertain only to the samples as received.
2. The laboratory-generated report includes the lab reference code, dates of sample reception, analysis, reporting, lab sample number, names of analytical and key technical personnel, sample quantity, description, and results.
3. Alpha Analytics is accredited by International Accreditation New Zealand (IANZ). All tests referenced in this report are performed in accordance with the terms of accreditation, except for those marked with an asterisk (*), which fall outside the scope of accreditation.
4. This certificate should be interpreted and distributed only in its entirety and must not be reproduced or shared in part.
5. Samples and original Chain of Custody (COC) forms are retained for one month only, while electronic copies of results and worksheets are stored for three years.

ALPHA ANALYTICS LIMITED

Results you can trust

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admin@alphaanalytics.co.nz
Phone - 022 649 6707

Fibre Legend:

CHR	Chrysotile (White asbestos)	AMO	Amosite (Brown asbestos)	CROC	Crocidolite (Blue asbestos)
ORG	Organic fibre	SMF	Synthetic mineral fibre	UMF	Unknown mineral fibre
NAD	No asbestos detected	NFD	No fibre detected		

Interpretation guide:

1. The asbestos percentage in the matrix is obtained from HSG 264 – 2012 (Asbestos: The Survey Guide, Appendix 2, relating to ACMs in buildings).
2. If a dash (-) is indicated, it signifies that no asbestos was detected in that specific portion of the sample during analysis
3. W/W% calculated above detection limit are marked in red.

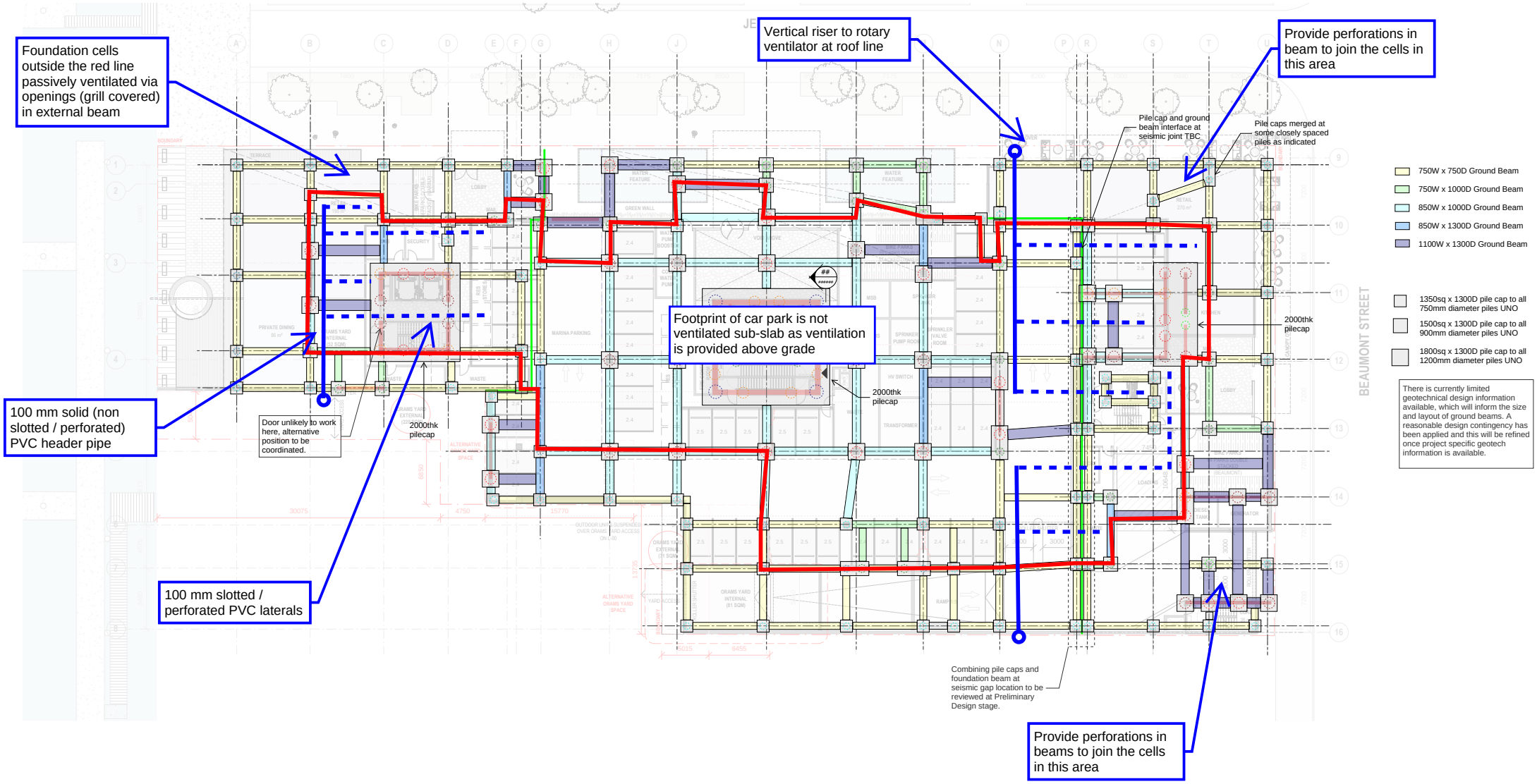
Detection Limit:

Sample fraction >10mm	0.1g dry weight
Sample fraction 10mm- 2mm	0.1g dry weight
Sample fraction <2mm	0.1g dry weight
Weight on asbestos in ACM	0.0001g dry weight
Weight of asbestos fines	0.0001g dry weight
Weight of fibrous asbestos	0.0001g dry weight
Asbestos in ACM as % of total sample	0.001 %W/W
Fibrous asbestos as % of total sample	0.001 %W/W
Asbestos fines as % of total sample	0.001 %W/W

End of report

Appendix C. Indicative vapour mitigation measures

Indicative sub-slab vapour ventilation network (suspended floor with void foundation option)



Robert Bird Group
Member of the Surbana Jurong Group

Foundation Plan

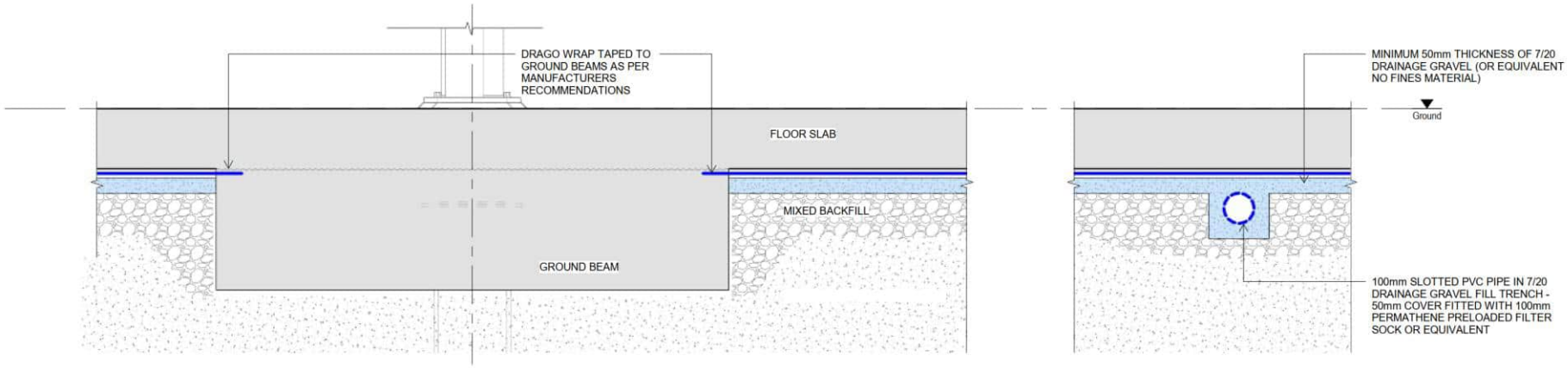
Do not scale. The copyright of this drawing remains with Warren and Mahoney Architects New Zealand Ltd.

Drawing Status
WORK IN PROGRESS
Drawing Details

Scale	1 : 200@ A1
Date	17/07/2025 5:55:15 pm
Job No	10442
Drawn	Author
Checked	Checker

WARREN AND MAHONEY

Indicative sub-slab vapour ventilation network (slab-on-grade foundation option)



CROSS SECTION OF TYPICAL VENTILATION NETWORK

DRAGO® WRAP
INSTALLATION INSTRUCTIONS



ENGINEERED PERFORMANCE
LIFE OF THE BUILDING™ PROTECTION

Additional Drago Wrap installation resources and videos are available on our website at:

stegoindustries.com/resources

CONTENTS

NOTE: While the photos in this guide show Drago® Wrap Vapor Intrusion Barrier, these installation instructions are also applicable to Drago® Wrap Soil Gas Barrier and Drago® Wrap Soil Gas Retarder, as all Drago Wrap membranes are installed using the same accessories and installation methodology.

The installation recommendations set forth in these instructions are generally based on ASTM E1643 and specific applications of Drago products. Each section provides explanations and options for the varying conditions.

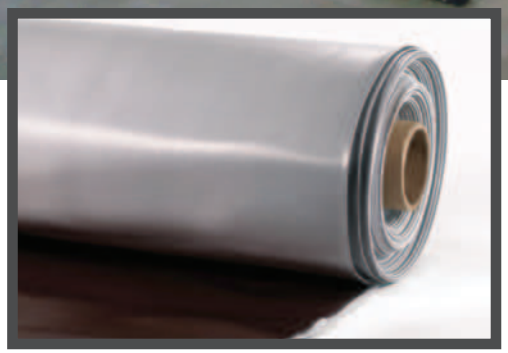
SECTION 1	**Drago Wrap and Drago Accessories**	3
SECTION 2	**Creating a Monolithic Membrane**	4
SECTION 3	**Where to Terminate the Drago Wrap**	5
SECTION 4	**Sealing Drago Wrap at Terminating Edges**	6,7
SECTION 5	**Sealing Damaged Areas**	8
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SECTION 7	**Sealing Multiple Pipe Penetrations**	10
SECTION 8	**Avoid Punctures with Beast Concrete Accessories**	11

Stego Installation Support - A Free Service

When you choose **Stego® Barrier Solutions** and products, you gain access to a large nationwide network of full-time technical sales representatives providing unmatched local support and service. If you ever have a question or concern regarding the following installation scenarios please contact us and take advantage of our free Stego Installation Support.



Drago Wrap Barriers & Retarders



DRAGO WRAP
VAPOR INTRUSION BARRIER
A multi-layered plastic extrusion that combines uniquely designed materials with only high grade, prime, virgin resins. This patent pending barrier technology provides high performance and longevity, allowing for the redevelopment of contaminated sites, creating a healthy built environment.



DRAGO WRAP
SOIL GAS BARRIER
A multi-layered plastic extrusion that combines gas barrier technology with only high-grade, prime, virgin resins. Drago Wrap Soil Gas Barrier can be used in systems for the control of VOCs, methane, radon, soil poisons, and sulfates.



DRAGO WRAP
SOIL GAS RETARDER
A multi-layered plastic extrusion manufactured with only high-grade, prime, virgin resins. Drago Wrap Soil Gas Retarder is a pre-emptive solution for contaminated sites with trace amounts of VOCs.

Drago Accessories

At Stego, we know every project has its own unique challenges. To make a Drago Wrap installation easy and flexible, we offer an extensive line of accessory items that gives you options to create a monolithic membrane between all interior intrusion pathways and vapor sources below the slab as well as at the slab perimeter. **Consult the project architect, owner's representative, and design engineer of record before proceeding with any of these options.**



DragoSeal® Tape
Combines Drago Wrap technology with a powerful adhesive for a barrier solution to seal seams, patches, and other details, defending against vapor intrusion.



DragoTack® Tape
A solvent-resistant, double-sided adhesive strip used to bond and seal Drago Wrap to concrete, masonry, wood, metal, and other surfaces.



Drago® Sealant
A two-component, high-performance epoxy, designed to be used with Drago Wrap for sealing utility and pipe penetrations.



Drago® Mastic
A polymer-modified anionic asphalt emulsion, designed to be used with Drago Wrap, for sealing utility, pipe penetrations, and terminating edges.



Drago® Sealant Form
A low-density, cross-linked, closed-cell polyethylene foam designed to be used as a detailing piece with Drago Sealant.

Creating a Monolithic Membrane

The key to an effective Drago Wrap installation is to create a monolithic layer of protection between the building foundation and vapor sources below. While Drago Wrap installation instructions are generally based on ASTM E1643 - *Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs*, these instructions are meant to be used as a guide, and do not take into account specific job site situations. Consult local building codes and regulations along with the building owner or owner's representative before proceeding.

ASTM E1643 discusses the selection of the vapor retarder and preparation of the subbase to minimize potential damage during installation and concrete placement.

ASTM E1643, Section 5.3.4.1 - *Select a vapor retarder material capable of withstanding potential construction site damage.*

ASTM E1643, Section 5.3.5.1 - *Select vapor retarder material capable of withstanding tear or puncture damage due to the type, gradation, and texture of the base material to be installed below the material. Prepare base material to minimize risk of puncture, for example, by rolling or compacting.*

ASTM E1643, Section 6.1 - *Level and compact base material.*

ASTM E1643 then states to create a monolithic membrane to protect the slab from adjacent moisture sources.

ASTM E1643, Section 6.4 - *. . . create a monolithic membrane between the surface of the slab and vapor sources below the slab as well as at the slab perimeter.*

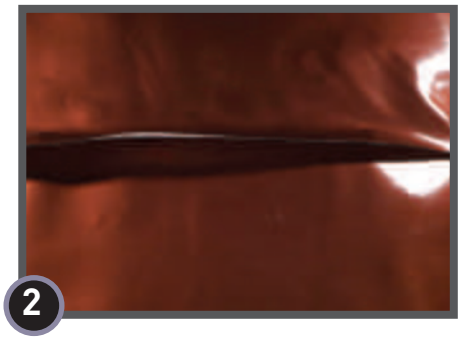
ASTM E1643, Section 6.5 - *Lap joints as instructed by the manufacturer and seal laps in accordance with the manufacturer's recommendations.*

Drago Wrap can be installed over an aggregate, sand, or tamped earth base. If installing on a design approved aggregate base, it is recommended to use a non-woven geotextile below Drago Wrap. Consult the design team for project-specific recommendations.



1 Unroll Drago Wrap over the area where the slab is to be placed.

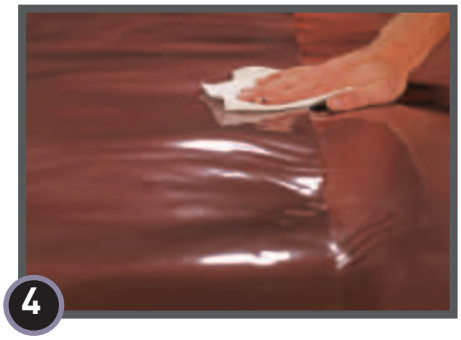
Note: Grey color side of membrane is face-down, copper color side is face-up.



2 Unless otherwise indicated by the design professional(s) of record, unfold Drago Wrap to completely cover the placement area.



3 All joints/seams should be overlapped a minimum of 12 inches.



4 Ensure Drago Wrap is clean and dry when applying DragoSeal Tape.

Tip: Use a cloth or other means to remove dust, debris, and excess moisture from Drago Wrap prior to applying DragoSeal Tape.



5 Seal the seams with DragoSeal Tape.

Note: Remove the release liner of DragoSeal Tape prior to application. After applying DragoSeal Tape, use consistent, firm pressure along the 4" width of DragoSeal Tape to ensure continuous adhesion. Optional ~4" steel roller is ideal.



OPTIONAL SEALING METHOD: Hot air wedge welding equipment is ideal for heat welding seams of Drago Wrap.

Where to Terminate the Drago Wrap

Always consult the project design team for where to terminate the vapor barrier to strike a balance between the location of the vapor barrier on or around foundation constructions and any structural concerns before proceeding.

ASTM E1643 provides direction on where to terminate the vapor barrier as follows:

ASTM E1643, Section 6.4 - *Extend vapor retarder over footings and seal to foundation wall, grade beam, or slab at an elevation consistent with the top of the slab or terminate at impediments such as waterstops or dowels...*

ASTM E1643, Section 6.6 - *Extend vapor retarder over the tops of pile caps and grade beams to a distance acceptable to the structural engineer.*

In accordance with ASTM E1643, terminate the Drago Wrap as follows:

At an elevation (height) consistent with the top of the slab;





Note: Turn Drago Wrap up foundation walls or forms. Ensure Drago Wrap is flush against the corner to avoid tenting.

At Impediments; OR





Note: Impediments may include rebar, dowels, water stops, etc. and may be located at interior grade beams in addition to perimeter walls and footings.

At a location of termination designated by the project design team.





Note: The distance to which the vapor barrier is extended adjacent to, onto, or completely over a footing or grade beam should be determined by the project design team.

If the location of vapor barrier termination has not been clearly addressed in the construction documents, then clarification should be requested from the project design team. Should no direction be given, Stego recommends the project team follow, at minimum, the guidelines of ASTM E1643.

Regardless of where the vapor barrier is determined to be terminated, ASTM E1643 requires the terminating edges to be sealed.

Sealing the Terminating Edges of Drago Wrap Up Foundation Walls & Vertical Surfaces **Using DragoTack Tape *or* DragoSeal Tape**

DragoTack Tape or DragoSeal Tape can be used to seal Drago Wrap to foundation walls, grade beams or other adjacent concrete constructions.

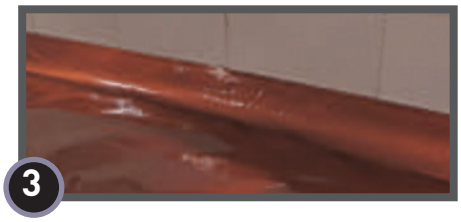
IMPORTANT: **Make sure the area of adhesion is free of dust, dirt, debris, moisture, and frost to allow maximum adhesion.**



1 Remove the release liner on one side of **DragoTack Tape** and adhere to foundation wall at the height of the slab or at impediments.

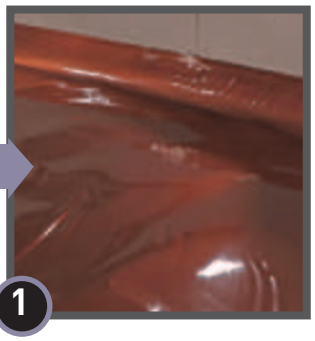


2 When ready to apply Drago Wrap, remove the exposed release liner from **DragoTack Tape**.



3 Press Drago Wrap firmly against **DragoTack Tape** to secure.

OR



1 Extend Drago Wrap up the vertical surface, likely to the height of the slab.

Note: See Where to Terminate the Drago Wrap, page 5.



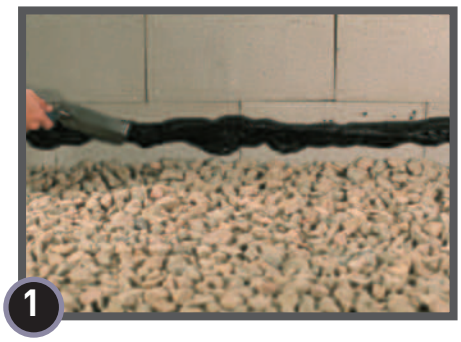
2 Apply **DragoSeal Tape** on the perimeter edge so that 2" is on the Drago Wrap and 2" is on the wall/vertical surface. Press firmly to secure.



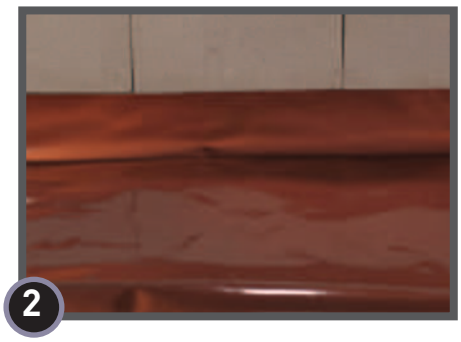
MECHANICAL SEAL OPTION:
If a mechanical seal is needed, fasten a termination bar over the top of the Drago Wrap inline with the **DragoTack Tape** (as shown in image) **or DragoSeal Tape.**

Using Drago Mastic

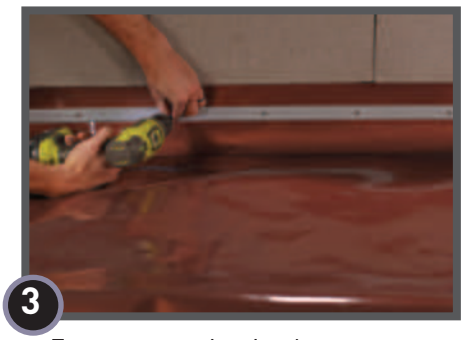
IMPORTANT: **Make sure the area of adhesion is free of dust, dirt, debris, moisture, and frost to allow maximum adhesion.**



1 Apply Drago Mastic to the foundation wall at the anticipated edge of the subsequently applied Drago Wrap at the height of the slab or impediments.



2 Press Drago Wrap firmly against the applied Drago Mastic on the foundation wall.



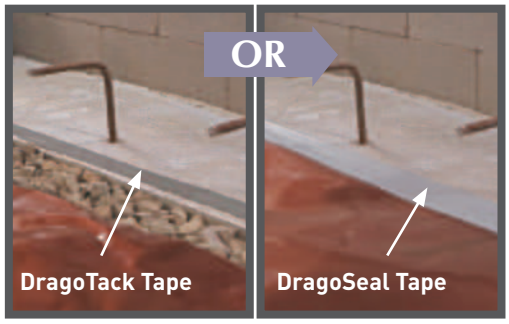
3 Fasten a termination bar over the top of the Drago Wrap inline with the Drago Mastic.

Sealing the Terminating Edges of Drago Wrap on a Horizontal Plane

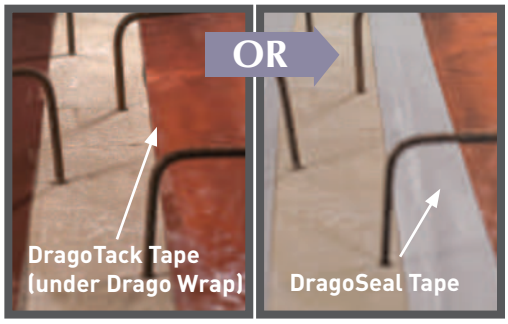
Always consult the project design team for where to terminate the vapor barrier to strike a balance between the location of the vapor barrier on or around foundation constructions and any structural concerns before proceeding.

After the location of where to terminate the vapor barrier has been determined, seal Drago Wrap along all terminating edges as indicated by the project team.

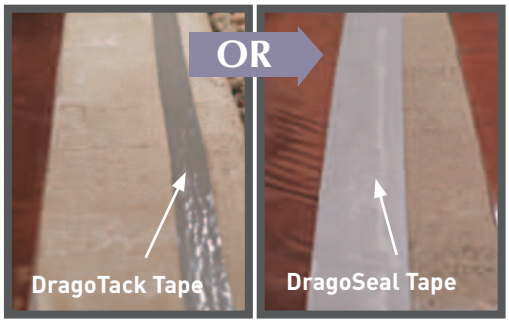
Using DragoTack Tape *or* DragoSeal Tape



Onto a Perimeter Footing at Impediments: Seal Drago Wrap to concrete with **DragoTack Tape or DragoSeal Tape**.



Onto Interior Grade Beams at Impediments: Seal Drago Wrap to concrete with **DragoTack Tape or DragoSeal Tape**.



At a Location Designated by the Design Team: Seal Drago Wrap to concrete with **DragoTack Tape or DragoSeal Tape**.



MECHANICAL SEAL OPTION:
If a mechanical seal is needed, fasten a termination bar over the top of the Drago Wrap inline with the **DragoTack Tape** (as shown in image); **or** fasten a termination bar over the 2" of **DragoSeal Tape** that is on top of Drago Wrap (not shown).

Not Allowed for

Using Drago Mastic



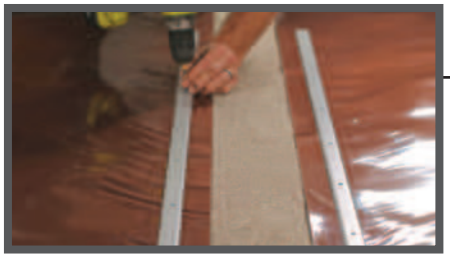
Onto a Perimeter Footing at Impediments: Seal Drago Wrap to concrete with Drago Mastic.



Onto Interior Grade Beams at Impediments: Seal Drago Wrap to concrete with Drago Mastic.



At a Location Designated by the Design Team: Seal Drago Wrap to concrete with Drago Mastic.

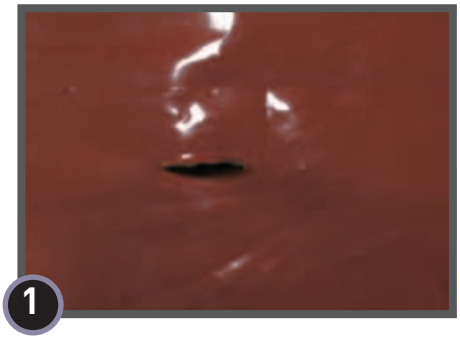


MECHANICAL SEAL OPTION:
If a mechanical seal is needed, fasten a termination bar over the top of the Drago Wrap inline with the Drago Mastic.

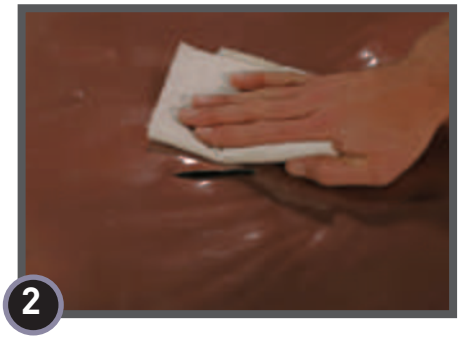
See "Where to Terminate the Vapor Barrier" on page 5 prior to choosing your terminating edge sealing accessory.

Sealing Damaged Areas: **Small Hole or Slice**

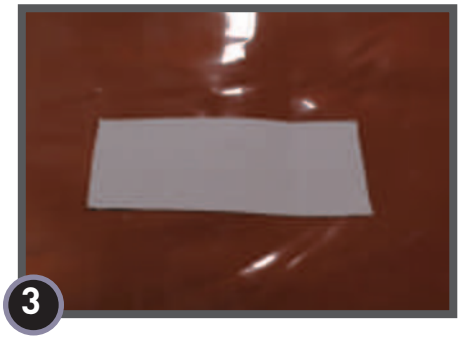
In the event that Drago Wrap is damaged during or after installation, repairs must be made. For smaller holes or slices in Drago Wrap, DragoSeal Tape can be used as noted below.



Small hole or slice in Drago Wrap.



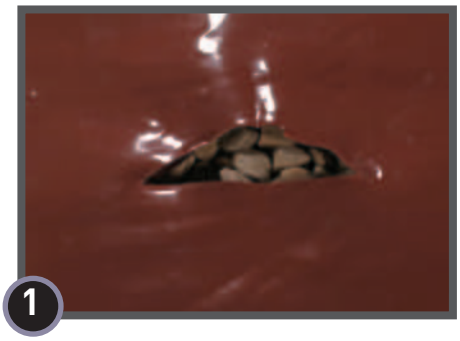
Clean area of adhesion.



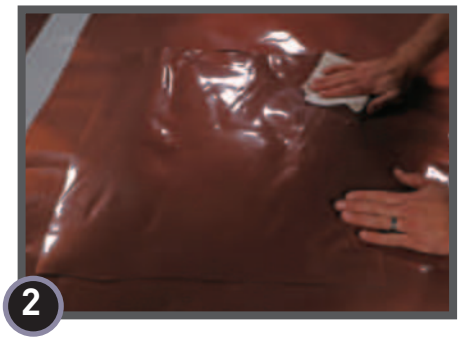
Center DragoSeal Tape over small hole or slice in Drago Wrap. Apply pressure to DragoSeal Tape after application.

Larger Hole

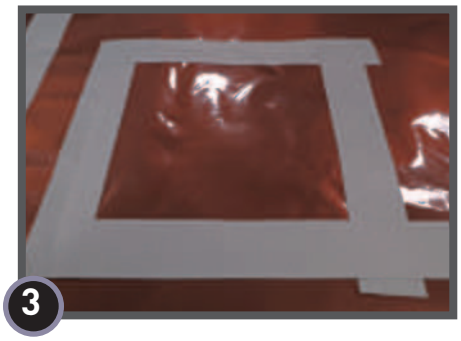
In the event that Drago Wrap is damaged during or after installation, repairs must be made. For larger holes, cut a piece of Drago Wrap to a size and shape that covers any damage by a minimum overlap of 6" in all directions. Clean all adhesion areas of dust, dirt, moisture, and frost. Tape down all edges using DragoSeal Tape.



Occasionally there are larger holes in the vapor barrier that require a patch.



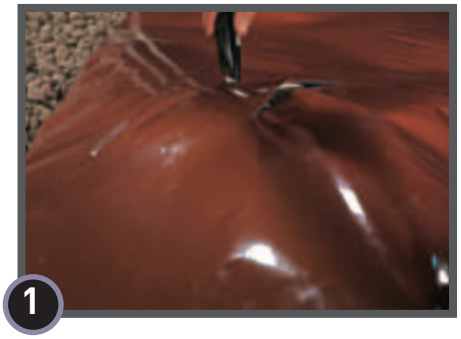
Measure and cut a piece of Drago Wrap to cover damaged area 6" in all directions. Clean area of adhesion.



Seal the patch with DragoSeal Tape.

Sealing Single Pipe Penetration: **Minimal Void Space**

All penetrations must be sealed. All pipe, ducting, rebar, wire penetrations and block outs should be sealed using Drago Wrap and either DragoSeal Tape, Drago Mastic, or Drago Sealant and Drago Sealant Form. If penetrations are encased in other materials, such as expansive materials like foam, unless otherwise specified, Drago Wrap should be sealed directly to the underlying penetration.



1

Install Drago Wrap around pipe penetrations by slitting/cutting material as needed. Try to minimize the void space created.



2

Pull material over and flatten. Clean area of adhesion where the Drago accessory will be applied.

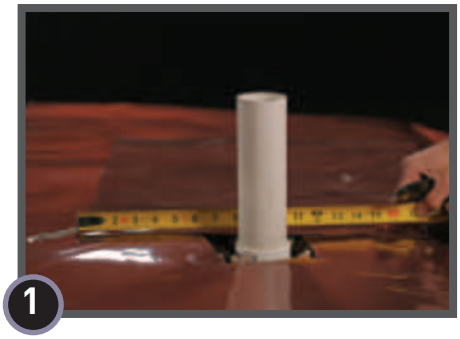


3

If Drago Wrap is close to pipe and void space is minimized then seal around pipe penetration with either DragoSeal Tape (as shown), Drago Mastic or Drago Sealant and Drago Sealant Form.

Larger Void Space Requires Detail Patch

To minimize void space around a larger penetration, a detail patch may be required.



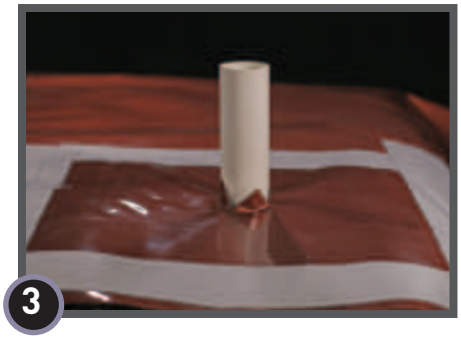
1

Cut a detail patch to a size and shape that creates a 6" overlap on all edges around the void space at the base of the pipe.



2

Cut an "X" the size of the pipe diameter in the center of the detail patch and slide tightly over pipe.



3

Seal all sides of the detail patch with DragoSeal Tape.



4a

Seal around the base of the pipe using DragoSeal Tape.

OR



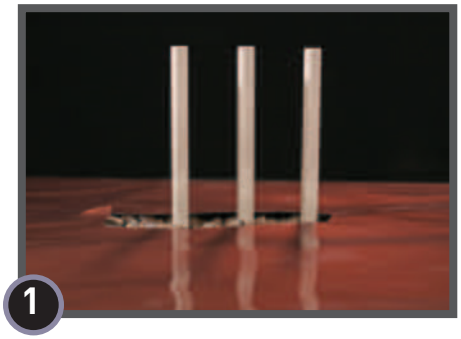
4b

Seal around the base of the pipe with Drago Mastic.

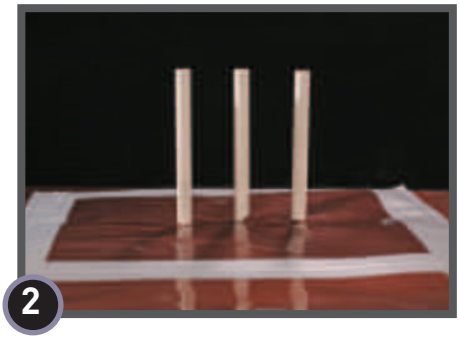
Note: apply using disposable glove, paint brush, or similar.

Sealing Multiple Pipe Penetrations:
Using Drago Mastic *or*
Using Drago Sealant and Drago Sealant Form

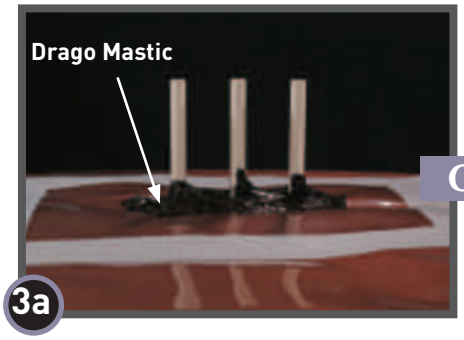
Multiple pipe penetrations in close proximity and very small pipes may be most efficiently sealed using Drago Wrap and Drago Mastic, or Drago Wrap, Drago Sealant, and Drago Sealant Form.



Cut a slit the size to accommodate the width of the multiple pipes. Try to minimize the void space created.



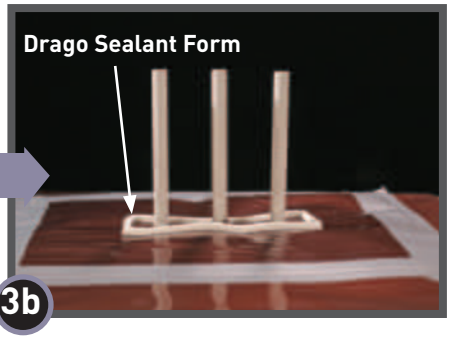
Place a detail patch over and around the base of the pipe penetrations as closely as possible, ensuring that it is flush with the base of the penetrations. Seal all sides of the detail patch with DragoSeal Tape.



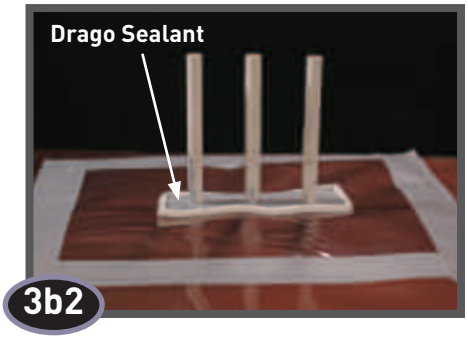
Apply Drago Mastic around the entire perimeter of the group of penetrations and between the penetrations to fill any void spaces present.

Note: apply using disposable glove, paint brush, or similar.

OR



Install Drago Sealant Form continuously to Drago Wrap and around the entire perimeter of the group of penetrations and at least 1 inch beyond the terminating edge of Drago Wrap.



Pour Drago Sealant inside of Drago Sealant Form to create a seal around the penetrations.

Note: If the void space between Drago Wrap and the penetrations is not minimized and/or the base course allows for too much drainage of sealant, a second coat of Drago Sealant may need to be poured after the first application has cured.

Drago Sealant pot/working life is roughly 30-45 minutes.

Avoid Punctures with Beast® Concrete Accessories

To help eliminate the use of non-permanent penetrations in Drago Wrap installation, Stego recommends the use of Beast vapor barrier-safe concrete accessories.

IMPORTANT: Avoid puncturing Drago Wrap with stakes while forming, bracing, and screeding.



BEAST® FORM STAKE can be used with **BEAST® FOOT** as part of the Stego vapor barrier-safe forming system which meets ASTM E1643 requirements.



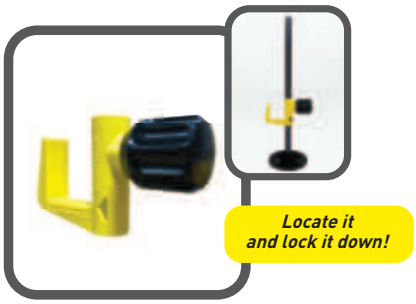
This concrete form stake takes the place of traditional nail stakes for interior forming applications, utilizing SpeedTrack™ Fastening Grooves for unlimited fastener placement.

Note: Refer to Beast Form Stake Installation Guide for detailed usage instructions.



Beast Form Stake is strong enough to withstand a beating during concrete placement while holding its shape. It is easy to remove and reusable for the next job.

Note: Beast Form Stake can be removed once concrete has set sufficiently to hold its shape. Fill and repair any voids in the concrete as necessary once the Beast Form Stake has been removed and strike Beast Form Stake against a hard surface to loosen the concrete buildup.



BEAST® HOOK is a **faster**, **easier** way to set 2x4 overhead screeds. Use Beast Foot and Beast Form Stake and make it a vapor barrier-safe screed system.

No tools are required, just grip the knob to loosen or tighten. Fast, easy, efficient.



BEAST® SCREED is a fixed-elevation, point-to-point guide screed system designed to replace common wet-screed methods.

Improve efficiency and maintain concrete floor levelness with the BEAST SCREED SYSTEM!



Set it and forget it. Beast Screed eliminates the need to frequently re-establish grade to ensure floor elevation has not changed during the screeding operation as is typical with traditional wet-screed methods.

Note: Refer to Beast Screed System Installation Instructions for detailed usage instructions.

NOTE: Stego Industries, LLC's ("Stego") installation instructions are based on ASTM E1643 - *Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.* These instructions are meant to be used as a guide, and do not take into account specific job site situations. Consult local building codes and regulations along with the building owner or owner's representative before proceeding. If you have any questions regarding the above mentioned installation instructions or Stego products, please call us at 877-464-7834 for technical assistance. While Stego employees and representatives may provide technical assistance regarding the utility of a specific installation practice or Stego product, they are not authorized to make final design decisions.



When it comes to building construction, ***don't take the vapor intrusion barrier installation lightly***. After all, it is there to protect the building's vital foundation from the threats lurking below the slab.

Stego's industry-leading barriers and unrivaled support equip you with the confidence to create resilient foundations for buildings where people work, learn, and gather.



We help keep you up to speed on the latest installation methods.

DISCUSS YOUR PROJECT NEEDS

Have questions? Give us a call.

877-464-7834

stegoindustries.com

Stego Industries, LLC ("Stego") Intellectual Property, Installation, Warranty, and State Approval Information: stegoindustries.com/legal . ©2025 Stego Industries, LLC. All rights reserved.

Appendix D. WWLA Site Management Plan

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Site Management Plan (Ground Contamination)

Site ID:	188 Beaumont Street	Rev 2, 20 March 2026

Overview:

Williamson Water & Land Advisory (WWLA) has been engaged by Westhaven Residential Limited Partnership to provide a detailed site investigation[1] in relation to the resource consent application for residential-led mixed use building comprising residential apartments, ground floor retail and ancillary car parking at 188 Beaumont Street, Auckland. The ground contamination assessment was provided for the purpose of a substantive application under the Fast-track Approvals Act 2024.

The site was previously occupied by a petrochemical storage facility and previous assessments have shown it to be contaminated by a range of hydrocarbons, solvents, cyanide and PFAS. Review of the contamination conditions in the context of the proposed development and associated construction works indicate that the primary ground contamination risks relate to:

- Deep excavations (extending beneath surficial engineered subbase and hardfill) where construction workers could be exposed to hydrocarbons in soil (or as SPH) that could present a nuisance through generation of odours;
- Offsite disposal of surplus soil or fill containing contaminants, especially PFAS; and
- Management of surface water and groundwater dewatering discharges.

This Site Management Plan (SMP) outlines procedures for contractors regarding soil management, removal, health and safety and response to unexpected contamination encounters. The contractor is responsible for following the requirements of this SMP and reporting on compliance to the SQEP. Where input is required by a SQEP (e.g. WWLA, details in letterhead), it is *highlighted* below.



Figure 1. Site location

[1] 188 Beaumont Street, Detailed Site Investigation. Report prepared for Westhaven Residential Limited Partnership by Williamson Water & Land Advisory Ltd, dated 20 March 2026. Reference: WWLA1615.

Procedures understood by the Contractor: ……..……..……....	Date: ……
Induction given by SQEP: ……..……..……	Date: ……

Task	Description	Check
1. Pre-works requirements	• Consideration should be given to undertaking additional testing of soils for PFAS once foundation designs and site levels are finalised as PFAS impacted material may not be accepted for disposal at landfill. All sampling and testing must be undertaken by a *SQEP*.	☐
	• If additional PFAS is identified in materials expected to be disturbed by the works, the *SQEP* shall liaise with the contractor and Westhaven Residential Limited Partnership to determine appropriate management or disposal options. Options could include: - Pre-treating the soils to secure acceptance for offsite disposal. - Over excavating to create space to retain PFAS contaminated soils onsite. - Placing the materials in the sub-slab void.	☐
	• The *SQEP* shall prepare a vapour risk assessment, which confirms the required vapour mitigation measures (if any), for approval by Council.	☐
	• Water management and treatment measures must be established (refer **Section 7**) and provided to Council for approval.	☐
	• Arrange disposal permits for soils proposed to be disposed offsite. The *SQEP can assist* if required.	☒
2. Site Establishment	• Establish earthworks controls according to Auckland Council's Guideline Document 2016/005, "*Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region* (GD05)" and the site-specific erosion and sediment control plan (ESCP).	☐
	• Establish dust controls in accordance with the Ministry for the Environment's *Good Practice Guide for Assessing and Managing Dust*, including: - Regular wetting of the work area and exposed soils. - Use of suppression methods that minimise over wetting and surface water runoff, such as hand-held hose with sprinkler nozzle for small areas or misting lines for larger areas	☐
	• *Inform the SQEP* of works commencement date and arrange an induction for this SMP (to sign off above). The induction shall address: - Contamination conditions, risks and implications for health and safety and environmental management. - Procedures for responding to unexpected contamination. - Water management. - Odour and vapour management. - Stockpiling and disposal requirements.	☐
	• Inform Auckland Council of works commencement date and arrange pre-works meeting, if required.	☐
	• Induct new workers/ subcontractors to requirements of this plan as works progress; the site manager may do this.	☐
	• Ensure that signage and a hazard boards address ground contamination matters as set out in this SMP.	☐
3. Health and safety	• Site workers should avoid any direct contact with soil and be aware of the potential for vapours and odours to be generated (refer below for vapour/ odour control).	☐
	• Contamination specific PPE requirements are: - Long sleeves and pants.	☐

Task	Description	Check
	- Disposable nitrile gloves should where direct contact with soils or water is required. Gloves should be changed regularly. - Dust masks (P2) and half-face respirators (fitted with organic cartridges) shall be available on site for staff that require them if odours/ vapours are observed and are persistent (**Section 5**).	
	• Ensure hands are washed before eating and drinking and boots are brushed down before entering vehicles.	☐
4. Asbestos in soil controls	Owing to its occasional detection in near surface fill materials, asbestos controls shall be in place during soil disturbance/ excavation works: • "Trace Asbestos Contamination" controls are applicable per the BRANZ (2024) Guidelines (refer to attached asbestos controls summary). • A licensed removalist is not required to oversee the work and no asbestos-specific PPE is required. • A boot wash shall be provided and facilities for workers to wash hands and faces before eating or drinking. • Exposed soil shall/fill be kept moist at all times, including dampening as required, to prevent dust generation.	☐
5. Petrochemicals in soil and water controls	Elevated concentrations of hydrocarbons are present at depth near the water table but can potentially be present at all depths. The following controls be in place during soil disturbance/ excavation works: • Smoking is strictly prohibited. • The *SQEP* (or suitably trained Contractor personnel) shall undertake monitoring using a PID and multi-gas meter at all times. The trigger levels at which stop-works procedures should be implemented are: 1. Explosive / combustible gasses: 10% LEL 2. O_2: <19.5% 3. H_2S: 0.5% 4. VOCs: 5 ppm If any of the above trigger levels are exceeded, soil disturbance shall immediately cease and the excavation area vacated until monitoring shows that the level has decreased to below the trigger (safe) levels. • The *SQEP* (or suitably trained Contractor personnel) shall also monitor odours. If unacceptable odours are encountered for a continuous period of more than 30 seconds, works in the affected area shall immediately cease and the area will be vacated until the odour reduces to acceptable levels. Unacceptable levels of odour are defined as those that may cause: • Discomfort to site personnel; and/or • A nuisance beyond the site boundary. Works shall cease immediately if site personnel experience dizziness, nausea or headaches related to odours. • Separate phase hydrocarbons accumulated in excavations shall be removed as soon as practicable to minimise odour / vapour impacts. Small volumes can be removed using absorbent pads (spills kits) larger volumes may need to be removed by pumping (e.g. skimming via diaphragm pump) to a holding tank or by appropriately certified vacuum loading (sucker truck). • Pumping of SPH to water treatment systems shall be avoided to prevent overloading of these facilities.	☐
6. Contingency measures for petrochemicals in soil and water controls	If ongoing exceedance of odour trigger or vapour levels set out in **Task 5** occur, advice shall be sought from the *SQEP* regarding the need for and type of additional control measures. Additional control measures could include: • Active ventilation of excavations.	

Task	Description	Check
	• Limiting open areas and/or progressively stabilising excavations as works progress. • Using deodorising solutions. • Additional PPE (e.g. half-face respirators with cartridges for volatile organic compounds).	
7. Water management	• All surface water (including wash water) and groundwater generated during excavation works shall be retained onsite and allowed to soak to ground. • If soakage is not effective water CANNOT not be disposed to stormwater without prior testing, and if necessary, treatment. Options may include: - Obtaining a temporary trade waste permit from Watercare; - Treatment through a silt removal system, oil/ water separator (if required) passing through an absorbent (such as activated carbon) to remove dissolved hydrocarbons, cyanide and/or PFAS, then discharging to stormwater or marine water; or - Tankering offsite for disposal at an approved liquid waste disposal facility. • All water testing shall be undertaken by the *SQEP* with samples submitted for analysis for TPH, BTEX and PFAS (as a minimum).	☐
8. Other monitoring	• Erosion and sediment controls shall also be monitored daily and following rainfall events.	☐
	• Visual monitoring for dust shall be undertaken during all soil disturbance/ excavation works.	☐
9. Cessation of controls	• Maintain vapour /odour and dust controls until the affected area of exposed soil is either covered by new structures, impervious surfaces (such as waterproofing membrane, shotcrete etc.) or a minimum of 50 mm thickness of clean hardfill. **Confirmation shall be provided by the *SQEP* prior to any control measures being stopped**.	☐
	• Maintain water management controls until generation of water discharges which have been in contact with exposed soil or groundwater has stopped, and water, including rainfall, is not coming into contact with site soils. Confirmation shall be provided by the *SQEP* prior to water management control being stopped.	☐
10. Soil reuse	There is not expected to be any soil reuse on the site although all materials in the upper 0.8 m can be reused if required.	
11. Soil disposal (subject to prior approval from disposal facility)	Pavements and surficial granular fill materials — Managed fill	
	Reclamation fill — Licensed Landfill	
	Natural ground (unlikely to encountered) — Cleanfill (further testing may be required)	
12. Imported soil and fill	• Ensure any imported materials (soil, recycled hardfill/concrete etc.) are clean. These must be either quarry sourced or *verified by the SQEP* as being from a non-HAIL site or being cleanfill.	☐
13. Unexpected contamination response	• *Liaise with the SQEP* should any unexpected contamination be identified and implement mitigation measures advised by the SQEP. Typical unexpected materials can include: - refuse or putrescible wastes (wood, organic materials etc.); - odorous materials (different to the expected hydrocarbon odours); - brightly discoloured soil (yellow, green, blue); or - bulk asbestos.	☐

Task	Description	Check
	If unexpected contamination is encountered the following steps must be taken by the Contractor: 1. Cease works in the immediate vicinity of the suspected contamination and tape or cone off. 2. Notify the project manager (client representative) and *the SQEP*. 3. Implement any contaminated land-related health and safety procedures and PPE *as deemed necessary by the SQEP*. 4. Update the Hazard Board to direct site workers should continued exclusion of the area be required. 5. Implement and maintain any additional controls required by the SQEP to manage contamination. 6. If necessary (to be agreed with the client's project manager and *SQEP*) notify Auckland Council.	
14. Post Works (*provide to SQEP*)	• Photographic records of the soil disturbance works (e.g. areas of cut, areas of fill etc.)	☐
	• Details of the locations where surplus soils has been reused/ placed on the site (if any).	☐
	• Weighbridge summaries of all soil, fill and concrete materials disposed from site.	☐
	• Details of any health and safety or environmental incidents during the works.	☐
	• Details of any unexpected discoveries and associated mitigation measures implemented during the works.	☐
15. Reporting	*The SQEP* shall prepare a works completion report on receipt of the post-works information (above) from the contractor.	☐

Attachments:

Asbestos controls

Asbestos works categorisation and controls required (per BRANZ Guidelines, 2024).

Scenario	Trace Asbestos Work	Low Level Asbestos Work	Class B Works	Class A Works
Asbestos concentrations	≤0.001% w/w AF+FA or ≤0.01% w/w ACM or ≤0.01 fibres/ml (air)	>0.001% w/w AF+FA or >0.01 % w/w ACM or ≤0.01 fibres/ml (air)	>0.01% w/w AF+FA or >1% ACM	>1% w/w AF+FA
Additional notification requirements	No additional documentation or notification required.	No additional documentation or notification required.	Asbestos removal control plan (ACRP) and WorkSafe notification for asbestos removal.	Asbestos removal control plan (ACRP) and WorkSafe notification for asbestos removal.
Oversight	*SQEP*.	SQEP.	Licensed removalist and SQEP.	Licensed removalist and SQEP.
Personal protective equipment	No asbestos-specific requirements as concentrations are unlikely to exceed trace levels in air.	Disposable coveralls rated type 5, category 3, nitrile gloves, steel toe capped gumboots or safety footwear with disposable overshoes.	Disposable coveralls rated type 5, category 3, nitrile gloves, steel toe capped gumboots or safety footwear with disposable overshoes.	Disposable coveralls rated type 5, category 3, nitrile gloves, steel toe capped gumboots or safety footwear with disposable overshoes.
Respiratory protective equipment	No asbestos-specific PPE as concentrations are unlikely to exceed trace levels in air.	Disposable P2 dust mask.	Half-face P3 respirator with particulate filter.	Full-face P3 respirator with particulate filter.
Dust/asbestos fibre suppression	Water spray via localised points.	Water spray via localised points.	As per ARCP prepared by licenced removalist.	As per ARCP prepared by licenced removalist.
Air monitoring	Air monitoring not required concentrations are unlikely to exceed trace levels in air.	Air monitoring not required.	Air monitoring not required but recommended where sensitive receptors are nearby.	Air monitoring required.
Cleaning facilities	Foot wash and used PPE collection area.	Dedicated cleaning area and foot wash	Dedicated cleaning area and foot wash.	Dedicated wet cleaning area or trailer. Consider powered and plumbed unit.
Vehicle (truck) protection	Truck lining/soil wrapping not required. All trucks should be covered.	Truck lining/soil wrapping depends on the receiving landfill. All trucks should be covered.	200 µm heavy-gauge polythene wrapped soil/lined trays and truck covered.	200 µm heavy-gauge polythene wrapped soil/lined trays and truck covered.
	Standard air conditioning.	Standard air conditioning.	Filter system fitted for all occupied vehicles where friable ACM on site (lagging, insulation, etc).	Filter system fitted for all occupied vehicles filter replaced or clean down with HEPA vacuum cleaner post work.
Vehicle washing Facilities	*Visual assessment by a competent person or SQEP* following brush and or wash down.	Visual assessment by a competent person / SQEP following brush and or wash down.	Visual assessment plus swab (if friable) by an independent assessor, competent person, or SQEP following brush and or wash down.	Visual assessment plus swab and air sampling inside the cab by an independent assessor or competent person.

Appendix E. Previous investigation report

REPORT

Tonkin+Taylor

Preliminary and Detailed Site Investigations (Ground Contamination)

142 - 188 Beaumont Street, Wynyard Quarter



Prepared for
Orams Marine
Prepared by
Tonkin & Taylor Ltd
Date
November 2018
Job Number
30881.2000.2.v4

Exceptional thinking together
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Document Control

Title: Preliminary and Detailed Site Investigations (Ground Contamination)					
Date	Version	Description	Prepared by:	Reviewed by:	Authorised by:
Nov 18	4	Design revisions	WMW/LKH	SRMM	PJM

Distribution:

Orams Marine	Electronic
Barker & Asscoiates Ltd	Electronic
Auckland Council	Electronic
Tonkin & Taylor Ltd (FILE)	1 copy

Executive Summary

Orams Marine (Orams) are developing Site 18 and the existing open yard of their adjacent current marine servicing operation to create a facility capable of servicing marine vessels up to 620 tonnes, including ferries, fishing vessels and commercial vessels as well as recreational yachts and motor vessels. The lifting facilities will see the natural deep water access increased to enable the large vessels to enter two proposed new travel lifts to be lifted onto land. Orams proposes to complete the marine elements of the site prior to the Americas Cup Regatta planned for early 2021. A residential and retail high rise structure proposed for the northern part of the site will be commenced in post Americas Cup.

Tonkin & Taylor Ltd (T+T) has prepared this preliminary and detailed site investigation to support the resource consenting process, detailed design and to inform documentation to support the ground improvement and construction process. The investigation and evaluation shows that currently contaminant discharge from Site 18 is occurring, including discharge of separate and dissolved phase contaminants. The evaluation confirms that following the proposed works separate phase discharges will be negligible and dissolved phased contaminants in groundwater will be significantly reduced, to at or below applicable protection levels. The natural attenuation process, shown to be currently occurring, will be significantly enhanced by the proposed works.

The table below summarises the key findings and ground contamination implications for the development and expands on the pre- and post-development evaluation above. It is important that the information presented below be read in conjunction with the relevant detail included in the main body of the report.

Development requirements	Key elements of the design where significant positive effects on existing contaminant discharges will occur include: • Strengthening and repairing the deteriorated seawall and wharf structure through use of deep soil mixing. • Development of a stabilised raft of cement mixed soil and pavement to 1.85 – 2.05 m depth below finished level to enable use of the site for marine servicing in line with its zoning. • Construction of two new travel lift structures in the coastal marine area (CMA) adjacent to Site 18 and dredging to deepen the seabed to enable large vessels to access the new travel lifts. The ground engineering and development works will reduce the mobility and mass of contaminants remaining onsite post development. The purpose of the investigations was to quantify effects and inform construction and post construction mitigation and monitoring measures. [Refer Section 2]
History	The site is within the former Western Reclamation, land reclaimed by the Auckland Harbour Board, now known as Ports of Auckland, from the sea from 1904 – 1917. Reclamation on Orams existing site extended into the 1980s. There is a long history of petroleum and marine industry activities on the land. Site 18 was used for petroleum hydrocarbon and petroleum product storage by Mobil Oil up until 2006, while Orams existing site has been used for marine service activities. A strip of land in the north of the Orams existing site was formerly part of Mobil's operations. Their operations included "special products" storage which incorporated solvents (including chlorinated compounds), transformer oils and petroleum fuels (diesel, kerosene, petrol and aviation gas).

	[Refer Section 4]
Setting	Reclamation materials comprises a granular upper layer which includes granular gasworks waste by-products (clinker and ash), underlain by marine hydraulic fill, natural insitu marine sediments, alluvial soils (Tauranga Group) and sedimentary rock (East Coast Bays Formation). Groundwater depth and flow direction within the western Reclamation is variable and influenced by subsurface structures and public service corridors in the road reserves. Generally groundwater is between 1.5 and 2.5 m below ground level (bgl) and flows west to the Waitemata Harbour, which lies adjacent to the western boundary of the site. The poor condition of the seawall means tidal effects are present, the greatest adjacent to the seawall. [Refer Section 3]
Previous data	Information on T+T project files, Council property files and reports provided by Panuku has been reviewed and where relevant used to assist the desk based and intrusive investigations. T+T previously undertook investigations of the Orams existing site and we have relied on this information for this report. Consequently no new soil data has been obtained but existing groundwater monitoring wells have been sampled and tested during the investigations. [Refer Section 5]
Potential for contamination	HAIL activities have occurred on the site, both Site 18 and Orams existing site. These activities mainly relate to storage and possible spills of petroleum-related products at Site 18 and in the north of Orams existing yard, and the use and discharge of hazardous materials including antifoulants and metals associated with marine activity uses within Orams existing yard. Potentially contaminating activities identified possibility for presence of contaminants in soil, groundwater, air and sediment on and adjacent to the site. A preliminary conceptual site model (CSM) suggests contaminants in these media may pose a risk to human or environmental receptors currently and, if mitigation measures are not appropriate, will continue during the development works. The preliminary CSM informed the sampling plan, as driving the site investigation approach and design. [Refer Section 6]
Data findings	Key findings of the data gathering are: • Intrusive investigations confirmed ground conditions predicted during the desk study review. Granular materials were prevalent over the Site 18 with gasworks waste by-products (clinker and ash) included in the upper layers in pockets rather than consistent across the site. In many locations former concrete tank support pads were encountered at ~1.5 m depth bgl. This may affect the depth of proposed cement stabilisation where they occur. The contaminant profile varied spatially in these materials, however generally petroleum hydrocarbons (TPH fractions C_7-C_{14}) occur along with polycyclic aromatic hydrocarbons and lead generally well distributed. Hydrocarbon odours are present, increasing with depth to the water table. • Petroleum hydrocarbons are prevalent in the underlying hydraulic fill across Site 18, within the water table fluctuation zone. Odour is greatest in these materials and in places separate phase hydrocarbons (SPH) are visible in soils and on the water table. Chromatographs produced during laboratory analysis confirm the aged/weathered nature of hydrocarbons. Lead is the most predominant metal present. • In the southwest of Site 18 and extending into the northwest of Orams existing site are residual chlorinated solvents and their derivatives extending through the layers described above, to the Tauranga Group sediments several metres below sea level. While DNAPL was not recorded, solvent levels in groundwater above product solubility limits suggest DNAPL is present, but given that it was not present in the monitoring wells, may be relatively immobile. A natural attenuation assessment confirms degradation of these products is occurring in an environment supportive of these processes. A secondary localised source of chlorinated solvents was recorded, in vapour only, in the area of Building 2.

	• Sediment quality was assessed within the proposed dredging footprint and close to the seawall along the length of Site 18. Contaminant concentrations in sediment decrease with depth but do not necessarily decrease with distance from the seawall suggesting input from contaminant sources not on the site or historic impacts from past activities on or adjacent to the site. Recent dredging works in the wider Westhaven Marina (2011) and Silo Park (2017) is expected to have affected the distribution and concentrations of contaminants. Dredging is proposed to - 6 m RL to support the travel lift operations and will result in removal of all sediment within the footprint. Tauranga Group soils to be exposed by the dredging programme have been tested and are shown to have low levels of contaminants, at typical background levels for soils. Elutriate testing shows contaminants in sediment have low potential for leaching, with the exception of zinc. Asbestos fibres were measured in surface sediment but at low levels, although these may present an issue for disposal and accordingly onland cement stabilisation and disposal of the near surface sediments is envisaged. Less contaminated, deeper sediments may be disposed to sea. [Refer Sections 7-9]
Conceptual site model	Primary sources of contamination, with the exception of existing underground fuel tanks in the northwest of the Orams existing facility, have been removed, however secondary contamination sources remain, both onsite derived and as a result of activities on adjacent land. Based on the data findings, the CSM was developed to determine what mechanisms exist to exposure by on and offsite human and environmental receptors. An assessment of the current exposure was undertaken to qualify the positive impacts development of the land will have on potential receptors. The developed CSM confirms that the current discharge of contaminants will be reduced by the development process. There will be a reduction in the mass of contamination and the volatile component in soil remaining. The process of cement stabilisation for ground improvement will also limit infiltration of surface water and likely reduce the potential for vapour to reach the surface or indoor air spaces. If the buildings are piled a vapour protection system will likely be required. Provided controls and monitoring of the effectiveness of the mitigation measures are in place during the works, the effects of development of land on workers, surrounding property occupants, the general public and the environment can be prevented. This must include controls to manage contaminated water, sediment and soil, water diversion and disposal, odour management, silt management both on land and in the CMA, and a monitoring programme that confirms the measures are effective. [Refer Section 10 and Figures 13A-A3D]
Regulatory requirements	The need for contamination-related resource consents for the site redevelopment has been assessed against regulatory requirements relevant to the Auckland region. The assessment shows consent is required as follows: • Under the National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health Regulation (2011), Restricted Discretionary basis under Regulation 10 is required given that contaminant levels exceed the applicable land use criteria for a range of contaminants in onsite soil. • Under the Auckland Unitary Plan – Operative in Part (November 2016) consent is required on a Controlled activity basis under Rule E30.4.1 (A6) given that Clause E30.6.2.1 4(b) *"discharges from the land are highly unlikely to cause significant adverse effects on the environment"* can be met. • Low/trace levels of asbestos fibres have been found in some near surface materials. The levels are low (at or below 0.001% w/w) and thus meet Unlicensed Works controls under the NZ Guidelines for Assessing and Managing Asbestos in Soils (November 2017). [Refer Section 11]

Construction implications	The CSM indicates potential for effects on people and the environment during development of the site. These risk are manageable through use of targeted remedial actions and industry best practice controls. Monitoring to assess the effectiveness of controls is also proposed. The T+T RAP and Heron DMP set out mitigation and monitoring measures that will be in place during the works. [Refer Section 11]
Post development implications	Once developed the potential for ground contamination effects will be significantly reduced compared with the existing situation: • The site will have a fully sealed surface, or covered by buildings, thus there will be no potential for site users and surface water runoff to contact contaminated reclamation and other fill materials during normal site operations. • The cement stabilised block created by ground improvement and seawall development works will: – Prevent current discharge of hydrocarbon product and lower the discharge of dissolved phase contaminants. – Protect marine industry-related workers from contact, inhalation and ingestion of contaminated soil, vapour and groundwater. If cement stabilisation does not occur under the buildings, then additional vapour protection measures will be required. • The Deep Soil Mixed (DSM) wall constructed behind the existing sea wall, supplemented by a partial perimeter cut off wall, will contain shallow contamination and limit flows of groundwater to the marine environment. • The cut off wall on the east and south sides of the site will, in addition to engineering functions, reduce mounding and limit groundwater flow within the site (and movement of petroleum hydrocarbons within the groundwater fluctuation zone). The effect of redirection of contaminated groundwater from land east and southeast of the site is negligible as the flow path for contaminants will be lengthened, whereby increasing degradation and attenuation processes. Potential for preferential flow within services will be limited to existing Beaumont Street infrastructure which is to be upgraded and is expected to be already acting as a conduit for contaminants derived upgradient of the site. Services trenches within Jellicoe Street have been installed in mudcrete which will prevent preferential migration should contaminants be directed beyond the northern-most panel. • Operational discharge management and monitoring will be in place for Orams ongoing operation of the site. • In-ground services and concrete structural elements within the site will be protected from ingress of contaminants, preferential migration and corrosive groundwater conditions. • Requirements for vapour mitigation for proposed buildings is dependent on the foundation solution and will be addressed during the detailed design process. [Refer Section 11]

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1 Introduction

Tonkin & Taylor Ltd (T+T) has been commissioned by Orams Marine (Orams) to undertake a ground contamination investigation for the proposed redevelopment and extension of its marine servicing facility on Beaumont Street, Wynyard Quarter, Auckland (Figure 1).

This report refers to the "Site" as encompassing:

- The entire property at 164-188 Beaumont Street, referred to as "Site 18".
- A portion of Orams existing facility at 142-160 Beaumont Street, referred to as "Orams existing site".
- Adjacent Coastal Marine Area (CMA) waterspace.

This report has been prepared in general accordance with the requirements for a PSI (Preliminary Site Investigation) and DSI (Detailed Site Investigation) referred to in the NES Soil Regulations[1], and as outlined in the MfE's Contaminated Land Management Guidelines[2]. The persons undertaking, managing reviewing and certifying this investigation are suitably qualified and experienced practitioners (SQEP), as required by the NES Soil and defined in the NES Soil Users' Guide (April 2012).

This investigation was undertaken in accordance with our proposal of 1 May 2018 and variation dated 15 June 2018.

Companion reports are provided separately covering Groundwater and Settlement Effects[3], Preliminary Geotechnical Interpretative (to be issued in October 2018), Factual geotechnical[4], Coastal Ecology[5] and Coastal Process[6] for the development.

1.1 Site identification

The site is located in Wynyard Quarter, Auckland. It is roughly rectangular in shape and the development area comprises approximately 3 hectares (refer Figure 2). The land is owned by Panuku Development Auckland Limited (Panuku), is zoned as 'City Centre Zone', and is utilised by a number of businesses (generally marine related, refer to Section 3). The site identification details are included in Table 1.1.

Table 1.1: Site identification

Property ID	Orams existing site	Site 18
Street address	142 - 160 Beaumont Street	164 - 188 Beaumont Street
Legal description	Lot 1 DP 135460, Lots 27 and 28 DP 9097 and part of Lot 1 DP 137407 (land) Lot 26 DP 133386 (adjacent water area)	Lots 2, 3 and 4 DP 135460 (land) Part Lot 1 DP 133386 (adjacent water area)

[1] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.
[2] Ministry for the Environment, updated 2011, Contaminated land management guidelines No. 1: *Reporting on Contaminated Sites in New Zealand*.
[3] T+T, November 2018: Groundwater and settlement effects report, 142 - 188 Beaumont Street, Wynyard Quarter. Prepared for Orams Marine Ltd, ref 30881.2000.1.v2.
[4] T+T, September 2018: Geotechnical Site Investigation Factual Report, 142 - 188 Beaumont Street, Wynyard Quarter. Prepared for Orams Marine Ltd, ref 30881.2000.1.v2.
[5] T+T, September 2018: Coastal Ecology Report, 142-188 Beaumont Street, Wynyard Quarter. Prepared for Orams Marine Ltd, ref 30881.2000.4.v2.
[6] T+T Letter dated 28 September 2018: Orams Marine redevelopment, 142-188 Beaumont Street, Wynyard Quarter Coastal Process Assessment. Ref. 30881.2000.3.v2.

Site owner	Panuku Development Auckland Limited (Panuku)	Panuku Development Auckland Limited (Panuku)
Site occupier	Orams Marine Ltd	Various tenants
Site area	~0.7 ha	~1.6 ha
Zoning	City Centre Zone	City Centre Zone

1.2 Background

The site (Site 18 and the development area within Orams existing site) has a long history of industrial use dating to its original reclamation around 1912. The predominant use within Site 18 being Mobil New Zealand's operation of its Special Products Terminal, while Orams existing site has been principally been used for marine vessel servicing since its reclamation, although a strip in the north of the site was previously part of Mobil's former adjacent operations. Petroleum storage and distribution and aspects of marine services are activities included on the MfE's HAIL list[7].

Orams proposes obtaining a long term lease for marine industry-related development of Site 18 and integration of new facilities into their own existing operation. Proposed development activities are described in Section 2. The investigations documented in this report have been undertaken to enable an assessment of effects on people and the environment to support resource consent for development of marine servicing facilities (Stage 1) and residential apartments (Stage 2) by Orams.

1.3 Objectives and scope of assessment

1.3.1 Objectives

The objectives of the investigation are to:

- Assess the current condition of the site with regards to ground contamination (soil and groundwater) and establish baseline data.
- Assess the condition of sediment proposed to be dredged from the seabed during development works.
- Determine specific remediation requirements, additional to ground improvement works (if any).
- Inform controls required during ground strengthening and seawall repair/ replacement works.
- Enable assessment of regulatory requirements (construction phase and ongoing).
- Inform possible disposal options for soil, groundwater and sediment.
- Gather initial data for risk to building occupants and the need for vapour barriers.

1.3.2 Scope of work

The scope of work for the contamination investigation comprised two stages:

1 A PSI, involving an assessment of site history and the potential for contamination to be present. This comprised the following:
   - Review Auckland Council property files.
   - Review of a "Site Contamination Enquiry".
   - Review of selected historical aerial photographs.
   - Review of existing reports for Site 18 and Orams existing site.

[7] Ministry for the Environment, Hazardous Activities and Industries List (HAIL).

- A site walkover inspection.
- Development of a preliminary conceptual site model to facilitate development of the site investigation strategy.

2 The DSI comprised the following intrusive investigations, undertaken concurrently with geotechnical investigation by T+T:

- Drilling of 24 boreholes and excavation of three test pits on land.
- Drilling of four boreholes and collection of six additional surface sediment samples in the harbour.
- Installation of 18 monitoring wells in the onshore boreholes for the purposes of monitoring groundwater levels and collecting groundwater samples.
- Collection of groundwater samples from 19 monitoring wells on Site 18 (including one existing monitoring well). One sampling round has been completed to date.
- Collection of groundwater samples from three available existing monitoring wells on Orams existing site.
- Installation and sampling of five vapour probes within the footprints of the proposed buildings to assess vapour risk.
- Scheduling laboratory analysis of selected soil, sediment and groundwater samples for a suite of analytes including heavy metals, total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), asbestos, cyanide, tributyltin (TBT), polychlorinated biphenyls (PCBs) and per- and poly-fluorinated substances (PFAS).
- Assessing results of soil, sediment, groundwater and vapour testing against appropriate evaluation criteria.
- Further developing the conceptual site model.
- Preparation of this report.

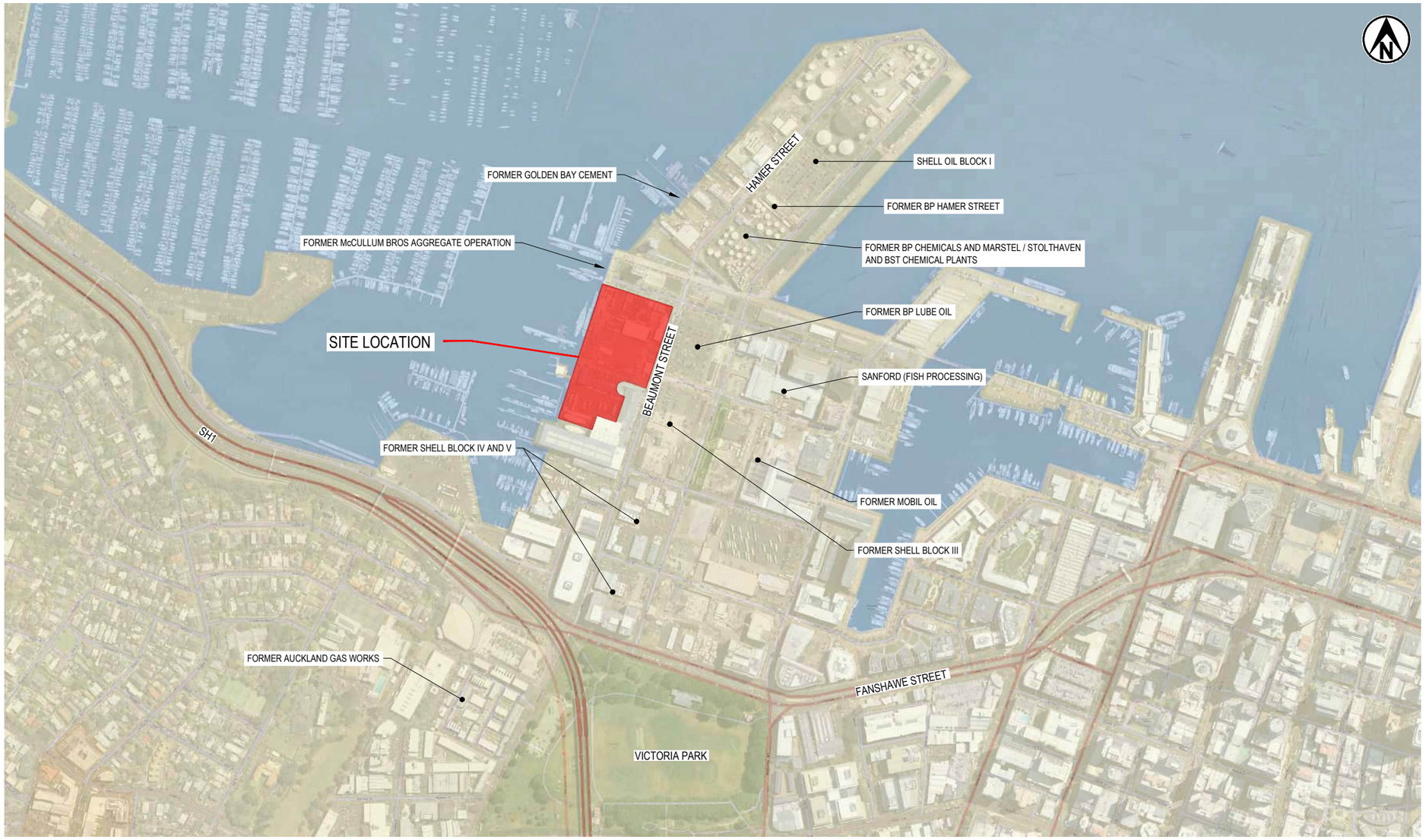
This report documents our findings and comments on ground contamination at the site, including the coastal marine area (CMA) within the development footprint, in the context of the marine service industry development as described in Section 3. This report identifies:

- Ground contamination-related resource consent implications to inform the overall project Assessment of Environmental Effects report (October 2018) prepared by Barker & Associates.
- Constraints or opportunities for the detailed design programme to consider, including implications for the ground improvement and seawall replacement components.
- Construction implications in regard to worker health and safety, earthworks controls including dust, sediment, water and odour and surplus materials pre-treatment (if any) and disposal requirements.
- Mitigation requirements to be provided for in the Remediation Action Plan (RAP) for ground contamination[8]. The RAP has been prepared subsequent to this report, also to inform consent, detailed design and construction phases.
- Inform likely long term management and monitoring requirements. An outline Long Term Monitoring and Management Plan (LTMMP) is provided in the RAP with a final document to be prepared on completion of ground disturbance works.

[8] T+T, November 2018. Remediation Action Plan for Ground Contamination, 142-188 Beaumont Street, Wynyard Quarter. Report prepared for Orams Marine Services Ltd. Reference 30881.2000.2.v2 (Draft).

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SITE LOCATION MAP

SCALE 1:7,500

A3 SCALE 1:7500

0 0.1 0.2 0.3 0.4 (km)

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DESIGNED	LKH	Sep. 18
DRAWN	JC	Sep. 18
CHECKED	AMM	Nov.18
APPROVED	WMW	DATE Nov.18

CLIENT **ORAMS MARINE**

PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
SITE LOCATION PLAN

SCALE (A3) 1:7500 FIG No. CONT - FIGURE 1 REV 2

2 Proposed Works

2.1 Overview

Orams current infrastructure allows land based activities on vessels either hauled via a slipway or lifted by the existing 75T travel lift. The expansion will see facilities that enable on-land servicing and repairs of large vessels, up to 620T. The development plan is presented as Figure 2. More detailed plans showing the specific elements of the works are set out in Appendix A.

Development within Site 18 will involve extensive ground works behind the existing seawall and northern wharf structures, both of which are in disrepair and structurally at the end of their lifecycle. Redevelopment works at the Orams existing site is limited to demolition of buildings and ground strengthening works.

Stage 1 of the development is proposed to be complete for the 2021 Americas Cup regatta.

The following sections set out the staging, an overview of the type of development works proposed, timing and construction activities.

2.2 Staging and proposed works details

Two main project stages are proposed as shown in Table 2.1 and Figure 2.

Table 2.1: Staging and proposed works details

Stage 1	Expansion and integration of Orams Marine facility including: • Demolition of existing structures within the Stage 1 development footprint including removal of pontoons and piles in the adjacent waterspace. • To support the 620T and separate 85T travel lift within the coastal Marine area (CMA), three travel lift runways (piers) with the following dimensions: 2 x 55m length and 1 x 25m will be constructed. *(Refer Drawing 30881-SK-21, SK-31 and SK-33, in Appendix A)* • Dredging of the seabed up to -6 m Chart Datum (CD) to accommodate vessels within the travel lift pocket during all tides from the Westhaven Marina fairway to the lift runways. *(Refer to Drawing 30881-SK-92 in Appendix A)* • Rectification of the southern seawall by development of a deep soil mixed (DSM) panel wall and reinforced buttress DSM panels behind the existing seawall/wharf including tying back the existing structures to the new wall. A sheetpile will be driven into the ground in front of the existing seawall to protect the existing piles from being exposed from seabed dredging. This will apply only to the area of wall adjacent to the dredging. *(Refer to Drawing 30881-SK-50, SK62, SK-63, SK65 in Appendix A)* • Demolition of the existing northern wharf and construct a 3H:1V rock revetment slope behind the existing seawall. DSM panels will be constructed at the top of the battered slope to provide contamination cut-off behind the existing seawall and rock revetment slope. *(Refer to Drawing 30881-SK-50, SK61, SK67, SK78 in Appendix A)* • Ground improvement across the entire Stage 1 area, to strengthen the ground to make it viable for marine and travel lift use. This includes stabilising the subgrade beneath the footprints of new buildings B1a, B1b and B2 if shallow raft foundations are utilised. Ground improvement will involve: – Removal of materials by excavation to approximately 1.85m below ground level (bgl) for the pavement subgrade and concrete slab. Existing tank bases will be left in place. Up to 2.05m of material will be excavated for the building subgrades and footings if shallow foundations are utilised.

	– Ex- situ mixing with dry cement in a pug mill or in-situ cement soil stabilisation. Reinstatement and compaction to form an up to 1.5 m thick stabilised raft of material. – Placement of an approximate 350 mm concrete pavement across the yard – The concrete pavement will create an impermeable surface and minimise water infiltration into the ground. Surface water runoff to be collected and treated prior to disposal to sea. *(Refer to Drawing 30881-SK-80 and SK85 in Appendix A)* • Construction of two new buildings: – Building B1A & B1B integrating retail facilities on the Beaumont Street road frontage, office levels above and marine services workshop fronting the yard. – Building B2 for marine servicing; high stud structures with roller doors fronting the yard. *(Refer to Drawing 30881-SK-80 and SK85 in Appendix A for stabilisation works)*
Stage 2	Development of a multi-level building (Building B3) in the north of the site fronting Jellicoe Street. The structure will encompass ground floor retail outlets with residential apartments above. No basement parking structure is proposed. The building will be piled to rock.

The Stage 2 area is to be developed in the interim by Panuku for use as a carpark. The carpark development will include installation of light poles, sealing unpaved or potholed areas and removal of existing landscaping. The carpark development is not part of applications by Orams, instead being developed for short term carparking by Panuku under separate consents.

2.3 Preliminary programme

The following is preliminary indication of timing of various components of the development.

Table 2.2: Proposed programme

Stage	Works description	Duration	Commence	Completion
1	Demolition of existing buildings and CMA structures	3 months	February 2019	April 2019
	Seawall construction	6 months	February 2019	August 2019
	Ground improvement	8 months	February 2019	October 2019
	Dredging	1 month	March 2019	May 2019
	North wharf reconfiguration and soil mixed wall installation	3 months	May 2019	August 2019
	Travel lift runway construction	6 months	June 2019	December 2019
	B1a and 1b construction	15 months	May 2019	July 2020
	B2 construction	15 months	May 2019	July 2020
	Seal yard	3 months	November 2019	January 2020
2	Demolition of existing buildings and development of a carpark	3 months	December 2018	February 2019
	Construction of building B3	2 years	2023	2025

2.4 Summary of earthworks and other site construction works

2.4.1 Stage 1

Earthworks will occur during ground improvement, seawall construction, dredging and during construction of Buildings B1a, B1b and B2. These individual works are summarised below with reference to Table 2.1, Figure 2 and concept drawings in Appendix A:

- Soil strengthening/ground improvement works: Excavation and exsitu, or insitu, cement stabilisation will be carried out progressively in a series of cells as shown in Drawings 30881-SK-80 and SK85 (Appendix A), extending locally up to 1.85 m to 2.05 bgl across the Stage 1 area. The final depth will be dictated by obstructions (buried former tank platforms). Excavated soil will be either partially removed, mixed insitu and compacted, or blended with cement in a pug mill before being placed back into the ground and compacted in 300 mm lifts to create a stabilised raft of up to 1.5 m thickness. Geogrid reinforcement will be installed in the stabilised raft. Where perched water is encountered, or the excavation is close to the seawall during high tide, local pumping of the cells may be required to control water seepage into the excavation until compaction reaches the surface of the water level. Where excavation approaches the Beaumont Street boundary on the east side and at the southern end of the site, a 7m deep cut off wall, comprising either a sheetpile or a deep soil mix panels, will be installed to provide cut off for upgradient groundwater (see Figure 2).

  If stabilised raft foundations are utilised for Buildings B1a, B1b and B2 (see options in the 'Building B1A, B1B and B2 foundations' bullet point below), the cut off wall will also provide retention for the excavation to construct the stabilised raft and limit settlement effects generated from the building loads.

  Cut to fill plans prepared to support conceptual design estimate 30,000 m^3 of soil will be processed/ or mixed insitu as part of the ground improvement and site grading works. Soil disturbance will be a staged process, undertaken in cells to limit the area of exposed ground at one time to approximately 1,000 m^2 and to allow for construction of buildings within the Site 18 portion of the site. Commencing in the south east of the site, soil generated from the initial section will be removed offsite. Ground improvement works will be undertaken in a step wise process thereafter with either materials being excavated and processed existu in the pug mill where cement will be blended, then the product will be immediately placed in the adjacent cell, or alternatively, blended with cement insitu, using soil mixing equipment. Improvement of ground to support the travel lift on Orams existing site will be the final area of works.

  Ground improvement works will be undertaken within the footprint of Buildings B1a, B1b and B2 if raft foundations are utilised. The proposed stabilisation works and foundation options for the buildings are discussed in more detail in the 'Building B1a, B1b and B2 foundations' section below.
- Concrete pavement: An approximate 350 mm thick pavement will be constructed on top of the ground improvements layer (shown as the area outlined in green on Drawing 30881-SK80 (Appendix A). Typical pavement details are shown in Drawing 300881-SK85 (Appendix A).
- Southern seawall construction: Installation of the deep soil mixed wall (10 - 18 m bgl) will occur concurrently with the ground improvement works. An overview of the sequencing for the southern seawall works is as follows and is illustrated on conceptual drawings (30881-SK50, SK62, SK63, SK65, and SK70) in Appendix A, and summarised below:
  - Excavate to 2.5 m bgl and prepare the surface for construction. Approximately 6,000 m3 of soil will be excavated. This will expose the top of the counterforts of the existing seawall (see Dwg 30881-SK65). A temporary sediment protection apron (such

as a sheetpile wall) will be installed in front of the existing seawall before commencing DSM operation.

- Install 1 m wide reinforced soil mixed buttress panels (buttress panels) and structural components (welded WC steel frames) to 17. 5 m bgl (-13 mCD) and at 3.15 m spacings. These will be located between the existing counterforts (refer 30881-SK50, Appendix A).
- Securely fix the existing seawall onto buttress panels, cut existing seawall tiebacks and install infill 0.6 m wide and 10 m deep unreinforced soil mixed panels parallel to the existing seawall (refer Drawing 30881-SK50, Appendix A). These panels will act as a cut off wall for containing landside contamination. Return panels will also extend 5 m at the south end and 10 m at the northern end to connect to the panels at the top of the northern revetment slopes (refer Drawing 30881-SK50, Appendix A).
- Construct 2.5 m high L-shape cast in-situ concrete wall to connect to the buttress panels, existing walls, and tie-back rods to the deadman (refer Drawing 30881-SK65, Appendix A).
- Construct 2.4m deep deadman and install tie-backs and construct stabilised raft above seawall. Localised deepening of the stabilised raft is required around the deadman to provide adequate passive support to the deadman. The depth of the deadman and surrounding stabilisation depth is shown on Dwg 30881-SK65.
- Contingency for 9 m long sheetpiles has been made to be driven into the ground in front of the existing seawall to protect the existing piles from being exposed from seabed dredging (refer Drawing 30881-SK65, Appendix A). This applies to length of the seawall in front of the dredged area only.
- At the location of the travel lift runways, dredge the seabed to -6mCD, leaving a 2H:1V berm in front of the seawall (refer Drawing 30881-SK65, Appendix A).

- Northern seawall construction: The existing northern seawall will be deconstructed to 0.4 mCD and profiled to form a 3H:1V rock revetment slope. The 10 m deep soil mixed panels from the southern seawall will continue along the top of the rock revetment slope. Approximately 2,000 m^3 of material will be removed during deconstruction of the seawall. An overview of the sequencing for the revetment works is as follow and as illustrated on conceptual drawings (Drawing 30881-SK50 and SK67) in Appendix A.
  - Install 0.6 m wide and 10 m deep soil mixed panels. These have been set back behind the inferred extent of the basalt boulder base of the existing seawall. Install temporary sediment protection apron, such as a sheetpile wall, in front of the existing northern wall before excavating the slope.
  - Excavate in front of the deep soil mixed panels to the bottom of the rock armour.
  - Place a layer of Texcel R900 Geotextile and 300 mm of underlay rock at the surface of the prepared slope, and install a 1 m thick rock armour to protect the slope from wave actions (refer Drawing 30881-SK67, Appendix A).
  - Our assessment indicate the proposed revetment slope design will achieve a factor of safety (FS) of 1.5 under static conditions. In the event that the stability of the slope is assessed to be less than 1.5 during detailed design, dredging material will be placed in front of the northern slope to partially backfill the channel dredged between 2011 and 2017, so to achieve the design factor of safety of 1.5.
- Dredging and travel lift: Dredging is required to extend the seabed depth up to -6 mCD over an area of 3,700 m^2 within the footprint of the travel lift. Dredging volumes in the order of 9,800 m^3 is anticipated. Preliminary assessment of disposal of the dredged sediment is

discussed in this document (refer Section 9.6.2). More details on the dredging methodology and approach are provided in the Dredging Management Plan[9].

Piling and construction of the travel lift piers will commence at the completion of the dredging works. The travel lift beams will be supported by reinforced concrete piles constructed with a 12 mm pavement steel tube casing and extended into East Coast Bays Formation (ECBF) rock to a depth of approximately 25 to 28 m below ground level (bgl).

- Buildings B1a, B1b and B2 foundations: Two foundation options have been proposed for the buildings as follow:
  - Strip or pad footings 750mm and 850mm thick constructed within the stabilised raft (See Dwg 30881-SK80). The operation will involve excavation, processing with cement and placement of approximately 7,000 m^3 of soil during construction of buildings.

    Up to 2.05 m deep excavation will be required to construct the foundations and approximately 1.2 m thick stabilised raft using ex-situ or in-situ mixing. Refer to Dwg 30881-SK85 for thickness of stabilised layer. The stabilisation will provide a raft for the building foundations and for distribution of the high floor loadings applied by the vessels.

    A sheetpile perimeter wall (cut off wall) will be constructed on along the Beaumont Street boundary and south of B1a building for temporary retention during stabilisation works and to provide load distribution for edge foundations (see Dwg 30881-SK80). It also acts as a cut-off wall for shallow groundwater flows and limit settlement effects to Council property and existing Orams buildings. The cut off wall along B1a building will extend towards the south end of the southern seawall to act as a groundwater and contamination cut-off barrier to minimise the mounding effects near the seawalls. Alternatively, a deep soil mixed panels may be used to provide the same function as a sheetpile wall.
  - Alternatively, buildings can be supported on piles embedded into East Coast Bays Formation (ECBF) rock. A vapour barrier will be placed beneath the floor slab to restrict vapours released from the contaminated material beneath the slab. Similar to the raft foundations, a sheetpile (or similar) cut off wall is required along the Beaumont Street and southern boundary to provide shallow groundwater flow cutoff.

While a detailed cut and fill balance is yet to be calculated for the works package, it is currently estimated that in the order of 10,500 m^3 of soil and 7,300 m^3 of sediment will be surplus to requirements and require disposal offsite.

Localised dewatering of the ground by pumping may be necessary within the construction cells to achieve the above works package.

2.4.2 Stage 2

Minor soil disturbance will occur during development of Building B3 as the structure will be piled. Localised deeper excavations are anticipated for lift shafts, otherwise only shallow excavations are likely. Details on earthworks will be provided with separate applications for Stage 2 development.

[9] Heron Construction Co. Ltd, September 2018: Orams Site 18 Project, Dredging and Stabilisation – Dredge Management Plan (DMP). Ref. Heron- PLAN-QA-001_DMP, Rev A.

2.5 Plant and equipment

Stage 1 activity on the site between January and December 2019 will be high with peak construction activity expected between June and December 2019. Plant onsite during construction is expected to include the following. Worker construction vehicle movements will be across all works phases.

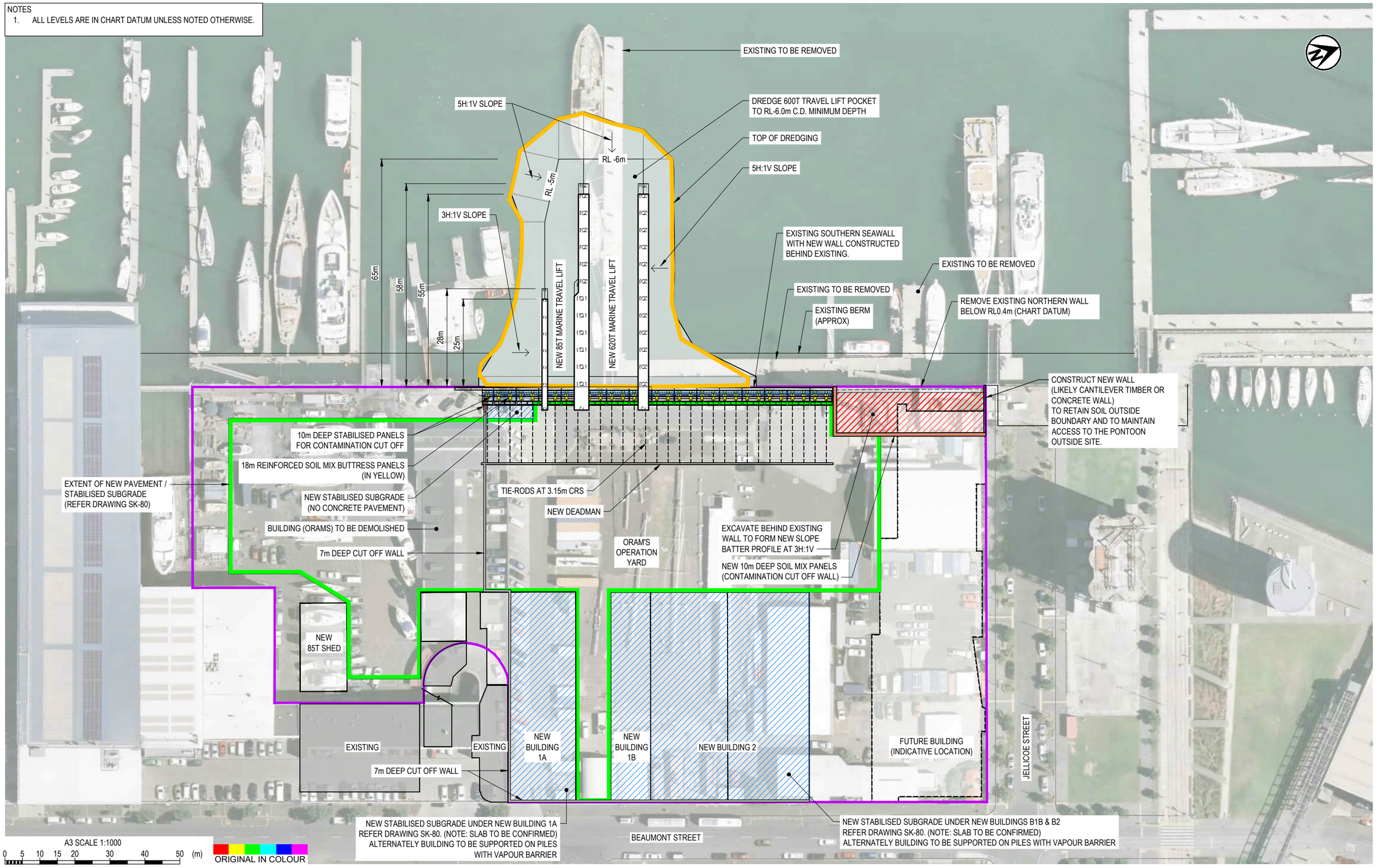
Table 2.3: Staging and proposed works details

Works	Plant and equipment
Demolition: • Buildings • CMA structures	• Excavators, truck and trailers, concrete crusher and screen • Barge mounted excavator, truck and trailers
Seawall construction and north wharf	• Diaphragm wall cutter mixer • Concrete cutters • Guide framing • Cement silos • Cranes • Silt buster system • CMA sediment mitigation systems (i.e. coffer dam/ sheet pile/ silt curtains) • Barge mounted excavator
Ground improvement	• Excavators • Road stabilising machines • Pug mill or insitu excavator supported and road stabilising machinery • Truck and trailers (disposal to landfill) • Dust and odour suppression equipment (compressors, spray guns) • Deep soil mixing equipment • Cement silo
Dredging	• Barge mounted excavator, bottom dumping barge (if sea disposal authorised) • Truck and trailers if landfill disposal required
Travel lift runway construction	• Barge mounted piling rig • Land based crane • Truck and trailers
B1a/b construction	• Trucks, contractor vehicles and materials transport, crane, piling machine
B2 construction	• Trucks, contractor vehicles and materials transport, crane, piling machine
Concrete pavement	• Concrete trucks, welding
Disestablishment	• Transporters

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NOTES
1. ALL LEVELS ARE IN CHART DATUM UNLESS NOTED OTHERWISE.



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DRAWN	WTHU	Sep. 18	
CHECKED	AMM	Nov.18	
	WMW	Nov.18	
	APPROVED	DATE	

CLIENT **ORAMS MARINE**
PROJECT **142-188 BEAUMONT STREET**
TITLE GROUND CONTAMINATION SITE INVESTIGATION DEVELOPMENT AND STAGING PLAN
SCALE (A3) 1:1000 FIG No. CONT - FIGURE 2 REV 2

3 Site Description and Setting

3.1 Site condition

Multiple site inspections were undertaken during the course of the preliminary and detailed investigations. Specific ground contamination-related inspections for the purposes of scoping detailed investigations were undertaken by contaminated land specialists from T+T in June 2018. Relevant observations made at the time of these inspections are summarised below.

3.1.1 Site 18

Key site features within Site 18 are shown on Figure 4 and selected photographs are included in Appendix B (Photographs 1 –12).

- The northwestern corner is occupied by 37 South, a super yacht support business, and is currently used for the storage of decking supplies and for housing administration staff. This portion of the site is fully fenced and is accessed off Jellicoe Street.
- The northern quadrant and northeastern corner is occupied by Emirates Team New Zealand. They utilise an existing two level building that fronts Beaumont Street with the balance of the yard housing shipping containers and yacht parts (Photograph 1). A carpark is situated between 37 South and the space occupied by Emirates Team New Zealand (Photograph 2).
- Central and southern quadrants are utilised by Rig Pro for the alteration (including the use of small volumes of solvents as discussed in Appendix C) and storage of masts (Photographs 3 – 6). Works were being undertaken in the open air. The maximum volume of hazardous goods stored at the site is 20 L of acetone, and 20 L of Spartite SP-2000 Part A and Part B. Rig Pro's Amenities include:
  - Two temporary prefabricated office blocks.
  - Several large temporary tents in which alteration (including sanding and painting) of masts is undertaken.
  - A large gravelled area used for the storage and alteration of masts.
  - Numerous shipping containers (contents include 20L (or less) containers of paint, sealants, paint thinners and solvents). No staining was observed in the vicinity of the shipping containers.
  - A concrete crane pad, raised approximately 0.30 m above ground level.
- The site surface lies around 5 m RL including with the seawall height varying between 4.6 and 4.8 m RL. Generally the site topography is relatively flat, with the ground gently sloping toward drainage points across Site 18.
- The ground surface of the periphery of Site 18 (comprising approximately 60% of the site) is a combination of asphalt and concrete hardstanding (access ways and parking). The hardstanding appeared in good condition, however scarring was visible in northeastern and northwestern corners. The surface in the centre of the property comprises gravel hardfill. No visible staining was observed during the walkover inspection.
- Raised concrete pads are present in the northwestern corner, in the location of the former crane pad, and the centre, in the location of a former building.
- The property has four egress/exit points, two off Beaumont Street and two off Jellicoe Street. Site 18 is fenced and is not accessible to the general public.
- Three electrical transformers are situated on Site 18:
  - Two smaller transformers are present in the northwest corner. The two northern transformers in the northwest corner are situated on gravel fill, oil staining was

observed adjacent to the western-most of these. The origin of this staining could not be identified however there was no indication the oil had leaked from the transformer (Photograph 7).

  - One larger transformer exists in the centre of the property bordering Beaumont Street. This central transformer is fully fenced and is situated on concrete hard standing. No staining was observed around the transformer pad (Photograph 8).

- An additional transformer is situated immediately adjacent to the northeast corner (not within the Site 18 boundaries) on Jellicoe Street.
- A firefighting pump house, including a fixed foam induction system, is situated in the northeast corner, adjacent to the Emirates Team New Zealand Building.
- Garden areas, typically raised approximately 20 cm above the surrounding ground level, is present in the site's northwestern corner, near the southwest corner and in the centre of the eastern boundary.
- The site's western boundary is a seawall which runs the length of the site. The sea wall consists of two different structures:
  - A northern wharf structure approximately 35 m in length, which was the former McCullums scoria distribution facility. This structure is in poor condition with cracks visible (Photograph 9).
  - The balance of the length (approximately 100 m in length) is a piled concrete faced structure, also in poor condition with visible cracks (Photograph 10).
- A raised footpath, approximately 3.5 m wide, runs the length of the seawall/wharf. This was recently lain to house services for Silo Park (power, communications, water).
- Two pontoons are present in the CMA adjacent to Site 18 as shown in Figure 4, one parallel with the seawall and the second at right angles to it extending approximately 90 m west. These pontoons are part of the Silo Park facility operated by Panuku.
- The site walkover identified two stormwater drains (one in the centre of the site and one on the southern boundary) running east-west across the site and discharging into the harbour. The outlet points of numerous underground services and tile drains were also observed in the seawall (Photographs 10 –12). A review of underground service plans identified that two wastewater lines enter the site from Jellicoe Street.

3.1.2 Orams existing site

Key features of the Orams existing site as they pertain to proposed works within it are shown in Figure 4 are summarised below:

- The central area of the site, where future works to strengthen the ground are proposed, is currently used for vessel maintenance activities. Vessels are parked on cradles and maintained including blasting, repainting, application of antifoulant and other internal repairs. The central area is surfaced in a mix of concrete paving stones and asphalt.
- A rectangular building running east west, which is proposed to be demolished prior to ground improvement works, currently houses various small marine servicing operations including mechanical workshops, fitting and turning.
- A larger building closest to the CMA is used for covered vessel maintenance and painting.
- Underground fuel tanks (UST) servicing the adjacent fuel pontoon are situated in the northwestern corner. Fuel stored there is transferred via pipeline to the fuel pontoon within the CMA.

- The fuel pontoon is accessed via a steel gangway and contains fuel pumps and a small steel building containing a shop.

3.2 Surrounding land use

Land use surrounding the site is as follows:

- North: Jellicoe Street, with Silo Park beyond.
- East: Beaumont Street, with car parking and commercial premises beyond including recently developed residential apartment buildings.
- South: Marine industry operations and a marina within the CMA.
- West: Pontoons associated with Orams Marine Village, Silo Park and the Westhaven Marina (Waitematā Harbour).

3.3 Geology

A summary of available geological information for the area is presented in this Section.

3.3.1 Published geology

The location of the site in the context of the regional geology is presented on Figure 3 with respect to the 1:50,000 geological map of Kermode (1992) [10]. The site is located within and area that was historically known as the Western Reclamation, which encompasses land largely reclaimed between 1905 and 1917[11]. This reclamation typically contains dredgings (referred to as hydraulic fill here in), clays and silty clays (from excavation of former city foreshore headlands), demolition material (predominantly brick and iron castings), incinerator ash, gasworks waste and basalt boulders.

3.3.2 Site geological information

Prior to detailed investigations T+T completed a desktop study of readily available geotechnical and ground contamination data. The documentation reviewed is provided in Section 5.

This information identified the expected geological conditions area as follows:

- Assorted and variable granular fill approximately 1 to 3 m.
- Hydraulic marine fill (dredgings) placed as part of the first stage of historic reclamation activities, expected to around 3-4 m bgl.
- Marine sediments to approximately 13 m bgl.
- Tauranga Group alluvium infilling the former Victoria Stream paleochannel to about 25 - 30 m bgl.
- Weathered grading to competent East Coast Bays Formation (ECBF) bedrock at approximately 30 m depth.

The inferred profile was updated following detailed investigations, detailed in Section 8.

[10] Kermode, L. O., 1992. Geology of the Auckland Urban Area. Scale 1: 50,000. Institute of Geological & Nuclear Sciences geological map 2. 1 sheet + 63 p. Institute of Geological & Nuclear Sciences Ltd., Lower Hutt, New Zealand.
[11] Auckland Harbour Board Foreshore Reclamations Map 851/8- Foreshore Reclamations to 1972, scale 1:10,000 (approx.).

3.4 Hydrogeology, hydrology and the marine environment

This section provides a general overview of the hydrogeological setting at the site and general area. Section 8.2 provides more detailed discussion of site conditions.

Based on topography, groundwater is expected to occur at around 1.5 m bgl and be tidally influenced. The tidal influence is expected to be greatest closest to the seawall, reducing in an easterly direction towards Beaumont Street. Variations up to 0.5 m are expected given the poor condition of the existing seawall and wharf structure and the prevalence of former in-ground services. Rainfall recharge of groundwater will occur where exposed soils occur in Wynyard Quarter, however these areas are limited given the largely built condition of upgradient sites. Recharge within Victoria Park, a large area where surface water infiltration is possible, will influence groundwater levels and hence hydraulic gradients to the north-northwest.

At the site and in the local area, shallow groundwater flows are influenced by tidal effects, permeability variability in upper materials and by historic factors including historic reclamation structures such as basalt walls and wharfs and underground services. It is also influenced by recent developments including single and multi-level basement structures, the deeper of which may act as groundwater diversions, and associated services up and cross gradient of the site. However, flow at the site is locally more or less east to west.

The Waitematā Harbour lies adjacent to the western boundary of the site. Dredging has been carried out in the harbour adjacent to the site on multiple occasions in recent times to facilitate navigation and berthing of vessels and so represents a modified marine environment. Dredging of the marina in 2011 and 2017[12] was carried out so that the seabed currently extends from about 0 m RL (chart datum) at the seawall to about -4 m RL (chart datum) in places to the fairway, the channel used for access to the adjacent marina (Westhaven) in the west and Silo Park and Orams to the east of the fairway. Bathometric survey information is provided and discussed in greater detail in the T+T Coastal Ecology report.

An extensive stormwater drainage network exists throughout the Western Reclamation with stormwater generated at most sites in the area being discharged to the Waitematā Harbour via the municipal drainage network or dedicated site outfalls. In times of wastewater overflow, the stormwater system carries some of this load, discharging to the harbour. Tidal movements up the stormwater lines can reach as far inland as Victoria Park, some 700 m south of the site.

Other underground services including former product supply pipelines, water, telecommunication, power and sewerage services are installed within the road reserves surrounding the site. These are typically installed at depths of less than 1 m bgl, except for former product and sewer lines which are understood to be installed at around 2 m bgl. Where these features intersect groundwater, they may create preferential pathways for the migration of contaminants to or from the site.

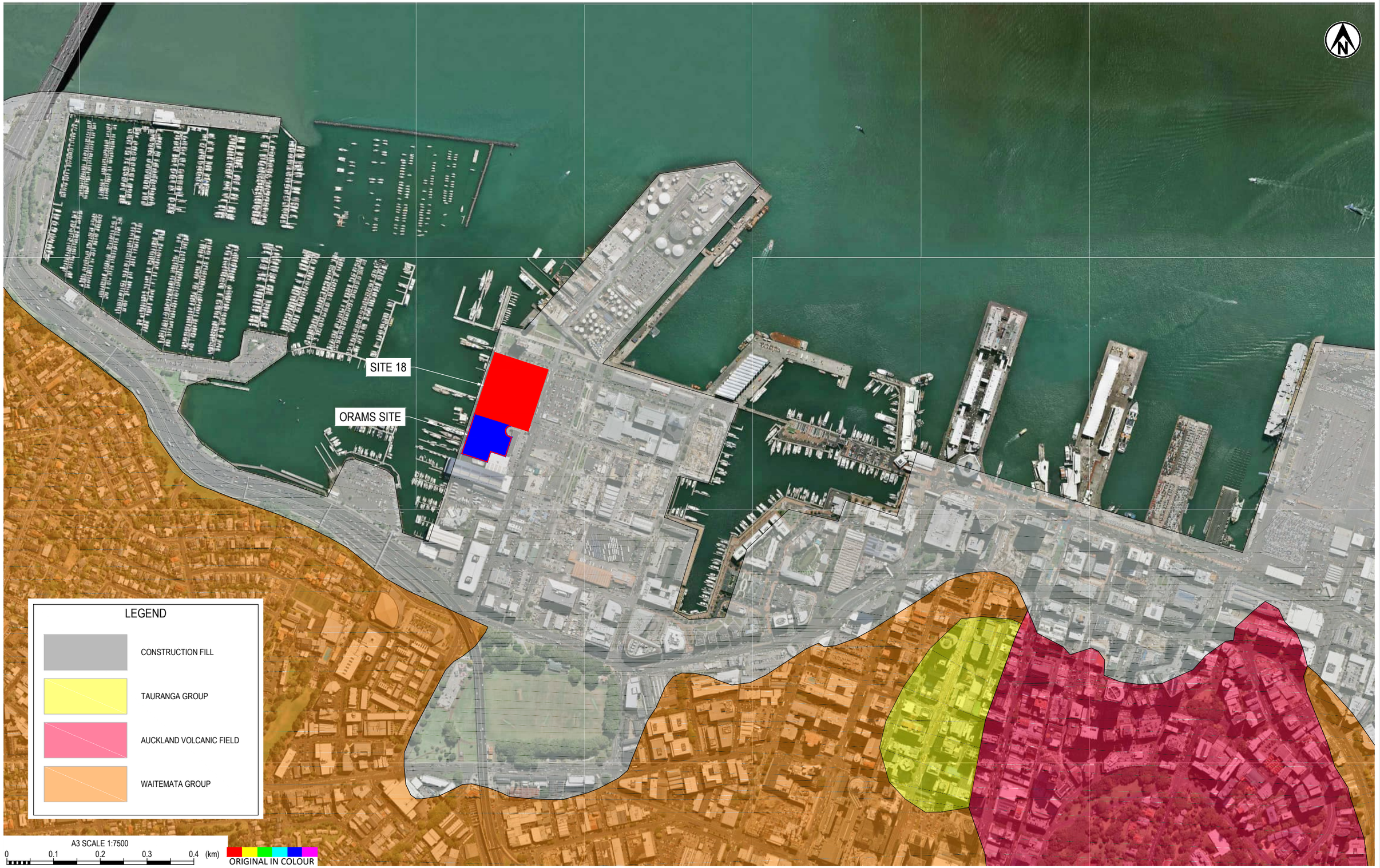
Deep stormwater and sewer services in Jellicoe Street, located immediately north of the site, outfall into the harbour. These were installed recently with mudcrete and with pipe dams so are considered unlikely to act as preferential pathways.

Groundwater is not used for supply in the area. Potable water is provided via the reticulated pipe network. Locally groundwater is pumped on a temporary basis during dewatering for construction of basements.

[12] Ports of Auckland, Hydrographic Section: Bathometric Surveys Westhaven Marina (2011) and Silo Park (2017).

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CHECKED	AMM	Oct.18
APPROVED	WMW	DATE Oct.18

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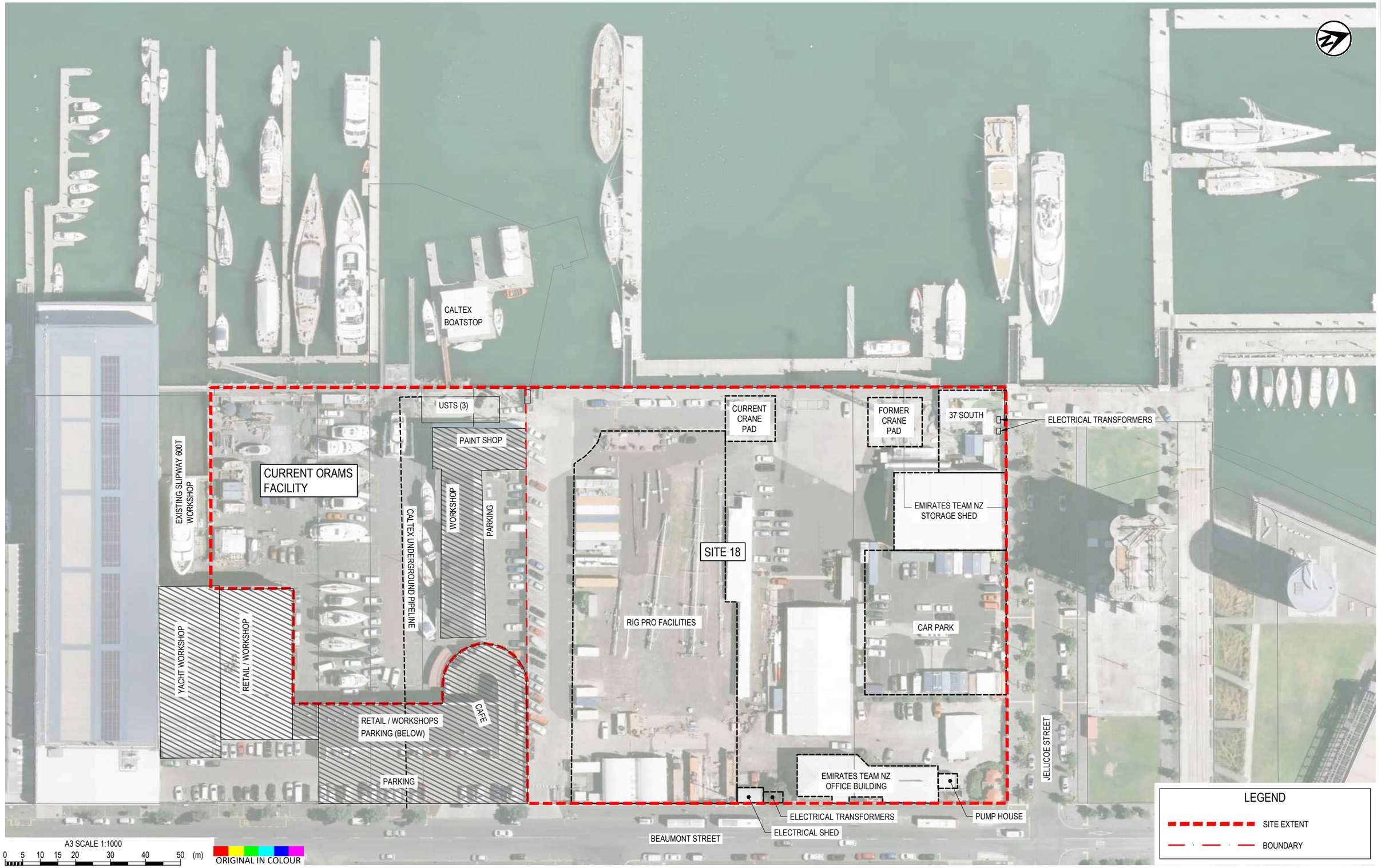
PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
SITE PLAN - PUBLISHED GEOLOGY

SCALE (A3) 1:7500 FIG No. CONT - FIGURE 3 REV 1

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NOTES:

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APPROVED	WMW	Oct.18

CLIENT **ORAMS MARINE**

PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
CURRENT SITE LAYOUT

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 4 REV 1

4 Site History

4.1 Information reviewed

4.1.1 Site 18

Historical information relating to the site was collected from a variety of sources including:

- Ports of Auckland reclamation maps.
- Historical aerial photographs sourced from GoogleEarth, T+T Library, Auckland Council's GeoMaps, Retrolens and the Alexander Turnbull Library.
- Auckland Council property files.
- Auckland Council Site Contamination Enquiry.
- Information from the Fire and Emergency New Zealand.
- Previous investigations of the site (provided by Panuku).
- Beca Infrastructure Ltd (Beca) 2005 report: Overview of Contamination within the Western Reclamation, prepared for the Ministry for the Environment.

Our data review documents on-site activities, except for the aerial photograph review where readily observable surrounding land use findings are also presented. The following summarises our findings with a more detailed review of the available information included in Appendix C.

4.1.2 Orams existing site

The history of the part of the site currently operated by Orams was summarised from previous assessments completed by T+T, specifically the December 2006 Geotechnical and Environmental Desk Study Assessment[13] (refer Section 5).

4.2 Historical overview

4.2.1 Site 18 historical summary

Review of historical information identified that the site was reclaimed from the harbour between 1902 and 1917[14], but predominantly in 1912. Materials typically used in the reclamation in this area include dredgings from the seabed (referred to as hydraulic fill), clays and silty clays (from excavation of former city foreshore headlands), demolition material (predominantly brick and iron castings), incinerator ash, gasworks waste and basalt boulders. The latter were used to form seawalls and wharves, and as breakwaters for the reclamation phases.

The site was utilised as a petroleum terminal from at least 1928 until 2006 with the site occupied by Atlantic Union Oil Co, Vacuum Oil Company Pty. Ltd and Mobil Oil NZ Ltd. While Atlantic Union and Vacuum's operations were primarily petroleum fuels, Mobil operated a Special Products terminal including a wide variety of petroleum-based products in above ground tanks including fuels, specialist solvents for a range of industries including motor vehicle, chemical and mechanical manufacturing, timber treatment and drycleaning. Transformer oils to support the electricity industry were also stored there.

Historic site plans and aerial photography show that the configuration of storage vessels changed over time as the plant was upgraded, presumably due to changing demands for the various and

[13] T+T, December 2006. Ariadne Australia Ltd, Project Pontoon, Geotechnical and Environmental Desk Study Assessment. Reference: 24057; report to Ariadne Australia Limited.
[14] Auckland Harbour Board/Ports of Auckland Foreshore Reclamations Plan 1972.

newly developed products. The layout of the site over time, as obtained from plans sources from the property files, is shown in the following figures:

- Figure 5A shows the layout of Site 18 in 1928.
- Figure 5B the layout of Site 18 in 1972.
- Figure 5B the layout of Site 18 in 1991.
- Figure 5D is the layout in 2006 prior to decommissioning later that year.

While tanks were numbered in the plans held by Council, specific information on what was stored in the individual tanks was not held by in their records. The plans show that initially Site 18 extended approximately 15 m south on to what is now the Orams existing site. This is discussed further below.

A photograph of Site 18 from 1981, whilst in operation, is presented in Plate 1 below.

Table 4.1 sets out the types of products stored as obtained from Auckland Council property files. Where indicated by the historic information the volumes stored is also included. It should be noted that the volumes and types of products stored will have varied as a result of demand, site operations etc.

Table 4.1: Mobil Special products terminal product types and volumes

Hydrocarbons	Recorded Storage Volume	Hydrocarbons	Recorded Storage Volume
Avgas 100	2,435,000 L	Power Kerosene	2 x 50,000 L
Avgas Slops	13,600 L	P.M.S. - Slops	87,400 L
Blender	22,600 L	S.D.A. 3A	172,300 L
Delvac 1330	89,200 L	Solv Blend 64T	48,700 L
Diesel	50,000 L	Stock 632	1,251,500 L
G 3440 SP	172,600 L	Stock 2697	87,500 L
Gasoline	1 x 455,000 L	Stock 5601	13,600 L
IPA	2 x 51,300 L 1 x 70,800	Stock 5613	50,000 L
Jet A1	50,000 L	Super XHP Oil	89,200 L
kero-pegasol A.A	Unknown	Toluol	319,800 L
Kerosene	3 x 455,000 L	Transformer oil	1 x 1,023,000 L 1 x 4,000 L
Kerosine	465,500 L	Turpentine	1 x 2,490,000 L
Light fuel oil	1 x 354,000 L 1 x 2,500,000 L 1 x 1,680,000 L	V.A.M	450,500 L
Lubrication oil	1 x 100,000 L 2 x 50,000 L 1 x 45,500 L	Whiterex 307	1 x 316,600 L 1 x 312,000 L
Methanol	50,000 L	Whiterex 334	305,000 L

Hydrocarbons	Recorded Storage Volume	Hydrocarbons	Recorded Storage Volume
Meths 95WP/ QP	172,800 L	Xylol	1 x 467,600 L 1 x 467,800 L
Methylated spirits	1 x 45,000 L 1 x 10,000 L	Solvents	Known Storage Volume
M.M.A	481,900 L	Acetone	179,200 L
Mobil Oil 30/40	89,200 L	B.A	1 x 320,700 L 1 x 319,200 L
Motor spirits	1 x 9,224,000 L	Mobil Dry cleaner	1 x 2,490,000 L 1 x 1,648,000 L
Pegasol AA	1 x 455,000 L 1 x 466,400 L 1 x 466,900 L	Dioctyl phthalate	1 x 312,000 L
Pegasol 600	51,000 L	Methyl Ethyl Ketone	1 x 306,800 L
Pegasol R100	179,200 L	Methyl isobutyl ketone	1 x 201,700 L
Pegasol R150	303,600 L	N.B.A	1 x 172,100 L
Petrol	Unknown	N Butanol	1 x 86,100 L
Petropine	3,492,000 L	P.C.E	1 x 178,800 L
Texanol	Unknown		

Pollution records on Council's files indicate a number of incidents of spills, although the majority were associated with rupture of fuel transfer pipelines to vessels, resulting in discharge to the harbour rather than land/ground. Additionally an uncontrolled demolition fire occurred in 1980. There was no indication that this fire involved tanks or products.

A report providing an overview of contamination within the Western Reclamation[15] indicated that an explosion occurred on Site 18 in 1971 involving vinyl acetate monomer (VAM) during which an unspecified amount of VAM was reported to escape to ground. The report also states that in 1976 there was a fire involving Toluol from which an unspecified amount of product escaped to ground. The report indicated that remediation to remove petroleum hydrocarbon contaminated soils had occurred at Site 18 by that time (2005).

Council property files indicates that the Mobil Terminal was decommissioned in 2006. A photograph of storage areas at the time of decommissioning showed the products stored onsite at the time and in which tanks. This is discussed in Appendix C and summarised on Figure 5D.

Use since the terminal closure has been predominantly associated with the marine industry and as an America's Cup base, initially for Luna Rossa and subsequently Team New Zealand (Figure 4).

4.2.2 Orams existing facility historical summary

Initial reclamation of the site occurred concurrently with Site 18 around 1912, however additional reclamation to extend the site's western boundary occurred over several additional stages, the final

[15] Beca Infrastructure Ltd 2005, report for MfE, Overview of Contamination within the Western Reclamation.

stage being completed in 1987. During and post its reclamation the land has, for the past 100 years, been used by the marine industry, with facilities such as slipways, onshore vessel servicing, fuel storage and refuelling operations occurring. As can be seen in the 1939 photograph (Plate B), there were many slipways in operation with only a slipway in the south of the site currently remaining.

Initially the petrochemical operations at Site 18 extended 15 m into the Orams existing facility boundary from the north (refer to Figures 5A and 5B). From the available plans, this area was primarily used as an accessway with some small tanks (storing Whiterex in 1981) and loading areas. By the 1990s the boundary of the current Orams facility was established (Figure 5C).

A refuelling pipeline was extended through the site and added to the CMA in the 1950s. The existing pontoon based refuelling facility was first established in 1974.

Many structures have been present on the property, inferred to be for use in vessel painting, maintenance and motor repairs.

Surface water and, historically, sediment from unpaved areas of the site and adjacent marine services land had discharged to sea. Treatment systems are now installed and monitored to ensure discharges to the CMA meet required rules and regulations.



Plate 1: Historical photograph of predominantly Site 18 in 1981 (Source. National Libraries, Whites Aviation).



Plate 2: Historical photograph of the site in 1939 (Source. National Libraries, Whites Aviation).

4.2.3 Surrounding site history

Land use surrounding the property has historically included former oil industry storage or processing facilities. Individual oil companies typically had multiple facilities across a number of sites. In close vicinity to the site was the former:

- Shell Oil's Block III facility (northern corner of Beaumont and Pakenham Street West), directly east of Beaumont Street and opposite Orams existing facility.
- BP Oil's lube oil facility (north of Shell Block III), also directly east of Beaumont Street opposite Site 18.
- Castrals Lube facility was located to the northeast of the site.

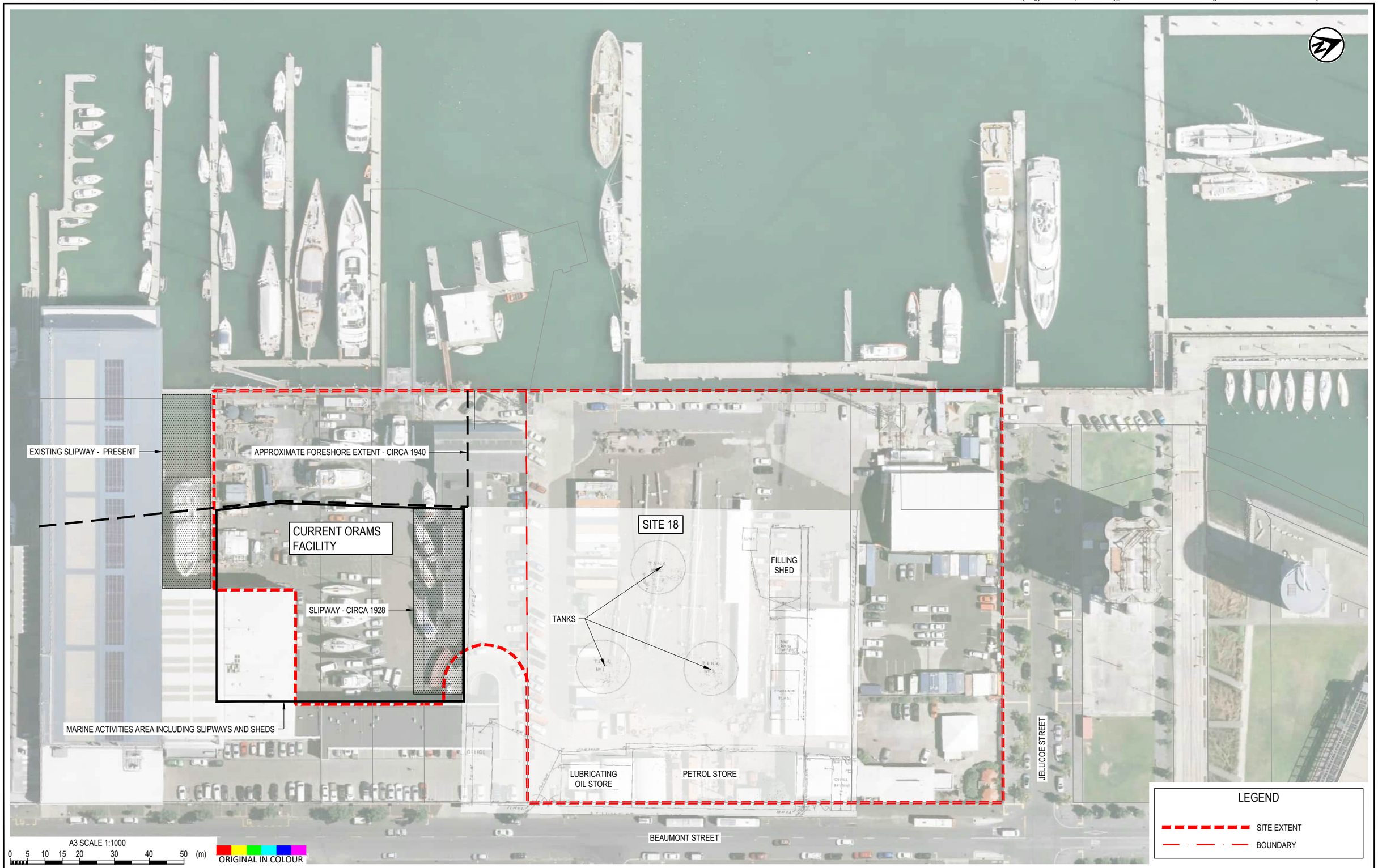
Other industries in the area have included marine services, fish processing and cement manufacturing. The position of relevant historical activities are shown on Figure 1.

A number of pollution incidents are reported to have occurred in the vicinity of the site with the most significant being a Jet A1 fuel spill of between 800,000 to 1,400,000 litres from Shell Block III in the mid-1980s. The spill spread widely in the areas adjacent to the source tank and Jet fuel is reported to have entered the harbour at three locations, including at the Westhaven Marine Centre directly south of Orams existing facility and the Jellicoe Street outfall north of the site. Given the magnitude of the spill and the proximity to the site, some impact by Jet fuel from this offsite source is anticipated at the site.

The former Auckland gasworks lies upgradient of Wynyard Quarter (18-20 Beaumont Street). Waste materials, including coke/clinker, ash and soils, excavated during its various stages of expansion and redevelopment, were disposed in the Western Reclamation (renamed Wynyard Quarter). As a result the reclaimed area is known to contain gasworks related contaminants in soils, typically within the upper 3 m, and cyanide in groundwater. These introduced materials, along with the presence of cyanide in groundwater, is expected on the site.

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PROJECT No.	30881.2000	
DESIGNED	MANR	Aug. 18
DRAWN	JC	Aug. 18
CHECKED	AMM	Oct.18
	WMW	Oct.18
	APPROVED	DATE

CLIENT **ORAMS MARINE**

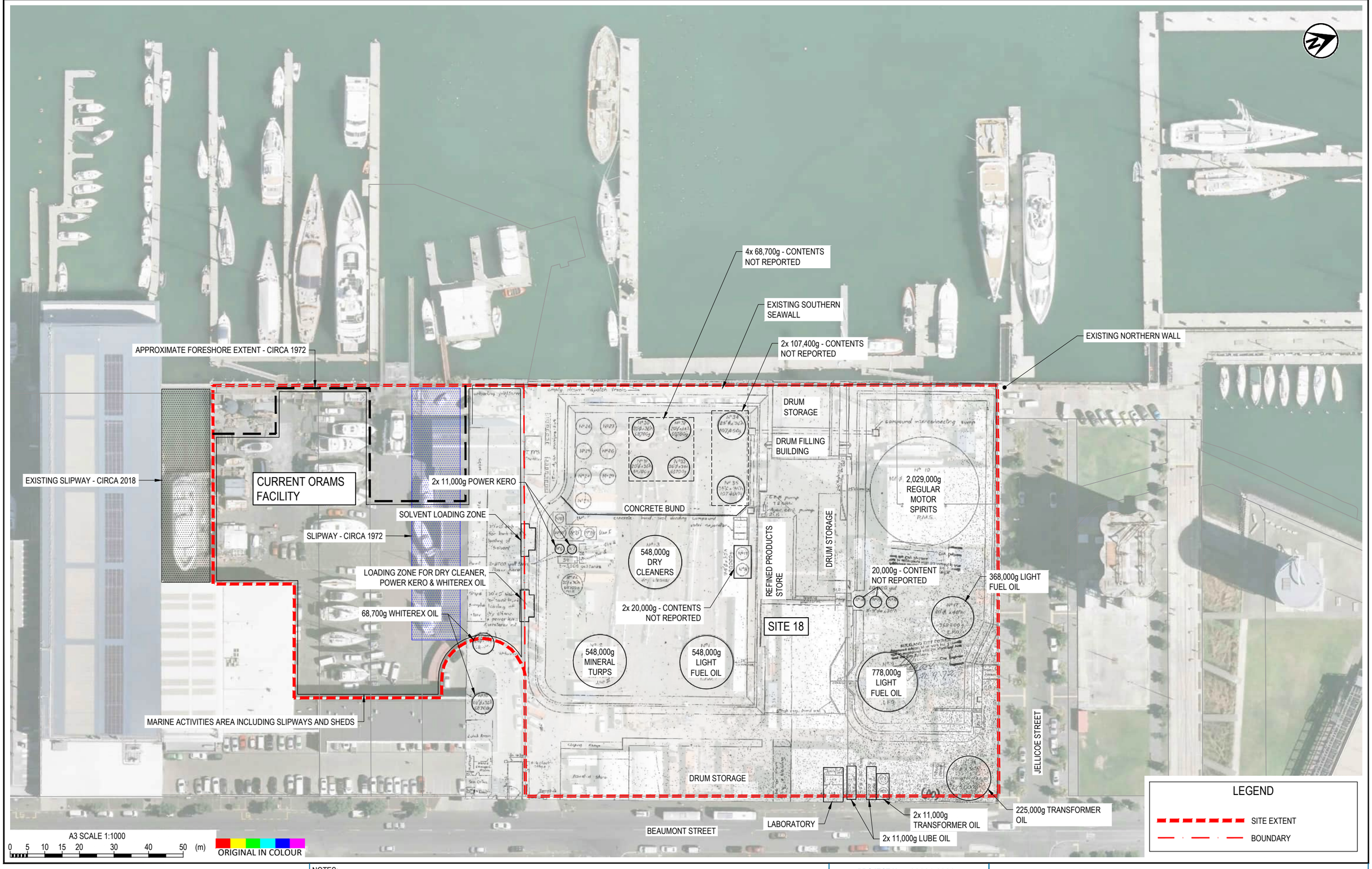
PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
LAYOUT OF SITE 18 IN 1928

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 5A REV 1

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CLIENT **ORAMS MARINE**

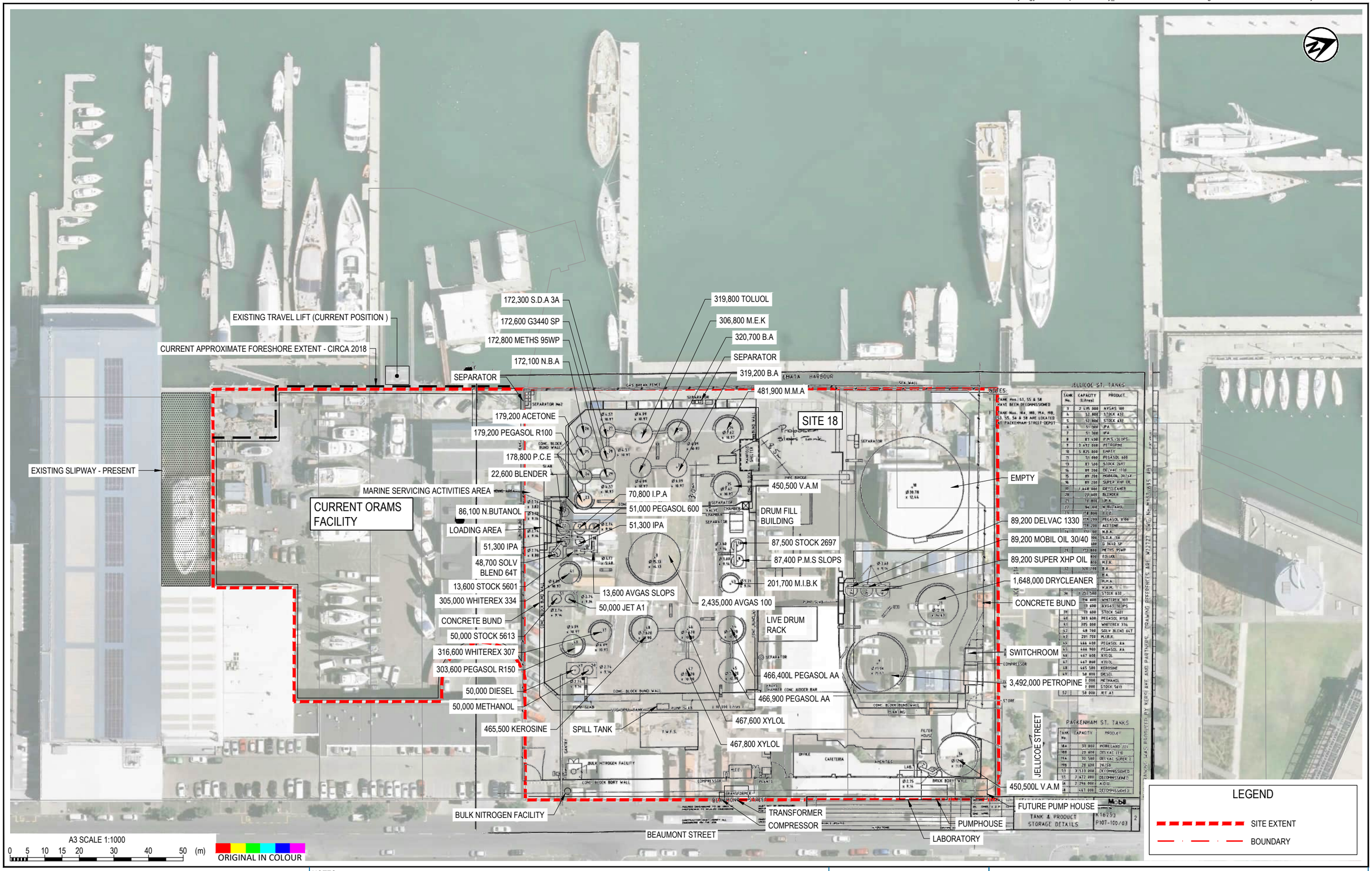
PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
LAYOUT OF SITE18 IN 1972

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 5B REV 1

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APPROVED	WMW	DATE	Oct.18

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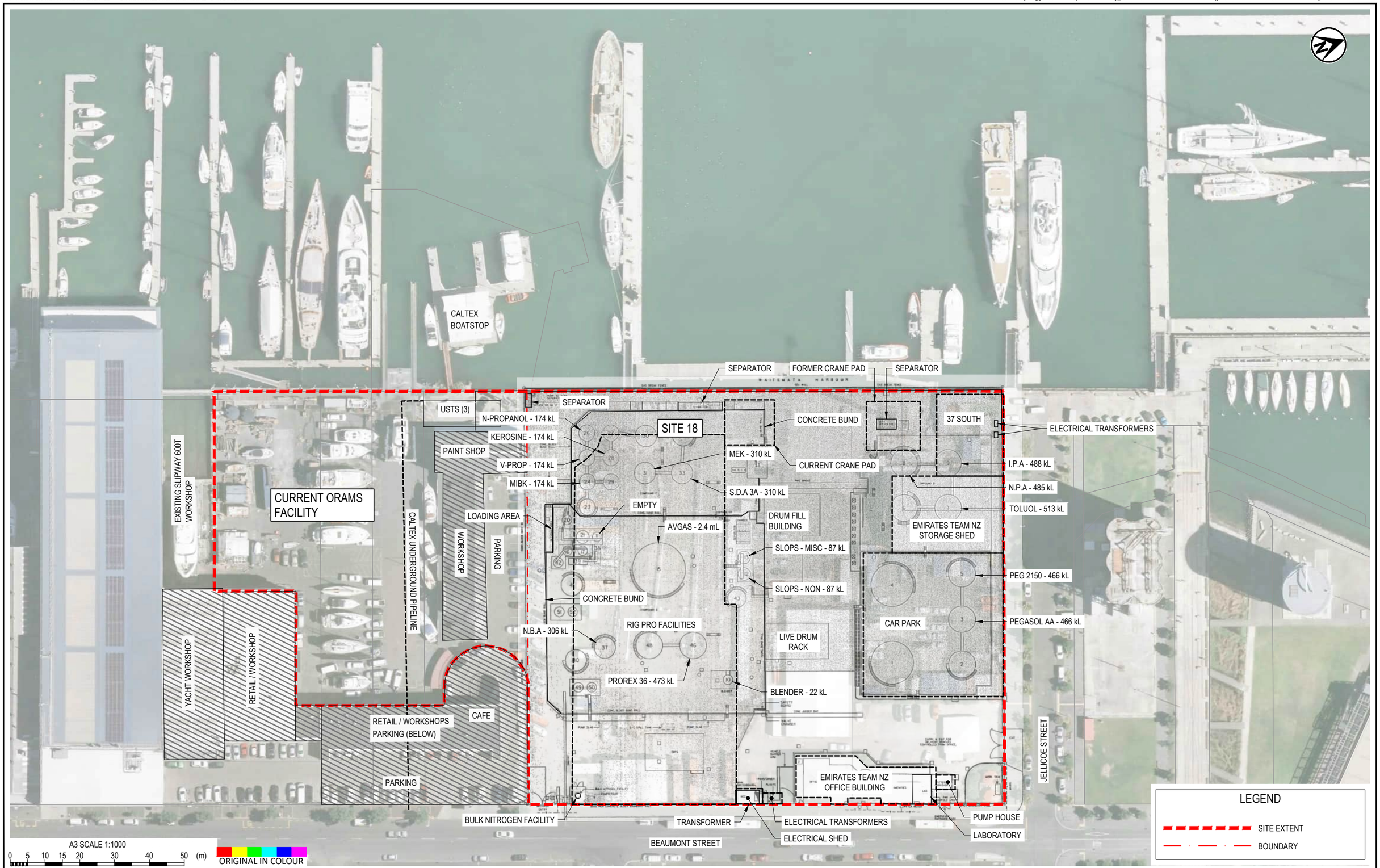
PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
LAYOUT OF SITE 18 IN 1995

SCALE (A3) 1:1000 FIG No. CONT - FIGURE5C REV 1

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	WMW	Oct.18
	APPROVED	DATE

CLIENT **ORAMS MARINE**

PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION LAYOUT OF SITE 18 IN 2006

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 5D REV 1

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5 Previous Investigations

5.1 Available reports for the site

The following reports for Site 18 were provided by Panuku, while those relevant to the existing Orams site were obtained from T+T records:

Site 18:

1 Beca Infrastructure Ltd, 2012. Jellicoe St to Madden St Western Edge – Geotechnical Factual Report. Report to Auckland Waterfront Agency.

2 T+T, June 2012. *Luna Rossa Base (Site 18) – soil vapour sampling*. Report to Auckland Waterfront Agency.

T+T has also considered the findings of reports prepared by URS Ltd for Mobil Oil Ltd during their site exit in 2006. While we are not able to reproduced specifics of these reports due to confidentiality constraints, we have considered URS's findings in our assessment.

Orams existing site:

3 T+T, December 2006. Ariadne Australia Ltd, Project Pontoon, Geotechnical and Environmental Desk Study Assessment. Reference: 24057; report to Ariadne Australia Limited.

4 T+T, July 2009. Pre-purchase assessment – Ground contamination and Geotechnical – Project Pontoon. Reference: 24057.100; report to Ariadne Australia Limited.

5 T+T, August 2011. Primary Site Appraisal Ariadne Marinas Oceania – Orams Marine Village, Auckland. Report to ANZ Banking Group.

6 T+T, 26 October 2012. Orams Marine Village – Annual Environmental Review. Letter to Ariadne Marinas Oceania Pty Ltd.

7 T+T, 12 March 2014. Orams Marine Village – Annual Groundwater Monitoring. Letter to Ariadne Marinas Oceania Pty Ltd.

There are numerous reports available on public record for properties in close proximity to, and upgradient, of the site, including those sites indicated in Section 4.2.3. Where we have referred to relevant information the source has been indicated.

5.2 Site 18

5.2.1 Jellicoe St to Madden St Western Edge – Beca 2012 Geotechnical Factual Report

In March 2012 Beca was engaged by Waterfront Auckland (now Panuku) to undertake a geotechnical investigation for the Jellicoe Street to Madden Street Western Edge Project. The report (Document 1) identified that the site was reclaimed with fill during the 1930s. The report states that the method of reclamation was to construct a perimeter seawall then place fill within the seawall. The report identified that since reclamation, the site has been used for the storage of bulk petroleum and cement.

The geotechnical investigation involved the excavation of three boreholes by Mobile Sonic 1000 drilling rig along the length of the seawall. The boreholes are shown on Figure 6 labelled Beca BH01-BH03. Borehole logs are included in Appendix I. Key findings of the investigations are:

- The geology encountered generally comprised silty gravel fill underlain by the Tauranga Group and East Coast Bay Formation (ECBF). Demolition material, including brick fragments and concrete, was observed at depths of 1.0 m bgl in boreholes Beca BH01 and BH02.

- Hydrocarbon odour was noted at a depth of 3.15 m bgl and at 1.0 m bgl in boreholes Beca BH01 and BH03, respectively. Purple staining was identified at a depth of 18.5 m bgl in borehole BH01.
- At the time of the geotechnical investigation, soil samples were collected from the three boreholes for the purposes of contamination testing. The samples were collected under instruction from T+T. The samples were collected to inform a human health risk assessment for Luna Rossa's proposed temporary use of the site. The testing was completed and reported for the Auckland Waterfront Development Agency (now Panuku).
- Soil samples were collected from depths of 0.3 to 9 m bgl. The samples were collected and submitted to Hill Laboratories of Hamilton in accordance with standard T+T procedures. All samples were submitted for analysis for total cyanide, heavy metals, total petroleum hydrocarbons, volatile organic compounds (VOCs) and semi volatile organic compounds (SVOCs).
- The results of the soil testing are presented alongside the results of the current Site 18 investigation in Tables 9.4 and 9.5 (Section 9). The results are discussed in detail in Section 9 of this report. However, in summary the testing indicated the presence of total petroleum hydrocarbons (TPH) and polyaromatic hydrocarbons (PAH) compounds to depth of 5.0 m bgl although generally below the relevant human health assessment criteria. Metals and cyanide concentrations were below the risk assessment criteria. Chlorinated solvents including tetrachloroethene (PCE), trichloroethene (TCE) and 1, 2-dichloroethene (DCE) were detected in Beca BH03 in the southwest corner of the site.

5.2.2 Luna Rossa Base (Site 18) – T+T soil vapour sampling

T+T was engaged by Auckland Waterfront Development Agency Ltd in June 2012 to undertake a preliminary assessment of soil vapour conditions at Site 18 as part of the development of the Luna Rossa base at the property (Document 2). The investigation comprised obtaining soil vapour samples from four existing shallow monitoring probes installed at the site.

These locations are shown on Figure 6 and the data is presented in Table 9.9 (Section 9). The sampling locations are not under the proposed building locations for the current development, however VP23 and VP29 are close to the eastern end of proposed Building B3 (retail and apartment building). All locations provide information for the outdoor air risk assessment.

Analytical results of the vapour sampling identified that one sample (VP10) marginally exceeded the workplace exposure standards for the $C_7 – C_9$ hydrocarbon band. All other samples returned concentrations below the workplace exposure limits. The report concluded that given the short term nature of the proposed site use, the average of concentrations across the site and as dilution would likely occur, the $C_7 – C_9$ exceedance was unlikely to present an unacceptable health risk.

The results are discussed in further detail in the Section 9.

5.3 Orams existing facility

5.3.1 T+T July 2009 Pre-purchase assessment report

T+T was engaged by the Ariadne Australia Limited to conduct a geotechnical and ground contamination pre-purchase assessment of what is now Orams existing site (142-148 and 150-152 Beaumont Street) (Document 4). The ground contamination assessment and findings are summarised here, geotechnical information has been incorporated into the geotechnical reports.

The potential for contamination at the site (as summarised from an earlier desk based assessment (Document 3) was noted to include the following:

- Placement of reclamation fill from industrial sources.
- Boat stripping and painting.
- Engine repairs and maintenance.
- Boat manufacture.
- Boat refuelling, including underground storage tanks in the northwest corner of the site.
- Dangerous good storage.
- Slipways.
- Vehicle parking.
- Migration of contaminants from offsite sources, particularly hydrocarbons and solvents.

Field investigations were completed to assess whether the above activities had resulted in onsite contamination. Ten soil sampling locations were selected based on a general grid basis with some locations targeting potential sources, while monitoring wells were installed in four of the ten locations to allow for groundwater monitoring and the collection of groundwater samples for contaminant testing. Two groundwater monitoring and sampling events were completed as part of the assessment. The position of the sampling and monitoring well locations are presented on Figure 6.

The results are assessed in more detail in the context of the current proposed works in Section 9, however in summary, the key findings of the 2009 report were:

- Reclamation fill was recorded across the site and comprised a granular fill to variable depth (generally to 3-4 m bgl) overlying hydraulic fill (sands and silty sands).
- The granular fill comprised a gravel unit with brick fragments, trace scoria and basalt gravels, and a silty sandy unit with minor gravels of clinker and cemented sand and silt (possibly reworked East Coast Bays Formation). Within the granular fill evidence of petroleum hydrocarbon contamination was noted in the top 1.5 m along the northern boundary with Site 18 (BH3, BH7 and BH8), and between 1.5 and 3.0 m along the southern half of the eastern boundary (BH10). In the southern part of the site (BH2 and BH5) a weathered petroleum hydrocarbon odour was noted at the water table depth.
- Generally metals, PAH, TPH and in isolated areas, volatile organic compounds (VOC) were recorded in soils across the site, likely associated with the original source of reclamation materials and with on and offsite activities post reclamation.
- Groundwater contamination was found to be minor, with cyanide and zinc the only two compounds tested being reported to exceed the Australian & New Zealand Guidelines for Fresh and Marine Water Quality (2018) (A&NZ 2018 Guidelines) at a 80% level of protection. No measurable thicknesses of separate phase hydrocarbons (SPH) were reported in the groundwater monitoring wells.
- Sediment samples were also collected from 19 locations in the adjacent CMA in order to inform baseline contamination levels in sediment within the coastal marine environment. No visual or olfactory evidence of contamination was noted in the sediment samples. Sediment quality was shown to be impacted by metals, cyanide, PAH and tributyltin (TBT) likely from a variety of source locations. This sediment has since been dredged and removed from the area and the data is not discussed further in this report.

5.3.2 Subsequent groundwater monitoring events (2011, 2012 and 2014)

Three subsequent groundwater monitoring and sampling events were completed by T+T over the period from 2011 to 2014 at Orams existing site (Documents 5-7). The sampling rounds were

undertaken as part of a Primary Site Appraisal of the site during a property transaction (2011), an annual environmental audit (2012) and follow up groundwater monitoring (2014).

The groundwater samples were collected from MW1, MW2 and MW3 during each monitoring round with samples tested for metals, cyanide, BTEX and TPH. MW4 was not able to be sampled during any of the three sampling rounds as the well head was covered by concrete.

The groundwater monitoring results are presented in Section 8.4. In summary, the groundwater results show contaminant levels remained relatively consistent over the monitoring period (2008 – 2014). Concentrations of zinc and cyanide were consistently been recorded at concentrations that exceed the 80% A&NZ marine water quality guideline values in MW2 and MW3 respectively. Copper was also recorded in groundwater at MW2 above the guideline criteria on one occasion.

6 Site Characterisation

6.1 Potential for contamination at Site 18

The desk study investigation identified that HAIL activities have occurred at Site 18. The activities, potential contaminants and an assessment of the likelihood, potential magnitude and possible extent of contamination are presented in Table 6.1. The inferred locations of these activities are presented on Figures 4 and 5(A-D).

Table 6.1: Potential for contamination – Site 18

Land use/activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference
Reclamation (both Site 18 and Orams existing facility)			
Inclusion of gasworks and other industrial wastes in reclamation materials.	A range of contaminants are possible depending on the nature of the wastes – commonly includes PAHs, phenolics, metals (particularly arsenic, lead, copper, chromium), cyanide.	Reclamation materials occur across the site and adjacent sites as indicated on the Ports of Auckland reclamation maps. It is expected, based on T+T's knowledge of the wider area, that gasworks waste, incinerator material and demolition materials may be heterogeneously distributed within the top 5 m of material at the site. Typically wastes incorporated into the reclamation included clinker and ash (coarse and fine black gravels) and bricks, usually within the top 2 m of the soil profile. These granular materials were used to form a workable surface following placement of other, usually dredged or headland materials. Contaminants associated with these materials are therefore expected in the upper granular layer (usually 1-3 m).	Activity I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.
Mobil Auckland Special Products Terminal			
Fuel and other petroleum-related product storage and handling.	Wide range of petroleum hydrocarbon compounds and lead (from lead fuel sludges).	Hydrocarbon contamination may extend down through the soil profile to groundwater interface where AST's were positioned or where large spills may have occurred (e.g. in bunded areas). In other areas hydrocarbon contamination of soil is likely at the groundwater interface. Water level fluctuations as a result of the tide and seasonal effects are also expected, thus a smear zone of hydrocarbon contamination is likely between 1 and 3 m depth. Groundwater quality is expected to be impacted where soil contamination occurs, both as dissolved and separate phases. Dissolved and separate phase hydrocarbons (SPH) also have potential to migrate from the source area, and from offsite sources, where a driving head remains.	Activity A13: Petroleum or petrochemical industries including a petroleum depot, terminal, blending plant or refinery, or facilities for recovery.

Land use/activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference
Chemical storage and handling.	Chlorinated hydrocarbons and their breakdown products, polychlorinated biphenols (PCB) (transformer oil), solvents.	Contamination is likely in soils in the immediate vicinity of the locations of the former ASTs (probable storage areas for chlorinated solvents was in the site's southwestern corner where cluster of smaller tanks was present), loading zones (adjacent to the site's southern boundary), fill points and beneath the ASTs. If present in pure form chlorinated solvents may sink below groundwater as a dense non aqueous phase liquid (DNAPL).	Activity A5: Dry-cleaning plants including dry-cleaning premises or the bulk storage of dry-cleaning. Activity A2: Chemical manufacture, formulation or bulk storage.
Chemical testing laboratory.	Wide range of organic and inorganic compounds including solvents, acids, metals, and mercury.	A laboratory was present onsite, located in the site's northeastern corner adjacent to Beaumont Street, from at least 1972 to 2006. Should spills have occurred contamination could be possible in soils in the immediate vicinity of the laboratory or via in wastewater pipes if disposed. However, the volumes handled are likely to have been small and the laboratory was located within the existing building, i.e. over a concrete floor.	Activity A3: Commercial analytical laboratory sites.
Electrical transformers.	Depending on the year of installation, contaminants may include PCBs, hydrocarbons, and metals.	If spills have occurred in the past contamination is most likely to be limited to the surface soils in the immediate vicinity of the transformers.	Activity B2: Electrical transformers.
Aqueous film forming foam (AFFF) storage and use.	Fluorinated compounds including per and polyfluoroalkl substances (PFAS).	PFAS contamination in surface soil could be expected adjacent to the AFFF system in the site's northeastern corner. No records for fuel fires exist, however should AFFF have been used at the site, PFAS contamination would also be expected in surface soils where foam was applied and in groundwater downgradient and potentially cross gradient of the source.	Activity A17: Storage tanks or drums for fuel, chemicals or liquid waste.
Construction and demolition of historic structures			
Construction and demolition of historic structures.	Asbestos and lead-based paints.	Buildings and structures were constructed and/or modified during the period when use of asbestos containing materials and lead-based paints were prevalent. Historical documents confirm that asbestos was present in some of the structures and was used in gaskets. It may also have been used as formwork in the construction of concrete tank slabs. It is possible that waste from these activities may have impacted soils however the extent of contamination is expected to be limited to surface soil (or still around the concrete in situ).	Activity E1: Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition, and Activity I (lead-based paints).
Existing activities - Rig Pro			

Land use/activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference
Alteration and repair of masts (including sanding, painting and the use of solvents).	Metals, solvents, paint residues.	Contamination would most likely be limited to the surface soils in the immediate vicinity of the areas in which the activities are undertaken (Figure 4).	Activity F5: Port activities including dry docks or marine vessel maintenance facilities.
Offsite Sources (both Site 18 and Orams existing facility)			
Upgradient sources of hydrocarbons principally former, Shell Block III terminal.	Principally Jet fuel from the Shell spill, however there is potential for other petroleum hydrocarbons.	Historical terminals were situated between Beaumont and Halsey Street. The Shell terminal (Shell Block III) was historically positioned on the eastern side of Beaumont Street, east of the Orams existing site. A significant spill of aviation fuel occurred in the mid-1980s that is expected to have migrated towards the site. SPH and dissolved phase hydrocarbons may be present in the southeast of the site. BP Oil's lube oil facility was located directly east of Beaumont Street opposite Site 18, and Castrol Lubes was located to the northeast.	Activity H: Any land that has been subject to the migration of hazardous substances from adjacent land in sufficient quantity that it could be a risk to human health or the environment.
Gasworks waste.	Cyanide.	Groundwater across the Wynyard Quarter and immediate surrounds is known to be affected by cyanide from gasworks wastes arising from the reclamation, including Victoria Park, but also the former gasworks itself.	

6.2 Potential for contamination at Orams existing site

The desk study investigation for the Orams existing site completed in 2006 (Document 3) identified that HAIL activities have occurred. Activities related to prior land reclamation and the potential for contamination associated with offsite sources of contamination as indicated in Table 6.1 are also relevant to Orams existing facility. Other potentially contaminating activities relevant to Orams existing site as listed in Table 6.2. The inferred locations of these activities are presented on Figures 4 and 5A-D.

Table 6.2: Potential for contamination – Orams existing site – Post reclamation activities only

Land use/activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference
Fuel and other petroleum-related product storage and handling.	Kerosene and white oils, and possibly other hydrocarbons.	The Site 18 facility extended approximately 15 m south on to the Orams existing site until the 1980s. This part of the facility appears to have been primarily for access and loading, however some small tanks are noted. Hydrocarbon contamination may extend down through the soil profile to groundwater interface where AST's were positioned. In other areas hydrocarbon contamination of soil may be present at the groundwater interface. Water level fluctuations	Activity A13: Petroleum or petrochemical industries including a petroleum depot, terminal, blending plant or refinery, or facilities for recovery.

Land use/activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference
		as a result of the tide and seasonal effects are also expected, thus a smear zone of hydrocarbon contamination is likely between 1 and 3 m depth. Groundwater quality is expected to be impacted where soil contamination occurs, both as dissolved and separate phases. Dissolved and separate phase hydrocarbons (SPH) also have potential to migrate from the source area, and from offsite sources, where a driving head remains.	
Boat stripping and painting.	Solvents, metals including lead and tin, tributyltin (TBT) and other organic pesticides in marine antifouling paints.	Current use unlikely to be causing contamination as site and painting bays fully sealed and enclosed, however past stripping and painting on unpaved surfaces may have caused near surface contamination. Particularly with large vessels this activity was most likely undertaken in the boatyards on unsealed yards close to the harbour. The shallow surface material is most likely affected with sediment adjacent to the land likely to be contaminated due to surface runoff.	Activity F5: Port activities including dry docks or marine vessel maintenance facilities.
Engine repairs and maintenance.	Metals, petroleum hydrocarbons, hydraulic fluid, oil.	Currently engineering repairs are undertaken in an enclosed paved workshop, however historically may have been undertaken on unpaved surfaces. Near surface contamination is possible. Any runoff from these unpaved surfaces may also have resulted in sediment contamination within marine foreshore area. If significant or frequent spills may have migrated to the groundwater table.	Activity F5: Port activities including dry docks or marine vessel maintenance facilities.
Boat manufacture.	Metals, fibreglassing related solvents and aldehydes.	Steel fabrication and engineering may cause metal contamination, most likely to be limited to near surface soils. Solvents and glues used in the manufacture of vessels may also have been spilt and be present in near surface soils. Any runoff off these unpaved surfaces may also have resulted in sediment contamination within marine foreshore area. Solvent spills if significant or frequent may have migrated to the groundwater table.	Activity F5: Port activities including dry docks or marine vessel maintenance facilities.
Boat re-fuelling.	Diesel, petrol.	In soil, contamination is most likely to be confined to the vicinity of the historical and upgraded USTs and pumps. May extend to the groundwater table or harbour if leaks occurred.	F7: Service stations including retail or commercial refuelling facilities.
Dangerous goods storage.	Solvents, metals, petroleum hydrocarbons, PAHs.	Early DG storage is likely to have been scattered within or outside individual buildings and containment measures limited or non-existent. Spills from DGs stored on unpaved surfaces	Activity A17: Storage tanks or drums for fuel,

Land use/activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference
		would have migrated into the underlying soil whereas spills from DGs in limited containment may also have affected subsurface soils and possibly been discharged to the harbour via stormwater.	chemicals or liquid waste.
Slipways.	Petroleum hydrocarbons, metals, TBT.	Pulling boats up on the slipways may result in spills of oil, fuel and antifoulants around the slipway and in harbour sediments close to the slipway.	Activity F5: Port activities including dry docks or marine vessel maintenance facilities.
Vehicle parking.	Petroleum hydrocarbons, metals.	Currently the site is paved so any vehicle parking related contamination would discharge to tradewaste via the interceptor, although historically any unpaved surfaces may have shallow contamination.	Unlikely to be a HAIL given typical small scale of drips/leaks.

6.3 Preliminary conceptual site model

A conceptual model, as defined by the Ministry for the Environment in the contaminated land management guidelines[16], sets out known and potential sources of contamination, potential exposure pathways, and potential receptors. For there to be an effect from the proposed activity there has to be a contamination source and a mechanism (pathway) for contamination to affect human health or the environment (receptor).

A preliminary conceptual site model (CSM) was developed for the site based on the available information and our understanding of the potential effects on human health and the environment. The purpose for development of the preliminary CSM was to inform the site investigation planning and analytical testing programme.

6.3.1 Sources

The desk study indicates that the primary sources of contamination are anticipated to comprise:

- Petroleum hydrocarbons, oils, solvents and PCBs in soil and groundwater (including the potential for SPH and DNAPL) resulting from the use of Site 18 as a bulk petrochemical facility.
- Possible soil and groundwater contamination arising from past and existing underground fuel tanks in the northwest corner of the Orams existing site.
- Industrial wastes used to form the reclamation (e.g. gasworks waste).
- Metals, solvents and paint residues resulting from recent use of the centre of Site 18 for mast alteration.
- Metals, solvents and antifoulants in soils on Orams existing facility arising from the period when the land was largely unpaved, and contained multiple slipways.
- Solvents, acids and other chemicals relating to the Site 18 chemical testing laboratory.

[16] Ministry for the Environment, updated 2011, *Contaminated Land Management Guidelines No. 5 Site Investigation and Analysis of Soils.*

- Asbestos in soil resulting from degradation of asbestos containing building materials or demolition of small buildings on Site 18 and possibly the recent import of surface fill material. Given the age of the original reclamation the potential for ACM in these materials is low.
- Localised PCBs, hydrocarbons and metals relating to presence of electrical transformers within Site 18.
- Persistent components of firefighting foams (PFAS/PFOS) resulting from foam storage and potentially use on Site 18.
- Petroleum hydrocarbons migrating onto the site from upgradient land east of Beaumont Street where historic large scale spills occurred. Former Shell Block III located to the southeast of the site had a significant aviation fuel spill from which migration onto the site is possible.
- Cyanide migrating in groundwater onto the site from upgradient soil and groundwater sources, including the former Auckland Gasworks.

6.3.2 Pathways

An exposure pathway is the mechanism by which a receptor (human or environmental) may be exposed to contaminants on the site, those derived from onsite activities and those potentially migrating onto the site from adjacent upgradient land. An exposure pathway comprises the following elements:

1 Transport medium such as soil, groundwater or air.

2 Point of exposure for a possible receptor.

3 Mechanism for intake of contaminants by the receptor (i.e. ingestion, dermal (skin), inhalation).

If one or more of these elements is absent then the pathway is incomplete, thus no human health or environmental risk exists. Proposed redevelopment of the land is expected to create possible pathways for contamination to affect receptors, the magnitude of this and potential means for mitigating effects is the subject of this investigation. Section 6.2.3 sets out how potential receptors may be impacted currently, during construction and post construction for the purposes of determining data collection requirements during the DSI, which was conducted to confirm or otherwise these preliminary assumptions.

6.3.3 Receptors

Potential receptors under the current, development and future land use scenarios are expected to be as per Table 6.3.

Table 6.3. Preliminary exposure assessment

Land use scenario	Description	Potential receptors	Potential pathways to exposure
Current (commercial)	Site 18 is currently used for marine services such as mast alterations (RigPro) and by Team New Zealand for storage and repairs on equipment. There are a number of buildings on the site, one of which is currently used as an office. Site 18 is	• People – existing site workers (indoor and outdoor), workers on adjacent sites and the general public. • Environment – flora and fauna of	• Ingestion of contaminated water via ingress into water supply pipes. • .Contaminant migration to the harbour via: - Dissolved phase migration in groundwater.

Land use scenario	Description	Potential receptors	Potential pathways to exposure
	currently sealed in part or covered in gravel. Orams existing site is currently used for marine servicing. The site is largely paved or covered by buildings. Soil excavation activities are likely limited to any non-routine maintenance works.	the Westhaven marina on the western boundary.	- Migration of separate phase product in groundwater. - Migration in preferential pathways such as historic or new underground service trenches (as dissolved phase or as separate phase product).
Construction (commercial)	During construction there will be a significant volume of soil disturbance to enable ground improvement of the upper 2.8 m and for levelling to develop surface gradients. Seawall repair/replacement works will also disturb soil to a depth of 18 m bgl. There is a greater potential for people to come in to contact with soil directly, and for the migration of contaminants in dust, vapour and entrained in sediment. Rainwater infiltration rates will temporarily increase as each part of the site is exposed until seawall and ground improvement works are completed. Surplus soil is expected, up to [TBC by Strata], and will require offsite disposal.	• People – excavation workers, workers on adjacent sites and the general public, disposal site operators. • Environment – flora and fauna of the Westhaven marina located adjacent to the site.	• Direct contact (ingestion, dermal contact) by workers. • Ingestion of contaminated water via ingress into water supply pipes. • Inhalation of vapours, asbestos fibres or contaminated dust by workers, or workers on adjacent sites and the general public during soil disturbance. • Direct contact by the public offsite during any offsite transport/disposal of contaminated material. • Contaminant migration to the harbour via: - Dust during soil disturbance. - Dissolution in water or sediment entrainment in stormwater on site. - Dissolved phase migration in groundwater. - Migration of separate phase product in groundwater. • Migration in preferential pathways such as historic or new underground service trenches (as dissolved phase or as separate phase product).
Future (commercial and high density residential).	The site will be almost entirely paved on completion including in the non-apartment area and 1.2-2.0 m thick stabilised soil mass. In terms of exposure to environmental receptors, the following pathways may be realised if appropriate	• People – future site workers (indoor and outdoor), future site residents (northern area of site only), workers on adjacent sites and	• Human health related pathways are expected to be incomplete; access to subsurface soil/ groundwater is prevented by surface paving. Vapour risks may remain unless addressed. • Effects on environmental receptors as indicated under the future situation may be reduced or incomplete if the

Land use scenario	Description	Potential receptors	Potential pathways to exposure
	remedial controls are not in place.	the general public. • Environment – flora and fauna of the Westhaven marina located adjacent to the site.	new seawall cuts off contamination but diffuse or direct discharges may occur in other parts of the site. Surface runoff is not a complete pathway to the as the site will be paved. Underground services will be installed in the stabilised subsoil and are unlikely to present preferential pathways.

In addition to human and environmental receptors are potential effects on property, including in-ground concrete structures should acid sulphate conditions exist in soil and degradation or permeation through plastics (e.g. water supply pipes) by hydrocarbon contaminants.

6.4 Direction for investigations

The preliminary CSM shows that there is potential for contaminants in soil, groundwater, air and sediment on and adjacent to the site to pose a risk to human or environmental receptors currently and, if mitigation measures are not appropriate, during and after completion of the development works.

The CSM informed the sampling plan, as detailed in Section 7.1. In general the following key areas drove the site investigation approach and design:

- Assessment of groundwater quality to understand the risk to marine environment.
- Assessment of soil quality to assess risk to human health during construction and to inform remediation requirements for future land use.
- Assessment of soil quality with regards to disposal of surplus soil during the works.
- Assessment of vapour risk to indoor air in the area of the proposed buildings (apartment and commercial buildings.
- Assessment of risk to in-ground concrete structures if acid sulphate soil conditions exist.
- Assessment of sediment quality to inform the dredging works and disposal of dredged material.

7 Site Investigations

7.1 Investigation rationale

The objective of the intrusive investigations was to obtain ground contamination data for soils, groundwater, vapour and sediment to characterise contaminant concentrations across the site to inform the objectives set out in Section 1.3.2, and evaluation of potential risks to receptors identified in Table 6.3.

Existing soils data was used to address risks related to soil strengthening works on the existing Orams site with additional groundwater sampling and testing undertaken to update the condition of groundwater since the last monitoring in 2014. Existing soil and groundwater data was also reassessed against evaluation criteria relevant to the current development proposal.

The land-based investigation approach for Site 18 was to:

- Review existing information to guide the investigation.
- Achieve coverage by utilising a broadly grid based layout.
- Targeted sampling in areas where specific localised activities occurred.
- Enable preliminary evaluation of short and long term risk associated with soil gas.
- Assess groundwater conditions near:
  - The point of discharge to the harbour.
  - Within the site.
  - On the eastern (upgradient) boundary to assess the quality of groundwater entering the site.
- Enable data to be collected to aid in understanding the hydrogeological setting and contaminant transport mechanisms.

The investigation location points were constrained by current commercial operations and existing buildings but overall are considered to provide robust coverage in the context of the sources (bulk storage rather than small hotspots) and proposed use (primarily outdoor).

The rationale for investigation of Site 18, with respect to the potential sources of contaminants is presented in Table 7.1. The investigation rationale at the Orams existing site in 2009 was focused on assessing whether the onsite and offsite activities had resulted in onsite contamination with the view to informing the purchase of the site. For this investigation the rationale was to update the existing data set on groundwater quality.

The rationale for sediment sampling was to inform potential impact from the site and more broadly the risks posed by dredging and disposal of dredged material. Locations were selected along the proposed dredging footprint and profile, as well as adjacent to the seawall.

All samples selected for testing were sent to laboratories accredited under IANZ. Laboratories used included Hill Laboratories and Assure Quality.

Table 7.1 Investigation rationale and targeted locations, Site 18

Land use/activity	Investigation rationale	Sampling points
Reclamation		
Gasworks and industrial (predominantly incinerator ash) wastes.	These materials predominantly occur in the upper 1-2 m where granular fill is present although deeper towards the harbour.	All sampling points had the potential to encounter this. Metals, PAH and cyanide testing was completed on selected samples based on observations Metals, PAH and cyanide in all groundwater sampling locations.
Mobil Auckland Special Products Terminal activities		
Fuel and other petroleum-related product storage.	Fuel and other petroleum related product storage covered the majority of the site, with the potential for spillage and subsequent migration to, and within, groundwater. Vapour risks are a concern where buildings are proposed. Some vapour data is already available near or beyond the building footprints.	All sampling locations were relevant. Selected soil samples were tested based on observations, PID readings and to provide spatial and vertical coverage. All groundwater sampling points. All vapour monitoring points.
	Bulk storage of transformer oils is thought to have occurred on the northern side of the site. Soils were tested for PCBs and down gradient groundwater was also tested.	Soil GBH103, CBH201. Groundwater deep (GBH109, GBH111) and shallow (CBH203, CBH204).
Chlorinated solvent storage.	The focus for this potential issue was in the southwest portion of the site where storage is storage occurred. Other potential sources areas may relate to the loading bay and other areas such as drum filling. Some existing information is available (Beca BH3).	GBH109, TP103, CBH206 and all investigation locations. Samples for testing from these locations were selected based on observations and PID readings.
Chemical testing laboratory.	Located in the northeast corner of the site. Potential effects to human health via soil and vapour, and to groundwater. Groundwater testing was used as a screen for gross impacts in the area.	GBH103.

Land use/activity	Investigation rationale	Sampling points
Electrical transformers.	The transformer situated adjacent to Beaumont Street is located in an area of concrete (150 mm thick). Consequently no samples were obtained directly adjacent to the transformer. The two transformers in the site's northwest corner were installed between 2012 and 2015, subsequent to the use of PCBs and consequently no samples were obtained from this area.	GBH107.
Aqueous film forming foam (AFFF) storage and use.	The foam storage area was located in the northeast corner of the site. There are records of fuel fires having occurred onsite. Testing of groundwater for PFAS was undertaken in selected wells downgradient of the known storage area, and then up and down gradient of the site to assess for other potential sources. No soil testing was completed for PFAS.	Groundwater from GBH103, GBH106, GBH107, GBH111, GBH201 and CBH204.
Construction and demolition of historic structures		
Construction and demolition of historic structures.	The potential for asbestos contamination relates to post-reclamation activities. As such near surface soils were tested for asbestos. Semi-quantitative testing was completed to inform H&S controls during the works.	All soil investigation locations. Samples were selected based on visual observations of demolition materials and shallow soils across the site to achieve coverage.
Existing activities - Rig Pro		
Alteration (including sanding, painting and the use of solvents) of masts.	Investigation locations were selected across the area utilised by RigPro where access was available.	GBH108, TP1, GBH107, CBH208, TP102, GBH106, CBH205.
Offsite Sources		
Upgradient sources of hydrocarbons. Gasworks waste.	The potential for migration of contaminants on to site from upgradient groundwater sources was investigated by the placement of groundwater wells on the upgradient boundary of the site, both in deep and shallow groundwater.	GBH119, GBH107, GBH105, GBH103 and GBH102.

7.2 Investigation methodology and sampling procedures

7.2.1 Soil

In addition to the rationale set out in Table 7.1, soil samples from locations within Site 18 were selected for testing based on their suitability for characterising the various stratigraphic layers, assessing vertical migration of contaminants and to inform objectives such as disturbance associated with cement stabilisation works. Observations made during the drilling and test pitting and PID field measurements were also used to guide the selection of soil samples for testing.

Soil sampling works comprised:

- Collection of soil samples from locations as follows:
  - Three test pits (TP101 – TP103) excavated in various locations across the site to depths up to 2.5 m bgl.

  - 19 boreholes (CBH200 series, and GBH100 series) positioned across the site[17].
  - Four off-shore boreholes (GBH300 series).
- Selected samples were tested for a selection of metals (including mercury), TPH, PAH, VOCs, asbestos, PCBs and TBT. The samples and analysis suites were selected based on the CSM and observations during the investigation programme.
- Submission of quality control samples for as detailed in Section 9.2.

Soil samples within Site 18 were collected in general accordance with MfE Contaminated Land Guideline No. 5 as follows:

- Soil samples were collected directly from the recovered core, directly from the test pit or from the excavator bucket/auger head with freshly-gloved hands, and were placed into laboratory-prepared sample jars. The samples were stored under chilled conditions prior to being delivered to Hill Laboratories in Auckland.
- For asbestos testing approximately 500 ml of soil was collected directly from the test pit/ auger head/ drill core with freshly-gloved hands, and placed into laboratory supplied containers. All material was visually inspected.
- The core barrel and all non-dedicated sampling equipment was decontaminated between sample locations using clean water and Decon90 (a phosphate-free detergent) followed by a clean water rinse.
- Soil samples were obtained from the surface (beneath the hard standing) and where changes in lithology were observed or at generally 0.5 – 1.0 m bgl intervals.
- The materials were logged in general accordance with the NZ Geotechnical Society guidance and were assessed for odour and evidence of contamination.
- Soil sub-samples were obtained for the purposes of field screening with a photo-ionisation detector (PID). The soil samples were collected directly into zip lock bags and sealed shut before being left to stand for approximately 10 minutes. The bags were then pierced with the nozzle of the PID to measure the headspace reading.
- Additional samples were held at the laboratory for further analysis, if required.

The BRANZ Asbestos Guidelines provide guidance on numbers of samples to assess the presence of asbestos in soil where it is suspected as being present, based on the area of a site. For the area of Site 18 (approximately 1.6 ha) the guidelines recommend some 25 sampling points. A total of 22 samples were tested, achieving close compliance with the guidance.

7.2.2 Groundwater monitoring and sampling

Groundwater monitoring wells were installed in 18 boreholes (all nine contamination boreholes and nine of the 11 geotechnical boreholes) within Site 18 as follows:

- The monitoring wells comprised 50 mm diameter PVC standpipe and 0.5 mm slotted screen.
- The screen sections of the monitoring wells were positioned to target the water table, with screen lengths of between 2 – 3.5 m, to allow for seasonal groundwater fluctuation.
- The filter pack of the screened section of the wells comprised K2 industrial silica sand (maximum particle size 2 mm), followed by bentonite to 0.25 m bgl.
- The wells were completed with a flush mounted toby box set in concrete.

[17] Note that GBH111 was originally drilled as a CPT and therefore no soil samples were obtained from this borehole.

Summary details of the monitoring wells installations are presented in Table 7.2. Installation records are summarised in the borelogs provided in Appendix J.

Table 7.2: Monitoring well details

Borehole ID[1]	Ground level RL (m)	Installation depth (mbgl)	Use
GBH102P	3.08	6.1 - 8.1 [2]	Monitoring well
GBH103P	2.84	1.1 – 5.6	Monitoring well + level logger
GBH104P	2.90	1.1 – 5.5	Monitoring well
GBH106P	2.90	1.1 – 4.3	Monitoring well
GBH107P	2.75	1.1 – 4.6	Monitoring well
GBH108P	3.08	1.1 – 4.6	Monitoring well
GBH109P	2.77	6 – 8 [2]	Monitoring well + level logger
GBH110P	2.73	6.1 – 7.9 [2]	Monitoring well
GBH111P	2.82	6.1 – 8.1 [2]	Monitoring well + level logger
CBH201P	3.06	1.0 – 4.5	Monitoring well
CBH202P	2.84	0.9 – 3.9	Monitoring well
CBH203P	2.54	1.0 – 4.5	Monitoring well + level logger
CBH204P	2.65	1.0 – 4.5	Monitoring well + level logger[3]
CBH205P	3.18	2.0 – 5.5	Monitoring well + level logger
CBH206P	2.67	1.5 – 4.5	Monitoring well
CBH207P	2.90	1.5 – 4.5	Monitoring well
CBH208P	3.48	1.5 – 4.5	Monitoring well
CBH209P	3.01	1.5 – 4.5	Monitoring well

Notes:

1. Monitoring wells were not installed in GBH101 or GBH105 given there were sufficient data points in the vicinity of these locations.
2. Screen interval installed below groundwater table level.
3. Level logger was removed on 10 August and placed in GBH109 for the remainder of the monitoring period.

Groundwater monitoring and sampling was undertaken by T+T between 25 July and 6 August 2018. Groundwater samples were obtained from all monitoring wells installed within Site 18 during the investigation plus four existing groundwater monitoring wells, three within the Orams existing site and one on Site 18. Refer to Figure 6 for well locations.

The following procedures were followed during groundwater sampling:

- Prior to sampling, the depth to water level was measured in all wells using an interface probe. The interface probe was then lowered to the base of the well to check for DNAPL.
- Product samples were collected in locations where product was present. The product samples were collected using dedicated bailers. Samples were placed into laboratory supplied bottles.

- The wells were purged using a peristaltic pump (for wells on Site 18) and a micropurge low-flow bladder pump (for the wells on Orams existing site). Water quality measurements (temperature, pH, dissolved oxygen, oxygen reduction potential (ORP) and electrical conductivity) were measured during purging and samples were obtained once field parameters had stabilised and at least three sample train volumes had been removed from the monitoring wells.
- The interface probe, YSI ProDSS and flow through cell were decontaminated between sample locations using clean water and Decon90 followed by a clean water rinse.
- Samples were collected directly into laboratory prepared bottles.

Sampling procedures for PFAS analysis followed the above procedures with the addition that sampling and decontamination of equipment was undertaken following "clean hands" "dirty hands" protocols in general accordance with the MfE Sampling and Analysis of Per- and Poly-fluorinated Substances draft guidance[18] currently out for consultation'.

The laboratory testing of the groundwater samples comprised:

- Submission of 19 groundwater samples within Site 18 and three from the Orams existing facility. All groundwater samples were analysed for TPH, PAHs, a suite of heavy metals, cyanide, VOCs and a corrosivity suite. Selected samples were also tested for PCBs and PFAS;
  - PFAS samples were collected from six monitoring wells (GBH103, GBH106, GBH107, GBH111, CBH201 and CBH204) chosen to give coverage of the site.
  - PBCs were tested from the four monitoring wells (GBH109, GBH111, CBH203, CBH204) located on the western boundary of the site to confirm that no gross sources of PCB were affecting groundwater.

7.2.3 Soil vapour sampling

In order to assess the indoor air inhalation risk five soil vapour monitoring points were installed on Site 18 within the footprints of the proposed buildings.

- The gas monitoring points were installed to a depth of 1.5 m bgl and comprised 50 mm diameter PVC standpipe and 0.5 mm slotted screen from 0.5 – 1.5 m bgl.
- The screen sections of the monitoring points were positioned above the water table to avoid infiltration of groundwater.
- The filter pack of the screened section of the vapour boreholes comprised K2 industrial sand (maximum particle size 2 mm), followed by bentonite to the surface.
- The monitoring ports were completed with a flush mounted toby box set in concrete.
- Soil vapour samples were collected using the following procedure:
  - Prior to sampling the wells were purged of at least one well volume using a GA5000 with a calibrated flow rate of 550 millilitres per minute (mL/min).
  - Soil gas samples were collected using laboratory prepared Summa whole air canisters and dedicated sampling trains. The flow rate on the sampling trains were set at a sampling rate of 180 mL/min.
  - During sampling leak testing was performed on the monitoring well and connections using a shroud filled with helium. The helium leak tracing procedure is provided in Appendix K. No helium was detected in the field in the canisters.
- The whole air canisters were submitted to Hills Laboratories for analysis under chain of custody conditions. Four primary and one duplicate samples were analysed for a suite of

[18] MfE Sampling and Analysis of Per- and Poly-fluorinated Substances draft guidance, undated.

VOCs and banded TPH in accordance with United States Environmental Protection Agency (USEPA 1999)[19] method TO-15.

The locations of the five vapour monitoring points are shown in Figure 6.

7.2.4 Marine sediment sampling

The sediment sampling works undertaken during this investigation programme comprised:

- Collection of samples of sediment from various depths from the four offshore boreholes, as described in Section 7.2.1.
- Collection of surface sediment samples at locations within the proposed area of dredging or adjacent to Site 18. Surface sediment samples were collected by hand auger from the pontoon, or by hand from the harbour edge.
- Submission of 19 sediment samples for analysis of TOC, metals, cyanide, TBT, PAH, TPH, VOCs, and a selection of samples for asbestos testing.
- Three samples were submitted for elutriation testing, including two samples of seawater for use in the analysis. Samples for elutriation testing were selected to provide coverage of the area of dredging and included samples with elevated contaminants.

The locations of the sediment sampling points are shown in Figure 6.

The following sediment sampling procedures were followed:

- Surface sediment samples were collected directly from the auger head (SS01 – SS04) or by hand (SS05 and SS06)) with freshly-gloved hands, and were placed into laboratory-prepared sample jars. The samples were stored under chilled conditions.
- The auger head was decontaminated between sample locations using clean water and Decon90 (a phosphate-free detergent) followed by a clean water rinse.
- The materials were logged in general accordance with the NZ Geotechnical Society guidance and were assessed for odour and evidence of contamination.
- Sub-samples were obtained for the purposes of field screening with a photo-ionisation detector (PID). The soil samples were collected directly into zip lock bags and sealed shut before being left to stand for approximately 10 minutes. The bags were then pierced with the nozzle of the PID to measure the headspace reading.
- Samples of seawater were also collected for use in elutriation laboratory testing. Seawater samples were collected from the top of the water column, directly into 10 L containers.

7.2.5 Surveying

The locations of the onshore boreholes and CPTs were surveyed by Survey Worx.

Horizontal positions of offshore boreholes along with onshore test pits were recorded using a handheld Trimble Geoexplorer 7x GPS. Vertical elevations of test pits were estimated from LiDAR using geospatial software.

Vertical elevation of offshore boreholes was calculated from tidal charts and on barge seafloor depth measurements. This was compared with bathymetric survey data for validation. Bathymetric survey data was provided by Panuku for the Westhaven marina post dredging in 2011 and 2017. Survey data is available on request.

[19] USEPA 1999. Compendium Method TO15: Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analysed by Gas Chromatography/Mass Spectrometry (GC/MS). United States Protection Agency. January 1999.

8 Investigation Observations

8.1 Stratigraphy

The borehole logs for Orams existing site are provided in Appendix H while borehole and test pit logs for Site 18 are presented in Appendix I. Cross-sections of the soil profile at the site are presented in Figures 7A, 7B, 7C and 7D. More detail on the site stratigraphy is presented in T+T Geotechnical Interpretative Report (October, 2018). The summary of the soil profile at the site is presented in Table 8.1.

Table 8.1 Summary of soil types

Soil type	Description	Distribution
Granular fill	Granular fill comprises a heterogonous mix of gravel with sand, silt and brick fragments that appears to be sourced from a variety of sources. It includes gasworks wastes.	Typically present from ground surface to between less than 1 m in the east thickening to the west towards the seawall. Near the seawall at Site 18 the granular fill is present to approximately 5 m depth. Granular fill is generally thicker within Orams existing facility. The groundwater table typically sits in this strata, or the underlying hydraulic fill where the granular fill layer is thin. A basalt rubble about 3.5m thick was identified consistently behind the northern seawall and is likely to be placed to retain the hydraulic fill.
Hydraulic fill	Hydraulic fill comprises a heterogonous mix including sands and broken fragments of shell with silts and clays, as well as areas of predominantly silt and clay soils. These observations are consistent with the expectation that these materials are made up of marine dredgings used in the reclamation process.	At Site 18 the hydraulic fill is located underlying the granular fill and sits on the pre-existing seabed of in situ marine sediments. The hydraulic fill thickness ranges from around 5 m in the east, thinning to the west near the seawall. The hydraulic fill strata is inferred to reduce to less than 0.5 m thickness or is absent to the south, within the Orams existing site area.
In situ marine sediments	Marine sediments comprise the original harbour sediments that were present prior to reclamation activities. These deposits are generally sandy and silty clays. It can be difficult to distinguish these from the hydraulic fill which was sourced from similar materials.	The in situ marine sediments are inferred to be present at a fairly consistent depth and thickness across the site. They were identified at a depth of the original seabed surface at around - 2 m RL extending down to where the upper Tauranga Group deposits start around – 5 m RL.
Tauranga Group	Sediments of the Tauranga Group, predominantly comprise clayey silts and sandy silts with variable organic content (fibrous). Within the cross sections (presented on Figures 7A-D), Tauranga Group Deposits have been divided into “upper” and “lower”, with the upper deposits typically comprised of silts with variable clay content and organics. Lower	The Tauranga Group deposits (upper and lower) are present across the site at a thickness ranging between approximately 15-23 m. The deposits are thicker in the area of the paleochannel in the rock surface described below.

Soil type	Description	Distribution
	deposits have been delineated on an increase in sand content with less organic material.	
ECBF rock	The ECBF rocks comprise interbedded extremely weak to weak siltstones and variably cemented sandstones which are locally capped by a thin veneer of residual soils.	The ECBF rock surface varies across the site with a paleochannel present; the rock surface depth ranges from - 15 m to -25 m RL, generally lower in the middle of Site 18 in a southwest/northeast orientation (refer to cross-section Figures 7A-C). Further details is provided in the Geotechnical Interpretive report.

8.2 Hydrogeology

Eighteen groundwater monitoring wells were installed, seven with level loggers, to monitor groundwater levels in the fill and marine sediments. Continuous monitoring of the groundwater levels were undertaken for one week using Solinst level loggers. Analysis of this data indicated groundwater flow from east to west, however, anomalous elevated groundwater in the southeast corner of the site indicates a south-west flow component. Groundwater contour plans are provided in Figures 8A and 8B. Groundwater flow is considered to be influenced by a combination of tidal effects (response/lag), variations in permeability in both ground and the seawall, and potentially more locally by services/seawall penetrations, such that flow directions across the site will vary over time. Seepage through the wall controls the hydraulic gradient that falls across the site, east to west, i.e. it modifies the general gradient which is expected to flow southeast to northwest.

Tidal monitoring data is presented in Appendix J and summarised on Table 8.2. Measurements indicate the tidal influence reduces with distance away from the seawall. Tidal variation of about 300mm was recorded at CBH205, about 35 m from the seawall. Negligible effect was noted at GBH106, about 55 m from the sea wall. No effect was noted adjacent to Beaumont Street at BH103 and GBH110. The largest tidal influence was noted at GBH111, located near the northwest corner of the site, where about 2.3 m variation was observed. Less influence was noted in the centre of the western boundary at GBH203 (about 0.7m variation) and at the southwest corner in GBH109, where only about 1m variation was observed. It is noted that the corner wells GBH111 and GBH109 are below the air-water interface at 6-8 m below ground. The difference in tidal influence between the northwest and southwest corners is presumed to be due to the presence of the basalt rubble at the bottom of the wharf structure in the northwest corner.

Groundwater levels within the western half of the site change with the tide. The westerly flow direction changes to easterly against the sea wall when the tide level is higher than the adjacent groundwater levels. Where more tidal influence is noted at the northwest corner, the flow direction change extends further inland.

Table 8.2 Summary of tidal variation data (++ Reduced level based on chart datum)

Borehole ID	Screen depth	Estimated tidal variation during monitoring period	Approximate response delay	RL at top of tidal variation^{++}
CBH203	1.0 m - 4.5 m	0.8 m	40 min	3.5 m
CBH204	1.0 m - 4.5 m	0.3 m	1 hr 09 min	2.5 m
CBH205	2.0 m - 5.5 m	0.4 m	1 hr 24 min	3.0 m
GBH103	1.0 m - 5.5 m	None	-	3.3 m

Borehole ID	Screen depth	Estimated tidal variation during monitoring period	Approximate response delay	RL at top of tidal variation[++]
GBH109	6 m - 8 m	1.0 m	8 hr 24 mins	2.8 m
GBH110	6 m - 8 m	None	-	3.1 m
GBH111	6 m - 8 m	1.7-2.5 m	20 min	3.7 m

The tidal effect appeared stronger in deeper than shallow wells near the seawall (GBH109 and GBH111, i.e. compared CBH203, CBH204). The water level in the deeper screened (6 m to 8 m depth) groundwater monitoring wells appears some 0.2 m to 0.5 m lower than those screened across the water table in the eastern half of the site where tidal influence was not apparent. This suggests a downward vertical gradient at the site. Gradients assessed for the data are presented in Table 8.3 below.

Table 8.3 Hydraulic gradients (m/m) measured August 2018

Monitored location	GBH106 to GBH109	GBH106 to GBH111	GBH107 to GBH106
Date	13 August 2018		1 August 2018
Low tide	0.018	0.056	0.0039
High tide	0.012	-0.012	

Water levels dropped about 110 mm to 130 mm over two weeks of monitoring, as measured in the monitoring wells located in the eastern half of the site. Seasonal fluctuations may anticipated to be up to 1 m.

It is expected that regional groundwater flow within the underlying ECBF rock occurs more in a northerly direction, reflecting movement from the surrounding ECBF ridges to the harbour. However, the deeper groundwater regime was not assessed during this investigation as the contamination occurs in the shallower stratigraphy (refer following sections) and the proposed works do not generally extend to the ECBF (limited piling only).

8.3 Contamination observations

8.3.1 Observations during drilling and test pitting

The following ground contamination observations were made during the investigation programme:

- Suspected gasworks waste was identified in five boreholes at depths ranging between 0.17 and 3.0 m bgl. These materials were observed to generally comprise black/dark brown gravels with sands and silts, commonly with trace bricks.
- Demolition material, including rebar, concrete, earthenware and brick fragments, was observed at depths ranging between 0.10 and 4.0 m bgl in the majority of samples across the site.
- A piece of suspected asbestos cement sheeting was observed in test pit TP101 at a depth of 0.5 m bgl. No other fragments of suspected asbestos-containing material was observed in any of the other soil sampling locations.
- Concrete slabs were identified during the intrusive works with locations and depths referenced in Table 8.4.
- Hydrocarbon odours were observed widely across the site. Odours were commonly noted to extend from near surface to some 4 m depth, with the strongest odours generally noted at or near the soil/groundwater interface (refer to Table 8.4).

- Perched water was observed in test pit TP103 at a depth of 0.5 m bgl in sandy gravel. No former tank foundations were observed in this test pit directly however such a feature may be causing this localised ponding in the granular fill.
- A sheen of suspected hydrocarbon discharge was observed seeping from the sea wall at approximate 0-1 RL at low tide approximately 16 m north of the site's southern boundary. This discharge was observed once during routine inspections throughout the investigation programme.

Table 8.4: Summary of borehole and test pit observations of contamination

Location	Comment
GBH101	• Maximum PID reading of ~10 ppm at 2.0 – 2.3 m bgl. • Strong sulphur odour observed at 6.45 m bgl. • A concrete slab, approximately 160 mm thick, was encountered at 0.24 m bgl.
GBH102	• Maximum PID reading of ~1,300 ppm at 2.4 – 2.5 m bgl. • Hydrocarbon odour observed at 0.80 – 2.0 m bgl.
GBH103	• Maximum PID reading of ~880 ppm at 2.35 – 2.60 m bgl. • Strong hydrocarbon odour observed from 1.30 – 1.55 m bgl, and 2.15 to 2.30 m bgl.
GBH104	• Maximum PID reading of ~210 ppm at 4.5 – 5.0 m bgl. • Hydrocarbon odour observed at 0.25 – 1.20 m bgl and at 4.70 – 5.40 m bgl. • Gas works coke observed at 2.50 – 3.0 m bgl.
GBH105	• Maximum PID reading of ~1800 ppm at 1.55 – 1.65 m bgl. • Hydrocarbon fluid observed at 1.50 – 1.65 m bgl. • Hydrocarbon odour observed from 0.50 –1.65 m, 2.40 – 3.0 m, and 3.50 – 4.20 m bgl.
GBH106	• HDPE vapour barrier observed at 1.20 m bgl. • Maximum PID reading of ~120 ppm at 2.55 – 3.0 m bgl.
GBH107	• HDPE vapour barrier observed at 2.0 m bgl. • Maximum PID reading of ~10 ppm at 1.6 – 2.0 m bgl. • Hydrocarbon odour observed from 0.13 – 0.35 m bgl.
GBH108	• Maximum PID reading of ~440 ppm at 1.90 – 2.10 m bgl. • Strong hydrocarbon odour observed from 1.60 – 3.0 m bgl. • A concrete slab, approximately 50 mm thick, was encountered at 0.40 m bgl.
GBH109	• Maximum PID reading of ~580 ppm at 2.50 – 2.90 m bgl. • Gasworks waste identified at 1.50 – 1.90 m bgl and 2.40 – 3.30 m bgl. • Hydrocarbon odour observed from 1.0 – 1.50 m bgl.
GBH110	• Maximum PID reading of ~330 ppm at 0.6 – 0.8 m bgl. • Hydrocarbon odour observed from 0.60 – 1.50 m bgl.
GBH111	• Borehole originally drilled as a CPT and therefore no contamination observations exist for this borehole.
CBH201	• HDPE vapour barrier observed at 0.3 m bgl. • Maximum PID reading of ~800 ppm at 2.10 – 2.60 m bgl. • Strong hydrocarbon odours observed from 2.10 to 3.65 m bgl.
CBH202	• Maximum PID reading of ~430 ppm at 4.40 – 4.5- m bgl. • Strong hydrocarbon odours observed 3.70 – 4.10 m bgl, 4.40 – 7.0 m bgl.
CBH203	• Maximum PID reading of ~40 ppm at 1.70 – 2.0 m bgl.

Location	Comment
	• Gasworks waste identified at 1.70 m bgl.
CBH204	• Maximum PID reading of ~600 ppm at 1.80 – 2.0 m bgl. • Product globules observed at 1.80 m bgl. • Gasworks identified at 0.87 m bgl. • Strong hydrocarbon odours observed from 1.80 – 3.80 m bgl.
CBH205	• Maximum PID reading of ~370 ppm. • A concrete slab approximately 300 mm thick was encountered at 1.0 m bgl. • Strong hydrocarbon odour observed from 4.40 – 4.50 m bgl.
CBH206	• Maximum PID reading of ~130 ppm at 3.0 m bgl. • Gasworks waste was identified at 0.17 m bgl. • Strong hydrocarbon odour observed from 3.0 – 3.2 m bgl.
CBH207	• Maximum PID reading of ~700 ppm at 1.10 m bgl. • Strong hydrocarbon odour observed from 0.60 to 1.10 m bgl and 2.0 – 2.50 m bgl.
CBH208	• Maximum PID reading of ~500 ppm at 2.0 m bgl. • Gasworks waste observed at 0.80 – 1.0 m bgl. • HDPE vapour barrier observed at 1.0 m bgl. • Strong hydrocarbon odour observed at 3.0 m bgl.
CBH209	• Maximum PID reading of ~810 ppm. • Strong hydrocarbon odours observed at 0.1.30 m bgl.
TP101	• Maximum PID reading of ~10 ppm at 1.60 m bgl. • Hydrocarbon odour observed from 1.0 – 1.50 m bgl.
TP102	• Maximum PID reading of ~10 ppm. • Strong hydrocarbon odour observed from 0.60 – 1.0 m bgl. • Concrete pad encountered at 1.0 m bgl.
TP103	• Maximum PID reading of ~270 ppm at 1.3 m bgl. • Strong hydrocarbon odour at 0.70 – 1.30 m bgl.

8.3.2 Observations during groundwater sampling event

Observations of contamination, stabilised field parameters and depth to water are presented are presented in Table J.1 in Appendix J. Table 8.5 below summarises the observations of contamination, while Table 8.6 summarises the location and thickness of recorded SPH in groundwater monitoring wells and suspected product indicated on the chromatograms. Product thickness data is also displayed on Figure 9.

Table 8.5 Groundwater observations

Monitoring well	Date Gauged	Observations during sampling
CBH201	25/07/2018	Hydrocarbon odour.
CBH202	30/07/2018	Not sampled at this time. Product thickness not measured.
	6/08/2018	-
CBH203	26/07/2018	Strong fuel/hydrogen sulphide odour.
CBH204	27/07/2018	-
CBH205	30/07/2018	Globules of product observed in water.

Monitoring well	Date Gauged	Observations during sampling
CBH206	26/07/2018	Not sampled.
	27/07/2018	Strong hydrocarbon odour. Globules in purged water. Sample broken by lab.
	1/08/2018	Resampled due to broken sample. Globules of product in purged water. Tubing stained yellow.
CBH207	26/07/2018	Hydrocarbon odour noted.
CBH208	30/07/2018	Hydrocarbon odour noted.
CBH209	23/07/2018	Hydrocarbon odour noted. Not sampled at this time.
	3/08/2018	Hydrocarbon odour noted, water was milky. No DNAPL noted in bailer sample.
GBH102	23/07/2018	Saline. Not sampled at this time.
	3/08/2018	Saline.
GBH103	23/07/2018	Sediment in bottom. Hydrocarbon odour. Not sampled at this time.
	6/08/2018	-
GBH104	23/07/2018	Product was yellow. Not sampled at this time.
	3/08/2018	Product sampled by bailer. Saline.
GBH106	1/08/2018	Hydrocarbon odour noted.
	14/08/2018	-
GBH107	1/08/2018	Well to be redeveloped due to sediment in bottom of well. Not sampled at this time.
	6/08/2018	Observable sheen on water.
GBH108	26/07/2018	-
GBH109	6/08/2018	Well purged dry. Recharge rate recorded. Probe detected NAPL at base of hole but bailer sample indicated the water was saline and no product present.
GBH110	31/07/2018	Saline. Not sampled at this time.
	3/08/2018	Saline water.
GBH111	1/08/2018	Saline, sampling abandoned to allow for re-developing due to sediment.
	6/08/2018	Saline.
Existing MW 1	23/07/2018	Well cap not secure. Strong effluent smell.
	14/08/2018	Well purged dry. Strong sulphur odour. Sediment and product observed in purged water.

Table 8.6 Product identification

Sample Name	SPH thickness	Suspected product based on chromatograms
CBH202 – Product 1	0.325 m – 06.08.2018	Weathered Diesel
CBH202 – Product 2		Weathered Diesel
GBH104 – Product	0.32 m – 23.07.2018 0.484 m – 03.08.2018	Weathered Diesel
GBH106 – Product	0.034 m – 01.08.2018 0.165 m – 14.08.2018	Weathered Fuel Oil and Jet Fuel

8.3.3 Observations during sediment sampling

Table 8.7 summarises the ground contamination observations made during sediment sampling.

Table 8.7: Sediment sampling observations

Location	Comment[20]
SS01	• Marine sediments comprising silt, trace sand (fine – coarse), grey.
SS02	• Marine sediments comprising silt, trace sand (fine – coarse), grey.
SS03	• PID reading of 11.3 ppm. • Marine sediments comprising silt, trace sand (fine – coarse), grey.
SS04	• PID reading of 78 ppm. • Marine sediments comprising silt, trace sand (fine – coarse), grey.
SS05	• PID reading of 0 ppm. • Marine sediments comprising silt, trace sand (fine – coarse), grey. Shell component. • Obtained adjacent to where hydrocarbon discharge was observed from the sea wall.
SS06	• PID reading of 0.8 ppm. • Marine sediments comprising silt, trace sand (fine – coarse), grey. Shell component. • Obtained downstream of SS05.
GBH301	• Maximum PID reading of 1.8 ppm at 1.25 - 1.45 m bgl. • Marine sediments observed from 0.0 – 0.75 m bgl.
GBH302	• Maximum PID reading of 1.9 ppm at 1.05 – 1.2 m bgl. • Marine sediments observed from 0.0 – 1.05 m bgl.
GBH303	• Maximum PID reading of 1.6 ppm at 6.6 – 6.8 m bgl. • Marine sediments observed from 0.0 – 1.30 m bgl.
GBH304	• Maximum PID reading of 0.9 ppm at 9.95 – 10.25. • Marine sediments observed from 0.0 – 2.45 m bgl.

[20] No odour noted expect where indicated.

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ORAMS CURRENT SITE BOUNDARY

SITE 18 BOUNDARY

CURRENT ORAMS FACILITY

SITE 18

NEW BUILDING 1A

NEW BUILDING 1B

NEW BUILDING 2

NEW BUILDING 3

BEAUMONT STREET

JELLICOE STREET

SS01 SS02 SS03 SS04 SS05 SS06

GBH303 GBH302 GBH301 GBH304 GBH109P GBH101 GBH111 GBH104P GBH106P GBH102P GBH108P GBH105 GBH103P GBH107P GBH110P

BH01 BH02 BH03 BH1 BH2/MW2 BH3/MW3 BH4 BH5 BH6/MW4 BH7 BH8 BH9/MW1 BH10 MW1

CBH204P CBH203P CBH202P CBH206P CBH205P CBH208P CBH201P CBH207P CBH209P

TP103 TP102 TP101

VMP10 VMP14 VMP23 VMP29

VP1 VP2 VP3 VP4 VP5 VP6

4.5 2 2.5 3 3.5 4 5 5.5

1 F5A 2 F5A 3 F3 4 F3 5 F4 6 F4

A3 SCALE 1:1000

0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

LEGEND

- SITE EXTENT
- BOUNDARY
- 3.5 EXISTING CONTOUR (0.5m INTERVAL)
- EXISTING CONTOUR (0.1m INTERVAL)

GEOTECHNICAL AND CONTAMINATION INVESTIGATION LOCATIONS:

- GBH# BOREHOLE LOCATION
- GBH#P BOREHOLE WITH PIEZOMETER
- TP# TEST PIT LOCATION

ADDITIONAL CONTAMINATION INVESTIGATION LOCATIONS:

- CBH#P BOREHOLE WITH PIEZOMETER LOCATION
- SS# SURFACE SAMPLE
- VP 2018 VAPOUR MONITORING POINT

PREVIOUS INVESTIGATION:

- BH# BOREHOLE LOCATION BY T+T
- BH# BOREHOLE LOCATION BY OTHERS
- VMP 2012 VAPOUR MONITORING POINT

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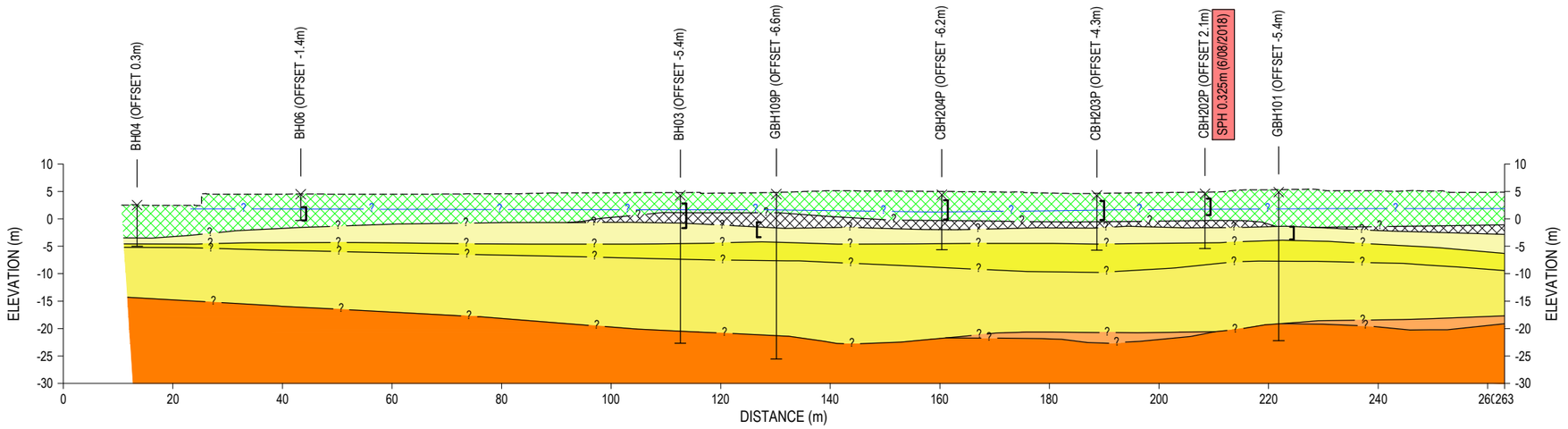
PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION SITE PLAN

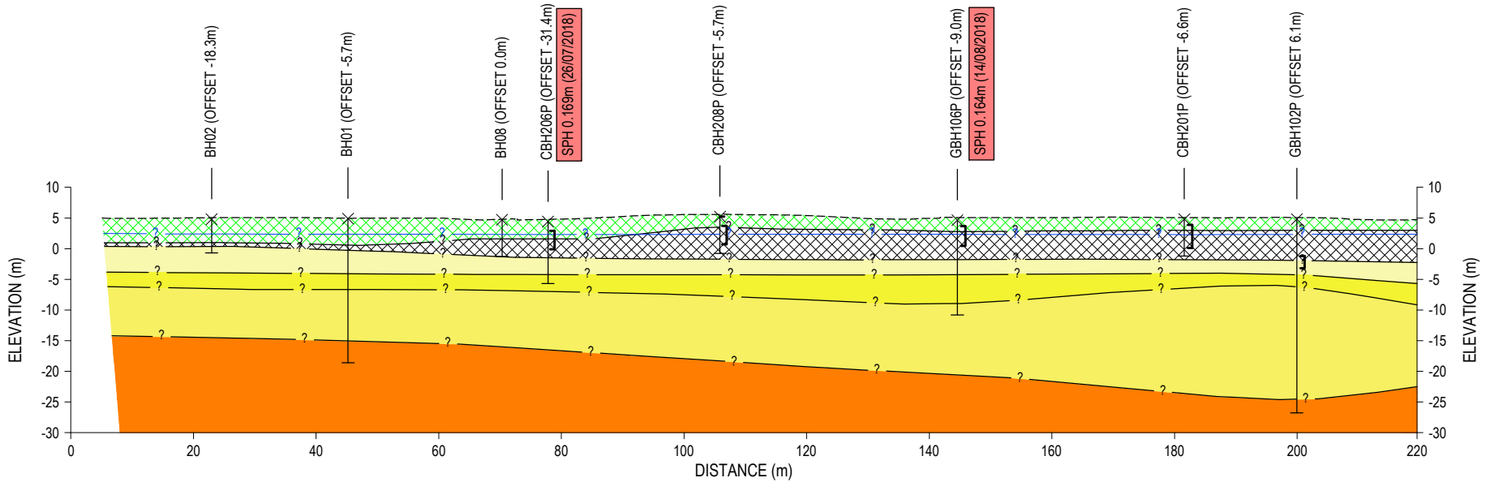
SCALE (A3) 1:1000 FIG No. CONT - FIGURE 6 REV 2

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SECTION 1
SCALE 1: 1000 F1



SECTION 2
SCALE 1: 1000 F1

LEGEND

- EXISTING GROUND PROFILE
- INFERRED GEOLOGICAL BOUNDARY
- AVERAGE PIEZOMETRIC LEVEL (EARLY AUGUST 2018)
- TIDAL FLUCTUATION
- FILL MATERIAL (GENERAL)
- FILL (HYDRAULIC)
- RECENT MARINE SEDIMENTS
- UPPER TAURANGA GROUP
- LOWER TAURANGA GROUP
- RESIDUAL EAST COAST BAYS FORMATION
- EAST COAST BAYS FORMATION
- SCREEN DEPTH

A3 SCALE 1:1000
0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

NOTES:

1. ALL DIMENSION ARE IN METRES UNLESS NOTED OTHERWISE.
2. LEVEL DATUM: CHART DATUM.

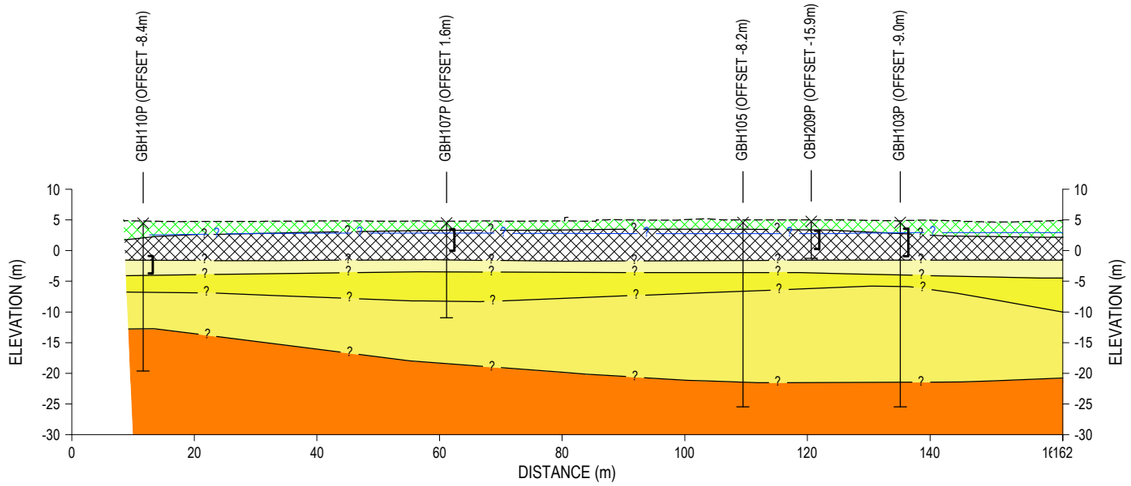
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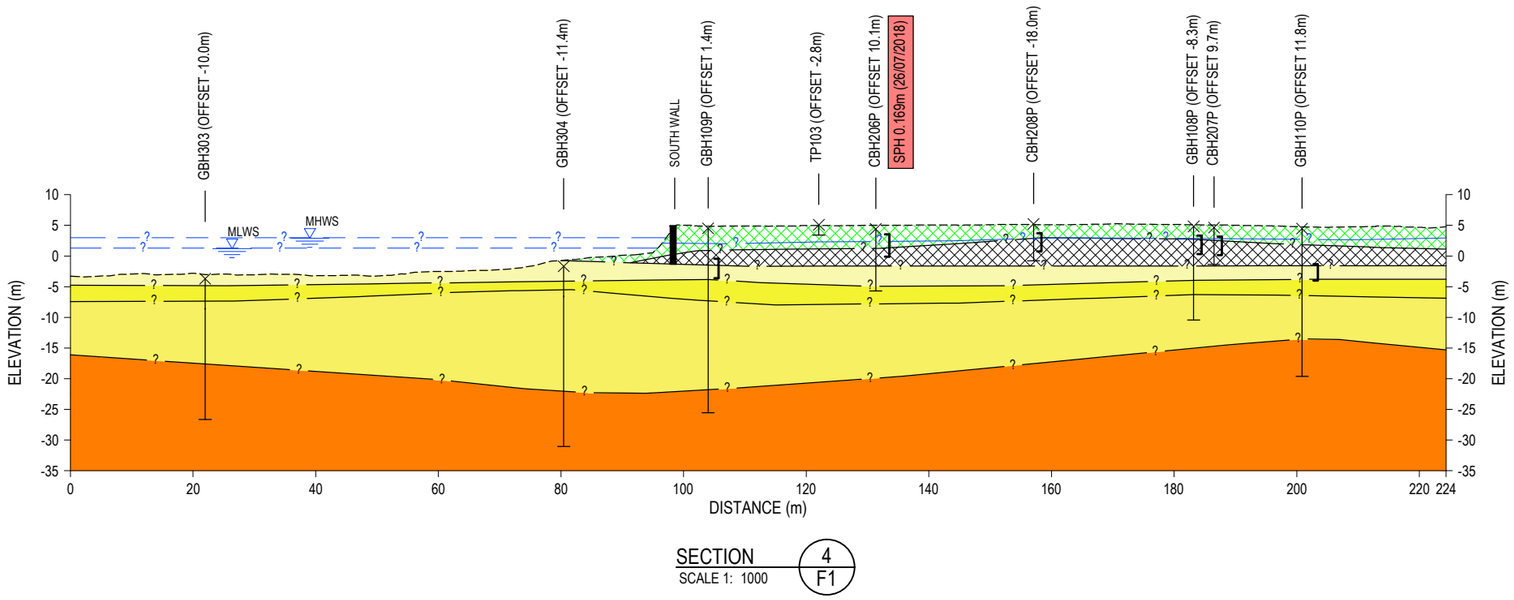
CLIENT **ORAMS MARINE**
PROJECT **142-188 BEAUMONT STREET**
TITLE GROUND CONTAMINATION SITE INVESTIGATION
CROSS SECTIONS 1 & 2
SCALE (A3) 1:1000 FIG No. CONT - FIGURE 7A REV 1

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SECTION 3
SCALE 1: 1000
F1



SECTION 4
SCALE 1: 1000
F1

LEGEND

- EXISTING GROUND PROFILE
- INFERRED GEOLOGICAL BOUNDARY
- AVERAGE PIEZOMETRIC LEVEL (EARLY AUGUST 2018)
- TIDAL FLUCTUATION
- FILL MATERIAL (GENERAL)
- FILL (HYDRAULIC)
- RECENT MARINE SEDIMENTS
- UPPER TAURANGA GROUP
- LOWER TAURANGA GROUP
- RESIDUAL EAST COAST BAYS FORMATION
- EAST COAST BAYS FORMATION
- SCREEN DEPTH

A3 SCALE 1:1000
0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

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NOTES:

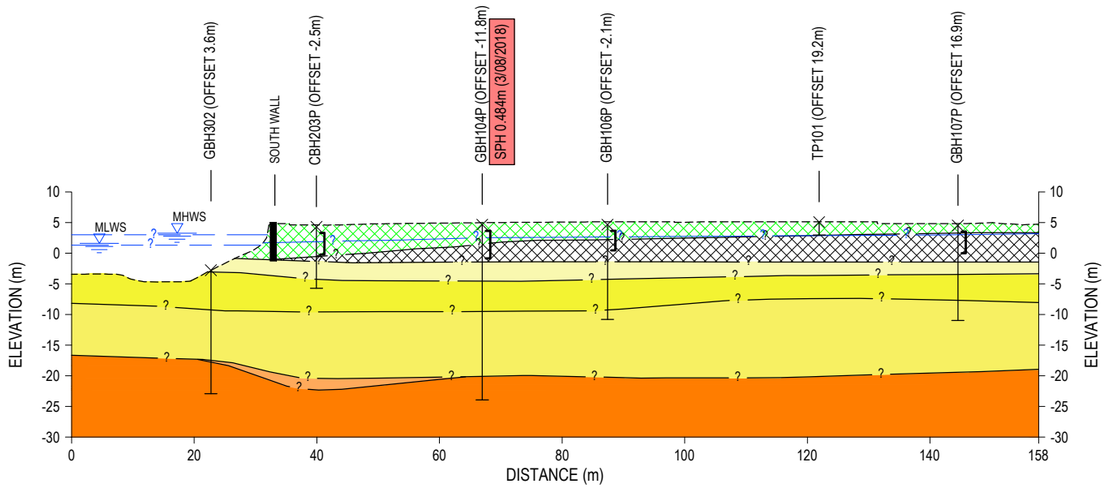
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2. LEVEL DATUM: CHART DATUM.

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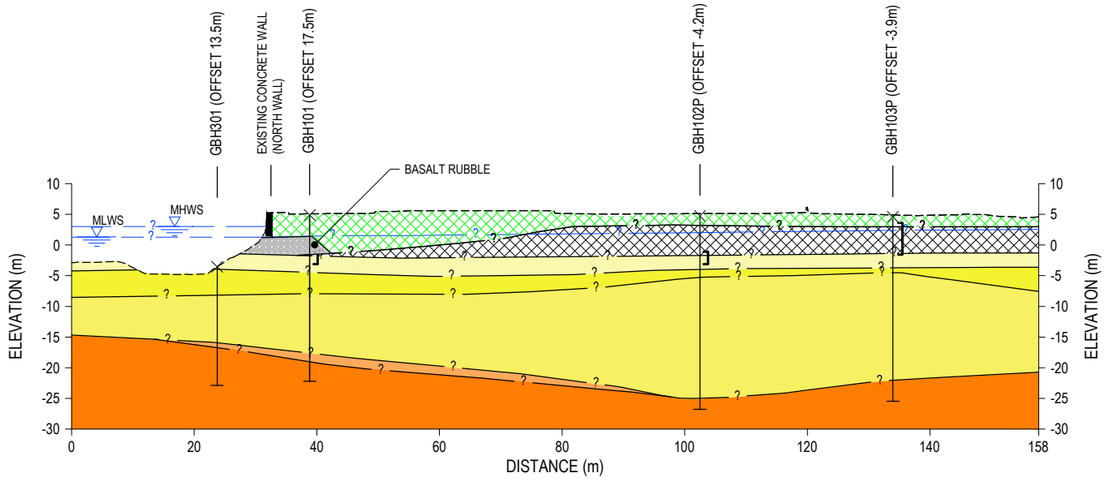
CLIENT **ORAMS MARINE**
PROJECT **142-188 BEAUMONT STREET**
TITLE GROUND CONTAMINATION SITE INVESTIGATION
CROSS SECTIONS 3 & 4
SCALE (A3) 1:1000 FIG No. CONT - FIGURE 7B REV 1

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SECTION 5 / F1
SCALE 1: 1000



SECTION 6 / F1
SCALE 1: 1000

LEGEND

- EXISTING GROUND PROFILE
- INFERRED GEOLOGICAL BOUNDARY
- AVERAGE PIEZOMETRIC LEVEL (EARLY AUGUST 2018)
- TIDAL FLUCTUATION
- FILL MATERIAL (GENERAL)
- FILL (HYDRAULIC)
- RECENT MARINE SEDIMENTS
- UPPER TAURANGA GROUP
- LOWER TAURANGA GROUP
- RESIDUAL EAST COAST BAYS FORMATION
- EAST COAST BAYS FORMATION
- SCREEN DEPTH

A3 SCALE 1:1000
0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

NOTES:

1. ALL DIMENSION ARE IN METRES UNLESS NOTED OTHERWISE.
2. LEVEL DATUM: CHART DATUM.

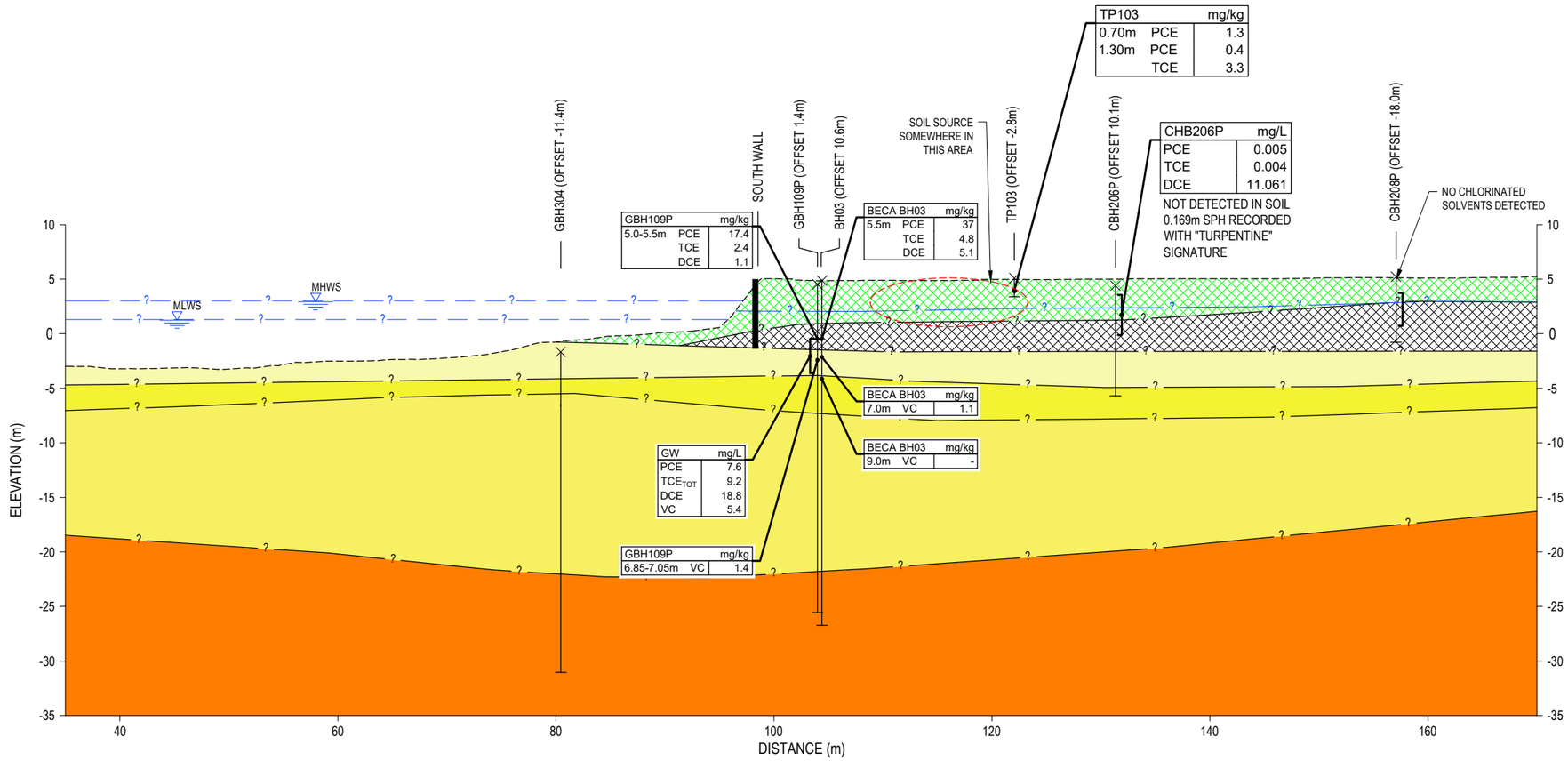
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CLIENT **ORAMS MARINE**
PROJECT **142-188 BEAUMONT STREET**
TITLE GROUND CONTAMINATION SITE INVESTIGATION CROSS SECTIONS 5 & 6
SCALE (A3) 1:1000 FIG No. CONT - FIGURE 7C REV 1

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SECTION 4
SCALE 1: 500 F1

LEGEND

- EXISTING GROUND PROFILE
- INFERRED GEOLOGICAL BOUNDARY
- AVERAGE PIEZOMETRIC LEVEL (EARLY AUGUST 2018)
- TIDAL FLUCTUATION
- FILL MATERIAL (GENERAL)
- FILL (HYDRAULIC)
- RECENT MARINE SEDIMENTS
- UPPER TAURANGA GROUP
- LOWER TAURANGA GROUP
- RESIDUAL EAST COAST BAYS FORMATION
- EAST COAST BAYS FORMATION
- SCREEN DEPTH

A3 SCALE 1:500
0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

NOTES:

1. ALL DIMENSION ARE IN METRES UNLESS NOTED OTHERWISE.
2. LEVEL DATUM: CHART DATUM.

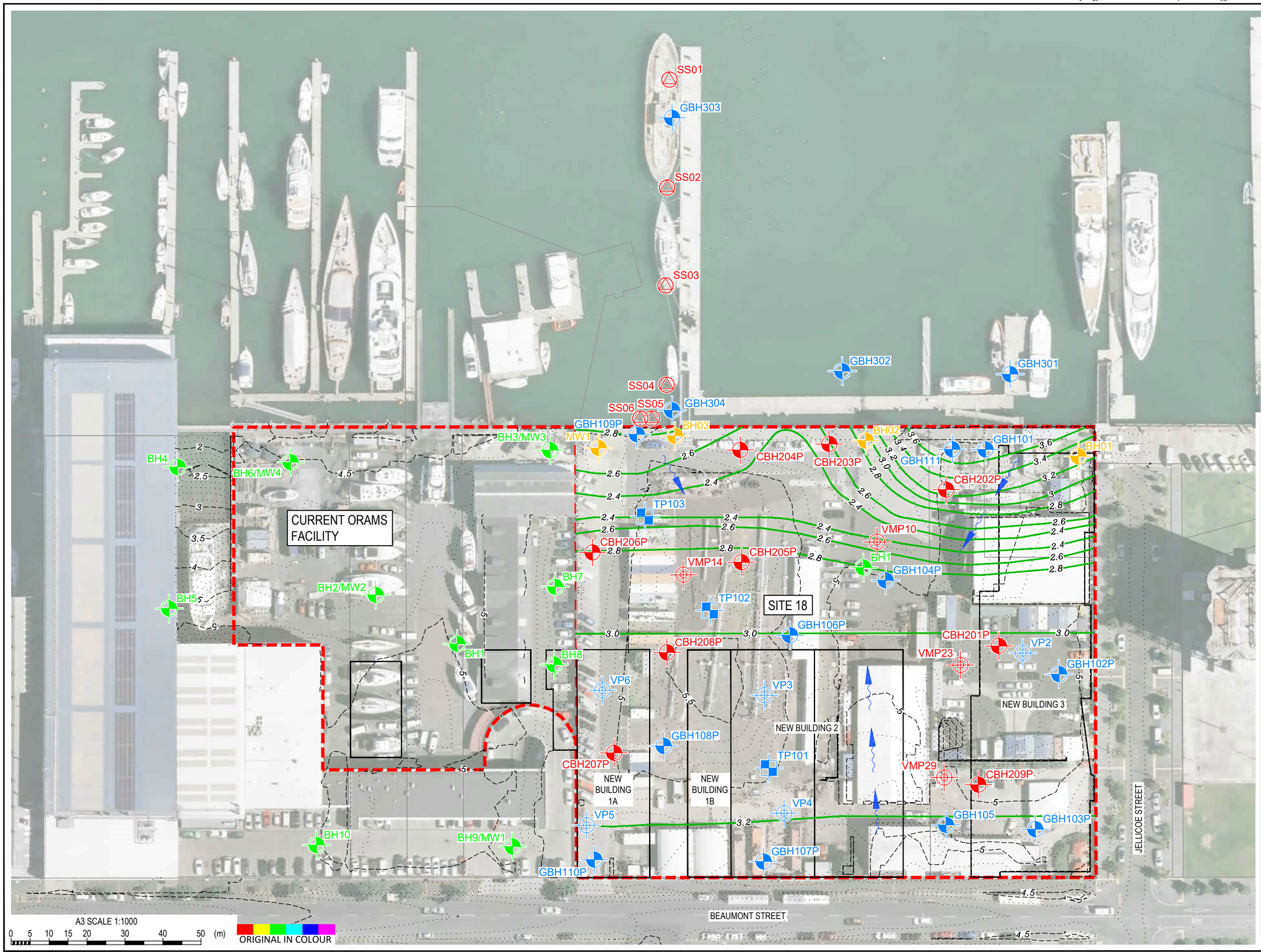
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PROJECT 142-188 BEAUMONT STREET
TITLE GROUND CONTAMINATION SITE INVESTIGATION
CROSS SECTIONS 4 - AREA OF CHLORINATED SOLVENT PLUME
SCALE (A3) 1:500 FIG No. CONT - FIGURE 7D REV 1

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LEGEND

- SITE EXTENT
- BOUNDARY
- EXISTING CONTOUR (0.5m INTERVAL)
- EXISTING CONTOUR (0.1m INTERVAL)
- GROUND WATER CONTOURS HIGH TIDE (RLCD)
- GROUND WATER FLOW DIRECTION

GEOTECHNICAL AND CONTAMINATION INVESTIGATION LOCATIONS:

- GBH# BOREHOLE LOCATION
- GBH#P BOREHOLE WITH PIEZOMETER
- TP# TEST PIT LOCATION

ADDITIONAL CONTAMINATION INVESTIGATION LOCATIONS:

- CBH#P BOREHOLE WITH PIEZOMETER LOCATION
- SS# SURFACE SAMPLE
- VP 2018 VAPOUR MONITORING POINT

PREVIOUS INVESTIGATION:

- BH# BOREHOLE LOCATION BY T+T
- BH# BOREHOLE LOCATION BY OTHERS
- VMP 2012 VAPOUR MONITORING POINT

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3. ALL LEVELS ON THE LAND ARE IN COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. NEW ZEALAND VERTICAL 2016.
4. PROPOSED BUILDING OUTLINE PROVIDED BY RTA STUDIO, REF. "18122 - 142-188 BEAUMONT STREET_RC01_SK-010 - SITE PLAN_WIP.dwg" DATED 2/07/2018.

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CLIENT **ORAMS MARINE**

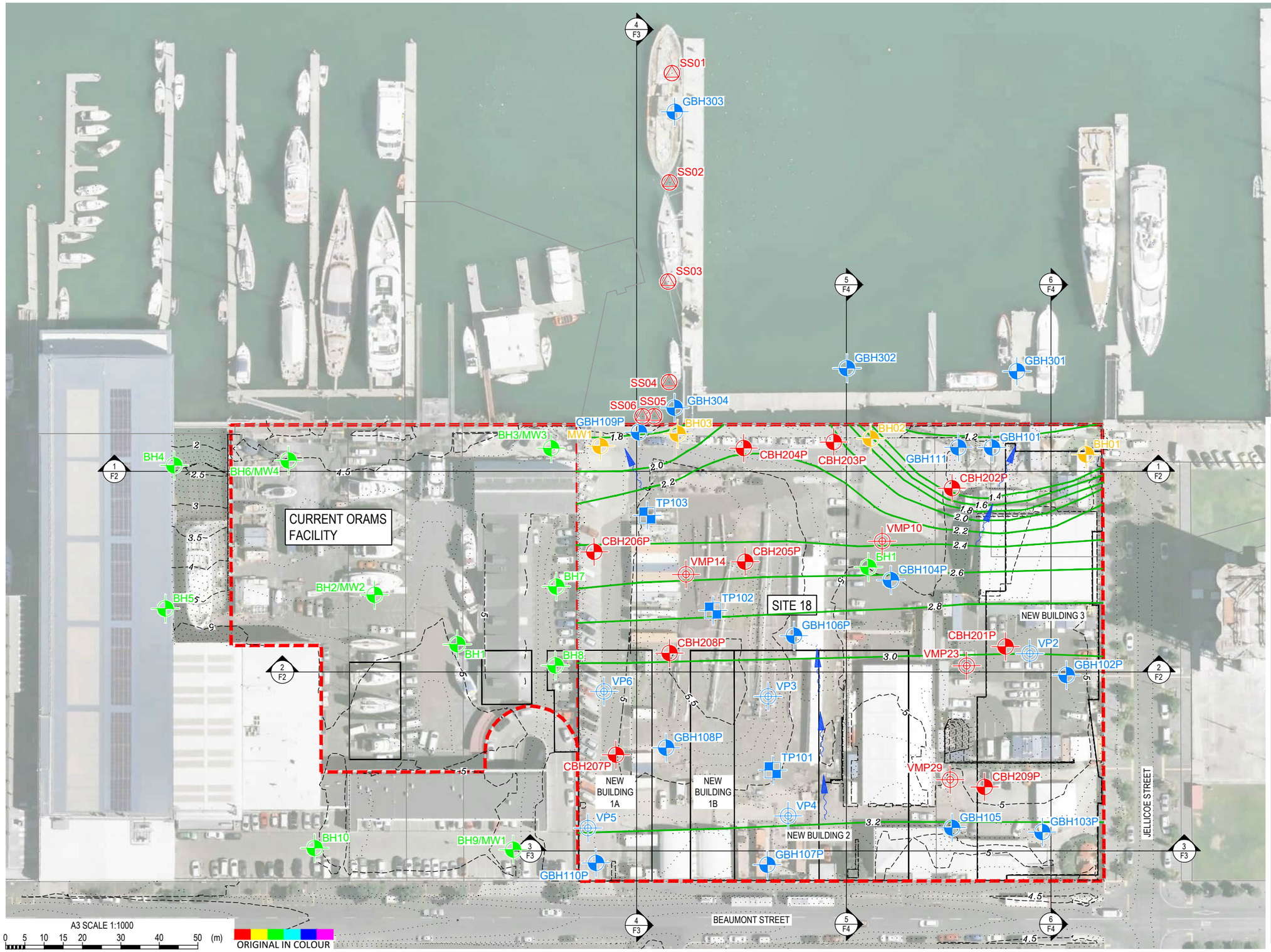
PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION GROUNDWATER CONTOURS - HIGH TIDE

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 8A REV 2

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LEGEND

- SITE EXTENT
- BOUNDARY
- EXISTING CONTOUR (0.5m INTERVAL)
- EXISTING CONTOUR (0.1m INTERVAL)
- GROUND WATER CONTOURS LOW TIDE (RLCD)
- GROUND WATER FLOW DIRECTION

GEOTECHNICAL AND CONTAMINATION INVESTIGATION LOCATIONS:

- GBH# BOREHOLE LOCATION
- GBH#P BOREHOLE WITH PIEZOMETER
- TP# TEST PIT LOCATION

ADDITIONAL CONTAMINATION INVESTIGATION LOCATIONS:

- CBH#P BOREHOLE WITH PIEZOMETER LOCATION
- SS# SURFACE SAMPLE
- VP 2018 VAPOUR MONITORING POINT

PREVIOUS INVESTIGATION:

- BH# BOREHOLE LOCATION BY T+T
- BH# BOREHOLE LOCATION BY OTHERS
- VMP 2012 VAPOUR MONITORING POINT

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2. ALL LEVELS ON THE LAND ARE IN COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. LEVEL DATUM: NEW ZEALAND VERTICAL 2016.
3. PROPOSED BUILDING OUTLINE PROVIDED BY RTA STUDIO, REF. "18122 - Site 18_RC01_SK-010 - SITE PLAN_WIP.dwg" DATED 2/07/2018.
4. EXISTING TOPO SURVEY SUPPLIED BY SURVEY WORX, REF "2549-105-01 Site Plan R1.dwg" DATED 18/07/2018.

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CLIENT **ORAMS MARINE**

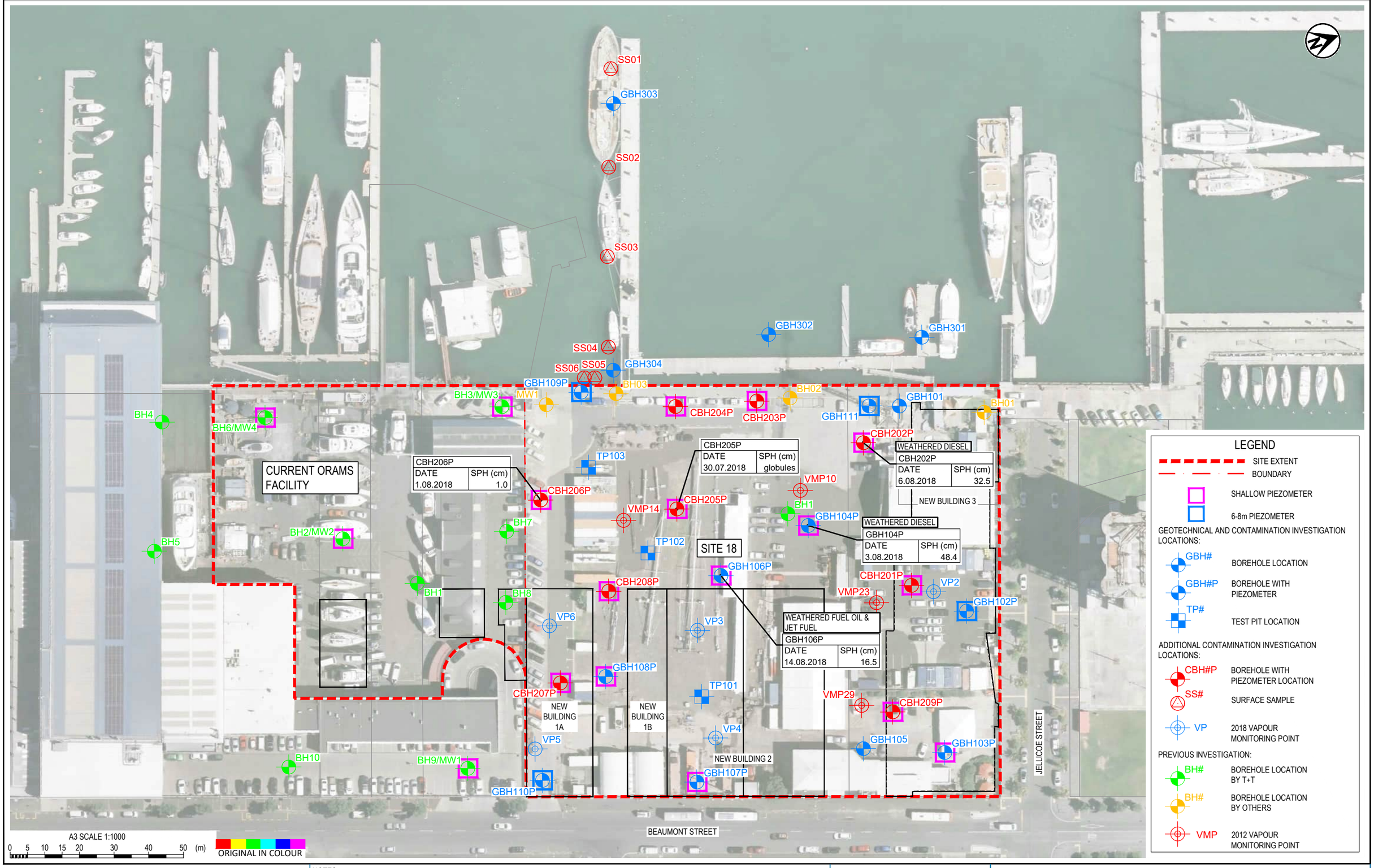
PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION GROUNDWATER CONTOURS - LOW TIDE

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 8B REV 2

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LEGEND

- SITE EXTENT
- BOUNDARY
- SHALLOW PIEZOMETER
- 6-8m PIEZOMETER

GEOTECHNICAL AND CONTAMINATION INVESTIGATION LOCATIONS:

- GBH# — BOREHOLE LOCATION
- GBH#P — BOREHOLE WITH PIEZOMETER
- TP# — TEST PIT LOCATION

ADDITIONAL CONTAMINATION INVESTIGATION LOCATIONS:

- CBH#P — BOREHOLE WITH PIEZOMETER LOCATION
- SS# — SURFACE SAMPLE
- VP — 2018 VAPOUR MONITORING POINT

PREVIOUS INVESTIGATION:

- BH# — BOREHOLE LOCATION BY T+T
- BH# — BOREHOLE LOCATION BY OTHERS
- VMP — 2012 VAPOUR MONITORING POINT

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NOTES:

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4. PROPOSED BUILDING OUTLINE PROVIDED BY RTA STUDIO, REF. "18122 - Site 18_RC01_SK-010 - SITE PLAN_WIP.dwg" DATED 2/07/2018.

PROJECT No.	30881.2000	
DESIGNED	LKH	Aug. 18
DRAWN	JC	Aug. 18
CHECKED	AMM	Nov.18
	WMW	Nov.18
	APPROVED	DATE

CLIENT **ORAMS MARINE**

PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION OBSERVATION OF SPH

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 9 REV 2

9 Analytical Results and Evaluation

9.1 Evaluation criteria

The evaluation criteria outlined in Table 9.1 have been used for comparison of sampling results presented in the following sections. The numerical criteria adopted are presented in the results tables in this section.

Table 9.1: Criteria for evaluation of soil, groundwater, sediment and vapour data

Evaluation criteria	Source
<u>Protection of human health:</u> • Soil contaminant standards or guidelines protective of human health: - During construction (based on commercial land use criteria, as a conservative proxy). - Commercial land use based criteria have been adopted for the proposed use of the site as a marine services facility. - High density residential land used for the Stage 2 development area in the north (apartment and retail building). • Inhalation of vapour data from soil, SPH and/or groundwater sources of volatile hydrocarbons collected from the vapour specific probes has been assessed in regards to worker health and safety and indoor/ outdoor inhalation in a commercial and high residential setting. • Evaluation of groundwater via ingestion was not relevant as groundwater is not suitable for potable supply.	<u>Soil</u> – Human health • NES Soil Contaminant Standards (SCS) for commercial land use, and in the area of the proposed future apartment, high density residential land use. • Where no NES Soil SCS are available the hierarchy outlined in the CLMG No. 2 (2011)[1] has been followed for the assessment of human health for criteria selection including: - New Zealand Petroleum Hydrocarbon Guidelines (1999)[2] – criteria for commercial and residential land use for sandy silt soils. Both the 'all pathways' criteria and the 'inhalation pathway' criteria were applied as appropriate. - New Zealand Asbestos in Soil Guidelines (2017)[3] for commercial and residential land use and to assess the level of control required to protect workers. - ASC NEPM Health Investigation Levels (HIL)[4] for commercial/industrial and high density residential land uses. - USEPA Regional Soil Screening Levels for composite workers (using a hazard quotient of 1 and a target risk of 10^{-5}). <u>Vapour:</u> • Worksafe NZ workplace exposure standards – time weighted average (for an eight hour shift) and short term exposure limits (over 15 minute exposure periods)[5]. • New Zealand Petroleum Hydrocarbon Guidelines (1999) – Appendix 4H Target concentrations for indoor and outdoor air. • ASC - NEPM HIL soil gas concentrations. • USEPA Vapour intrusion screening levels. <u>Groundwater (vapour risk only)</u> • New Zealand Petroleum Hydrocarbon Guidelines – groundwater acceptance criteria for the inhalation pathway. The scenario of commercial/industrial use, gravel (for the unsaturated zone) and groundwater at 2 m bgl was adopted to provide a conservative assessment. Both indoor and outdoor air values were used.
<u>Environmental protection</u> • Risk-based environmental assessment criteria to assess potential risks to environmental receptors (i.e. flora and fauna in the Westhaven Marina) via:	<u>Soil</u>: • Permitted Activity (PA) Soil Acceptance Criteria as defined in Chapter E.30 of the Auckland Unitary Plan[6] (Table E30.6.1.4.2). Where contaminants are not listed in the table, the hierarchy noted within the AUP Chapter E.30 has been adopted as follows: - New Zealand Petroleum Hydrocarbon Guidelines – Criteria for the protection of groundwater quality Table 4.20. - Soil quality guidelines for current site use (commercial).

Evaluation criteria	Source
- Leaching of contaminants in soil. - Existing contaminants in sediment. • The groundwater onsite has the potential to exit the site and enter the Westhaven Marina. The contaminant concentrations in groundwater onsite have been assessed against the Australian & New Zealand Guidelines for Fresh and Marine Water Quality (2018) (A&NZ 2018 Guidelines). This direct comparison does not allow for any dilution in the harbour and is therefore a conservative first tier assessment.	- Where land use is changing (i.e. for the area of the proposed apartment), the Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines for the protection of the environment and human health, have been used where available. <u>Sediment:</u> • A&NZ 2018 Guidelines: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, toxicant default guideline values for sediment quality[6]. <u>Groundwater</u>: • A&NZ 2018 Guidelines: Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Marine water quality guidelines for 80% protection level as per the controlled activity rules in the AUP. A 95% protection level was adopted for benzene as per the AUP. These assessment criteria have recently been updated however for the contaminants of concern these are the same as the ANZECC 2000[21] to which the AUP refers. • Draft ANZECC Australian and New Zealand Water Quality Guidelines reported in Government of Western Australia Department of Environmental Regulation (WA DER, updated 2017) Interim Guideline on the Assessment and Management of Perfluoroalkly and Polyfluoroalkyl Substances (PFAS) Contaminated Sites Guidelines.
<u>Property effects</u> • Acidic and sulphate rich soil and groundwater can present aggressive environments for concrete. • Hydrocarbon ingress into water supply pipes.	• New Zealand Standard 3101.2 2006 Concrete Structures Standard - Table 3.3 (groundwater only). • SPH presence used to determine whether water supply pipe materials may be compromised.
<u>Disposal</u> • Criteria used to determine the suitability of soil and sediment for acceptance for disposal at clean fill, managed fill or licensed landfill facilities.	• Published background concentrations for non-volcanic soils in the Auckland Region to assess suitability for disposal to a cleanfill facility. • Managed Fill criteria vary considerably between permitted facilities. However in general they cannot take odorous or wet materials. Only Ridge Road Managed Fill at Bombay can currently take asbestos (at or <0.001%). • Licensed landfill criteria also vary and there are two (Redvale and Hampton Downs). • The sediment data has also been assessed against the human health criteria (for soil) to determine potential for onsite reuse of these materials.

Notes:

1 Ministry for the Environment, Contaminated Land Management Guidelines No. 2 Hierarchy and Application in New Zealand of Environmental Guideline Values (2011).

2 Ministry for the Environment, Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (1999).

3 BRANZ, New Zealand Guidelines for Assessing and Managing Asbestos in Soil (2017).

4 National Environment Protection Council – Assessment of Site Contamination National Environment Protection Measure amended 2013.

[21] Australian & New Zealand Guidelines for Fresh and Marine Water Quality (2000).

5 Worksafe New Zealand, Workplace Exposure Standards and Biological Exposure Indices (9th edition) November 2107, updated 2018.
6 The default guideline values have been used, and organic compounds adjusted to 1% total organic carbon. For comparison sake, the Guideline Value – High have also been presented an indicator of potential toxicity problems.

9.2 Data quality

A quality assurance and quality control (QA/QC) program was implemented as part of field procedures, which included:

- Decontaminating sampling equipment between sampling locations.
- Preservation of samples with ice during transport from the field to the laboratory.
- Transportation of samples with accompanying Chain of Custody documentation.
- Compliance with laboratory sample holding times.
- Collection of the following QA/QC samples:
  - Duplicate soil samples were obtained at approximately one per ten soil samples. Three duplicate soil samples (Dup 1, Dup 5 and Dup 15) were analysed for a range of analytes including a suite of heavy metals, PAHs and VOCs.
  - Two field duplicates (MWB and MWE) were obtained during the groundwater monitoring investigation and were analysed for a mix of analytes including a suite of heavy metals, TPH, BTEX, VOCs and PFAS compounds.
  - Samples undergoing PFAS analysis were subject to the following QA/QC:
    - One field duplicate obtained during the groundwater monitoring investigation (MWE).
    - One sample obtained of the control water used for decontamination.
    - One rinsate sample obtained following decontamination of the interface probe.

Additional samples for QA/QC were obtained during the PFAS sampling and were held at the laboratory pending a review of the initial results.

Tables 9.2 and 9.3 (below) present the QA/QC data. Note that only contaminants which recorded concentrations above the laboratory level of detection have been reported. It is typically considered acceptable (refer to MfE Guideline No. 5) if an RPD range of less than 50% is achieved for soil samples.

As shown in Tables 9.2 and 9.3, the metal concentrations in soil and groundwater in duplicate samples generally reported RPDs within this range indicating that variability in sample collection, handling and analysis is acceptable. Several compounds reported RPDs that exceeded 50% however, the compounds that significantly exceeded this threshold (>75%) were limited to mercury and some PAH compounds. These compounds were reported at concentrations well below the human health acceptance criteria and this level of variability is therefore not considered to compromise the data quality. While mercury was reported at concentrations close to or above the environmental acceptance criteria the soil data has been superseded by analysis of groundwater, more accurately reflecting actual mercury concentrations, such that the variability in soil data is not considered to compromise the findings of this investigation.

In general, the groundwater QA/QC duplicate results compared well with the primary samples with all relative percentage differences (RPD), excluding four analytes, of less than 20%. The majority of compounds detected in the duplicate groundwater samples reported RPDs within the acceptable range. The RPDs for cumene, propylbenzene, zinc and light-end TPH compounds were reported above the acceptable range. However, the duplicate sample was collected from monitoring well

GBH104, in which the presence of a measurable apparent thickness of SPH has been reported. This level of variability is therefore interpreted to reflect the presence of residual SPH and is not considered to compromise the data quality.

Table 9.2: Summary of soil QA/QC data (mg/kg)

Sample ID Depth (m)	TP101 1.6	Dup 1	RPD%	CBH208 0.2-0.6	DUP 5	RPD%	CBH203A 1.7-2.0	Dup 15	RPD%
Metals									
Arsenic	9	6	40%	4	6	40%	18	15	18%
Cadmium	< 0.10	< 0.10	-	0.21	0.29	32%	0.18	0.16	12%
Chromium	5	6	18%	26	28	7%	39	38	3%
Copper	3	5	50%	60	69	14%	71	53	29%
Lead	8.5	8.9	5%	195	340	54%	127	104	20%
Mercury	0.11	0.35	104%	0.13	0.22	51%	0.44	0.2	75%
Nickel	13	7	60%	68	60	13%	81	82	1%
Zinc	250	183	31%	320	450	34%	240	240	0%
PAH									
1-Methylnaphthalene	< 0.013	-	-	< 0.012	0.039	-	1.18	0.56	71%
2-Methylnaphthalene	< 0.013	-	-	< 0.012	0.065	-	0.55	0.27	68%
Perylene	< 0.013	-	-	0.013	0.034	89%	0.078	0.043	58%
B(a)P eq.	0.04	-	-	0.07	0.1	35%	0.4	0.22	58%
Benzo[a]pyrene Toxic Equivalence (TEF)	0.04	-	-	0.07	0.09	25%	0.4	0.22	58%
Acenaphthylene	< 0.013	-	-	< 0.012	0.017	-	0.182	0.116	44%
Acenaphthene	< 0.013	-	-	< 0.012	< 0.013	-	0.3	0.171	55%
Anthracene	< 0.013	-	-	< 0.012	< 0.013	-	0.14	0.125	11%
Benzo[a]anthracene	0.043	-	-	0.023	0.044	63%	0.24	0.088	93%
Benzo[a]pyrene (BAP)	0.028	-	-	0.04	0.069	53%	0.27	0.155	54%
Benzo[b]fluoranthene + Benzo[j]fluoranthene	0.037	-	-	0.055	0.115	71%	0.24	0.135	56%
Benzo[e]pyrene	0.026	-	-	0.041	0.111	92%	0.13	0.071	59%
Benzo[g,h,i]perylene	0.018	-	-	0.059	0.091	43%	0.27	0.153	55%
Benzo[k]fluoranthene	0.021	-	-	0.023	< 0.013	-	0.097	0.056	54%
Chrysene	0.03	-	-	0.018	0.038	71%	0.24	0.102	81%
Dibenzo[a,h]anthracene	< 0.013	-	-	< 0.012	< 0.013	-	0.044	0.025	55%
Fluoranthene	0.113	-	-	0.051	0.104	68%	0.52	0.187	94%
Fluorene	0.032	-	-	< 0.012	< 0.013	-	0.22	0.115	63%
Indeno(1,2,3-c,d)pyrene	0.022	-	-	0.064	0.082	25%	0.26	0.129	67%
Naphthalene	< 0.07	-	-	< 0.06	0.06	-	0.8	0.36	76%
Phenanthrene	< 0.013	-	-	< 0.012	0.02	-	0.6	0.22	93%
Pyrene	0.185	-	-	0.053	0.106	67%	0.59	0.24	84%
BTEX in VOC Soils by Headspace GC-MS									
Ethylbenzene	< 0.3	< 0.3	-	< 0.3	-	-	0.3	0.3	0%

Table 9.3: Summary of groundwater QA/QC data (mg/L)

Sample ID	GBH104	MWB	RPD%	GBH103	MWE	RPD%
Date	3/08/2018	3/08/2018		6/08/2018	6/08/2018	
Heavy metals						
Dissolved Arsenic	< 0.004	< 0.004	-	< 0.004	< 0.004	-
Dissolved Cadmium	< 0.0002	< 0.0002	-	< 0.0002	0.0022	-
Dissolved Chromium	< 0.0010	< 0.0010	-	< 0.0010	< 0.0010	-
Dissolved Copper	< 0.0010	< 0.0010	-	< 0.0010	< 0.0010	-
Dissolved Lead	< 0.0010	< 0.0010	-	0.0035	0.0039	11%
Dissolved Mercury	< 0.00008	< 0.00008	-	< 0.00008	< 0.00008	-
Dissolved Nickel	< 0.007	< 0.007	-	< 0.007	< 0.007	-
Dissolved Zinc	0.007	0.004	55%	< 0.004	< 0.004	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	0.11	0.16	37%	0.46	0.46	0%
C10 - C14	1.9	2.1	10%	2	1.5	29%
C15 - C36	3.1	2.5	21%	1.2	0.8	40%
Total hydrocarbons (C7 - C36)	5.1	4.8	6%	3.6	2.8	25%
Monoaromatic Hydrocarbons in VOC						
n-Butylbenzene	< 0.005	< 0.005	-	0.019	0.018	5%
tert-Butylbenzene	< 0.003	< 0.003	-	0.003	< 0.003	-
4-Isopropyltoluene (p-Cymene)	< 0.005	< 0.005	-	< 0.005	< 0.005	-
Isopropylbenzene (Cumene)	0.023	0.041	56%	0.134	0.126	6%
n-Propylbenzene	0.022	0.047	72%	0.28	0.26	7%
sec-Butylbenzene	< 0.003	0.029	-	0.017	0.016	6%
Styrene	< 0.005	< 0.005	-	< 0.005	< 0.005	-
1,2,4-Trimethylbenzene	< 0.003	< 0.003	-	< 0.003	< 0.003	-
1,3,5-Trimethylbenzene	< 0.003	< 0.003	-	< 0.003	< 0.003	-
Poly- and Perfluorinated Alkyl Substances						
Total Perfluorohexanesulfonic acid (T-PFHxS)	-	-	-	1.6	1.7	6%
Total Perfluorooctanesulfonic acid (T-PFOS)	-	-	-	4.4	4.4	0%
Sum of Total PFOS & PFHxS	-	-	-	6	6.1	2%
Perfluorooctanoic acid (PFOA)	-	-	-	<0.10	<0.10	-

9.3 Soil results

The results of the soil investigation for Site 18 are presented in Tables 9.4 and 9.5, while evaluation of the existing Orams facility data is provided in Table 9.6. Full laboratory results are presented in Appendix L.

9.3.1 Site 18 – contaminant types and distribution

The soil testing data for Site 18 indicates the following:

- Light fraction hydrocarbons (TPH C_7- C_9) were recorded in the majority of samples tested across Site 18. The highest concentrations were recorded in the northeast corner (CBH209, GBH103 and GBH105) and in the centre-north (GBH102 and CBH201). The higher concentrations were recorded at a depth of 1 -3 m bgl, within granular and hydraulic fill and corresponding with the groundwater table fluctuation zone.
- Mid-range (TPH C_{10}-C_{14}) data showed a similar pattern to the light fraction but high concentrations were also recorded in the southwest (CBH109, CBH206), centre west (CBH203 and CBH204) and southeast (CBH108, GBH106 and CBH207). Again the higher concentrations were recorded in granular and hydraulic fill at the water table (between 1-3 m bgl). In the northwest corner (CBH202) elevated mid-range TPH was recorded at 4.5 and 6 m bgl, below sea level within insitu marine sediments.
- The highest concentrations of heavy end TPH (C_{15}-C_{36}), were recorded in CBH203 in the centre west of the site and then at varying concentrations across the majority of the site, all within the granular and hydraulic fill.
- Chromatographs from the soil testing results where TPH was detected indicate that the product types present in the soil are variable, commonly with mixtures of product types present. Based on a qualitative review of the chromatograms (summarised in Tables 9.4 and 9.5) diesel, jet fuel, turpentine, petrol, kerosene, light fuel oil, lube oil, and monoaromatic hydrocarbons were present in soil. Assessment of the product signatures indicate the petroleum hydrocarbons are weathered or moderately weathered based on subdued peaks.
- BTEX compounds were only reported above the laboratory limit of reporting in CBH206 at 3.0 m bgl, CBH201 at 2.1-2.6 m bgl and ethylbenzene in GBH109 at 2.5-2.9 m bgl again within hydraulic fill.
- Chlorinated solvents were detected in soil in the southwest corner of the site (GBH109, TP103 and Beca BH03). PCE, TCE, DCE were recorded in soils down to 5.5 m bgl (highest concentrations at this depth) and VC at around 7 m bgl, all within in situ marine sediments. These compounds were not detected in samples obtained from greater than 7 m depth, nor at any depth elsewhere onsite. PCE was reported at the highest concentration which indicates this was the product stored onsite. TCE, DCE and VC are breakdown products of PCE (refer to discussion in Section 9.5) and can also be included as impurities in PCE product.
- Other VOCs recorded in soil include monoaromatic hydrocarbons, which were detected in numerous locations, the highest being in CBH206 on the southern boundary and CBH204 in the centre west of the site. The position of VOCs in the soil profile corresponds with light and mid fraction TPH and within the groundwater table fluctuation zone.
- PAHs were detected in the majority of granular and hydraulic fill samples across the site. The highest concentrations were located within the granular fill and associated with gasworks waste. The highest concentrations were recorded in Beca BH01 in the northwest, GBH109 and TPH103 in the southwest, GBH107 in the west. As with other hydrocarbons PAHs were typically not reported, or only at low concentrations below 4 m bgl.
- One or more heavy metals (except cadmium) were reported above published background concentrations in the majority of samples locations across the site.
- Cyanide concentrations in the majority of samples tested at the site were low, below 4 mg/kg but ranged up to 40 mg/kg, with the highest recorded in surface materials in Beca BH03 (western boundary).
- PCB compounds were not reported above the laboratory limit of reporting in areas of former transformer oil storage or use (GBH103, GBH107 and CBH201).
- Selected near surface soil samples were tested for TBT. Trace levels were detected in CBH208 and GBH108 in the centre of the site.

- Asbestos fibres were either not detected (12 samples) or detected at or below 0.001 % (w/w) (ten samples). The highest recorded results was 0.001% in GBH109 in granular fill at 1.0-1.1 m.

9.3.2 Orams existing site – contaminant types and distribution

The 2009 soil data for the existing Orams facility indicates:

- Basecourse material beneath the surfacing materials contains elevated metals above background concentrations, and along the northern side of the site, hydrocarbons. Shallow soil (0.25 m bgl) in BH7 in the centre north of the Orams existing site (adjacent to Site 18) contained BTEX.
- Granular material (reworked ECBF and industrial wastes) included clinker, incinerator ash and demolition materials (mainly brick and scoria). Fill with these inclusions had a signature of metal and PAH contamination associated with gasworks waste. Concentrations of metals varied across the site in this material, with high concentrations of lead in particular at 0.5-1.5 m bgl in places across the site. Fill along the northern side of the site (BH3, BH8 - adjacent to Site 18) and eastern boundary (BH10) recorded petroleum hydrocarbons. The hydrocarbon contamination was degraded and therefore likely to have resulted from offsite or historical onsite sources (not the boat stop refuelling facility onsite). TPH ranges varied being mainly heavy end at BH3 and BH8 and mid-range at BH10. VOCs were only tested at BH10 and were not detected.
- The hydraulically emplaced fill material underlying this had low concentrations or concentrations below the limit of reporting for metal and organic contaminants, indicating that the contaminants in the overlying fill had not migrated vertically.

9.3.3 Comparison with evaluation criteria

The findings of the testing are described in the context of the potential effects in each of the following sections. The soil testing results have been compared to the evaluation criteria presented in Section 9.1. A summary of the soil contamination data that exceeds the commercial land use criteria for the protection of human health is presented in Figure 10A; and the soil data that exceeds the AUP PA criteria for environmental protection is presented in Figure 10B.

9.3.3.1 Protection of human health

The soil data pertaining to the full site have been compared to commercial land use based criteria for in order to assess the risk to construction workers and, in the non-apartment area, the risk for future site users. The soil data within the footprint of the apartment is also compared to residential land use criteria in the subsequent section. The low level asbestos contamination is discussed separately as concentrations do not exceed land use based criteria but there are implications for construction phase works.

The NZ Petroleum Guidelines approach to the use of C10-C14 as a surrogate for PAHs where diesel is present has not been applied in the assessment of the data. This is because there typically a mixture of hydrocarbons present. PAH and TPH data have been collected.

9.3.3.1.1 Commercial

Soil data compared to commercial criteria is presented in Tables 9.4 (Site 18 – proposed commercial area), Table 9.5 (Site 18 – proposed apartment area) and Table 9.6 (Orams existing site). The position of soil contamination data that exceeds the commercial land use criteria for the protection of human health is presented in Figure 10A.

The assessment of soil data against the commercial land use criteria for the site indicates that exceedances are related to hydrocarbon contaminants only, in the following areas:

- In the northeast corner of the site (CBH209 and GBH103) concentrations of light- and mid-range TPH at depth of around 1.5 m bgl.
- In the northwestern corner of the site (CBH202 and Beca BH01) concentrations of light- and mid-range TPH fractions exceeded the criteria at around 4 m bgl.
- A concentration of B(a)P of 341 mg/kg was also recorded in Beca BH01 in this location.
- In CBH203, at seawall edge contained a concentration of mid-range TPH above the commercial criteria at 1.7-2.0 m depth.
- The southwest corner of the site (GBH109) recorded concentrations of mid-range TPH at 2.5 m bgl and concentrations pf TCE and VC at greater than 5 m bgl. Concentrations of TCE at 5.5 m and VC at 7 m in Beca BH03 exceeded the commercial human health criteria.
- GBH107 on the Beaumont Street boundary recorded B(a)P above the criteria in surface soils (0.1-0.2 m bgl).
- Within the Orams existing site lead was recorded in soil at concentrations above the commercial land use criteria (BH1, BH2 and BH8). BH2 also returned an arsenic concentration above commercial values. The elevated concentrations were recorded in the upper 1.5 m of the soil profile.

9.3.3.1.2 High density residential

Soil data from within the footprint of Building B3 (retail/apartment) is compared to high density criteria in Table 9.5 (Site 18 – proposed apartment area). Soil data from GBH101 and GBH105 are (Table 9.4) also considered with regards to vapour risk due to the proximity of these investigation locations to the proposed apartment. Exceedances of the high density residential criteria (for locations where this land use is proposed) are presented on Figure 10B.

The soil assessment data from within the footprint of Building B3 (retail/apartment) indicates that:

- Concentrations of low- and mid-range TPH exceed the high density residential criteria in the west (Beca BH1), centre (CBH201 and GBH102) and south (CBH209 and GBH103). An exceedance in GBH105 for light-end TPH was also recorded at 2.7-3.0 m bgl.
- A concentration of B(a)Peq of 341 mg/kg was also recorded in Beca BH01 in the western end of the proposed apartment. This concentration was recorded at 4 m depth and is unlikely to present a risk to human health.
- All other results were below the relevant assessment criteria.

9.3.3.1.3 Asbestos

The data collected for asbestos concentrations in soil indicates that:

- Asbestos-in-soil data was obtained for near surface granular fill within Site 18 (< 1.0 m bgl) as these were considered the highest risk materials to contain asbestos. No ACM fragments were detected in any sample, although one suspected fragment was observed during sampling in TP101 at 0.5 m bgl (no testing was completed). Chrysotile asbestos fibres were recorded in 10 of the 22 samples at concentrations at or below the laboratory limit of reporting of 0.001%. No results exceeded the commercial or residential land use based criteria.
- Based on the results and application of the New Zealand Asbestos in Soil Guidelines, during the excavation and handling of granular fill the works can be considered as unlicensed asbestos works due to the low level of asbestos contamination of soil.

The soil samples that detected asbestos are presented in Figure 10C.

9.3.3.2 Environmental protection

The soil results that exceed the AUP PA criteria are presented in Figure 10B.

- Elevated concentrations of metals (nickel, lead, mercury, copper and zinc) were detected above the AUP PA criteria in surface soil across the site. At Site 18 the exceedances were generally restricted to near surface soil (< 1.0m bgl); the exception being lead at GBH109 at 2.5 m bgl. At the Orams existing site exceedances were present across a wider depth range from near surface to 4.0 m bgl.
- Benzene and vinyl chloride were detected above the AUP PA criteria in the southwestern corner of Site 18 (GBH109 and CBH206) at depths of 3 m or greater. Benzene was also detected above the AUP PA in BH7 on the centre north of Orams existing site.

While soil data have been compared to the AUP PA criteria onsite, testing of groundwater for the contaminants of concern has been completed and reported in Section 9.4. The groundwater testing considered more relevant for the assessment of potential environmental effects.

9.3.3.3 Other relevant results

For compounds other than those discussed in the sections above:

- TBT compounds were detected at trace levels surface soil at CBH208 and GBH108 in centre south of the site but below all criteria.
- Soils tested for cyanide detected a maximum concentration of 3.8 mg/kg, well below all criteria.
- Concentrations of all PCB compounds were below the laboratory limit of reporting and therefore below the assessment criteria.

9.3.3.4 Disposal assessment

Soils tested from across the site within the upper 4 m generally contained concentrations of contaminants above published or expected natural background concentrations, meaning that it is unlikely to be practical to separate any materials for disposal as cleanfill. Disposal of surplus soil to a facility licensed to receive such materials would be required. Acceptance criteria for managed fills vary however generally will not receive odorous or wet materials. Such materials will likely require disposal to landfill, even if the contaminant concentrations are within acceptable levels.

Deeper soils have not been routinely tested across the site and may, if kept separate from overlying contaminated soil, be suitable for disposal as cleanfill. This will require complete separation of the deeper soils from shallower contamination (for example by use of cased pile holes) as any mixing with the shallow soils and/or SPH will make the materials unsuitable. In addition, contamination is present at depth in the area of the chlorinated solvent contamination in the southwest corner of Site 18. Deep soils derived from within and adjacent to this area would not be able to disposed of as cleanfill (if excavated and taken offsite).

Based on the available data, shallow soils (at least the upper 1.0 m) contains low level asbestos (at or below 0.001%) which will limit disposal of this material to facilities licensed to take asbestos contaminated soils (if not co-contaminated).

A more detailed assessment of the available soil data can be undertaken once the locations, depths and volumes of soil intended for disposal are better understood.

Table 9.4 **Soil sampling results - Site 18 (not including the area of proposed apartment) (mg/kg)**

Sample ID							CBH202	CBH202	CBH202	CBH203A	CBH203A	CBH203A	CBH204	CBH204	CBH204	CBH205	CBH205	CBH205	CBH206	CBH206	CBH206	CBH207	CBH207	CBH207	CBH207	CBH208	CBH208	CBH208
Depth (m)							0.5	4.4 - 4.5	6.1 - 6.2	0.2 - 0.4	1.7 - 2.0	5.7 - 5.9	0.9	1.8 - 2.0	5.8 - 6.0	0.5 - 0.6	2.0 - 2.2	5.0 - 5.2	0.2 - 0.6	3.0 - 3.2	5.7 - 6.0	0.2 - 0.4	0.6-0.7	2.0 - 2.2	5.0 - 5.2	0.2 - 0.6	3.0 - 3.2	5.8 - 6.0
Date							29/06/2018	3/07/2018	4/07/2018	11/07/2018	11/07/2018	11/07/2018	29/06/2018	4/07/2018	4/07/2018	2/07/2018	2/07/2018	2/07/2018	5/07/2018	5/07/2018	5/07/2018	5/07/2018	5/07/2018	5/07/2018	5/07/2018	3/07/2018	3/07/2018	3/07/2018
Lab ID	AUP Discharge Criteria [0]	NES Soil human health criteria for commercial / industrial land use [1]	Inhalation pathway [2] (outdoor)	Inhalation pathway [2] (indoor)	Non-volcanic Background [3]	Max	2008130.3	2009906.24	2010644.3	2013973.1	2013973.5	2013973.9	2008130.2	2010644.8 / 2010645.1	2010644.11	2009174.2	2009174.7	2009174.11	2011332.2	2011332.7	2011332.11	2011332.14	2011331.3	2011332.16	2011332.22	2009906.9	2009906.16	2009906.19
Geological unit							Fill - silty gravel	Fill - sand	Fill - sand	Fill - silty gravel	Fill - sandy gravel	Marine sediments	Fill - gravelly silt	Fill - silty gravel	Fill - sand with gravel	Fill - silty gravel	Fill - silty sand	Fill - sand, shells and gravel	Fill - sandy gravel	Fill - sandy silt	Marine sediments	Fill - silty sandy gravel	Fill - silt, minor sand and gravel	Fill - silt, minor sand	Marine sediments	Fill - sandy gravel	Fill - silty sand	Marine sediments
TOC (g/100g dry weight)							-	-	-	-	-	-	-	-	-	-	-	-	-	1.23	-	-	-	-	-	-	-	-
Metals and metaloids (totals)																												
Arsenic	100	70	-	-	12	36	< 2	4	-	< 2	18	-	9	5	-	4	3	-	12	8	-	6		-	-	4	4	-
Cadmium	7.5	1,300	-	-	0.65	0.57	< 0.10	< 0.10	-	< 0.10	0.18	-	0.18	0.1	-	0.22	< 0.10	-	0.57	0.1	-	0.17	-	-	-	0.21	< 0.10	-
Chromium	400	NL	-	-	55	300	42	18	-	44	39	-	32	45	-	33	14	-	32	31	-	39	-	-	-	26	18	-
Copper	325	NL	-	-	45	240	42	15	-	63	71	-	49	51	-	52	8	-	77	28	-	55	-	-	-	60	22	-
Lead	250	3,300	-	-	65	**1620**	2	9.2	-	2.5	127	-	200	143	-	66	12.1	-	210	169	-	191	-	-	-	195	13.1	-
Mercury	0.75	4,200	-	-	0.45	**4.3**	< 0.10	< 0.10	-	< 0.10	0.44	-	0.57	0.2	-	0.14	< 0.10	-	**4.3**	0.49	-	0.47	-	-	-	0.13	< 0.10	-
Nickel	105	6,000 [4]	-	-	35	**210**	**190**	47	-	**166**	81	-	47	56	-	74	4	-	72	35	-	104	-	-	-	68	31	-
Zinc	400	400,000 [4]	-	-	180	**560**	42	78	-	59	240	-	197	173	-	176	10	-	340	124	-	135	-	-	-	320	95	-
Total Cyanide	1,500 [4]	1,500 [4]	-	-	<LD	40	-	-	-	-	0.13	-	1.17	-	-	-	0.48	-	1.62	-	-	-	-	-	-	3.8	-	-
Tributyltin																												
Dibutyltin	250 [5]	250 [5]	-	-	<LD	0.033	-	-	-	< 0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.005	-	-
Monobutlytin	-	-	-	-	<LD	0.077	-	-	-	< 0.007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.007	-	-
Tributyltin	250 [5]	250 [5]	-	-	<LD	0.025	-	-	-	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.004	-	-
Triphenyltin	-	-	-	-	<LD	0	-	-	-	< 0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.003	-	-
Asbestos																												
FA/AF % (weight/weight)	-	0.001% [6]	-	-	<LD	0.001	ND	-	-	ND	-	-	-	ND	-	ND	-	-	ND	-	-	-	<0.001	-	-	<0.001	-	-
ACM % (weight/weight)	-	0.05% [6]	-	-	<LD	0	ND	-	-	ND	-	-	-	ND	-	ND	-	-	ND	-	-	-	ND	-	-	ND	-	-
Asbestos form	-	-	-	-	-	0	ND	-	-	ND	-	-	-	ND	-	ND	-	-	ND	-	-	-	Chrysotile, loose fibres	-	-	Chrysotile, loose fibres	-	-
Polyaromatic Hydrocarbons																												
1-Methylnaphthalene	730 [5]	730 [5]	-	-	<LD	9.3	< 0.011	-	-	< 0.011	1.18	-	0.021	0.99	-	< 0.012	0.2	-	0.062	1.33	-	0.015	-	-	-	< 0.012	0.48	-
2-Methylnaphthalene	3000 [5]	3000 [5]	-	-	<LD	3.4	< 0.011	-	-	< 0.011	0.55	-	< 0.013	0.66	-	< 0.012	0.04	-	0.066	1.48	-	< 0.012	-	-	-	< 0.012	0.069	-
Perylene	-	-	-	-	<LD	5.8	0.011	-	-	< 0.011	0.078	-	0.093	< 0.13	-	0.021	0.021	-	0.155	0.128	-	0.087	-	-	-	0.013	< 0.014	-
Benzo[a]pyrene Potency Equivalency Factor	-	35	-	-	<LD	48	< 0.03	-	-	< 0.03	0.4	-	0.27	< 0.4	-	0.09	0.09	-	0.65	0.51	-	0.36	-	-	-	0.07	< 0.04	-
Acenaphthylene	-	-	-	-	<LD	3.1	< 0.011	-	-	< 0.011	0.182	-	0.019	< 0.13	-	0.013	< 0.013	-	0.123	0.072	-	0.019	-	-	-	< 0.012	< 0.014	-
Acenaphthene	-	-	-	-	<LD	6.8	< 0.011	-	-	< 0.011	0.3	-	< 0.013	< 0.13	-	< 0.012	< 0.013	-	0.031	0.178	-	< 0.012	-	-	-	< 0.012	< 0.014	-
Anthracene	-	-	-	-	<LD	11.3	< 0.011	-	-	< 0.011	0.14	-	0.016	< 0.13	-	0.012	0.059	-	0.103	0.179	-	< 0.012	-	-	-	< 0.012	< 0.014	-
Benzo[a]anthracene	-	-	-	-	<LD	65	0.014	-	-	< 0.011	0.24	-	0.154	0.14	-	0.061	0.115	-	0.41	0.32	-	0.125	-	-	-	0.023	< 0.014	-
Benzo[a]pyrene (BAP)	20	35	NL	1000 (surface); NL (1-4m); NL (>4m)	<LD	20	< 0.011	-	-	< 0.011	0.27	-	0.189	0.14	-	0.064	0.059	-	0.44	0.34	-	0.29	-	-	-	0.04	< 0.014	-
Benzo[b]fluoranthene + Benzo[j]fluoranthe	-	-	-	-	<LD	89	< 0.011	-	-	< 0.011	0.24	-	0.198	< 0.13	-	0.082	0.068	-	0.75	0.49	-	0.3	-	-	-	0.055	< 0.014	-
Benzo[e]pyrene	-	-	-	-		48	< 0.011	-	-	< 0.011	0.13	-	0.135	< 0.13	-	0.05	0.048	-	0.5	0.3	-	0.25	-	-	-	0.041	< 0.014	-
Benzo[g,h,i]perylene	-	-	-	-	<LD	48	< 0.011	-	-	< 0.011	0.27	-	0.146	0.13	-	0.052	0.025	-	0.42	0.4	-	0.26	-	-	-	0.059	< 0.014	-
Benzo[k]fluoranthene	-	-	-	-	<LD	35	< 0.011	-	-	< 0.011	0.097	-	0.077	< 0.13	-	0.032	0.047	-	0.26	0.16	-	0.097	-	-	-	0.023	< 0.014	-
Chrysene	-	-	-	-	<LD	77	0.017	-	-	< 0.011	0.24	-	0.143	< 0.13	-	0.055	0.076	-	0.48	0.29	-	0.144	-	-	-	0.018	< 0.014	-
Dibenzo[a,h]anthracene	-	-	-	-	<LD	10.7	< 0.011	-	-	< 0.011	0.044	-	0.016	< 0.13	-	< 0.012	< 0.013	-	0.017	0.018	-	< 0.012	-	-	-	< 0.012	< 0.014	-
Fluoranthene	-	-	-	-	<LD	260	0.018	-	-	< 0.011	0.52	-	0.23	0.16	-	0.078	0.34	-	1.05	1	-	0.172	-	-	-	0.051	0.015	-
Fluorene	-	-	-	-	<LD	7.1	< 0.011	-	-	< 0.011	0.22	-	< 0.013	< 0.13	-	< 0.012	0.158	-	0.035	0.23	-	< 0.012	-	-	-	< 0.012	0.027	-
Indeno(1,2,3-c,d)pyrene	-	-	-	-	<LD	45	< 0.011	-	-	< 0.011	0.26	-	0.134	0.16	-	0.061	< 0.013	-	0.39	0.39	-	0.23	-	-	-	0.064	< 0.014	-
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [4]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	**5.5**	< 0.06	-	-	< 0.06	**0.8**	-	< 0.07	< 0.7	-	< 0.06	< 0.07	-	0.11	**1.11**	-	< 0.06	-	-	-	< 0.06	< 0.07	-
Phenanthrene	-	-	-	-	<LD	280	< 0.011	-	-	< 0.011	0.6	-	0.096	< 0.13	-	0.016	0.37	-	0.32	0.88	-	0.021	-	-	-	< 0.012	< 0.014	-
Pyrene	7.9 [7]	NL [8]	NL	NL	<LD	**210**	0.031	-	-	< 0.011	0.59	-	0.29	< 0.13	-	0.071	0.41	-	1.18	1.03	-	0.26	-	-	-	0.053	< 0.014	-
Polychlorinated Biphenyls																												
Total PCB (Sum of 35 congeners)	1.2 [1]	1.2	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons																												
C7 - C9	(5,200) [7]	(500) (surface); (500) (1-4m); (12,000) (>4m) [8]	5,200 (surface); 9,800 (1-4m); 12,000 (>4m)	NL	<LD	1030	< 8	120	84	-	106	< 8	< 8	96	< 8	-	88	< 9	-	109	< 9	-	-	-	200	-	-	23	< 9
C10 - C14	(9,200) [7]	(1,700) (surface); (2,200) (1-4m); (3,400) (>4m) [8]	7,800 (surface); 10,000 (1-4m); 16,000 (>4m)	NL	<LD	5600	< 20	3,200	1,230	-	5,600	26	59	2,100	< 20	-	520	40	-	1,040	< 20	-	-	1,900	-	-	320	< 20
C15 - C36	NL [7]	NL [8]	NL	NL	<LD	10100	< 40	1,550	580	-	10,100	55	147	760	< 40	-	490	< 40	-	340	< 40	-	-	640	-	-	84	< 40
Total hydrocarbons (C7 - C36)	-	-	-	-	<LD	15700	< 70	4,900	1,900	-	15,700	81	210	2,900	< 70	-	1,090	< 70	-	1,490	< 70	-	-	2,700	-	-	430	< 70
Suspected Product								Weathered Diesel	Moderately Weathered Diesel		Weathered Jet Fuel/Diesel/ Lube Oil			Weathered Turpentine/ Diesel			Weathered Petrol/Diesel			Weathered Kerosene/Diesel			Weathered Kerosene/Diesel			Weathered Diesel	
BTEX in VOC																												
Benzene	0.029 [7]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m) [8]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m)	480 (surface); 610 (1-4m); 860 (>4m)	<LD	**0.9**	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.2	-	< 0.2	< 0.3	-	**0.9**	< 0.3	-	-	< 0.3	< 0.3	< 0.17	< 0.3	< 0.3
Ethylbenzene	7.2 [7]	(200) (surface); (300) (1-4m); (450) (>4m) [8]	200 (surface); 300 (1-4m); 450 (>4m)	6,200 (surface); NL (1-4m); NL (>4m)	<LD	4.8	-	< 0.3	< 0.3	-	0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	4.8	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Toluene	6.0 [7]	(270) (surface); (480) (1-4m); (790) (>4m) [4]	270 (surface); 550 (1-4m); 790 (>4m)	NL	<LD	0.4	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	0.4	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
m&p-Xylene	3.7 [7]	(200) (surface); (420) (1-4m); (590) (>4m) [8]	200 (surface); 420 (1-4m); 590 (>4m)	NL	<LD	2	-	< 0.5	< 0.5	-	< 0.6	< 0.5	-	< 0.5	< 0.4	-	< 0.4	< 0.5	-	2	< 0.5	-	-	< 0.5	< 0.5	< 0.4	< 0.5	< 0.5
o-Xylene					<LD	0.6	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	0.6	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Halogenated Aliphatics																												
cis-1,2-Dichloroethene	20 [5]	20 [5]	-	-	<LD	5.1	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Tetrachloroethene (tetrachloroethylene)	400 [5]	400 [5]	-	-	<LD	37	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Trichloroethene (trichloroethylene)	19 [5]	19 [5]	-	-	<LD	4.8	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Vinyl chloride	175	175	-	-	<LD	**1.4**	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Monoaromatic Hydrocarbons																												
n-Butylbenzene	58,000 [5]	58,000 [5]	-	-	<LD	22	-	0.7	0.7	-	< 0.3	< 0.3	-	10.2	< 0.3	-	1	0.7	-	22	< 0.3	-	-	0.6	< 0.3	< 0.3	0.8	< 0.3
tert-Butylbenzene	120,000 [5]	120,000 [5]	-	-	<LD	0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Isopropylbenzene (Cumene)	9,900 [5]	9,900 [5]	-	-	<LD	44	-	0.9	1	-	< 0.3	< 0.3	-	17.2	< 0.3	-	0.6	1.1	-	44	< 0.3	-	-	1.5	< 0.3	< 0.3	1.1	< 0.3
4-Isopropyltoluene (p-Cymene)	-	-	-	-	<LD	0.8	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	0.8	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
n-Propylbenzene	24,000 [5]	24,000 [5]	-	-	<LD	117	-	2.5	2.4	-	0.3	0.3	-	45	0.3	-	1.4	3.3	-	117	0.3	-	-	4.4	< 0.3	< 0.3	3.7	< 0.3
sec-Butylbenzene	-	-	-	-	<LD	5.1	-	1.6	1.4	-	< 0.3	< 0.3	-	2.6	< 0.3	-	1.7	< 0.3	-	4.5	< 0.3	-	-	1.2	< 0.3	< 0.3	1.1	< 0.3
1,2,4-Trimethylbenzene	1,800 [5]	1,800 [5]	-	-	<LD	48	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	48	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trimethylbenzene	1,500 [5]	1,500 [5]	-	-	<LD	17.8	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	17.8	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Other VOC																												
Carbon disulphide	3,500 [5]	3,500 [5]	-	-	<LD	0	-	< 0.05	< 0.05	-	< 0.3	< 0.3	-	< 0.05	< 0.05	-	< 0.05	< 0.05	-	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [4]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	**3.3**	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	< 0.3	-	**3.3**	< 0.3	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Other SVOC (Beca BHs only)																												
4,4'-DDD	1,000 [1 (total DDT)]	1,000 [1 (total DDT)]	-	-	<LD	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	-	-	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	1,000 [5]	1,000 [5]			<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
All results in mg/kg (except where otherwise stated)
NL = no limit
<LD = below level of laboratory detection
NC = not calculated due to insufficient values above laboratory detection

Assessment
Red text Human Health (COMMERCIAL) criteria exceeded
Bold text AUP criteria exceeded
Highlighted - above lab detection limit (excluding metals)
Non-volcanic background exceeded

0. Auckland Unitary Plan Permitted Activity Standards, Chapter E.30
1. National Environmental Standard - Soil Contamination Standard - commerical land use
2. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria
Commercial/industrial use INHALATION PATHWAY, sandy silt, various depths
3. Background concentrations of trace elements in Auckland soils (non-volcanic soils) Table E30.6.1.4.2 the AUP.
4. National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *Commercial/industrial land use*
5. USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, composite worker, chronic effects
6. BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *commercial land use*
7. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria
Protection of Groundwater Quality, sandy silt, contamination at <1m depth, groundwater at 2m depth.
8. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria
Commercial/industrial use ALL PATHWAYs, sandy silt, various depths
9. Duplicate soil sample recorded in table as analytical results provide useful vinyl chloride information.

Table 9.4 **Soil sampling results - Site 18 (not including the area of proposed apartment) (mg/kg)**

Sample ID							GBH101	GBH101	GBH104	GBH104	GBH104	GBH105	GBH105	GBH105	GBH106	GBH106	GBH107	GBH107	GBH108	GBH108	GBH108	GBH109	GBH109	GBH109	GBH109	GBH110	GBH110
Depth (m)							0.9 - 1.0	6.5 - 7.05	0.3 - 0.7	1.2 - 1.7	4.5 - 5.0	0.15 - 0.25	1.55 - 1.65	2.7 - 3.0	0.5 - 0.8	2.7 - 3.0	0.13 - 0.2	3.0 - 3.5	0.45 - 0.6	1.9 - 2.1	5.1 - 5.3	1.0-1.1	2.5 - 2.9	5.0 - 5.5	6.85 - 7.05	0.6-0.8	2.4-2.65
Date	AUP Discharge Criteria [0]	NES Soil human health criteria for commercial / industrial land use [1]	Inhalation pathway [2] (outdoor)	Inhalation pathway [2] (indoor)	Non-volcanic Background [3]	Max	23/07/2018	24/07/2018	2/07/2018	2/07/2018	2/07/2018	6/07/2018	6/07/2018	6/07/2018	24/07/2018	25/07/2018	10/07/2018	10/07/2018	6/07/2018	6/07/2018	6/07/2018	12/07/2018	13/07/2018	13/07/2018	16/07/2018	12/07/2018	18/07/2018
Lab ID							2019525.3	2020257.4	2009174.15	2009174.17	2009174.18	2012478.2	2012478.4	2012478.5	2020257.5	2021090.5	2013217.1	2013217.5	2011994.16	2011994.2	2011994.25	2014707.3 / 2014713	2015346.3	2015346.8	2016128.1	2014707.5/ 2014713	2017470.1
Geological unit							Fill - sandy gravel	Marine sediment - silt	Fill - sandy gravel	Fill - sandy gravel	Fill - clayey silt	Fill - sandy gravel	Fill - silty sand, with gravel	Fill - silty sand, shells	Fill - sandy gravel	Fill - gravelly silt	Fill - sand and gravel	Fill - marine sediments	Fill - gravelly silt	Fill - marine sediments	Fill - marine sediments	Fill - silty gravel	Fill - silt, gasworks waste	Fill - marine sediments	Fill - marine sediments	Fill - clayey silt with sand	Fill - sandy silt with gravel
TOC (g/100g dry weight)							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.18	0.53	-	-
Metals and metaloids (totals)																											
Arsenic	100	70	-	-	12	36	36	-	3	3	-	< 2	5	6	< 2	-	16	7	6	3	-	10	11	-	-	5	< 2
Cadmium	7.5	1,300	-	-	0.65	0.57	0.42	-	0.22	< 0.10	-	< 0.10	< 0.10	< 0.10	< 0.10	-	< 0.10	< 0.10	0.23	< 0.10	-	0.36	< 0.10	-	-	< 0.10	< 0.10
Chromium	400	NL	-	-	55	300	28	-	27	17	-	50	5	6	23	-	300	15	23	18	-	30	19	-	-	13	13
Copper	325	NL	-	-	45	240	44	-	113	27	-	63	3	3	46	-	39	22	240	20	-	94	72	-	-	12	12
Lead	250	3,300	-	-	65	**1620**	74	-	47	135	-	2	26	9.8	28	-	**850**	11.1 #1	**320**	11.1	-	**1,620**	**280**	-	-	54	7.4
Mercury	0.75	4,200	-	-	0.45	**4.3**	< 0.10	-	0.1	0.34	-	< 0.10	< 0.10	0.6	< 0.10	-	-	-	0.39	< 0.10	-	**1.41**	0.62	-	-	< 0.10	< 0.10
Nickel	105	6,000 [4]	-	-	35	**210**	78	-	**133**	11	-	**210**	5	4	**109**	-	28	56 #1	41	10	-	44	47	-	-	9	16
Zinc	400	400,000 [4]	-	-	180	**560**	74	-	191	74	-	55	28	28	92	-	80	60	**560**	46	-	330	200	-	-	31	46
Total Cyanide	1,500 [4]	1,500 [4]	-	-	<LD	40	-	-	-	1.05	-	-	0.6	-	-	-	-	-	-	-	-	-	0.25	-	-		
Tributyltin																											
Dibutyltin	250 [5]	250 [5]	-	-	<LD	0.033	-	-	-	-	-	< 0.005	-	-	-	-	-	-	0.033	-	-	-	-	-	-		-
Monobutlytin	-	-	-	-	<LD	0.077	-	-	-	-	-	< 0.007	-	-	-	-	-	-	0.077	-	-	-	-	-	-		-
Tributyltin	250 [5]	250 [5]	-	-	<LD	0.025	-	-	-	-	-	< 0.004	-	-	-	-	-	-	0.025	-	-	-	-	-	-		-
Triphenyltin	-	-	-	-	<LD	0	-	-	-	-	-	< 0.003	-	-	-	-	-	-	< 0.003	-	-	-	-	-	-		-
Asbestos																											
FA/AF % (weight/weight)	-	0.001% [6]	-	-	<LD	0.001	ND	-	<0.001	-	-	ND	-	-	<0.001	-	ND	-	<0.001	-	-	0.001	-	-	-	ND	
ACM % (weight/weight)	-	0.05% [6]	-	-	<LD	0	ND	-	ND	-	-	ND	-	-	ND	-	ND	-	ND	-	-	ND	-	-	-	ND	
Asbestos form	-	-	-	-	-	0	ND	-	Chrysotile, loose fibres	-	-	ND	-	-	Chrysotile, loose fibres	-	ND	-	Chrysotile, loose fibres	-	-	Chrysotile, loose fibres	-	-	-	ND	
Polyaromatic Hydrocarbons																											
1-Methylnaphthalene	730 [5]	730 [5]	-	-	<LD	9.3	1.11	-	0.036	< 0.014	-	< 0.011	9.3	-	< 0.012	-	2.6	< 0.013	0.024	3	-	0.58	3.6	-	-	0.018	0.176
2-Methylnaphthalene	3000 [5]	3000 [5]	-	-	<LD	3.4	1.34	-	0.036	< 0.014	-	< 0.011	2.2	-	< 0.012	-	1.57	< 0.013	0.029	3.4	-	0.81	0.57	-	-	< 0.014	< 0.015
Perylene	-	-	-	-	<LD	5.8	5	-	0.014	0.024	-	< 0.011	0.017	-	0.027	-	5.8	0.027	0.013	0.018	-	2.7	0.107	-	-	< 0.014	< 0.015
Benzo[a]pyrene Potency Equivalency Factor	-	35	-	-	<LD	48	23	-	< 0.03	0.08	-	< 0.03	0.09	-	0.08	-	48	< 0.04	< 0.03	< 0.04	-	23	0.76	-	-	0.04	< 0.04
Acenaphthylene	-	-	-	-	<LD	3.1	1.14	-	< 0.012	< 0.014	-	< 0.011	0.134	-	< 0.012	-	3.1	< 0.013	< 0.012	0.062	-	0.067	< 0.015	-	-	< 0.014	< 0.015
Acenaphthene	-	-	-	-	<LD	6.8	0.29	-	< 0.012	< 0.014	-	< 0.011	0.44	-	< 0.012	-	4.1	< 0.013	< 0.012	0.22	-	1.07	0.52	-	-	< 0.014	< 0.015
Anthracene	-	-	-	-	<LD	11.3	2.6	-	< 0.012	0.02	-	< 0.011	0.096	-	0.019	-	7.1	< 0.013	< 0.012	< 0.013	-	2.7	0.22	-	-	< 0.014	< 0.015
Benzo[a]anthracene	-	-	-	-	<LD	65	10.1	-	0.032	0.07	-	< 0.011	0.064	-	0.065	-	65	0.016	< 0.012	< 0.013	-	9.5	0.57	-	-	0.024	< 0.015
Benzo[a]pyrene (BAP)	20	35	NL	1000 (surface); NL (1-4m); NL (>4m)	<LD	20	15	-	0.013	0.051	-	< 0.011	0.063	-	0.061	-	10.6	< 0.013	0.02	< 0.013	-	17.8	0.48	-	-	0.031	< 0.015
Benzo[b]fluoranthene + Benzo[j]fluoranthen	-	-	-	-	<LD	89	20	-	0.019	0.067	-	< 0.011	0.074	-	0.074	-	89	0.021	0.023	0.027	-	11	0.62	-	-	0.041	< 0.015
Benzo[e]pyrene	-	-	-	-		48	12	-	0.021	0.044	-	< 0.011	0.045	-	0.042	-	48	< 0.013	0.03	0.024	-	12.6	0.31	-	-	0.035	< 0.015
Benzo[g,h,i]perylene	-	-	-	-	<LD	48	16.3	-	0.013	0.047	-	< 0.011	0.049	-	0.037	-	48	0.021	0.043	< 0.013	-	12	0.31	-	-	< 0.014	< 0.015
Benzo[k]fluoranthene	-	-	-	-	<LD	35	8.4	-	0.012	0.042	-	< 0.011	0.036	-	0.017	-	35	< 0.013	< 0.012	< 0.013	-	3.2	0.27	-	-	< 0.014	< 0.015
Chrysene	-	-	-	-	<LD	77	13.1	-	0.027	0.077	-	< 0.011	< 0.013	-	0.055	-	77	< 0.013	< 0.012	< 0.013	-	8.6	0.44	-	-	0.014	< 0.015
Dibenzo[a,h]anthracene	-	-	-	-	<LD	10.7	2.5	-	< 0.012	< 0.014	-	< 0.011	< 0.013	-	< 0.012	-	10.7	< 0.013	< 0.012	< 0.013	-	1.89	0.068	-	-	< 0.014	< 0.015
Fluoranthene	-	-	-	-	<LD	260	20	-	0.016	0.196	-	< 0.011	0.25	-	0.154	-	260	0.074	0.018	0.063	-	6.1	1.72	-	-	0.029	< 0.015
Fluorene	-	-	-	-	<LD	7.1	0.59	-	0.022	< 0.014	-	< 0.011	0.57	-	< 0.012	-	1.13	< 0.013	< 0.012	< 0.013	-	0.72	0.78	-	-	< 0.014	< 0.015
Indeno(1,2,3-c,d)pyrene	-	-	-	-	<LD	45	18.7	-	< 0.012	0.043	-	< 0.011	0.053	-	0.03	-	45	0.017	0.026	< 0.013	-	8.4	0.4	-	-	< 0.014	< 0.015
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [8]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	**5.5**	**1.42**	-	< 0.06	< 0.07	-	< 0.06	**1.03**	-	< 0.06	-	**5.5**	< 0.07	< 0.06	**0.46**	-	**1.88**	**1.07**	-	-	< 0.07	< 0.08
Phenanthrene	-	-	-	-	<LD	280	10.7	-	0.046	0.041	-	< 0.011	0.75	-	0.045	-	280	0.071	< 0.012	0.128	-	9	1.67	-	-	< 0.014	< 0.015
Pyrene	7.9 [7]	NL [8]	NL	NL	<LD	**210**	**23**	-	0.063	0.21	-	< 0.011	0.43	-	0.161	-	**210**	0.053	0.026	0.088	-	**16.5**	1.56	-	-	0.044	< 0.015
Polychlorinated Biphenyls																											
Total PCB (Sum of 35 congeners)	1.2 [1]	1.2	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	< 0.4	-	-	-	-	-	-	-	-		-
Total Petroleum Hydrocarbons																											
C7 - C9	(5,200) [7]	(500) (surface); (500) (1-4m); (12,000) (>4m) [8]	5,200 (surface); 9,800 (1-4m); 12,000 (>4m)	NL	<LD	1030	-	< 9	29	< 8	12	-	1,030	520	< 8	133	270	< 8	< 8	84	< 9	< 8	104	< 8	< 9	< 9	< 9
C10 - C14	(9,200) [7]	(1,700) (surface); (2,200) (1-4m); (3,400) (>4m) [8]	7,800 (surface); 10,000 (1-4m); 16,000 (>4m)	NL	<LD	5600	-	< 20	200	< 20	158	-	2,600	740	< 20	1,490	840	< 20	< 20	1,820	< 20	< 20	**2,800**	< 20	< 20	< 20	35
C15 - C36	NL [7]	NL [8]	NL	NL	<LD	10100	-	< 40	430	< 40	99	-	1,170	105	75	1,430	3,600	< 40	1,000	880	< 40	440	1,730	< 40	< 40	< 40	< 40
Total hydrocarbons (C7 - C36)	-	-	-	-	<LD	15700	-	< 70	660	< 70	270	-	4,800	1,370	75	3,100	4,700	< 70	1,000	2,800	< 70	440	4,700	< 70	< 70	< 70	< 70
Suspected Product									Weathered all ranges		Weathered Diesel		Weathered Petrol/Kerosene/ Diesel/Light Fuel Oil	Weathered Petrol/Kerosene/ Diesel/Light Fuel Oil		Weathered Diesel	Weathered Lube Oil/Heavy End		Weathered Light Fuel Oil/Lube Oil	Weathered Diesel		Weathered Lube Oil/Heavy End	Weathered Kerosene				
BTEX in VOC																											
Benzene	0.029 [7]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m) [8]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m)	480 (surface); 610 (1-4m); 860 (>4m)	<LD	**0.9**	-	< 0.3	< 0.17	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.18	< 0.3	< 0.3	< 0.3
Ethylbenzene	7.2 [7]	(200) (surface); (300) (1-4m); (450) (>4m) [8]	200 (surface); 300 (1-4m); 450 (>4m)	6,200 (surface); NL (1-4m); NL (>4m)	<LD	4.8	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	0.3	< 0.3	< 0.3	< 0.3	< 0.3
Toluene	6.0 [7]	(270) (surface); (480) (1-4m); (790) (>4m) [8]	270 (surface); 550 (1-4m); 790 (>4m)	NL	<LD	0.4	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
m&p-Xylene	3.7 [7]	(200) (surface); (420) (1-4m); (590) (>4m) [8]	200 (surface); 420 (1-4m); 590 (>4m)	NL	<LD	2	-	< 0.5	< 0.4	< 0.5	< 0.6	-	< 0.5	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	< 0.5	< 0.5	< 0.6	< 0.4	< 0.6	< 0.5	< 0.5
o-Xylene					<LD	0.6	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Halogenated Aliphatics																											
cis-1,2-Dichloroethene	20 [5]	20 [5]	-	-	<LD	5.1	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	1.1	< 0.3	< 0.3	< 0.3
Tetrachloroethene (tetrachloroethylene)	400 [5]	400 [5]	-	-	<LD	37	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	17.4	< 0.3	< 0.3	< 0.3
Trichloroethene (trichloroethylene)	19 [5]	19 [5]	-	-	<LD	4.8	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	**2.4**	< 0.3	< 0.3	< 0.3
Vinyl chloride	175	175	-	-	<LD	**1.4**	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	**1.4**	< 0.3	< 0.3
Monoaromatic Hydrocarbons																											
n-Butylbenzene	58,000 [5]	58,000 [5]	-	-	<LD	22	-	< 0.3	< 0.3	< 0.3	< 0.3	-	9	4.6	-	1.1	-	< 0.3	-	2.6	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
tert-Butylbenzene	120,000 [5]	120,000 [5]	-	-	<LD	0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	0.3	0.3	-	< 0.3	-	< 0.3	-	0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Isopropylbenzene (Cumene)	9,900 [5]	9,900 [5]	-	-	<LD	44	-	< 0.3	< 0.3	< 0.3	< 0.3	-	7.9	5.2	-	1.3	-	< 0.3	-	4.5	< 0.3	< 0.3	10.4	< 0.3	< 0.3	< 0.3	0.3
4-Isopropyltoluene (p-Cymene)	-	-	-	-	<LD	0.8	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
n-Propylbenzene	24,000 [5]	24,000 [5]	-	-	<LD	117	-	< 0.3	0.3	< 0.3	< 0.3	-	25	14.5	-	2	-	< 0.3	-	12.7	< 0.3	< 0.3	5.5	< 0.3	< 0.3	< 0.3	0.9
sec-Butylbenzene	-	-	-	-	<LD	5.1	-	< 0.3	< 0.3	< 0.3	< 0.3	-	5.1	3.1	-	1.1	-	< 0.3	-	3.7	< 0.3	< 0.3	2.2	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trimethylbenzene	1,800 [5]	1,800 [5]	-	-	<LD	48	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trimethylbenzene	1,500 [5]	1,500 [5]	-	-	<LD	17.8	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.3	< 0.3	< 0.3	0.3	< 0.3	< 0.3	< 0.3	< 0.3
Other VOC																											
Carbon disulphide	3,500 [5]	3,500 [5]	-	-	<LD	0	-	< 0.3	< 0.05	< 0.05	< 0.06	-	< 0.05	< 0.05	-	< 0.3	-	< 0.17	-	< 0.17	< 0.19	< 0.3	< 0.3	< 0.18	< 0.3	< 0.3	< 0.3
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [8]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	**3.3**	-	< 0.3	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	-	< 0.3	-	< 0.3	-	< 0.6	< 0.6	< 0.3	< 0.4	< 0.3	< 0.3	< 0.3	< 0.3
Other SVOC (Beca BHs only)																											
4,4'-DDD	1,000 [1 (total DDT)]	1,000 [1 (total DDT)]	-	-	<LD	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	-	-	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	1,000 [5]	1,000 [5]	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
All results in mg/kg (except where otherwise stated)
NL = no limit
<LD = below level of laboratory detection
NC = not calculated due to insufficient values above laboratory detection

Assessment
Red text Human Health (COMMERCIAL) criteria exceeded
Bold text AUP criteria exceeded
Highlighted - above lab detection limit (excluding metals)
Non-volcanic background exceeded

0. Auckland Unitary Plan Permitted Activity Standards, Chapter E.30
1. National Environmental Standard - Soil Contamination Standard - commerical land use
2. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* INHALATION PATHWAY, sandy silt, various depths
3. Background concentrations of trace elements in Auckland soils (non-volcanic soils) Table E30.6.1.4.2 the AUP.
4. National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *Commercial/Industrial land use*
5. USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, composite worker, chronic effects
6. BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *commercial land use*
7. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Protection of Groundwater Quality,* sandy silt, contamination at <1m depth, groundwater at 2m depth.
8. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* ALL PATHWAYs, sandy silt, various depths
9. Duplicate soil sample recorded in table as analytical results provide useful vinyl chloride information.

Table 9.4 **Soil sampling results - Site 18 (not including the area of proposed apartment) (mg/kg)**

Test pits

Sample ID	AUP Discharge Criteria [0]	NES Soil human health criteria for commercial / industrial land use [1]	Inhalation pathway [2] (outdoor)	Inhalation pathway [2] (indoor)	Non-volcanic Background [3]	Max	TP101	TP101	TP102	TP103	TP103	Beca BH2	Beca BH2	Beca BH2	Beca BH2	Beca BH2	Beca BH3	Beca BH3	Beca BH3	Beca BH3	Beca BH3
Depth (m)							0.5	1.6	0.6	0.7	1.3	0.3-0.5	2.5-3.0	5	7	9	0.8	2.8-3.0	5.5	7	7 (dup) [9]	9
Date							29/06/2018	29/06/2018	29/06/2018	29/06/2018	29/06/2018	16/12/2011	16/12/2011	16/12/2011	16/12/2011	16/12/2011	17/12/2011	17/12/2011	17/12/2011	17/12/2011	17/12/2011	17/12/2011
Lab ID							2008130.7 / 2008135.7	2008130.8	2008130.12 / 2008135.12	2008130.16 / 2008135.16	2008130.14	-	-	-	-	-	-	-	-	-	-
Geological unit							Fill - sandy gravel	Fill - marine sediments	Fill - sand	Fill - sandy gravel	Fill - silty gravel	-	-	-	-	-	-	-	-	-	-
TOC (g/100g dry weight)							-	-				-	-	-	-	-	-	-	-	-	-
Metals and metaloids (totals)																					
Arsenic	100	70	-	-	12	36	3	9	9	< 2	6	10	17	5	9	3	8	< 2	2	9	< 2
Cadmium	7.5	1,300	-	-	0.65	0.57	0.22	< 0.10	< 0.10	< 0.10	0.25	0.4	0.44	< 0.10	< 0.10	< 0.10	0.34	0.1	< 0.10	< 0.10	< 0.10
Chromium	400	NL	-	-	55	300	43	5	4	48	18	27	23	14	19	10	45	11	16	16	17
Copper	325	NL	-	-	45	240	67	3	5	53	28	37	59	14	5	4	41	6	14	6	6
Lead	250	3,300	-	-	65	**1620**	165	8.5	23	10.6	66	114	162	6.6	7.8	8	310	22	6.1	7	6.7
Mercury	0.75	4,200	-	-	0.45	**4.3**	0.51	0.11	< 0.10	< 0.10	0.34	-	-	-	-	-	-	-	-	-	-
Nickel	105	6,000 [4]	-	-	35	**210**	**177**	13	6	**168**	39	32	47	14	8	< 2	51	5	14	8	7
Zinc	400	400,000 [4]	-	-	180	**560**	210	250	54	64	121	370	260	48	39	6	350	220	44	34	34
Total Cyanide	1,500 [4]	1,500 [4]	-	-	<LD	40	-	1.5	-	< 0.10	-	0.13	0.26	< 0.10	< 0.10	< 0.10	40	0.3	< 0.10	< 0.10	< 0.10
Tributyltin																					
Dibutyltin	250 [5]	250 [5]	-	-	<LD	0.033	-	< 0.005	-	-	-	-	-	-	-	-	-	-	-	-	-
Monobutyltin	-	-	-	-	<LD	0.077	-	< 0.007	-	-	-	-	-	-	-	-	-	-	-	-	-
Tributyltin	250 [5]	250 [5]	-	-	<LD	0.025	-	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-
Triphenyltin	-	-	-	-	<LD	0	-	< 0.003	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos																					
FA/AF % (weight/weight)	-	0.001% [6]	-	-	<LD	0.001	<0.001	-	<0.001	ND	-	-	-	-	-	-	-	-	-	-	-
ACM % (weight/weight)	-	0.05% [6]	-	-	<LD	0	ND	-	ND	ND	-	-	-	-	-	-	-	-	-	-	-
Asbestos form	-	-	-	-	-	0	Chrysotile, loose fibres	-	Chrysotile, loose fibres	ND	-	-	-	-	-	-	-	-	-	-	-
Polyaromatic Hydrocarbons																					
1-Methylnaphthalene	730 [5]	730 [5]	-	-	<LD	9.3	< 0.011	< 0.013	< 0.012	1.78	3.3										
2-Methylnaphthalene	3000 [5]	3000 [5]	-	-	<LD	3.4	< 0.011	< 0.013	0.012	1.33	3	< 0.8	1.8	< 0.8	< 0.9	< 0.9	< 0.7	< 0.8	< 0.7	< 0.9	< 0.9
Perylene	-	-	-	-	<LD	5.8	0.014	< 0.013	0.014	4.8	2.9										
Benzo[a]pyrene Potency Equivalency Factor	-	35	-	-	<LD	48	0.06	0.04	< 0.03	32	17.8	< 2.9	< 3.2	< 2.9	< 3.4	< 3.4	< 8	< 3	< 2.6	< 3.2	< 3.2
Acenaphthylene	-	-	-	-	<LD	3.1	0.012	< 0.013	< 0.012	0.86	0.53	< 0.8	< 0.9	< 0.8	< 0.9	< 0.9	< 0.7	< 0.8	< 0.7	< 0.9	< 0.9
Acenaphthene	-	-	-	-	<LD	6.8	< 0.011	< 0.013	< 0.012	6.8	5	< 0.8	< 0.9	< 0.8	< 0.9	< 0.9	0.9	< 0.8	< 0.7	< 0.9	< 0.9
Anthracene	-	-	-	-	<LD	11.3	< 0.011	< 0.013	< 0.012	11.3	8.9	< 0.8	< 0.9	< 0.8	< 0.9	< 0.9	< 0.7	< 0.8	< 0.7	< 0.9	< 0.9
Benzo[a]anthracene	-	-	-	-	<LD	65	0.041	0.043	0.014	21	13	< 0.8	< 0.9	< 0.8	< 0.9	< 0.9	3.4	< 0.8	< 0.7	< 0.9	< 0.9
Benzo[a]pyrene (BAP)	20	35	NL	1000 (surface); NL (1-4m); NL (>4m)	<LD	20	0.037	0.028	< 0.012	20	11.2	< 1.5	< 1.7	< 1.5	< 1.8	< 1.8	< 1.4	< 1.6	< 1.4	< 1.7	< 1.7
Benzo[b]fluoranthene + Benzo[j]fluoranthen	-	-	-	-	<LD	89	0.052	0.037	0.013	25	14.7	< 1.5	< 1.7	< 1.5	< 1.8	< 1.8	7.3	< 1.6	< 1.4	< 1.7	< 1.7
Benzo[e]pyrene	-	-	-	-		48	0.049	0.026	0.022	10.1	6										
Benzo[g,h,i]perylene	-	-	-	-	<LD	48	0.085	0.018	0.022	9.4	6	< 1.5	< 1.7	< 1.5	< 1.8	< 1.8	5.6	< 1.6	< 1.4	< 1.7	< 1.7
Benzo[k]fluoranthene	-	-	-	-	<LD	35	0.037	0.021	< 0.012	9.7	5.6	< 1.5	< 1.7	< 1.5	< 1.8	< 1.8	3.6	< 1.6	< 1.4	< 1.7	< 1.7
Chrysene	-	-	-	-	<LD	77	0.041	0.03	0.012	19.2	10.8	< 0.8	< 0.9	< 0.8	< 0.9	< 0.9	4.5	< 0.8	< 0.7	< 0.9	< 0.9
Dibenzo[a,h]anthracene	-	-	-	-	<LD	10.7	< 0.011	< 0.013	< 0.012	3.2	2	< 1.5	< 1.7	< 1.5	< 1.8	< 1.8	1.4	< 1.6	< 1.4	< 1.7	< 1.7
Fluoranthene	-	-	-	-	<LD	260	0.051	0.113	0.015	50	33	< 0.8	0.8	< 0.8	< 0.9	< 0.9	7.2	< 0.8	< 0.7	< 0.9	< 0.9
Fluorene	-	-	-	-	<LD	7.1	< 0.011	0.032	< 0.012	7.1	5.4	< 0.8	< 0.9	< 0.8	< 0.9	< 0.9	< 0.7	< 0.8	< 0.7	< 0.9	< 0.9
Indeno(1,2,3-c,d)pyrene	-	-	-	-	<LD	45	0.065	0.022	0.012	18.8	8	< 1.5	< 1.7	< 1.5	< 1.8	< 1.8	4.8	< 1.6	< 1.4	< 1.7	< 1.7
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [8]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	**5.5**	< 0.06	< 0.07	< 0.06	0.22	**0.44**	< 0.8	< 0.9	< 0.8	< 0.9	< 0.9	< 0.7	< 0.8	< 0.7	< 0.9	< 0.9
Phenanthrene	-	-	-	-	<LD	280	0.017	< 0.013	0.014	34	26	< 0.8	< 0.9	< 0.8	< 0.9	< 0.9	1.3	< 0.8	< 0.7	< 0.9	< 0.9
Pyrene	7.9 [7]	NL [8]	NL	NL	<LD	**210**	0.057	0.185	0.054	**47**	**30**	< 0.8	0.9	< 0.8	< 0.9	< 0.9	6.1	< 0.8	< 0.7	< 0.9	< 0.9
Polychlorinated Biphenyls																					
Total PCB (Sum of 35 congeners)	1.2 [1]	1.2	-	-	<LD	0	-	-	-	-	-										
Total Petroleum Hydrocarbons																					
C7 - C9	(5,200) [7]	(500) (surface); (500) (1-4m); (12,000) (>4m) [8]	5,200 (surface); 9,800 (1-4m); 12,000 (>4m)	NL	<LD	1030	< 8	9	< 8	< 8	13	< 10	< 11	< 10	< 11	47	15	< 11	< 9	< 10	< 11
C10 - C14	(9,200) [7]	(1,700) (surface); (2,200) (1-4m); (3,400) (>4m) [8]	7,800 (surface); 10,000 (1-4m); 16,000 (>4m)	NL	<LD	5600	< 20	220	54	190	660	133	200	< 20	< 30	< 30	990	< 30	< 20	< 20	< 30
C15 - C36	NL [7]	NL [8]	NL	NL	<LD	10100	128	300	570	2400	2600	155	860	< 40	< 50	< 50	3400	< 50	< 40	< 40	< 50
Total hydrocarbons (C7 - C36)	-	-	-	-	<LD	15700	128	530	620	2600	3200	290	1060	< 70	< 80	< 80	4400	< 80	< 70	< 70	< 80
Suspected Product								Weathered Diesel	Weathered Light Fuel Oil	Weathered Fuel Oil/Heavy End	Weathered Kerosene/Fuel Oil/Heavy End										
BTEX in VOC																					
Benzene	0.029 [7]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m) [8]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m)	480 (surface); 610 (1-4m); 860 (>4m)	<LD	**0.9**	-	< 0.3	< 0.17	< 0.15	< 0.18	< 0.5	< 0.6	< 0.5	< 0.6	< 0.6	< 0.4	< 0.5	< 0.4	< 0.5	< 0.6
Ethylbenzene	7.2 [7]	(200) (surface); (300) (1-4m); (450) (>4m) [8]	200 (surface); 300 (1-4m); 450 (>4m)	6,200 (surface); NL (1-4m); NL (>4m)	<LD	4.8	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.9	< 1.1	< 0.9	< 1.2	< 1.2	< 0.8	< 1.0	< 0.8	< 1.0	< 1.1
Toluene	6.0 [7]	(270) (surface); (480) (1-4m); (790) (>4m) [8]	270 (surface); 550 (1-4m); 790 (>4m)	NL	<LD	0.4	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.5	< 0.6	< 0.5	< 0.6	< 0.6	< 0.4	< 0.5	< 0.4	< 0.5	< 0.6
m&p-Xylene	3.7 [7]	(200) (surface); (420) (1-4m); (590) (>4m) [8]	200 (surface); 420 (1-4m); 590 (>4m)	NL	<LD	2	-	< 0.5	< 0.4	< 0.3	< 0.4	< 0.5	< 0.6	< 0.5	< 0.6	< 0.6	< 0.4	< 0.5	< 0.4	< 0.5	< 0.6
o-Xylene					<LD	0.6	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.5	< 0.6	< 0.5	< 0.6	< 0.6	< 0.4	< 0.5	< 0.4	< 0.5	< 0.6
Halogenated Aliphatics																					
cis-1,2-Dichloroethene	20 [5]	20 [5]	-	-	<LD	5.1	-	< 0.3	< 0.3	< 0.3	3.3	< 0.5	< 0.6	< 0.5	< 0.6	< 0.6	0.7	< 0.5	5.1	< 0.5	< 0.6
Tetrachloroethene (tetrachloroethylene)	400 [5]	400 [5]	-	-	<LD	37	-	< 0.3	< 0.3	1.3	0.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	3.4	< 1.0	37	< 1.0	< 1.0
Trichloroethene (trichloroethylene)	19 [5]	19 [5]	-	-	<LD	4.8	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.5	< 0.6	< 0.5	< 0.6	< 0.6	0.6	< 0.5	4.8	< 0.5	< 0.6
Vinyl chloride	175	175	-	-	<LD	**1.4**	-	< 0.3	< 0.3	< 0.3	< 0.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**1.1**	< 1.0
Monoaromatic Hydrocarbons																					
n-Butylbenzene	58,000 [5]	58,000 [5]	-	-	<LD	22	-	< 0.3	< 0.3	< 0.3	< 0.3										
tert-Butylbenzene	120,000 [5]	120,000 [5]	-	-	<LD	0.3	-	< 0.3	< 0.3	< 0.3	< 0.3										
Isopropylbenzene (Cumene)	9,900 [5]	9,900 [5]	-	-	<LD	44	-	< 0.3	< 0.3	< 0.3	< 0.3										
4-Isopropyltoluene (p-Cymene)	-	-	-	-	<LD	0.8	-	< 0.3	< 0.3	< 0.3	< 0.3										
n-Propylbenzene	24,000 [5]	24,000 [5]	-	-	<LD	117	-	< 0.3	< 0.3	< 0.3	< 0.3										
sec-Butylbenzene	-	-	-	-	<LD	5.1	-	0.4	< 0.3	< 0.3	< 0.3										
1,2,4-Trimethylbenzene	1,800 [5]	1,800 [5]	-	-	<LD	48	-	< 0.3	< 0.3	< 0.3	< 0.3										
1,3,5-Trimethylbenzene	1,500 [5]	1,500 [5]	-	-	<LD	17.8	-	< 0.3	< 0.3	< 0.3	< 0.3										
Other VOC																					
Carbon disulphide	3,500 [5]	3,500 [5]	-	-	<LD	0	-	< 0.05	< 0.05	< 0.05	< 0.05										
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [2]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	**3.3**	-	< 0.3	< 0.3	< 0.3	< 0.3										
Other SVOC (Beca BHs only)																					
4,4'-DDD	1,000 [1 (total DDT)]	1,000 [1 (total DDT)]	-	-	<LD	1.9	-	-	-	-	-	< 1.5	< 1.7	< 1.5	< 1.8	< 1.8	1.9	< 1.6	< 1.4	< 1.7	< 1.7
Carbazole	-	-	-	-	<LD	0	-	-	-	-	-	< 1.5	< 1.7	< 1.5	< 1.8	< 1.8	< 1.4	< 1.6	< 1.4	< 1.7	< 1.7
Dibenzofuran	1,000 [5]	1,000 [5]	-	-	<LD	0	-	-	-	-	-	< 1.5	< 1.7	< 1.5	< 1.8	< 1.8	< 1.4	< 1.6	< 1.4	< 1.7	< 1.7

Notes:
All results in mg/kg (except where otherwise stated)
NL = no limit
<LD = below level of laboratory detection
NC = not calculated due to insufficient values above laboratory detection

Assessment
Red text Human Health (COMMERCIAL) criteria exceeded
Bold text AUP criteria exceeded
Highlighted - above lab detection limit (excluding metals)
Non-volcanic background exceeded

0. Auckland Unitary Plan Permitted Activity Standards, Chapter E.30
1. National Environmental Standard - Soil Contamination Standard - commerical land use
2. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria
Commercial/industrial use INHALATION PATHWAY, sandy silt, various depths
3. Background concentrations of trace elements in Auckland soils (non-volcanic soils) Table E30.6.1.4.2 the AUP.
4. National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *Commercial/Industrial land use*
5. USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, composite worker, chronic effects
6. BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *commercial land use*
7. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria
Protection of Groundwater Quality, sandy silt, contamination at <1m depth, groundwater at 2m depth.
8. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria
Commercial/industrial use ALL PATHWAYS, sandy silt, various depths
9. Duplicate soil sample recorded in table as analytical results provide useful vinyl chloride information.

Table 9.5 **Soil sampling results - Site 18 (area of proposed apartment only) (mg/kg)**

Sample ID								CBH201	CBH201	CBH201	CBH209	CBH209	GBH102	GBH102	GBH102	GBH103	GBH103	GBH103	GBH103	Beca BH1	Beca BH1	Beca BH1	Beca BH1	Beca BH1	Beca BH1	Beca BH1
Depth (m)								0.7 - 1.0	2.1 - 2.6	5.0 - 5.2	0.2 - 0.6	1.4 - 1.9	0.8 - 1.0	2.4 - 2.5	5.0 - 5.1	0.15-0.25	1.3 - 1.55	4.1 - 4.5	5.45 - 5.7	0.3	2.5-2.75	4	4 (dup)	5.2	7	9
Date								6/07/2018	6/07/2018	6/07/2018	3/07/2018	3/07/2018	11/07/2018	11/07/2018	11/07/2018	4/07/2018	4/07/2018	4/07/2018	4/07/2018	15/12/2011	15/12/2011	15/12/2011	16/12/2011	15/12/2011	15/12/2011	15/12/2011
Lab ID	AUP Discharge Criteria [0]	NES Soil human health criteria for commercial / industrial land use [1]	NES Soil human health criteria for high-density residential land use [1b]	Inhalation pathway [2] (outdoor)	Inhalation pathway [2] (indoor)	Non-volcanic Background [3]	Max	2011994.3	2011994.9	2011994.14	2009906.1	2009906.3	2013973.23	2013973.18	2013973.2	2010645.3	2010644.26	2010644.23	2010644.22	-	-	-	-	-	-	-
Geological unit								Fill - silty gravel	Fill - sand with minor gravel	Fill - clayey silt	Fill - silty gravel	Fill - gravelly sand	Fill - gravelly sand	Fill - Sandy silt, shells	Tauranga Group Clay	Fill - sandy gravel	Fill - sandy silt	Fill - sandy silt, gravel, shells	Fill - sandy silt, gravel, shells	-	-	-	-	-	-	-
Metals and metaloids (totals)																										
Arsenic	100	70	45	-	-	12	13	< 2	6	-	6	6	7	5	-	-	6	6	-	5	6	10	13	7	10	< 2
Cadmium	7.5	1,300	230	-	-	0.65	4.2	< 0.10	< 0.10	-	0.12	< 0.10	0.26	< 0.2	-	-	< 0.10	< 0.10	-	0.21	0.21	4.2	1.0	0.36	< 0.10	< 0.10
Chromium	400	NL	NL	-	-	55	57	34	10	-	23	5	23	5	-	-	4	16	-	19	29	57	57	19	20	7
Copper	325	NL	NL	-	-	45	**480**	44	17	-	41	5	69	< 4	-	-	2	15	-	64	66	220	480	29	4	5
Lead	250	3,300	500	-	-	65	**400**	4.2	88	-	135	23	**400**	12.9	-	-	32	19.8	-	146	97	97	112	42	6.7	5
Mercury	0.75	4,200	1,000	-	-	0.45	0.59	< 0.10	0.1	-	0.26	< 0.10	0.59	< 0.2	-	-	< 0.10	0.55	-	-	-	-	-	-	-	-
Nickel	105	6,000 [4]	1,200 [4b]	-	-	35	**143**	**143**	19	-	67	6	58	< 4	-	-	5	12	-	48	29	132	101	45	7	3
Zinc	400	400,000 [4]	60,000 [4b]	-	-	180	280	38	76	-	137	25	280	21	-	-	20	58	-	270	87	260	260	79	34	9
Total Cyanide	0.9 [10]	1,500 [4]	300 [4b]	-	-	<LOR	0.19	-	-	-	-	-	-	-	-	-	-	-	-	0.19	0.19	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Tributyltin																										
Dibutyltin	-	250 [5]	19 [5b]	-	-	<LOR	0	< 0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monobutyltin	-	-	-	-	-	<LOR	0	< 0.007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tributyltin	-	250 [5]	19 [5b]	-	-	<LOR	0	< 0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triphenyltin	-	-	-	-	-	<LOR	0	< 0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos																										
FA/AF % (weight/weight)	-	0.001% [6]	0.001% [6b]	-	-	<LOR	0	ND	-	-	<0.001	-	<0.001	-	-	ND	-	-	-	-	-	-	-	-	-	-
ACM % (weight/weight)	-	0.05% [6]	0.04% [6b]	-	-	<LOR	0	ND	-	-	ND	-	ND	-	-	ND	-	-	-	-	-	-	-	-	-	-
Asbestos form	-	-	-	-	-	-		ND	-	-	Chrysotile, loose fibres	-	Chrysotile, loose fibres	-	-	ND	-	-	-	-	-	-	-	-	-	-
Polyaromatic Hydrocarbons																										
1-Methylnaphthalene	-	730 [5]	180 [5b]	-	-	<LOR	23	< 0.011	8.6	-	0.081	22	0.071	7.7	-	-	23	0.02	-							
2-Methylnaphthalene	-	3000 [5]	240 [5b]	-	-	<LOR	12.2	< 0.011	12.2	-	0.104	1.69	0.075	7.9	-	-	7.1	< 0.013	-	< 0.7	< 0.9	< 1.0	5.7	< 0.9	< 0.9	< 0.8
Perylene						<LOR	0.07	< 0.011	< 0.012	-	0.069	0.06	0.034	< 0.013	-	-	0.03	0.07	-							
Benzo[a]pyrene Potency Equivaler	-	-	-	-	-	<LOR	340.9	< 0.03	0.08	-	0.22	0.19	0.22	0.03	-	-	0.26	0.23	-	< 3.3	< 8.5	< 22.5	340.9	< 3.2	< 3.2	< 3
Benzo[a]pyrene Toxic Equivalence	-	35	24	-	-	<LOR	0.26	< 0.03	0.08	-	0.22	0.19	0.22	0.03	-	-	0.26	0.23	-							
Acenaphthylene	-	-	-	-	-	<LOR	4.4	< 0.011	0.187	-	0.034	0.41	0.021	< 0.013	-	-	0.53	< 0.013	-	< 0.7	< 0.9	4.4	1.4	< 0.9	< 0.9	< 0.8
Acenaphthene	-	-	-	-	-	<LOR	43	< 0.011	0.43	-	< 0.012	1.07	< 0.014	0.158	-	-	1.56	< 0.013	-	< 0.7	< 0.9	< 1.0	43	< 0.9	< 0.9	< 0.8
Anthracene	-	-	-	-	-	<LOR	166	< 0.011	0.058	-	0.016	0.24	0.03	< 0.013	-	-	0.4	0.018	-	< 0.7	1.3	12.7	166	< 0.9	< 0.9	< 0.8
Benzo[a]anthracene	-	-	-	-	-	<LOR	200	< 0.011	0.038	-	0.098	0.125	0.102	0.014	-	-	0.22	0.129	-	0.9	4.3	13.3	200	< 0.9	< 0.9	< 0.8
Benzo[a]pyrene (BAP)	20	35	24	NL	1000 (surface); NL (1-4m); NL (>4m)	<LOR	**132**	< 0.011	0.058	-	0.162	0.132	0.148	0.027	-	-	0.192	0.179	-	< 1.4	3.7	8.7	**132**	< 1.7	< 1.7	< 1.6
Benzo[b]fluoranthene + Benzo[j]fl	-	-	-	-	-	<LOR	126	< 0.011	0.054	-	0.21	0.157	0.139	0.019	-	-	0.22	0.196	-	< 1.4	3.4	8.3	126	< 1.7	< 1.7	< 1.6
Benzo[e]pyrene		-	-	-	-		0.166	< 0.011	0.025	-	0.157	0.166	0.091	< 0.013	-	-	0.165	0.126	-							
Benzo[g,h,i]perylene	-	-	-	-	-	<LOR	75	< 0.011	0.033	-	0.188	0.188	0.153	0.013	-	-	0.126	0.104	-	< 1.4	2.6	6.1	75	< 1.7	< 1.7	< 1.6
Benzo[k]fluoranthene	-	-	-	-	-	<LOR	60	< 0.011	0.019	-	0.059	0.045	0.055	< 0.013	-	-	0.08	0.055	-	< 1.4	2	5.1	60	< 1.7	< 1.7	< 1.6
Chrysene	-	-	-	-	-	<LOR	156	< 0.011	0.02	-	0.107	0.07	0.1	< 0.013	-	-	0.137	0.129	-	1	3.5	10.2	156	< 0.9	< 0.9	< 0.8
Dibenzo[a,h]anthracene	-	-	-	-	-	<LOR	20	< 0.011	< 0.012	-	< 0.012	< 0.013	0.02	< 0.013	-	-	< 0.012	< 0.013	-	< 1.4	< 1.7	< 1.9	20	< 1.7	< 1.7	< 1.6
Fluoranthene	-	-	-	-	-	<LOR	480	< 0.011	0.134	-	0.2	0.5	0.22	0.064	-	-	0.79	0.27	-	2.3	9.1	34	480	< 0.9	< 0.9	< 0.8
Fluorene	-	-	-	-	-	<LOR	53	< 0.011	0.74	-	< 0.012	1.36	0.016	0.45	-	-	1.92	< 0.013	-	< 0.7	< 0.9	5.3	53	< 0.9	< 0.9	< 0.8
Indeno(1,2,3-c,d)pyrene	-	-	-	-	-	<LOR	72	< 0.011	0.029	-	0.157	0.13	0.148	0.015	-	-	0.108	0.112	-	< 1.4	1.8	4.1	72	< 1.7	< 1.7	< 1.6
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [8]	63 (surface); 83 (1-4m); (130) (>4m) [8]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LOR	**11.3**	< 0.06	**0.85**	-	< 0.06	**2.4**	< 0.07	0.32	-	-	< 0.06	< 0.07	-	< 0.7	< 0.9	1.3	**11.3**	< 0.9	< 0.9	< 0.8
Phenanthrene	-	-	-	-	-	<LOR	370	< 0.011	0.64	-	0.072	1.47	0.108	0.48	-	-	2.1	0.059	-	1.4	2.8	31	370	< 0.9	< 0.9	< 0.8
Pyrene	7.9 [7]	NL [8]	(1,600) (surface); NL (1-4m); NL (>4m) [9]	NL	NL	<LOR	**420**	< 0.011	0.16	-	0.24	0.65	0.22	0.078	-	-	1.15	0.39	-	2.6	10.4	31	**420**	< 0.9	< 0.9	< 0.8
Polychlorinated Biphenyls							0																			
Total PCB (Sum of 35 congeners)	1.2 [1]	1.2	0.33	-	-	<LOR	0	< 0.4	-	-	-	-	-	-	-	-	< 0.4	-	-							
Total Petroleum Hydrocarbons																										
C7 - C9	(5,200) [7]	(500) (surface); (500) (1-4m); (12,000) (>4m) [8]	(500) (surface); (500) (1-4m); (3,800) (>4m) [9]	5,200 (surface); 9,800 (1-4m); 12,000 (>4m)	NL	<LOR	2200	< 8	670	< 10	< 8	2,200	< 8	1,500	< 9	-	510	< 8	-	< 9	< 11	750	400	< 19	< 11	< 10
C10 - C14	(9,200) [7]	(1,700) (surface); (2,200) (1-4m); (3,400) (>4m) [8]	(510) (surface); (670) (1-4m); (1,000 (>4m) [9]	7,800 (surface); 10,000 (1-4m); 16,000 (>4m)	NL	<LOR	6200	< 20	1,690	< 20	58	5,500	35	1,500	< 20	-	6,200	< 20	-	< 20	< 30	2,100	2,100	< 40	< 30	< 20
C15 - C36	NL [7]	NL [8]	NL [9]	NL	NL	<LOR	17100	< 40	1,010	< 40	360	2,900	780	790	< 40	-	3,800	< 40	-	45	< 50	17,100	5,800	< 80	< 50	< 40
Total hydrocarbons (C7 - C36)	-	-	-	NL	-	<LOR	20000	< 70	3,400	< 70	420	10,600	810	3,800	< 70	-	10,500	< 70	-	< 70	< 80	20,000	8,800	< 140	< 80	< 70
Suspected Product									Weathered Diesel and Mono aromatic hydrocarbons		Weathered Diesel/Heavy End	Weathered Turpentine/Petrol/Kerosene	Weathered Fuel Oil/Lube Oil	Weathered Petrol/Turpentine		-	Weathered Turpentine/Diesel/Heavy End										
BTEX in VOC																										
Benzene	0.029 [7]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m) [8]	1.1 (surface); 1.9 (1-4m); 2.4 (>4m) [9]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m)	480 (surface); 610 (1-4m); 860 (>4m)	<LOR	**0.6**	-	**0.6**	< 0.3	-	< 0.19	< 0.3	< 0.19	< 0.3	-	-	< 0.19	< 0.4	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
Ethylbenzene	7.2 [7]	(200) (surface); (300) (1-4m); (450) (>4m) [8]	(59) (surface); (92) (1-4m); (140) (>4m) [9]	200 (surface); 300 (1-4m); 450 (>4m)	6,200 (surface); NL (1-4m); NL (>4m)	<LOR	0.4	-	0.4	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 0.8	< 1.1	< 12	< 10	< 1.1	< 1.1	< 1.0
Toluene	6.0 [7]	(270) (surface); (480) (1-4m); (790) (>4m) [8]	(82) (surface); (170) (1-4m); (240) (>4m) [9]	270 (surface); 550 (1-4m); 790 (>4m)	NL	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
m&p-Xylene	3.7 [7]	(200) (surface); (420) (1-4m); (590) (>4m) [8]	(59) (surface); (130) (1-4m); (180) (>4m) [9]	200 (surface); 420 (1-4m); 590 (>4m)	NL	<LOR	0.6	-	0.6	< 0.6	-	< 0.4	< 0.5	< 0.4	< 0.5	-	-	< 0.4	< 0.7	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
o-Xylene						<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
Halogenated Aliphatics																										
cis-1,2-Dichloroethene	5 [10]	20 [5]	31 [5b]	-	-	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
Tetrachloroethene (tetrachloroeth	0.2 [10]	400 [5]	81 [5b]	-	-	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 1.0	< 1.0	< 6	< 5	< 1.0	< 1.0	< 1.0
Trichloroethene (trichloroethylene	5 [10]	19 [5]	4.1 [5b]	-	-	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 0.4	< 0.6	< 6	< 5	< 0.6	< 0.6	< 0.5
Vinyl chloride	-	175	0.59 [5b]	-	-	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4	< 1.0	< 1.0	< 6	< 5	< 1.0	< 1.0	< 1.0
Monoaromatic Hydrocarbons																										
n-Butylbenzene	-	58,000 [5]	3,900 [5b]	-	-	<LOR	14.7	-	4.4	< 0.3	-	14.7	< 0.3	2	< 0.3	-	-	< 0.3	< 0.4							
tert-Butylbenzene	-	120,000 [5]	7,800 [5b]	-	-	<LOR	0.5	-	0.3	< 0.3	-	0.5	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4							
Isopropylbenzene (Cumene)	-	9,900 [5]	1,900 [5b]	-	-	<LOR	20	-	8.4	< 0.3	-	20	< 0.3	3.6	< 0.3	-	-	< 0.3	< 0.4							
4-Isopropyltoluene (p-Cymene)	-	-	-	-	-	<LOR	0.9	-	0.9	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4							
n-Propylbenzene	-	24,000 [5]	3,800 [5b]	-	-	<LOR	62	-	21	< 0.3	-	62	< 0.3	7.1	< 0.3	-	-	< 0.3	< 0.4							
sec-Butylbenzene	-	-	-	-	-	<LOR	10	-	3.3	< 0.3	-	10	< 0.3	1.8	< 0.3	-	-	< 0.3	< 0.4							
1,2,4-Trimethylbenzene	-	1,800 [5]	300 [5b]	-	-	<LOR	0.6	-	0.6	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4							
1,3,5-Trimethylbenzene	-	1,500 [5]	270 [5b]	-	-	<LOR	0	-	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4							
Other VOC																										
Carbon disulphide		3,500 [5]	770 [5b]	-	-	<LOR	0	-	< 0.14	< 0.3	-	< 0.05	< 0.3	< 0.19	< 0.3	-	-	< 0.05	< 0.07							
Naphthalene	0.28 [7]	(210) (surface); (270) (1-4m); (420) (>4m) [8]	63 (surface); 83 (1-4m); (130) (>4m) [9]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LOR	0	-	< 0.6	< 0.6	-	< 0.3	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.4							
Other SVOC (Beca BHs only)																										
4,4'-DDD	1,000 [1 (total DDT)]	1,000 [1 (total DDT)]	240 [1 (total DDT)]	-	-	<LOR	0	-	-	-	-	-	-	-	-	-	-	-	-	< 1.4	< 1.7	< 1.9	< 1.6	< 1.7	< 1.7	< 1.6
Carbazole	-	-	-	-	-	<LOR	36	-	-	-	-	-	-	-	-	-	-	-	-	< 1.4	< 1.7	3	36	< 1.7	< 1.7	< 1.6
Dibenzofuran	-	1,000 [5]	73 [5b]	-	-	<LOR	32	-	-	-	-	-	-	-	-	-	-	-	-	< 1.4	< 1.7	3.4	32	< 1.7	< 1.7	< 1.6

Notes:
All results in mg/kg (except where otherwise stated)
NL = no limit
<LOR = below level of laboratory detection
NC = not calculated due to insufficient values above laboratory detection

Assessment:
Human Health (COMMERCIAL) criteria exceeded
red text Human Health (HIGH DENSITY RESIDENTIAL) criteria exceeded
bold text AUP criteria exceeded
highlighted - above lab detection limit (excluding metals)
non-volcanic background exceeded

0. Auckland Unitary Plan Permitted Activity Standards, Chapter E.30
1.National Environmental Standard - Soil Contamination Standard - commerical land use
1b. National Environmental Standard - Soil Contamination Standard - high density residential land use
2. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* INHALATION PATHWAY, sandy silt, various depths
3. Background concentrations of trace elements in Auckland soils (non-volcanic soils) Table E30.6.1.4.2 the AUP.
4.National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *Commercial/Industrial land use*
4b. National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *High density residential land use*
5. USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, composite worker, chronic effects
5b. USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, resident, chronic effects
6. BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *commercial land use*
6b. BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *high density residential land use*
7. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Protection of Groundwater Quality,* sandy silt, contamination at <1m depth, groundwater at 2m depth.
8. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* ALL PATHWAYs, sandy silt, various depths
9. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Residential use* ALL PATHWAYs, sandy silt, various depths
10. Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines for the protection of the environment and human health (residential values)

Table 9.6 **Soil sampling results - Orams current facility - 2008 (mg/kg)**

Sample ID	AUP Discharge Criteria [0]	NES Soil human health criteria for commercial / industrial land use [1]	Inhalation pathway [10] (outdoor)	Inhalation pathway [10] (indoor)	Non-volcanic Background	Max	BH1	BH1	BH1	BH2	BH2	BH2	BH2	BH2	BH2	BH3	BH3	BH3	BH3	BH4	BH4	BH4	BH4	BH4	BH4	BH5	BH5	BH5	BH5
Depth (m)							0.5	2.5	4	0.25	1.5	3	4	4.5	5	0.25	0.5	1.5	2.5	0.25	0.5	2.5	4	5.5	6	0.5	1	2	3.5
Date							10/12/2007	10/12/2007	10/12/2007	11/12/2007	11/12/2007	11/12/2007	11/12/2007	11/12/2007	11/12/2007	11/12/2007	11/12/2007	11/12/2007	11/12/2007	15/12/2007	15/12/2007	15/12/2007	15/12/2007	15/12/2007	15/12/2007	15/12/2007	15/12/2007	15/12/2007	15/12/2007	15/12/2007
Lab ID							623289.2	623289.6	623289.8	623289.11	623289.14	623289.17	623289.19	623289.2	623289.21	623289.22	623289.23	623289.25	623289.27	623897.1	623897.2	623897.5	623897.8	623897.11	623897.12	623897.17	623897.18	623897.2	623897.23
Geological unit																													
Metals and metaloids (totals)																													
Antimony	-	-	-	-	-	6.6	6.6						< 0.40	-	-	-	3.9	-	-	< 0.40	-	< 0.40	-	< 0.40	-	-	< 0.40		
Arsenic	100	70	-	-	12	96	< 2.0	3.3	-	-	96	4.5	7	-	4.6	-	7.7	9.2	7.2	6.5	3	7.3	5.7	5.6	5.3	4.9	< 2.0	-	-
Beryllium	-	-	-	-	-		< 0.20				-		0.55		-		2.4	-	-	0.78	-	0.46	-	0.42	-	-	0.94	-	-
Cadmium	7.5	1,300	-	-	0.65	6.5	0.1	< 0.10	-	-	6.5	0.19	< 0.10	-	< 0.10	-	1.6	0.38	< 0.10	< 0.10	< 0.10	< 0.10	0.14	< 0.10	0.12	0.17	0.15	-	-
Chromium	400	NL	-	-	55	94	7	22	-	-	55	19	12	-	18	-	49	19	14	13	17	14	21	13	15	22	24	-	-
Copper	325	NL	-	-	45	6800	9.4	60	-	-	**6800**	51	6.4	-	17	-	140	41	45	93	36	21	25	7	8.9	31	31	-	-
Lead	250	3,300	-	-	65	15000	**2600**	39	-	-	15000	28	8.2	-	27	-	**700**	**370**	230	21	31	7.6	49	7.4	8.1	20	7.4	-	-
Mercury	0.75	4,200	-	-	0.45	58	< 0.10	0.47	-	-	**58**	0.32	0.13	-	0.25	-	0.35	0.34	0.12	0.34	**0.98**	< 0.10	**0.87**	< 0.10	< 0.10	0.28	< 0.10	-	-
Nickel	105	6,000 [3]	-	-	35	210	24	13	-	-	55	16	17	-	18	-	83	39	37	34	22	19	22	6.3	6.9	30	28	-	-
Zinc	400	400,000 [3]	-	-	180	7000	85	110	-	-	**7000**	180	36	-	57	-	**620**	280	120	59	63	56	110	26	28	130	95	-	-
Total Cyanide	1,500 [3]	1,500 [3]	-	-	<LD	2.3	< 0.021	< 0.026	-	< 0.019	1.6	-	-	< 0.024	-	-	2.3	-	-	< 0.027	-	0.029	-	-	< 0.028	0.037	-	< 0.024	-
Polyaromatic Hydrocarbons																													
Acenaphthene	-	-	-	-	<LD	0.37	< 0.029	-	-	-	0.37	< 0.029	-	< 0.032	< 0.032	-	-	< 0.031	0.05	-	< 0.037	< 0.028	< 0.034	-	< 0.037	-	-	< 0.034	< 0.028
Acenaphthylene	-	-	-	-	<LD	0.68	< 0.029	-	-	-	0.68	< 0.029	-	< 0.032	< 0.032	-	-	< 0.031	0.036	-	< 0.037	< 0.028	0.062	-	< 0.037	-	-	< 0.034	< 0.028
Anthracene	-	-	-	-	<LD	2.2	< 0.029	-	-	-	2.2	< 0.029	-	< 0.032	< 0.032	-	-	0.059	< 0.033	-	< 0.037	< 0.028	0.17	-	< 0.037	-	-	< 0.034	< 0.028
Benzo[a]anthracene	-	-	-	-	<LD	7.7	< 0.029	-	-	-	7.7	0.031	-	< 0.032	0.048	-	-	0.22	0.038	-	0.058	< 0.028	0.4	-	< 0.037	-	-	< 0.034	< 0.028
Benzo[a]pyrene (BAP)	20	35	NL	1000 (surface); NL (1-4m); NL (>4m)	<LD	7	< 0.029	-	-	-	7	0.03	-	< 0.032	0.081	-	-	0.38	0.037	-	0.1	< 0.028	0.76	-	< 0.037	-	-	< 0.034	< 0.028
Benzo[b]fluoranthene + Benzo[j]fluoranthe	-	-	-	-	<LD	16	< 0.029	-	-	-	16	0.078	-	0.06	0.14	-	-	0.58	0.08	-	0.12	< 0.028	0.92	-	< 0.037	-	-	< 0.034	< 0.028
Benzo[g,h,i]perylene	-	-	-	-	<LD	5.7	< 0.029	-	-	-	5.7	0.031	-	0.038	0.076	-	-	0.35	0.055	-	0.11	< 0.028	0.72	-	< 0.037	-	-	< 0.034	< 0.028
Benzo[k]fluoranthene	-	-	-	-	<LD	4.8	< 0.029	-	-	-	4.8	< 0.029	-	< 0.032	0.034	-	-	0.27	0.035	-	0.07	< 0.028	0.51	-	< 0.037	-	-	< 0.034	< 0.028
Chrysene	-	-	-	-	<LD	8.3	< 0.029	-	-	-	8.3	0.039	-	0.033	0.095	-	-	0.41	0.055	-	0.13	< 0.028	0.81	-	< 0.037	-	-	< 0.034	< 0.028
Dibenzo[a,h]anthracene	-	-	-	-	<LD	2	< 0.029	-	-	-	2	< 0.029	-	< 0.032	< 0.032	-	-	0.12	< 0.033	-	< 0.037	< 0.028	0.21	-	< 0.037	-	-	< 0.034	< 0.028
Fluoranthene	-	-	-	-	<LD	17	< 0.029	-	-	-	17	0.072	-	0.056	0.14	-	-	0.61	0.13	-	0.2	< 0.028	1.4	-	< 0.037	-	-	< 0.034	< 0.028
Fluorene	-	-	-	-	<LD	0.83	< 0.029	-	-	-	0.83	< 0.029	-	< 0.032	< 0.032	-	-	< 0.031	0.056	-	< 0.037	< 0.028	< 0.034	-	< 0.037	-	-	< 0.034	< 0.028
Indeno(1,2,3-c,d)pyrene	-	-	-	-	<LD	4.4	< 0.029	-	-	-	4.4	< 0.029	-	< 0.032	0.052	-	-	0.25	< 0.033	-	0.065	< 0.028	0.52	-	< 0.037	-	-	< 0.034	< 0.028
Naphthalene	0.28 [9]	(210) (surface); (270) (1-4m); (420) (>4m) [2]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	0.92	< 0.15	-	-	-	0.92	< 0.15	-	< 0.16	< 0.16	-	-	< 0.16	< 0.17	-	< 0.19	< 0.14	< 0.17	-	< 0.19	-	-	< 0.17	< 0.14
Phenanthrene	-	-	-	-	<LD	9.8	< 0.029	-	-	-	9.8	0.048	-	< 0.032	0.052	-	-	0.23	0.13	-	0.061	< 0.028	0.47	-	< 0.037	-	-	< 0.034	< 0.028
Pyrene	7.9 [9]	NL [2]	NL	NL	<LD	16	< 0.029	-	-	-	16	0.075	-	0.066	0.15	-	-	0.72	0.12	-	0.24	< 0.028	1.8	-	< 0.037	-	-	< 0.034	< 0.028
1-Methylnaphthalene	-	-	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	-	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perylene	-	-	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor	-	35	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	-	35	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[e]pyrene		-	-	-		0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons																													
C7 - C9	(5,200) [9]	(500) (surface); (500) (1-4m); (12,000) (>4m) [2]	5,200 (surface); 9,800 (1-4m); 12,000 (>4m)	NL	<LD	340	-	-	< 8.0	-	-	-	< 8.0	< 9.4	-	< 8.0	15	-	-	-	-	-	-	-	-	-	-	-	< 8.4
C10 - C14	(9,200) [9]	(1,700) (surface); (2,200) (1-4m); (3,400) (>4m) [2]	7,800 (surface); 10,000 (1-4m); 16,000 (>4m)	NL	<LD	3500	-	-	< 20	-	-	-	< 20	< 20	-	< 20	1500	-	-	-	-	-	-	-	-	-	-	-	< 20
C15 - C36	NL [9]	NL [2]	NL	NL	<LD	9100	-	-	< 30	-	-	-	< 30	< 30	-	< 30	9100	-	-	-	-	-	-	-	-	-	-	-	< 30
Total hydrocarbons (C7 - C36)	-	-	-	-	<LD	11000	-	-	< 60	-	-	-	< 60	< 60	-	< 60	11000	-	-	-	-	-	-	-	-	-	-	-	< 60
BTEX in VOC																													
Benzene	0.029 [9]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m) [2]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m)	480 (surface); 610 (1-4m); 860 (>4m)	<LD	0.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	6.0 [9]	(270) (surface); (480) (1-4m); (790) (>4m) [2]	270 (surface); 550 (1-4m); 790 (>4m)	NL	<LD	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	7.2 [9]	(200) (surface); (300) (1-4m); (450) (>4m) [2]	200 (surface); 300 (1-4m); 450 (>4m)	6,200 (surface); NL (1-4m); NL (>4m)	<LD	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m&p-Xylene	3.7 [9]	(200) (surface); (420) (1-4m); (590) (>4m) [2]	200 (surface); 420 (1-4m); 590 (>4m)	NL	<LD	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene					<LD	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VOCS							-	-	-	-	-	-	-	-	-	-	-	-											
1,1,2,2-Tetrachloroethane	-	-	-	-		2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	-	-	-	-		0.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	-	-	-	-		0.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	58,000 [6]	58,000 [6]	-	-	<LD	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	120,000 [6]	120,000 [6]	-	-	<LD	0.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene (Cumene)	9,900 [6]	9,900 [6]	-	-	<LD	3.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Propylbenzene	24,000 [6]	24,000 [6]	-	-	<LD	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	-	-	-	-	<LD	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	1,800 [6]	1,800 [6]	-	-	<LD	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	1,500 [6]	1,500 [6]	-	-	<LD	3.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	0.28 [9]	(210) (surface); (270) (1-4m); (420) (>4m) [2]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	3.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
all results in mg/kg
NL = no limit
<LD = below level of laboratory detection
NC = not calculated due to insufficient values above laboratory detection

Assessment:
red text Human Health (COMMERCIAL) criteria exceeded
bold text AUP criteria exceeded
highlighted - above lab detection limit (excluding metals)
non-volcanic background exceeded

0 Auckland Unitary Plan Permitted Activity Standards, Chapter E.30
1 National Environmental Standard - Soil Contamination Standard - commerical land use
1b National Environmental Standard - Soil Contamination Standard - high density residential land use
2 Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* ALL PATHWAYs, sandy silt, various depths
3 National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *Commercial/Industrial land use*
3b National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *High density residential land use*
4 Interim Soil Gas Investigation Level (ASC NEPM)
5 BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *commercial land use*
5b BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *high density residential land use*
6 USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, composite worker, chronic effects
6b USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, resident, chronic effects
6c USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, outdoor worker, chronic effects
6d USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, indoor worker, chronic effects
7 Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Residential use* ALL PATHWAYs, sandy silt, various depths
8 National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - Residential *land use*
9 Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Protection of Groundwater Quality,* sandy silt, contamination at <1m depth, groundwater at 2m depth.
10 Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* INHALATION PATHWAY, sandy silt, various depths

Table 9.6 **Soil sampling results - Orams current facility - 2008 (mg/kg)**

Sample ID							BH5	BH6	BH6	BH6	BH7	BH7	BH7 1.5	BH7	BH7	BH8	BH8	BH8	BH8	BH9	BH9	BH9	BH9
Depth (m)							5	0.25	1	4.5	0.25	1	1.5	2.5	4	0.5	1	1.5	3	0.5	1.5	2.5	4.5
Date	AUP Discharge Criteria [0]	NES Soil human health criteria for commercial / industrial land use [1]	Inhalation pathway [10] (outdoor)	Inhalation pathway [10] (indoor)	Non-volcanic Background	Max	15/12/2007	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008
Lab ID							623897.26	626135.2	626135.4	626135.6	626135.8	626135.1	626135.11	626135.13	626135.16	626135.22	626135.23	626135.24	626135.27	626135.36	626135.38	626135.4	626135.44
Geological unit																							
Metals and metaloids (totals)																							
Antimony	-	-	-	-	-	6.6		< 0.40	1.3														
Arsenic	100	70	-	-	12	96	6.3	3.6	8.6	4.3	< 2.0	-	-	4.3	4.8	-	42	< 2.0	4.6	3.9	< 2.0	-	7.1
Beryllium	-	-	-	-	-		-	1.2	0.48														
Cadmium	7.5	1,300	-	-	0.65	6.5	0.11	0.11	0.55	< 0.10	0.28	-	-	< 0.10	0.15	-	1.5	< 0.10	0.11	0.2	0.1	-	< 0.10
Chromium	400	NL	-	-	55	94	21	26	94	24	58	-	-	24	23	-	15	8.7	14	43	35	-	23
Copper	325	NL	-	-	45	6800	25	120	130	25	170	-	-	33	34	-	260	12	27	310	87	-	18
Lead	250	3,300	-	-	65	15000	8.1	35	1000	56	**530**	-	-	16	12	-	4600	33	8.7	130	11	-	12
Mercury	0.75	4,200	-	-	0.45	58	0.11	0.16	< 0.10	**2.2**	0.53	-	-	< 0.10	< 0.10	-	**9.4**	< 0.10	< 0.10	0.21	< 0.10	-	0.14
Nickel	105	6,000 [3]	-	-	35	210	33	110	210	19	**210**	-	-	20	27	-	17	22	21	**150**	**160**	-	20
Zinc	400	400,000 [3]	-	-	180	7000	96	95	1300	64	170	-	-	74	100	-	**1300**	87	79	170	54	-	62
Total Cyanide	1,500 [3]	1,500 [3]	-	-	<LD	2.3	-	-	-	< 0.10	< 0.10	-	-	< 0.10	< 0.10	-	1.3	0.1	< 0.10	0.12	< 0.10	-	< 0.10
Polyaromatic Hydrocarbons																							
Acenaphthene	-	-	-	-	<LD	0.37	< 0.027	< 0.028	< 0.028	-	-	< 0.031	-	< 0.031	-	-	-	< 0.029	< 0.033	< 0.024	-	< 0.034	-
Acenaphthylene	-	-	-	-	<LD	0.68	< 0.027	< 0.028	< 0.028	-	-	< 0.031	-	< 0.031	-	-	-	< 0.029	< 0.033	< 0.024	-	< 0.034	-
Anthracene	-	-	-	-	<LD	2.2	< 0.027	< 0.028	< 0.028	-	-	< 0.031	-	< 0.031	-	-	-	< 0.029	< 0.033	0.038	-	< 0.034	-
Benzo[a]anthracene	-	-	-	-	<LD	7.7	< 0.027	< 0.028	< 0.028	-	-	0.037	-	< 0.031	-	-	-	0.17	< 0.033	0.17	-	< 0.034	-
Benzo[a]pyrene (BAP)	20	35	NL	1000 (surface); NL (1-4m); NL (>4m)	<LD	7	< 0.027	< 0.028	< 0.028	-	-	0.061	-	< 0.031	-	-	-	0.26	< 0.033	0.2	-	< 0.034	-
Benzo[b]fluoranthene + Benzo[j]fluoranthe	-	-	-	-	<LD	16	< 0.027	0.033	< 0.028	-	-	0.037	-	< 0.031	-	-	-	0.26	< 0.033	0.2	-	< 0.034	-
Benzo[g,h,i]perylene	-	-	-	-	<LD	5.7	< 0.027	< 0.028	< 0.028	-	-	0.065	-	< 0.031	-	-	-	0.24	< 0.033	0.19	-	< 0.034	-
Benzo[k]fluoranthene	-	-	-	-	<LD	4.8	< 0.027	0.028	< 0.028	-	-	0.032	-	< 0.031	-	-	-	0.1	< 0.033	0.12	-	< 0.034	-
Chrysene	-	-	-	-	<LD	8.3	< 0.027	< 0.028	< 0.028	-	-	0.039	-	< 0.031	-	-	-	0.18	< 0.033	0.18	-	< 0.034	-
Dibenzo[a,h]anthracene	-	-	-	-	<LD	2	< 0.027	< 0.028	< 0.028	-	-	< 0.031	-	< 0.031	-	-	-	0.09	< 0.033	0.1	-	< 0.034	-
Fluoranthene	-	-	-	-	<LD	17	< 0.027	0.042	< 0.028	-	-	0.042	-	< 0.031	-	-	-	0.4	< 0.033	0.35	-	< 0.034	-
Fluorene	-	-	-	-	<LD	0.83	< 0.027	< 0.028	< 0.028	-	-	< 0.031	-	< 0.031	-	-	-	0.15	< 0.033	< 0.024	-	< 0.034	-
Indeno(1,2,3-c,d)pyrene	-	-	-	-	<LD	4.4	< 0.027	< 0.028	< 0.028	-	-	0.043	-	< 0.031	-	-	-	0.23	< 0.033	0.18	-	< 0.034	-
Naphthalene	0.28 [9]	(210) (surface); (270) (1-4m); (420) (>4m) [2]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	0.92	< 0.14	< 0.14	< 0.14	-	-	0.23	-	0.25	-	-	-	< 0.15	< 0.17	< 0.12	-	< 0.17	-
Phenanthrene	-	-	-	-	<LD	9.8	< 0.027	< 0.028	< 0.028	-	-	< 0.031	-	0.042	-	-	-	0.32	< 0.033	0.1	-	< 0.034	-
Pyrene	7.9 [9]	NL [2]	NL	NL	<LD	16	< 0.027	0.052	< 0.028	-	-	0.052	-	< 0.031	-	-	-	0.4	< 0.033	0.41	-	< 0.034	-
1-Methylnaphthalene	-	-	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	-	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perylene	-	-	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene Potency Equivalency Facto	-	35	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	-	35	-	-	<LD	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo[e]pyrene		-	-	-		0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons																							
C7 - C9	(5,200) [9]	(500) (surface); (500) (1-4m); (12,000) (>4m) [2]	5,200 (surface); 9,800 (1-4m); 12,000 (>4m)	NL	<LD	340	-	< 8.4	-	-	190	< 9.2	42	< 9.1	< 8.7	< 8.6	70	52	< 9.7	< 8.0	< 8.3	-	< 8.1
C10 - C14	(9,200) [9]	(1,700) (surface); (2,200) (1-4m); (3,400) (>4m) [2]	7,800 (surface); 10,000 (1-4m); 16,000 (>4m)	NL	<LD	3500	-	< 20	-	-	950	< 20	< 20	26	< 20	< 20	420	970	< 20	< 20	< 20	-	< 20
C15 - C36	NL [9]	NL [2]	NL	NL	<LD	9100	-	< 30	-	-	1700	< 30	< 30	< 30	< 30	< 30	3000	430	< 30	< 30	< 30	-	< 30
Total hydrocarbons (C7 - C36)	-	-	-	-	<LD	11000	-	< 60	-	-	2800	< 60	< 60	< 60	< 60	< 60	3500	1500	< 60	< 60	< 60	-	< 60
BTEX in VOC																							
Benzene	0.029 [9]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m) [2]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m)	480 (surface); 610 (1-4m); 860 (>4m)	<LD	0.31	-	-	-	-	**0.31**	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	6.0 [9]	(270) (surface); (480) (1-4m); (790) (>4m) [2]	270 (surface); 550 (1-4m); 790 (>4m)	NL	<LD	0.17	-	-	-	-	0.17	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	7.2 [9]	(200) (surface); (300) (1-4m); (450) (>4m) [2]	200 (surface); 300 (1-4m); 450 (>4m)	6,200 (surface); NL (1-4m); NL (>4m)	<LD	1.7	-	-	-	-	1.7	-	-	-	-	-	-	-	-	-	-	-	-
m&p-Xylene	3.7 [9]	(200) (surface); (420) (1-4m); (590) (>4m) [2]	200 (surface); 420 (1-4m); 590 (>4m)	NL	<LD	2.1	-	-	-	-	2.1	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene					<LD	0.11	-	-	-	-	0.11	-	-	-	-	-	-	-	-	-	-	-	-
VOCS																							
1,1,2,2-Tetrachloroethane	-	-	-	-		2.7	-	-	-	-	< 1.0	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	-	-	-	-		0.23	-	-	-	-	< 0.20	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	-	-	-	-		0.23	-	-	-	-	< 0.20	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	58,000 [6]	58,000 [6]	-	-	<LD	4.8	-	-	-	-	4.8	-	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	120,000 [6]	120,000 [6]	-	-	<LD	0.48	-	-	-	-	< 0.20	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene (Cumene)	9,900 [6]	9,900 [6]	-	-	<LD	3.7	-	-	-	-	3.7	-	-	-	- [6]	-	-	-	-	-	-	-	-
n-Propylbenzene	24,000 [6]	24,000 [6]	-	-	<LD	9	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	-	-	-	-	<LD	5.9	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	1,800 [6]	1,800 [6]	-	-	<LD	25	-	-	-	-	25	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	1,500 [6]	1,500 [6]	-	-	<LD	3.7	-	-	-	-	3.7	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	0.28 [9]	(210) (surface); (270) (1-4m); (420) (>4m) [2]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	3.7	-	-	-	-	**3.7**	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
all results in mg/kg
NL = no limit
<LD = below level of laboratory detection
NC = not calculated due to insufficient values above laboratory detection

Assessment:
red text Human Health (COMMERCIAL) criteria exce
bold text AUP criteria exceeded
highlighted - above lab detection limit (excluding m
non-volcanic background exceeded

Auckland Unitary Plan Permitted Activity Standards, Chapter E.30
National Environmental Standard - Soil Contamination Standard - commerical land use
National Environmental Standard - Soil Contamination Standard - high density residential land use
Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* ALL PATHWAYs
National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *Commercial/Industric*
National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *High density resident*
Interim Soil Gas Investigation Level (ASC NEPM)
BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *commercial land use*
BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *high density residential land use*
USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, composite worker, chronic effects
USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, resident, chronic effects
USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, outdoor worker, chronic effects
USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, indoor worker, chronic effects
Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Residential use* ALL PATHWAYs, sandy silt,
National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - Residential *land use*
Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Protection of Groundwater Quality,* sandy
Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* INHALATION P

Table 9.6 **Soil sampling results - Orams current facility - 2008 (mg/kg)**

Sample ID	AUP Discharge Criteria [0]	NES Soil human health criteria for commercial / industrial land use [1]	Inhalation pathway [10] (outdoor)	Inhalation pathway [10] (indoor)	Non-volcanic Background	Max	BH10	BH10	BH10	BH10	BH10
Depth (m)							0.25	1	1.5	3	4.5
Date							12/01/2008	12/01/2008	12/01/2008	12/01/2008	12/01/2008
Lab ID							626135.49	626135.51	626135.52	626135.55	626135.58
Geological unit											
Metals and metaloids (totals)											
Antimony	-	-	-	-	-	6.6					
Arsenic	100	70	-	-	12	96	4.3	< 2.0	-	9.2	-
Beryllium	-	-	-	-	-						
Cadmium	7.5	1,300	-	-	0.65	6.5	0.13	0.16	-	0.17	-
Chromium	400	NL	-	-	55	94	7.3	12	-	20	-
Copper	325	NL	-	-	45	6800	8.4	13	-	22	-
Lead	250	3,300	-	-	65	15000	16	5.7	-	7.4	-
Mercury	0.75	4,200	-	-	0.45	58	< 0.10	0.13	-	0.13	-
Nickel	105	6,000 [3]	-	-	35	210	13	8.4	-	38	-
Zinc	400	400,000 [3]	-	-	180	7000	170	210	-	64	-
Total Cyanide	1,500 [3]	1,500 [3]	-	-	<LD	2.3	< 0.10	< 0.10	-	< 0.10	-
Polyaromatic Hydrocarbons											
Acenaphthene	-	-	-	-	<LD	0.37	< 0.033	-	-	-	-
Acenaphthylene	-	-	-	-	<LD	0.68	< 0.033	-	-	-	-
Anthracene	-	-	-	-	<LD	2.2	< 0.033	-	-	-	-
Benzo[a]anthracene	-	-	-	-	<LD	7.7	< 0.033	-	-	-	-
Benzo[a]pyrene (BAP)	20	35	NL	1000 (surface); NL (1-4m); NL (>4m)	<LD	7	< 0.033	-	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthe	-	-	-	-	<LD	16	< 0.033	-	-	-	-
Benzo[g,h,i]perylene	-	-	-	-	<LD	5.7	< 0.033	-	-	-	-
Benzo[k]fluoranthene	-	-	-	-	<LD	4.8	< 0.033	-	-	-	-
Chrysene	-	-	-	-	<LD	8.3	< 0.033	-	-	-	-
Dibenzo[a,h]anthracene	-	-	-	-	<LD	2	< 0.033	-	-	-	-
Fluoranthene	-	-	-	-	<LD	17	< 0.033	-	-	-	-
Fluorene	-	-	-	-	<LD	0.83	< 0.033	-	-	-	-
Indeno(1,2,3-c,d)pyrene	-	-	-	-	<LD	4.4	< 0.033	-	-	-	-
Naphthalene	0.28 [9]	(210) (surface); (270) (1-4m); (420) (>4m) [2]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	0.92	< 0.17	-	-	-	-
Phenanthrene	-	-	-	-	<LD	9.8	< 0.033	-	-	-	-
Pyrene	7.9 [9]	NL [2]	NL	NL	<LD	16	< 0.033	-	-	-	-
1-Methylnaphthalene	-	-	-	-	<LD	0	-	-	-	-	-
2-Methylnaphthalene	-	-	-	-	<LD	0	-	-	-	-	-
Perylene	-	-	-	-	<LD	0	-	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor	-	35	-	-	<LD	0	-	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	-	35	-	-	<LD	0	-	-	-	-	-
Benzo[e]pyrene		-	-	-		0	-	-	-	-	-
Total Petroleum Hydrocarbons											
C7 - C9	(5,200) [9]	(500) (surface); (500) (1-4m); (12,000) (>4m) [2]	5,200 (surface); 9,800 (1-4m); 12,000 (>4m)	NL	<LD	340	< 9.9	< 8.6	340	< 8.7	< 9.5
C10 - C14	(9,200) [9]	(1,700) (surface); (2,200) (1-4m); (3,400) (>4m) [2]	7,800 (surface); 10,000 (1-4m); 16,000 (>4m)	NL	<LD	3500	< 20	< 20	**3500**	< 20	< 20
C15 - C36	NL [9]	NL [2]	NL	NL	<LD	9100	< 30	< 30	1100	< 30	< 30
Total hydrocarbons (C7 - C36)	-	-	-	-	<LD	11000	< 60	< 60	5000	< 60	< 60
BTEX in VOC											
Benzene	0.029 [9]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m) [2]	3.6 (surface); 7.2 (1-4m); 9.3 (>4m)	480 (surface); 610 (1-4m); 860 (>4m)	<LD	0.31	-	-	< 0.10	-	-
Toluene	6.0 [9]	(270) (surface); (480) (1-4m); (790) (>4m) [2]	270 (surface); 550 (1-4m); 790 (>4m)	NL	<LD	0.17	-	-	< 0.10	-	-
Ethylbenzene	7.2 [9]	(200) (surface); (300) (1-4m); (450) (>4m) [2]	200 (surface); 300 (1-4m); 450 (>4m)	6,200 (surface); NL (1-4m); NL (>4m)	<LD	1.7	-	-	< 0.10	-	-
m&p-Xylene	3.7 [9]	(200) (surface); (420) (1-4m); (590) (>4m) [2]	200 (surface); 420 (1-4m); 590 (>4m)	NL	<LD	2.1	-	-	< 0.10	-	-
o-Xylene					<LD	0.11	-	-	< 0.10	-	-
VOCS											
1,1,2,2-Tetrachloroethane	-	-	-	-		2.7	-	-	2.7	-	-
2-Chlorotoluene	-	-	-	-		0.23	-	-	0.23	-	-
4-Chlorotoluene	-	-	-	-		0.23	-	-	0.23	-	-
n-Butylbenzene	58,000 [6]	58,000 [6]	-	-	<LD	4.8	-	-	2.1	-	-
tert-Butylbenzene	120,000 [6]	120,000 [6]	-	-	<LD	0.48	-	-	0.48	-	-
Isopropylbenzene (Cumene)	9,900 [6]	9,900 [6]	-	-	<LD	3.7	-	-	2	-	-
n-Propylbenzene	24,000 [6]	24,000 [6]	-	-	<LD	9	-	-	3.9	-	-
sec-Butylbenzene	-	-	-	-	<LD	5.9	-	-	5.9	-	-
1,2,4-Trimethylbenzene	1,800 [6]	1,800 [6]	-	-	<LD	25	-	-	< 0.20	-	-
1,3,5-Trimethylbenzene	1,500 [6]	1,500 [6]	-	-	<LD	3.7	-	-	< 0.20	-	-
Naphthalene	0.28 [9]	(210) (surface); (270) (1-4m); (420) (>4m) [2]	210 (surface); 270 (1-4m); 420 (>4m)	2,400 (surface); 8,700 (1-4m); NL (>4m)	<LD	3.7	-	-	0.38	-	-

Notes:
all results in mg/kg
NL = no limit
<LD = below level of laboratory detection
NC = not calculated due to insufficient values above laboratory detection

Assessment:
red text Human Health (COMMERCIAL) criteria exce
bold text AUP criteria exceeded
highlighted - above lab detection limit (excluding m
non-volcanic background exceeded

Auckland Unitary Plan Permitted Activity Standards, Chapter E.30
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National Environmental Standard - Soil Contamination Standard - high density residential land use
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Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Tier 1 soil acceptance criteria *Commercial/industrial use* INHALATION P

9.4 Groundwater results

9.4.1 General findings

9.4.1.1 Site 18

The results of the first groundwater sampling event at Site 18 are presented in Table 9.7, compared to the evaluation criteria discussed earlier. Full laboratory transcripts are presented in Appendix L. In general, the first groundwater monitoring round at Site 18 showed:

- The deep wells where the screen was below groundwater level, the only contaminants detected above laboratory limits of reporting were cyanide in the downgradient wells (CBH109 and GBH111), VOCs (in particular chlorinated solvents) in GBH109 in the southwest corner of the site and PFAS in GBH111.
- In shallow groundwater wells, where the screen straddles the water table and the monitoring wells extend to up to 5.0 m bgl, the following was measured:
  - Concentrations of lead and other metals were detected.
  - TPH was present at all locations except for GBH107 on the Beaumont Street boundary, GBH108 in the southeast of the site and CBH203 at the seawall. The highest concentrations of total TPH were recorded in Existing Well 1 in the southwest corner of the site.
  - PAH compounds were recorded above laboratory limits of reporting in all shallow wells except for CBH203 and GBH108.
  - BTEX and chlorinated solvents were detected in the southwest corner (CBH206).
  - Ethylbenzene was detected in the centre west (CBH204).
  - Other VOCs detected in shallow groundwater were generally monoaromatic hydrocarbons and were found at levels close to the limit of reporting in most shallow groundwater monitoring wells.
  - Substituted benzenes were detected in groundwater widely across the site. Concentrations in shallow groundwater were higher than in deeper groundwater.
  - PFAS was detected in four of the five samples tested, with the highest concentration occurring in the northern half of the site.
  - PCBs were not detected in any tested locations.
- Chromatographs from the groundwater testing results where TPH was detected indicate that the dissolved product types present in the groundwater are variable. A qualitative review of the chromatograms is summarised in Table 9.7. In the northeastern corner of the site (GBH103) the chromatographs suggest that weathered jet fuel was present. Weathered mineral turpentine signatures were noted in CBH206 in the south of Site 18 and in CBH209 in the northeast. It was inferred at that weathered kerosene was present in groundwater in CBH208. Remaining signatures of dissolved TPH in groundwater were either weathered diesel or weathered petrol.

9.4.1.2 Orams existing site

Six rounds of groundwater sampling have been completed from 2008 to 2018 from three to four monitoring wells spread across the current Orams facility. The results (Table 9.8) indicated the following:

- No SPH was recorded in the monitoring wells although a product sheen was noted in MW3 (northwest corner) following installation.

- TPH was detected in the northeast (MW1) and the northwest (MW3) sampling locations at low concentrations. Recent samples results from MW3 did not detect TPH above laboratory limits of reporting.
- Metals, particularly zinc and cyanide were detected in groundwater.
- BTEX compounds were detected in all locations during the 2008 monitoring rounds but detected in any monitoring wells in subsequent events.
- Other VOCs were detected only in MW1 and MW3 along the northern boundary with Site 18 in 2008 (VOCs were not included in the analysis suite in subsequent sampling events until the most recent monitoring event). MW1 and MW3 contained detectable VOCs such as cumene, propylbenzene such as is seen on Site 18. Chlorinated solvents were not detected in any of the groundwater sampling locations at any time. However, it is noted that none of the monitoring wells are installed at depth on the Orams site, maximum 6 m bgl with long screen length (i.e. potentially diluting any chlorinated solvent contamination).
- Sulphate concentrations were recorded in all three wells monitored in the recent sampling event, up to a maximum of 2,200 mg/L.

9.4.2 Comparison to evaluation criteria

The groundwater sampling results are compared to the evaluation criteria presented in Section 9.1 in the following sections.

9.4.2.1 Protection of human health

The concentrations recorded in groundwater do not exceed the acceptance criteria based on an inhalation pathway risk from groundwater sources to either indoor or outdoor receptors.

9.4.2.2 Environmental protection

A summary of the groundwater data that exceeds the water quality guidelines for marine water at 80% protection level is presented in Figure 11A.

- Marine water quality guidelines for chlorinated solvents, aromatic hydrocarbons and naphthalene were exceeded in the southwest corner of Site 18. Benzene, ethylbenzene, toluene, xylene, DCE, VC cumene and naphthalene were recorded at concentrations in shallow groundwater at CBH206 and DCE, PCE, TCE and VC were recorded in deeper groundwater in GBH109 above the guideline values. Cumene was also recorded above the guideline in shallow groundwater in Existing Well 1.
- Zinc concentrations were recorded in MW2 (centre of the current Orams facility) above the 80% A&NZ 2018 Guidelines for marine water quality during most sampling events. Copper was also present in the sample from MW2 at a concentration above the guideline on two occasions and in MW4 during the most recent round only.
- PAH compounds were detected at concentrations above the relevant guidelines at various locations across Site 18 (not on the Orams existing site).
- Cumene was recorded at concentrations above the marine quality guideline value in shallow groundwater monitoring wells across the Site 18 – CBH207, CBH209 and GBH103 on the eastern side of the site and CBH204 near the seawall.
- Cyanide concentrations exceeded the AUP PA in wells across the site. Cyanide was not detected in the deep upgradient wells but was detected above the A&NZ 2018 Guidelines for water quality in the deep downgradient wells. Cyanide was detected in the shallow wells in upgradient locations and detected at concentrations above the A&NZ 2018 Guidelines for water quality in downgradient wells.

PFAS compounds were detected in all six of the groundwater samples tested but all were below the WA DER (2017) 80% protection level values.

9.4.2.3 Property effects

Sulphate and pH results for groundwater have been compared to values in Table 3.3 of the NZS 3101.2:2006 for concrete structures. A summary of the groundwater data that exceeds the NZS values is presented in Figure 11B. Shallow groundwater in the centre west of Site 18 (CBH203 and CBH202) and in monitoring wells across the Orams existing site contained concentrations of sulphate that place it in the XA2 range. Shallow groundwater upgradient location southeast (CBH107) contained concentrations of sulphate that place it in the XA1 range.

The requirements for concrete subject to aggressive groundwater attack are presented in Section 3 of NZS 3101.2:2006. The strength and protection of in-ground concrete structures such as piles supporting proposed Building B3 and underground services will need to be considered during detailed design.

No quantitative assessment of hydrocarbon contamination on property such as water supply pipes has been completed. Due the presence of SPH onsite, barrier pipe materials will be required to be used.

9.4.3 Salinity

The salinity of the groundwater, as measured by the chloride concentrations, indicates the following:

- All deep groundwater wells (GBH102, GBH109, GBH110 and GBH111) contained elevated chloride concentrations.
- In the shallow groundwater, the chloride concentrations generally increased towards the harbour, with the highest concentration in CBH203, MW3 and MW4.

Chloride concentrations in groundwater are presented in Figure 11C.

The data compliments the ground water level monitoring, confirming the ingress of seawater occurs, and illustrating as the water level data does, that effects are noted closest to the harbour boundary and decrease in an eastward direction.

Table 9.7 **Groundwater sampling results - Site 18 (mg/L)**

Sample ID	Assessment Criteria				Max	GBH102	GBH103	GBH104	GBH106	GBH107	GBH108	GBH109	GBH110	GBH111	CBH201	CBH202	CBH203	CBH204	CBH205	CBH206	CBH207	CBH208	CBH209	Existing MW1
Date	**A&NZ Guidelines marine water 80% protection of species [1]**	**Groundwater acceptance criteria inhalation pathway [2]**	**Maximum of background range: Auckland non-volcanic aquifers [3]**	**Corrosivity for classification of chemical attack of concrete [4]**		3/08/2018	6/08/2018	3/08/2018	1/08/2018	6/08/2018	26/07/2018	6/08/2018	3/08/2018	6/08/2018	25/07/2018	6/08/2018	26/07/2018	25/07/2018	30/07/2018	1/08/2018	26/07/2018	30/07/2018	3/08/2018	14/08/2018
Lab ID						2026369.2	2027205.4	2026369.3	2024974.2	2027205.1	2021746.3	2027205.3	2026369.1	2027205.5	2021090.9	2027205.2	2021746.1	2021090.10	2023317.1	2024974.1	2021746.20	2023317.20	2026369.4	2031679.4
pH				6.5	8	7.6	7.2	7.3	7.4	6.6	7.1	7.7	7.8	8	7.6	7.6	7.6	7.4	7.2	6.9	7	7.3	7.2	7.5
Electrical Conductivity (EC)	-	-	-	-	3380	1,566	167.3	321	110.2	115.3	89.5	849	1,651	629	183.9	2,120	3,380	139.4	99.9	414	80.6	142.2	87.1	2,880
Total Dissolved Solids (TDS)	-	-	-	-	23000	9,000	1,060	1,950	690	890	520	5,200	9,700	3,600	1,030	13,500	23,000	820	620	2,900	480	920	560	19,100
Chloride		-	-	-	10600	5,200	169	680	105	55	44	2,700	5,400	1,650	300	6,600	10,600	145	50	1,000	44	66	30	9,600
Sulphate	-	-	-	XA1 200-600 XA2 600-3000	1220	96	67	64	2.5	420	< 0.5	126	129	58	4.5	780	1,220	1.8	1.1	32	< 0.5	< 0.5	0.8	-
Metals and metaloids																								
Dissolved Arsenic	0.270 [UR]	-	0.0101	-	0.006	0.006	< 0.004	< 0.004	0.0012	< 0.0010	< 0.0010	< 0.004	0.005	< 0.004	0.0013	< 0.004	< 0.02	< 0.0010	< 0.0010	< 0.005	< 0.0010	0.0013	< 0.0010	< 0.004
Dissolved Cadmium	0.036	-	-	-	0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.00005	< 0.00005	< 0.00005	< 0.0002	0.0002	< 0.0002	< 0.00005	< 0.0002	< 0.0010	< 0.00005	< 0.00005	< 0.00010	< 0.00005	< 0.00005	< 0.00005	< 0.0002
Dissolved Chromium	0.0906/ 0.085	-	<0.0005	-	0.0014	0.0014	< 0.0010	< 0.0010	< 0.0005	< 0.0005	< 0.0005	< 0.0010	< 0.0010	< 0.0010	< 0.0005	< 0.0010	< 0.010	< 0.0005	< 0.0005	0.0012	< 0.0005	< 0.0005	< 0.0005	< 0.0010
Dissolved Copper	0.008	-	0.001	-	0.003	0.003	< 0.0010	< 0.0010	< 0.0005	< 0.0005	< 0.0005	< 0.0010	0.0014	< 0.0010	< 0.0005	< 0.0010	< 0.010	0.0021	< 0.0005	< 0.0010	< 0.0005	< 0.0005	< 0.0005	< 0.0010
Dissolved Lead	0.012	-	0.0008	-	0.0035	< 0.0010	0.0035	< 0.0010	0.00012	< 0.00010	< 0.00010	< 0.0010	< 0.0010	< 0.0010	0.00061	< 0.0010	< 0.002	< 0.00010	0.00019	0.0006	0.00016	0.00012	0.00142	< 0.0010
Dissolved Mercury	0.0014	-	-	-	0	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008
Dissolved Nickel	0.56 [A]	-	0.03	-	0.014	0.014	< 0.007	< 0.007	< 0.0005	0.0016	< 0.0005	< 0.007	< 0.007	< 0.007	< 0.0005	< 0.007	< 0.010	< 0.0005	< 0.0005	< 0.0010	< 0.0005	< 0.0005	< 0.0005	<0.007
Dissolved Zinc	0.043	-	0.055	-	0.008	0.008	< 0.004	0.007	< 0.0010	0.0017	< 0.0010	< 0.004	< 0.004	< 0.004	< 0.0010	< 0.004	< 0.02	0.0058	< 0.0010	< 0.002	< 0.0010	0.0015	< 0.0010	< 0.004
Total Cyanide	0.014	-	-	-	0.154	< 0.02	0.08	0.06	0.004	**0.023**	0.0084	**0.03**	< 0.02	**0.03**	0.0062	**0.02**	**0.025 #1**	**0.029**	**0.015**	**0.154**	0.0084	**0.015**	**0.095**	< 0.02
Polycyclic Aromatic Hydrocarbons																								
Acenaphthene	-	-	-	-	0.00165	< 0.00010	0.00045	0.00151	0.00141	< 0.00010	0.00013	< 0.00010	< 0.00010	< 0.00010	0.00035	0.00056	< 0.00010	0.00014	0.00165	0.00105	0.00023	0.00027	0.0007	0.00014
Acenaphthylene	-	-	-	-	0.00024	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0001	0.00018	0.00024	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Anthracene	0.0001 [UR]	-	-	-	0.0008	< 0.00010	< 0.00010	**0.0008**	**0.00016**	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	**0.00015**	< 0.00010	< 0.00010	**0.00029**	**0.00051**	< 0.00010	< 0.00010	**0.00064**	< 0.00010
Benzo[a]anthracene	-	-	-	-	0.00026	< 0.00010	< 0.00010	0.00023	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00017	< 0.00010	< 0.00010	< 0.00010	0.00011	< 0.00010	< 0.00010	0.00026	< 0.00010
Benzo[a]pyrene (BAP)	0.0001 [UR]	S / S	-	-	0.00014	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	**0.00014**	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	-	-	-	0.0002	< 0.00010	< 0.00010	0.00014	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.0002	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00015	0.00018
Benzo[g,h,i]perylene	-	-	-	-	0.00015	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00015
Benzo[k]fluoranthene	-	-	-	-	0.00012	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00012	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Chrysene	-	-	-	-	0.00021	< 0.00010	< 0.00010	0.00019	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00021	< 0.00010
Dibenzo[a,h]anthracene	-	-	-	-	0	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Fluoranthene	0.001 [UR]	-	-	-	0.00159	< 0.00010	< 0.00010	**0.00159**	0.00012	0.00018	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00068	< 0.00010	0.00012	0.00042	0.00081	< 0.00010	< 0.00010	**0.00123**	0.00021
Fluorene	-	-	-	-	0.0026	< 0.0002	0.0006	0.0024	0.0026	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0007	0.0008	< 0.0002	0.0002	0.002	0.0014	0.0006	0.0004	0.0012	< 0.0002
Indeno(1,2,3-c,d)pyrene	-	-	-	-	0.00013	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00011	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	0.00013
Naphthalene	0.12	S / S	-	-	0.097	< 0.0005	< 0.0010	< 0.0005	< 0.0005	< 0.0010	< 0.0005	< 0.0010	< 0.0005	< 0.0010	0.0007	< 0.0010	< 0.0005	0.0017	0.0012	0.097	< 0.0005	0.0015	< 0.0005	< 0.0005
Phenanthrene	0.0006 [UR]	-	-	-	0.0041	< 0.0004	< 0.0004	**0.0041**	**0.0013**	0.0008	< 0.0004	< 0.0004	< 0.0004	< 0.0004	< 0.0004	**0.0007**	< 0.0004	< 0.0004	**0.0012**	**0.0027**	< 0.0004	< 0.0004	**0.0024**	< 0.0004
Pyrene	-	S / S	-	-	0.0011	< 0.0002	< 0.0002	0.0011	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0007	< 0.0002	< 0.0002	0.0004	0.0006	< 0.0002	< 0.0002	0.0007	0.0002
Polychlorinated Biphenyls Screening in Water, By Liq/Liq																								
Total PCB (Sum of 35 congeners)	0.0001 [A]		-		0	-	-	-	-	-	-	< 0.005	-	< 0.005	-	-	< 0.005	< 0.005	-	-	-	-	-	-
Total Petroleum Hydrocarbons in Water																								
C7 - C9	-	S / S	-	-	9.9	< 0.06	0.46	0.11	0.25	< 0.06	< 0.06	9.9	< 0.06	< 0.06	1.05	0.24	< 0.06	0.06	< 0.06	2	0.13	0.15	1.4	0.24
C10 - C14	-	S / S	-	-	12.2	< 0.2	2	1.9	0.9	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.4	2.9	< 0.2	1.2	1.1	5.9	0.5	1.5	1.5	12.2
C15 - C36	-	S / S	-	-	11.9	< 0.4	1.2	3.1	1.1	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	2.3	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.5	< 0.4	11.9
Total hydrocarbons (C7 - C36)	-	-	-	-	24	< 0.7	3.6	5.1	2.3	< 0.7	< 0.7	9.9	< 0.7	< 0.7	1.4	5.4	< 0.7	1.3	1.1	7.9	< 0.7	2.1	2.9	24
Suspected product						-	Weathered Jet Fuel	Weathered Diesel	Could not be identified	-	-	No chromatogram	-	-	Could not be identified	Weathered Diesel	-	Weathered Petrol	Weathered Petrol	Weathered Turpentine	Weathered Petrol	Weathered Kerosene	Weathered Mineral Turpentine	Weathered Jet and Lub Oil
BTEX																								
Benzene	0.7 [B]	5.2 / 330	-	-	0.87	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.008	< 0.003	< 0.003	0.029	< 0.003	< 0.003	< 0.003	< 0.003	**0.87**	< 0.003	< 0.003	< 0.003	< 0.003
Ethylbenzene	0.005 [UR]	110 / S	-	-	0.39	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	**0.007**	< 0.005	**0.39**	< 0.005	< 0.005	< 0.005	< 0.005
Toluene	0.180 [UR]	450 / S	-	-	0.76	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.021	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**0.76**	< 0.003	< 0.003	< 0.003	< 0.003
m&p-Xylene	0.275 [UR]	S/S	-	-	0.28	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	**0.28**	< 0.005	< 0.005	< 0.005	< 0.005
o-Xylene	0.350 [UR]		-	-	0.13	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.004	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.13	< 0.003	< 0.003	< 0.003	< 0.003
Halogenated Aliphatics																								
1,1-Dichloroethene	0.7 [UR]	-	-	-	0.014	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.013	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.014	< 0.003	< 0.003	< 0.003	< 0.003
cis-1,2-Dichloroethene	0.010 [a]	-	-	-	18.4	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**18.4**	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**11**	< 0.003	< 0.003	< 0.003	< 0.003
trans-1,2-Dichloroethene		-	-	-	0.4	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**0.4**	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**0.047**	< 0.003	< 0.003	< 0.003	< 0.003
Tetrachloroethene (tetrachloroethylene)	0.07 [UR]	-	-	-	7.6	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**7.6**	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.005	< 0.003	< 0.003	< 0.003	< 0.003
Trichloroethene (trichloroethylene)	0.33 [UR]	-	-	-	9.2	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**9.2**	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.004	< 0.003	< 0.003	< 0.003	< 0.003
Vinyl chloride	0.1 [UR]	-	-	-	5.4	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**5.4**	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	**3.7**	< 0.003	< 0.003	< 0.003	< 0.003
Monoaromatic Hydrocarbons																								
n-Butylbenzene	-	-	-	-	0.103	< 0.005	0.019	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.026	0.021	0.103	0.006	< 0.005	0.021	< 0.005
tert-Butylbenzene	-	-	-	-	0.004	< 0.003	0.003	< 0.003	< 0.003	< 0.003	0.004	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
4-Isopropyltoluene (p-Cymene)	-	-	-	-	0.007	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.007	< 0.005	< 0.005	< 0.005	< 0.005
Isopropylbenzene (Cumene)	0.03 [UR]	-	-	-	0.87	< 0.003	**0.134**	0.023	< 0.003	< 0.003	0.028	**0.042**	< 0.003	< 0.003	0.014	< 0.003	< 0.003	**0.29**	0.007	**0.87**	**0.082**	0.009	**0.164**	**0.058**
n-Propylbenzene	-	-	-	-	1.68	< 0.005	0.28	0.022	< 0.005	< 0.005	0.027	0.024	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.32	< 0.005	1.68	0.157	< 0.005	0.34	0.008
sec-Butylbenzene	-	-	-	-	0.026	< 0.003	0.017	< 0.003	< 0.003	< 0.003	0.01	< 0.003	< 0.003	< 0.003	0.003	< 0.003	< 0.003	0.009	< 0.003	0.026	0.014	0.006	0.02	0.004
1,2,4-Trimethylbenzene	-	-	-	-	1.61	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	1.61	< 0.003	< 0.003	< 0.003	< 0.003
1,3,5-Trimethylbenzene	-	-	-	-	0.64	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.64	< 0.003	< 0.003	< 0.003	< 0.003
Trihalomethanes																								
Bromodichloromethane	-	-	-	-	0.107	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.107	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Chloroform (Trichloromethane)	0.37 [UR]	-	-	-	0.004	0.004	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Other VOC																								
Naphthalene	0.12				0.125	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	**0.125**	< 0.005	< 0.005	< 0.005	< 0.005
Poly- and Perfluorinated Alkyl Substances in Water (presented in PPT)																								
Total Perfluorohexanesulfonic acid (T-PFHxS)	-	-	-	-	2.8	-	1.6	-	1	0.16	-	-	-	2.8	1.7	-	-	0.1	-	-	-	-	-	-
Total Perfluorooctanesulfonic acid (T-PFOS)	-	-	-	-	5.6	-	4.4	-	5.6	<0.10	-	-	-	4.5	4.7	-	-	0.049	-	-	-	-	-	-
Sum of Total PFOS & PFHxS	31 [5,6]	-	-	-	7.3	-	6	-	6.6	0.16	-	-	-	7.3	6.4	-	-	0.15	-	-	-	-	-	-
Perfluorooctanoic acid (PFOA)	1,824 [5,6]	-	-	-	0.17	-	<0.10	-	<0.10	<0.10	-	-	-	0.17	<0.10	-	-	0.017	-	-	-	-	-	-

Notes:

1 - Australian and New Zealand Water Quality Guidelines (2018).

2 - Ministy for the Environment, 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand: Groundwater acceptance criteria for gravels; commercial/ industrial use; groundwater at 2 m depth; (indoor air / outdoor air).

3 - Auckland Regional Council (2007), State of the Environment Monitoring: Groundwater Quality Data Report 1998-2005. ARC Technical Publication 352.

4 - NZS 3101: Part 1 2006 Amendment 2 - less stringent of the ranges provided. See relevant section in report for details.

5 - Heads of EPAs Australia and New Zealand (HEPA, 2018) PFAS National Environmental Management Plan.

6- Draft ANZECC Australian and New Zealand Water Quality Guidelines reported in Government of Western Australia Department of Environmental Regulation (WA DER, updated 2017) Interim Guideline on the Assessment and Management of Perfluoroalkly and Polyfluoroalkyl Substances (PFAS) Contaminated Sites Guidelines.

UR - unknown reliability value .

A - indicatesthat trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure.

B - 95% protection value adopted, as per AUP Chapter E.30 rules.

S - Calculated water criteria exceeds solubility limit for pure compound in water.

a - ANZECC water quality guideline for recreational purposes.

b - ANZECC Guidelines for chemical compounds in water found to cause tainting of fish flesh and other aquatic organisms.

	Exceeds limit of detection
red bold	Exceeds ANZECC 80% criteria
green bold	Inhalation pathway criteria exceeded
	Sulphate concentations within the XA1 classification
	Sulphate concentations within the XA2 classification

Table 9.8 **Groundwater sampling results - Orams current facility - 2008-2014 (mg/L)**

Sample ID	Assessment Criteria				Max	MW1					MW2						MW3						MW4	
Screen depth						2.5-6.0 m bgl					2.0-4.5 m bgl						1.5-6.0 m bgl						2.4-4.8 m bgl	
Date	A&NZ Guidelines marine water 80% protection of species [1]	Groundwater acceptance criteria inhalation pathway [2]	Maximum of background range: Auckland non-volcanic aquifers [3]	Corrosivity for classification of chemical attack of concrete [4]		20/01/2008	7/03/2008	11/07/2011	15/10/2012	10/01/2014	20/01/2008	7/03/2008	11/07/2011	15/10/2012	10/01/2014	23/08/2018	20/01/2008	7/03/2008	11/07/2011	15/10/2012	10/01/2014	23/08/2018	20/01/2008	23/08/2018
pH				6.5	7.5	-	-	-	-	-	-	-	-	-	-	6.4	-	-	-	-	-	7.5	-	7.7
Electrical Conductivity (EC)	-	-	-	-	4230	-	-	-	-	-	-	-	-	-	-	2,310	-	-	-	-	-	4,230	-	4,840
Total Dissolved Solids (TDS)	-	-	-	-	29000	-	-	-	-	-	-	-	-	-	-	15,300	-	-	-	-	-	29,000	-	34,000
Chloride		-	-	-	15700	-	-	-	-	-	-	-	-	-	-	8,300	-	-	-	-	-	15,700	-	18,500
Sulphate	-	-	-	XA1 200-600 XA2 600-3000	1690	-	-	-	-	-	-	-	-	-	-	1,140	-	-	-	-	-	1,690	-	2,200
Heavy metals																								
Dissolved Arsenic	0.270 [UR]	-	0.0101	-	0	< 0.0040	< 0.0040	< 0.005	< 0.002	< 0.004	< 0.0040	< 0.0040	< 0.010	< 0.02	< 0.004	< 0.004	< 0.0040	< 0.0040	< 0.005	< 0.02	< 0.004	< 0.004	< 0.0040	< 0.004
Dissolved Cadmium	0.036	-	-	-	0.0008	< 0.00020	< 0.00020	< 0.0003	< 0.00010	< 0.0002	< 0.00020	< 0.00020	< 0.0005	< 0.0010	< 0.0002	0.0008	< 0.00020	< 0.00020	< 0.0003	< 0.0010	< 0.0010	< 0.0002	< 0.00020	< 0.0002
Dissolved Chromium	0.0906/ 0.085	-	<0.0005	-	0.0043	< 0.0010	< 0.0010	< 0.003	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.005	< 0.010	< 0.0010	< 0.0010	< 0.0010	0.0043	< 0.003	< 0.010	< 0.0010	0.0011	< 0.0010	0.0015
Dissolved Copper	0.008	-	0.001	-	0.65	< 0.0010	< 0.0010	< 0.003	< 0.0010	< 0.0010	< 0.0010	0.0023	< 0.005	**0.199**	0.0024	**0.65**	< 0.0010	< 0.0010	< 0.003	< 0.010	< 0.0010	< 0.0010	0.0025	**0.098**
Dissolved Lead	0.012	-	0.0008	-	0.0056	0.0056	< 0.0010	< 0.0005	< 0.0002	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.002	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0005	< 0.002	< 0.005	< 0.0010	< 0.0010	0.0028
Dissolved Mercury	0.0014	-	-	-	0	< 0.000080	< 0.000080	-	-	-	< 0.000080	< 0.000080	-	-	-	< 0.00008	< 0.000080	< 0.000080	-	-	-	< 0.00008	< 0.000080	< 0.00008
Dissolved Nickel	0.56 [A]	-	0.03	-	0.086	< 0.0060	< 0.0060	< 0.003	< 0.0010	< 0.006	0.036	0.035	0.032	0.086	0.079	0.052	< 0.0060	< 0.0060	< 0.003	< 0.010	< 0.03	< 0.007	0.012	< 0.007
Dissolved Zinc	0.043	-	0.055	-	5.4	< 0.0040	0.0085	< 0.005	< 0.002	< 0.004	**0.1**	**0.13**	**0.085**	**0.55**	**0.35**	**5.4**	< 0.0040	< 0.0040	< 0.005	< 0.02	< 0.004	< 0.004	0.024	**0.141**
Total Cyanide	0.014	-	-	-	0.26	0.0029	0.0042	0.0048	0.004	0.005	0.0019	0.0029	0.0047	0.0023	< 0.005	< 0.02	0.004	**0.065**	**0.0164**	**0.0172**	**0.26**	< 0.02	0.0045	< 0.02
TPH																								
C7 - C9	-	S/S	-	-	0	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.06	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.06	< 0.10	< 0.06
C10 - C14	-	S/S	-	-	1	0.27	0.26	< 0.2	0.3	0.3	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.2	1	0.33	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.2
C15 - C36	-	S/S	-	-	0	< 0.40	< 0.40	< 0.4	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.4	< 0.4	< 0.40	< 0.4
Total hydrocarbons (C7 - C36)	-	-	-	-	1	< 0.70	< 0.70	< 0.7	< 0.7	< 0.7	< 0.70	< 0.70	< 0.7	< 0.7	< 0.7	< 0.7	1	< 0.70	< 0.7	< 0.7	< 0.7	< 0.7	< 0.70	< 0.7
BTEX																								
Benzene	0.7 [B]	5.2 / 330	-	-	0.01	< 0.0050	< 0.0050	< 0.0010	< 0.0010	< 0.0010	< 0.0050	< 0.0050	< 0.0010	< 0.0010	< 0.0010	< 0.003	0.0066	0.01	< 0.0010	< 0.0010	< 0.0010	< 0.003	< 0.0050	< 0.003
Ethylbenzene	0.005 [UR]	110 / S	-	-	0	< 0.010	< 0.010	< 0.0010	< 0.0010	< 0.0010	< 0.010	< 0.010	< 0.0010	< 0.0010	< 0.0010	< 0.005	< 0.010	< 0.010	< 0.0010	< 0.0010	< 0.0010	< 0.005	< 0.010	< 0.005
Toluene	0.180 [UR]	450 / S	-	-	0.0098	0.0098	< 0.0050	< 0.0010	< 0.0010	< 0.0010	0.0064	< 0.0050	< 0.0010	< 0.0010	< 0.0010	< 0.003	0.0082	< 0.0050	< 0.0010	< 0.0010	< 0.0010	< 0.003	< 0.0050	< 0.003
m&p-Xylene	0.075 [UR]	S/S	-	-	0.013	0.013	< 0.0050	< 0.002	< 0.002	< 0.002	0.0077	< 0.0050	< 0.002	< 0.002	< 0.002	< 0.005	0.0062	< 0.0050	< 0.002	< 0.002	< 0.002	< 0.005	0.0055	< 0.005
o-Xylene	0.350 [UR]	-	-	-	0	< 0.0050	< 0.0050	< 0.0010	< 0.0010	< 0.0010	< 0.0050	< 0.0050	< 0.0010	< 0.0010	< 0.0010	< 0.003	< 0.0050	< 0.0050	< 0.0010	< 0.0010	< 0.0010	< 0.003	< 0.0050	< 0.003
VOC [5]																								
Isopropylbenzene (Cumene)	0.03 [UR]	-	-	-	0.17	0.019	0.025	-	-	-	< 0.0050	< 0.0050	-	-	-	< 0.0050	0.17	0.14	-	-	-	< 0.0050	< 0.0050	< 0.0050
n-Propylbenzene	-	-	-	-	0.22	0.041	0.059	-	-	-	< 0.0050	< 0.0050	-	-	-	< 0.0050	0.22	0.094	-	-	-	< 0.0050	< 0.0050	< 0.0050
Styrene	0.25 b	-	-	-	0.012	< 0.0050	0.012	-	-	-	< 0.0050	< 0.0050	-	-	-	< 0.0050	< 0.0050	< 0.0050	-	-	-	< 0.0050	< 0.0050	< 0.0050
1,2,4-Trimethylbenzene	-	-	-	-	0	< 0.0050	<0.0050	-	-	-	< 0.0050	< 0.0050	-	-	-	< 0.003	< 0.0050	< 0.0050	-	-	-	< 0.003	< 0.0050	< 0.003
PAH [5]																								
Fluoranthene	0.001 [UR]	-	-	-	0.00031	-	-	-	-	-	-	-	-	-	-	0.00031	-	-	-	-	-	< 0.00010	-	< 0.00010

1 - Australian and New Zealand Water Quality Guidelines (2018)

2 - Ministry for the Environment, 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand: gravels; commercial/ industrial use; groundwater at 2 m depth; (indoor air / outdoor air).

3 - Auckland Regional Council (2007), State of the Environment Monitoring: Groundwater Quality Data Report 1998-2005. ARC Technical Publication 352.

4 - NZS 3101: Part 1 2006 Amendment 2 - less stringent of the ranges provided. See relevant section in report for details.

5 - Full analyte suites were tested, only detected compounds are presented in this table. Refer to the laboratory transcripts for laboratory limits of detection for individual VOC and PAH

A - indicates that trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure

B - 95% protection value adopted, as per AUP Chapter E.30 rules

a - ANZECC 2000 water quality guideline for recreational purposes

b - ANZECC 2000 Guidelines for chemical compounds in water found to cause tainting of fish flesh and other aquatic organisms

UR - unknown reliability value

ID - insufficient data

	Exceeds limit of detection
red bold	Exceeds ANZECC 80% criteria
green bold	Inhalation pathway criteria exceeded
	Sulphate concentrations within the XA1 classification
	Sulphate concentrations within the XA2 classification

9.4.4 Natural attenuation assessment

A preliminary assessment of potential natural attenuation or degradation processes acting on chlorinated solvents has been undertaken during these investigations. As well as testing for the breakdown products (TCE, DCE and VC), the assessment comprised field measurement of groundwater for parameters including temperature, redox potential (ORP), dissolved oxygen, pH, conductivity and laboratory testing of groundwater samples for sulphate, chloride and pH. The results of the field measurements are presented in Appendix J and the laboratory testing results in Tables 9.7 and 9.8. Total organic carbon (TOC) data was also gathered for the aquifer matrix at the depths where chlorinated solvents have been detected in groundwater. These results are presented in the soil results data Table 9.4.

The available information has been assessed based on the USEPA Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water (1998). The assessment indicates that:

- Daughter products of the chlorinated solvents reportedly stored on Site 18 (tetrachloroethylene) have been detected in groundwater and soil in the impacted area. These include TCE, DCE and VC suggesting that degradation processes are occurring at the site.
- Chloride concentrations across the site are high as a result of seawater impacts and will likely mask any chloride resulting from the formation of daughter products.
- Anaerobic conditions generally exist with ORP results typically in the range of -100 mV to -200 mV in shallow groundwater. Values in the deeper groundwater were higher, ranging between -10.9 and -107.6 mV.
- The in-situ dissolved oxygen concentrations in groundwater do not necessarily correlate with the ORP results and suggest aerobic conditions may also exist in places. Concentrations of DO are greater than 5 mg/L in GBH103, GBH107, GBH111, MW1 and GBH109; this may be a result of tidal influence or oxidation during sampling.
- The pH of the groundwater is in the optimal range for reducing conditions.
- Sulphate concentrations present in the north and west of Site 18 and across Orams existing site are elevated, which may compete with the reductive pathway in those areas.
- TOC tested in the aquifer matrix (soil) from GBH109 and CBH209 ranged from 0.18 to 1.23 g/100g dry weight. This indicates there carbon present support the dechlorination process.

In addition, the presence of hydrocarbons in shallow soils is likely to promote co-metabolism of chlorinated solvents (i.e reduction and breakdown of these products). Evidence of this process is supported by the lack of chlorinated compounds in shallow groundwater.

Overall the data shows that anaerobic conditions are present and, coupled with the presence of degradation products in the soil and groundwater data, suggest that degradation of chlorinated solvents is occurring. This natural attenuation process are expected to continue and the pathway for discharge of these contaminants will be lengthened by the proposed DSM seawall. The groundwater assessment (refer Groundwater and Settlement Effects Report, has determined the discharge flows from the site will be decreased by a factor of 5-10 times. More detailed assessment is difficult as a comparison with upgradient data is not possible due to the presence of other sources. Also comparison with downgradient data is not possible as this area is beneath the harbour.

9.4.5 Assessment of groundwater discharges

As described in Section 9.4.2, at Site 18 one or more of cyanide, ethylbenzene or cumene exceed the marine water quality protection criteria in each of the shallow screened wells directly adjacent to

the existing seawall. Marine water quality protection criteria are also exceeded by numerous chlorinated compounds, cyanide and cumene in deeper groundwater in GBH109P.

For this reason estimates of the levels of contaminants discharging from groundwater to the harbour, with and without the DSM wall, were made. The assessment process and findings are described in detail in Appendix M, but can be summarised as follows:

- Installation of the DSM wall will reduce discharges in shallow groundwater at Site 18 by providing a low permeability barrier to groundwater flow, effectively cutting off the discharge. Given that contaminant levels are not significantly elevated above marine protection criteria, levels below the criteria are expected post wall installation. In the same manner, while it is already expected to have low mobility, any residual SPH is expected to be trapped behind the DSM.
- Fate and transport modelling of chlorinated compounds in deeper groundwater predicts significantly reduced concentrations (about 2 orders of magnitude) after the DSM walls have been installed. Predicted discharge concentrations exceed marine environment protection values before the DSM wall, but not after a 10 m deep wall has been completed. Given that there will be dilution and dispersion as the discharge enters the harbour (which is not accounted for in the modelling), surface water concentrations would therefore be expected to be further attenuated (i.e. lower than calculated).
- The proposed 7 m deep cutoff walls on the south and east sides of the site will further reduce mounding in the site and limit flow (and transport of contaminants) south to north, i.e. around the ends of the seawall.

Input values used in the model were generally selected from the conservative end of the range, especially for variables in which no site data is available. As a risk mitigation measure it is proposed to address any potential uncertainty in the modelling results by deepening selected DSM panels in the south-western corner of the site. It is expected that relatively small increases in depth (~2 m) of a limited number of panels (~10) will result in significant increases in attenuation. The depth and number of panels to be deepened will be confirmed during detailed design.

Installation of the 7 m cut off wall on Beaumont Street and on the south side of Site 18 (refer Figure 2) will in part divert upgradient groundwater around the site. Largely flow in a northerly direction is predicted by modelling detailed in the T+T Groundwater and Settlement Effects report, before it re-enters the site at the northern end of the Beaumont Street cut off wall. The result will be a lengthened flow path for any shallow/ or separate phase contamination entering the site from land east and southeast of the site, and thus a corresponding increase in the degradation and attenuation potential. Preferential pathways do exist outside the site, particularly the Beaumont Street stormwater/sewer but these are to be upgraded using the same method of mudcrete and pipe dams as was installed at Jellicoe Street. The Beaumont Street services are already expecting to be acting as preferential pathways for upgradient contamination, thus the increase in flow to these is expected to be minor. Deeper regional contamination such as cyanide is not expected to be significantly affected by the shallow walls.

Only minor increase in water elevation (less than 0.3 m) is expected along the upstream side of the southern cut off wall. Given the minimal water level rise, the impact on contaminant flow is expected to be negligible and not result in any increase in discharge to the harbour.

9.5 Vapour testing results

Vapour samples were collected from five vapour probes located within the footprints of the three proposed buildings on Site 18 (B1a, B1b & B2 retail, and B3 apartment/retail). Vapour monitoring was also completed in 2012 to inform an earlier proposed development at the site (refer to Section

5.2.2 for details on the investigation works). The 2012 sampling points are not within the current proposed building footprints but do assist with informing the relationship between soil and groundwater contamination and soil vapour conditions. The sampling locations are presented in Figure 6. The results are presented in Table 9.9. Full laboratory transcripts are presented in Appendix K.

The data indicate:

- Compounds above the laboratory reporting limit recorded in the 2018 vapour samples for assessment of the buildings include BTEX, other monoaromatic hydrocarbons, TCE and cyclohexane, propene and styrene. TPH fractions were detected in all samples. The highest concentrations were detected in VP4 within the footprint of proposed Building B2, the proposed large marine servicing shed.
- The sampling in 2012 in outdoor areas detected compounds at ultra-trace levels above the detection limit. Compounds detected included DCE, trimethylpentane, cyclohexane, hexane and PCE. TPH fractions were only detected in vapour from VMP10, in the centre of the site.
- Evaluation against WES-TWA and the WES-STEL values show all data is below these levels, where the standards are available.
- In comparison with health-based target indoor air concentrations from the New Zealand Petroleum Guidelines and the NEPM HILs show all data is below these levels, where the standards are available, except for TCE in VP4.
- Compared against the USEPA vapour screening levels the only measured concentrations to exceed were for PCE TCE in VP3 and VP4, both under a proposed Building B2.

Two foundation solutions are being considered for the Buildings B1a, B1b and B2:

1 Strip foundation on the stabilised ground, or

2 Piling to rock.

For the strip foundation option, cement stabilisation up to 1.2 m thickness for ground improvement would be completed beneath Buildings B1a, B1b and B2. This raft of material will be densely compacted and thus significantly less permeable (expected to be in the order of 10^{-9} m/s) that the current situation. As a result it is expected the vapour retardation will result in a lower risk to indoor air accumulation thereby further reducing any potential risk. In addition, as indicated, comparison of the soil vapour data to the WES shows that all sampling comply with these criteria. This is relevant in the parts of the proposed marine services buildings where workers will likely be handling and using hazardous substances (e.g. fuels, solvents etc.). The WES provides the more appropriate exposure standard in that instance and the controls implemented to manage worker exposure to hazardous substances during their routine work are therefore also expected to address the potential exposures from any soil vapour entering the new buildings. On this basis we conclude that based on the preliminary design information a vapour barrier is not required for this option.

If a piling foundation solution is selected, based on the available data a vapour barrier and ventilation system would be required to address potential risks to the building users.

The evaluation indicates there should be no unacceptable inhalation risk to construction workers in an outdoor setting during works (ground improvement, deep soil mixed seawall and other cement mixed walls). However, nuisance odour may create an unpleasant work environment and

Table 9.9 Vapour sampling results (ug/m^3)

Building footprint:		Evaluation criteria									Building 1		Building 2		Building 3 - apartment	Outdoor areas			
Sample Name:											VP5	VP6	VP3	VP4	VP2	VMP10s	VMP14s	VMP29s	VMP23s
Date:		WES - Time weighted average [1]	WES - Short term exposure limit [1]	MfE target soil-air concentrations at 1 m depth		NEPM HILs		USEPA target subslab concentrations		Max	31/07/2018	31/07/2018	31/07/2018	31/07/2018	31/07/2018	2012	2012	2012	2012
Lab Number:				Industrial / commerical [2]	Residential [3]	Industrial / commerical [4]	High Density Residential [5]	Industrial / commerical [6]	Residential [7]		2023996.2	2023996.1	2023996.4	2023996.3	2023996.6	998083.2	998083.5	998083.1	998083.3
1,2-Dichloroethane	ppbv	810,000	1,010,000	-	-	-	-	-	7000	27	< 5	< 10	< 10	< 50	< 10	27	< 5	< 5	< 5
2,2,4-Trimethylpentane	µg/m3	-	-	-	-	-	-	-	-	2400000	580	74,000	39,000	2,400,000	25,000	68,000	< 5	< 6	89
Benzene	µg/m3	3,190	7,990	632	126	-	-	-	-	8	< 4	8	< 8	< 40	< 8	<LOR	<LOR	<LOR	<LOR
Carbon disulfide	µg/m3	31,000	-	-	-	-	-	3,070	24,300	51	< 7	51	< 15	< 80	< 15	< 13	< 7	< 7	11
cis-1,2-Dichloroethene	µg/m3	-	-	-	-	300	80	-	-	103	< 5	< 9	< 10	103	< 10	<LOR	<LOR	<LOR	<LOR
Cyclohexane	µg/m3	350,000	1,050,000	-	-	-	-	26,300	209,000	6900	62	3,900	1,200	< 40	2,200	6,900	< 4	< 4	10
Hexane	µg/m3	72,000	3,500,000	-	-	-	-	3,010	24,300	270	< 4	< 8	< 9	< 50	< 9	270	< 4	< 4	< 4
Cumene (Isopropylbenzene)	µg/m3	125,000	375,000	-	-	-	-	1,750	13,900	480	16	< 500	30	480	21	<LOR	<LOR	<LOR	<LOR
n-Propylbenzene	µg/m3	-	-	-	-	-	-	4,380	34,800	430	38	< 500	37	430	27	<LOR	<LOR	<LOR	<LOR
Propene	µg/m3	-	-	-	-	-	-	-	-	530	4	530	< 5	< 20	< 4	<LOR	<LOR	<LOR	<LOR
Styrene	µg/m3	-	-	-	-	-	-	4,380	34,800	19	19	< 10	< 10	< 50	12	<LOR	<LOR	<LOR	<LOR
Tetrachloroethene	µg/m3	335,000	1,005,000	-	-	8,000	2,000	175	1,390	3000	11	< 16	520	3,000	72	< 14	< 7	74	7
Toluene	µg/m3	188,430	-	63,800	19,100	-	-	21,900	174,000	240	240	210	95	< 50	110	<LOR	<LOR	<LOR	<LOR
Trichloroethene	µg/m3	55,000	135,000			80	20	8.76	16	320	< 6	< 12	23	320	< 13	<LOR	<LOR	<LOR	<LOR
Whole Air Sampling Volatile Compounds TPH																			
C5 TPH referenced to n-heptane	µg/m3	-	-	-	-	-	-	-	-	124000	3,700	76,000	19,600	124,000	14,300	40,000	< 300	< 400	< 400
C6 TPH referenced to n-heptane	µg/m3	-	-	-	-	-	-	-	-	4200000	6,300	175,000	95,000	4,200,000	51,000	93,000	< 800	< 800	< 800
C7-C9 TPH referenced to n-heptane	µg/m3	-	-	3,990,000	1,210,000	-	-	-	-	3600000	33,000	1,280,000	360,000	3,600,000	178,000	55,000	< 4,000	< 5,000	< 5,000
C10-C14 TPH referenced to n-heptane	µg/m3	-	-	344,000	108,000	-	-	-	-	129000	17,300	101,000	63,000	129,000	62,000	< 6,000	< 3,000	< 3,000	< 3,000

Notes:
µg/m3 = micrograms per cubic metre of air
WES - TWA = Workplace Exposure Standard - Time Weighted Average (over 8 hour period)
WES - STEL = Workplace Exposure Standard - Short Term Exposure Limit (over 15 minute period)
1.Worksafe, Workplace Exposure Standards and Biological Exposure Indices (9th edition) November 2107, updated 2018.
2. Target soil-air concentration data at 1 m for commercial / industrial land use. Appendix 4J of the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Ministry for the Environment 1999, Revised 2011.
3 Target soil-air concentration data at 1 m for commercial / industrial land use. Appendix 4J of the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Ministry for the Environment 1999, Revised 2011.
4. NEPM Health Investigation Levesls - Soil Gas - commercial/industrial land use values
5. NEPM Health Investigation Levesls - Soil Gas - high density residential land use values
6. USEPA Target sub-slab and Near-Source Soil Gas Concentration - industrial/commercial
7. USEPA Target sub-slab and Near-Source Soil Gas Concentration - resident
Bold exceeds the NEPM value
Highlight exceeds the USEPA criteria

mitigation, including ability to provide suppression and/or venting, coupled with monitoring will be required.

9.6 Sediment and offshore soil results

The results of the sediment testing and testing of in-situ soils below the sediment, completed during the recent investigation programme, are presented in Table 9.10. Full laboratory transcripts are presented in Appendix L. The sediment testing results have been compared to the evaluation criteria discussed in Section 9.1.

The assessment against risk to the coastal marine area is discussed in Section 9.7.1. In this assessment, for organic compounds the reported concentrations have been adjusted to 1% TOC in line with the guidelines.

Evaluation against human health criteria is discussed in regards to potential onsite reuse in Section 9.7.2.

9.6.1 Environmental protection

Comparison of the sediment data within the footprint of proposed dredging (SS series and BH303 and BH304) against A&NZ 2018 Guidelines default sediment guideline values (DGV) and the high guideline values (GV-High) indicates the following. The exceedances of the criteria are presented in Figure 12.

- Mercury concentrations in five locations exceeded the GV-High. The highest concentration of mercury was however detected in a sample from 1.0m depth at the borehole furthest from land (GBH303) suggesting that there a various sources of mercury in the harbour environment.
- Copper and lead concentrations in sediment exceeded the DGV and the background concentration for non-volcanic soils in a number of samples and cadmium in one location, but are all below the GV-High value.
- Nickel concentrations in a number of samples exceeded the DGV but are below the background concentration for non-volcanic soil and are therefore considered not to present a risk in the local context.
- No samples exceed the DGV or GV-High for total PAH.
- TBT was present in the majority of marine sediment samples exceeding the DGV. Three are above the GV-High value.
- No light- or mid-range TPH was detected in the marine sediment samples. Heavy-end TPH was detected in the majority of the marine sediment samples. In one location (surface sediment in GBH302) the concentration exceeded the DGV. The concentration did not exceed GV-High.
- No VOC compounds were detected in the marine sediment samples.
- Cyanide was not detected in the marine sediments samples.

Typically contaminant concentrations in sediment decrease with depth but do not necessarily decrease with distance from the seawall, suggesting input from contaminant sources not on the site or historic impacts from past activities on or adjacent to the site. Recent dredging works in the wider Westhaven Marina and Silo Park are also likely to have affected the distribution and concentrations of contaminants.

Dredging is proposed to -6 m RL within the footprint shown on Figure 4. Dredging will result in removal of all accumulated sediment within this footprint, exposing Tauranga Group alluvial soils. Materials to be exposed by the dredging programme have been tested and are shown on Table 9.10

(Tauranga Group deposits). Contaminant levels in soils to be exposed are below both DGV and published background concentrations for non-volcanic soils.

9.6.1.1 Elutriate data

The results of elutriate testing is presented in Table 9.11. Three samples were tested with results compared to the A&NZ 2018 Guidelines for marine water quality (80% protection level) as the environment is already disturbed. The results indicate that only zinc generated concentrations that exceeded the guideline value. This means that disturbance during removal is not expected to have significant impact on water quality during dredging, but this does not however negate the requirement for mitigation measures during dredging.

9.6.2 Disposal options including use on the site

The disposal options for dredged sediment are currently being considered and full assessment of the data in regards to disposal will be undertaken as part of the disposal options appraisal.

Options include but are not limited to; disposal to sea (northern disposal area), licensed landfill following a reduction in the moisture content, and onsite use of soil.

In regards to the potential option for the use of sediment on Site 18:

- If disposed onsite, sediments will be incorporated into the stabilised raft.
- All contaminant testing results for the marine sediments meet human health based soil assessment criteria for commercial land use and the AUP permitted activity discharge criteria (with the exception of one mercury data point). This means there should be no constraint on landside disposal of these materials.
- Asbestos was detected in five of the nine of samples tested. Where detected, asbestos was in fibre/fines form and the volume of asbestos to volume of sediment was below the laboratory limit of reporting 0.001%. If sediment is reused onsite, unlicensed works controls would be applicable under the BRANZ (i.e. standard earthworks controls with additional worker hygiene controls). Asbestos is not typically considered to be a significant environmental contaminant and will be isolated from environmental receptors once placed onsite. As indicated above discharges of sediment will need to be managed during dredging works, these controls are expected to also mitigate discharges of asbestos fibres.

Table 9.10 **Offshore sediment and soil sampling results (mg/kg)**

Sample ID	Environmental Assessment		Reuse of soil on Site 18 - non-residential areas only	Disposal offsite		Max	SS01	SS02	SS03	SS04	SS05	SS06	GBH301	GBH301	GBH302	GBH302
Depth (m)							NA	NA	NA	NA	NA	NA	0.5-0.6	1.25-1.45	0.0-1.0	3.65-4.2
Date							13/07/2018	13/07/2018	27/06/2018	27/06/2018	13/07/2018	13/07/2018	27/07/2018	27/07/2018	26/07/2018	26/07/2018
Lab ID							2015346.4 / 2015351.3	2015346.5 / 2015351.4	2006862.1	2006862.2	2015346.6	2015346.7	2022549.4	2022549.7	2021746.4	2021746.6
Geological unit	**A&NZ 2018 Guidelines DGV [0]**	**A&NZ 2018 Guidelines GV-High [0]**	**NES Soil human health criteria for commercial / industrial land use [1]**	**Non-volcanic Background**	**Managed fill acceptance criteria**		Marine Sediment	Marine Sediment	Marine Sediment	Marine Sediment	Marine Sediment	Marine Sediment	Marine sediment	Silt, some clay - Tauranga Group	Marine sediment	Silt, some clay - Tauranga Group
Other																
Total Cyanide	-	-	1,500 [2]	<LOR		0	< 0.10	< 0.10	< 0.10	< 0.10	-	-	< 0.10	-	< 0.10	< 0.10
Total Organic Carbon (g/100g dry weight)	-	-					1.22	1.06	1.06*	0.46*	0.45	0.44	0.7	-	1.13	0.58*
Metals																
Arsenic	20	70	70	12		14	10	12	10	9	14	13	9	< 2	13	8
Cadmium	1.5	10	1,300	0.65		1.53	0.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chromium	80	370	NL	55		28	25	24	25	15	16	16	20	7	20	13
Copper	65	270	NL	45		123	60	88	96	17	123	113	58	13	89	13
Lead	50	220	3,300	65		89	69	84	60	17.4	57	64	41	2.6	77	9.6
Mercury	0.15	1	4,200	0.45		2	**1.1**	**1.88**	0.76	0.19	0.59	0.63	0.16	< 0.10	**1.57**	< 0.10
Nickel	21	52	6,000 [2]	35		25	13	25	11	8	14	13	10	< 2	19	10
Zinc	200	410	400,000 [2]	180		155	129	137	133	51	150	146	83	5	140	36
PAH (concentrations adjusted to 1% TOC)																
1-Methylnaphthalene	-	-	-	< LOR		0.08	<LOR	<LOR	<LOR	<LOR	<LOR	0.08	0.05	-	<LOR	<LOR
2-Methylnaphthalene	-	-	-	< LOR		0.10	<LOR	<LOR	<LOR	<LOR	<LOR	0.10	0.05	-	<LOR	<LOR
Perylene	-	-	-	< LOR		0.30	0.11	0.09	<LOR	0.07	0.06	0.30	0.17	-	0.11	0.076
Acenaphthylene	-	-	-	< LOR		0.08	0.03	0.03	<LOR	<LOR	<LOR	0.03	0.06	-	0.07	<LOR
Acenaphthene	-	-	-	< LOR		0.42	<LOR	<LOR	<LOR	<LOR	<LOR	0.42	0.07	-	<LOR	<LOR
Anthracene	-	-	-	< LOR		0.43	0.05	0.02	<LOR	0.03	<LOR	0.33	0.43	-	0.05	<LOR
Benzo[a]anthracene	-	-	-	< LOR		1.02	0.23	0.18	0.07	0.36	0.16	1.02	0.66	-	0.25	<LOR
Benzo[a]pyrene (BAP)	-	-	35	< LOR		1.14	0.33	0.25	<LOR	0.25	0.28	1.14	0.67	-	0.42	<LOR
Benzo[b]fluoranthene + Benzo[j]fluoranthe	-	-	-	< LOR		1.25	0.39	0.34	0.08	0.39	0.33	1.25	0.74	-	0.51	<LOR
Benzo[e]pyrene	-	-	-	< LOR		0.73	0.21	0.20	0.08	0.23	0.19	0.73	0.40	-	0.28	<LOR
Benzo[g,h,i]perylene	-	-	-	< LOR		0.75	0.26	0.20	<LOR	0.10	0.20	0.75	0.40	-	0.35	<LOR
Benzo[k]fluoranthene	-	-	-	< LOR		0.50	0.19	0.14	<LOR	0.10	0.12	0.50	0.31	-	0.22	<LOR
Chrysene	-	-	-	< LOR		0.98	0.25	0.19	0.08	0.41	0.13	0.98	0.67	-	0.25	<LOR
Dibenzo[a,h]anthracene	-	-	-	< LOR		0.11	0.05	0.03	<LOR	<LOR	<LOR	0.11	0.10	-	0.05	<LOR
Fluoranthene	-	-	-	< LOR		2.84	0.52	0.41	0.15	0.76	0.33	2.84	1.97	-	0.54	<LOR
Fluorene	-	-	-	< LOR		0.32	<LOR	<LOR	<LOR	<LOR	<LOR	0.32	0.19	-	0.03	<LOR
Indeno(1,2,3-c,d)pyrene	-	-	-	< LOR		0.75	0.25	0.20	<LOR	0.06	0.20	0.75	0.37	-	0.32	<LOR
Naphthalene	-	-	(210) (surface); (270) (1-4m) [3]	< LOR		0.02	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	-	<LOR	<LOR
Phenanthrene	-	-	-	< LOR		2.13	0.19	0.10	0.04	0.14	0.10	1.84	2.13	-	0.18	<LOR
Pyrene	-	-	NL [4]	< LOR		2.68	0.58	0.42	0.15	0.76	0.33	2.68	1.97	-	0.58	<LOR
Total PAHs	10	50		< LOR		16.07	3.72	2.88	0.83	3.82	2.61	16.07	11.38	-	4.27	0.388
Tributyltin (concentrations adjusted to 1% TOC)																
Dibutyltin	-	-	24.6 [4]	< LOR		0.12	0.02	0.01	0.05	0.017	0.122	0.07	0.03	-	0.009	-
Monobutlytin	-	-	-	< LOR		0.03	<LOR	<LOR	0.01	<LOR	0.031	0.03	<LOR	-	<LOR	-
Tributyltin	0.009	0.07	24.6 [4]	< LOR		0.14	0.015	0.011	0.037	0.02	**0.133**	**0.141**	0.05	-	0.017	-
Triphenyltin	-	-	-	< LOR		0.02	<LOR	<LOR	0.02	<LOR	<LOR	<LOR	<LOR	-	<LOR	-
Total Petroleum Hydrocarbons in Soil (concentrations adjusted to 1% TOC)																
C7 - C9	-	-	(500) (surface); (500) (1-4m) [3]	< LOR		0	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
C10 - C14	-	-	(1,700) (surface); (2,200) (1-4m) [3]	< LOR		0	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
C15 - C36	-	-	NL [3]	< LOR		390	133	144	<LOR	<LOR	253	<LOR	98.57	<LOR	345	<LOR
Total hydrocarbons (C7 - C36)	280	550	-	< LOR		390	133	144	<LOR	<LOR	253	0	<LOR	<LOR	345	<LOR
Suspected Product															Weathered Lube Oil	
Asbestos																
FA/AF (% weight/weight)	-	-	0.001% [5]	< LOR		0	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND	-	-	-	-
ACM (% weight/weight)	-	-	0.05% [5]	< LOR		0	< 0.001	< 0.001	< 0.001	< 0.001	ND	ND	-	-	-	-
Asbestos form	-	-	-	-		-	Chrysotile (White Asbestos) detected.	Chrysotile (White Asbestos) detected.	Chrysotile (White Asbestos) detected.	Chrysotile (White Asbestos) detected.	ND	ND	-	-	-	-
BTEX	-	-	-	-	-	-	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR
OTHER VOCs	-	-	-	-	-	-	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR

Notes:
all results in mg/kg (unless otherwise stated)
NL = no limit
<LOR = below level of laboratory detection
NC = not calculated due to insufficient values above laboratory detection
* = Sample was not analysed for TOC. TOC concentrations from samples similar in location, depth and grain size have been used instead.

0. A&NZ 2018 Guidelines: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, toxicant default guideline values for sediment quality, with organic concentrations adjusted to 1% TOC
1.National Environmental Standard - Soil Contamination Standard - commerical land use
2.National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *Commercial/Industrial land use*
4.USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, composite worker, chronic effects
5.BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *commercial land use*

	exceeds soil background concentration
	exceeds laboratory limit of detection
underline	exceeds A&NZ 2018 Guidelines - Default Guideline Value
red bold	exceeds A&NZ 2018 Guidelines - DV-High
	exceeds human health criteria for the assessment for reuse onsite

Table 9.10 **Offshore sediment and soil sampling results (mg/kg)**

Sample ID	Environmental Assessment		Reuse of soil on Site 18 - non-residential areas only	Disposal offsite		Max	GBH303	GBH303	GBH303	GBH303	GBH304	GBH304	GBH304	GBH304	GBH304
Depth (m)							0.2 - 0.4	0.6 - 0.8	1.0-1.2	1.85-2.1	0.35-0.55	0.6-0.8	1.0-1.2	2.45-2.65	4.5-4.7
Date							31/07/2018	31/07/2018	31/07/2018	31/07/2018	31/07/2018	31/07/2018	31/07/2018	31/07/2018	31/07/2018
Lab ID	**A&NZ 2018 Guidelines DGV [0]**	**A&NZ 2018 Guidelines GV-High [0]**	**NES Soil human health criteria for commercial / industrial land use [1]**	**Non-volcanic Background**	**Managed fill acceptance criteria**		2024121.1	2024121.2	2024121.3	2024121.5	2024121.1	2024121.11	2024121.12	2024121.14	2024121.16
Geological unit							Marine Sediment	Marine Sediment	Marine sediment	Clayey silt - Tauranga Group	Marine sediment	Marine Sediment	Marine sediment	Clayey silt - Tauranga Group	Clayey silt - Tauranga Group
Other															
Total Cyanide	-	-	1,500 [2]	<LOR		0		-	< 0.10	< 0.10	< 0.10	-	< 0.10	-	-
Total Organic Carbon (g/100g dry weight)	-	-					1.22*	1.28*	1.28	0.58	0.46	0.46*	0.43	-	-
Metals															
Arsenic	20	70	70	12		14	9.3	12.2	11	< 2	9	9.6	9	-	
Cadmium	1.5	10	1,300	0.65		1.53	1.53	0.118	0.13	< 0.10	< 0.10	0.034	< 0.10	-	
Chromium	80	370	NL	55		28	28	23	23	6	16	18.8	15	-	-
Copper	65	270	NL	45		123	105	84	51	11	5	5.5	6	-	-
Lead	50	220	3,300	65		89	44	76	89	5.9	6.8	7	6.1	-	-
Mercury	0.15	1	4,200	0.45		2	0.49	**1.53**	**2.00**	< 0.10	< 0.10	0.03	< 0.10	-	-
Nickel	21	52	6,000 [2]	35		25	12	24	12	< 2	7	8.5	8	-	-
Zinc	200	410	400,000 [2]	180		155	155	138	133	9	33	40	29	-	-
PAH (concentrations adjusted to 1% TOC)															
1-Methylnaphthalene	-	-	-	< LOR		0.08	0.003	0.005	< LOR	< LOR	< LOR	< LOR	< LOR	-	-
2-Methylnaphthalene	-	-	-	< LOR		0.10	0.004	0.007	< LOR	< LOR	< LOR	< LOR	< LOR	-	-
Perylene	-	-	-	< LOR		0.30	0.035	0.082	0.059	< LOR	< LOR	0.007	< LOR	-	-
Acenaphthylene	-	-	-	< LOR		0.08	0.010	0.027	0.023	< LOR	< LOR	< LOR	< LOR	-	-
Acenaphthene	-	-	-	< LOR		0.42	0.011	0.009	<LOR	< LOR	< LOR	< LOR	< LOR	-	-
Anthracene	-	-	-	< LOR		0.43	0.022	0.041	0.044	< LOR	< LOR	< LOR	< LOR	-	-
Benzo[a]anthracene	-	-	-	< LOR		1.02	0.082	0.203	0.154	< LOR	< LOR	< LOR	< LOR	-	-
Benzo[a]pyrene (BAP)	-	-	35	< LOR		1.14	0.129	0.320	0.219	< LOR	< LOR	< LOR	< LOR	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthe	-	-	-	< LOR		1.25	0.156	0.383	0.289	< LOR	< LOR	< LOR	< LOR	-	-
Benzo[e]pyrene	-	-	-	< LOR		0.73	0.085	0.188	0.156	< LOR	< LOR	< LOR	< LOR	-	-
Benzo[g,h,i]perylene	-	-	-	< LOR		0.75	0.107	0.242	0.172	< LOR	< LOR	< LOR	< LOR	-	-
Benzo[k]fluoranthene	-	-	-	< LOR		0.50	0.067	0.144	0.119	< LOR	< LOR	< LOR	< LOR	-	-
Chrysene	-	-	-	< LOR		0.98	0.095	0.227	0.188	< LOR	< LOR	< LOR	< LOR	-	-
Dibenzo[a,h]anthracene	-	-	-	< LOR		0.11	0.021	0.048	0.029	< LOR	< LOR	< LOR	< LOR	-	-
Fluoranthene	-	-	-	< LOR		2.84	0.213	0.453	0.430	< LOR	< LOR	< LOR	< LOR	-	-
Fluorene	-	-	-	< LOR		0.32	0.010	0.012	<LOR	< LOR	< LOR	< LOR	< LOR	-	-
Indeno(1,2,3-c,d)pyrene	-	-	-	< LOR		0.75	0.126	0.289	0.195	< LOR	< LOR	< LOR	< LOR	-	-
Naphthalene	-	-	(210) (surface); (270) (1-4m) [3]	< LOR		0.02	<LOR	0.013	<LOR	< LOR	< LOR	< LOR	< LOR	-	-
Phenanthrene	-	-	-	< LOR		2.13	0.096	0.164	0.164	< LOR	< LOR	< LOR	< LOR	-	-
Pyrene	-	-	NL [4]	< LOR		2.68	0.213	0.461	0.445	< LOR	< LOR	< LOR	< LOR	-	-
Total PAHs	10	50		< LOR		16.07	1.486	3.305	2.739	NC	NC	0.07	NC		
Tributyltin (concentrations adjusted to 1% TOC)															
Dibutyltin	-	-	24.6 [4]	< LOR		0.12	0.043	0.016	0.028	< LOR	< LOR	< LOR	< LOR	-	-
Monobutlytin	-	-	-	< LOR		0.03	0.008	<LOR	<LOR	< LOR	< LOR	< LOR	< LOR	-	-
Tributyltin	0.009	0.07	24.6 [4]	< LOR		0.14	**0.105**	0.019	0.05	< LOR	< LOR	< LOR	< LOR	-	-
Triphenyltin	-	-	-	< LOR		0.02	0.015	<LOR	<LOR	< LOR	< LOR	< LOR	< LOR	-	-
Total Petroleum Hydrocarbons in Soil (concentrations adjusted to 1% TOC)															
C7 - C9	-	-	(500) (surface); (500) (1-4m) [3]	< LOR		0	-	-	<LOR	<LOR	<LOR	-	< LOR	< LOR	< LOR
C10 - C14	-	-	(1,700) (surface); (2,200) (1-4m) [3]	< LOR		0	-	-	<LOR	<LOR	<LOR	-	< LOR	< LOR	< LOR
C15 - C36	-	-	NL [3]	< LOR		390	-	-	67	<LOR	<LOR	-	< LOR	< LOR	< LOR
Total hydrocarbons (C7 - C36)	280	550	-	< LOR		390	-	-	67	<LOR	<LOR	-	< LOR	< LOR	< LOR
Suspected Product															
Asbestos															
FA/AF (% weight/weight)	-	-	0.001% [5]	< LOR		0	-	-	<0.001	-	ND	-	ND	-	-
ACM (% weight/weight)	-	-	0.05% [5]	< LOR		0	-	-	ND	-	ND	-	ND	-	-
Asbestos form	-	-	-	-		-	-	-	Chrysotile, loose fibres	-	ND	-	ND	-	-
BTEX	-	-	-	-	-	-	-	-	< LOR	< LOR	< LOR	-	< LOR	< LOR	< LOR
OTHER VOCs	-	-	-	-	-	-	-	-	< LOR	< LOR	< LOR	-	< LOR	< LOR	< LOR

Notes:
all results in mg/kg (unless otherwise stated)
NL = no limit
<LOR = below level of laboratory detection
NC = not calculated due to insufficient values above laboratory detection
* = Sample was not analysed for TOC. TOC concentrations from samples similar in location, depth and grain size have been used instead.

0. A&NZ 2018 Guidelines: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, toxicant default guideline values for sediment quality concentrations adjusted to 1% TOC
1.National Environmental Standard - Soil Contamination Standard - commerical land use
2.National Environment Protection Council - National Environment Protection Measure (Assessment of Site Contamination) - Health Investigation Levels - *Commercial/Industrial land use*
4.USEPA Regional Soil Screening Values, hazard quotient of 1, target risk value of 10-5, composite worker, chronic effects
5.BRANZ/ALGA New Zealand Guidelines for Assessing and Managing Asbestos in Soil (November 2017), *commercial land use*

	exceeds soil background concentration
	exceeds laboratory limit of detection
underline	exceeds A&NZ 2018 Guidelines - Default Guideline Value
red bold	exceeds A&NZ 2018 Guidelines - DV-High
	exceeds human health criteria for the assessment for reuse onsite

Table 9.11 **Elutriate results - Site 18 (mg/L)**

Sample ID	Assessment Criteria	Max	Seawater 1	GBH303 0.2-0.4	GBH303 0.6-0.8	GBH304 0.6-0.8
Lab ID	A&NZ Guidelines marine water 80% protection of species [1]		2024121.2	2024121.17	2024121.18	2024121.19
Metals and metaloids (total)						
Dissolved Arsenic	0.270 [UR]	0.0172	< 0.0042	0.0103	0.0097	0.0172
Dissolved Cadmium	0.036	0.00027	< 0.00021	< 0.00021	< 0.00021	0.00027
Dissolved Chromium	0.0906/ 0.085	0	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Dissolved Copper	0.008	0.0031	0.0031	< 0.0011	0.0025	0.0014
Dissolved Lead	0.012	0	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Dissolved Mercury	0.0014	0	< 0.00008	< 0.00008	< 0.00008	< 0.00008
Dissolved Nickel	0.56 [A]	0	< 0.007	< 0.007	< 0.007	< 0.007
Dissolved Zinc	0.043	0.117	0.0047	**0.078**	**0.094**	**0.117**
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	-	0.000019	< 0.000008	< 0.000008	< 0.000008	0.000019
Acenaphthylene	-	0	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Anthracene	0.0001 [UR]	0	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Benzo[a]anthracene	-	0	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Benzo[a]pyrene (BAP)	0.0001 [UR]	0	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Benzo[b]fluoranthene + Benzo[j]fluoranthene	-	0	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Benzo[g,h,i]perylene	-	0	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Benzo[k]fluoranthene	-	0	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Chrysene	-	0	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Dibenzo[a,h]anthracene	-	0	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Fluoranthene	0.001 [UR]	0	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Fluorene	-	0.000014	< 0.000008	< 0.000008	< 0.000008	0.000014
Indeno(1,2,3-c,d)pyrene	-	0	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Naphthalene	0.12	0	< 0.00004	< 0.00004	< 0.00004	< 0.00004
Phenanthrene	0.0006 [UR]	0.000023	< 0.000008	< 0.000008	< 0.000008	0.000023
Pyrene	-	0.00001	< 0.000008	< 0.000008	< 0.000008	0.00001
Tributyltin						
Dibutyltin		0	< 0.00006	< 0.00007	< 0.00007	< 0.00007
Tributyltin	0.00005	0	< 0.00005	< 0.00006	< 0.00006	< 0.00006
Triphenyltin		0	< 0.00004	< 0.00005	< 0.00005	< 0.00005

1. Australian and New Zealand Water Quality Guidelines (2018).

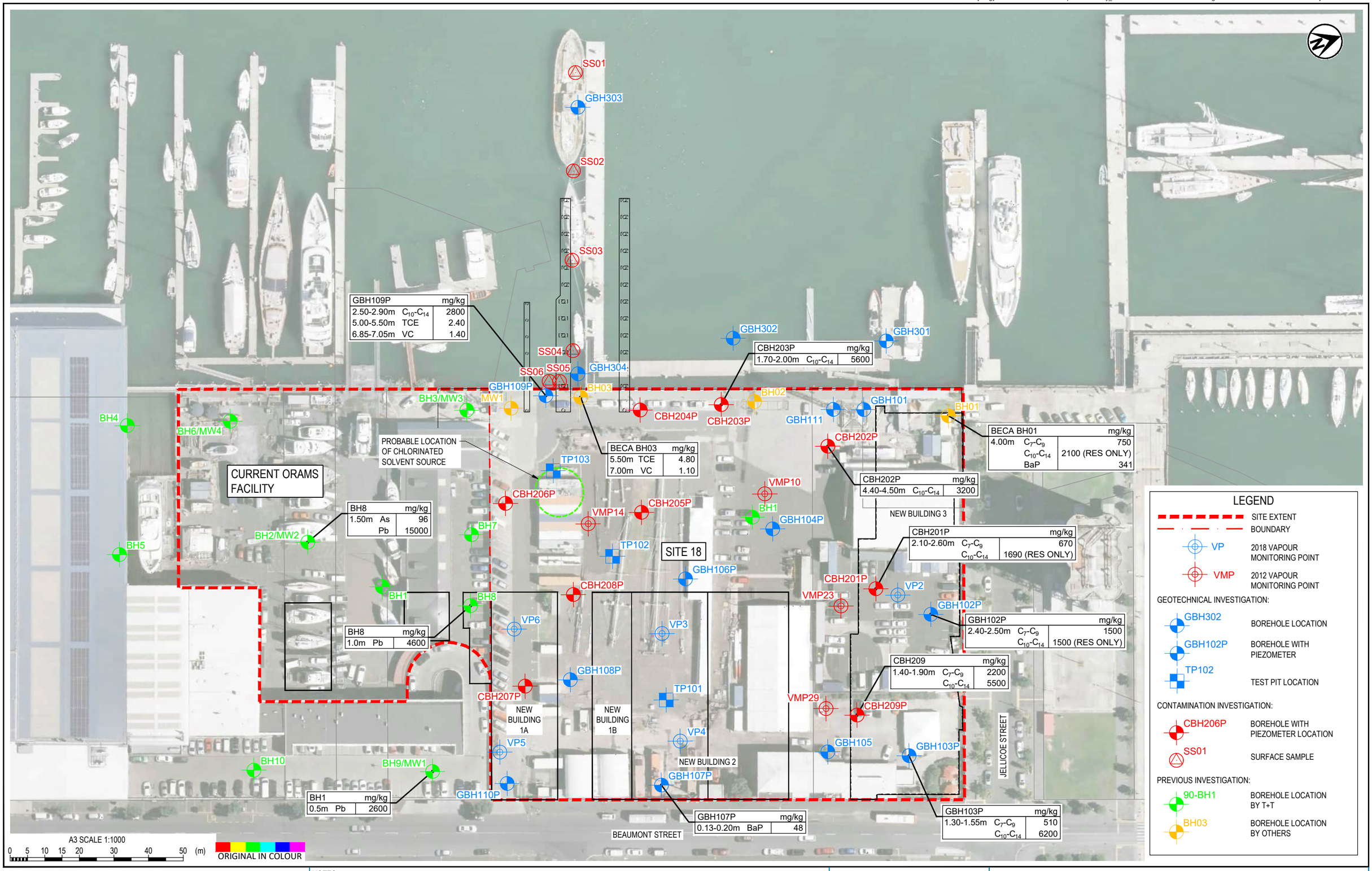
UR - unknown reliability value .

A - indicates that trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure.

bold and underlined - indicates that the A&S Water Quality Guideline is exceeded.

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C:\12dSynergy\data\ALBTCAD\Orams Expansion Facility_166\CAD\FIG\30881-CONT-F10A.dwg 2018-Nov-12 10:50:19 AM Plotted By: MARK ENNION



NOTES:

1. AERIAL PHOTO SOURCED FROM AUCKLAND COUNCIL GEOMAPS, LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 3.0 NEW ZEALAND LICENCE (CC BY 3.0).
2. ALL SEABED ARE IN CHART DATUM UNLESS NOTED OTHERWISE.
3. ALL LEVELS ON THE LAND ARE IN COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT COORDINATES. NEW ZEALAND VERTICAL 2016.
4. PROPOSED BUILDING OUTLINE PROVIDED BY RTA STUDIO, REF. "18122 - 142-188 BEAUMONT STREET_RC01_SK-010 - SITE PLAN_WIP.dwg" DATED 2/07/2018.

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PROJECT No.	30881.2000	
DESIGNED	LKH	Aug. 18
DRAWN	JC	Aug. 18
CHECKED	LKH	Nov.18
APPROVED	WMW	DATE Nov.18

CLIENT **ORAMS MARINE**

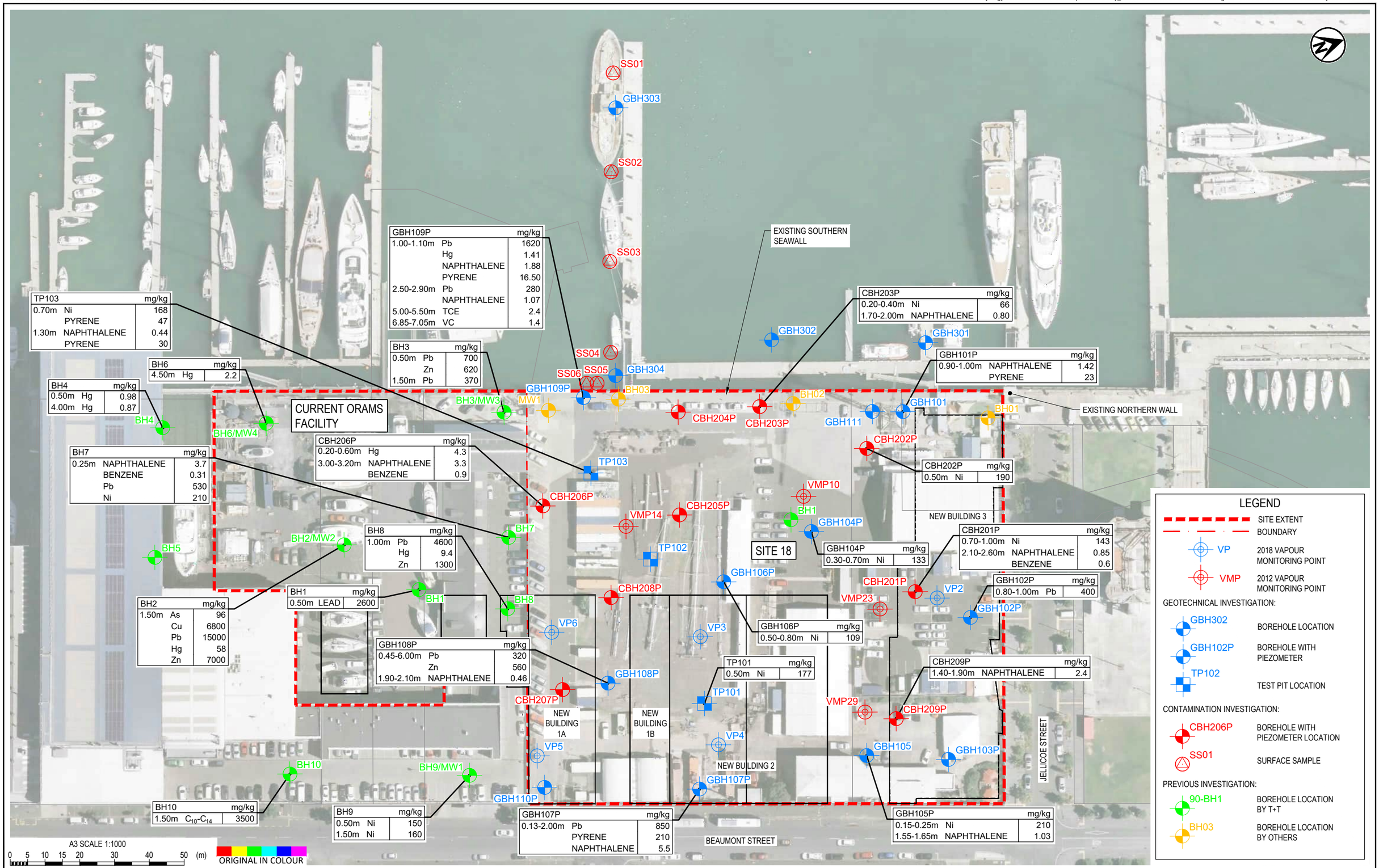
PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
CONCENTRATIONS IN SOIL - EXCEEDANCES OF HUMAN HEALTH CRITERIA

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 10A REV 3

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GBH109P		mg/kg
1.00-1.10m	Pb	1620
	Hg	1.41
	NAPHTHALENE	1.88
	PYRENE	16.50
2.50-2.90m	Pb	280
	NAPHTHALENE	1.07
5.00-5.50m	TCE	2.4
6.85-7.05m	VC	1.4

TP103		mg/kg
0.70m	Ni	168
	PYRENE	47
1.30m	NAPHTHALENE	0.44
	PYRENE	30

CBH203P		mg/kg
0.20-0.40m	Ni	66
1.70-2.00m	NAPHTHALENE	0.80

BH3		mg/kg
0.50m	Pb	700
	Zn	620
1.50m	Pb	370

GBH101P		mg/kg
0.90-1.00m	NAPHTHALENE	1.42
	PYRENE	23

BH6		mg/kg
4.50m	Hg	2.2

BH4		mg/kg
0.50m	Hg	0.98
4.00m	Hg	0.87

CBH206P		mg/kg
0.20-0.60m	Hg	4.3
3.00-3.20m	NAPHTHALENE	3.3
	BENZENE	0.9

BH7		mg/kg
0.25m	NAPHTHALENE	3.7
	BENZENE	0.31
	Pb	530
	Ni	210

CBH202P		mg/kg
0.50m	Ni	190

BH8		mg/kg
1.00m	Pb	4600
	Hg	9.4
	Zn	1300

CBH201P		mg/kg
0.70-1.00m	Ni	143
2.10-2.60m	NAPHTHALENE	0.85
	BENZENE	0.6

GBH104P		mg/kg
0.30-0.70m	Ni	133

GBH102P		mg/kg
0.80-1.00m	Pb	400

BH1		mg/kg
0.50m	LEAD	2600

BH2		mg/kg
1.50m	As	96
	Cu	6800
	Pb	15000
	Hg	58
	Zn	7000

GBH106P		mg/kg
0.50-0.80m	Ni	109

GBH108P		mg/kg
0.45-6.00m	Pb	320
	Zn	560
1.90-2.10m	NAPHTHALENE	0.46

TP101		mg/kg
0.50m	Ni	177

CBH209P		mg/kg
1.40-1.90m	NAPHTHALENE	2.4

BH10		mg/kg
1.50m	C_{10}-C_{14}	3500

BH9		mg/kg
0.50m	Ni	150
1.50m	Ni	160

GBH107P		mg/kg
0.13-2.00m	Pb	850
	PYRENE	210
	NAPHTHALENE	5.5

GBH105P		mg/kg
0.15-0.25m	Ni	210
1.55-1.65m	NAPHTHALENE	1.03

LEGEND

- SITE EXTENT
- BOUNDARY
- VP — 2018 VAPOUR MONITORING POINT
- VMP — 2012 VAPOUR MONITORING POINT

GEOTECHNICAL INVESTIGATION:

- GBH302 — BOREHOLE LOCATION
- GBH102P — BOREHOLE WITH PIEZOMETER
- TP102 — TEST PIT LOCATION

CONTAMINATION INVESTIGATION:

- CBH206P — BOREHOLE WITH PIEZOMETER LOCATION
- SS01 — SURFACE SAMPLE

PREVIOUS INVESTIGATION:

- 90-BH1 — BOREHOLE LOCATION BY T+T
- BH03 — BOREHOLE LOCATION BY OTHERS

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	WMW	Nov.18
	APPROVED	DATE

CLIENT **ORAMS MARINE**

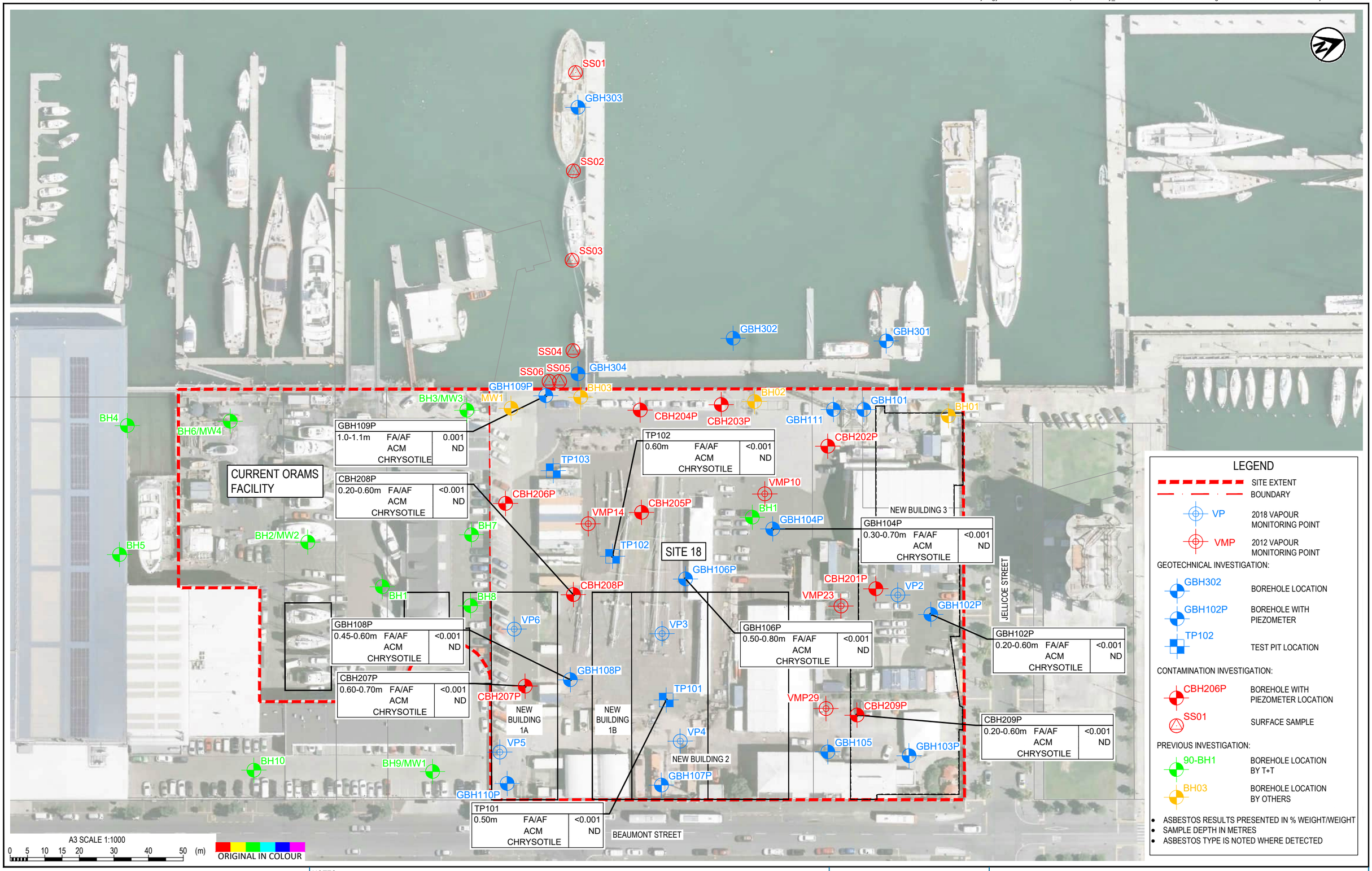
PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
CONCENTRATIONS IN SOIL - EXCEEDANCES OF AUP PA CRITERIA

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 10B REV 2

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LEGEND

- SITE EXTENT
- BOUNDARY
- VP 2018 VAPOUR MONITORING POINT
- VMP 2012 VAPOUR MONITORING POINT

GEOTECHNICAL INVESTIGATION:

- GBH302 BOREHOLE LOCATION
- GBH102P BOREHOLE WITH PIEZOMETER
- TP102 TEST PIT LOCATION

CONTAMINATION INVESTIGATION:

- CBH206P BOREHOLE WITH PIEZOMETER LOCATION
- SS01 SURFACE SAMPLE

PREVIOUS INVESTIGATION:

- 90-BH1 BOREHOLE LOCATION BY T+T
- BH03 BOREHOLE LOCATION BY OTHERS

- ASBESTOS RESULTS PRESENTED IN % WEIGHT/WEIGHT
- SAMPLE DEPTH IN METRES
- ASBESTOS TYPE IS NOTED WHERE DETECTED

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	APPROVED	DATE

CLIENT **ORAMS MARINE**

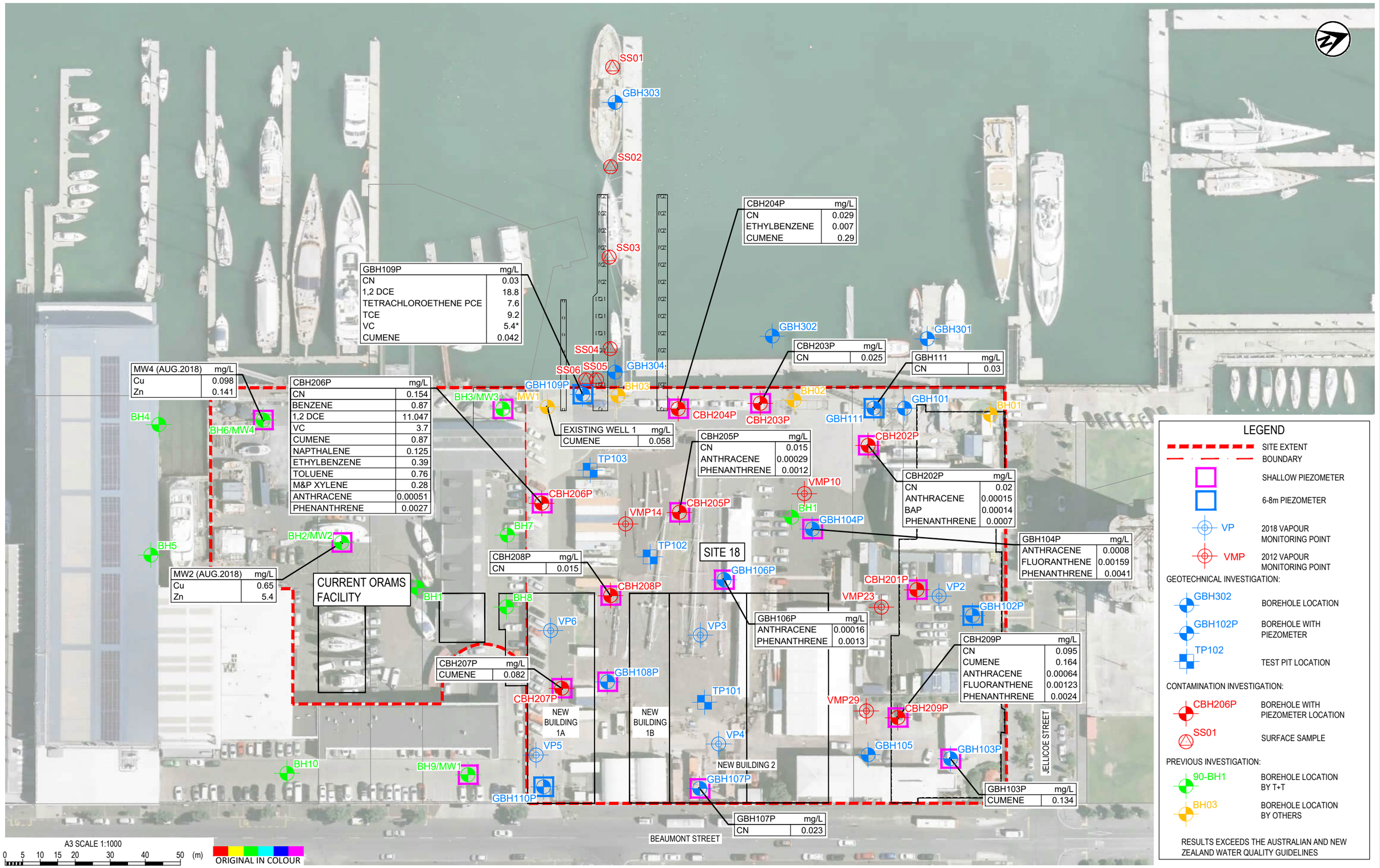
PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION CONCENTRATIONS IN SOIL - ASBESTOS

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 10C REV 2

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C:\12dSynergy\data\ALBTCAD\Orams Expansion Facility_166\CAD\FIG\30881-CONT-F11A.dwg 2018-Nov-02 3:31:48 PM Plotted By: MARK ENNION



GBH109P	mg/L
CN	0.03
1,2 DCE	18.8
TETRACHLOROETHENE PCE	7.6
TCE	9.2
VC	5.4*
CUMENE	0.042

CBH204P	mg/L
CN	0.029
ETHYLBENZENE	0.007
CUMENE	0.29

CBH203P	mg/L
CN	0.025

GBH111	mg/L
CN	0.03

MW4 (AUG.2018)	mg/L
Cu	0.098
Zn	0.141

CBH206P	mg/L
CN	0.154
BENZENE	0.87
1,2 DCE	11.047
VC	3.7
CUMENE	0.87
NAPTHALENE	0.125
ETHYLBENZENE	0.39
TOLUENE	0.76
M&P XYLENE	0.28
ANTHRACENE	0.00051
PHENANTHRENE	0.0027

EXISTING WELL 1	mg/L
CUMENE	0.058

CBH205P	mg/L
CN	0.015
ANTHRACENE	0.00029
PHENANTHRENE	0.0012

CBH202P	mg/L
CN	0.02
ANTHRACENE	0.00015
BAP	0.00014
PHENANTHRENE	0.0007

GBH104P	mg/L
ANTHRACENE	0.0008
FLUORANTHENE	0.00159
PHENANTHRENE	0.0041

MW2 (AUG.2018)	mg/L
Cu	0.65
Zn	5.4

CBH208P	mg/L
CN	0.015

GBH106P	mg/L
ANTHRACENE	0.00016
PHENANTHRENE	0.0013

CBH207P	mg/L
CUMENE	0.082

CBH209P	mg/L
CN	0.095
CUMENE	0.164
ANTHRACENE	0.00064
FLUORANTHENE	0.00123
PHENANTHRENE	0.0024

GBH103P	mg/L
CUMENE	0.134

GBH107P	mg/L
CN	0.023

LEGEND

- SITE EXTENT
- BOUNDARY
- SHALLOW PIEZOMETER
- 6-8m PIEZOMETER
- VP — 2018 VAPOUR MONITORING POINT
- VMP — 2012 VAPOUR MONITORING POINT

GEOTECHNICAL INVESTIGATION:

- GBH302 — BOREHOLE LOCATION
- GBH102P — BOREHOLE WITH PIEZOMETER
- TP102 — TEST PIT LOCATION

CONTAMINATION INVESTIGATION:

- CBH206P — BOREHOLE WITH PIEZOMETER LOCATION
- SS01 — SURFACE SAMPLE

PREVIOUS INVESTIGATION:

- 90-BH1 — BOREHOLE LOCATION BY T+T
- BH03 — BOREHOLE LOCATION BY OTHERS

RESULTS EXCEEDS THE AUSTRALIAN AND NEW ZEALAND WATER QUALITY GUIDELINES

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PROJECT No.	30881.2000	
DESIGNED	LKH	Aug. 18
DRAWN	JC	Aug. 18
CHECKED	AMM	Nov.18
APPROVED	WMW	Nov.18

CLIENT **ORAMS MARINE**

PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
CONCENTRATIONS IN GROUNDWATER - EXCEEDANCES OF WATER QUALTY GUIDELINES

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 11A REV 2

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LEGEND

- SITE EXTENT
- BOUNDARY
- SHALLOW PIEZOMETER
- 6-8m PIEZOMETER
- VP — 2018 VAPOUR MONITORING POINT
- VMP — 2012 VAPOUR MONITORING POINT

CHEMICAL EXPOSURE CLASSIFICATION:
SULPHATE CONCENTRATION IN GROUNDWATER

- 500 mg/L
- XA2
- XA1

NOTE: pH ALL UNRESTRICTED ie. >6.5

GEOTECHNICAL INVESTIGATION:

- GBH302 — BOREHOLE LOCATION
- GBH102P — BOREHOLE WITH PIEZOMETER
- TP102 — TEST PIT LOCATION

CONTAMINATION INVESTIGATION:

- CBH206P — BOREHOLE WITH PIEZOMETER LOCATION
- SS01 — SURFACE SAMPLE

PREVIOUS INVESTIGATION:

- 90-BH1 — BOREHOLE LOCATION BY T+T
- BH03 — BOREHOLE LOCATION BY OTHERS

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CLIENT **ORAMS MARINE**

PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
SULPHATE CONCENTRATIONS IN GROUNDWATER

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 11B REV 2

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SS01
GBH303
SS02
SS03
GBH302
GBH301
SS04
SS06
SS05
GBH304
GBH109P
BH03
BH02
BH01
BH3/MW3
MW1
BH4
BH6/MW4
18500
15700
9600
2700
145
CBH204P
CBH203P
10600
1650
GBH111
GBH101
CBH202P
6600
CURRENT ORAMS FACILITY
TP103
CBH206P
1000
50
CBH205P
VMP14
VMP10
BH1
GBH104P
680
NEW BUILDING 3
BH7
BH2/MW2
BH5
8300
TP102
SITE 18
GBH106P
105
CBH201P
300
VP2
VMP23
GBH102P
5200
CBH208P
66
BH1
BH8
VP6
VP3
NEW BUILDING 2
GBH108P
44
CBH207P
44
TP101
VMP29
CBH209P
30
NEW BUILDING 1A
NEW BUILDING 1B
VP4
VP5
GBH105
GBH103P
169
JELLICOE STREET
BH10
BH9/MW1
GBH107P
55
GBH110P
5400
BEAUMONT STREET

A3 SCALE 1:1000
0 5 10 15 20 30 40 50 (m)
ORIGINAL IN COLOUR

LEGEND

- SITE EXTENT
- BOUNDARY
- SHALLOW PIEZOMETER
- 6-8m PIEZOMETER
- VP — 2018 VAPOUR MONITORING POINT
- VMP — 2012 VAPOUR MONITORING POINT

CHLORIDE CONCENTRATION IN GROUNDWATER:

5000 mg/L

GEOTECHNICAL INVESTIGATION:

- GBH302 — BOREHOLE LOCATION
- GBH102P — BOREHOLE WITH PIEZOMETER
- TP102 — TEST PIT LOCATION

CONTAMINATION INVESTIGATION:

- CBH206P — BOREHOLE WITH PIEZOMETER LOCATION
- SS01 — SURFACE SAMPLE

PREVIOUS INVESTIGATION:

- 90-BH1 — BOREHOLE LOCATION BY T+T
- BH03 — BOREHOLE LOCATION BY OTHERS

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APPROVED	WMW	DATE Nov.18

CLIENT **ORAMS MARINE**
PROJECT **142-188 BEAUMONT STREET**
TITLE GROUND CONTAMINATION SITE INVESTIGATION CHLORIDE CONCENTRATIONS IN GROUNDWATER
SCALE (A3) 1:1000 FIG No. CONT - FIGURE 11C REV 2

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C:\12dSynergy\data\ALBTCAD\Orams Expansion Facility_166\CAD\FIG\30881-CONT-F12.dwg 2018-Nov-02 3:32:22 PM Plotted By: MARK ENNION

SS01	mg/kg
Cu	60
Pb	69
Hg	*1.1
TBT	0.015
ASBESTOS DETECTED	

SS02	mg/kg
Cu	88
Pb	84
Hg	*1.88
TBT	0.011
Ni	25
ASBESTOS DETECTED	0.018

SS03	mg/kg
Cu	96
Hg	0.76
Pb	60
TBT	0.037
ASBESTOS DETECTED	0.018

SS04	mg/kg
TBT	0.02
Hg	0.19
ASBESTOS DETECTED	0.039

SS05	mg/kg
Pb	57
Cu	123
Hg	0.59
TBT	*0.133
ASBESTOS DETECTED	

SS06	mg/kg
Cu	113
Hg	0.59
Pb	64
TBT	*0.141
ASBESTOS DETECTED	
TOTAL PAH	16.07

GBH303		mg/kg
0.20-0.40m	Cd	1.53
	Cu	105
	Hg	0.49
	TB	*0.105
0.60-0.80m	Cu	84
	Pb	76
	Hg	*1.53
	Ni	24
	TBT	0.019
1.00-1.20m	Pb	89
	Hg	*2.0
	TBT	0.05
ASBESTOS DETECTED		
1.85-2.10m	-	-

GBH304		mg/kg
0.35-0.55m	-	-
0.60-0.80m	-	-
1.00-2.00m	-	-
2.45-2.65m	-	-
4.50-4.70m	-	-

GBH301		mg/kg
0.50-0.60m	TOTAL PAHs	11.38
	TBT	0.05
1.25-1.45m	-	-

GBH302		mg/kg
0.00-1.00m	Cu	89
	Pb	77
	Hg	*1.57
	TBT	0.017
	TPH	345
3.65-4.20m	-	-

SS01 GBH303 SS02 SS03 SS04 SS05 SS06 GBH304 GBH302 GBH301 GBH109P BH03 BH02 BH01 BH3/MW3 MW1 BH4 BH6/MW4 CBH204P CBH203P GBH111 GBH101 CBH202P TP103 CBH206P VMP10 VMP14 CBH205P BH1 GBH104P BH7 BH2/MW2 BH5 TP102 SITE 18 GBH106P CBH208P CBH201P VP2 VMP23 GBH102P BH1 BH8 VP6 VP3 GBH108P TP101 VMP29 CBH209P CBH207P VP4 VP5 GBH105 GBH103P BH10 BH9/MW1 GBH107P GBH110P

EXTENT OF DREDGING

CURRENT ORAMS FACILITY

NEW BUILDING 3

NEW BUILDING 2

NEW BUILDING 1A

NEW BUILDING 1B

JELLICOE STREET

BEAUMONT STREET

A3 SCALE 1:1000

0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

LEGEND

- SITE EXTENT
- BOUNDARY
- VP 2018 VAPOUR MONITORING POINT
- VMP 2012 VAPOUR MONITORING POINT

GEOTECHNICAL INVESTIGATION:

- GBH302 BOREHOLE LOCATION
- GBH102P BOREHOLE WITH PIEZOMETER
- TP102 TEST PIT LOCATION

CONTAMINATION INVESTIGATION:

- CBH206P BOREHOLE WITH PIEZOMETER LOCATION
- SS01 SURFACE SAMPLE

PREVIOUS INVESTIGATION:

- 90-BH1 BOREHOLE LOCATION BY T+T
- BH03 BOREHOLE LOCATION BY OTHERS

SEDIMENT SAMPLING RESULTS WHERE CONCENTRATIONS EXCEED THE A&NZ 2018 GUIDELINES DGV. CONCENTRATIONS IN *BOLD ALSO EXCEEDS THE GV-HIGH

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CLIENT **ORAMS MARINE**

PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION CONCENTRATIONS IN SEDIMENTS AND OFFSHORE SOIL

SCALE (A3) 1:1000 FIG No. CONT - FIGURE 12 REV 2

10 Developed Conceptual Site Model

This section updates the preliminary CSM, setting out identified contaminant sources and updating the exposure assessment. Figures 13A-13D illustrates the key elements of the developed CSM and the sections below describe identified contaminant sources and the exposure assessment in the context of the proposed works (Section 2).

10.1 Sources

Primary sources of contamination (the various hydrocarbon product tanks) were removed during Mobil's decommissioning programme in 2006 or during earlier upgrades to their facility. Secondary source areas remain on the site, both onsite derived and as a result of activities on adjacent land. Table 10.1 summarises the sources of contamination within the development area (Site 18 and the portion of Orams existing facility that will be subjected to ground improvement).

Table 10.1 lists the sources and indicates how each contaminant source will be reduced the proposed works (Section 2).

Table 10.1. Contaminant sources and extent

Type	Extent and affected media
Granular reclamation materials	• Granular reclamation materials placed during the sites reclamation form the top of the stratigraphic profile across Site 18 and the existing Orams facility. The granular materials are generally in the order of 1-2 m thick but thicken to up to 5 m in the west near the seawall. • These materials contain gasworks, incinerator and marine activity derived contaminants (metals, cyanide, TBT, PAHs), and in places low/trace levels of asbestos. Ground improvement and pavement works will result in in the upper 1.2 – 1.5 m of these materials being cement stabilised and re-compacted, with inclusion of the pavement the layer will be 1.85 – 2.05 m thick.
Chlorinated solvents	• Southwest corner Site 18 (refer Figure 10A for location of original storage chlorinated solvent storage area). There is some uncertainty around the northern and southern extents. • Chlorinated solvents are present in deeper sandier in situ marine sediments below sea level and low levels of chlorinated solvents occur in shallow soil within the area where chlorinated solvents were stored (refer cross section Figure 7D). • Investigations completed to date have not measured DNAPLs in any monitoring wells, however based on the concentrations in groundwater relative to the products effective solubility residual DNAPL may be present. Given that DNAPL was not measured in the monitoring wells it suggests DNAPL is relatively immobile. • A plume of dissolved phase contaminants is likely to extend offsite into the harbour. Detailed assessment of the discharge to the harbour is presented in Appendix M. • A secondary source of chlorinated solvents was identified in the eastern part of the site beneath proposed Building B2. This was identified in vapour only and the lack of soil or groundwater impacts, combined with the known layout of storage facilities suggests this is a localised source. The proposed works will result in cement stabilisation and removal associated with the ground improvement and deep soil mixed seawall installation. This will reduce the mass of residual chlorinated solvent contamination, particularly in shallow soils. The DSM wall will result in a reduction of discharges to the harbour. These effects are demonstrated by the detailed assessment presented in Appendix M. As noted in Section 9.4.5, as a risk mitigation measure it is proposed to locally deepen selected DSM

Type	Extent and affected media
	panels in the south-western corner of the site. The depth and number of panels to be deepened will be confirmed during detailed design. The placement of vapour protection system (stabilised ground or vapour barrier) for the buildings in this area will address the potential risk from vapour from this source.
Hydrocarbons	• Present across almost the entire Site 18 area, residual (degraded) hydrocarbons occur in granular and dredged hydraulic reclamation materials predominantly within the water table fluctuation zone (1-3 m bgl). Based on review of the chromatographs it is inferred that the hydrocarbons principally relate to degraded diesel, petrol, kerosene, jet fuel, turpentine, light fuel oil and lube oil. • In places SPH (LNAPL) was recorded (four of the 22 wells), generally weathered diesel with a mixture of fuel oil and jet oil in the centre of the site. Given the length of time the product has remained in ground, and supported by experience during works in Jellicoe Street, it is highly likely that it will have significant mobility, only being released locally during direct excavation of the materials. • A sheen of suspected hydrocarbon discharge was observed seeping from the sea wall at approximate 0-1 RL at low tide approximately 16 m north of the site's southern boundary. • Residual hydrocarbons in soil, as SPH and dissolved in groundwater is a source of vapour however the assessment indicates that the risks to construction workers is low. Vapour mitigation works may be required to address potential risks to future site users depending on the foundation solution selected during detailed design. The top 1.85 – 2.05 m of the site will be cement stabilised and formed as pavement during the development. This expected to have the following effects: • A degree of vapour retardation is expected due to placement of the mixed and recompacted cement stabilised ground, and placement of pavement above. If the buildings are piled, vapour protection system will be installed. • Residual SPH will be prevented from reaching the coast by the seawall and additional cut off walls to be placed around the site's perimeter. • Dissolved phase hydrocarbon contamination in groundwater currently discharging to the coast is expected to be slowed significantly, if not stopped, by the addition of the seawall (refer to Appendix M).
Other products	• PFAS is present in groundwater highest in the northern part of the site. All recorded concentrations are below the marine discharge evaluation criteria. No soil testing for PFAS has been conducted. The pathways for discharge of groundwater to the coast will be lengthened by installation of the seawall, as detailed in Appendix M.
Offsite derived	• Jet fuel is observed in places across the site and may have resulted in part from historic spill from the former Shell Block III facility located east/southeast of the site. • Cyanide is a regional gasworks-derived contaminant in Wynyard Precinct as documented in the preliminary CSM and is confirmed as present in groundwater, both in upgradient (shallow and deep) and downgradient wells (deep only). The proposed cut off walls along the southern half of Beaumont Street boundary and the south of Site 18 will significantly slow, if not stop, upgradient discharges entering the site. The pathways for discharge of groundwater to the coast will be lengthened by installation of the DSM wall, as detailed in Appendix M.
Sediment	• Sediment directly offshore from Site 18 and within the area proposed to be dredged contains contaminants consistent with general marine use and accumulation of sediments derived from the large urbanised catchment. Contaminant levels decrease with depth but not necessarily with distance from the seawall.

Type	Extent and affected media
	Dredging will remove all sediment within the dredged zone and expose natural in situ alluvial soils. Soils that will be exposed post dredging contain trace levels of contaminants, inferred to be natural background levels. Sediment that is remaining onsite is likely similar to the sediment quality of the broader area, based on the contaminant distribution across the full data set from this investigation. Therefore there is no effect from the site relative to the wider port area.

10.2 Exposure assessment

The preliminary CSM identified a number of potential receptors should pathways or mechanisms for receptors to be exposed be present. The following confirms key risks to receptors and an assessment of whether mechanisms exist for exposure during and post development (i.e. is the pathway to the identified receptor complete). The current exposure has also been assessed as a means of qualifying the positive impacts development of the land will have on potential receptors.

Table 10.2. Current land use exposure assessment

Receptor	Pathway/ mechanism	Complete	Potential risk
Currently the site is largely sealed or covered in hardstand with temporary and permanent buildings occupied on short term lease arrangements. There are marine servicing related activities occurring within external areas.			
Site workers in buildings	• Vapour inhalation indoors.	Yes	Low. The current uses are temporary. Would need to be quantified with indoor air testing.
Site workers outside	• Dermal contact with contaminated soils. • Inhalation of contaminants via dust. • Inhalation of vapour. • Nuisance odours.	No	Low. Under normal operations as the pathways are incomplete. High. If soil disturbance occurred and proper mitigation was not in place.
Aquatic organisms in harbour	• Discharge of contaminants via groundwater. • Discharge of SPH. • Dissolution of contaminants to sediment pore-space water. • Discharge of contaminants via stormwater.	Yes	Moderate. Poor water quality would limit benthic varieties however the area is in a highly urbanised catchment and is likely already impacted. .
Users of the harbour in the vicinity of the site	• Dermal contact with SPH and stormwater (via bedding materials or old broken pipes) discharge to harbour. • Ingestion of SPH or contaminated stormwater discharges	Yes	Low. Not readily accessible or safe for swimming due to navigational hazards and swimmers (if any) would be exposed to contaminant seepage over a short timeframe and dilution effects are large.

Table 10.3. Construction related exposure assessment

Receptor	Pathway/ mechanism	Complete	Potential risk
Seawall upgrade, ground improvement works, dredging and construction of structures in the CMA is occurring as part of the site development. A RAP has been prepared that sets out mitigation measures for the contractors to follow to mitigate effects.			
Onsite workers	• Dermal contact with contaminated soils. • Inhalation of contaminants via dust. • Inhalation of vapour. • Nuisance odours. • Inhalation of asbestos fibres.	Yes	Low. If appropriate mitigation measures are in place (refer RAP).
Surrounding site workers and general public	• Inhalation of contaminants via dust including asbestos and vapour. • Nuisance odours.	Yes	Low. If appropriate mitigation measures are in place (refer RAP).
Aquatic organisms in harbour	• Discharge of contaminants via groundwater. • Discharge of SPH. • Dissolution of contaminants in sediment during dredging. • Discharge of contaminants via stormwater.	Yes	Low. The RAP and Dredging Management Plan set out procedures for mitigating effects, particularly potential contaminated surface water and sediment discharges. In addition elutriate testing shows that contaminants in sediment, aside from zinc, are not expected to be mobile to a level where environmental effects will occur. Discharges of groundwater to the harbour are not expected to change during construction given that the DSM walls will be initiated at commencement of the project. If any discharges do occur they are anticipated to be short term, until the DSM walls are complete.
Users of the harbour in the vicinity of the site	• Dermal contact with SPH and stormwater (via bedding materials or old broken pipes) discharge to harbour. • Ingestion of SPH or contaminated stormwater discharges.	No (CMA access will be restricted during works).	N/A.
People and the environment at disposal site if soil/ sediment disposed offsite	• Dermal contact and inhalation risk to workers. • Nuisance odours. • Runoff of contaminated sediment and surface water to water bodies or public networks.	Yes	Low. If appropriately consented disposal locations used.

Table 10.4. Future/ post construction land use exposure assessment

Receptor	Pathway/ mechanism	Complete	Potential risk
The development proposal will remove or cement stabilise contaminated soils in the upper 1.85 m of the soil profile (including the 350 mm pavement) A new seawall and diversion structure up to from 10 m depth (to 18 m where deep panels are proposed) will be in place along the western boundary. New buildings will be constructed – two marine services/retail buildings will be constructed in the centre south in Stage 1. In Stage 2 an apartment building will be constructed on the north of the site.			
Site workers and residents in buildings	• Vapour inhalation indoors.	Yes	Low to moderate. Concentrations of vapour in the area of buildings B1a, B1b/B2 indicates a low to moderate risk, with risk in part dependent on the final foundation solution. If a cement stabilised block and concrete slab foundation solution is selected for Buildings B1a, B1b and B2, the expected the vapour retardation will result in a lower risk to indoor air accumulation thereby further reducing any potential risk. If a piled foundation solution is selected, then vapour risk mitigation will likely be required. Data within or near the apartment (building B3) footprint indicates a low risk. Further assessment on the requirement for a vapour barrier for the apartment will be completed at detailed design stage.
Site workers outside	• Dermal contact with contaminated soils. • Inhalation of contaminants via dust. • Inhalation of vapour. • Nuisance odours.	No	Negligible. The site will be fully sealed and vapour concentrations comply with acceptance criteria under outdoor use.
Aquatic organisms in harbour	• Discharge of contaminants via groundwater. • Discharge of SPH. • Dissolution of contaminants in sediment. • Discharge of contaminants via stormwater.	Yes	Low. With regard to petroleum hydrocarbons the seawall and diversion structures will prevent SPH and contaminated groundwater discharges to the harbour. Stormwater will be treated prior to discharge and new pipework will be protected via pipe dams. The plume of chlorinated solvents in the southwest of Site 18 has been shown by modelling (refer Appendix M) to be significantly reduced by installation of the DSM wall to acceptable levels. Contaminated sediment within the dredging footprint will be fully removed exposing soils that have natural background levels of site-derived contaminants. Remaining sediments likely to be similar quality to those in the surrounding area.

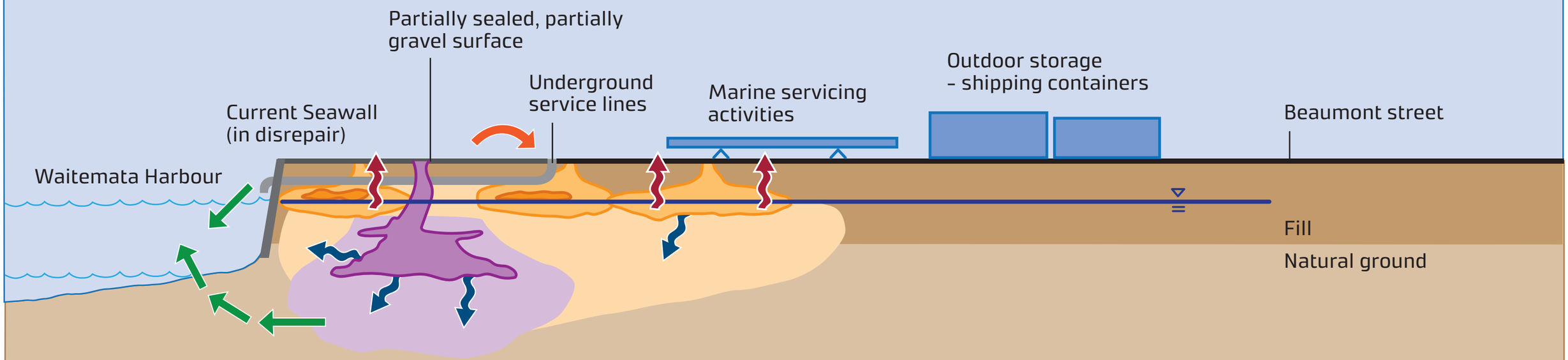
Receptor	Pathway/ mechanism	Complete	Potential risk
Users of the harbour in the vicinity of the site	• Dermal contact with SPH and stormwater (via bedding materials or old broken pipes) discharge to harbour. • Ingestion of SPH or contaminated stormwater discharges.	No	Negligible. The seawall and diversion structures will prevent SPH discharges to the harbour and the area will be inaccessible for swimming due to vessel lifting operations.

10.3 Risks to property

Aggressive groundwater conditions for concrete have been identified in the seaward side of the site in the area of the seawall, and to a lesser degree on the Beaumont Street boundary. Restrictions on concrete constitution for XA1 or XA2 conditions may need to be considered in these areas. Aggressive conditions in soil has not been considered to date, and further assessment maybe required.

The presence of elevated hydrocarbons including SPH will require the use of barrier pipes, such as HDPE, to protect the quality of potable water supply. This may be able to be reviewed by assessing the mudcrete during placement.

Pre-development – South



Leaching of contaminants to groundwater

Volatilisation of contaminants

Discharge to harbour

Overland flow

Separate phase product

Hydrocarbons in soil

Dissolved phase hydrocarbons in ground water

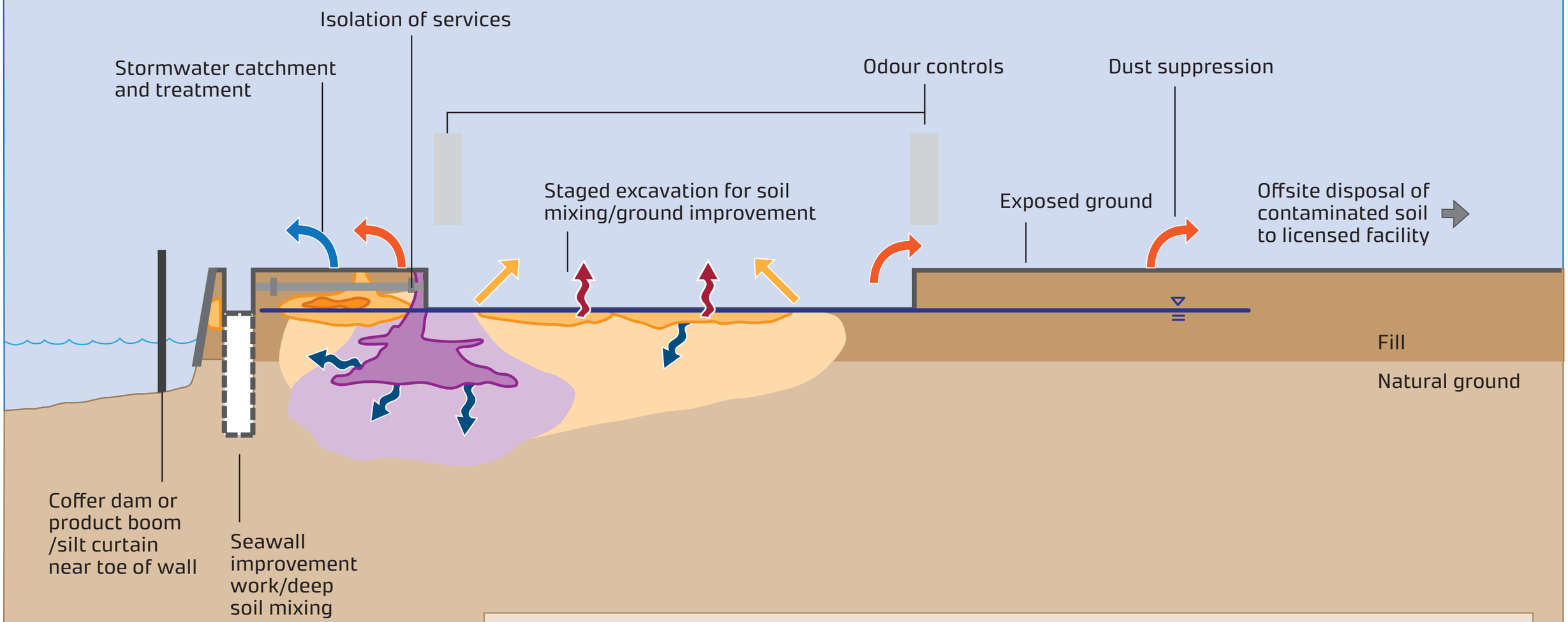
Chlorinated solvent in soil

Dissolved phase chlorinated solvents in groundwater

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GROUND CONTAMINATION SITE INVESTIGATION
FIGURE 13A - CONCEPTUAL SITE MODEL - PRE-DEVELOPMENT SOUTH

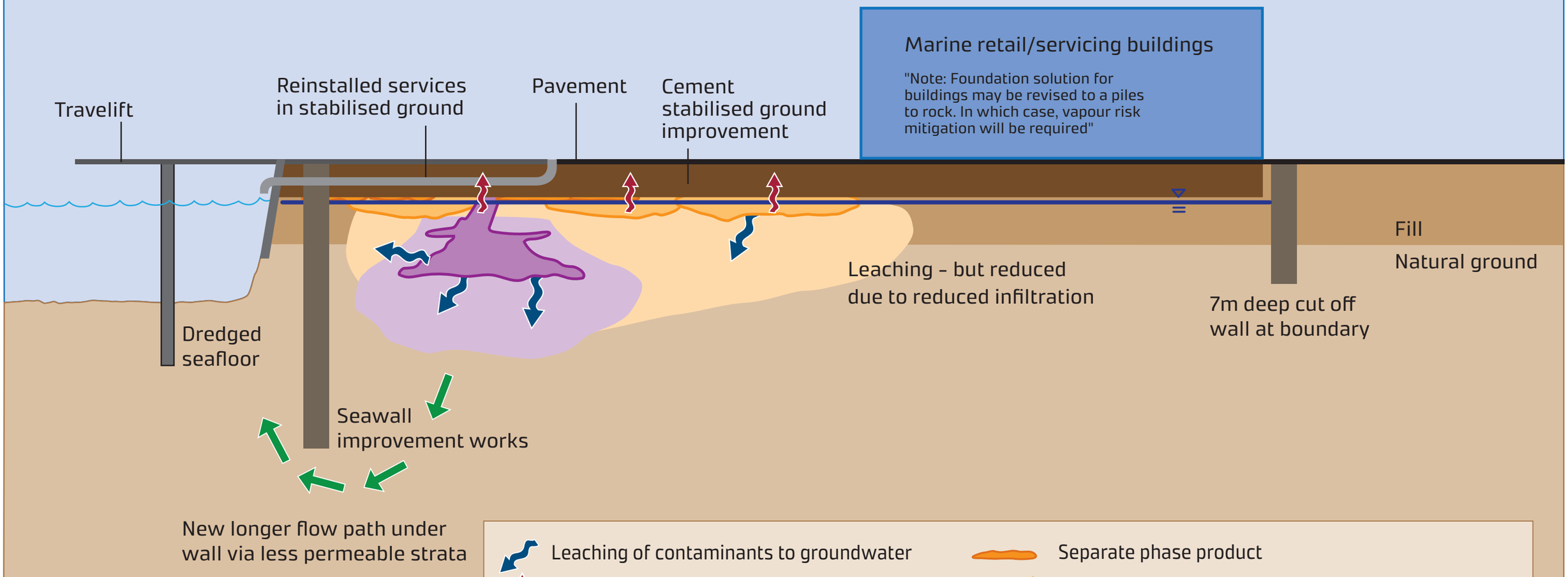
During construction



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GROUND CONTAMINATION SITE INVESTIGATION
FIGURE 13B - CONCEPTUAL SITE MODEL - DURING CONSTRUCTION

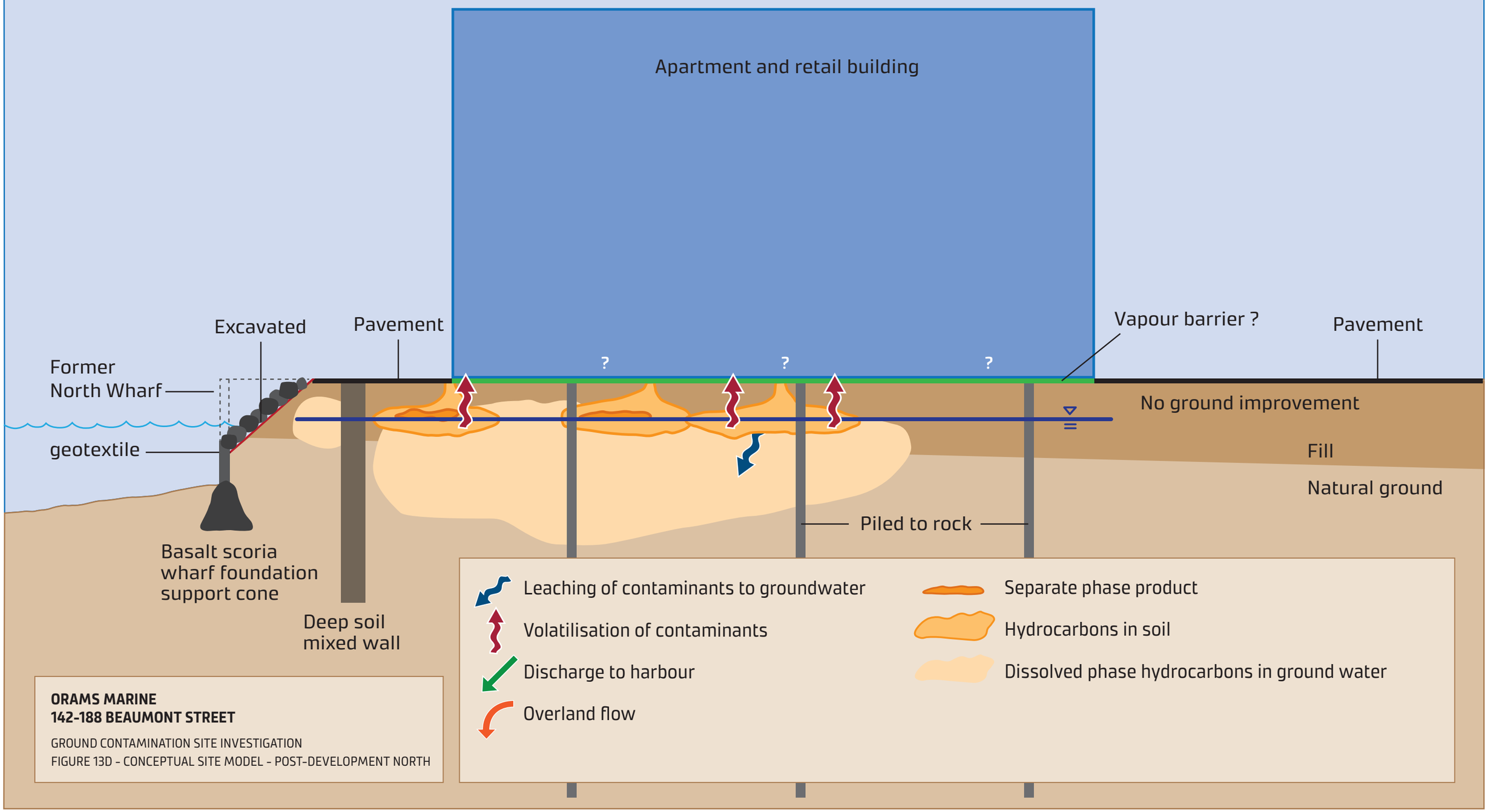
Post-development – South



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GROUND CONTAMINATION SITE INVESTIGATION
FIGURE 13C – CONCEPTUAL SITE MODEL – POST-DEVELOPMENT SOUTH

Post-development – North



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GROUND CONTAMINATION SITE INVESTIGATION
FIGURE 13D - CONCEPTUAL SITE MODEL - POST-DEVELOPMENT NORTH

11 Development Implications

The implications on consents and earthworks for development the site and facilities in the CMA are discussed below.

11.1 Regulatory implications

In the Auckland Region the key legislation and planning controls around contaminated sites are specified in the following documents:

- The National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES Soil) Regulations (2011).
- The Auckland Unitary Plan – Operative in Part (referred to as the AUP).
- Health and Safety at Work (Asbestos) Regulation (2016).

The NES Soil Regulation consider issues relating to land use and the protection of human health. The Unitary Plan has regard to issues relating to the protection of the general environment, including ecological receptors.

In addition to the above, the management of in soils is regulated under the Health and Safety at Work (Asbestos) Regulations 2016 (Asbestos Regulations). In order to help achieve compliance with the Asbestos Regulations, WorkSafe New Zealand has prepared an Approved Code of Practice (ACoP): Management and Removal of Asbestos (September 2016). The ACoP refers readers to the *"New Zealand Guidelines for Assessing and Managing Asbestos in Soil"* (Asbestos Guidelines) which were published in November 2017 by BRANZ Ltd.

The need, or otherwise, for contamination-related resource consents for the site redevelopment is assessed against these regulatory requirements in the following sections.

11.1.1 NES Soil

This report confirms the site has been subjected to HAIL activities thus the regulation applies and consent is required because soil disturbance, soil disposal and land use change is proposed to occur above permitted activity thresholds.

Based on the results of the testing, consent under the NES Soil is required on a Restricted Discretionary basis under Regulation 10 given that contaminant levels exceed the applicable land use criteria for a range of contaminants in onsite soil. A Draft Remediation Action Plan (RAP) for ground contamination and Dredging Management plan have been prepared to support the consent applications.

11.1.2 AUP

Contaminant levels in the reclamation fill in places exceed the "discharge" criteria set out in the AUP thus consent for discharges is required on a Controlled activity basis under Rule E30.4.1 (A6) on the basis that Clause E30.6.2.1 4(b) *discharges from the land are highly unlikely to cause significant adverse effects on the environment*.

11.1.3 Asbestos Regulations

An asbestos survey should be undertaken to assess whether asbestos is present within the remaining buildings.

If asbestos is present on the buildings, their demolition will require careful management to prevent contamination of soil or spread of ACM about the site. If asbestos is found in the buildings then

testing of soils will be required post demolition to inform disposal of near surface soils that may be been affected by the demolition. The removal of asbestos is notifiable to Worksafe NZ and the demolition contractor (if asbestos is found) will need to have the necessary qualifications under the Asbestos Regulation to undertake the works.

Low/trace levels of asbestos fibres have been found in some near surface materials. The levels are low (at or below 0.001% w/w) and thus the disturbance of these materials is considered as Unlicensed Works controls under the Asbestos Guidelines.

11.2 Construction implications

The CSM indicates potential for effects on people and the environment during development of the site. These risk are manageable through use of targeted remedial actions and industry best practice controls. Monitoring to assess the effectiveness of controls is also proposed.

Remedial and construction requirements are set out in:

1 Remediation Action Plan for ground contamination prepared by T+T (November 2018). This document is currently in a draft form for Council and peer review feedback during consenting. It will be finalised prior to commencement of works.

2 Dredging Management Plan prepared by Heron Construction Co. Ltd. This document is also in a draft form, submitted in support of consent applications.

The above plans include proposed mitigation and monitoring in respect of soil disturbance and sediment removal. A number of other monitoring plans will be produced including specifications for monitoring:

- Groundwater flow and related settlement.
- Shorebird effects.
- Noise and vibration.

The following sections summarise the key issues including ground contamination-related remedial requirements addressed by these plans, as identified in the CSM (Section 10).

11.2.1 General management provisions

The CSM (Section 10) confirms the following ground contamination-related aspects will need to be managed during the development of the site:

- Earthworks controls will be required during disturbance of soils.
- Asbestos management during demolition (if buildings are found to contain asbestos). A low level of control (unlicensed works) will also need to be implemented during disturbance of asbestos contaminated soils.
- Environmental effects management including appropriate disposal of all water (surface or ground) accumulated during the works will need to be disposed to tradewaste via a permit obtained from Watercare Services, or a licensed liquid waste disposal facility. Water will require treatment prior to discharge to tradewaste if this is the selected option, including removal of sediment, pH control and removal of SPH. There are flow limits of 1-2 L/sec and these are restricted by tidal variation. Suitable storage will also need to be allowed for during the works.
- SPH will need to be collected where possible and disposed to a licensed liquid waste facility.
- Odour management will be required to improve conditions for site workers and minimise impacts on the general public and adjacent property workers.

- Surplus excavated material to be disposed of offsite must be taken to an approved disposal site licensed to receive the material based on the levels of contamination. Disposal to licensed landfill is indicated by the available data. Odour is likely to constrain any other disposal options.
- Dredged sediment disposal is still being assessed but may include on or offshore disposal depending on its ability to meet permitting requirements. Contamination conditions do not impose any constraints for use of the material onsite.
- Imported fill must be clean (i.e. meet published background levels).
- Measures to protect workers during sub-ground works such as the ground improvement and seawall construction works and services installation. This will include monitoring, physical venting methods (if required), health and safety and PPE requirements. Training will be an important component of the health and safety implementation process.
- Controls for dredging and disturbance of seawall to mitigate potential discharges of SPH and/or contaminated soils/sediment.

11.2.2 Ground contamination remedial actions

The works being undertaken at the site for geotechnical and development purposes will in themselves result in contamination pathways being addressed. In particular a considerable proportion of SPH and most likely volatile hydrocarbon fractions will be removed during excavation and placement of the stabilised raft. The seawall repair works are expected to effectively stop the discharge of petroleum hydrocarbon contaminants to the harbour from Site 18.

The seawall works are also expected to result in a significant reduction in the discharge of chlorinated compounds in deeper groundwater such that surface water concentrations are expected to be well below the marine protection criteria post-DSM wall installation (refer to Appendix M). As a risk mitigation measure it is proposed to address any potential uncertainty in the modelling results by deepening selected DSM panels in the south-western corner of the site. It is expected that relatively small increases in depth (~2 m) of a limited number of panels (~10) will result in significant increases in attenuation. The depth and number of panels to be deepened will be confirmed during detailed design.

Specific remedial actions are required in conjunction with the geotechnical requirements of the ground improvement to assist in contaminant (SPH and dissolved phase contaminants in groundwater) encapsulation and retardation. These include:

- Installation of vapour barriers. The data indicates permanent measures to prevent vapour intrusion into the proposed commercial buildings will likely be required where cement stabilisation of the ground is not completed. Vapour risk mitigation will be assessed in more detail including quantitative assessment of the ground stabilisation scenario, during detailed design. Input into the detailed design process will be important to achieve the required level of protection (if any).
- Strength and protection of in-ground concrete structures to account for possible degradation of concrete due to high sulphate, low pH levels.
- Installation of potable water pipes with ability to prevent ingress of hydrocarbons, if placed outside or beneath the stabilised raft (unlikely). Further assessment may be required of the stabilised ground following placement to ensure suitability for installation of potable water pipes.

Remedial activities and the basis for these is set out in the RAP.

Although the investigation data indicates that specific remedial action is not required to the address the following matters, the proposed works are expected to have secondary benefits including:

- Fixing of metals and other gasworks derived contaminants within the granular fill through the cement stabilisation works.
- Reduction in infiltration through the site surface reducing the potential for migration of contaminants to the saturated zone.

11.3 Post construction implications

Post development the site will be fully sealed or covered by buildings thus there will be no potential for site users and surface water runoff to contact contaminated reclamation and other fill materials during normal site operations. Vapour inhalation pathways will also be reduced by the ground improvement process and/or the installation of vapour mitigation measures (if required).

Environmental effects will be significantly reduced by installation of the cement stabilised block to 1.85 m below finished level and to 10 m depth below ground along the harbour frontage as part of the ground improvement, seawall installation and wharf structure stabilisation programmes. A 7m deep cut off wall will also be constructed on the east and south sides of Site 18. These elements will stop current discharge of SPH to the harbour and significantly reduce the discharge of dissolved phase contaminants. The lengthened flow path for deeper groundwater will also enhance the natural attenuation process.

This assessment indicates that the concentrations of chlorinated compounds discharging in deeper groundwater after the DSM walls have been installed should be significantly reduced (about 2 orders of magnitude), complying with the marine environment protection values. In addition, as noted in Section 9.4.5, as a risk mitigation measure to address any potential uncertainty in the modelling results, it is proposed to locally deepen selected DSM panels in the south-western corner of the site. The depth and number of panels to be deepened will be confirmed during detailed design.

Operational discharge management will be in place for the marine services business going forward through installation of proprietary devices to treat storm and waste water. Ongoing monitoring of operational discharges will be in place.

In-ground services and concrete structural elements will be protected from ingress of contaminants, preferential migration and corrosive groundwater conditions. However, once installed no further action will be required in respect of these features, i.e. business as usual approach.

12 Applicability

This report has been prepared for the exclusive use of our client Orams Marine , 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 discrete sampling data. The nature and continuity of subsoil away from the sampling points are inferred and it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:



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Wendi Williamson

Senior Contaminated Land Specialist



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Lucy Hine

Contaminated Land Specialist

Authorised for Tonkin & Taylor Ltd by:



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Peter Millar

Project Director

12-Nov-18

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Appendix A: Development Plans

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ORAMS MARINE
SITE 18

Resource Consent Issue

DRAWING	Rev	Title
GENERAL		
● 30881-SK01	2	DRAWING LIST AND LOCATION PLAN
● 30881-SK02	5	SITE LAYOUT
TRAVEL LIFT		
● 30881-SK21	4	PLAN (55m OPTION, WITH BERM)
● 30881-SK31	3	600T TRAVEL LIFT SECTION (55m OPTION)
● 30881-SK33	3	85T TRAVEL LIFT SECTION (25m OPTION)
● 30881-SK35	3	DETAILS (CONCRETE OPTION) SHEET 1
● 30881-SK36	4	DETAILS (CONCRETE OPTION) SHEET 2
● 30881-SK37	4	DETAILS (STEEL OPTION)
SEAWALL		
● 30881-SK50	3	OVERALL PLAN
● 30881-SK61	1	NORTH WALL LONG SECTION
● 30881-SK62	1	SOUTH WALL LONG SECTION (PART 1)
● 30881-SK63	1	SOUTH WALL LONG SECTION (PART 2)
● 30881-SK65	4	SOUTH WALL CROSS SECTION
● 30881-SK67	2	NORTH WALL CROSS SECTION
● 30881-SK78	1	SOUTH WALL - SOIL PANEL DETAILS
PAVEMENT AND STABLISATION		
● 30881-SK80	4	PLAN
● 30881-SK85	3	SECTIONS AND DETAILS
DREDGING		
● 30881-SK92	2	PLAN OF PROPOSED DREDGING



SITE LOCATION PLAN
SCALE: NTS

● Denotes drawing this issue: 02/11/2018

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REV	DESCRIPTION	CAD	CHK	DATE
1	FOR RESOURCE CONSENT	MLE	PT	21.09.18
2	REVISED FOR RESOURCE CONSENT	MLE	WMW	02.11.18

DESIGNED	PT	Jul.18
DRAWN	MLE	Jul.18
DESIGN CHECKED	CPR	Nov.18
DRAWING CHECKED	AMM	Nov.18

DRAWING STATUS: RESOURCE CONSENT

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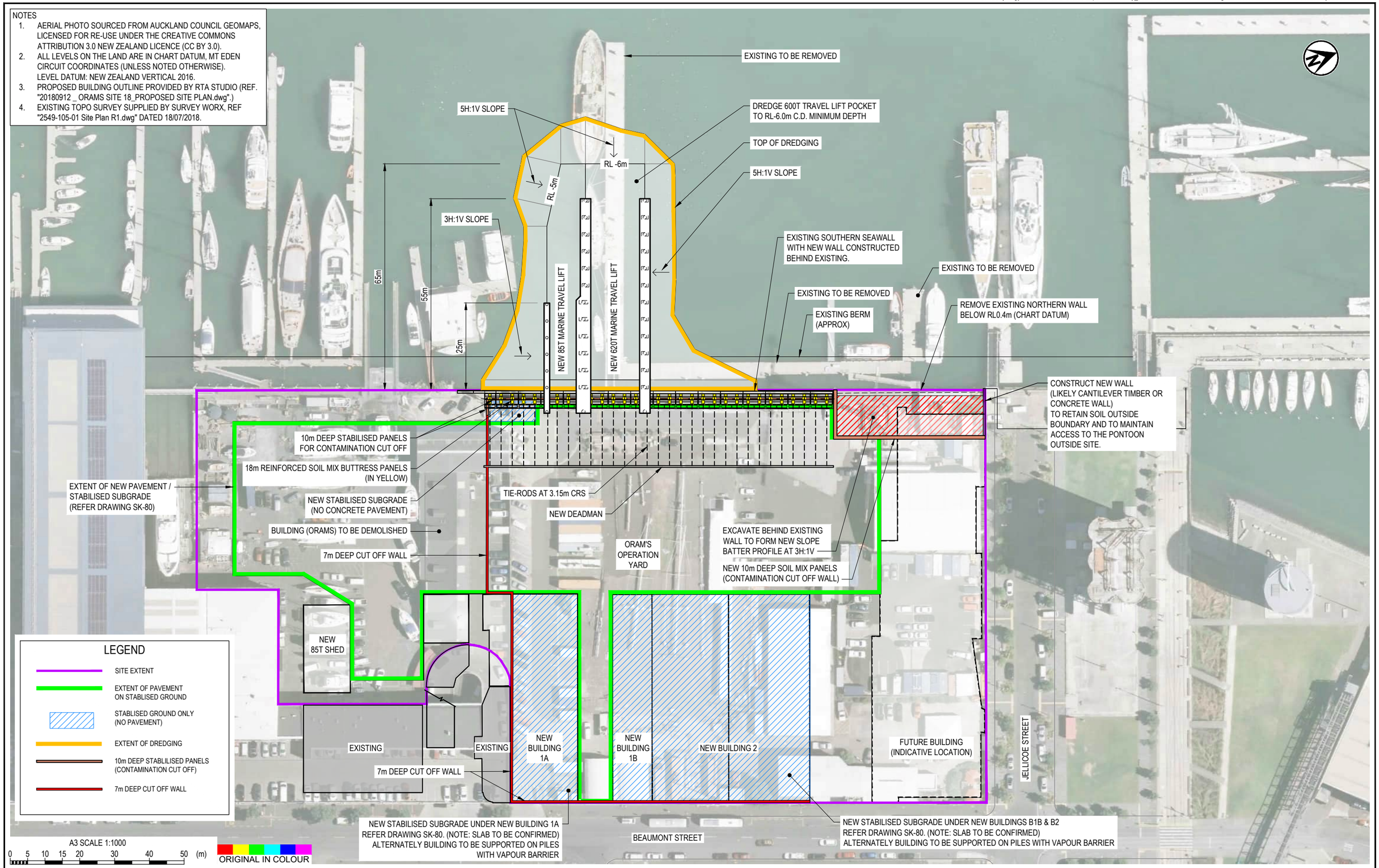
APPROVED DATE

CLIENT **ORAMS MARINE**
PROJECT **SITE 18**
TITLE GENERAL
DRAWING LIST AND LOCATION PLAN
SCALE (A3) AS SHOWN DWG No. 30881-SK01 REV 2

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NOTES
1. AERIAL PHOTO SOURCED FROM AUCKLAND COUNCIL GEOMAPS, LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 3.0 NEW ZEALAND LICENCE (CC BY 3.0).
2. ALL LEVELS ON THE LAND ARE IN CHART DATUM, MT EDEN CIRCUIT COORDINATES (UNLESS NOTED OTHERWISE). LEVEL DATUM: NEW ZEALAND VERTICAL 2016.
3. PROPOSED BUILDING OUTLINE PROVIDED BY RTA STUDIO (REF. "20180912 _ ORAMS SITE 18_PROPOSED SITE PLAN.dwg".)
4. EXISTING TOPO SURVEY SUPPLIED BY SURVEY WORX, REF "2549-105-01 Site Plan R1.dwg" DATED 18/07/2018.



REV	DESCRIPTION	CAD	CHK	DATE
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3	FOR INFORMATION	MLE	PT	11.09.18
4	FOR RESOURCE CONSENT	MLE	PJM	19.09.18
5	REVISED FOR RESOURCE CONSENT	MLE	WMW	02.11.18

DESIGNED	PT	Jul.18	DRAWING STATUS
DRAWN	MLE	Jul.18	RESOURCE CONSENT
DESIGN CHECKED	CPR	Nov.18	
DRAWING CHECKED	AMM	Nov.18	

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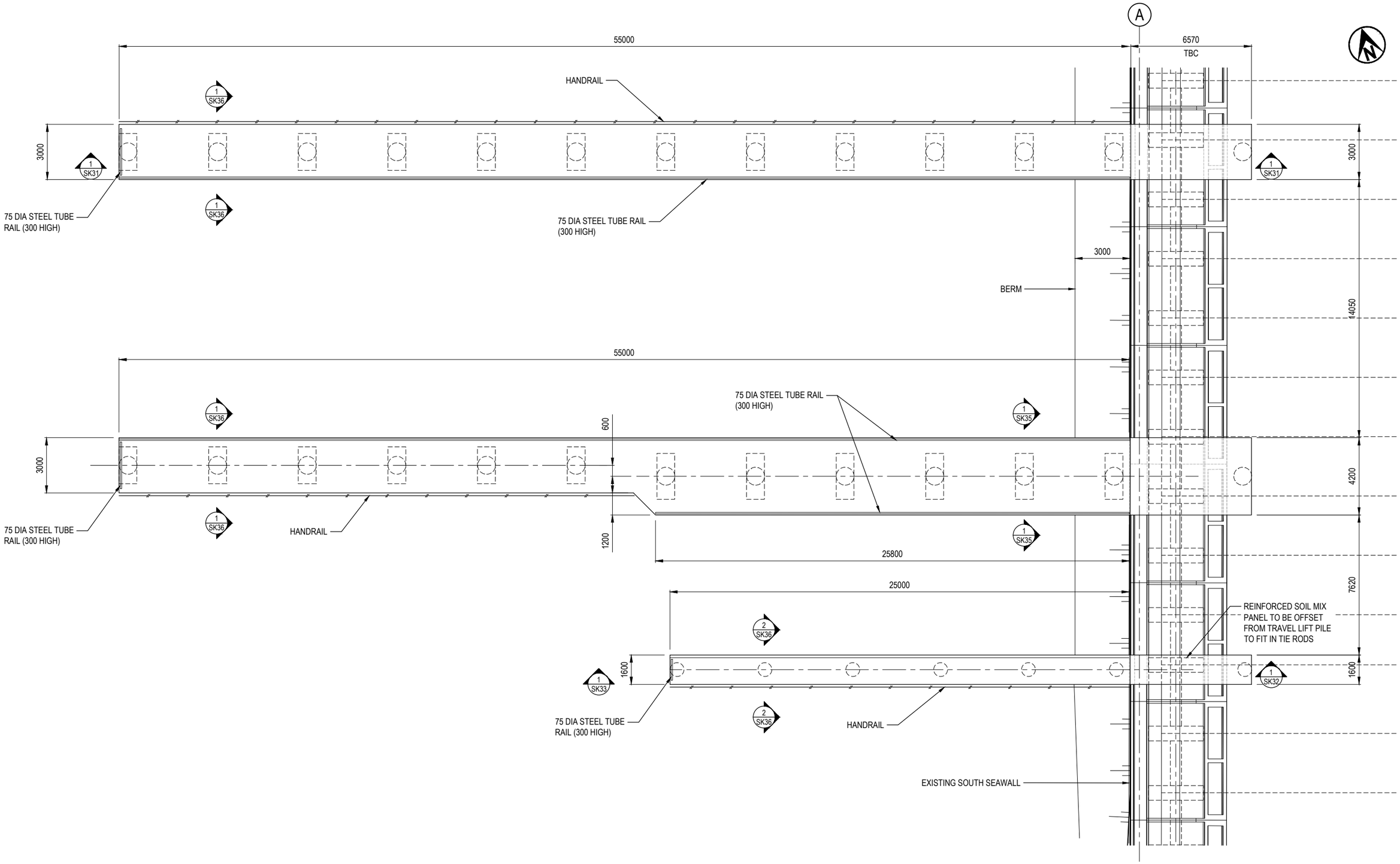
APPROVED DATE

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CLIENT **ORAMS MARINE**
PROJECT **SITE 18**
TITLE GENERAL SITE LAYOUT
SCALE (A3) 1:1000 DWG No. 30881-SK02 REV 5

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A3 SCALE 1:200

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REV	DESCRIPTION	CAD	CHK	DATE
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2	FOR INFORMATION	MLE	PT	07.09.18
3	UPDATED FOR INFORMATION	MLE	PT	14.09.18
4	FOR RESOURCE CONSENT	MLE	PJM	19.09.18

DESIGNED	TW	Jul.18	DRAWING STATUS: RESOURCE CONSENT
DRAWN	MLE	Jul.18	
DESIGN CHECKED	PJM	Sep. 18	
DRAWING CHECKED	AMM	Sep. 18	

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APPROVED DATE

CLIENT **ORAMS MARINE**

PROJECT **SITE 18**

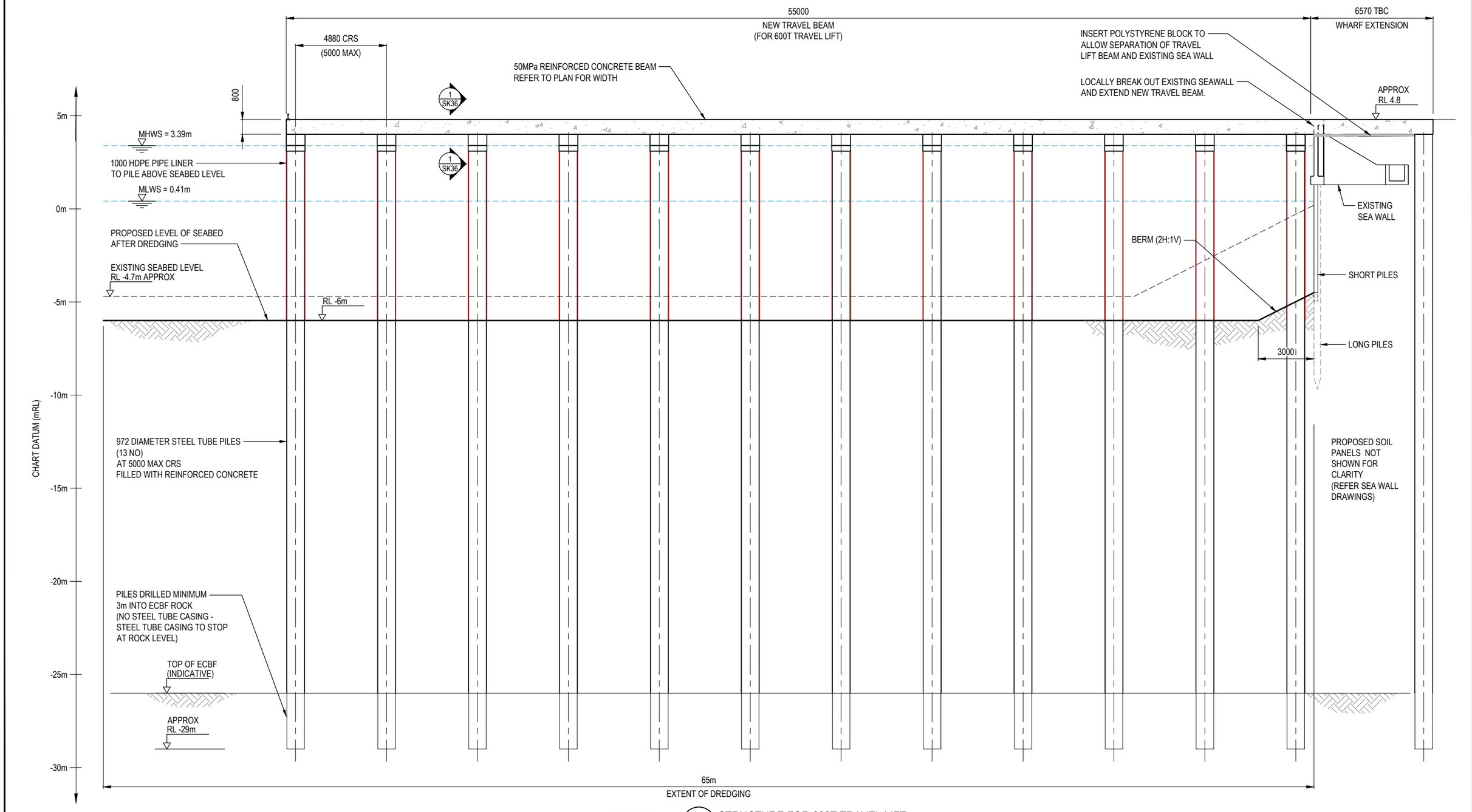
TITLE TRAVEL LIFT
PLAN (55m OPTION, WITH BERM)

SCALE (A3) 1:200 DWG No. 30881-SK21 REV 4

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C:\12dSynergy\1\Orams Expansion Facility_4\CAD\SKT\30881-SK31.dwg 2018-Sep-19 9:44:11 AM Plotted By: MARK ENNION

NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN CHART DATUM UNLESS NOTED OTHERWISE.



SECTION 1 STRUCTURE FOR 600T TRAVEL LIFT
SCALE 1:200

A3 SCALE 1:200
0 2 4 6 8 10 (m)
ORIGINAL IN COLOUR

Tonkin+Taylor
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REV	DESCRIPTION	CAD	CHK	DATE
1	FOR DISCUSSION	MLE	PT	03.08.18
2	FOR INFORMATION	MLE	PT	07.09.18
3	FOR RESOURCE CONSENT	MLE	PJM	19.09.18

DESIGNED	PT	Jul.18
DRAWN	MLE	Jul.18
DESIGN CHECKED	PJM	Sep. 18
DRAWING CHECKED	AMM	Sep. 18

DRAWING STATUS: RESOURCE CONSENT

NOT FOR CONSTRUCTION

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED

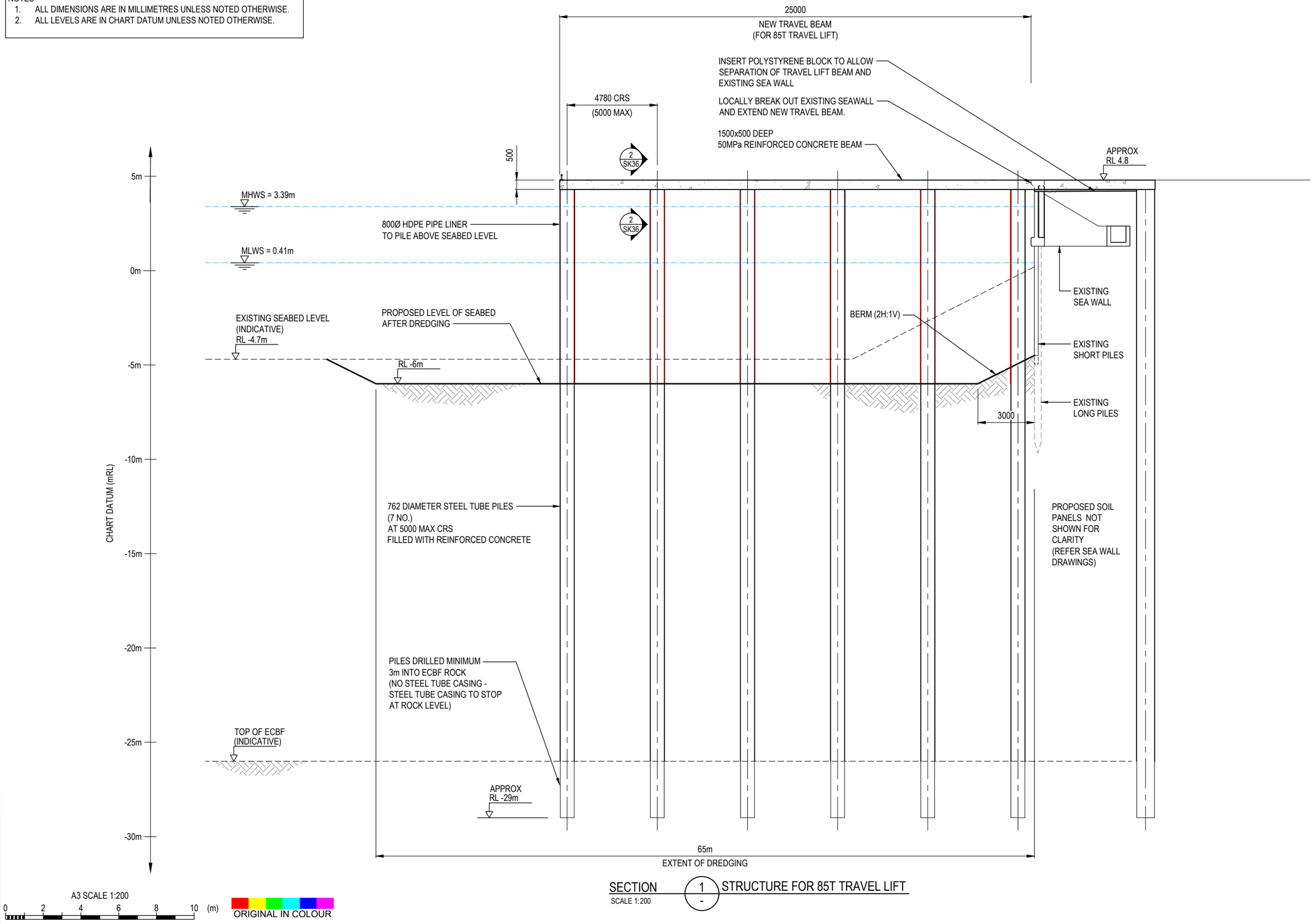
APPROVED DATE

CLIENT **ORAMS MARINE**
PROJECT **SITE 18**
TITLE TRAVEL LIFT
600T TRAVEL LIFT SECTION (55m OPTION)
SCALE (A3) 1:200 DWG No. 30881-SK31 REV 3

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NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN CHART DATUM UNLESS NOTED OTHERWISE.



SECTION 1 STRUCTURE FOR 85T TRAVEL LIFT
SCALE 1:200

A3 SCALE 1:200
0 2 4 6 8 10 (m)

ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE
1	FOR DISCUSSION	MLE	PT	03.08.18
2	FOR INFORMATION	MLE	PT	07.09.18
3	FOR RESOURCE CONSENT	MLE	PJM	19.09.18

DESIGNED	PT	Jul.18
DRAWN	MLE	Jul.18
DESIGN CHECKED	PJM	Sep. 18
DRAWING CHECKED	AMM	Sep. 18

DRAWING STATUS: RESOURCE CONSENT

NOT FOR CONSTRUCTION

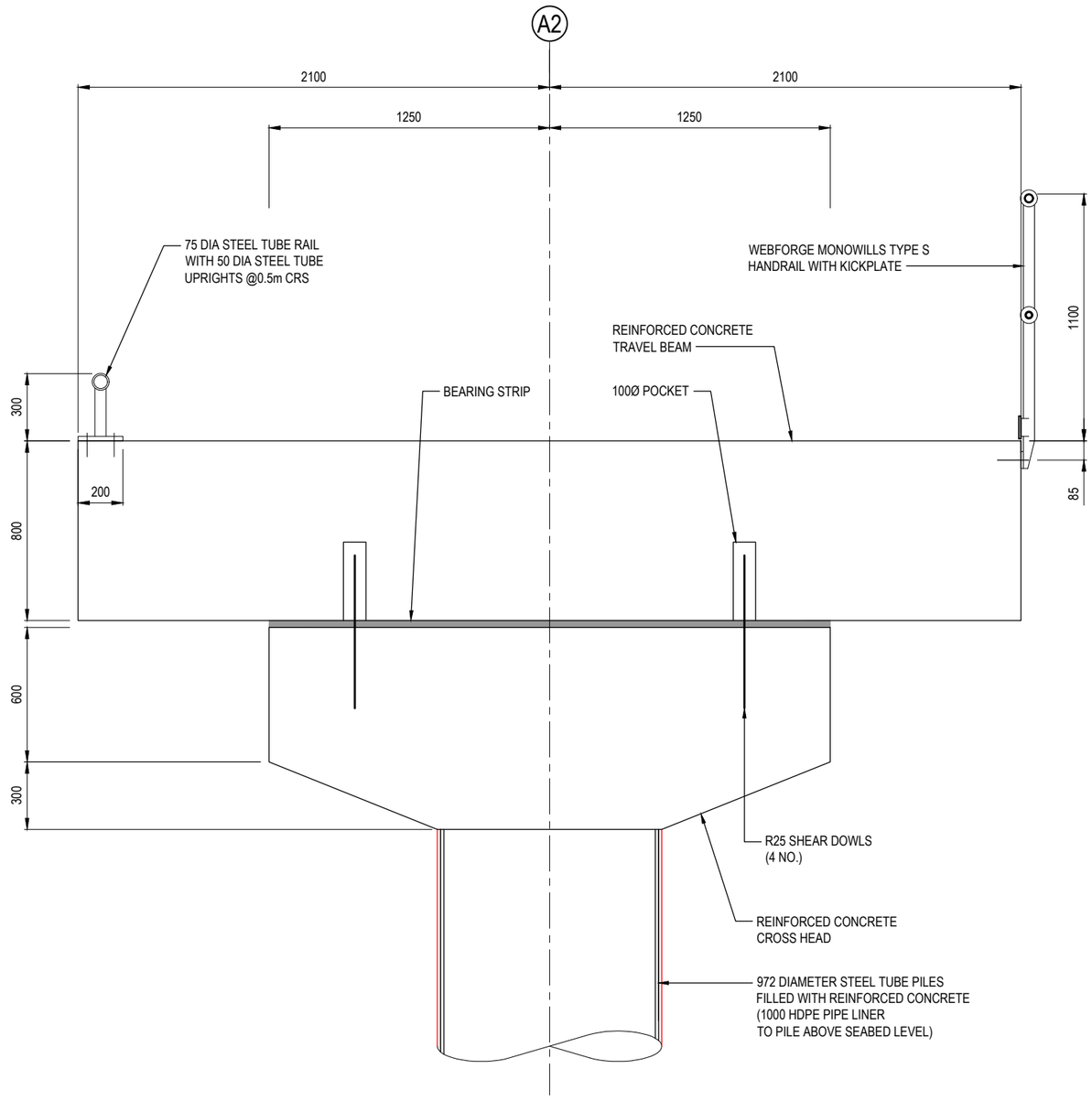
THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED

APPROVED DATE

CLIENT ORAMS MARINE
PROJECT SITE 18
TITLE TRAVEL LIFT
85T TRAVEL LIFT SECTION (25m OPTION)
SCALE (A3) 1:200 DWG No. 30881-SK33 REV 3

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SECTION 1 SK21 3500 WIDE BEAM AT PILE
SCALE 1: 25

A3 SCALE 1: 25
0 0.5 1.0 1.5 (m)
ORIGINAL IN COLOUR

Tonkin+Taylor
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REV	DESCRIPTION	CAD	CHK	DATE
1	FOR INFORMATION	MLE	PT	07.09.18
2	UPDATED FOR INFORMATION	MLE	PT	14.09.18
3	FOR RESOURCE CONSENT	MLE	PJM	19.09.18

DESIGNED	PT	Jul.18
DRAWN	MLE	Jul.18
DESIGN CHECKED	PJM	Sep. 18
DRAWING CHECKED	AMM	Sep. 18

DRAWING STATUS: RESOURCE CONSENT

NOT FOR CONSTRUCTION

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED

APPROVED DATE

CLIENT **ORAMS MARINE**

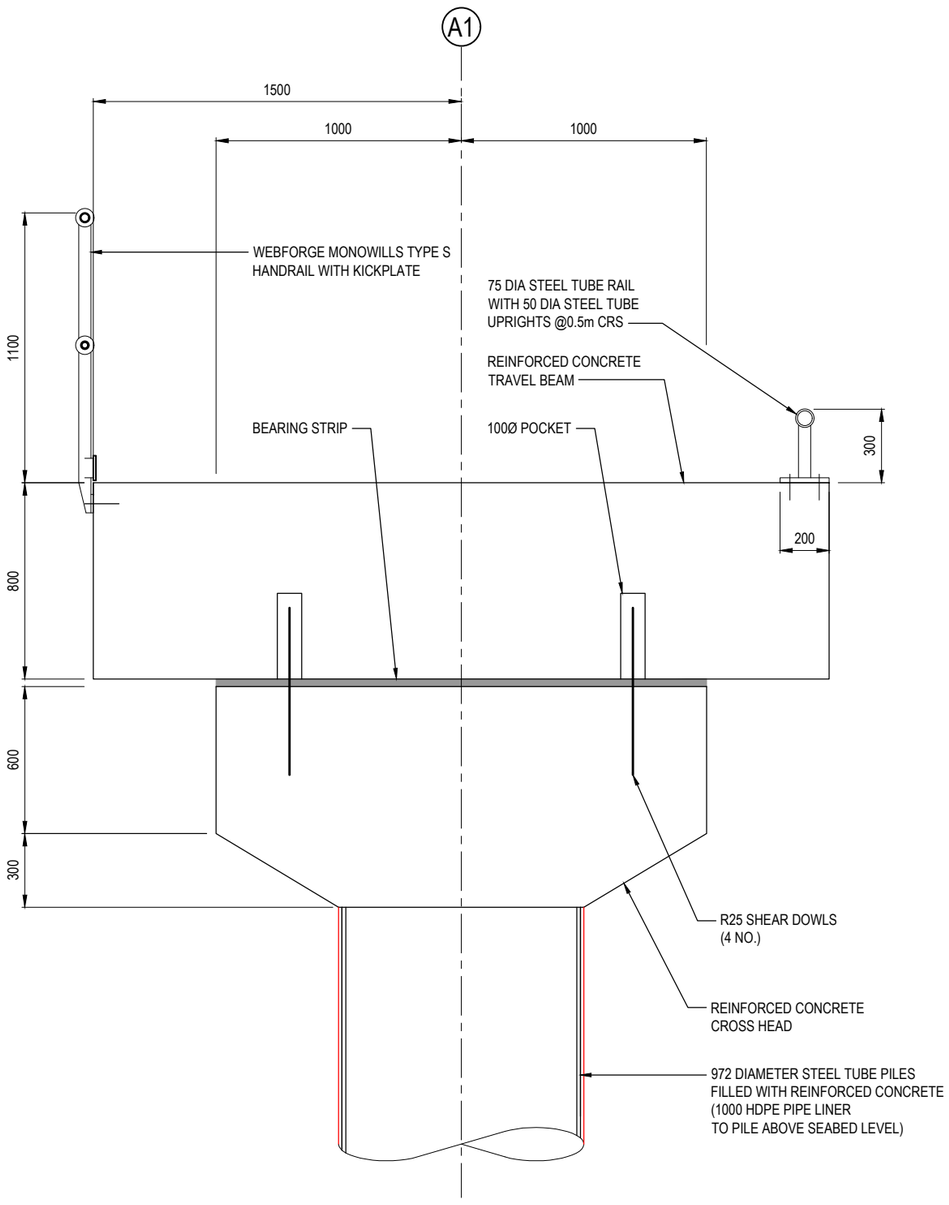
PROJECT **SITE 18**

TITLE TRAVEL LIFT
DETAILS (CONCRETE OPTION) SHEET 1

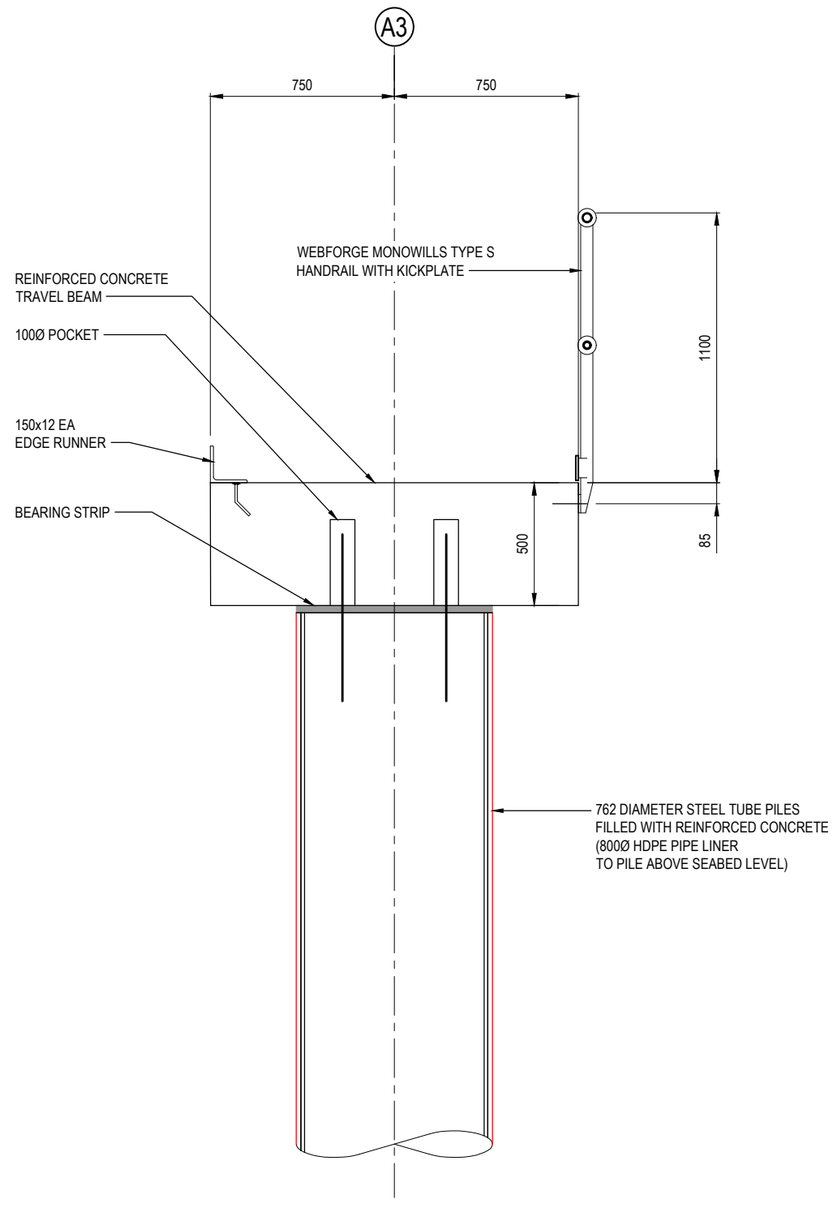
SCALE (A3) 1:25 DWG No. 30881-SK35 REV 3

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C:\12dSynergy\1\Orams Expansion Facility_4\CAD\SKT\30881-SK36.dwg 2018-Sep-19 9:44:30 AM Plotted By: MARK ENNION



SECTION 1 SK21 3000 WIDE BEAM AT PILE
SCALE 1:25



SECTION 2 SK21 1500 WIDE BEAM AT PILE
SCALE 1:25

A3 SCALE 1:25
0 0.5 1.0 1.5 (m)
ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE
1	PRELIMINARY DRAFT	MLE	PT	03.08.18
2	FOR INFORMATION	MLE	PT	07.09.18
3	UPDATED FOR INFORMATION	MLE	PT	14.09.18
4	FOR RESOURCE CONSENT	MLE	PJM	19.09.18

DESIGNED	PT	Jul.18
DRAWN	MLE	Jul.18
DESIGN CHECKED	PJM	Sep. 18
DRAWING CHECKED	AMM	Sep. 18

APPROVED DATE

DRAWING STATUS
RESOURCE CONSENT

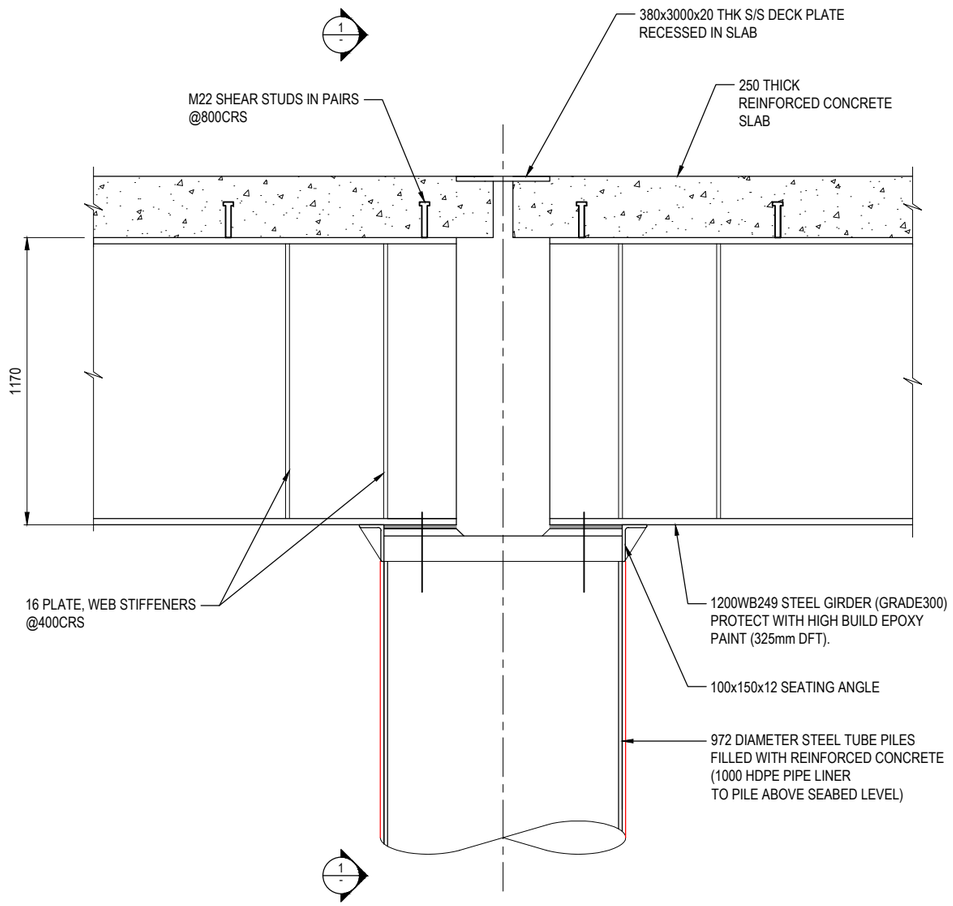
NOT FOR CONSTRUCTION

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CLIENT **ORAMS MARINE**
PROJECT **SITE 18**
TITLE TRAVEL LIFT
DETAILS (CONCRETE OPTION) SHEET 2
SCALE (A3) 1:25 DWG No. 30881-SK36 REV 4

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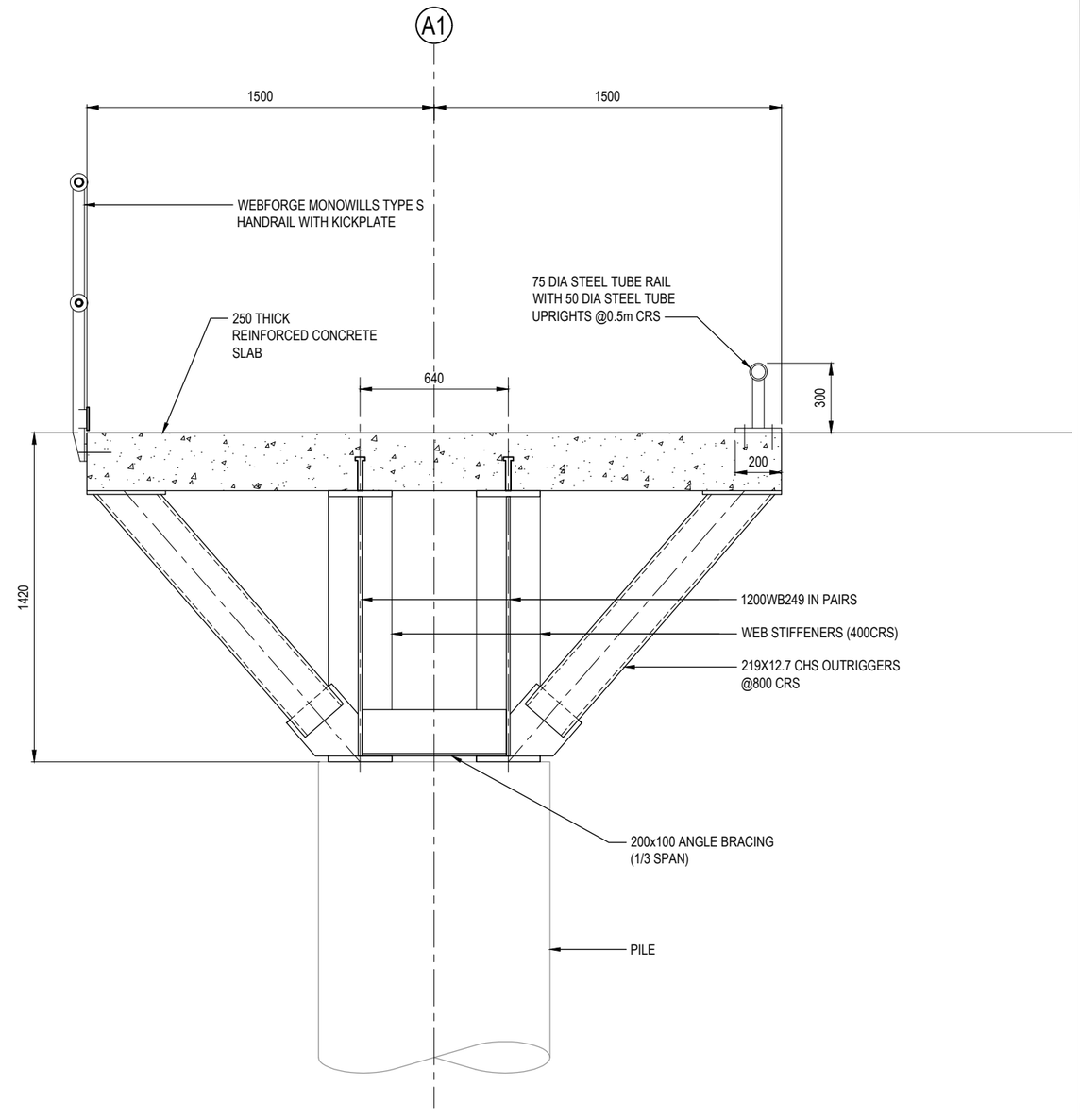
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SECTION A - SCALE 1:25

STEEL OPTION - LONGITUDINAL DETAIL

CHS OUTRIGGERS NOT SHOWN FOR CLARITY



SECTION 1 - SCALE 1:25

STEEL OPTION - CROSS SECTION THROUGH TRAVEL BEAM

SK20

A3 SCALE 1:25

0 0.5 1.0 1.5 (m)

ORIGINAL IN COLOUR

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1	FOR DISCUSSION	MLE	PT	03.08.18
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DRAWING CHECKED	AMM	Sep. 18

APPROVED DATE

DRAWING STATUS: RESOURCE CONSENT

NOT FOR CONSTRUCTION

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CLIENT **ORAMS MARINE**

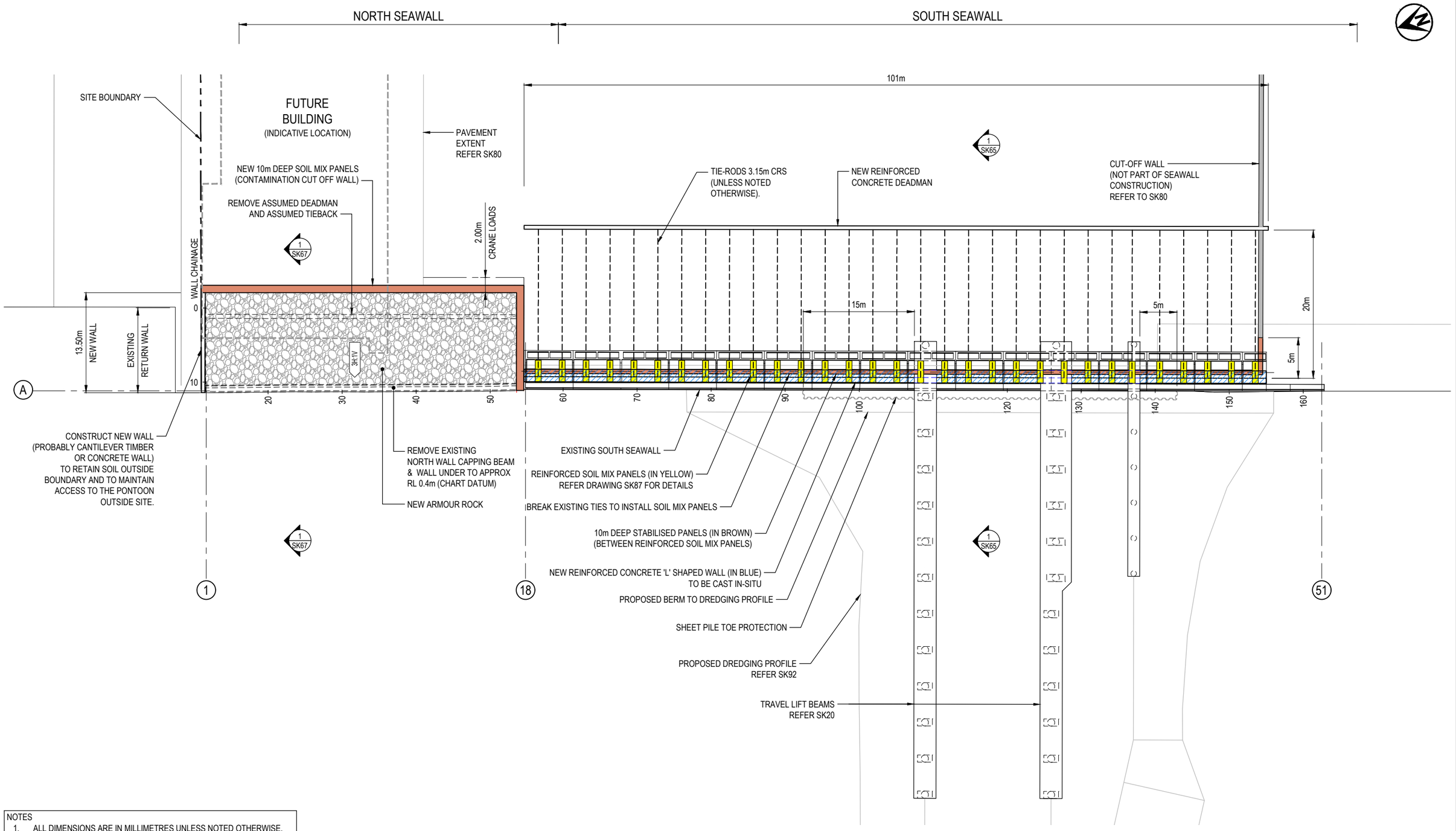
PROJECT **SITE 18**

TITLE TRAVEL LIFT
DETAILS (STEEL OPTION)

SCALE (A3) 1:25 DWG No. 30881-SK37 REV 4

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NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN CHART DATUM UNLESS NOTED OTHERWISE.

A3 SCALE 1:500
0 5 10 15 20 25 (m)

ORIGINAL IN COLOUR

PLAN A SEA WALL - NORTH & SOUTH
SCALE 1:500 -

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REV	DESCRIPTION	CAD	CHK	DATE
1	FOR RESOURCE CONSENT	MLE	PJM	19.09.18
2	REVISED FOR RESOURCE CONSENT	MLE	PT	21.09.18
3	REVISED FOR RESOURCE CONSENT	MLE	WMW	02.11.18

DESIGNED	PT	Jul.18
DRAWN	MLE	Jul.18
DESIGN CHECKED	CPR	Nov. 18
DRAWING CHECKED	AMM	Nov. 18

DRAWING STATUS: RESOURCE CONSENT

NOT FOR CONSTRUCTION

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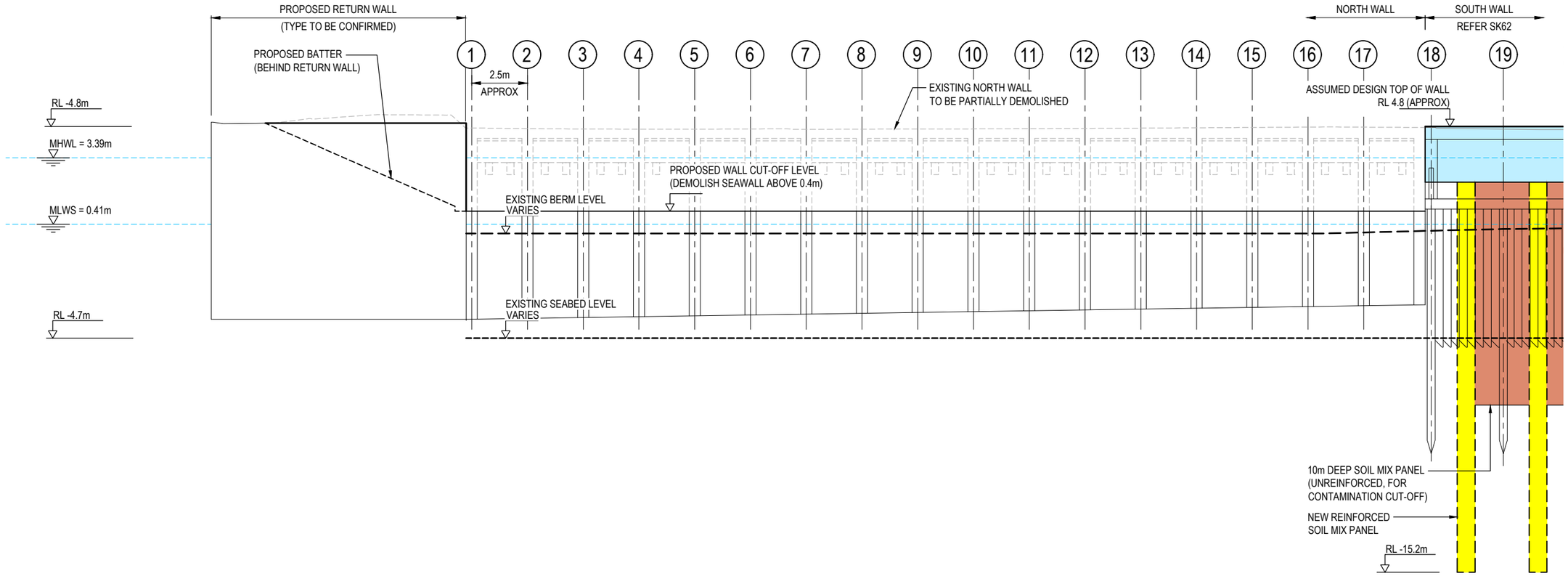
APPROVED DATE

CLIENT ORAMS MARINE
PROJECT SITE 18
TITLE SEAWALL OVERALL PLAN
SCALE (A3) 1:500 DWG No. 30881-SK50 REV 3

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NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN CHART DATUM UNLESS NOTED OTHERWISE.
3. EXISTING SURFACE LEVEL HAS BEEN CONVERTED TO CHART DATUM FROM AUCKLAND VERTICAL DATUM 1946. ORIGINAL DATA CAN BE FOUND ON THE SURVEYWORX SURVEY DRAWINGS.



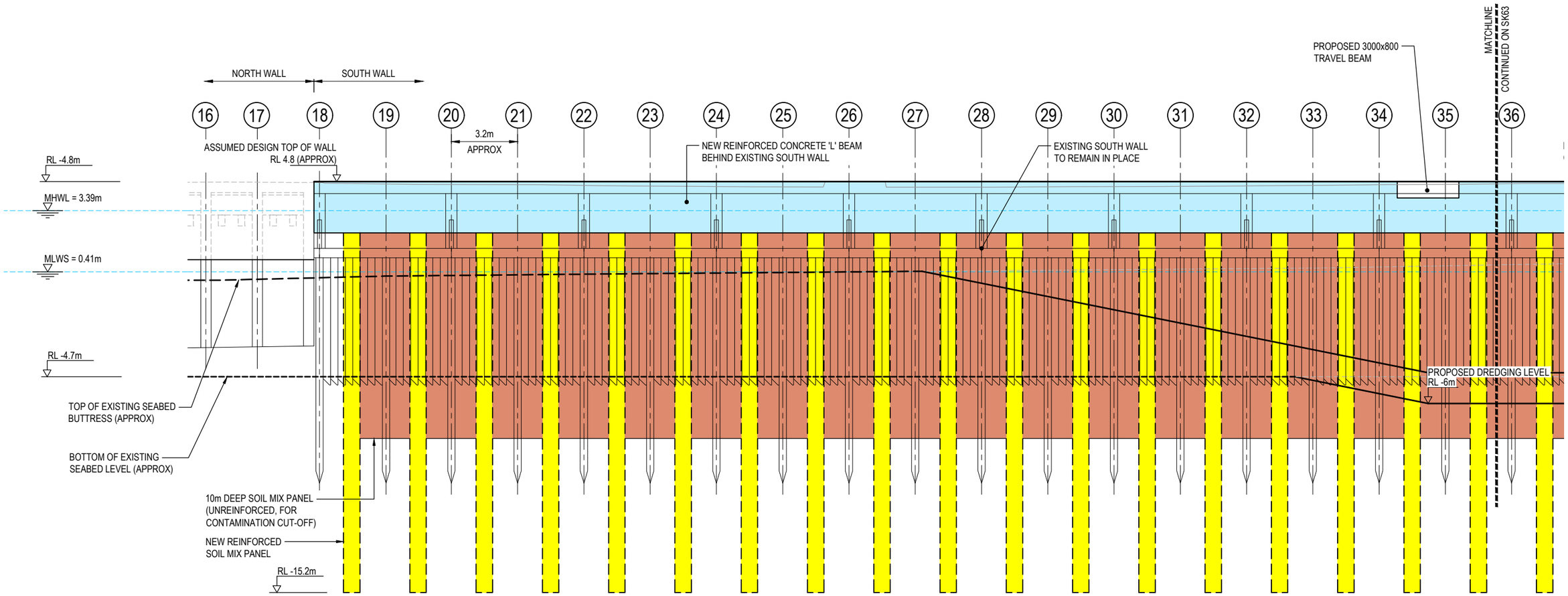
DATUM -17m

| | | |

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NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN CHART DATUM UNLESS NOTED OTHERWISE.
3. EXISTING SURFACE LEVEL HAS BEEN CONVERTED TO CHART DATUM FROM AUCKLAND VERTICAL DATUM 1946. ORIGINAL DATA CAN BE FOUND ON THE SURVEYWORX SURVEY DRAWINGS.



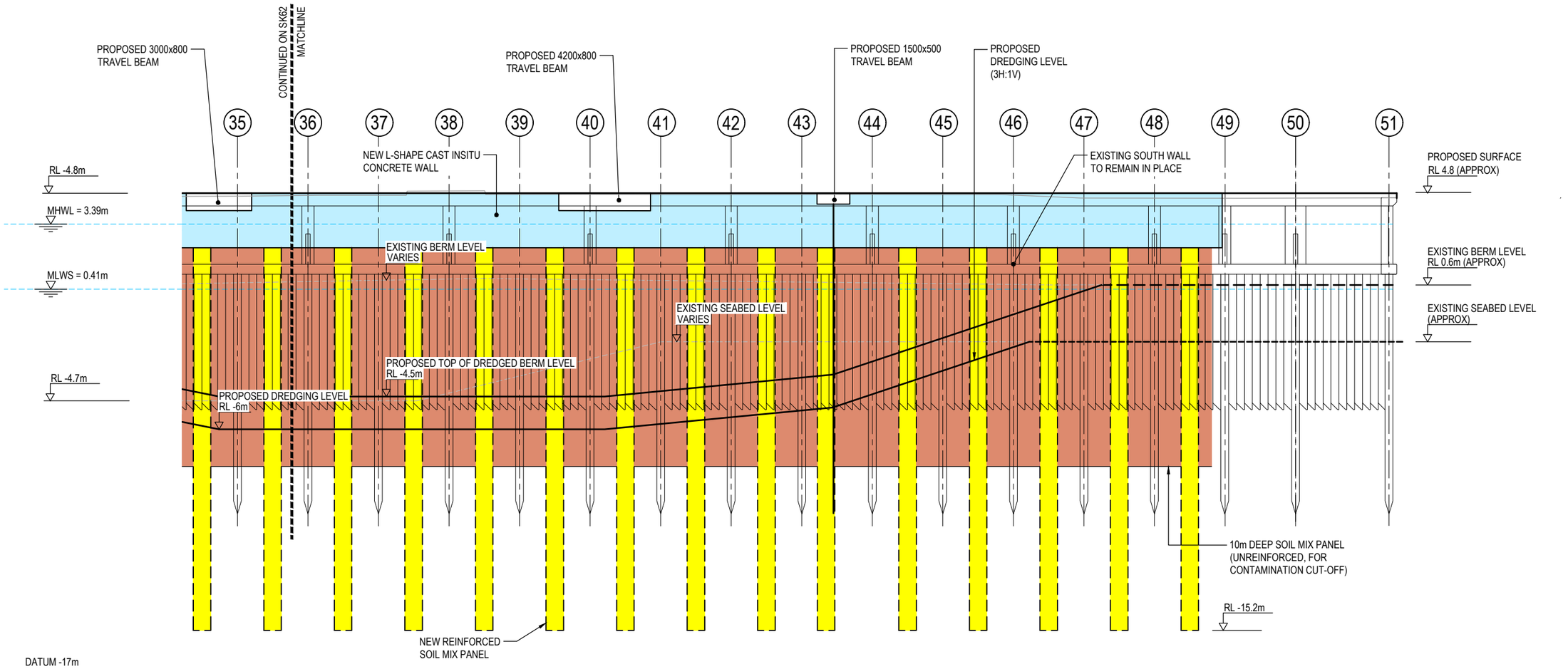
DATUM -17m

| | | |

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NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN CHART DATUM UNLESS NOTED OTHERWISE.
3. EXISTING SURFACE LEVEL HAS BEEN CONVERTED TO CHART DATUM FROM AUCKLAND VERTICAL DATUM 1946. ORIGINAL DATA CAN BE FOUND ON THE SURVEYWORX SURVEY DRAWINGS.



DATUM -17m

CHAINAGE (m)	110.00	115.00	120.00	125.00	130.00	135.00	140.00	145.00	150.00	155.00	160.00	163.00
EXISTING SURFACE (m) (REFER NOTE 3)	4.67	4.71	4.91	4.75	4.73	4.74	4.74	4.72	4.57	4.57	4.58	4.59

SECTION 3 / - SOUTH WALL - PART 2
SCALE 1:200

A3 SCALE 1:200
0 2 4 6 8 10 (m)
ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE
1	FOR RESOURCE CONSENT	MLE	PJM	19.09.18

DESIGNED	PT	Jul.18	DRAWING STATUS
DRAWN	MLE	Jul.18	RESOURCE CONSENT
DESIGN CHECKED	PJM	Sep. 18	
DRAWING CHECKED	AMM	Sep. 18	

NOT FOR CONSTRUCTION — APPROVED — DATE

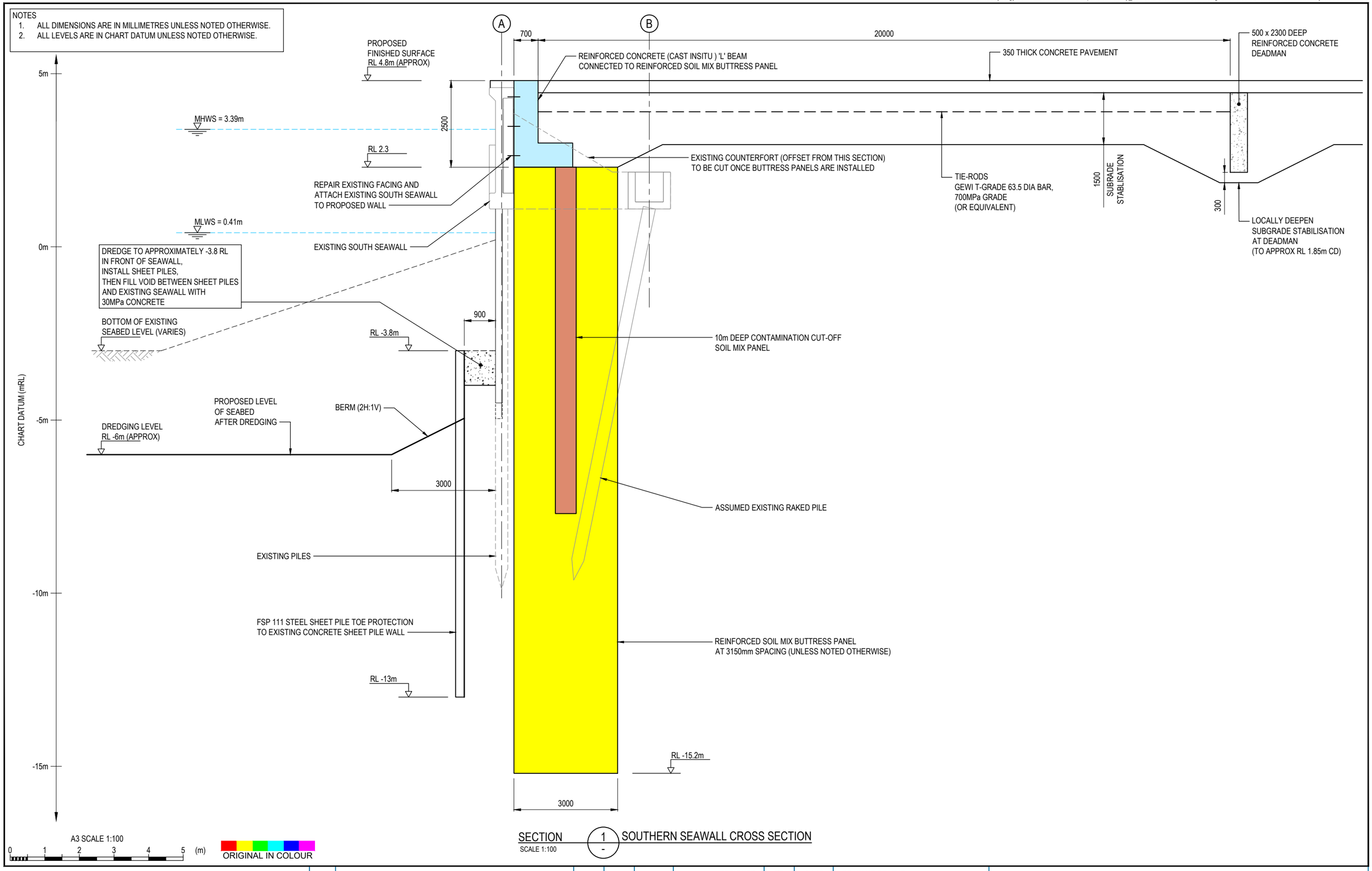
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CLIENT **ORAMS MARINE**
PROJECT **SITE 18**
TITLE SEAWALL
SOUTH WALL LONG SECTION (PART 2)
SCALE (A3) 1:200 DWG No. 30881-SK63 REV 1

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NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN CHART DATUM UNLESS NOTED OTHERWISE.



A3 SCALE 1:100
0 1 2 3 4 5 (m)
ORIGINAL IN COLOUR

SECTION 1 SOUTHERN SEAWALL CROSS SECTION
SCALE 1:100 -

REV	DESCRIPTION	CAD	CHK	DATE
1	PRELIMINARY DRAFT	MLE	PT	06.07.18
2	FOR RESOURCE CONSENT	MLE	PJM	19.09.18
3	REVISED FOR RESOURCE CONSENT	MLE	PT	21.09.18
4	REVISED FOR RESOURCE CONSENT	MLE	WMW	02.11.18

DESIGNED	PT	Jul.18	DRAWING STATUS
DRAWN	MLE	Jul.18	RESOURCE CONSENT
DESIGN CHECKED	CPR	Nov. 18	
DRAWING CHECKED	AMM	Nov. 18	

APPROVED DATE

NOT FOR CONSTRUCTION

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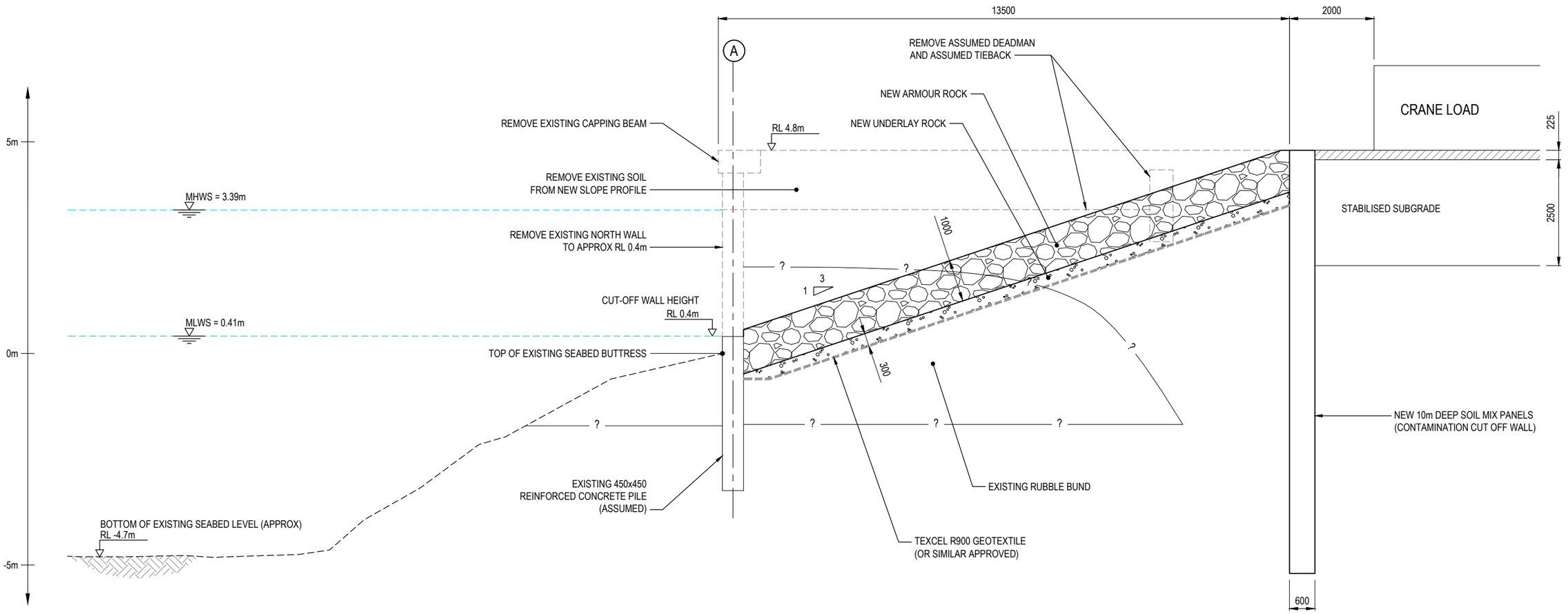
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CLIENT **ORAMS MARINE**
PROJECT **SITE 18**
TITLE SEAWALL
SOUTH WALL CROSS SECTION
SCALE (A3) 1:100 DWG No. 30881-SK65 REV 4

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NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN CHART DATUM UNLESS NOTED OTHERWISE.



SECTION 2 NORTHERN SEAWALL CROSS SECTION
SCALE 1:100 -

A3 SCALE 1:100
0 1 2 3 4 5 (m)

ORIGINAL IN COLOUR

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REV	DESCRIPTION	CAD	CHK	DATE
1	FOR DISCUSSION	MLE	PT	06.07.18
2	FOR RESOURCE CONSENT	MLE	PJM	19.09.18

DESIGNED	PT	Jul.18
DRAWN	MLE	Jul.18
DESIGN CHECKED	PJM	Sep. 18
DRAWING CHECKED	AMM	Sep. 18

DRAWING STATUS: RESOURCE CONSENT

NOT FOR CONSTRUCTION

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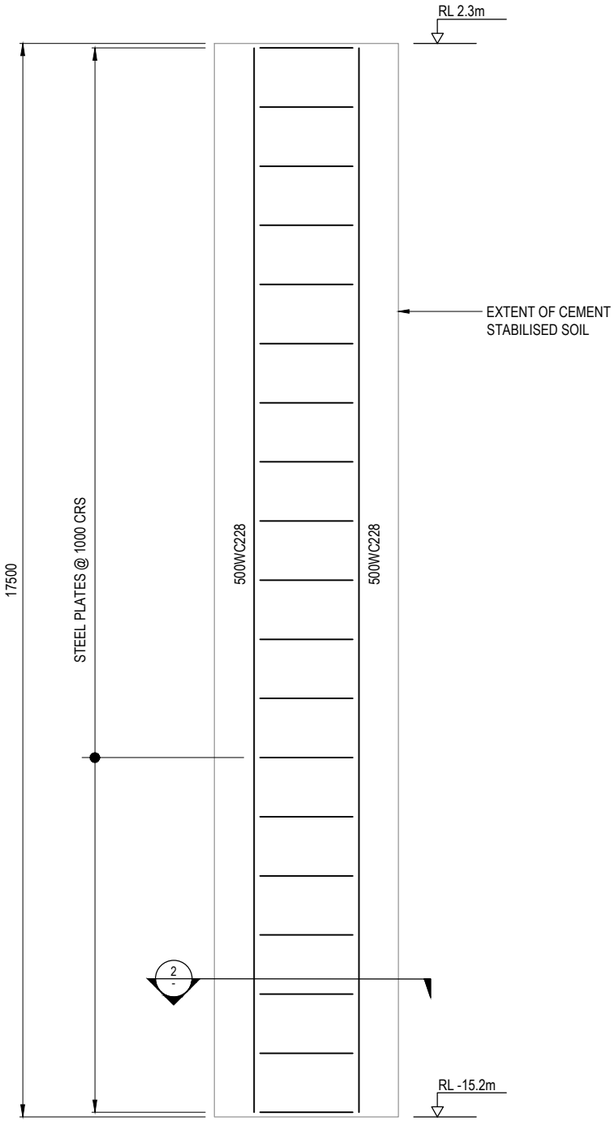
APPROVED DATE

CLIENT **ORAMS MARINE**
PROJECT **SITE 18**
TITLE SEAWALL
NORTH WALL CROSS SECTION
SCALE (A3) 1:100 DWG No. 30881-SK67 REV 2

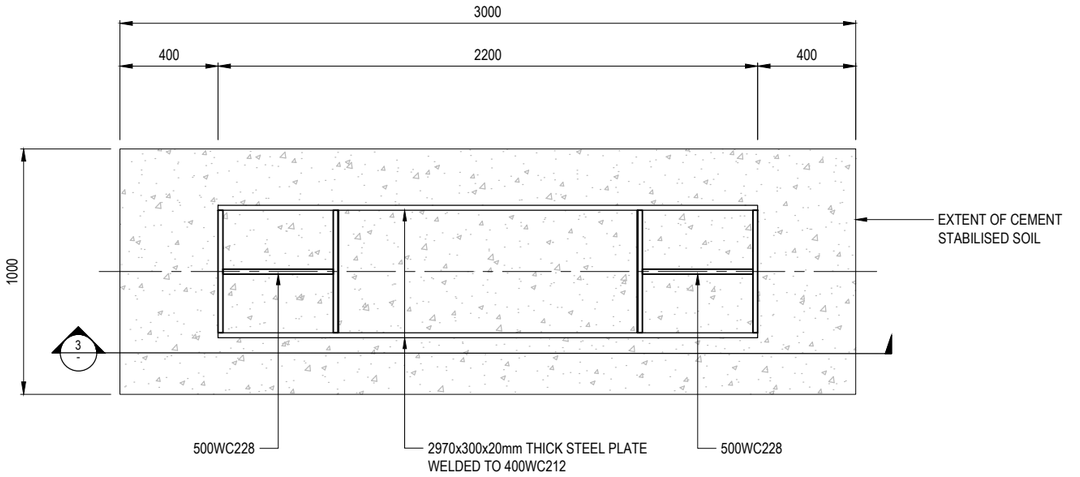
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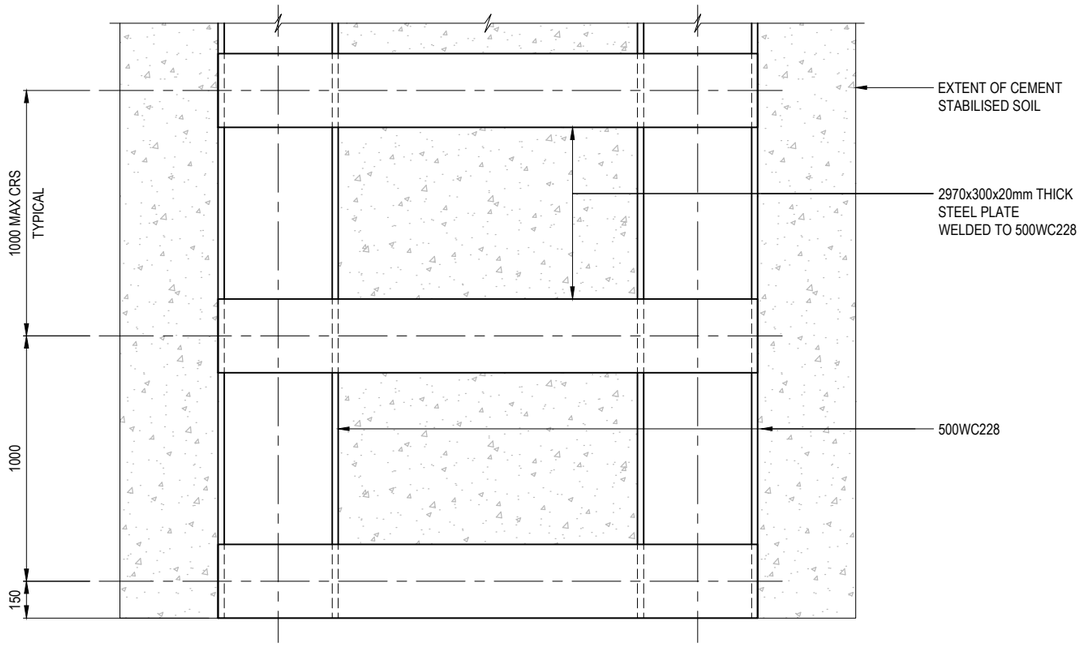
NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.



ELEVATION 1 - STEEL CAGE
SCALE 1:100



PLAN 2 - SOIL MIX PANELS - STEELWORK
SCALE 1:25



ELEVATION 3 - SOIL MIX PANELS - STEELWORK
SCALE 1:25

A3 SCALE 1:100
0 1 2 3 4 5 (m)
ORIGINAL IN COLOUR

A3 SCALE 1:25
0 0.5 1.0 1.5 (m)

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REV	DESCRIPTION	CAD	CHK	DATE
1	FOR RESOURCE CONSENT	MLE	PJM	19.09.18

DESIGNED	TW	Jul.18	DRAWING STATUS: RESOURCE CONSENT
DRAWN	MLE	Jul.18	
DESIGN CHECKED	PJM	Sep. 18	
DRAWING CHECKED	AMM	Sep. 18	

NOT FOR CONSTRUCTION

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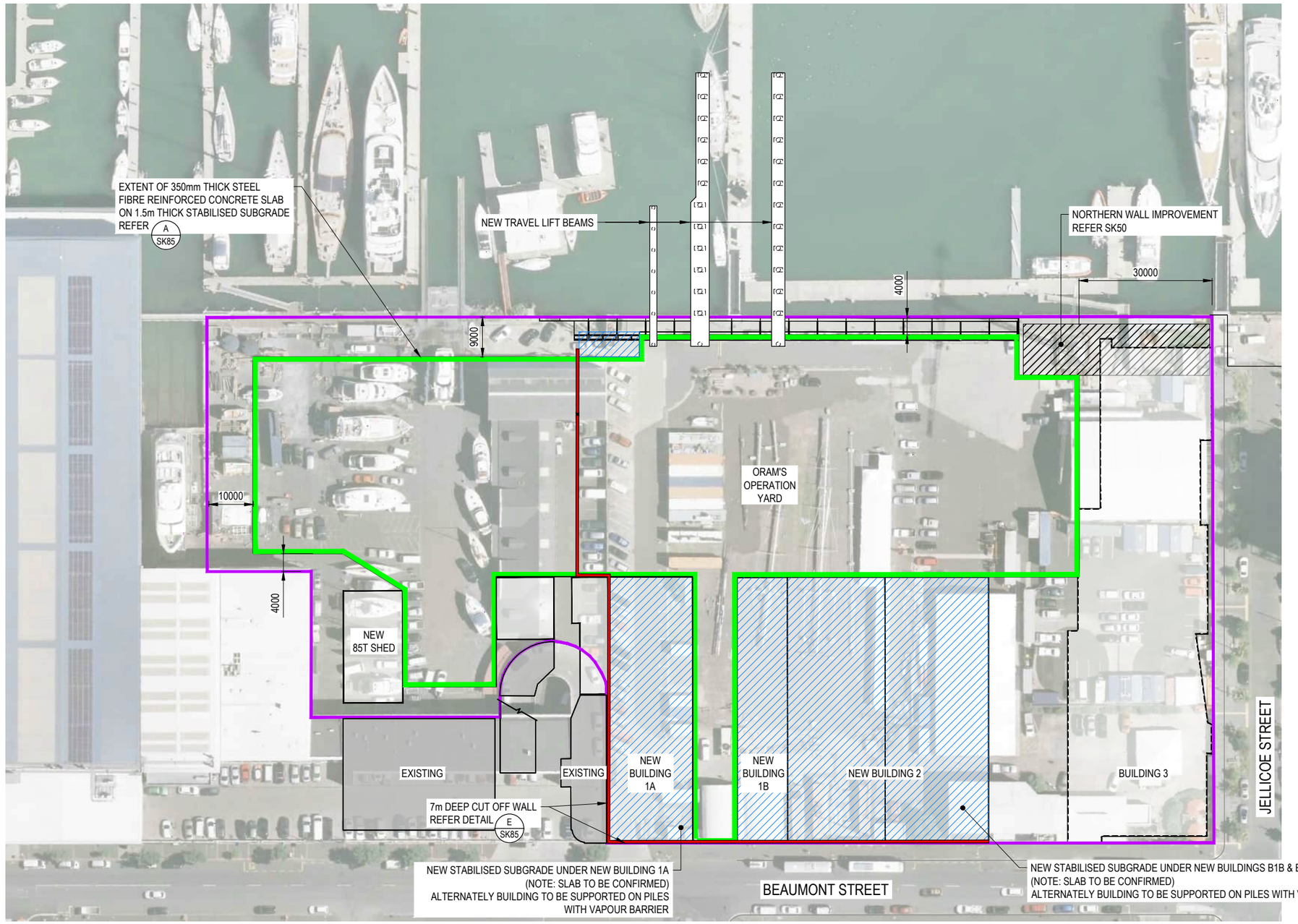
APPROVED DATE

CLIENT **ORAMS MARINE**
PROJECT **SITE 18**
TITLE SEAWALL
SOUTH WALL - SOIL PANEL DETAILS
SCALE (A3) AS SHOWN DWG No. 30881-SK78 REV 1

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NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. FLOOR AND BEAMS AT BUILDING LOCATIONS TO BE CONFIRMED.
3. DESIGN OF FIBRE REINFORCED CONCRETE PAVEMENT PREPARED BY BOSFA PTY LTD, BASED ON INPUTS PROVIDED BY TONKIN+TAYLOR.



PLAN A PAVEMENT
SCALE 1:1000

LEGEND
- SITE EXTENT
- EXTENT OF PAVEMENT ON STABLISED GROUND (REFER A SK85).
- STABLISED GROUND ONLY, NO PAVEMENT (OR ALTERNATELY PILED FOUNDATIONS) REFER NOTE 2 & DETAIL D SK85
- 7m DEEP CUT OFF WALL REFER DETAIL E SK85

A3 SCALE 1:1000
0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

Tonkin+Taylor
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REV	DESCRIPTION	CAD	CHK	DATE
1	FOR DISCUSSION	MLE	PT	03.08.18
2	FOR INFORMATION	MLE	PT	31.08.18
3	FOR RESOURCE CONSENT	MLE	PJM	19.09.18
4	REVISED FOR RESOURCE CONSENT	MLE	WMW	02.11.18

DESIGNED	PT	Jul.18
DRAWN	MLE	Jul.18
DESIGN CHECKED	CPR	Nov.18
DRAWING CHECKED	AMM	Nov.18

DRAWING STATUS: RESOURCE CONSENT

NOT FOR CONSTRUCTION

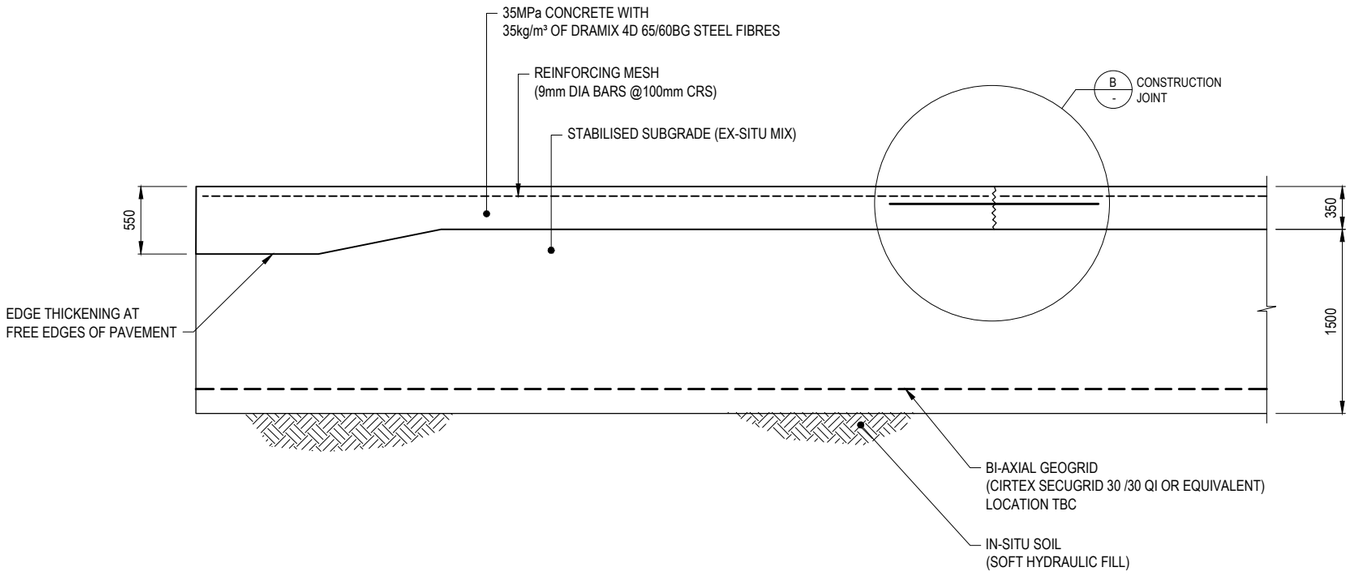
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APPROVED DATE

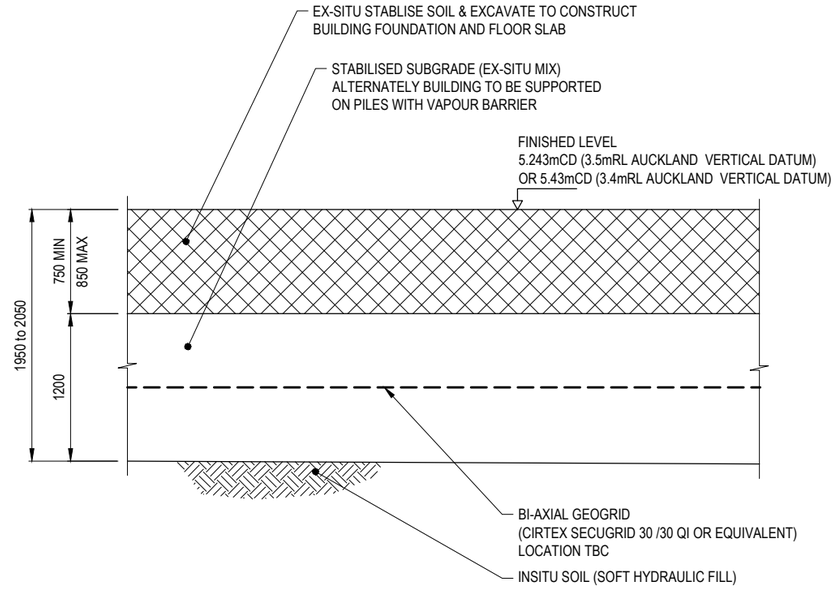
CLIENT ORAMS MARINE
PROJECT SITE 18
TITLE PAVEMENT AND STABLISATION PLAN
SCALE (A3) 1:1000 DWG No. 30881-SK80 REV 4

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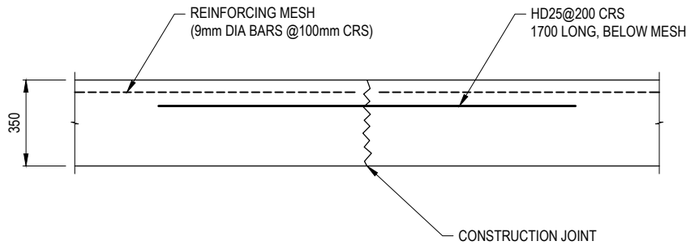
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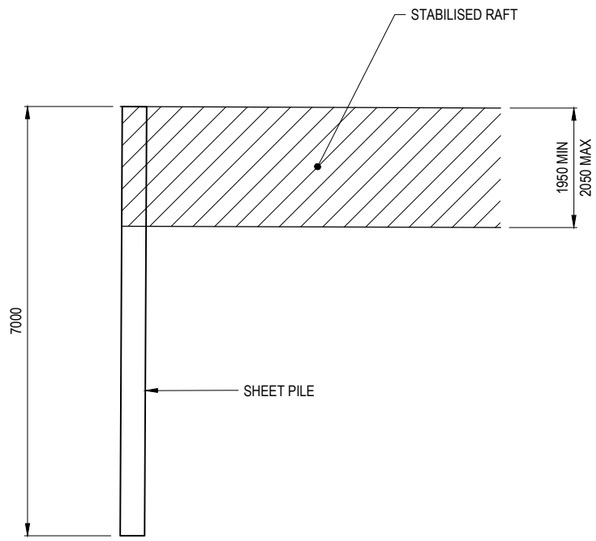
DETAIL A - TYPICAL PAVEMENT
SCALE 1:50



DETAIL D - TYPICAL STABISATION BENEATH BUILDINGS B1A, B1B & B2
SCALE 1:50



DETAIL B - CONSTRUCTION JOINT
SCALE 1:25
CONSTRUCTION JOINT SPACING TO BE DETERMINED BY CONTRACTOR



DETAIL E - TYPICAL SHEETPILE (7m DEEP)
SCALE 1:100

A3 SCALE 1:100
0 1 2 3 4 5 (m)

A3 SCALE 1:50
0 0.5 1.0 1.5 2.0 2.5 (m)

A3 SCALE 1:25
0 0.5 1.0 1.5 (m)

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REV	DESCRIPTION	CAD	CHK	DATE
1	PRELIMINARY DRAFT	MLE	PT	03.08.18
2	FOR RESOURCE CONSENT	MLE	PJM	19.09.18
3	REVISED FOR RESOURCE CONSENT	MLE	WMW	02.11.18

DESIGNED	PT	Jul.18
DRAWN	MLE	Jul.18
DESIGN CHECKED	CPR	Nov.18
DRAWING CHECKED	AMM	Nov.18

APPROVED DATE

DRAWING STATUS: RESOURCE CONSENT

NOT FOR CONSTRUCTION

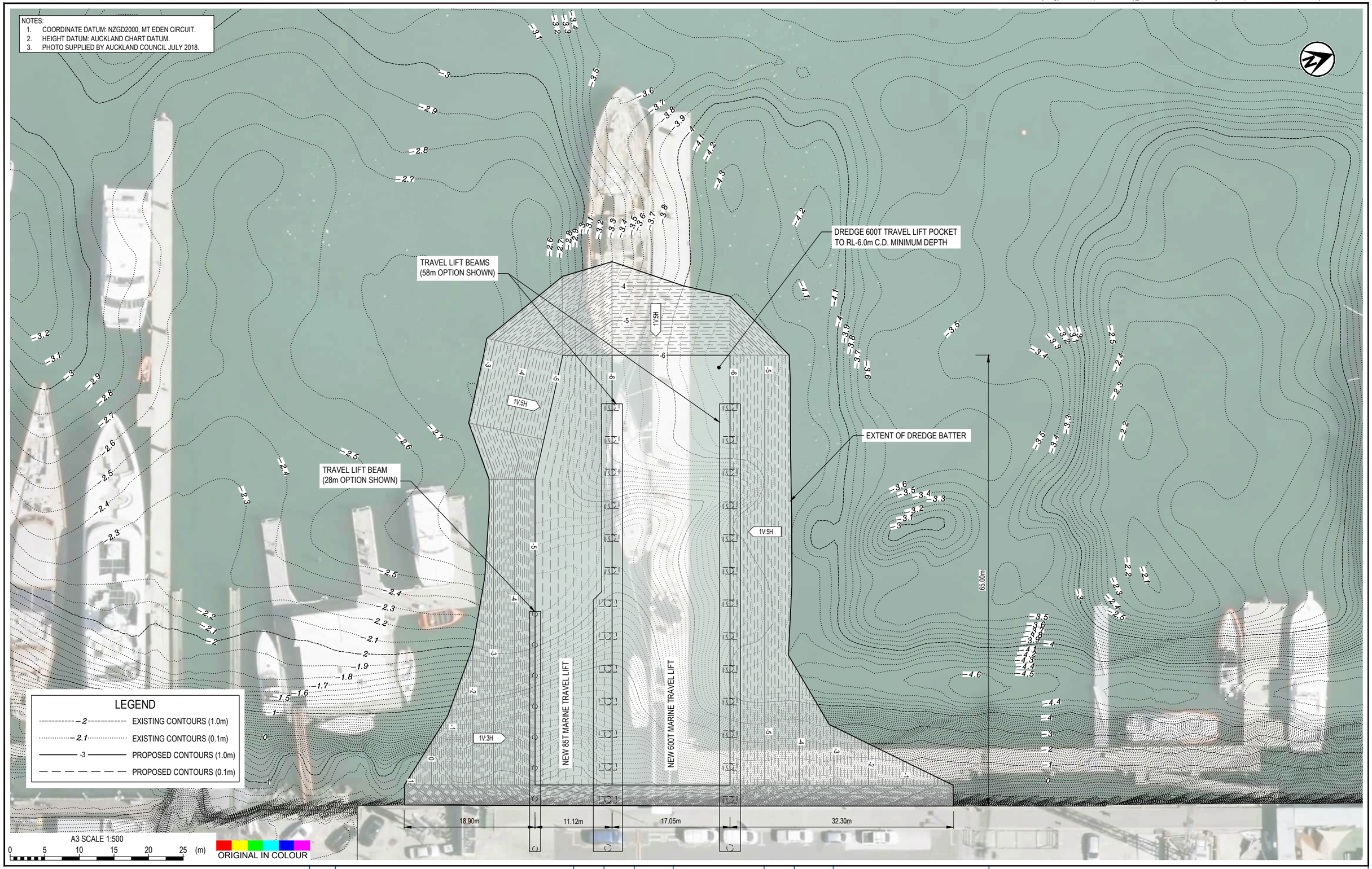
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CLIENT **ORAMS MARINE**
PROJECT **SITE 18**
TITLE PAVEMENT AND STABLISATION SECTIONS AND DETAILS
SCALE (A3) AS SHOWN DWG No. 30881-SK85 REV 3

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C:\12dSynergy\1\Orams Expansion Facility_4\CAD\SKT\30881-SK92.dwg 2018-Sep-19 9:45:45 AM Plotted By: MARK ENNION

NOTES:
1. COORDINATE DATUM: NZGD2000, MT EDEN CIRCUIT.
2. HEIGHT DATUM: AUCKLAND CHART DATUM.
3. PHOTO SUPPLIED BY AUCKLAND COUNCIL JULY 2018.



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REV	DESCRIPTION	CAD	CHK	DATE
1	FOR INFORMATION	MLE	PT	07.09.18
2	FOR RESOURCE CONSENT	MLE	PJM	19.09.18

DESIGNED	GWP	Jul.18	DRAWING STATUS
DRAWN	MLE	Jul.18	RESOURCE CONSENT
DESIGN CHECKED	PJM	Sep. 18	
DRAWING CHECKED	AMM	Sep. 18	

NOT FOR CONSTRUCTION

APPROVED DATE

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CLIENT **ORAMS MARINE**

PROJECT **SITE 18**

TITLE DREDGING
PLAN OF PROPOSED DREDGING

SCALE (A3) 1:500 DWG No. 30881-SK92 REV 2

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REPORT

Volume 2 of 2

Tonkin+Taylor

Preliminary and Detailed Site Investigations (Ground Contamination)

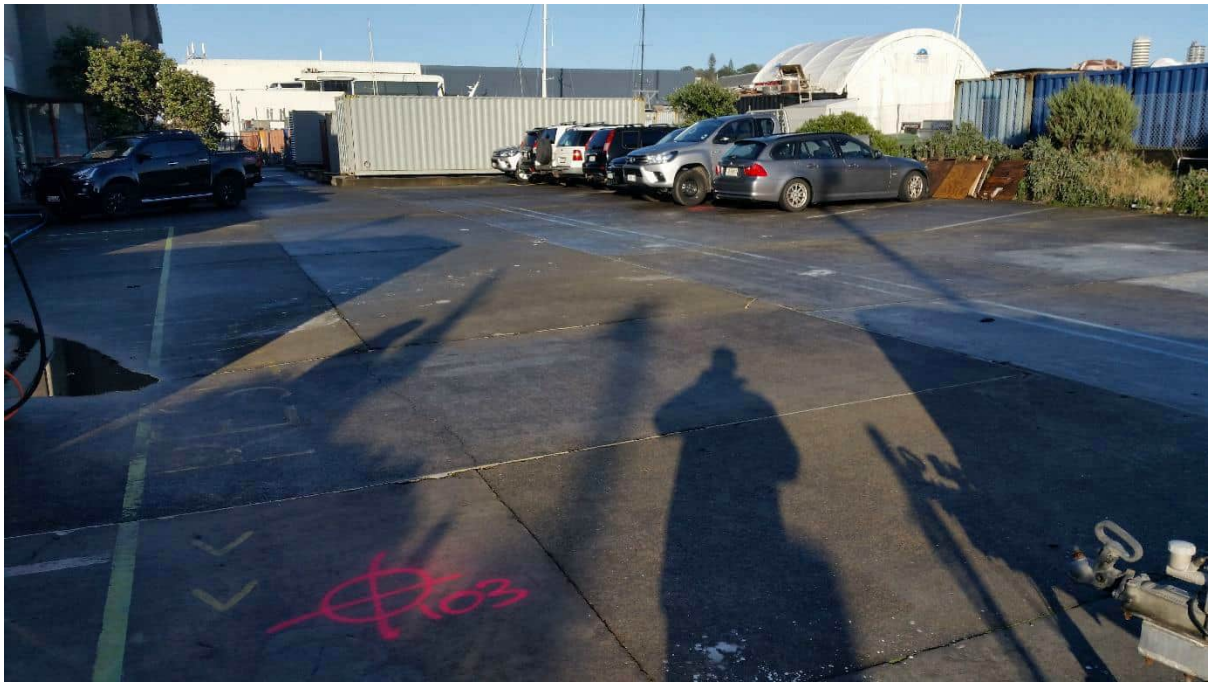
142 - 188 Beaumont Street, Wynyard Quarter

Prepared for
Orams Marine
Prepared by
Tonkin & Taylor Ltd
Date
November 2018
Job Number
30881.2000.2.v4



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Appendix B: Site Photographs



Photograph 1: Looking southwest from the site's northeastern corner.



Photograph 2: The carpark situated off Jellicoe Street.



Photograph 3: Looking southeast at Rig Pros storage facilities.



Photograph 4: Looking northeast from the site's southwestern corner.



Photograph 5: Looking southwest towards Rig Pros mast storage area.



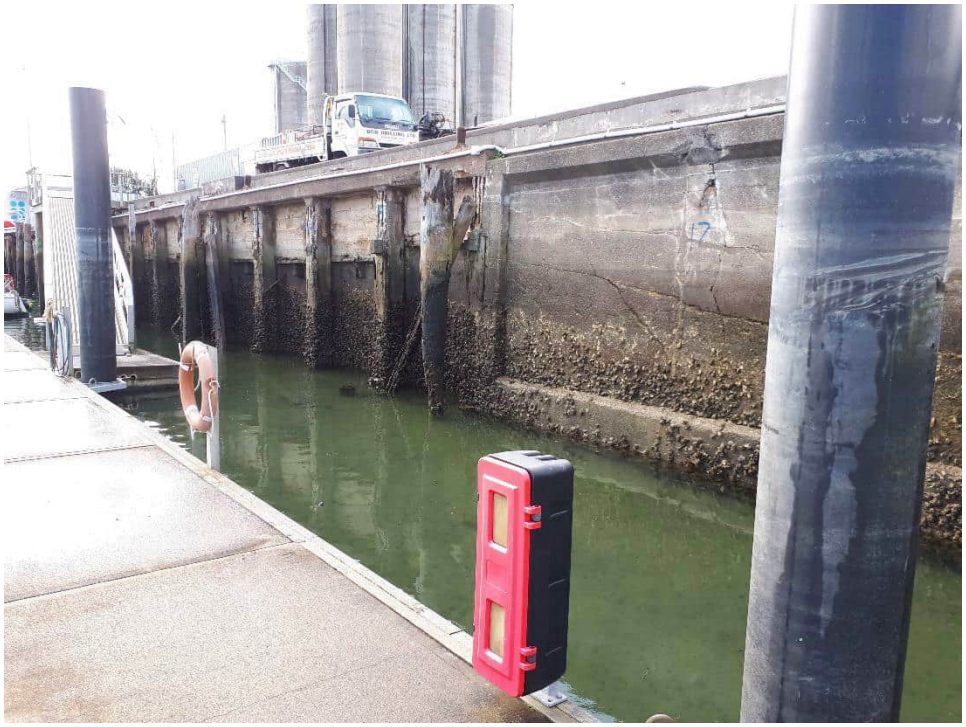
Photograph 6: Looking northwest towards Rig Pros mast storage area.



Photograph 7: Staining observed adjacent to the transformers located in the site's northwest corner.



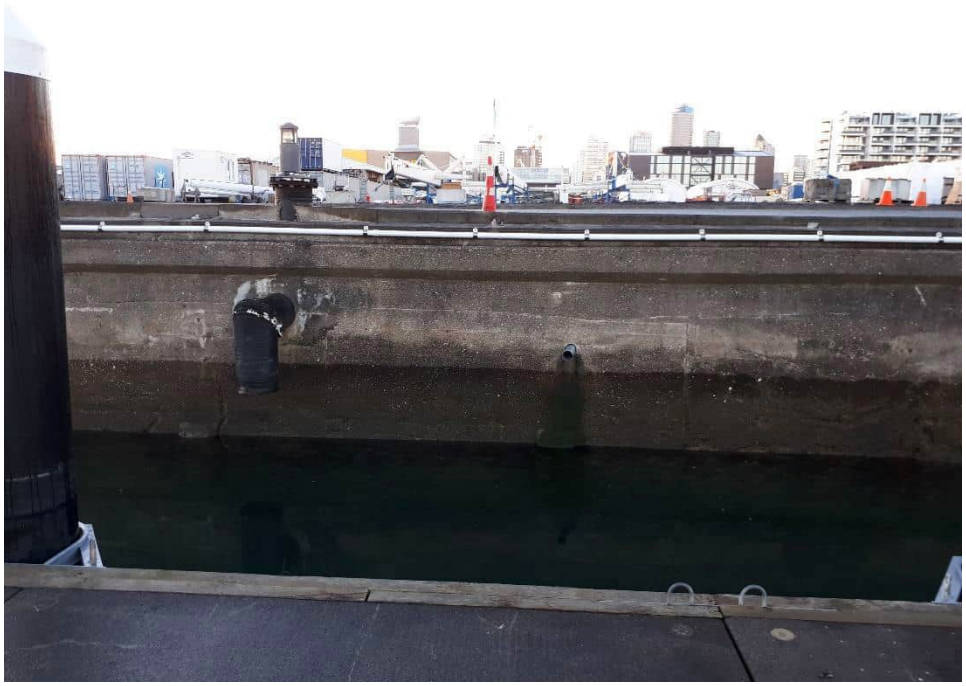
Photograph 8: Looking east towards the transformer and electrical shed located adjacent to Beaumont Street.



Photograph 9: Northern sea wall structure.



Photograph 10: Southern sea wall structure.



Photograph 11: Services outlet points.



Photograph 12: Service outlet points circled in red.

Appendix C: Site History Information – Site 18

Historical information relating to Site 18 has been collected from a variety of sources. The information presented documents on-site activities, except for the aerial photograph review where comments are also provided on readily observable surrounding land use. The information that has been reviewed is summarised in this appendix.

This site history summary relates to Site 18 only. Site history for the Orams current facility is discussed in Section 5.3 of the main report.

C 1 Ports of Auckland Reclamation plans

The Auckland Harbour Board Foreshore Reclamations plan dated 1972 indicates the land was reclaimed from the sea between 1905 and 1912 in a reclamation referred to as "*Freemans Bay North of Victoria Park*".

C 2 Historical aerial photographs

Historical aerial photographs were sourced from T+T Library, Retrolens, Auckland Council GeoMaps and Google Earth. Oblique photos were obtained from Alexander Turnbull Library. Relevant features of the site and surrounding land use from each aerial photograph are described in Table C2.1 below. Copies of the aerial photographs are provided in Appendix D.

Table C2.1: Summary of aerial photograph review – Site 18

Date, run number and source	Key site features (Site 18)	Surrounding land features (from Site 18)
1939 **Alexander Turnbull Library**	The 1939 aerial image is an oblique aerial image taken looking northeast towards the site. The image shows the site to be utilised for industrial use with four circular above ground storage tanks (ASTs) of various sizes present. One large AST is in the process of being constructed in the site's northwestern corner. Three rectangular buildings border the site's southeastern boundary, with an additional two buildings present in the site's centre and adjacent to Waitematā Harbour. The seawall on the site's western boundary has been constructed.	Land use in the wider vicinity of the site appears to be used for industrial purposes. Jellicoe Street to the northeast and Beaumont Street to the southeast have been formed. The Shell Terminal, with numerous large ASTs, is present to the southeast of the site, beyond Beaumont Street. The property to the immediate south of the site appears to be utilised for boat storage. The seawall identified to border the site does not extend to the south.
1940 **Auckland Council GeoMaps**	The 1940 aerial image shows construction of the AST in the northwestern corner to be complete. Two additional buildings border the site's southwestern boundary. The southwestern quadrant of the site in which three ASTs are present appears to be bunded. No other significant changes observed from the 1939 aerial image.	No significant changes observed from the 1939 aerial image.
1959 **Auckland Council GeoMaps**	An additional AST is present in the northeastern portion of the site. The southwest corner appears to be utilised for storage with what appears to	Silo park to the north of the site has been developed and contains numerous buildings and ASTs. No other significant changes observed from the 1940 aerial image.

Date, run number and source	Key site features (Site 18)	Surrounding land features (from Site 18)
	be numerous containers or tankers present. No other significant changes observed from the 1940 aerial image.	
1968 **T+T Library**	The southwest corner of the site has been developed and now contains at least 18 ASTs of various sizes and associated above ground pipework. An additional AST is also present in the site's northeastern corner. No other significant changes observed from the 1959 aerial image.	No significant changes observed from the 1959 aerial image.
1974 **T+T Library**	No significant changes observed from the 1968 aerial image.	
1981 **Whites Aviation**	The site now contains a large quantity of ASTs of various sizes and associated pipework. The large building previously identified to be situated against to Beaumont Street has been removed. A jetty has been constructed, protruding west from the site's southwestern corner.	The property to the immediate south of the site is now vacant and appears to be in the process of reclamation.
1996 **Auckland Council GeoMaps**	The 1996 aerial image is of poor resolution. The two ASTs previously identified in the site's northwestern and northeastern corner have been removed with several ASTs now in its place. A large building is now present adjacent to Beaumont Street. Two ASTs, previously identified to be situated on the site's southern boundary have been removed. The remainder of the site appears to be in similar condition to the 1981 aerial image.	The property immediately south of the site has been developed and now appears to contain several buildings and numerous boats. A pontoon has been constructed and is now present to the west of the site.
2001 **Auckland Council GeoMaps**	No significant changes observed from the 1996 aerial image. The site still appears operational.	Construction of what appears to be a building is occurring to the south of the site. Three large ASTs previously identified in the shell terminal have been removed with a car park now present in the property's northwest corner. No other significant changes observed from the 1996 aerial image.
2006 **Auckland Council GeoMaps**	No significant changes observed from the 2001 aerial image. The site still appears operational.	

Date, run number and source	Key site features (Site 18)	Surrounding land features (from Site 18)
2008 **Auckland Council GeoMaps**	The 2008 aerial image shows the site to have been decommissioned. One large building is present along the site's southeastern boundary and several smaller buildings are present across the site. All ASTs, aboveground lines and other infrastructure previously visible has been removed from site.	No significant changes observed from the 2006 aerial image.
2010/2011 **Auckland Council GeoMaps**	No significant changes observed from the 2008 aerial image.	The property to the east of Beaumont Street has been decommissioned with the building and tanks previously identified on the site removed.
2012 **Auckland Council GeoMaps**	The northwestern corner of the site appears to be utilised for car parking. The remainder of the site appears to be disused. No other significant changes observed from the 2010/2011 aerial image.	The property to the north appears to have been decommissioned with all infrastructure, excluding six ASTS, removed from the property. The remainder of the property is grassed and/or concreted. No other significant changes observed from the 2010/2011 aerial image.
2017 **Auckland Council GeoMaps**	The site appears to be utilised for industrial purposes with numerous buildings of various sizes located across the site. What appear to be two transformers are present in the site's northwestern corner. A crane is also present in the northwestern corner. Numerous shipping containers are located on site, including bordering the site's southern access way and the car park situated in the northern portion of the site. Several yacht masts are present in the site's centre. The periphery of the site appears to be hardstanding (concrete or asphalt) whilst the centre of the site appears to be gravelled and grassed in parts.	The present-day pontoons situated to the west of the site have been constructed. No other significant changes observed from the 2012 aerial image.

C 3 Council property files

The property file for 164 – 188 Beaumont Street, Auckland, was obtained from Auckland Council on 18 June 2018. The documents most relevant to prior land use and potential contamination are summarised below. The relevant information is appended in Appendix E.

- An archive list stating that the sea wall, oil and petrol stores and a shed were erected at the site by Mobil Oil NZ Ltd in 1928.
- Plans, dated January 1928, detailing the construction of a seawall by Atlantic Union Oil Co. Limited.

- Plans, dated January 1928, detailing the layout of the Atlantic Union Oil Co Limited Auckland Terminal. The plans show the site to comprise three ASTs in the site's centre, a filling shed located on the site's northeastern boundary and a petrol store and lubricating oil store located adjacent to Beaumont Street.
- A plan, dated 22 October 1948, for the proposed construction of a drum cleaning shed (note that the quality of the figure is poor and the location of the building cannot be determined).
- A building application form, dated February 1957, to erect a steel frame building for the filling of drums with refined oil products.
- Plans, dated April 1957, and issued to Standard- Vacuum Oil Company, detailing the structural requirements for above ground tanks.
- A building application form, dated June 1960, to make alterations to the solvent store and terminal at Beaumont Street. The building application states that the roof of the building is made of fibrolite. The location of this structure was not indicated.
- A letter, dated November 1963, stating that historically petroleum had been discharged into the harbour by tankers, pipelines had burst and that petrol had run back down foam lines onto the street.
- An application, dated December 1963, for the conversion of two 50 ft diameter roof oil storage tanks to fixed cone roof tanks at the Atlantic Union Oil Company's Beaumont Street Terminal.
- A letter, dated August 1964, stating that the Atlantic Union Oil Co. were proposing to install two 20,000 L tanks, one 10,000 L tank and two 3,000 Gallon Tanks at the Beaumont Street Terminal.
- A letter, dated July 1966, stating that the Atlantic Union Oil Co. (NZ) propose to install 15 steel tanks for the bulk storage of petroleum products at Beaumont Street, Freemans Bay. The letter also states that as part of the installation requirements, foam stocks held by the Harbour Board were to be increased to 2,000 gallons and stocks held by the oil companies were to be increased to 6,000 gallons.
- A memorandum, dated September 1966, for the approval for 15 additional tanks to be erected at the site. A condition of approval is that the 15 tanks are separately bunded as a group.
- A memorandum, dated September 1968 and on behalf of Atlantic Union Oil Co. seeking consent to erect two vertical steel tanks (10,000 and 20,000 gallons) for the bulk storage and distribution of lubrication oil. The memo states that approximately 4 million gallons of petroleum products are already stored on the site.
- A memorandum, dated September 1968, for the proposed installation of lubricating oil tanks.
- A letter to the Department of Works & Services, dated May 1971, seeking consent to erect two vertical steel tanks for the bulk storage of petroleum chemicals.
- An application to the Department of Works on behalf of the Atlantic Union Oil Co, (NZ) Ltd, dated June 1971, seeking consent to erect two vertical steel tanks. The tanks are each proposed to have a capacity of 68,700 gallons with one proposed to store dioctyl phthalate (a plasticiser) and Whiterex 307 (a light oil).
- A plan, dated September 1972, showing the following tanks to be present at the site:
  - 2,029,000 gallon regular motor spirit.
  - 778,000 gallon light fuel oil.
  - 548,000 gallon dry cleaner.
  - 548,000 gallon light fuel oil.

- 548,000 gallon turps.
- 368,800 gallon light fuel oil.
- 225,000 gallon transformer oil.
- 2 x 68,700 gallon whiterex oil (a light oil).
- 2 x 11,000 gallon transformer oil.
- 2 x 11,000 gallon lube oil.
- 2 x 11,000 gallon power kero.
- Numerous tanks, contents not reported, as follows:
    - 2 x 107,400 gallon.
    - 1 x 68,700 gallon.
    - 4 x 67,700 gallon.
    - 5 x 20,000 gallon.
    - 2 x 3,000 gallon.
    - 11 x tanks of unknown volume.
- The plan also identifies the following:
    - The southwestern tank compound has a concrete bund.
    - Loading zones (for solvents, dry cleaner, whiterex oil and power kero) are present adjacent to the site's southern egress point.
    - A laboratory in the site's northeastern quadrant, adjacent to Beaumont Street.
    - Three drum storage buildings (adjacent to Beaumont Street and the Waitematā Harbour, and in the site's centre).
    - A drum filling building adjacent to Waitematā Harbour.
    - A refined products store in the site's centre.

- A plan, dated January 1978, detailing the construction of two underground spill storage tanks (one 5,000L and one 7,500 L tank).
- Plans, dated August 1978, showing the following:
    - A transformer oil tank present in the northeastern corner of the site.
    - Two tanks present on the site's northern boundary.
- A letter, dated September 1978, stating that a 10,000 gallon tank will be installed at the site and would be used to blend and store coloured methylated spirits. The letter states that fire protection would comprise a 4" foam line, similar to ones already existing on site.
- A consent application, dated January 1979, to erect a 45,000 L methylated spirits storage tank within an existing tank compound.
- A consent application, dated February 1980, for the erection of five for petroleum products and/or bulk solvents and chemicals in place of an existing tank at the site.
- A consent application, dated March 1980, to replace an existing 2 million gallon capacity storage tank with six smaller tanks with a collective storage capacity of 0.54 million gallons on the western corner of the Beaumont/Jellicoe Street intersection. The tanks were proposed to hold scheduled products including gasoline, kerosene and Pegasol AA.
- A letter from the New Zealand Fire Service, dated December 1980, stating that the fire service was required to extinguish an un-authorised demolition fire at 180 Beaumont Street, located adjacent to the Mobil Oil Co. site. The letter does not detail what was used to extinguish the fire (water or foam etc) or if the fire just comprised demolition materials.

- A letter to the Town Clerk and from Mobil Oil NZ Ltd, dated January 1981, applying to erect use six storage tanks for petroleum products and/or bulk solvents and chemicals in place of an existing storage tank. The six storage tanks are proposed to contain the following:
  - 1 x 455,000 L regular gasoline.
  - 3 x 455,000 L kerosene.
  - 1 x 455,000 L pegason AA.
  - 1 x 182,000 L spare tank.
- A plan, dated July 1981 and produced for Mobil Oil NZ Limited Auckland, showing the location of numerous above ground tanks. A drum storage and drum fill area is located in the centre of the site adjacent to the Waitematā Harbour. A refined products store is situation in the centre of the site. A transformer is located along the site's northeastern boundary with Jellicoe Road. A switchroom is located adjacent to Beaumont Street.
- A plan, dated August 1981, detailing the construction of switchroom. The plan details that a transformer slab, approximately 150 mm thick, would be located immediately adjacent to the switchroom. The plans detail that the switchroom also has a concrete base 150 mm thick.
- A building permit application, dated September 1981 and submitted by Mobil Oil NZ Limited, to erect a switchroom building at 164 – 188 Beaumont Street, Auckland.
- A letter from the Department of Planning and Community Development, dated August 1982, stating that Mobil Oil NZ is approved for erect five 455,000 L tanks and one 182,000 L tank.
- A building permit application, dated July 1982 and submitted on behalf of Mobil Oil NZ Ltd, stating that the present use of the site is for the storage of premium motor spirits and is proposed to be used for the storage of chemicals including methyl isobutyl ketone, kero-pegasol A.A and motor spirits. The application is for the erection of chemical tanks.
- Plans, dated March 1982 and produced on behalf of Mobil Oil NZ Limited Auckland, showing approximately the location of 33 tanks of various sizes at the site. The plans also show the location of a drum fill area and drum storage in the site's northwestern corner adjacent to the Waitematā Harbour. The plans also show a refined products store in the centre of the site and a tank wagon fill shelter located adjacent to Beaumont Street.
- A letter to Auckland City Council, dated February 1983, stating that a laboratory would be constructed at the Mobil Oil NZ Limited Jellicoe Street Depot. The letter states that the laboratory will be used to test Class 3a products.
- Plans, dated March 1983, detailing the proposed construction of a facilities building for Mobil Oil NZ Ltd. The plans also identify that a laboratory would be present on the ground floor.
- A letter, dated March 1983, stating that in February 1980 the Atlantic Union Oil Co. was consolidated into Mobil.
- A letter, dated April 1983, stating that Mobil Oil NZ Limited planned to erect amenity buildings and an office at the site.
- A general site layout plan, dated August 1984, showing a workshop located adjacent to Jellicoe Street.
- A plan, dated December 1991, showing the following tanks to be present onsite:
  - 1 x 179,200 L acetone
  - 1 x 2,435,000 L Avgas 100
  - 1 x 13,600 L Avgas Slops
  - 1 x 320,700 L B.A
  - 1 x 319,200 L B.A
  - 1 x 22,600 L Blender

- 1 x 89,200 L Delvac 1330
- 1 x 50,000 L Diesel
- 1 x 1,648,000 L Drycleaner
- 1 x 172,600 L G 3440 SP
- 2 x 51,300 L IPA
- 1 x 70,800 IPA L
- 1 x 50,000 L Jet A1
- 1 x 465,500 L Kerosine
- 1 x 306,800 L M.E.K
- 1 x 50,000 L Methanol
- 1 x 172,800 Meths 95WP
- 1 x 481,900 L M.M.A
- 1 x 89,200 L Mobil Oil 30/40
- 1 x 172,100 L N.B.A
- 1 x 86,100 L N Butanol
- 1 x 178,800 L P.C.E
- 1 x 466,400 Pegasol AA
- 1 x 466, 900 Pegasol AA
- 1 x 51,000 L Pegasol 600
- 1 x 179,200 L Pegasol R100
- 1 x 303,600 L Pegasol R150
- 1 x 3,492,000 L Petropine
- 1 x 87,400 L P.M.S Slops
- 1 x 172,300 L S.D.A 3A
- 1 x 48,700 L Solv Blend 64T
- 1 x 1,251,500 L Stock 632
- 1 x 87,500 L Stock 2697
- 1 x 13,600 L Stock 5601
- 1 x 50,000 L Stock 5613
- 1 x 89,200 L Super XHP Oil
- 1 x 319,800 L Toluol
- 1 x 450,500 L V.A.M
- 1 x 316,600 L Whiterex 307
- 1 x 305,000 L Whiterex 334
- 1 x 467,600 L Xylol
- 1 x 467,800 L Xylol

- A letter and associated plans, dated December 1991, for the construction for a 13,000 L horizontal slops tank at the site.
- Plans, dated September 1994 and drawn for Mobil, for the Stage 2 Jellicoe Street Environmental Upgrade.

- A letter, dated October 1994, stating that the Mobil Terminal was working on a Stage 2 Environmental Upgrade which included the following aspects:
  - Upgrading five tanks to contain the following:
    - The installation of HDPE impermeable liners under the compounds.
    - Upgrading the tanks with new foundations, secondary containment, overfill alarms, fire protection water drench rings and foam aerators.
  - Installing a new oil water separator.
- A resource consent application, dated November 1994 and submitted by Mobil Oil NZ Limited, for the storage of petroleum products.
- A letter, dated November 1994, stating that the Mobil Terminal was working on a Stage 2 upgrade which included the following aspects:
  - Construction of New Compound B.
  - Tanks to be in relocated from existing positions.
  - Fire systems to be installed included:
    - Fixed pipe tank water sprays.
    - Fixed pipe foam supply to each tank.
- Plans, dated February 1995 and drawn for Mobil, for the Stage 2 Jellicoe Street Environmental Upgrade. The plans show the Stage 2 works to comprise the construction of "New Compound B" which contains five ASTs of various sizes. The plans also show that forty ASTs are currently present across the site. The plans also show the location of a proposed fire pumphouse located in the site's eastern corner, bordering Jellicoe Street and Beaumont Street.
- A scope of works report, dated August 2006, for the demolition of the special products terminal, Auckland. The report states that the demolition will include all facilities and will be demolished down to concrete and bitumen level. The report also states that all flange joints are considered to contain asbestos gaskets.
- A building consent application, dated September 2006 and submitted by Mobil Oil NZ Limited, for the demolition of all above ground bulk petroleum storage tanks and associated equipment. The application states that the storage farm was constructed pre-1930. Associated plans, dated September 2006, show the proposed demolition area which included the entire site excluding the transformer and building located in the eastern corner of the site.
- A code of compliance certificate, dated October 2006, for the demolition of all above ground bulk petroleum storage tanks and associated equipment.
- Plans, dated February 2012, for the construction of a container complex proposed to be utilised as an America's Cup team base. The plans show the proposed building to be located 5 and 44 m from Beaumont Street and Jellicoe Street, respectively.
- A resource consent application, dated March 2012, for the establishment of the site for the Luna Rossa America's Cup base which will include the construction of two temporary structures. The application states that temporary structures will be constructed out of shipping containers and will be semi-enclosed by a PVC roof structure. The application also states that a mobile lifting crane will be positioned in the site's northwest corner.
- A resource consent application, dated April 2012 and issued to Auckland Waterfront Development Agency Limited, for the erection of two temporary buildings (constructed from shipping containers) for repairing and constructing boats for a period of 12 months. Associated plans, dated April 2012, show the proposed buildings to be located 5 and 44 m from Beaumont Street and Jellicoe Street, respectively, and on the boundary of Jellicoe Street approximately 25 m from the Waitematā Harbour.

- A technical memo, dated January 2013, for the dredging, erection and placement of piled pontoons located to the west of Site 18 and Site 26, and for the construction of an ancillary car park at Site 18.
- A project information memorandum (PIM) (No. HM/96/7438), date unknown, for proposed foundation work for a relocated steel blending tank. The PIM also states that the site is located in an area of known instability and has fill in it.
- A document, undated, stating that the Mobil Terminal at Freeman's Bay has approximately 5.71 million gallons of chemical storage including fuels and solvents stored in eight tanks.

C 6 Council contamination enquiry

A contamination enquiry was placed with Auckland Council on 15 June 2018. The information provided is included in Appendix F and states that the site was utilised as a bulk hydrocarbon product storage facility from 1940 until 2006. The Council also stated that there is the potential for the site to be on reclaimed land classified as "filled/weak ground".

Resource consents related to the site or properties immediately surrounding the site (including existing, superseded and surrendered consents) are attached in Appendix F.

Three surrendered or expired consents exist for the site, two for the installation of bores and one to authorise the diversion and discharge of stormwater and contaminated stormwater. No existing consents exist for the site.

C 7 Dangerous Goods Licence

Auckland Council provided Dangerous Goods Licences for Site 18 for 1994 and 1995 (appended in Appendix E). The Dangerous Good Licences state the following:

1994				**1995**			
Class 3a Flammable Liquids							
Above ground tanks: 10,055,039	Containers over 60L: 600,000	Containers below 60L: 15,000	Workroom Containers: 72,000	Above ground tanks: 11,131,600	Containers over 60L: 600,000	Containers below 60L: 15,000	Workroom Containers: 72,000
Class 3b Flammable Liquids							
Above ground tanks: 11,576,766	Containers over 60L: 250,000	Containers below 60L: 10,000	Workroom Containers: 25,000	Above ground tanks: 10,500,205	Containers over 60L: 250,000	Containers below 60L: 10,000	Workroom Containers: 25,000
Class 3c Flammable Liquids							
Above ground tanks: 1,961,335	Containers over 60L: 25,000	Containers below 60L: 5,000	Workroom Containers:	Above ground tanks: 1,961,335	Containers over 60L: 25,000	Containers below 60L: 5,000	Workroom Containers:

C 8 Fire and Emergency records

An official information request was placed with Fire Emergency New Zealand on 20 June 2018 to assess the potential for use of firefighting foams at the site. The information provided recorded incidents from 2005 – 2014 and did not identify that any fires or use of firefighting foam had occurred at the site during that period. Copies of the information provided by Fire Emergency New Zealand are included in Appendix G.

C 9 Beca 2005 report

Beca completed an assessment to provide an overview of contamination within the Western Reclamation[1]. The assessment indicated that an explosion occurred on Site 18 in 1971 involving vinyl acetate monomer (VAM) during which an unspecified amount of VAM was reported to escape to ground. The report also states that in 1976 there was a fire involving Toluol from which an unspecified amount of product escaped to ground. The report indicated that remediation to remove petroleum hydrocarbon contaminated soils had occurred at Site 18 by that time (2005).

C 10 Information from RigPro

Information on the hazardous substances used onsite (type and volume) by RigPro is provided in Appendix G. A variety of solvents and other products are used in their operations but all volumes are minor. The maximum volume of hazardous goods stored at the site is 20 L of acetone, and 20 L of Spartite SP-2000 Part A and Part B.

C 10 Other information

A product information board from 2006 when Site 18 was being decommissioned was obtained by T+T during a site visit. The products shown on the board at this time are listed in Table C2.2.

Table C2.2: Summary of products shown on 2006 photograph

Products stored onsite	Products that appear not to be have been stored at the time the photograph was taken, but had been stored in the past
• Pegosol AA • White spirits • Toluol • NPA • IPA • Blender • Avgas 100 • MIBK • V-PROP • N-propanol • Kerosine • M.E.K • S.D.A – 3A • N.B.A • Prorex 36 A number of tanks were also storing slops at this time.	• Pegasol R100 • White spirits/drycleaner • N-Butonol • Diesel • Blend 64T • SDA- 4FMeths 95 WP • Xylol • Acetone • Texanol • Methanol • VAM • Whiterex 334 • Jet A1 • Meths 95QP • Whiterex 307

[1] Beca Infrastructure Ltd 2005, report for MfE, Overview of Contamination within the Western Reclamation



Photograph C1: Site information board – photograph taken during site visit in 2006.

Appendix D: Historical Aerial Photographs



Historical Aerial Image 1: *1939. Approximate Site 18 boundary indicated by red outline; approximate Orams existing site in blue dash (Source: Alexander Turnbull Library).*



Historical Aerial Image 2: *1940. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: Auckland Council GeoMaps).*



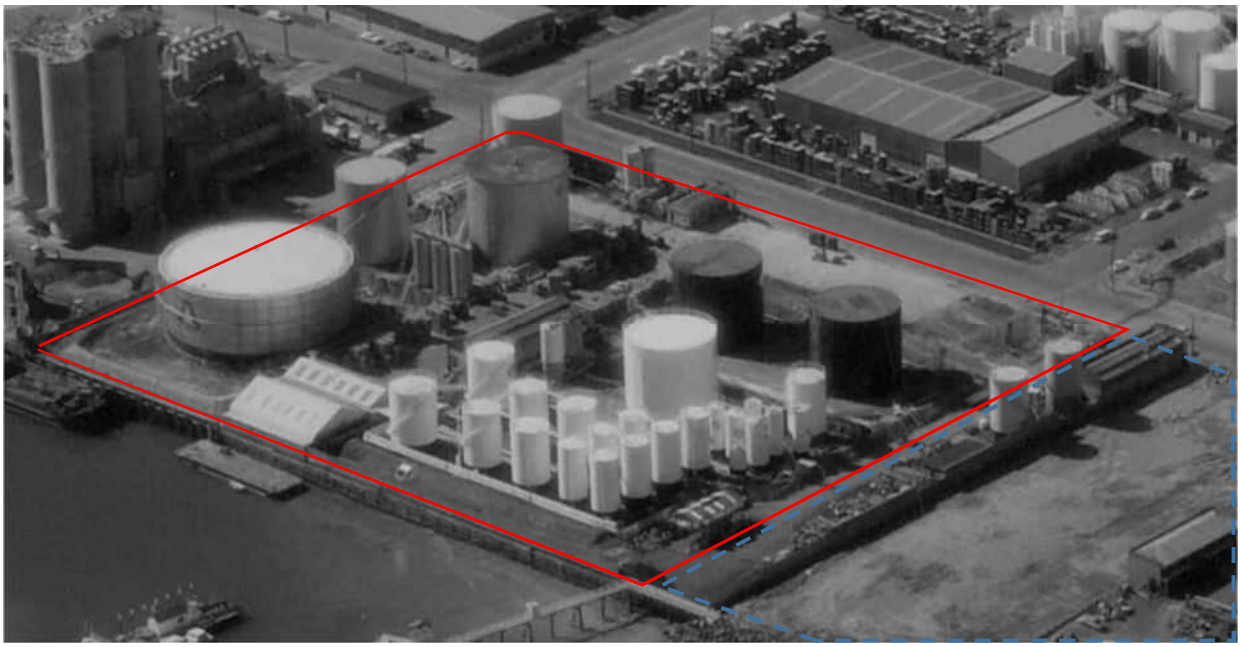
Historical Aerial Image 3: *1959. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: Auckland Council GeoMaps).*



Historical Aerial Image 4: *1968. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: T+T Library).*



Historical Aerial Image 5: *1974. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: T+T Library).*



Historical Aerial Image 6: *1981. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: Alexander Turnbull Library).*



Historical Aerial Image 7: *1996. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: Auckland Council GeoMaps).*



Historical Aerial Image 7: *2001. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: Auckland Council GeoMaps).*



Historical Aerial Image 7: *2006. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: Auckland Council GeoMaps).*



Historical Aerial Image 8: *2008. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: Auckland Council GeoMaps).*



Historical Aerial Image 9: *2010/2011. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: Auckland Council GeoMaps).*



Historical Aerial Image 10: *2012. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: Auckland Council GeoMaps).*



Historical Aerial Image 11: *2017. Approximate site boundary indicated by red outline; approximate Orams existing site in blue dash (Source: Auckland Council GeoMaps).*

Appendix E: Relevant Council Property File Information

AUCKLAND *CITY*

Private Bag Wellesley Street Auckland 1 New Zealand

SEE ROLL 8.28

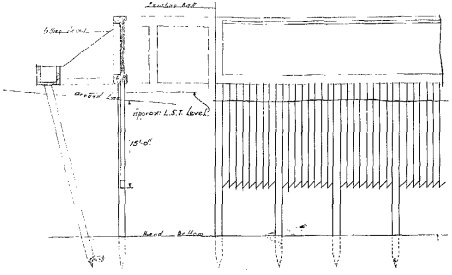
ARCHIVAL

164 - 188 BEAUMONT STREET

Owner MOBIL OIL NZ LTD

Contractor

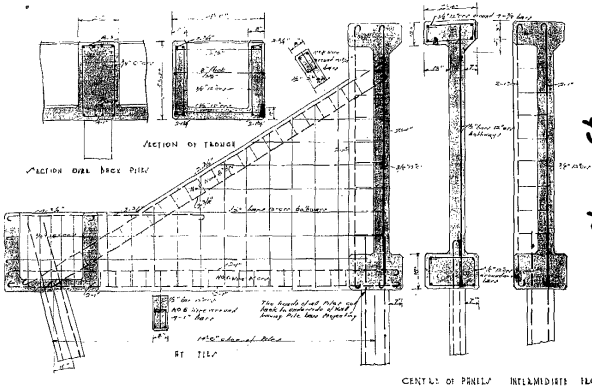
Particulars			
er sea wall	UNKNOWN	4737	4.1.1928
er oil and petrol stores and tank stands	"	4907	1.2.1928
er shed	"	5895	16.6.1928
Extension to store	"	9575	2.2.1929
er watchman's house	"	7817	5.3.1929
er storage shed	£ 700	8750	6.7.1929
er protective wall around tank	£ 2147	1562	22.1.1942
conv. store to locker/messroom and messroom to office	£ 455	173	20.10.1948



CROSS SECTION AT TILT



PART ELEVATION OF WALL



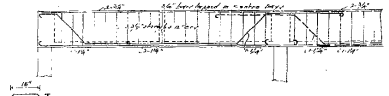
SECTION OF TROUGH

SECTION ONE BRICK PILE

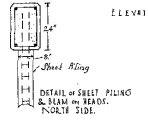
AT TILT

CENTRE OF PANELS

INTERMEDIATE FRONT PILES



ELEVATION OF TROUGH



DETAIL OF SHEET PILING & BEAM ON HEADS. NORTH SIDE.

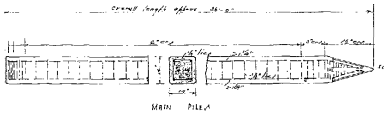


HORIZONTAL SECTION MAIN WALL

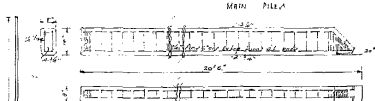
TYPICAL SECTIONS



SHEET PILING



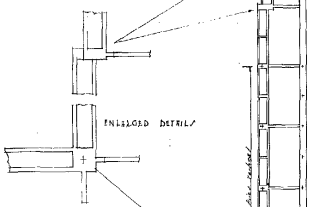
MAIN PILES



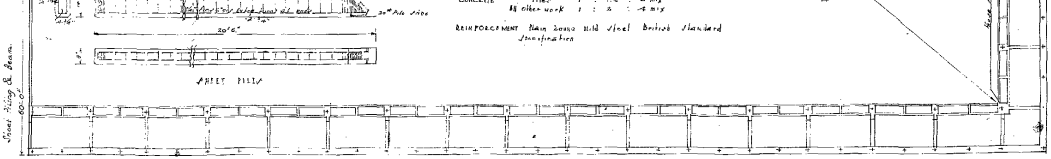
SHEET PILES

CONCRETE Piles 1 : 1½ : 3 mix
All other work 1 : 2 : 4 mix

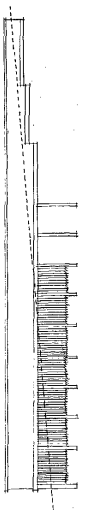
REINFORCEMENT Main bonds Mild Steel British Standard Specification



ENLARGED DETAIL



PLAN OF WALL



ELEVATION OF RETURN WALL

BEAUMONT ST (ATLANTIC UNION OIL) (AL) 1 OF 1

PN 4737

J.D. Maxwell 4/1/28

ATLANTIC UNION OIL CO. LIMITED

AUCKLAND TERMINAL

DETAILS OF SEA WALL

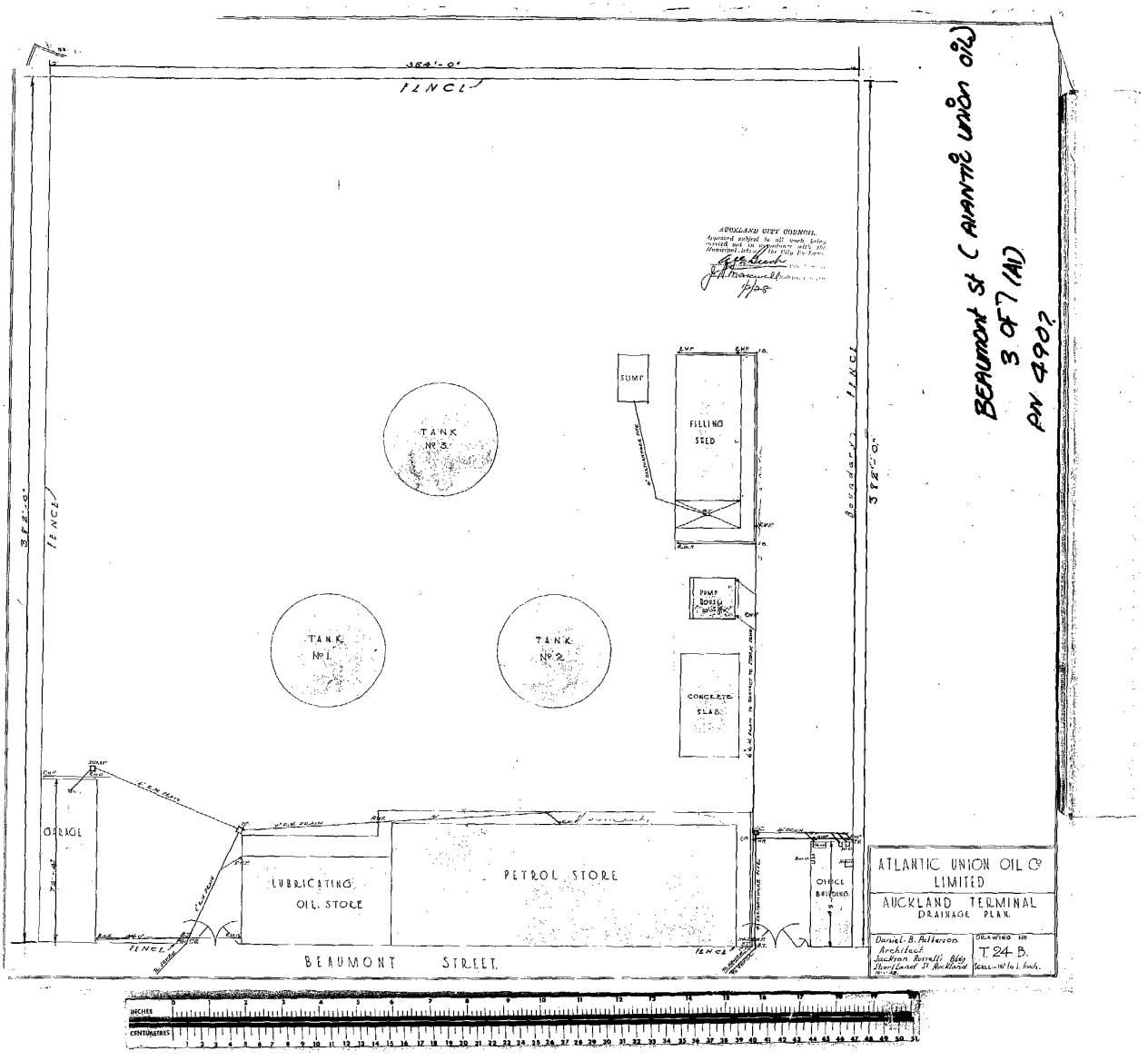
Drawing No. ST. 3. B.

Scale - 1/8 1/4 1/2

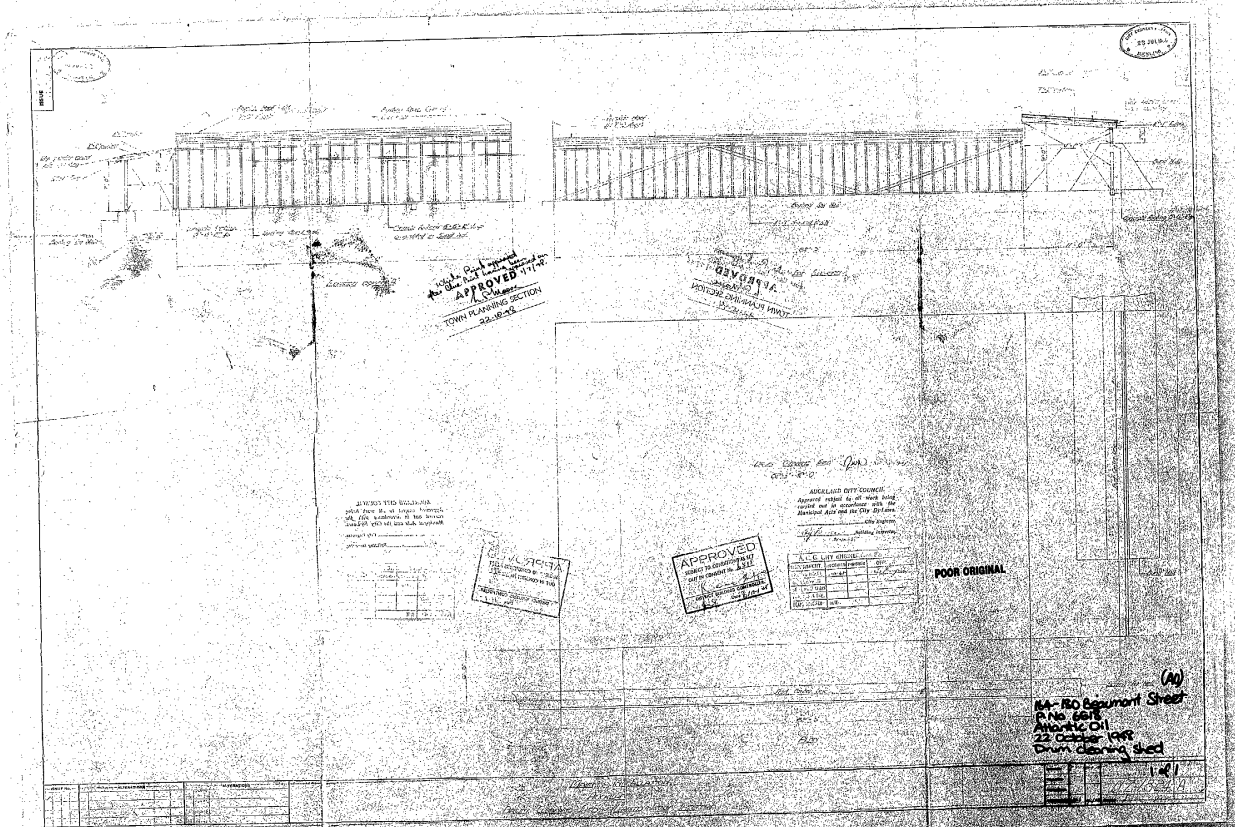
Drawn: B. Paterson

S.T. Silver, Mitchell & Co. Consulting Engineers, Jackson Russell Bldg. Shortland St. Auckland





BEAUMONT St (ATLANTIC UNION OIL)
3 OF 7 (A1)
PN 490?


APPROVED
TOWN PLANNING SECTION
APPROVED
APPROVED
AUCKLAND CITY COUNCIL
POOR ORIGINAL
(A1)
14-150 Beaumont Street
P.No. 6618
Melville, Oil
22 October 1998
Drum cleaning shed
1 of 1

Form No. 1

AUCKLAND CITY COUNCIL

BUILDING APPLICATION FORM

Date 4th Feb 19 57

To - The CITY ENGINEER.

Sir,

I hereby apply for permission to Erect Steel Frame Building

at Beaumont St, Freemans Bay (House number and Street) for Atlantic Union Oil Co (Owner)

of Boat 1053 Auck Canal. (Address), according to locality plan and detailed plans, elevations, cross-sections, and specifications of building deposited herewith in duplicate.

PARTICULARS OF LAND: Lot No.

Allotment No.

Section

D.P.

LENGTH OF BOUNDARIES: Front 500'

Back 500'

Side 380

Side 380

Area 190,000 sq ft.

PARTICULARS OF BUILDING:

Foundations Reinf Concrete Floors Concrete

Walls Corrugated Sheet iron Roof Corrugated Sheet iron

Area of ground floor 62' x 25' = 1550 square feet

Area of outbuildings — square feet

Number of Storeys: Above Kerb level one

Below Kerb level

Average distance of set back of front of buildings from street boundary line 51'6" ft

ESTIMATED COST: Building Steel Frame Concrete Foundation £ 16190-0-0

Sanitary Plumbing and Drainage £ 1477-0-0

TOTAL: £ 3096-0-0

Proposed purposes for which every part of building is to be used or occupied (describing separately each part intended for use or occupation for a separate purpose): Filling of drums with refined oil products.

Proposed use or occupancy of other parts of building: /

Nature of ground on which building is to be placed and of the subjacent strata: Filling, Clay & rock.

Yours faithfully,

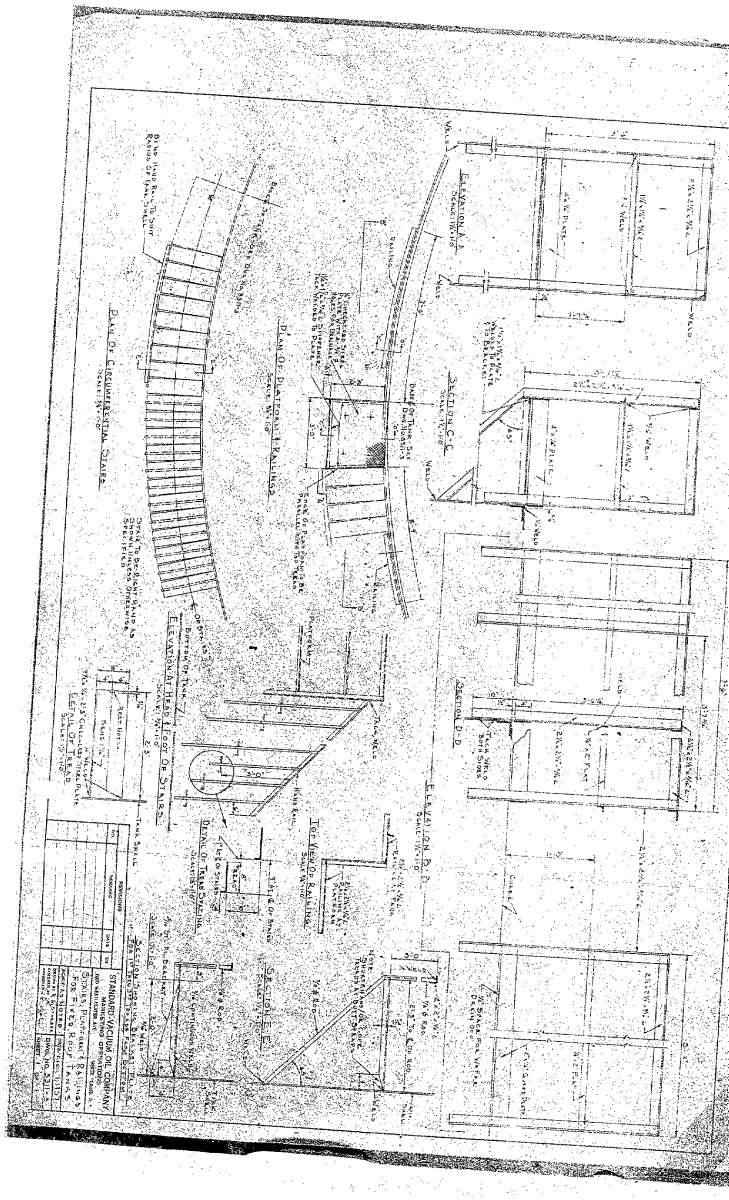
ATLANTIC UNION OIL CO. [illegible] Owner

Builder

Builder's Address

OFFICE USE ONLY

Permit No. 11252 Date 15/3/57

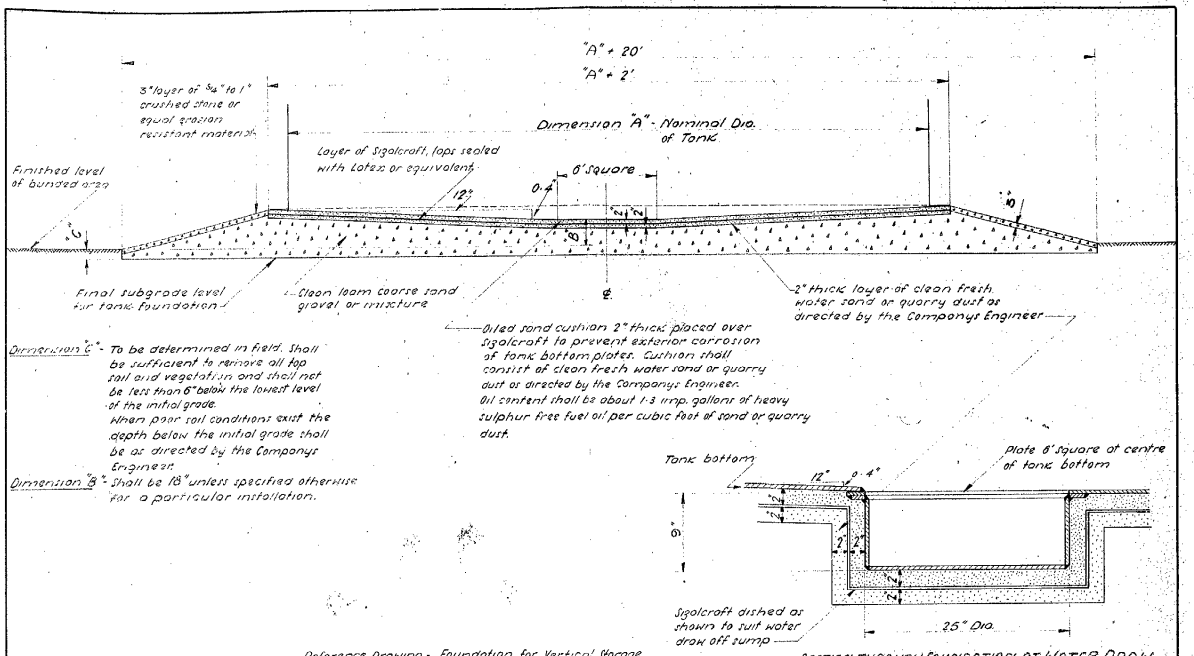


BEAUMONT St (ATLANTIC UNION OIL)
(A2) 1 of 15
PN 140579

3 BEAUMONT ST (ATLANTIC UNION OIL)
(A2) 2 OF 15
PN ~~H0059~~
140579

BEAUMONT ST (ATLANTIC UNION OIL)
(RD 3 OF 15 - PW ~~#####~~ 140579.

CIVIL ENGINEERS OFFICE
RECEIVED
29 AUG 1962
AUCKLAND



Reference Drawing - Foundation for Vertical Storage Tanks with Dished Bottoms - Drg. N.Z. 3390 C

SECTION THROUGH FOUNDATION AT WATER DRAW OFF SUMP

ISSUE NO.	ALTERATIONS
1	

ALL CENTRES

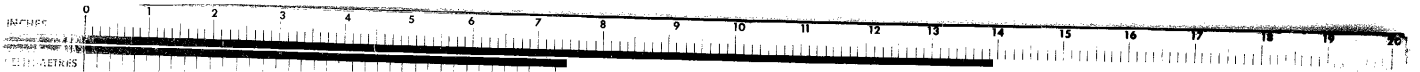
FOUNDATION PLAN FOR VERTICAL STORAGE TANKS WITH DISHED BOTTOMS

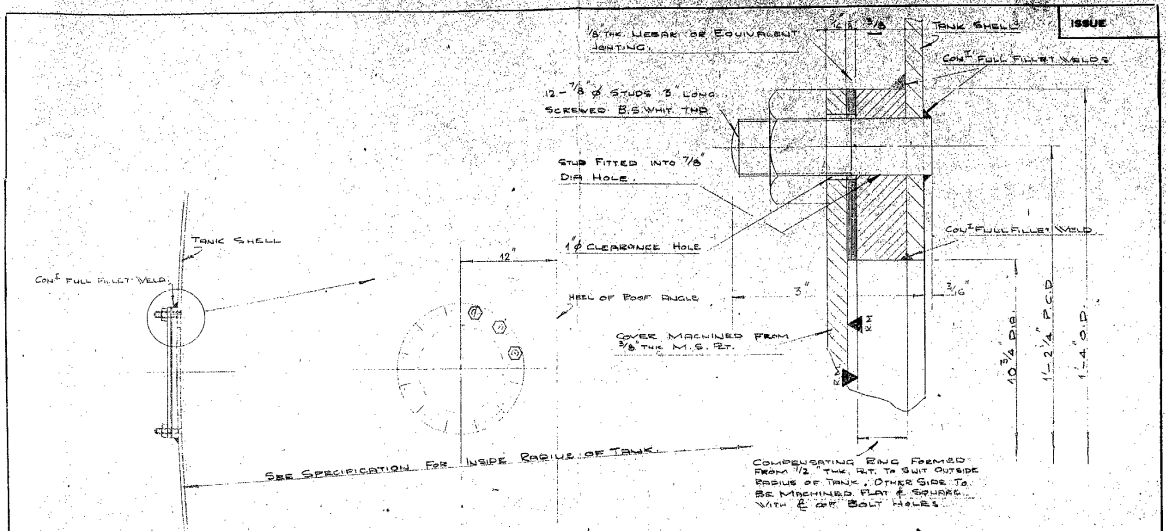
DRAWN	G.J.F.	16/7/58
TRACED		
CHECKED		
APPROV	E.A.B.	24/7/58

N.Z. 4602 C.

SCALE NIL

BEAUMONT ST (ATLANTIC UNION OIL) (NZ) 1 9/15 PM 140579

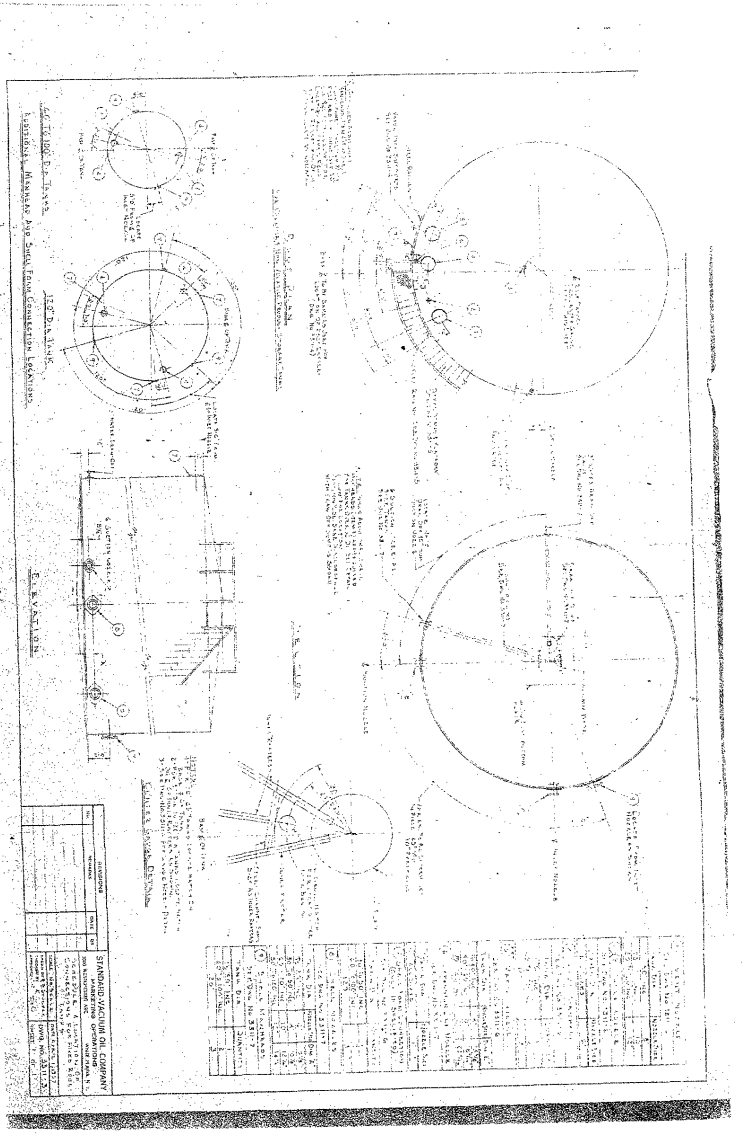




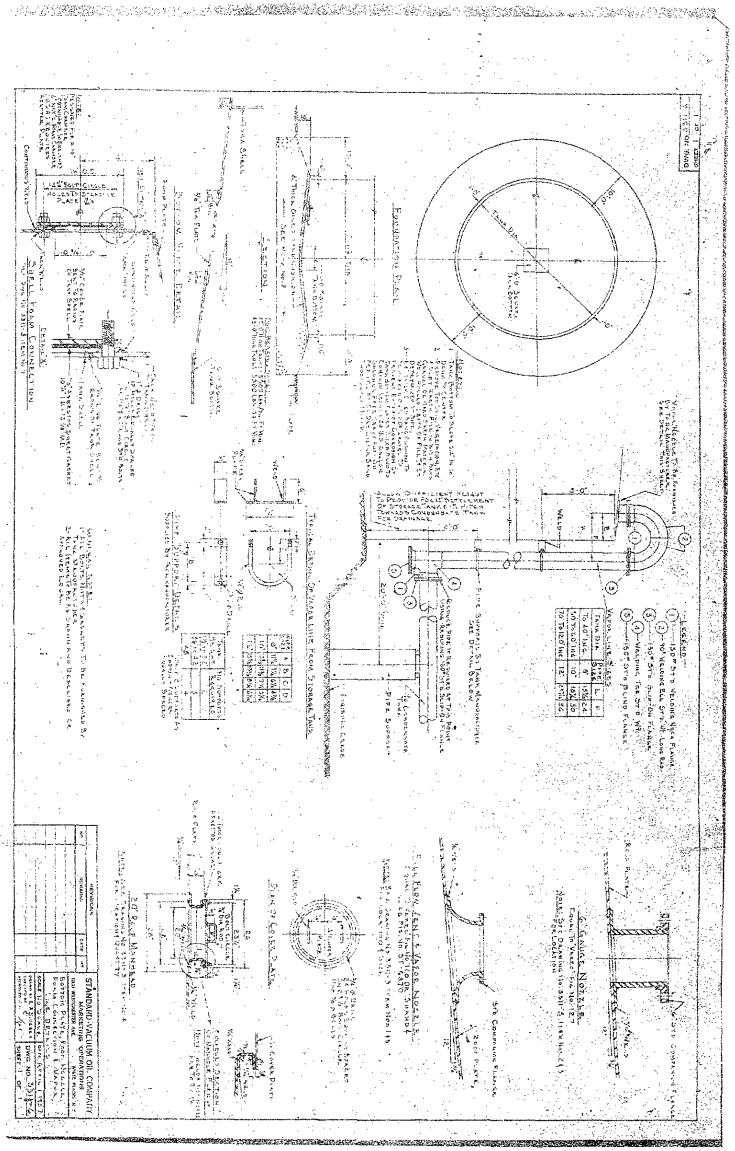
ISSUE NO.	ALTERATION				ISSUE
		DETAIL OF FORM CONNECTION FOR ALL CONE ROOF STORAGE TANKS.	DRAWN	PE.	15/2/62
			TRACED		
			CHECKED		1/12/62
			APPROVED	[illegible]	18/12/62

STANDARD.
N.Z. 5956C.
SCALE 1/8 F. SIZE.

B EAUMONT ST (ATLANTIC UNION OIL)
PW 140579 5 OF 15
(A12)



BEAUMONT ST (A2)
(ALANTIC - union - OIL)
6 of 15
PN 140579



BEAUMONT ST (ATLANTIC-UNION-OIL)

(A2) 7 of 15

PN 140579

Form No. 1

AUCKLAND CITY COUNCIL

BUILDING APPLICATION FORM

Date 27-6-60 19

To The CITY ENGINEER,

Sir,

I hereby apply for permission to MAKE ALTERATIONS TO OUR SOLVENT STORE at AVO TERMINAL BEAUMONT ST. for ATLANTIC UNION OIL CO. PTY. LTD. (Owner)
(House number and Street)

of 79 SHORTLAND ST AUCKLAND. (Address), according to locality plan and detailed plans, elevations, cross-sections, and specifications of building deposited herewith in duplicate.

PARTICULARS OF LAND: Lot No.

Allotment No.

Section

D.P.

LENGTH OF BOUNDARIES: Front

Back

Side Area

Side

PARTICULARS OF BUILDING:

Foundations CONCRETE Floors CONCRETE

Walls BRICK Roof FIBROLITE.

Area of ground floor 76' x 30' square feet

Area of outbuildings N.A. square feet

Number of Storeys: Above Kerb level N.A.

Below Kerb level N.A.

Average distance of set back of front of buildings from street boundary line N.A

ESTIMATED COST: Building £ 1950

Sanitary Plumbing and Drainage £

TOTAL: £ 1950.

Proposed purposes for which every part of building is to be used or occupied (describing separately each part intended for use or occupation for a separate purpose):

STORE HOUSE

Proposed use or occupancy of other parts of building:

N.A.

Nature of ground on which building is to be placed and of the subjacent strata:

N.A.

Yours faithfully,

M. Chadwick pp Owner

V.H. FARNSWORTH LTD. Builder

HAMER ST Builder's Address

CITY OF AUCKLAND CITY ENGINEER'S DEPARTMENT RECEIVED

OFFICE USE ONLY

Permit No. 7385 Date

AUCKLAND METROPOLITAN FIRE BOARD

Fire Headquarters,
Pitt Street, C.2

20th November, 1963.

The Chairman and Members,
Auckland Metropolitan Fire Board

RE: AUCKLAND HARBOUR BOARD PLAN FOR CONSOLIDATION OF THE OIL INDUSTRY AT FREEMANS BAY, AUCKLAND

Following consultation with all Brigade Executive Officers and Station Officer Glen, Parnell, I submit the following comments relating to the Auckland Harbour Board scheme covering the Oil Industry at Freemans Bay.

For as long as bulk oil has been imported through the Port of Auckland, the oil industry has been situated in Freemans Bay and in later years also at Mechanics Bay. The industry has been dispersed among timber yards, boat builders, engineering shops, bulk stores and likewise, which must be admitted is very poor planning.

Due to the strict enforcement of the Dangerous Goods Regulations, fires are not frequent in the oil industry. However, due to human error sometimes, events occur resulting in fires or a serious fire risk eventuating. In recent years the number of errors resulting in a very serious fire situation, has been considerable. Petroleum has been discharged onto the harbour by tankers, pipelines have burst, and petrol has run back down foam lines onto the street. On one occasion, petrol from supposed empty lines was ignited by kerosene road lamps. With the present set up of mixed industries and oil farms thrown together, a fire situation could develop that could get completely out of hand.

I think that it will be agreed by all that the industry would be best situated in an out of town isolated area, where it would be of threat only to itself. Failing this, rather than contain the present situation any longer the area at Freemans Bay should be consolidated as a security area and Mechanics Bay Oil tanks shifted to Freemans Bay.

Freemans Bay should become a complete security area, ultimately free of any other industry. Even before agreeing to this, I feel that certain fire safeguards and provisions should be made in the interests of fire prevention and extinguishment in the area concerned.

In recent years the provision of foam, foam making equipment, fixed foam lines etc., has been considerably improved due to the efforts of the Fire Board. It is felt however, that if the industry is to remain on a permantly planned basis futher improvement is desired and essential.

As the fire prevention of the bulk oil industry is governed by the Dangerous Goods Regulations, under the juristriction of the Chief Inspector of Explosives, I feel that the recommendations listed in this report should be enforced by the Chief Inspector.

Recommendations

1. Provision of an oil boom for placing around tankers discharging or alternatively the enclosing of the oil berth with the provision of a boom at the entrance.
2. The provision of a fully equiped fire tug or alternatively increasing the output of foam generating equipment including deck monitors, on the Te Awhina and Aucklander.
3. Provision of 2 - 5000 G.P.M. foam monitors on trailers with 150 gal. foam tanks.

Byboard

BL:HSS
T.P.2917A

10th December, 1963.

THE TOWN CLERK:

ORDINANCE 8 APPLICATION

re: PROPOSED CONVERSION OF OIL STORAGE TANKS FOR ATLANTIC UNION OIL COMPANY (N.Z.) LIMITED.

REFERENCE:

1. Application for building permit dated 16.9.63 from Atlantic Union Oil Company (N.Z.) Ltd, 79 Shortland Street, C.1.

2. Report dated 31.10.63.

3. Minute of Town Clerk dated 14.11.63 advising that the closing date for receipt of objections would be 9.12.63.

REPORT:

It is proposed to convert 2 existing 50ft. diameter by 30ft. high floating roof oil storage tanks to 50ft. diameter by 45ft.high fixed cone roof tanks at the Atlantic Union Oil Company's Beaumont Street Terminal.

This is a conditional use in the Industrial C.D Zone and the Company's intentions have, therefore, been advertised in the Press and adjoining property owners have been given written advice as required by Ordinance 8 of the Code. No objections have been received the closing date for the receipt of which being 9.12.63.

RECOMMENDATION:

It is recommended that this application be approved subject to compliance with the relevant by-laws.

A.J. DICKSON,
DIRECTOR OF WORKS & CITY ENGINEER.

Per:

KHD:JMS
T.P. 2917A

5th August, 1964.

THE TOWN CLERK:

ORDINANCE 8 APPLICATION

Re: PROPOSAL TO ERECT TWO 20,000 GALLON TANKS, ONE 10,000 GALLON TANK AND TWO 3,000 GALLON TANKS
ATLANTIC UNION OIL CO. TERMINAL, BEAUMONT STREET

Location:
Western Reclamation (zoning sheet 4A).

Reference:
Building application dated 30th July 1964, from the Atlantic Union Oil Co., P.O. Box 1059, Auckland, C.1.

Report:
Permission is sought to erect five small tanks (maximum height 30 ft) as above in the Industrial CD zone in which bulk oil storage is a conditional use.

As the existing use of the land is not being changed Committee may consider that the new work may proceed without advertising the proposal in the press.

A visit to the site showed that the tanks are over 27 chains away from the nearest residential property.

Recommendation:
It is recommended that the proposal be approved subject to compliance with the relevant by-laws.

B.D. DUFFIELD
ACTING CITY ENGINEER.

Per:

T.P. 2917.A

Auckland Metropolitan Fire Board

TELEPHONES
CHIEF FIRE OFFICER
SECRETARY
ENQUIRIES } 20-479
All Correspondence must be Addressed to the Secretary.

When Replying Please Quote
1.5/26

FIRE BRIGADE HEADQUARTERS
PITT STREET
AUCKLAND, C.2.

RJWL:SW

14 July 1966

The Town Clerk,
City of Auckland,
Private Bag,
AUCKLAND.

008138

Dear Sir,

re: Beaumont Street - Freemans Bay T.P.2917

I wish to acknowledge receipt of your letter dated 6th July 1966 concerning an application from Steel Tanks and Structures Ltd on behalf of Atlantic Union Oil Co. (N.Z.) Ltd for permission to erect 15 steel tanks for the bulk storage of petroleum products at Beaumont Street, Freemans Bay.

The Auckland Metropolitan Fire Board wishes to register objection to the proposal on the grounds that while the Board agreed to a consolidation of oil storage facilities at Freemans Bay until a final move was made by the industry to Te Atatu, it did so on the understanding that certain Fire Protection requirements were to be carried out by the Auckland Harbour Board, Auckland City Council and the associated Oil Companies.

These mandatory requirements have only partially been met and the following matters have not as yet been attended to:-

1. Provision of an oil boom to be placed around shipping under discharge at the oil berths. ✓
2. Two 5,000 gallon per minute foam monitors for rapid application of foam on tank or bund fires. ✓
3. Foam stocks held by Harbour Board to be increased to 2,000 gallons and that held by the Oil Companies to 6,000 gallons. X
4. That Drenchers be provided on all Oil Tanks. (This is a ring main with Jets around the circumference of each tank.) c I

In addition to the mandatory requirements the following recommendations were also made. The Board considers that they should be adopted as they would greatly assist in the fire protection and security of the area:-

(a) Provision of a Fire Tug. X

(b) Improved Ring water main encircling the area Halsey St. Jellicoe St., Beaumont St. and Fanshawe St. to offset valuable time, equipment and personnel involved in long hose lays and re-lay pumping. Auckland City Council has indicated that provision will be made in future works programmes to include this recommendation but it has not as yet been implemented. c c

Gillespie returned 15/7/66
Clinton noted JDS 18.7.66
Corbett
* Conditional use application for further report. Draft comments for report before agenda closing 10/8/66

(c) Locality to be declared a security area: This can only be achieved when the area is cleared of all other industry. cc

(d) Re-location of present foam store site. O. Company

(e) Separate bunding of oil tanks. CT

I will be prepared to appear before a meeting of the Town Planning Committee to present the Board's submissions in support of the objections made.

Yours faithfully,

R.J.W. Leyis,
SECRETARY.

29 Beaumont St.

T.P. 2917 A.

TOWN CLERK'S OFFICE, AUCKLAND,

17th September, 1968

MEMORANDUM for the DIRECTOR OF WORKS AND CITY ENGINEER

Your attention is directed to the following minute of the TWN:DGO

TOWN PLANNING COMMITTEE **dated** 10.9.68

G.D. SIMS,
Town Clerk.

Your Ref: JIC:JW 1P.2917 A

Per:

ORDINANCE 802 APPLICATION : PROPOSED LUBRICATING OIL TANKS JELLICOE STREET (MAP 4A)

It was resolved that your report of the 30th August 1968 be adopted.

E TO MP	CI N	INITIALS	
Manfurlane			18-9-68
Ledger	noted		19.9.68
Clerk	Noted		19-9-68

T.P. 2917 A.

TOWN CLERK'S OFFICE, AUCKLAND.

17th September, 1968

MEMORANDUM for the DIRECTOR OF WORKS AND CITY ENGINEER

Your attention is directed to the following minute of the TOWN PLANNING COMMITTEE **dated** 10.9.68

TWN:DGO

G.D. SIMS,
Town Clerk.

Your Ref: JIC:JW 1p.2917 A

Per:

ORDINANCE 802 APPLICATION : PROPOSED LUBRICATING OIL TANKS JELLICOE STREET (MAP 4A)

It was resolved that your report of ~~the 30th August 1968~~ be adopted.

TO	TITLE	
Manager		18-9-68
Ledger Keeper		19.9.68
Clerk	Noted	19-9-68

Ry Board

Department of Works & Services,
Administration Building

Please quote:
JIC:JW
T.P.2917A

30th August, 1968

THE TOWN CLERK:

ORDINANCE 802 APPLICATION : PROPOSED LUBRICATING OIL TANKS, JELLICOE STREET (Map 4A)

Zoning: Manufacturing M.6, previously Industrial CD.

Reference:
(1) Application letter and plans, dated 16.7.68, from Messrs. Buddle, Weir & Co., P.O. Box 1309, Auckland, on behalf of Atlantic Union Oil Co. (N.Z.) Ltd.
(2) My letter, dated 19.7.68, advising of names and addresses required for the conditional use application.
(3) Statutory declaration, dated 29.8.68, from Messrs. Buddle, Weir & Co. The closing date for the receipt of objections was 23.8.68.
(4) Letters of objection: Nil.

Report: The applicants seek consent, as a conditional use, to erect two vertical steel tanks for the bulk storage and distribution of lubricating oil.

The storage of bulk lubricating oil in this zone is a conditional use in both the Operative and Reviewed Schemes. This type of oil stored in tanks is not classified as dangerous goods under the Dangerous Goods Act.

The two tanks, both 30 ft. high, have a capacity of 10,000 and 20,000 gallons respectively, and are to be contained within the bulk storage depot of the applicants with frontage to Beaumont Street. The rear boundary of the depot site abuts the Westhaven boat harbour.

The applicants are the leasehold occupiers of the property, the freehold owner of which is the Auckland Harbour Board.

Compared with recent applications for petroleum storage facilities in the general area, this proposal is only of a minor nature. Some four million gallons of petroleum products are already stored within the depot area of the applicants.

Under both the Operative and Reviewed Schemes the storage of lubricating oil is a conditional use in this area.

Following conditional use procedures no letters of objection have been received. However, the Auckland Metropolitan Fire Board (Messrs. Wilson and Glen) have verbally requested that the usual sprinkler system be installed as a condition of approval.

Conclusion: In the circumstances it would appear that permission could be given to the erection of the two tanks without the necessity of a hearing. Should Committee be of this opinion, it is recommended that approval be given subject to:

(a) compliance with all relevant by-laws
(b) a sprinkler system, to the satisfaction of the City Engineer, being installed.

A.J. DICKSON,
DIRECTOR OF WORKS & CITY ENGINEER

Department of Works,
Administration Building.

Please quote: JIC:JW
T.P.2917A

24th June, 1971

THE TOWN CLERK:

ORDINANCE 802 APPLICATION
PROPOSED STORAGE TANKS :
ATLANTIC UNION OIL CO. (N.Z.) LTD., JELLICOE STREET

Location: Jellicoe Street West, near Beaumont Street.

Zoning: Manufacturing M.6 (Map 4A).

Reference: (1) Application letter and plans, dated 30.3.71, from Messrs. Buddle, Weir & Co., P.O. Box 1309, Auckland 1, on behalf of Atlantic Union Oil Co. (N.Z.) Ltd.
(2) My letter, dated 10.5.71, advising those names and addresses required for a conditional use application.
(3) Statutory declaration, dated 27.5.71, from the solicitors. The closing date for the receipt of objections was 17.6.71.
(4) Letters of objection: Nil.

Report: The applicants seek consent, as a conditional use, to erect two vertical steel tanks for the bulk storage of petroleum chemicals. The storage of bulk petroleum products in this zone is a conditional use of the land.

Both proposed tanks have a diameter of 12 ft. and a height of 36 ft. and each have a capacity of 68,700 imperial gallons. They are to be contained within the present bulk storage depot of the applicants, which is just south of Wilson's Cement silos. The applicants are the leasehold occupiers of the property, the freehold owner of which is the Auckland Harbour Board.

The applicants state, inter alia, "The steel tanks represent a minor addition to numerous tanks already built and in operation in Atlantic Union Oil Co. (N.Z.) Ltd's oil terminal situated at Jellicoe Street.

"The erection of such tanks already has the approval of all the relevant Government departments.

"One tank will be used for the storage of Di-octyl Phthalate which is used as a plasticiser in the plastics industry. The annual requirement in the Auckland District for the product is 400 to 800 tons. The other tank will be used for the storage of Whiterex 307, which is the basic medicinal light oil used for the prevention and treatment of bloat in cattle. The annual requirement is approximately 140,000 gallons. Both these products are petroleum based and are shipped into New Zealand by sea via tanker."

Following conditional use procedures, no letters of objection have been received. However, the Auckland Metropolitan Fire Board requested some time ago that, for all future installations of this nature, the usual sprinkler system be installed as a condition of approval.

"B"

CITY OF AUCKLAND

DEPARTMENT OF WORKS & SERVICES

PRIVATE BAG
WELLESLEY ST.
AUCKLAND, N.Z.
TELEPHONE 74-650

ADMINISTRATION BUILDING
CIVIC CENTRE

IN REPLY,
PLEASE QUOTE JIC:JW T.P.2917A
IF TELEPHONING OR CALLING,
PLEASE ASK FOR Mr. Clark

10th May, 1971

Messrs. Buddle, Weir & Co.,
P.O. Box 1309,
AUCKLAND 1.

Attention Mr. M.L.Curtis

Dear Sirs,

THE TOWN & COUNTRY PLANNING ACT, 1953
APPLICATION UNDER SECTION 28 (c)
DISTRICT SCHEME : ORDINANCE 802

Land affected: Lots 38 & 39 D.P.9449, C.T.473/251, Jellicoe Street, Auckland 1.
Your client: Atlantic Union Oil Co. (N.Z.) Ltd.

Receipt is acknowledged of your application dated 30th March, 1971, reference 26957/MLC , seeking consent to a Conditional Use to permit the erection and use of two vertical steel tanks for the bulk stor age of petroleum chemicals.

I have to advise that the officer authorised in terms of Regulation 32 (2) considers that the persons and bodies listed below/~~attached~~ have a greater interest in the application than the community generally, and accordingly should be served with copies of the application in terms of Regulation 32 (5).

The hearing of the application will be facilitated by the early receipt by Council of the Statutory Declaration of Compliance (Regulation 32 (6)) and it is requested that this shall include advice as to the dates of the newspaper advertisements and of individual service, and the closing date for objections.

Yours faithfully,

B.D. DUFFIELD,
DIRECTOR OF WORKS

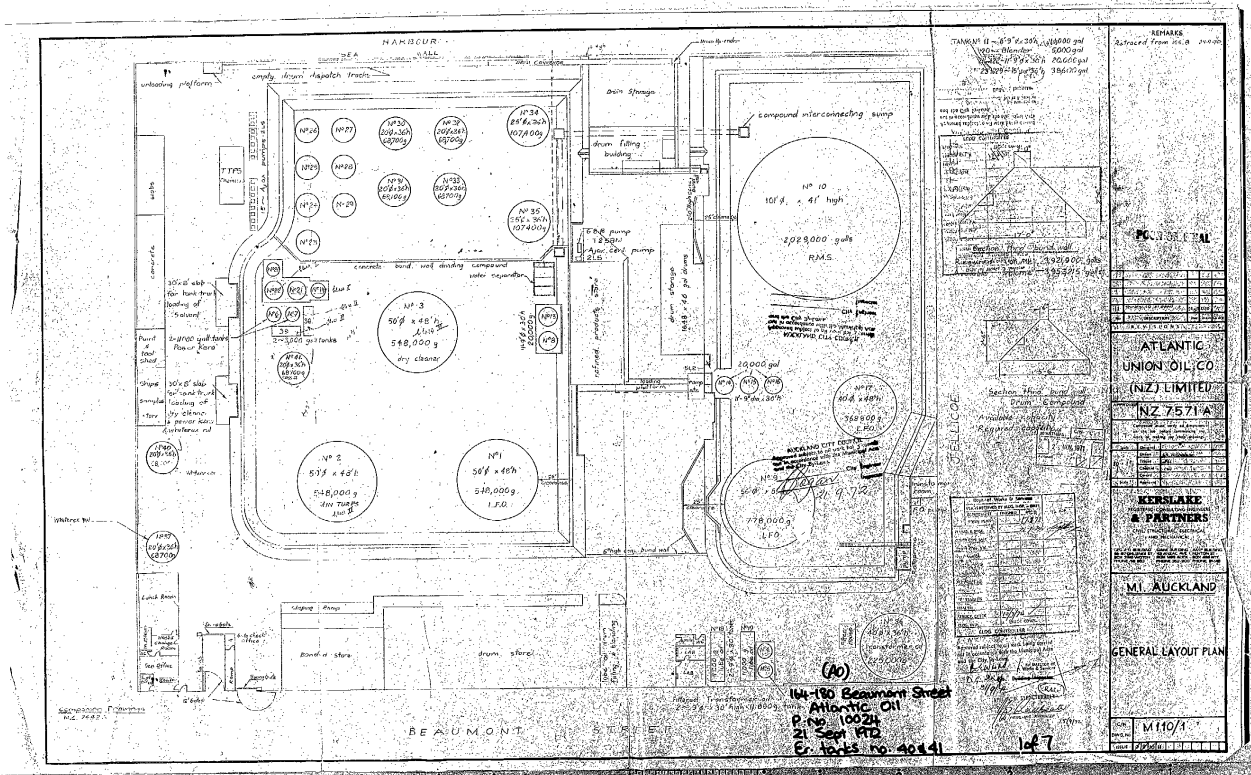
Per: B Ledger.

SCHEDULE:

Mobil Oil N.Z. Ltd., P.O. Box 2497, Wellington.
Shell Oil N.Z. Ltd., P.O. Box 2091, Wellington.
Auckland Harbour Board, P.O. Box 1259, Auckland.
Caltex Oil N.Z. Ltd., P.O. Box 2297, Wellington.
The Secretary, Auckland Metropolitan Fire Board, Pitt Street, Auckland.
Chief Inspector of Explosives, Wellington.
Commodore, Navy Department, Auckland.
Civil Administration Officer, Northern Military District, Auckland.
The Officer in Charge, R.N.Z.A.F., Auckland.
The Secretary, Freemans Bay Advisory Committee, 79 Home Street, Auckland 1.

This is the Schedule marked "B" referred to in the annexed Declaration of MICHAEL LAWRENCE CURTIS declared at Auckland this 27th day of May 1971 before me:

A Solicitor of the Supreme Court of New Zealand


HARBOUR
SEA WALL
unloading platform
empty drum dispatch tracks
drum filling building
drum storage
compound interconnecting sump
No 10
101'ϕ x 41' high
2,029,000 gals
RMS
No 3
50'ϕ x 48'h
548,000 g
dry cleaner
No 2
51'ϕ x 48'h
548,000 g
dry Tuegs
No 1
50'ϕ x 48'h
548,000g
I.F.O.
No 11
80'ϕ x 48'h
768,000 g
LFO
No 9
50'ϕ x 48'h
548,000 g
LFO
20,000 gal
Section 1 Part Bond of Drum Compound
Available for Payment
Drum Compound
Section 1 Part Bond of Drum Compound
Section 1 Part Bond of Drum Compound
Section 1 Part Bond of

PN 2313.

NOTE:

Any permit is issued subject to all work being carried out in accordance with all relevant Acts, Regulations and By-laws.

Approved for the issue of a permit.

Building Inspector

Date 28.10.88.

(A2)

80 Beaumont St
P.Ne 2313
Install underground
spill storage tanks
31 October 1988

1 of 2

2510 (5000 Litre) 3300 (7600) Litre
150 2210 (5000 Litre) 3000 (7500) Litre 150

2350 (5000 Litre) 2810 (7600 Litre)
150 2050 (5,000 Litre) 2510 (7500 Litre) 150

D10 at 300

DANGEROUS GOODS PERMIT REQUIRED

663 mesh, 50 top cover.

665 mesh.

H12 at 200
40 bottom cover.

10x10 rebate with polysulphide sealant all round joint to slab

BUILDING PERMIT
NE 02313
AUCKLAND CITY COUNCIL

Provide fine sealant all round joint to cover

D12@350
50 cover each side

750

750

50 cover

K.P 663 mesh

TYPICAL DETAIL FOR COMMON WALL INTERSECTION

2,400

150

110 40

SECTION A

40 110

110 40

SECTION B

40 110

750

663 mesh, central.

663 mesh, 50 cover to outer face.

600

Extent of additional 665 mesh.

663 mesh, central.

663 mesh, 50 cover to outer face.

50 cover

PLAN

300 min

300 min

TYPICAL MESH LAP DETAILS

2810 (7500 Litre)

2810 (7500 Litre)

2350 (5000 Litre)

2050 (5,000 Litre)

150

150

NOTES:

APPROVED STRUCTURALLY

1. Concrete to have a minimum Strength of 20MPa @ 28 days. Concrete to be mixed in accordance with NZS 3109, Chap 3.3A or NZS 3104, and shall be placed in accordance with NZS 3109, Chap 3.3A
2. All mesh shall conform with NZS 3422: 1976
   All bar reinforcing shall confirm with NZS 3402 P: 1978
   HY60 high yield deformed bars shown: H12
   Mild steel deformed bars shown: D10
3. Slabs & wall reinforcement to be fixed in position to centres shown with supports & chairs to the following maximum spacings:
   a) Walls - along bottom: 2,000
   joint forms: 1,500 each way
   b) Slabs: 1,000 "
   All spacers & chairs to be approved by engineer.
4. Pits are to be constructed either in-situ after excavation to a 1½:1 batter has been made to the level of the pit base or to have the walls precast above ground level and be sunk to depth where the bottom slab shall be poured after the excavation has been pumped dry.

These plans are copyright to BROWN & THOMSON and may be used only for the project for which they are issued:

AUCKLAND REGIONAL AUTHORITY

PLANNING APPROVAL ONLY

This certifies that the building/s shown on this plan complied with the provisions of the district scheme (subject to compliance with all relevant bylaws and any endorsements hereon)

on 13/10/88

Chief Planner (or Delegate)

Construction must not begin until a building permit has been issued.

THIS APPROVAL IS VALID FOR 2 YEARS

Underground Spill Tank

Brown & Thomson
consulting engineers
cpo box 795 auckland
797-744

7,500 & 5,000 Litre Underground tank pit

STANDARD DESIGN

STRUCTURAL DETAILS

SHEET:

DRAWN VE CHECKED DATE JAN 1988 SCALES 1:20 REVNS OF

TRACED

(A2)

180 Beaumont Street
P.№ 2313

2of2

AUCKLAND CITY COUNCIL
PERMIT PROCESSING

DEPARTMENT	TO SEE	DATE APPVD	SIGNATURE
BUILDING		5/10/88	
PLUMBING & DRAINAGE	N/A		
DANGEROUS GOODS	✓	5/10/88	
LICENSING			
HEALTH			
WATER WORKS			
STREETS DESIGN	N/A		
DRAINAGE DESIGN		11/10/88	
STRUCTURAL 2/7	✓	11/10/88	
PLANNING		13/10/88	

NOTE

Any permit is issued subject to all work being carried out in accordance with all relevant Acts, Regulations and By-laws.

Approved for the issue of this permit

Building Inspector

Date 28.10.88.

DANGEROUS GOODS PERMIT REQUIRED
for Tank Installation

DANGEROUS GOODS PERMIT REQUIRED

September 8, 1978

Mr. M. Perkins,
Technical Liaison Officer,
N.Z. Fire Brigade,
Pitt Street,
AUCKLAND, 1.

Dear Sir,

We wish to advise you that it is our intention to install additional 10,000 gallon tank - 9' diameter x 29' high at our Beaumont Street Terminal in the position shown on the attached Drawing AK-29C. This tank will be used to blend and store Coloured Methylated Spirit.

Regarding fire protection, we are providing 4" foam line, similar to the existing ones.

Would you kindly advise whether this facility will meet with your requirements and approval.

Yours faithfully,

for
ENGINEERING MANAGER

EKPindur:vp
Enclosure

TP 2917A Mr Taylor:MS

11 January 1979

THE CITY SECRETARY:

Attention: Planning Committee

AN APPLICATION UNDER SECTIONS 72 AND 75 OF THE TOWN AND COUNTRY PLANNING ACT 1977 BY ATLANTIC UNION OIL COMPANY (N.Z.) LTD FOR CONSENT TO USE PROPERTY ON THE WESTERN RECLAMATION

1. References:

1.1 Application lodged by Mr. D. McGregor of Buddle, Weir and Coy, Box 6740, Auckland, on behalf of Atlantic Union Oil (COPY ATTACHED).

1.2 Letter of objection entered by Mr. D.E. Smith on behalf of the Ponsonby-Herne Bay Community Committee (COPY ATTACHED).

2. Statutory History:

2.1 Application dated 13 October 1978.

2.2 List of names dated 23 November 1978.

2.3 Newspaper advertisements dated 24 November 1978 and 25 November 1978.

2.4 Closing date for objections - 18 December 1978.

3. Location:

Sheets 4A (operative scheme) and A4 (proposed review), western corner of Beaumont/Jellicoe Streets intersection.

4. Zoning:

Operative - Manufacturing 10.
Proposed - Industrial H.

5. Proposal:

The applicant company seeks planning consent to erect a 45,000 litre methylated spirits storage tank within an existing tank compound.

6. Section 72 and 75 Application:

Bulk stores for the wholesale storage, handling, filling, blending and distribution of those goods specified in the Schedule to the Dangerous Goods Act 1974 are a conditional use in the M.10 and I.H zones. Accordingly, and for this reason, the applicant has made application under Sections 72 and 75 of the Act.

7. Statutory Criteria:

In considering the application, the Act requires the Council to have regard to:

"(a) The suitability of the site for the proposed use, determined by reference to the provisions of the operative district scheme; and

(b) The likely effect of the proposed use on the existing and foreseeable future amenities of the neighbourhood, and on the health, safety, convenience and the economic, cultural, social and general welfare of the people of the district."

8. Objections:

One objection has been formally entered to the granting of the application. The objector has indicated a wish not to be heard in support of its objection.

9. Conclusions:

9.1 In terms of the scale of existing oil-product storage on the Western Reclamation, the proposed tank is small indeed. Thirty feet in height and nearly nine feet in diameter, the tank will hold but a mere 11,000 gallons of product. It is unlikely that this small addition to the volume of dangerous goods storage in the area will have any deleterious effect upon the existing and future amenities of the neighbourhood or on the general or particular welfare of the people of the district. Furthermore, and because the applicant's site is already intensively used for oil-product storage, it is considered appropriate for the Council to grant the consent sought.

10. Recommendation:

10.1 That a time and a date be set for a hearing of the application.

10.2 That, on the basis of the information contained in this report, and subject to the submission of additional information at the hearing, the application should be approved pursuant to Sections 72 and 75 of the Town and Country Planning Act 1977.

J.W. Edwards
PRINCIPAL PLANNER - APPLICATIONS

for: CITY PLANNER

TP 2917A Mr Taylor:MS

27 March 1980

THE CITY SECRETARY:

Attention: Planning Committee

AN APPLICATION UNDER SECTIONS 72 AND 75 OF THE TOWN AND COUNTRY PLANNING ACT 1977 BY MOBIL OIL (N.Z.) LTD FOR CONSENT TO ERECT AND USE PETROLEUM PRODUCT STORAGE TANKS ON THE WESTERN RECLAMATION

1. Reference:

Application lodged by Mr D. McGregor of Buddle, Weir and Coy, Box 6740, Auckland, on behalf of Mobil Oil (COPY ATTACHED).

2. Statutory History:

2.1 Application dated 5 February 1980.

2.2 Newspaper advertisements dated 15 February 1980 and 16 February 1980.

2.3 Closing date for objections - 11 March 1980.

3. Location:

Sheets A4 (proposed review) and 4A (operative scheme), western corner of Beaumont/Jellicoe Streets intersection.

4. Zoning:

Proposed - Industrial H
Operative - Manufacturing 10

5. Proposal:

The applicant company seeks planning consent to replace an existing two million gallon capacity storage tank with six smaller tanks of 0.54 million gallon collective capacity. All six tanks will hold scheduled products including regular gasoline, kerosene and Pegasol AA.

6. Section 167 Waiver

The applicant's agent has pointed out that an error exists in the application as notified. While the notice of application refers to a 'cluster of five tanks', the plans and memorandum accompanying the notice clearly envisage six storage tanks. If it is satisfied that no third party interests will be prejudiced then the Committee has the power to cure the error.

7. Section 72 and 75 Application:

Bulk stores for the wholesale storage, handling, filling, blending and distribution of those goods specified in the Schedule to the Dangerous Goods Act 1974 are a conditional use in the M.10 and the I.H zones. Accordingly, and for this reason, the applicant has made application under sections 72 and 75 of the Act.

8. Statutory Criteria:

In considering the application, the Act requires the Council to have regard to:

"(a) The suitability of the site for the proposed use determined by reference to the provisions of the operative district scheme; and

(b) the likely effect of the proposed use on the existing and foreseeable future amenities of the neighbourhood, and on the health, safety, convenience and the economic, cultural, social and general welfare of the people of the district."

9. Objections:

No objections have been formally entered to the granting of the application.

10. Conclusions:

10.1 The proposed tankage replaces an existing tank which has reached the end of its useful and safe life.

10.2 A substantial reduction in storage capacity will follow from any consent to the proposal.

10.3 The proposed tankage will be sited on land already intensively used for the storage of dangerous goods, and in an area where such storage is widely established.

10.4 In view of the reason for the tank replacement, and bearing in mind the nature of the product stored, it is suggested that the Council's consent is not only desirable but absolutely necessary.

11. Recommendations:

11.1 That, in the absence of any objections a hearing of the application be dispensed with.

11.3 That the application be approved pursuant to Sections 72 and 75 of the Town and Country Planning Act 1977 and subject to compliance with the relevant bylaws.

11.2 THAT PURSUANT TO S. 167 OF THE TCPA 1977, COMPLIANCE BE WAIVED IN RESPECT OF THE ERROR INCORPORATED IN THE NOTICE OF APPLICATION.

J.W. Edwards
PRINCIPAL PLANNER - APPLICATIONS

IN THE MATTER of the Town and Country Planning Act 1977

APPLICATION FOR PLANNING CONSENT

TO: The Town Clerk,
Auckland City Council,
Private Bag,
AUCKLAND.

MOBIL OIL NEW ZEALAND LIMITED a duly incorporated company having its registered office at Wellington (hereinafter called "the Applicant") hereby apply for erection and use of a cluster of five (5) storage tanks for petroleum products and/or bulk solvents and chemicals in place of an existing storage tank being an overall reduction in the existing volume of storage and in terms of tank size being approximately 3feet lower and smaller in diameter generally in accordance with the plans accompanying the application. The property in respect of which the application is made is situated on the corner of Beaumont and Jellicoe Street, Auckland City.

The Applicant is the Lessee of the property.
Name of Owner: Auckland Harbour Board.
Name of Occupier: Mobil Oil New Zealand Limited.

DATED this 5th day of February 1980

MOBIL OIL NEW ZEALAND LIMITED by its duly authorised agents and solicitors Messrs Buddle Weir & Co.

ADDRESS FOR SERVICE C/- the offices of Messrs Buddle Weir & Co., 6th Floor, Auckland Savings Bank Building, Cnr. Queen & Wellesley Streets, Auckland 1.

Memorandum

1. Mobil are tenants of the Auckland Harbour Board and store product in sundry tanks for distribution throughtout the the Auckland Metropolitan Area. These products are brought to Auckland by sea, some from the Whangarei Refinery and others from overseas.

2. One of the tanks, number 10, has reached the end of its useful life and needs to be replaced. The company wishes to erect several smaller tanks on the same site.

3. Provision of this tankage will further facilitate the routine cleaning and maintenance of our other tanks, a necessary feature of Plant operation to maintain product quality at the tight specifications required for manufacturing processes.

4. Initial use -

1 x 100,000 gallon	-	Regular Gasoline
3 x 100,000 gallon	-	Kerosine
1 x 100,000 gallon	-	Pegasol AA
1 x 40,000 gallon	-	Spare

5. The proposed tanks will be smaller in overall dimensions than the existing large tank, and reduce total volume of Class 3a Dangerous Goods stored on this site by 1.46 million gallons. Nominal capacity of T10 is 2 million gallons whilst that for the new complex is only .54 million gallons.

6. Visual impact from Westhaven will also be reduced because of a lower profile.

1451

AUCKLAND CITY COUNCIL

Please Quote: 81/12/2 Mrs Jarrold/KJ

Department of Works

Administration Building, 1 Greys Avenue,
Private Bag, Wellesley Street,
AUCKLAND, New Zealand.
Telephone: 792-020
Director of Works: B.T. Anderson

11 December 1981

The Manager
Mobil Oil N Z Ltd
P O Box 1709
AUCKLAND 1

REFERRED TO MR	ACTION	INITIALS	DATE
			16 DEC 1981

Attention: The Engineering Manager

Dear Sir

CANCELLATION OF PERMIT

I acknowledge receipt of your letter dated 7 December 1981 advising that you wish to cancel the following permit, and requesting refund of street damage deposit accordingly.

Address of Property: 182 Beaumont Street

Permit No: 34275

Once inspection confirms no work has commenced, refund will be made to the permit holder.

It will also be necessary for you to return the permit and approved plans you are holding for cancellation. Please address these for the attention of the writer.

Yours faithfully

Senior Assistant
for CITY BUILDING SURVEYOR

✓

1451 80/1

NEW ZEALAND FIRE SERVICE

Please address reply to: The Commander, No. 1A, Area, Fire Brigade Headquarters, Pitt Street, Auckland 1. Telephone 774-019

Date: 15 December 1980

Ref: FS1A/27/5

Town Clerk,
Auckland City Council
Private Bag
AUCKLAND 1

APPROX 180 BEAUMONT ST

Dear Sir,

For your information the Brigade was required to extinguish an [redacted]/ un-authorised demolition/[redacted]fire, burning out of control.

The New Zealand Fire Service has requested that such circumstances be reported to your Council, with a request that appropriate action be taken.

Attached please find a report from the Officer attending the incident.

Will you kindly advise the Fire Brigade of the result of your inquiries and action taken.

Yours faithfully,

(H.E.G. HENDERSON)
Divisional Officer (Fire Safety)
for Commander
No. 1A Area
(AUCKLAND).

Encl...

A & C. PAGE BOAT BUILDERS

AHB?

COMBUSTIBLE RUBBISH STILL ON SITE

REFERRED TO MR	ACTION	INITIALS	DATE
Geldart			
Gibson	Rptd		15.1.81
A. Thorne			15-1-81
	18 DEC 1980		

LETTER TO SEN. PLANNING OFFICER AUCK. H. BOARD

LETTER TO NZ FIRE SERVICE MR. HENDERSON

N.Z. FIRE SERVICE AUCKLAND

OUT OF CONTROL RUBBISH/DEMOLITION FIRE REPORT

FIRE CALL NO: 9293 DATE: 10/12/80 TIME 1940 HRS

ADDRESS: Beaumont Street, Freemans Bay

CALL RECEIVED PER: R/T OFFICER IN CHARGE: S.S.O. Clarkson

STATIONS ATTENDING: Otahuhu

NO. OF APPLIANCES IN ATTENDANCE: One (1) IN USE: One (1)

TYPE OF FIRE: ~~XXXXXXX~~/DEMOLITION EXTINGUISHING USING: 1 x HPD

Was fire dangerous to property? ~~YES~~/NO Was fire out of control YES/~~XXX~~

2. Was permit obtained from Local Authority: YES/NO If applicable -

Issuing Authority: Not known

Permit No: ..... Permit issued to: .....

Address: .....

Were all conditions of Permit observed? YES/NO

State conditions not observed: .....

.....

.....

3. Name person in charge of fire/or last in attendance: No person in attendance

Address: .....

(NOTE: Full address and NOT P.O. Box number, must be supplied.)

State capacity (i.e. Owner, Agent, Workman, etc.) .....

Did you obtain this information directly from the above person? YES/NO

If not from whom did you obtain this information? .....

Address: .....

Did he admit lighting the fire? YES/NO Being in control? YES/NO

To whom did he admit the above particulars? .....

Did fire damage property? ~~YES~~/NO

If applicable, assessment of damage to property: N.A.

.....

4. Wind conditions in relation to fire: Strong

Weather conditions: Fine and windy

Location of fire: On vacant section beside Mobil Oil Co

Distance of fire from section boundaries: 2m

Distance of fire from buildings: (i) On section: 8m

(ii) adjacent section/s: 2m

Intensity of fire: Severe Height of fire: 2m

Area of fire: 8m x 4m

P.T.O.

5. REMARKS: Fire was on empty section in close proximity to storage tanks belonging to Mobil Oil Co, Beaumont Street. This section is approx 100m south of Madden Street on the west side, off Beaumont Street. At the time the direction of the wind carried heat and smoke away from neighbouring tanks and across the road

---

6. Otahuhu Fire Station Signed: A. W. Clarkson

Date: 11/12/80 Rank: Senior Station Officer

F.S.D. USE ONLY Report forwarded to Local Authority YES/NO

FILE NO. FS1A/27/4 Date:

DATE: Action taken by Local Authority:

SIGNED:

S.F.S.O.

AUCKLAND CITY COUNCIL

Please Quote: TP 2917A JWE:MT

Department of Planning & Social Development

Administration Building, Civic Centre.
Private Bag, Wellesley Street, Auckland,
New Zealand. Telephone: 792-020

4 March 1981

THE TOWN AND COUNTRY PLANNING ACT 1977
Notice of Application for Planning Consent

To PERSONS AFFECTED

I enclose a copy of an application for planning consent which has been received by the Council. Also enclosed is a copy of a plan illustrating the application.

The application and the plans submitted with it (you may have been served with a reduced copy of the plans) may be inspected at the public counter on the 8th floor of the City Council Administration Building, Cook Street, Auckland, between 9.00 a.m. and 4.30 p.m. on the days which the Council offices are open to the public.

The applicaiton is being advertised and objections to this application will be received by the Council on or before TUESDAY 31 March 1981.

If you wish to object to the application you may use Form J prescribed in the First Schedule to the Town and Country Planning Regulations 1978 or write to the Town Clerk expressing your objection and how your objection would be satisfied. (For example, you may wish some modification to be made to the proposal, or may wish the application to be declined in full).

All objections must be addressed to: The Town Clerk
Auckland City Council
Private Bag
AUCKLAND 1.

IF YOU OBJECT YOU MUST ALSO SENT A COPY OF YOUR OBJECTION TO THE APPLICANT
****

Copies of Form J are available on request from the Department of Planning and Community Development of the Auckland City Council.

SENT 4-3-81

J. W. Edwards,
PRINCIPAL PLANNER : APPLICATIONS

Encl. 2.

IN THE MATTER of the Town and Country Planning Act, 1977

APPLICATION FOR PLANNING CONSENT

REFERRED TO MR	ACTION	INITIALS	DATE
			26 FEB 1931

TO: The Town Clerk,
Auckland City Council,
Private Bag,
AUCKLAND.

MOBIL OIL NEW ZEALAND LIMITED a duly incorporated Company having its registered office at Wellington (hereinafter called "the Applicant") hereby apply for erection and use of a cluster of six (6) storage tanks for petroleum products and/or bulk solvents and chemicals in place of an existing storage tank being an overall reduction in the existing volume of storage and in terms of tank size being approximately 4 metres lower and smaller in diameter generally in accordance with the plans accompanying the application. ~~This application is in substitution of the application dated the 5th day of February 1980 and approved of in the terms of the decision of the Auckland City Council of the 24th day of April 1980~~. The property in respect of which the application is made is situated on the corner of Beaumont and Jellicoe Street, Auckland City.

The Applicant is the Lessee of the property.

Name of Owner: Auckland Harbour Board

Name of Occupier: Mobil Oil New Zealand Limited

DATED this 29th day of January 1981

MOBIL OIL NEW ZEALAND LIMITED by its duly authorised agents and solicitors Messrs Buddle, Weir & Co.,

Address for Service: c/- the offices of Messrs Buddle, Weir & Co., 8th Floor, Auckland Savings Bank Building, Cnr. Queen & Wellesley Streets, Auckland, 1.

M E M O R A N D U M

1. Mobil are tenants of the Auckland Harbour Board and store product in sundry tanks for distribution throughout the Auckland Metopolitan Area. These products are brought to Auckland be sea, some from the Whangarei Refinery and others from overseas.

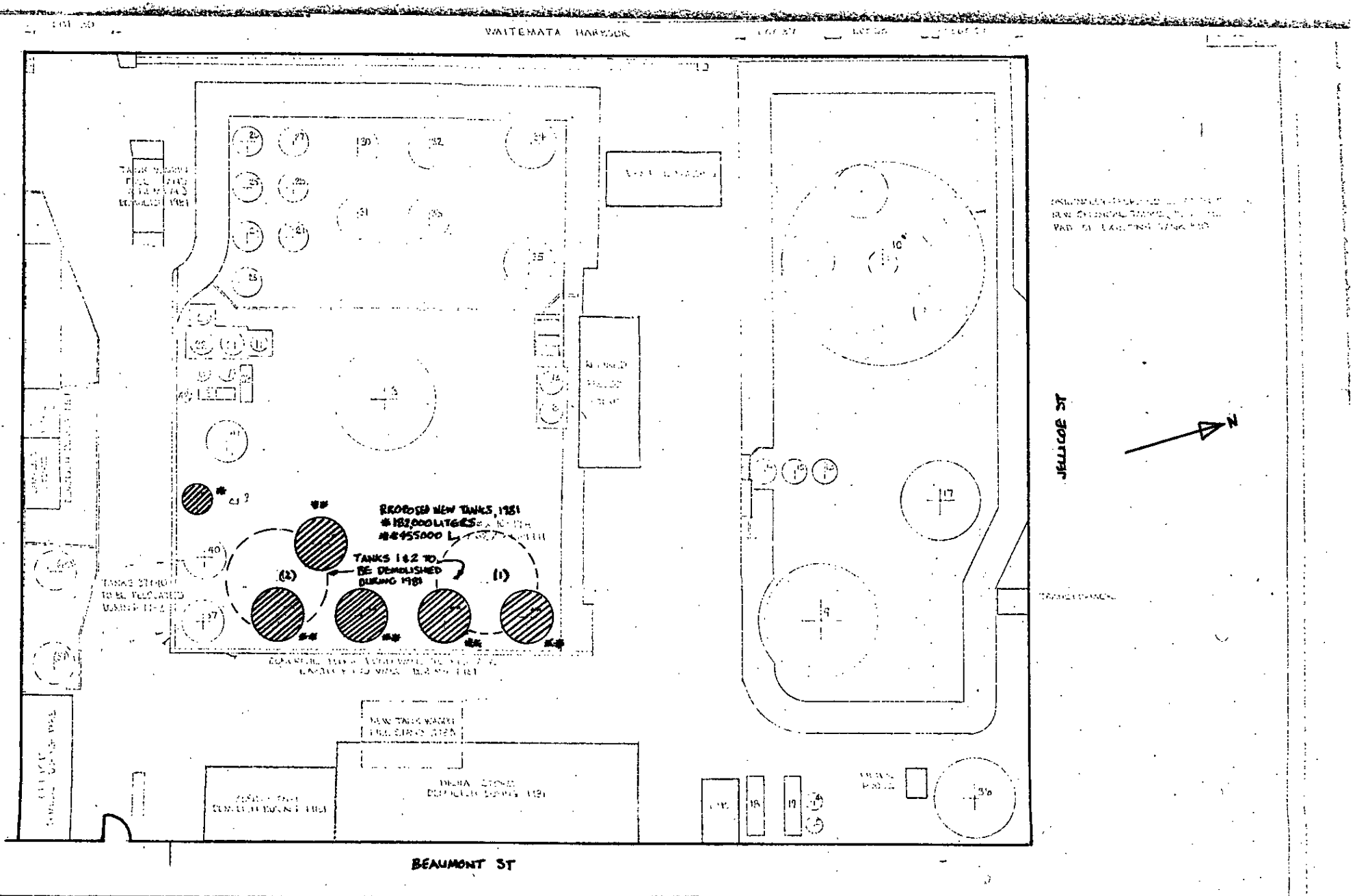
2. Long term proposals are that this facility will be transferred to Wiri when the pipeline facility at that location is complete which is scheduled for 1984.

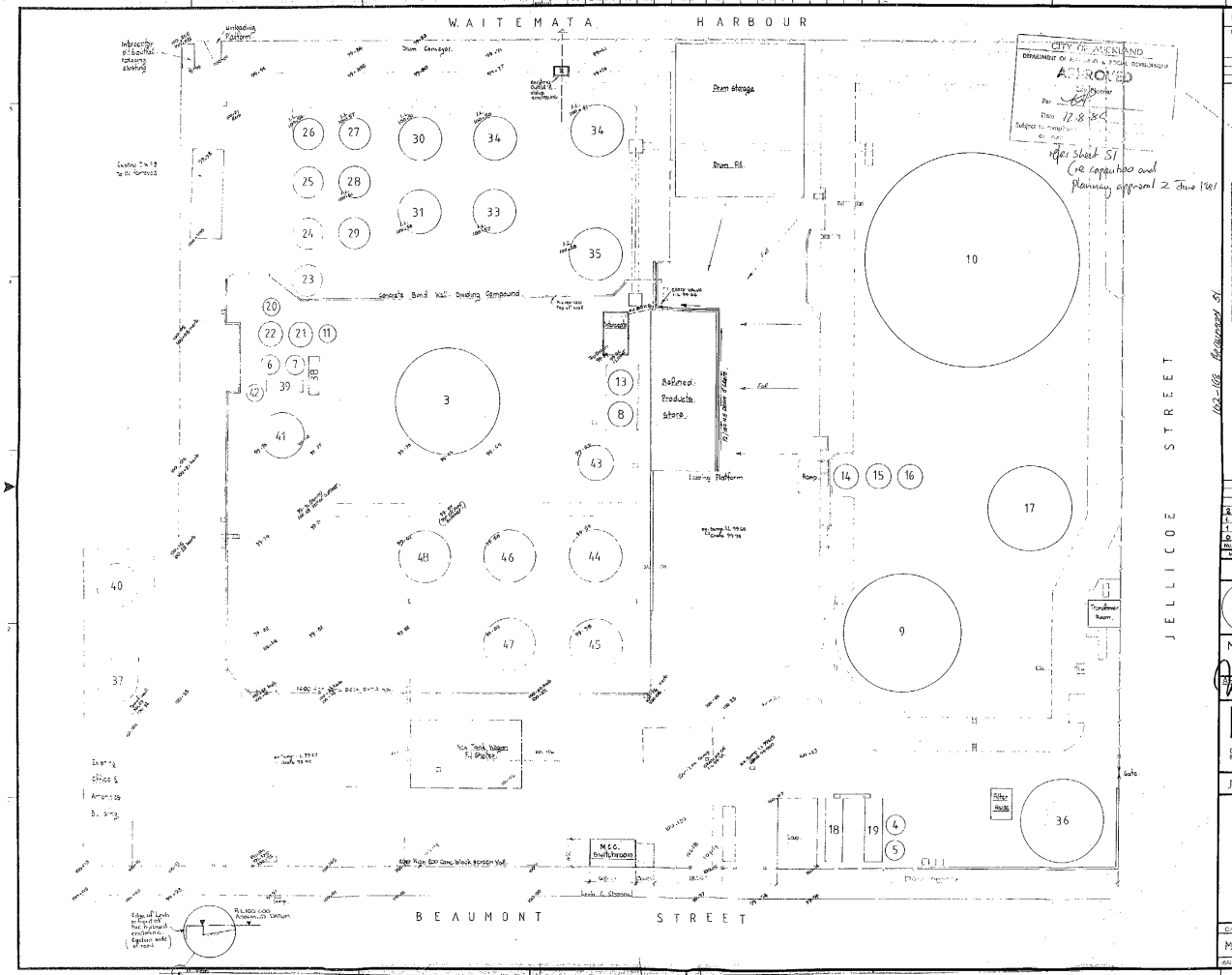
3. Provision of this tankage will further facilitate the routine cleaning and maintenance of our other tanks, a necessary feature of Plant operation to maintain product quality at the right specifications required for manufacturing processes.

4. Initial use - 1 x 455,000 litres (100,000 gallons)
   Regular Gasoline
   3 x 455,000 litres (100,000 gallons)
   Kerosine
   1 x 455,000 litres (100,000 gallons)
   Pegason AA
   1 x 182,000 litres (40,000 gallons)
   Spare

5. The proposed tanks will be smaller in overall dimensions than the existing two tanks and reduce total volume of Class 3A Dangerour Goods stored on this site by approximately half.

6. Visual impact from Westhaven will also be reduced because of a lower profile.


WAITEMATA HARBOUR
PROPOSED NEW TANKS, 1981
#182,000 LITRES
#455000
TANKS 1&2 TO BE DEMOLISHED DURING 1981
(2)
(1)
JELLICOE ST
N
BEAUMONT ST



SERIAL No W. 14813

NOTE Metric dimensions of length where:
no symbol is given = in WHOLE NUMBERS = mm
in DECIMALISED EXPRESSIONS = m

DRAWING REFERENCES

BYLAW REQUIREMENTS

THIS PLAN AND SPECIFICATION MUST BE KEPT ON THE SITE OF THE WORKS DURING CONSTRUCTION SO THAT THE BUILDING MAY CHECK WORK FROM IT.

NOTIFIABLE INSPECTIONS

1. NO CONCRETE WORK OR MASONRY IN THE FOUNDATIONS UNTIL THE EXCAVATIONS AND ALL REINFORCEMENT HAVE BEEN EXAMINED AND PASSED BY THE INSPECTOR
2. SLAB FLOORS SATISFACTORILY LAID AND PREPARATION
3. ELECTRICITY INSTALLED AND WASHOUTS.
4. PLUMBING

APPROVED SUBJECT TO ALL WORK BEING CARRIED OUT IN ACCORDANCE WITH THE CITY BYLAWS AND ALL RELEVANT ACTS AND REGULATIONS

BUILDING INSPECTOR

No.	ISSUE / REVISIONS	Date	Drawn
2	For Construction	22/10/81	WM
1	Tanks alter	31/8/81	WM
1	Plan as at Issued	26/6/81	WM
0	For Approval	11/5/81	WM

METRIC SCALE 1–250

Contractor must verify all dimensions on the job before commencing any work or making any shop drawings

	Designed	Date
	Drawn	
	Traced	
	Checked	
	Co-ord.	
	Approved	

MOBIL OIL NZ LIMITED
AUCKLAND

APPROVED 1/81

NZ. 9212

KERSLAKE CONSULTING REGISTERED ENGINEERS AND PARTNERS
CIVIL, STRUCTURAL, ELECTRICAL, MECHANICAL ENERGY AND BUILDING SERVICES ENGINEERS

JELLICOE ST. DEPOT

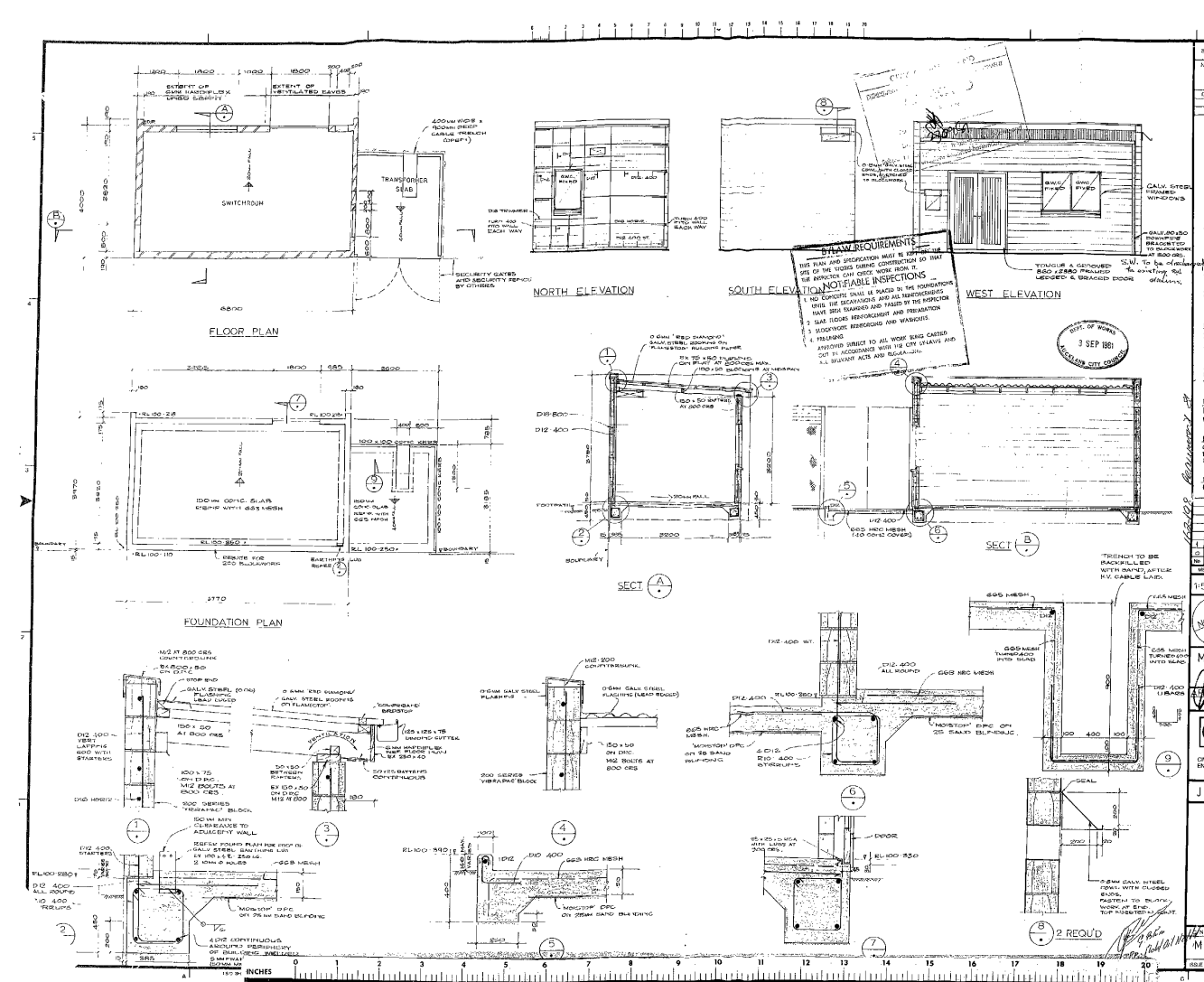
EXISTING SITE LEVELS

C/N	DWG No	Metric
M 110 373	S.1	

ISSUE No 2

INCHES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

CENTIMETRES 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 19 21 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51


FLOOR PLAN
NORTH ELEVATION
SOUTH ELEVATION
WEST ELEVATION
FOUNDATION PLAN
SECT A
SECT B
SWITCHROOM
TRANSFORMER SLAB
SECURITY GATES AND SECURITY FENCE BY OTHERS
150 THK CONC. SLAB
BY-LAW REQUIREMENTS
NOTIFIABLE INSPECTIONS
DEPT. OF WORKS
3 SEP 1981
AUCKLAND CITY COUNCIL
TRENCH TO BE BACKFILLED WITH SAND, AFTER H.V. CABLE LAID.
MOBIL OIL NZ LIMITED
AUCKLAND
NZ 9223
KERSLAKE AND PARTNERS
CONSULTING REGISTERED ENGINEERS
CIVIL, STRUCTURAL, ELECTRICAL, MECHANICAL ENERGY AND BUILDING SERVICES ENGINEERS
JELLICOE ST. DEPOT
SWITCHROOM DETAILS
DWG No M110/373 S6
ISSUE No. 1
Metric
Design
INCHES
CENTIMETRES

ce this set of forms on a hard surface
e a pen with tiffin nib or ball point
rite firmly on top copy
t will show through on the other copy

Auckland City Council
Application for Building Permit

B.I.1

Address of property: 164 - 188 (30-32) BEAMONT ST, AUCKLAND

Legal description of land: Lot: 33-36 D.P.: 9097, 9449

Certificate of Title: 470/218 Area: 1.2826 Ha Sq. metres/perches:

Name of owner of land: AUCKLAND HARBOUR BOARD Address: BOX 1259 AUCKLAND

Name of owner of building: " " " Address: " " "

Name of occupier: MOBIL OIL (NZ) LTD Address: BOX 1709 AUCKLAND

Name of builder: TO BE ADVISED Address: TO BE ADVISED

Name of plumber: NA Address: NA

Name of drainlayer: NA Address: NA

Present use of site or building: EMPTY

Use of proposed building: ELECTRICAL SWITCHROOM

Description of proposed work: ERECT SWITCHROOM BUILDING

If block of flats:– Number of units: NA

Building to be rented/leased:– YES ☐ NO ☑ *(tick appropriate box)*

MICROFILMED

DEPT. OF WORKS 3 SEP 1981 AUCKLAND CITY COUNCIL Sq. metres/ft.

SCOPE OF PERMIT:–

Complete building ☑ Foundations only ☐ Building only ☐

Building registration number:

Estimated starting date: 1-10-81

Estimated completion date: 30-10-81

Area of ground floor: 35.481 Sq. metres/ft.

Total area all floors: 35.481 Sq. metres/ft.

CONSTRUCTION DETAILS:–

FLOOR: CONCRETE

WALLS: CONCRETE BLOCK

ROOF: TIMBER

VALUE OF:–

1. BUILDINGS: $ 8000.
2. DRAINAGE: $
3. SANITARY PLUMBING: $

TOTAL $ 8000.

I/WE HEREBY APPLY FOR PERMISSION TO: ERECT SWITCHROOM BUILDING as detailed in the plans deposited herewith in duplicate.

Dated at Auckland this third day of September 19 81

Signature of applicant: G. Blom

Signature of owner: G BLOM pp MOBIL OIL being owner, builder, or other; specify: pp OCCUPIER

Full name and address for service: MOBIL OIL (NZ) LTD P.O. BOX 1709

Telephone number: 32-759

NOTE: Building Controller registration required over $20,000, or authorisation required over $60,000.

SEE BACK OF SHEET FOR SPECIAL NOTES ON EXCAVATION, DEMOLITION, DRAINAGE AND UNDERPINNING

OFFICE USE ONLY:

RECEIPT No.: 3052 PERMIT No.: 35485 DATE: 3/9/81

AUCKLAND CITY COUNCIL

Please Quote TP 2917A KP:MS

Department of Planning and Community Development

Administration Building, Civic Centre,
Private Bag, Wellesley Street, Auckland, New Zealand.
Telephone. 792-020. Telex N.Z. 2750
Director V.R.C. Warren.

26 August 1982

The Manager,
Mobil Oil Ltd,
Level 15, Aurora House,
The Terrace,
WELLINGTON.

MICROFILMED

Dear Sir,

BULK STORAGE : MOBIL TANK FARM, BEAUMONT STREET, AUCKLAND

Your company has recently submitted two building permits for the construction of six storage tanks at the Beaumont Street depot.

I draw your attention to the approval granted by the Planning Committee of the Auckland City Council on 2 June 1981 (attached for your information).

The position of these tanks, as shown on the building permits, has been altered from that of those plans submitted with the planning consent (refer attached plans). However, as the capacity of the tanks is as per the approved planning consent, and they are contained in the same area of the tank farm as those approved by this consent, it is considered that approval can be granted for these building permits in accordance with the planning consent of 2 June 1981.

Approval is confined to:

> 5 tanks of 455,000 litres capacity and one tank of 182,000 litres capacity, being tanks numbers 43, 44, 45, 48, 47 and 48 on building permits numbers 848 and 925 A.C.C.

To erect any additional storage tanks on this site will require further notified planning consents to be sought, pursuant to Section 72 of the Town and Country Planning Act 1977.

I draw these matters to your attention, and have forwarded a copy of this letter to Messrs Buddle, Weir and Company for their information.

Yours faithfully,

P. No. 848

J.B. Childs
PRINCIPAL PLANNER - APPLICATIONS

By Post. Cheque Held 1978: Cakes Each Set

Place this set of forms on a hard surface
Use a pen with fine nib or ball point
Write firmly on top copy
It will show through on the other copy

Auckland City Council

B.J.1

Application for Building Permit

164-168 ~~152-156~~ BEAUMONT STREET

Address of property: Mobil Instalation (Crnr Jellicoe Street and Beaumont Street) Auckland

Legal description of land: Lot: 31-39 Freemans Bay D.P. 9449 - 8538 - 9097

Certificate of Title: Area: 17,200 Sq. metres/perches: 680

Name of owner of land: Auckland Harbour Board Address: P.O. Box 1259, Auckland

Name of owner of building: Mobil Oil N.Z. Ltd Address: P.O. Box 2497, Wellington

Name of occupier: Mobil Oil N.Z. Ltd Address: P.O. Box 2497, Wellington

Name of builder: Whangarei Engineering Co., Ltd Address: P.O. Box 24, Whangarei

Name of plumber: Refer Gibons Construction Address: Private Bag, Glenfield

Name of drainlayer: Refer Gibons Construction Address: Private Bag, Glenfield

Present use of site or building: For Storage of premium motor spirit MICROFILMED

Use of proposed building: For the storage of chemicals (m.i.b.k. Kero-pegasol A.A. Reg. motor spirit)

Description of proposed work: Erection of chemical tanks (Other Buildings) (storage)

D/D

If block of flats:— Number of units: N/A

Building to be rented/leased:— YES [ ] NO [✓] (tick appropriate box)

SCOPE OF PERMIT:—

Complete building [ ] Foundations only [ ] Building only [✓]

Building registration number: 8110141

Estimated starting date: 10th June 1982

Estimated completion date: 30th September 1982

CONSTRUCTION DETAILS:—

FLOOR: 10 mm Steel Plate

WALLS: 6 mm Steel Plate

ROOF: 5 mm Steel Plate

Area of ground floor: 1425 x 5 Sq. metres/ft.

Total area all floors: 71.25 Sq. metres/ft.

VALUE OF:—

1. BUILDINGS:	$ 500,000.00
2. DRAINAGE:	$ N/A
3. SANITARY PLUMBING:	$ N/A
TOTAL	$ 500,000.00

I/WE HEREBY APPLY FOR PERMISSION TO: Erect 5 only Chemical Tanks as detailed in the plans deposited herewith in duplicate.

Dated at Whangarei this 13th day of July 19 82

Signature of ~~owner~~ Agent for Kerslake and Partners

Signature of applicant: Project Controller Agent

being owner, builder, or other; specify:

Full name and address for service: Grant Ford, C/- W.E.C.O. P.O. Box 24, Whangarei

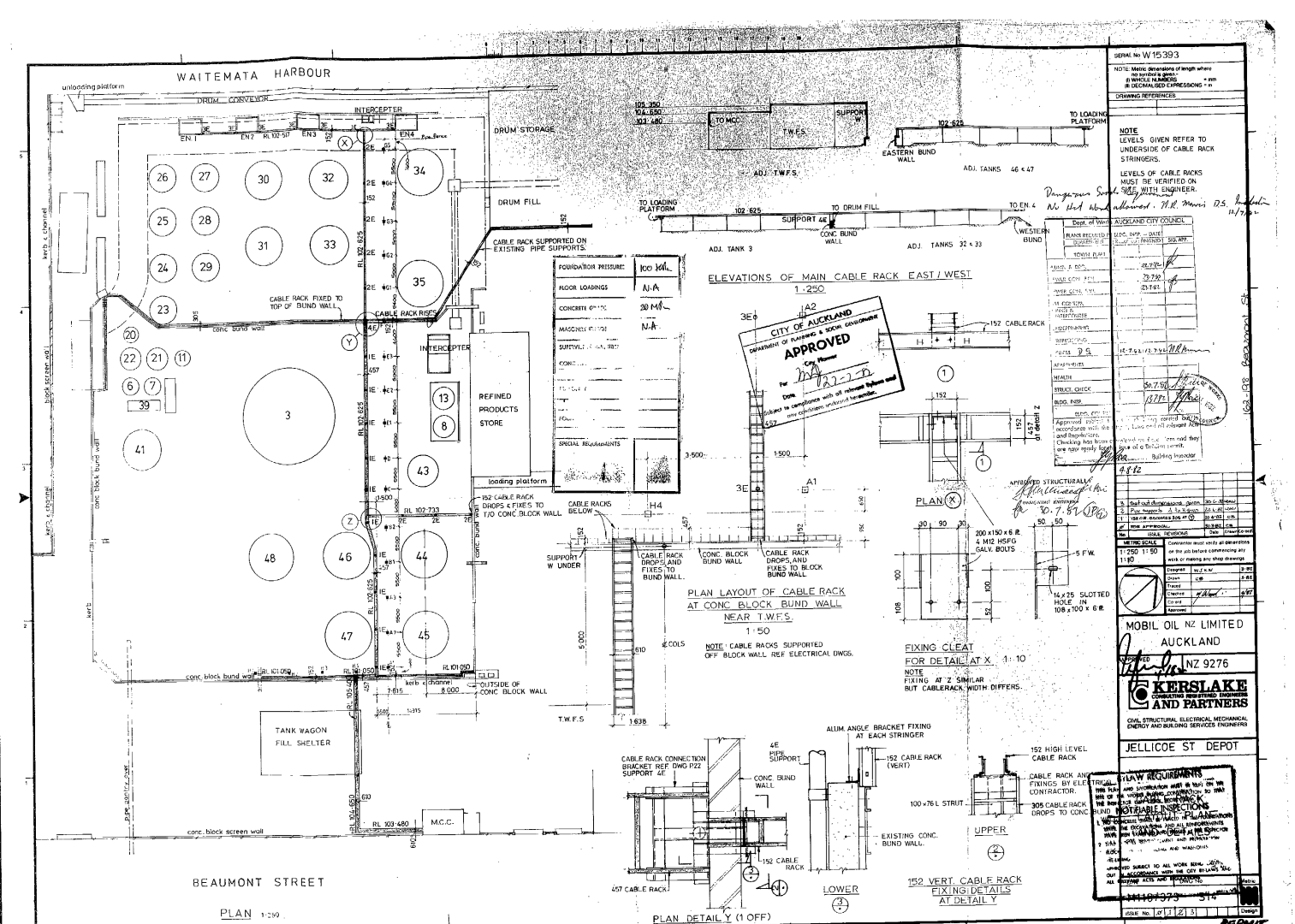
Telephone number: 82219 Ext 875 Whangarei

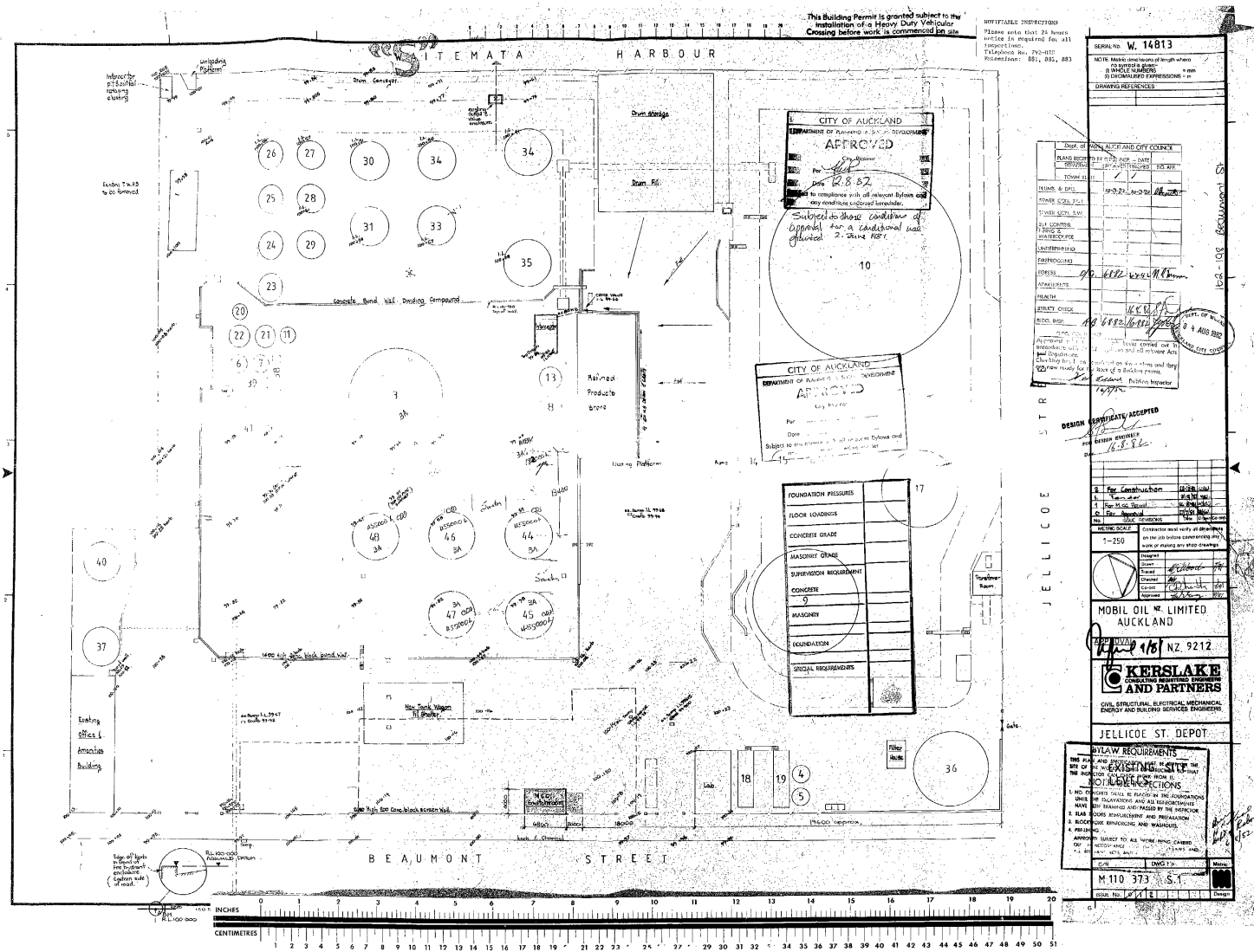
NOTE: Building Controller registration required over $20,000, or authorisation required over $60,000.

SEE BACK OF SHEET FOR SPECIAL NOTES ON EXCAVATION, DEMOLITION, DRAINAGE AND UNDERPINNING

OFFICE USE ONLY:

RECEIPT No.: 8733 PERMIT No.: 848 DATE: 5-8-82


WAITEMATA HARBOUR
unloading platform
DRUM CONVEYOR
INTERCEPTER
DRUM STORAGE
DRUM FILL
TO LOADING PLATFORM
TO M.C.C.
T.W.F.S.
SUPPORT W
EASTERN BUND WALL
ADJ. TANKS 46 & 47
ADJ. T.W.F.S.
TO DRUM FILL
TO EN 4
CONC BUND WALL
WESTERN BUND
ADJ. TANK 3
ADJ. TANKS 32 & 33
CABLE RACK SUPPORTED ON EXISTING PIPE SUPPORTS.
CABLE RACK FIXED TO TOP OF BUND WALL.
CABLE RACK RISES
conc bund wall
INTERCEPTER
REFINED PRODUCTS STORE
loading platform
152 CABLE RACK DROPS & FIXES TO T/O CONC BLOCK WALL.
CABLE RACKS BELOW
SUPPORT W UNDER
CABLE RACK DROPS AND FIXES TO BUND WALL.
CONC. BLOCK BUND WALL
CABLE RACK DROPS AND FIXES TO BLOCK BUND WALL
conc. block bund wall
kerb & channel
OUTSIDE OF CONC BLOCK WALL
TANK WAGON FILL SHELTER
conc. block screen wall
BEAUMONT STREET
FOUNDATION PRESSURE: 100 kPa
FLOOR LOADINGS N.A
CONCRETE 50 MPa
MASONRY N.A
SPECIAL REQUIREMENTS
ELEVATIONS OF MAIN CABLE RACK EAST / WEST
1:250
CITY OF AUCKLAND
DEPARTMENT OF PLANNING & BOOK CONSTRUCTION
APPROVED
City Planner
Date
Subject to compliance with all relevant Bylaws and any conditions endorsed hereon.
152 CABLE RACK
PLAN (X)
200 x 150 x 6 ø 4 M12 HSFG GALV. BOLTS
5 F.W.
14 x 25 SLOTTED HOLE IN 108 x 100 x 6 ø.
FIXING CLEAT FOR DETAIL AT X. 1:10
NOTE
FIXING AT Z SIMILAR BUT CABLERACK WIDTH DIFFERS.
PLAN LAYOUT OF CABLE RACK AT CONC BLOCK BUND WALL NEAR T.W.F.S.
1:50
NOTE: CABLE RACKS SUPPORTED OFF BLOCK WALL REF ELECTRICAL DWGS.
CABLE RACK CONNECTION BRACKET REF DWG P22 SUPPORT 4E
4E PIPE SUPPORT
CONC. BUND WALL
ALUM. ANGLE BRACKET FIXING AT EACH STRINGER
152 CABLE RACK (VERT)
100 x 76 L STRUT
EXISTING CONC. BUND WALL.
152 CABLE RACK
457 CABLE RACK
LOWER
UPPER
152 HIGH LEVEL CABLE RACK
CABLE RACK AND FIXINGS BY ELECTRICAL CONTRACTOR.
305 CABLE RACK DROPS TO CONC BUND
152 VERT. CABLE RACK FIXING DETAILS AT DETAIL Y
PLAN 1:250
PLAN DETAIL Y (1 OFF)
SERIAL No W 15393
NOTE: Metric dimensions of length where no symbol is given:- (i) WHOLE NUMBERS = mm (ii) DECIMALISED EXPRESSIONS = m
DRAWING REFERENCES
NOTE
LEVELS GIVEN REFER TO UNDERSIDE OF CABLE RACK STRINGERS.
LEVELS OF CABLE RACKS MUST BE VERIFIED ON SITE WITH ENGINEER.
Dangerous Goods Store not allowed. M.R. Morris 12/7/90
Dept. of Works AUCKLAND CITY COUNCIL
PLANS RECEIVED
TOWN PLANS
WATER SUPPLY
DRAINAGE
PUBLIC HEALTH
BUILDING INSPECTOR
Approved subject to compliance with all relevant Bylaws and Regulations. Checking has been carried out only as far as it affects the provisions of the Building Act and they are now ready for issue of a Building permit.
Building Inspector
APPROVED STRUCTURALLY
10.7.87
MOBIL OIL NZ LIMITED
AUCKLAND
NZ 9276
KERSLAKE CONSULTING ENGINEERS AND PARTNERS
CIVIL STRUCTURAL ELECTRICAL MECHANICAL ENERGY AND BUILDING SERVICES ENGINEERS
JELLICOE ST DEPOT
BYLAW REQUIREMENTS
NOTIFIABLE INSPECTIONS
PERMIT
ISSUE No. 0 1 2 3


This Building Permit is granted subject to the installation of a Heavy Duty Vehicular Crossing before work is commenced on site
INSPECTABLE INSPECTIONS
Please note that 24 hours notice is required for all inspections.
Telephone No. 792-037
Extensions: 881, 882, 883
SERIAL NO. W. 14813
NOTE: Metric conversions of length where
(i) WHOLE NUMBERS = mm
(ii) DECIMALISED EXPRESSIONS = m
DRAWING REFERENCES
S T E M A T A H A R B O U R
B E A U M O N T S T R E E T
J E L L I C O E S T R
Unloading Platform
Interface for P.T.S. partial replacing cladding
Existing T.W.S. to be removed
Drum Conveyor
Drum Storage
Drum Fill
CITY OF AUCKLAND
DEPARTMENT OF PLANNING & BUILDING DEVELOPMENT
APPROVED
City Engineer
For
Date 2.8.82
Subject to compliance with all relevant Bylaws and any conditions endorsed hereunder.
Subject to above conditions of approval for a conditional use granted 2 June 1981.
Concrete Bund Wall Dividing Compound
Cross Valve c/w Pit
Retained Products Store
Loading Platform
Area
CITY OF AUCKLAND
DEPARTMENT OF PLANNING & BUILDING DEVELOPMENT
APPROVED
City Engineer
For
Date
Subject to compliance with all relevant Bylaws and
FOUNDATION PRESSURES
FLOOR LOADINGS
CONCRETE GRADE
MASONRY GRADE
SUPERVISION REQUIREMENT
CONCRETE
MASONRY
FOUNDATION
SPECIAL REQUIREMENTS
Transformer Room
1600 ht. 20c. block bund wall
New Tank Wagon Fill Shelter
Existing Office & Amenities Building
New Oil Interceptor
New High Ext. Conc. block screen Wall
Edge of kerb in front of new hydrant enclosure (where sold of road.
Lab
Filter House
Dept. of Works, Auckland City Council
PLANS RECEIVED BY BUILDING INSP. - DATE
APPROVED
TOWN PLAN
DRAINS & SPTS.
POWER CON. S.W.
SEWER CON. S.W.
PIT CONTROL
PIPING & WATERSUPPLY
UNDERPINNING
FIREPROOFING
EGRESS
ATMOSPHERE
HEALTH
STRUCT. CHECK
BLDG. INSP.
Accepted subject to compliance with all relevant Bylaws and Regulations. Checking by Council will not be carried out in respect of any matters not shown on the plans and long form ready for inspection at each of the following stages.
Building Inspector
DESIGN CERTIFICATE ACCEPTED
DESIGN ENGINEER
Date
2 For Construction
1 For B.C.C. Submit
0 For Approval
No. DESCRIPTION
METRIC SCALE 1-250
Contractor must verify all dimensions on the job before commencing any work or making any shop drawings
Designed
Drawn
Traced
Checked
Co-ord
Approved
MOBIL OIL NZ. LIMITED
AUCKLAND
APPROVED
NZ. 9212
KERSLAKE
CONSULTING REGISTERED ENGINEERS
AND PARTNERS
CIVIL, STRUCTURAL, ELECTRICAL, MECHANICAL, ENERGY AND BUILDING SERVICES ENGINEERS
JELLICOE ST. DEPOT
BYLAW REQUIREMENTS
EXISTING SITE
NOTES
INSPECTIONS
1. NO CONCRETE SHALL BE PLACED IN THE FOUNDATIONS UNTIL THE EXCAVATIONS AND ALL REINFORCEMENT HAVE BEEN EXAMINED AND PASSED BY THE DIRECTOR
2. SLAB FLOORS REINFORCEMENT AND PREPARATION
3. BOX FLOOR, REINFORCING AND WASHOUTS.
4. PRESTRESSED CONCRETE
APPROVAL SUBJECT TO ALL WORK BEING CARRIED OUT IN ACCORDANCE WITH THE BYLAWS AND ALL RELEVANT ACTS, AND
C/N
DWG No.
M 110 373 S 1
ISSUE No.
Metric
Design
INCHES
CENTIMETRES

krta
Kingston Reynolds Thom & Allardice Limited
Architects Engineers Planners & Quantity Surveyors

Quay Tower Cnr Customs St & Albert St Auckland New Zealand
CPO Box 4498 Telephone 795 700 Telex KRTAAK NZ 21-385
Bank NSW Building Lambton Quay Wellington
Box 3582 Telephone 728 755 Telex KRTAWN NZ 3050
Telegraphic address Kingsdice

REFERRED TO Mr	ACTION	INITIALS	DATE
Geldard			
Gibson	4 FEB 1983		15.2.83
Morris	letter MRH		4.2.83

Please reply to Auckland Office
Ref: P 2447 BJ:mah

2 February 1983

Auckland City Council
Dangerous Goods Insepctor
Private Bag
Wellesley Street
AUCKLAND

Attention: Mr Morris

Dear Sir

No? 182 BEAUMONT ST

MOBIL OIL NZ LIMITED JELICOE STREET DEPOT - NEW LABORATORY

We would confirm the basic points discussed at our meeting yesterday afternoon.

i. The new laboratory will replace the existing laboratory.

ii. The new laboratory will be used for testing class 3a products. One test that will be performed in the laboratory fume cupboard is a flash point test.

iii. The quantity of dangerous goods products of class 3a to be stored in the laboratory in small quantities will be limited to 15 litres.

iv. The laboratory should have two means of egress located opposite to each other.

v. The construction of the laboratory should be such that the walls, floor and ceiling have a 2 hour fire rating and the doors have a 1 hour fire rating.

vi. Laboratory should have a positive means of exhaust ventilation which would provide a minimum of 12 air changes per hour. The exhaust ventilation fan need not have a flameproof motor provided that it is mounted outside of the air duct and outside of the laboratory fire compartment. Note the exhaust ventilation system need only be operated when dangerous goods are being tested or handled.

.../2

Directors R Kingston FICE FIPENZ
I B Reynolds B ARCH FNZIA MRTPI
D A Thom FICE FIPENZ
N W Allardice BE MNZIE
P E Weston B ARCH FNZIA RIBA
P G M Imrie ME MIPENZ DIC (Soils)
G H Wheeler ME MIPENZ

Associate Directors L J P Fenelon BE MIPENZ
J B Good ARICS ANZIQS
D C Hopkins BE (Hons) PH D MICE MIPENZ
A K Perry B ARCH (Hons) ANZIA DIP URB VAL
P M Walker BE (Hons) MIPENZ
W J Tracey BE MIPENZ

Trade Promotion Council
Export Award 1981

vii. The exhaust ventilation air discharge point and the fume cupboard air discharge point shall be located above the roof as far away as possible from 15 meter dangerous goods zone around tank number 9. The air discharge points shall be directed away from tank number9.

viii. All electrical wiring and fittings (namely lights, switches and socket outlets) within the laboratory shall be flameproof. Note the electrical laboratory equipment at present used within the existing laboratory may be transferred to the new laboratory although it is not of a flameproof standard.

ix. To help speed up the granting of a building permit you would grant preliminary approval of the proposed new construction if we could forward to you three copies of the construction drawings with above amendments included as soon as possible. This we will endeavour to do.

Thank you for your help and co-operation in this matter.

Yours faithfully
KINGSTON REYNOLDS THOM & ALLARDICE LIMITED

B JONES

c.c. Mobil Oil New Zealand Limited

S 5/105/5
42/186
SITES

Mobil Oil New Zealand Limited

CHELSEA HOUSE
85 FORT STREET
P.O. BOX 1709
AUCKLAND
TELEPHONE 32-759
TELEGRAMS & CABLES MOBILOIL
REF.

REFERRED TO	ACTION	INITIALS	DATE
Geldard			
Gibson	Noted		11.3.83
	3 MAR 1983		
	copy given to C. DAVIS		

March 1, 1983

The City Surveyor,
Auckland City Council,
Private Bag,
AUCKLAND

ATTN: Mr I. Gibson

5168-182 Jellicoe Street

Dear Sir,

RE: RE DEED OF LICENCE 22/7/76,
RELOCATION OF EXISTING
150 N.B. STAINLESS STEEL LINE

Further to our recent telephone conversation regarding the variation to the Deed of Licence for our 150 N.B. stainless steel chemical line, perhaps the following details may assist in clarifying the position.

1. The original line was installed in 1976/77, and the application was made in the name of Atlantic Union Oil Co. N.Z. Limited, as the pipeline terminated in the then Atlantic Plant in Beaumont Street.

2. In early 1980, a section of the line running through the Castrol yard in Jellicoe Street had to be re-aligned to cater for development work at Castrol. However, in February 1980, the Atlantic Marketing Organisation had been consolidated into Mobil, and to all intents and purposes ceased to exist. In fact operationally and internally, they had been one company for many years.

3. The variation to the Deed of Licence was accordingly made in the name of Mobil, even though the original application 4 years earlier had been in Atlantic's name, as the Beaumont Street Plant had by then become officially Mobil.

We realise the situation can well have led to some confusion, but trust the explanation above clarifies it for you.

Regarding an "as built" plan, we cannot trace one at present in our files. However, on return of our Area Engineer from leave I will follow up for you, and should be able to furnish one in two to three weeks time.

Yours faithfully,

J.R.K. Barron
PLANT MANAGER

JRKB:hjw

SECTION A-A 1:50

SECTION B-B 1:50

01 EAVES 1:10

02 RIDGE 1:10

03 WINDOW HEAD 1:10

04 WINDOW SILL 1:10

05 SOFFIT EDGE 1:10

06 SILL 1:10

07 SILL 1:10

08 1:10

09 1:10

10 1:10

11 1:10

12 WALL / ROOF JUNCTION 1:10

13 W28 / ROOF JUNCTION 1:10

14 W28 JAMB 1:10

15 COLUMN / WINDOW JAMB

16 1:10

18 1:10

19 1:10

20 1:10

21 SECTION THRU SUNSCREEN 1:10

22 HEAD W6,7,8. 1:10

23 1:10

24 1:10

CITY OF AUCKLAND
BUILDING DIVISION
APPROVED

NOTES

1. Flexing & weatherproofing of window industries could result in damage to the membrane. At every instance the Builder must be satisfied by visual inspection that no damage is occurring.
2. Details generally allow for relative settlement of superstructure on two storeys only in relation to the ground floor. All relative movements must accomplished up to 10mm settlement without distortion or overload.

BYLAW REQUIREMENTS

MOBIL OIL NZ LTD. & CALTEX NEW ZEALAND LTD.
FACILITIES UPGRADING
JELLICOE STREET, DEPOT, AUCKLAND

SECTIONS & FABRIC DETAILS

Drawing 2447
Revision A6

Designed G.H.R./W.C.B.H. Scales 1:50 / 1:10 & 1:1
Drawn P.J.C.
Traced
Checked DEPINUTH Date MARCH 85

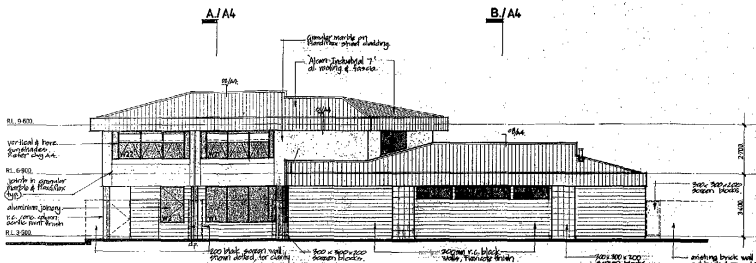
krta
Kingston Reynolds Thom & Allardice Limited
Architects Engineers Planners and Quantity Surveyors
PO Box 5348 Auckland PO Box 3550 Wellington

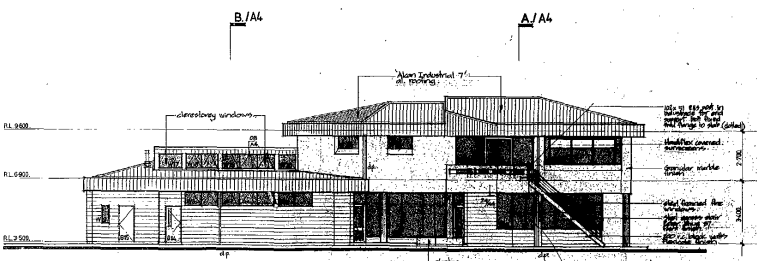
Copyright of this drawing is vested in Kingston Reynolds Thom & Allardice Limited

Original size 841mm x 1189mm

INCHES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

CENTIMETRES





NOT TO BE FIRE WINDOWS COMPLYING WITH NZS 1188.

NOTIFIABLE INSPECTIONS

Please note that 24 hours notice is required for all inspections.
Telephone No. 793-020
Extensions: 881, 882, 883

CITY OF AUCKLAND
DEPARTMENT OF PLANNING & BUILDING INSPECTION
APPROVED
Per
Date 16.5.88
Subject to compliance with all relevant By-laws in any conditions attached hereunto

BYLAW REQUIREMENTS

THIS PLAN AND SPECIFICATION MUST BE KEPT ON THE SITE OF THE WORKS DURING CONSTRUCTION SO THAT THE INSPECTOR CAN CHECK WORK FROM IT.

NOTIFIABLE INSPECTIONS

1 NO CONCRETE SHALL BE PLACED IN THE FOUNDATIONS UNTIL THE EXCAVATIONS AND ALL REINFORCEMENTS HAVE BEEN EXAMINED AND PASSED BY THE INSPECTOR
2 REAR RECORD REINFORCEMENT AND PRETASSATION
3 BLOCKWORK REINFORCING AND WASHOUTS
4 REBARING

APPROVED SUBJECT TO ALL WORK BEING CARRIED OUT IN ACCORDANCE WITH THE CITY BY-LAWS AND ALL RELEVANT ACTS AND REGULATIONS

Revision	Drawn	Checked	Date

MOBIL OIL NZ LTD.
FACILITIES BUILDING.
JELLICOE STREET DEPOT AUCKLAND.

ELEVATIONS.

Project	Drawing	Revision
2447	A3	

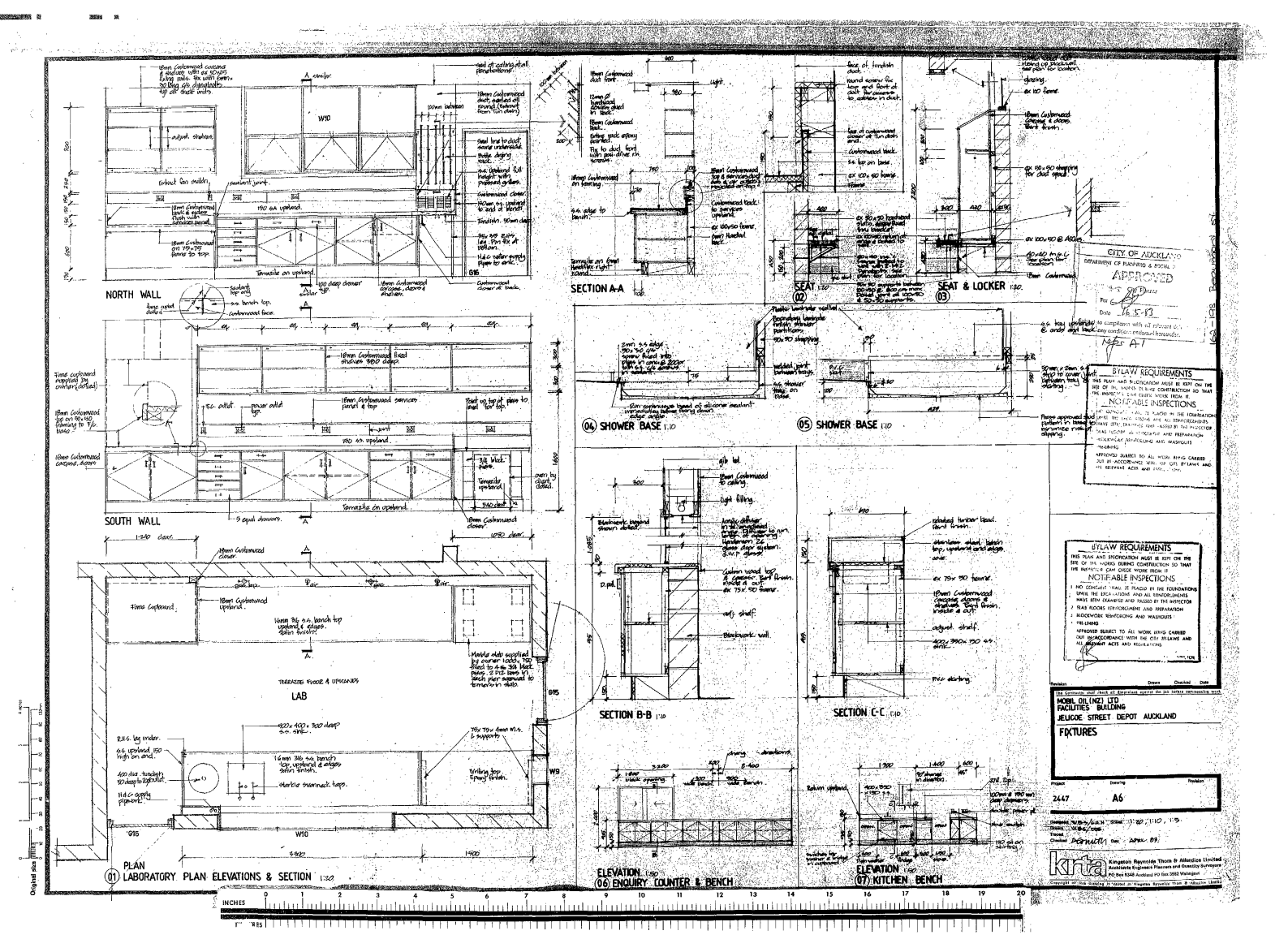
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Drawn GMcK / DJSC.
Traced JDS.
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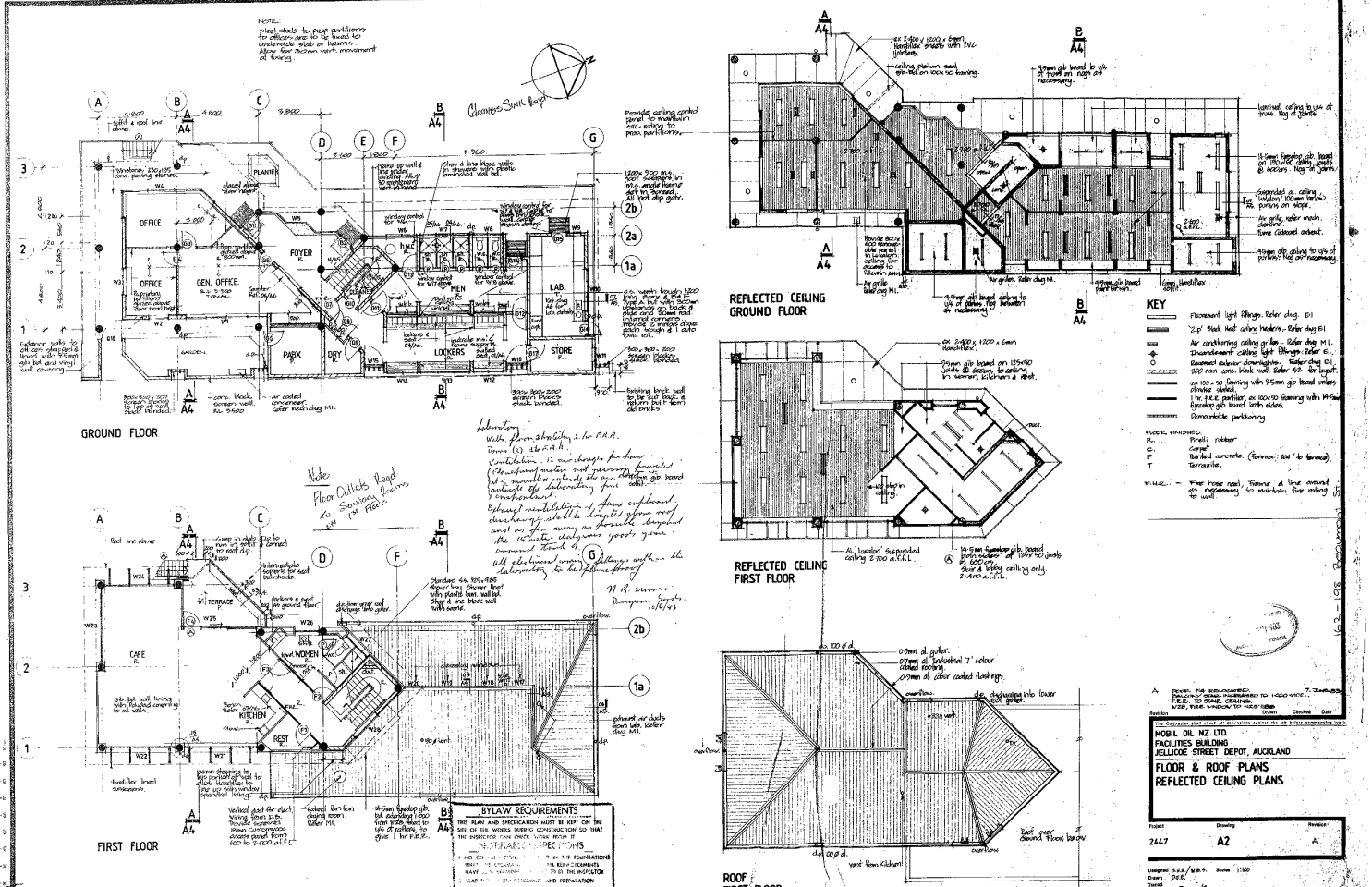
krta Kingston Reynolds Thom & Allardice Limited
Architects Engineers Planners and Quantity Surveyors
PO Box 5049 Auckland NZ Fax 3662 Telephone 793-020

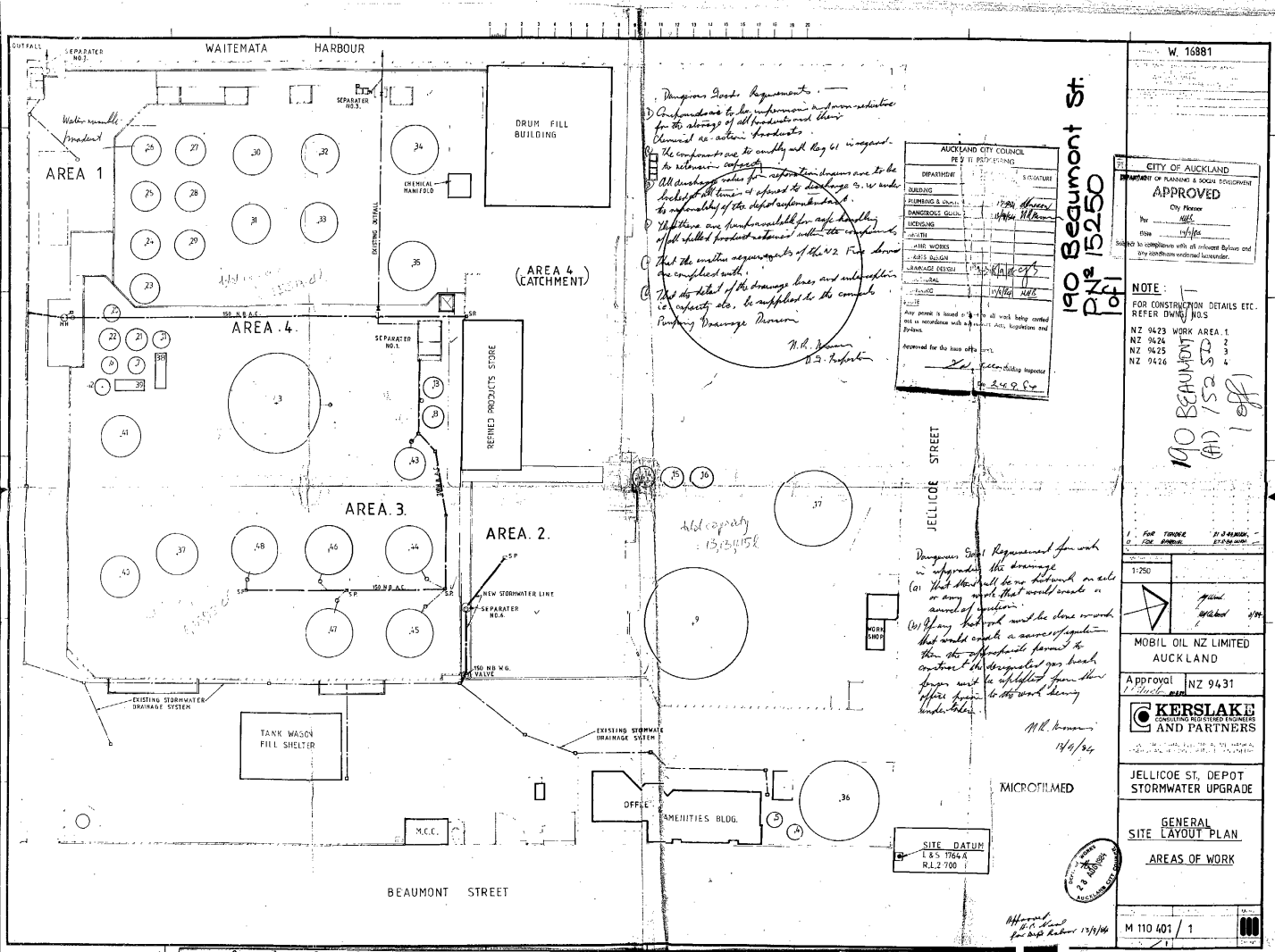
Copyright of this drawing is vested in Kingston Reynolds Thom & Allardice Limited

Original size [illegible]

INCHES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
CENTIMETRES 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51


NORTH WALL
SOUTH WALL
01 LABORATORY PLAN ELEVATIONS & SECTION 1:50
PLAN
LAB
SECTION A-A
02 SEAT 1:10
03 SEAT & LOCKER 1:10
04 SHOWER BASE 1:10
05 SHOWER BASE 1:10
SECTION B-B 1:10
SECTION C-C 1:10
06 ENQUIRY COUNTER & BENCH 1:50
07 KITCHEN BENCH 1:50
CITY OF AUCKLAND
APPROVED
BYLAW REQUIREMENTS
NOTIFIABLE INSPECTIONS
MOBIL OIL (NZ) LTD
FACILITIES BUILDING
JELICOE STREET DEPOT AUCKLAND
FIXTURES
2447
A6
Kingston Reynolds Thom & Allardice Limited
Architects Engineers Planners and Quantity Surveyors


GROUND FLOOR
FIRST FLOOR
REFLECTED CEILING GROUND FLOOR
REFLECTED CEILING FIRST FLOOR
ROOF FIRST FLOOR
KEY
BYLAW REQUIREMENTS
Floor Offsets Raised to Structural Beams not Floor Levels
Note: steel studs to prop partitions for officers and to be fixed to underside slab or beams. Allow for shown vent movement at fixing.
Provide ceiling control panel to manufacturers spec. relating to prop. partitions.
Chemtex Steel Prop
Laboratory with fume cupboard, ventilation & air changes for fume cupboard (Manufacturers written and measured figures) to be submitted before work commences. Provide all necessary ductwork, grilles, penetrations & enclosures. 2 fume cupboard discharges shall be located above roof ridge running as possible beyond and up from the nearest doors, windows, ventilators, openings, etc. All electrical wiring, switching & fittings to be flameproof. M.R. Mason Engineer 10/6/93
All electrical wiring, switching & fittings to be flameproof
Verified dust tight ducted wiring from 3 ph. Provide suspended room conformated access panel from 600 to 6000 a.f.f.c.
Extend 3ph 6amp power, lighting & ventilation to serve new shower lining


WAITEMATA HARBOUR
OUTFALL
SEPARATER NO.1
SEPARATER NO.3
SEPARATER NO.2
SEPARATER NO.4
Water manifold
Hydrant
AREA 1
AREA 4 (CATCHMENT)
AREA 4.
AREA 3.
AREA 2.
DRUM FILL BUILDING
CHEMICAL MANIFOLD
EXISTING JETTY
REFINED PRODUCTS STORE
150 N.B. A.C.
NEW STORMWATER LINE
150 N.B. W.G. VALVE
EXISTING STORMWATER DRAINAGE SYSTEM
TANK WAGON FILL SHELTER
M.C.C.
OFFICE AMENITIES BLDG.
WORK SHOP
JELLICOE STREET
BEAUMONT STREET
SITE DATUM
I.S.'s 1764 A
R.L. 2.700
Dangerous Goods Requirements.
1) Confirmation as to be information & information satisfactory for the storage of all products and their chemical reactions products.
2) The components are to comply with Reg 61 in regard to retention capacity.
3) All discharge water for information drawings are to be checked at all times of spread to discharge to sewer.
4) The responsibility of the depot superintendent.
5) That there are fire hydrants available for safe handling of all bulked products retained within the compounds.
6) That the various requirements of the N.Z. Fire Service are complied with.
7) That the detail of the drainage lines and interception capacity also, be supplied to the complete Trade Waste Drainage Division.
N.R. Kerslake
D.S. Inspector
AUCKLAND CITY COUNCIL
PERMIT TO PROCEED
DEPARTMENT
SIGNATURE
BUILDING
PLUMBING & DRAINAGE
DANGEROUS GOODS
LICENSING
HEALTH
TRADE WASTES
ROADS DESIGN
DRAINAGE DESIGN
PLANNING
Any permit is issued only on the condition that all work being carried out is in accordance with all relevant Acts, Regulations and Bylaws.
Approved for the Issue of Permit
Building Inspector
190 Beaumont St.
PWs 15250
Pof 1
W. 16881
CITY OF AUCKLAND
DEPARTMENT OF PLANNING & BOROUGH DEVELOPMENT
APPROVED
City Planner
Per
Date
Subject to compliance with all relevant Bylaws and any conditions endorsed hereunder.
NOTE:
FOR CONSTRUCTION DETAILS ETC. REFER DWNG NOS
NZ 9423 WORK AREA 1
NZ 9424 " 2
NZ 9425 " 3
NZ 9426 " 4
190 BEAUMONT ST
(A1) 1:50
1 off
1:250
MOBIL OIL NZ LIMITED
AUCKLAND
Approval
NZ 9431
KERSLAKE
CONSULTING REGISTERED ENGINEERS
AND PARTNERS
JELLICOE ST, DEPOT
STORMWATER UPGRADE
GENERAL
SITE LAYOUT PLAN
AREAS OF WORK
M 110 401 / 1
MICROFILMED
Approved
for Drainage Purposes 13/9/94

Mobil Oil New Zealand Limited

AURORA HOUSE 54-64 THE TERRACE
P.O. BOX 2497 WELLINGTON
TELEPHONE 4984-000 TELEX NZ3589

December 19, 1881

HOBSON EASTERN BAYS
AREA OFFICE
FILE REF: SITE ?
RECEIVED: 23 DEC 1991
REFERRED TO | INITIALS | DATE
DAN | RM | 9/1/92

Dangerous Goods Inspector
Auckland City Council
P O Box 7107
Wellesley St
AUCKLAND

Attention R Marsh

Dear Sir

MOBIL SPECIAL PRODUCTS
TERMINAL, BEAUMONT ST

162 - 188 B'MONT ST.

We wish to apply for a Dangerous Goods Permit to carry out the construction of a 13,000L horizontal slops tank at the above site.

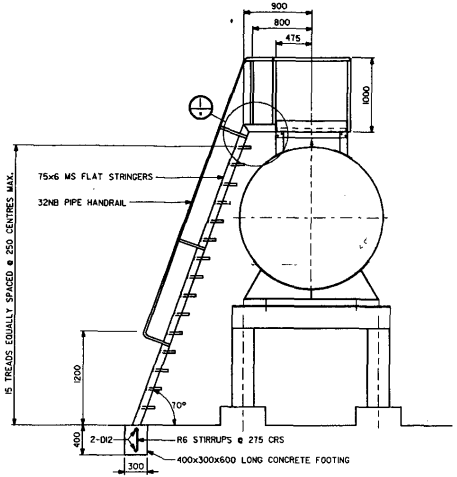
Please find attached a copy of the drawings for the proposed new tank which detail the tank construction and tank support structure. The tank will be positioned on existing channel supports in compound D beside the chemical manifold.

We trust this meets with your approval.

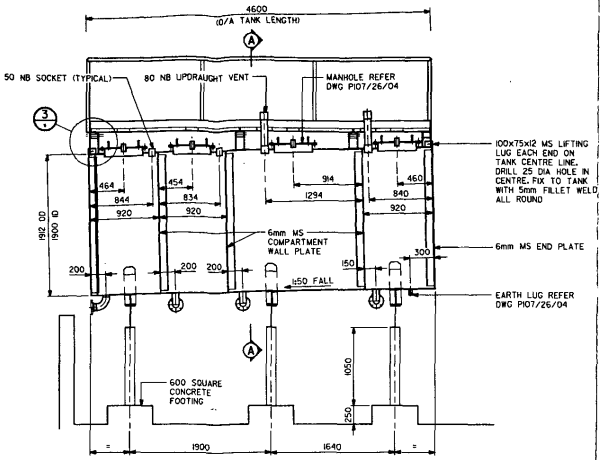
Yours faithfully

A J Hutley
FIELD ENGINEER
PLANT & COMMERCIAL

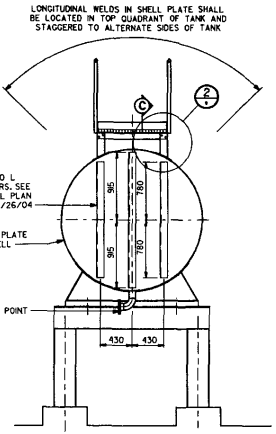
AJH:cs



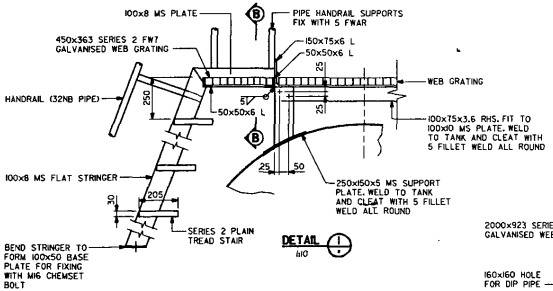
END ELEVATION
1:25

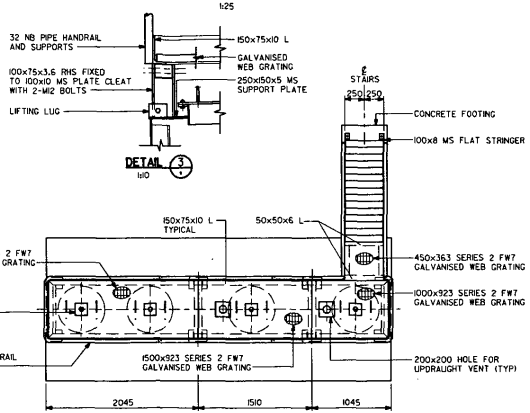


TANK SECTIONAL ELEVATION
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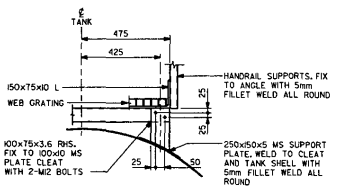


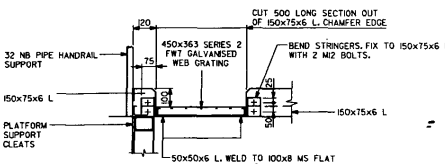
SECTION A
1:25



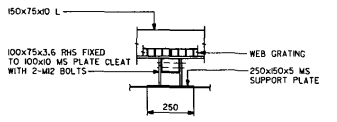


PLAN OF TANK
1:25





SECTION B
1:10



SECTION C
1:10

FIGURED DIMENSIONS TO BE USED IN PREFERENCE TO SCALED DIMENSIONS

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON THE JOB

MUST NOT BE REPRODUCED WITHOUT CONSENT FROM B/O EPHL FOR LATEST ISSUE

DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE

ISSUE	ALTERATIONS	DRAWN	DATE	APVD

DRAWN TH 2.5.14
DES. CHECK. [illegible] 2/5/14
ENG. APPRO. [illegible] 2/5/14
APPROVED
SCALE AS SHOWN

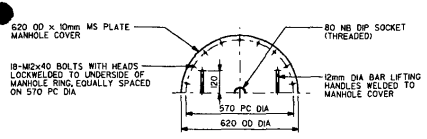
JELLICOE STREET AUCKLAND

SLOPS TANK CONSTRUCTION DETAILS 1

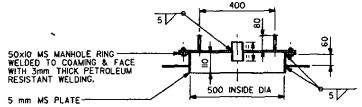
Mobil

DRAWING No. PI07/26/03

ISSUE

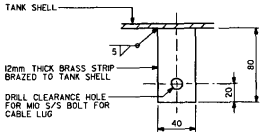


HALF PLAN

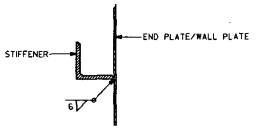


CROSS SECTION

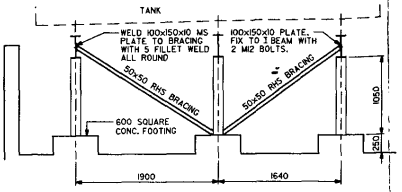
MANHOLE DETAILS
1:10



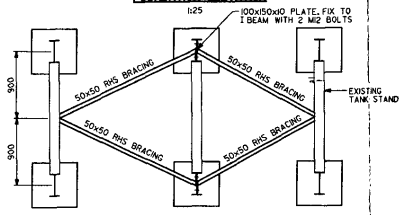
EARTH LUG DETAIL
1:2



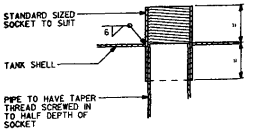
SECTIONAL PLAN OF STIFFENER
1:5



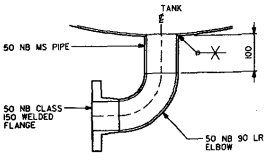
FOUNDATION ELEVATION



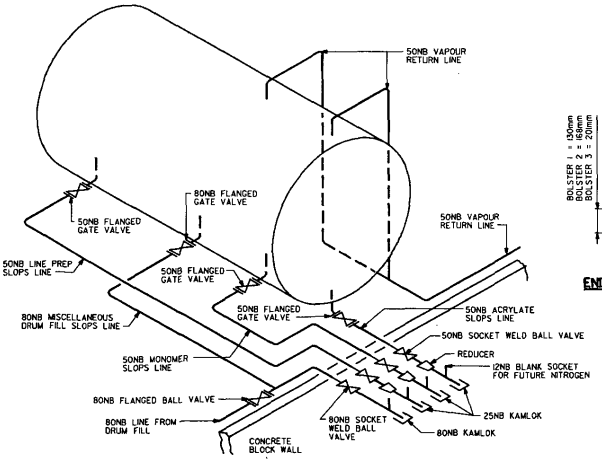
FOUNDATION BRACING PLAN
1:25



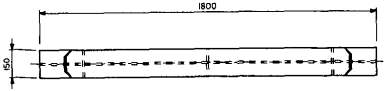
SOCKET JOINT
NTS



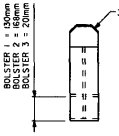
SUCTION/FILL POINT DETAIL
NTS



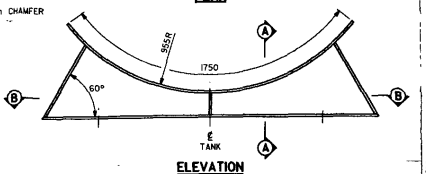
PIPEWORK SCHEMATIC
NTS



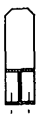
PLAN



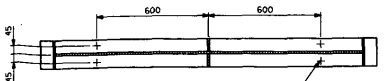
END ELEVATION



ELEVATION



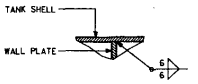
SECTION AA



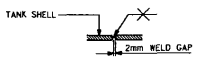
SECTION B

BOLSTER DETAILS
1:10

FABRICATE FROM 12mm MS PLATE WITH 6mm FILLET WELD ALL ROUND



COMPARTMENT WALL JOINT

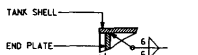


CIRCUMFERENTIAL JOINT



LONGITUDINAL JOINTS ARE TO BE LOCATED IN THE TOP QUADRANT OF THE TANK AND ARE TO BE STAGGERED.

LONGITUDINAL JOINT



END JOINT

WELDED JOINT DETAILS
1:2

ISSUE	ALTERATIONS	DRAWN	DATE	APPD

DRAWN TN 5.5.5
DES. CHKD. [illegible] 5/12/94
ENG. APPD. [illegible]
APPROVED
SCALE AS SHOWN

JELLICOE STREET AUCKLAND

SLOPS TANK CONSTRUCTION DETAILS 2

Mobil

DRAWING No. P107/26/04

ISSUE

DRAWING SUPERSEDED TO BE USED IN PREFERENCE TO SCALED DIMENSIONS

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON THE JOB

COPYRIGHT ON ALL DRAWINGS AND DESIGNS IS VESTED IN MOBIL OIL NZ LTD. AND MUST NOT BE REPRODUCED OR USED WITHOUT THEIR PERMISSION

DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE

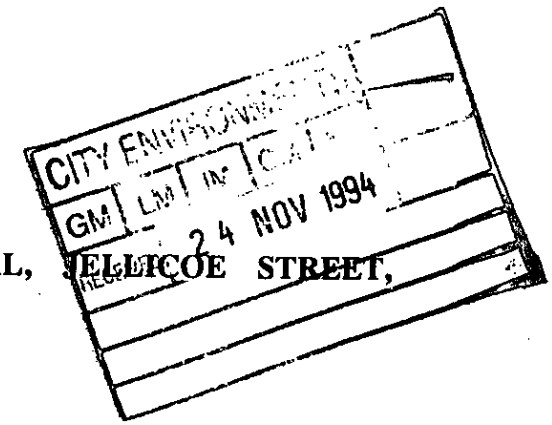
ISSUED FOR TENDER 5.5.5

2807491/5
1WL21258.WP5

22 November 1994

Auckland City Council
P O Box 7107
Wellesley Street
AUCKLAND

Attention : Dangerous Goods Inspector



Dear Sir

MOBIL OIL NEW ZEALAND LIMITED
AUCKLAND SPECIAL PRODUCTS TERMINAL, ELLICOE STREET, AUCKLAND

ENVIRONMENTAL UPGRADE STAGE 2

Mobil have recently commissioned Stage 1 of the above upgrade project and are now working on Stage 2. We have been requested by Mobil to provide to you the essential outline details of the proposed works. It is anticipated that you will forward any necessary documents to Department of Labour (OSH) with the aim of obtaining any approvals which ACC cannot provide.

The basic criteria and standards used for Stage 2 are the same as for Stage 1. Details are shown on the attached drawings which describe :-

- Basic revised tank layout (shows Stg 1 & Stg 2).
- Dangerous Goods clearances and spill containment.
- Bund wall, tank mounds and drainage.
- HDPE compound liner (an impervious membrane under the compound).

Please note the following points :-

- Stage 2 relates to New Compound B (see drawings).
- Tanks in the revised layouts are relocated from existing positions (which are noted on the plans).
- Tank clearances/containment calculations are based on Class 3A products in all tanks.
- Fire protection systems to be installed are :-
  - Fixed pipe tank water sprays.
  - Fixed pipe foam supply to each tank.

  The water spray systems will become fully operational when a pumped fire water supply is commissioned at a future date.

- Product pipework will be constructed to meet the requirement of ASME B31.3. Lines include wharflines (divert existing), tank fill (new), tank wagon fill lines (new pumped lines).
- Tanks will be inspected against API 653. The scope of repair work will follow the general standard previously agreed with Mr Roger Marshall for Mobil projects.
- Tank modifications will be to API 653.
- Tank mounds will be pre-consolidated using water fill in each tank (except T45 which is on an old footprint).
- BCHF Ltd has previously submitted a Building Consent Application to ACC for the Workshop and Canopy structures.
- ACC Water Supply department has approved water supply details.

The following drawings (2 sets, A3 size) are enclosed :-

Civil	P107/35/000 to P107/35/009	(Issue 1)
Structural	P107/35/010 to P107/35/015	(Issue 1)

Please note that the drawing Index (Drg/000) shows the full list of drawings for the project. We can make these and the project specification available to you or OSH if there is a need to evaluate these.

It is Mobil's intention that tank dossiers would be submitted to OSH for approval after each of the tanks has been relocated and all work including pipework is completed ready for re-commissioning.

Would you please confirm that the scheme as documented meets necessary Dangerous Goods requirements for the intended bulk storage facility. We assume that because the total quantity of dangerous goods on the site is unchanged, no amendment to Mobil's existing Dangerous Goods Licence will be required - would you please confirm this point.

We would be please to assist with any detailed points you may have.

Yours faithfully
BECA CARTER HOLLINGS & FERNER LTD

I D LEASK
idl:fjh

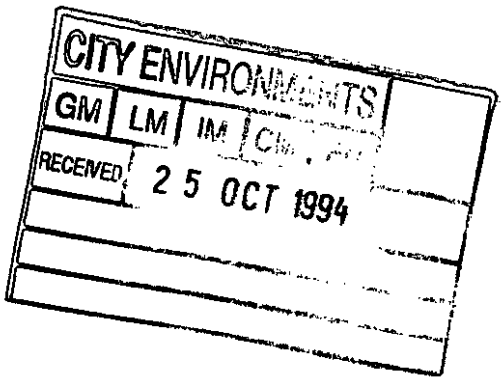
Copy : Andrew Milton, Mobil Oil New Zealand Limited, P O Box 2497, Wellington

Mobil Oil New Zealand Limited

AURORA HOUSE 54-64 THE TERRACE
P.O. BOX 2497 WELLINGTON
TELEPHONE (04) 4984-000 TELEX NZ3589

18 October 1994

City Environments,
Auckland City,
Dangerous Goods Inspector
Private Bag 26 701,
AUCKLAND.



Attention Mr D. Frith

Dear David

ENVIRONMENTAL UPGRADE STAGE TWO
AUCKLAND SPECIAL PRODUCTS TERMINAL

We would like to confirm that we have now let the contract for the Environmental Upgrade Stage Two at Auckland Special Products Terminal at Jellicoe street, Auckland. The work involves upgrading five tanks in accordance with the standards already agreed and implemented between Occupational Safety and Health and Mobil Oil New Zealand Ltd. We will require your assistance in witnessing the hydro-testing of the tanks in the second and third quarter of 1995.

Briefly the tank farm scope of works include:

1/ Construction of an impermeable liner (HDPE) under the compounds.
2/ Upgrading the tanks with new foundations, secondary containment, overfill alarms, fire protection water drench rings, and foam aerators/ pourer including associated pipe work and fire brigade connections.
3/ New oily water separator with coalescing multiplate packs.
4/ Of the five tanks 3 are 10.9m height by 7.62m diameter, 1 at 14.63m height by 12.19m diameter while the fifth is 11.0m height by 12.19m diameter.

This multi million dollar upgrade will provide Mobil Oil New Zealand Ltd with a facility to serve its needs for the next 20 to 30 years. It takes into account of the company's quality and production requirements, health and safety standards. It addresses the environmental requirements of new legislation such as the Resource Management Act and imminent changes to local and regional council district schemes.

Please find attached a copy of the existing layout (P107/35/001) and proposed site layout (P107/35/002). Work is scheduled to start 31 October 1994 with completion one year after that date.

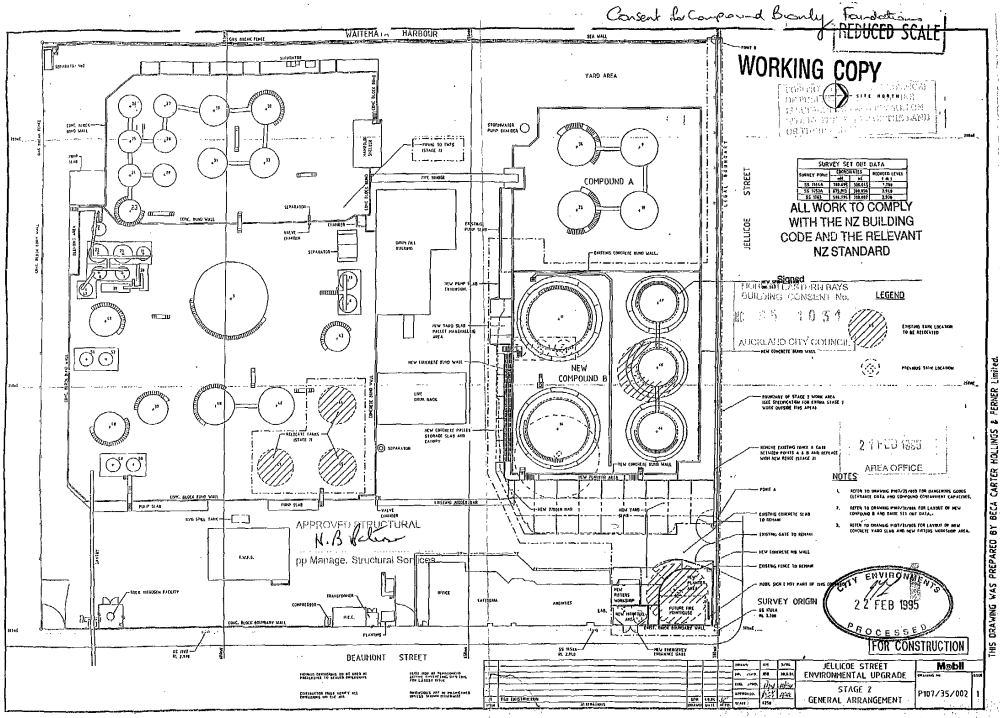
If you have any queries or would like to discuss the above project in greater detail please contact Andrew Milton an 04 498-4001.

Yours sincerely

A B Milton
LOGISTICS ENGINEER

Attach

cc: B. Hobson DX 82619
G. Smith DX 68215



(A2)

164 - 188 Beaumont Street

P.N° HC 95/1031

& New Oil tank foundations

22 March 1995

1 OF 4

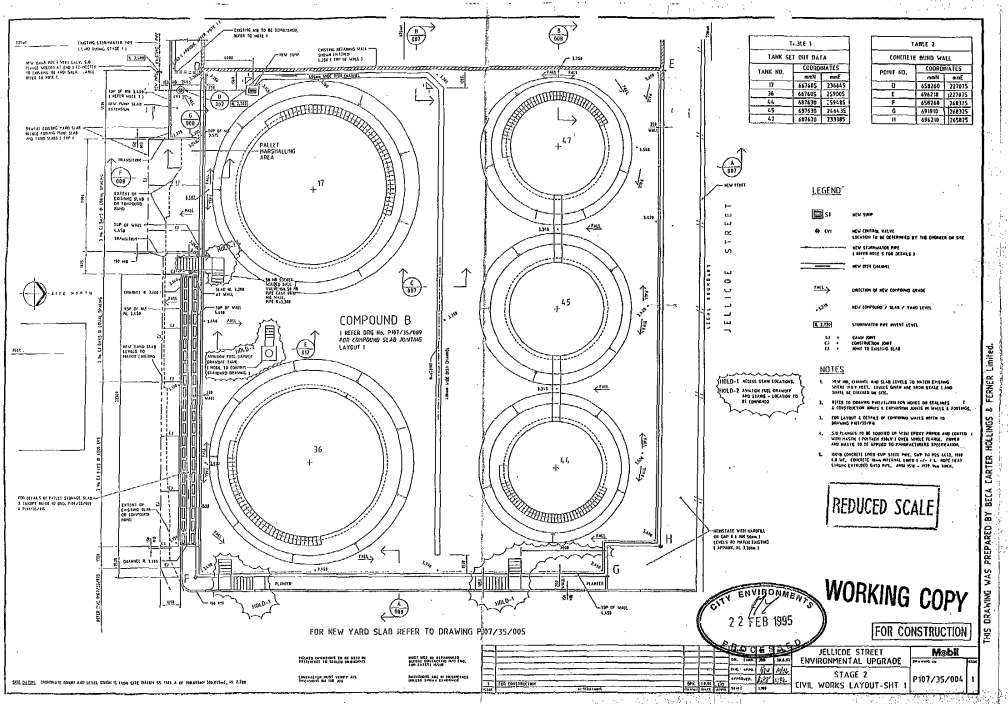


TABLE 1
TANK SET OUT DATA

TANK NO.	COORDINATES north	COORDINATES east
17	6676415	2366455
36	6676095	2369065
44	6675839	2369185
45	6675539	2369135
47	6675630	2369395

TABLE 2
CONCRETE BUND WALL

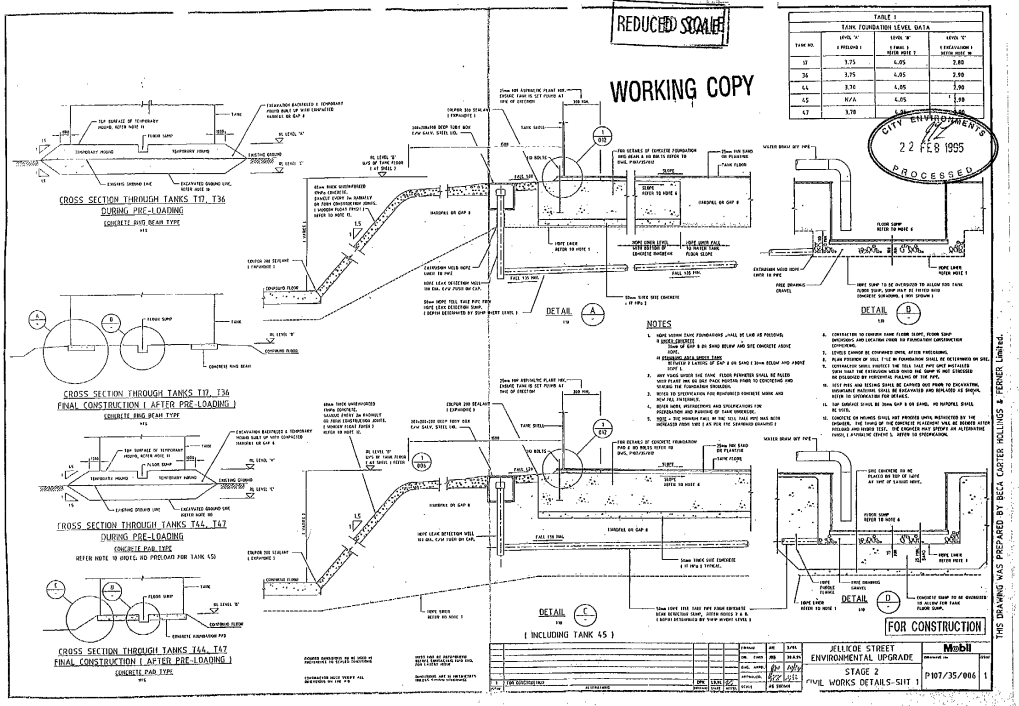
POINT NO.	COORDINATES north	COORDINATES east
D	6676260	2370175
E	6676218	2370175
F	6675360	2369375
G	6675150	2369375
H	6676210	2369375

(A2)

164 - 188 Beaumont Street

P.N° HC 95/1031

2 OF 4

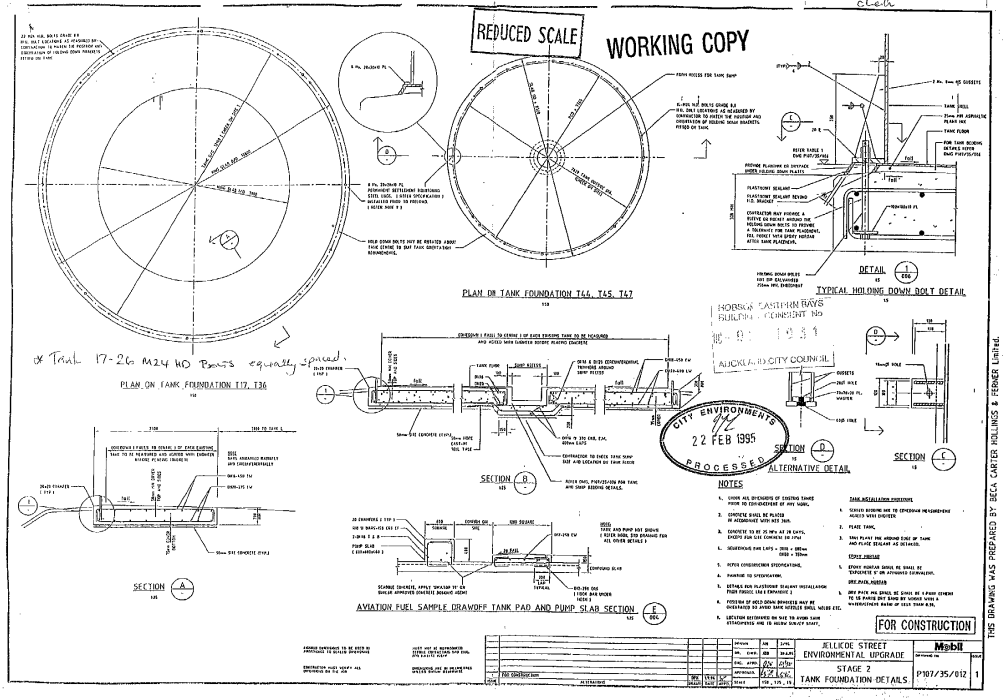


(A2)

164 - 188 Beaumont Street

P.N° HC 95/1031

3 OF 4



(A2)

164-188 Beaumont Street

P.No: HC 95/1031

4 OF 4

164-188
28 Beaumont St.

533121

~~53/1057~~ TP2917.

TOWN CLERK'S OFFICE, AUCKLAND.

22nd September, 1966.

Dickson. Corbett

MEMORANDUM for the DIRECTOR OF WORKS AND CITY ENGINEER

Your attention is directed to the following minute of the TOWN PLANNING COMMITTEE dated 14.9.66

TWN:SMM

Gillespies noted 3/10

Ledger noted BL 3/10/66

Stamper noted BL 3/10/66

J. SHAW
Acting Town Clerk.

Per:

STORAGE TANKS BEAUMONT STREET

It was resolved:

(a) That the application to erect the 15 additional tanks be approved.

(b) That this decision is not to be taken as a precedent for any future applications in respect of the applicant's site or any site in the City of Auckland area.

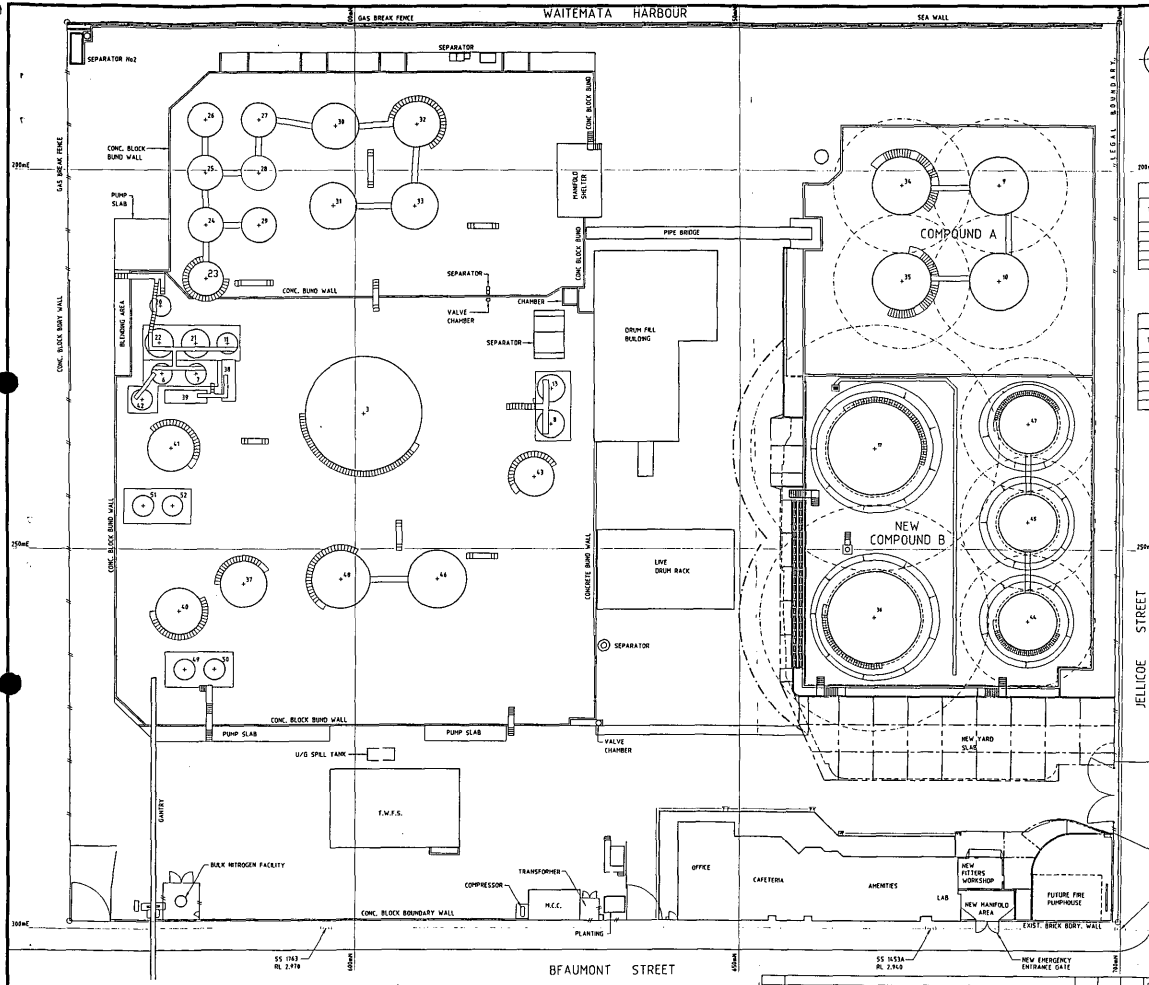
(c) Nevertheless, the approval set out in (a) above is subject to the following:

(i) Foam injection points to be installed on the existing tanks on the site belonging to Applicant Company to the satisfaction of Council's Dangerous Goods Inspector.

(ii) The 15 tanks to be separately bunded as a group to the satisfaction of the Dangerous Goods Inspector.

(iii) Compliance with the relevant By-Laws.

Ordinance 8 Cond use applic



TANK SET OUT DATA		
TANK NO.	COORDINATES	
	mmN	mmE
34	671125	281980
35	671125	276625
9	683770	281980
10	683770	276625
17	667605	236645
36	667605	259885
44	687630	259485
45	687630	264635
47	687630	233385

DGR TANK DATA STAGE ONE					
TANK NO.	CAPACITY (m3)	DIA. (m)	HEIGHT (m)	TANK DGR DISTANCE (m)	PROTECTED WORKS DGR DISTANCE (m)
34	590.272	7.632	10.97	5.002	10.001
35	590.272	7.632	10.97	5.002	10.001
9	590.272	7.632	10.97	5.002	10.001
10	590.272	7.632	10.97	5.002	10.001
TOTAL	2361.088				

CLASS 3a

DGR TANK DATA STAGE TWO						
TANK NO.	CAPACITY (m3)	DIA. (m)	HEIGHT (m)	TANK DGR DISTANCE (m)	PROTECTED WORKS DGR DISTANCE (m)	PUBLIC PLACE DGR DISTANCE (m)
17	1707.425	12.19	14.63	10.122	12.415	7.387
36	1293.378	12.19	11.00	8.851	11.568	7.284
44	497.088	7.632	10.90	4.977	9.977	4.994
45	497.088	7.632	10.90	4.977	9.977	4.994
47	497.088	7.632	10.90	4.977	9.977	4.994
TOTAL	4482.443					

CLASS 3a

COMPOUND CONTAINMENT CAPACITIES		
COMPOUND	CONTAINMENT CAPACITY (m3)	VOLUME OF LARGEST TANK IN COMPOUND (m3)
A	800	590
B	865	1707
A & B	2100	1707
NOTE: TANKS & TANK MOUNDS HAVE BEEN TAKEN INTO ACCOUNT IN CONTAINMENT CALCULATIONS		

LEGEND

PROTECTED WORKS DGR CLEARANCE ZONE

TANK DGR CLEARANCE ZONE (MINIMUM DISTANCE BETWEEN TANKS)

FOR CONSTRUCTION

PIGURED DIMENSIONS TO BE USED IN PREFERENCE TO SCALED DIMENSIONS

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON THE JOB

MUST NOT BE REPRODUCED BEFORE CONTACTING ICI/ THE FOR LATEST

DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE

ISSUE	ALTERATIONS	DRAWN	DATE	APPD.
1	FOR CONSTRUCTION	DPK	19.94	

DRAWN	AM	3/94
DR. CHKD.	JBB	30.6.94
ENG. APPD.		
APPROVED		
SCALE	1:250	

JELLICOE STREET ENVIRONMENTAL UPGRADE

STAGES 1 & 2 DGR CLEARANCES PLAN

Mobil

DRAWING No. P107/35/003 ISSUE 1

THIS DRAWING WAS PREPARED BY BECA CARTER HOLLINGS & FERNER Limited.

Code compliance certificate

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Section 95, Building Act 2004
(Form 7 – Building (Forms) Regulations 2004)

THE BUILDING

Building consent number:	BLD20062165101	Date building consent issued:	25-Oct-2006

Street Address: 164-188 Beaumont Street, Auckland Central, Auckland 1010

Legal description:

Lot number and DP: Lot 2 DP 135460 11065m2, Lot 3 DP 135460 4176m2, Lot 4 DP 135460 1000m2

Parcel:		Valuation Number:	
Class:	Bulk Tank / Silo Service Station	Intended life:	More Than 50 Years.

THE OWNER

Name of owner: Mobil Oil NZ Limited

Mailing address: P O Box 1709, Auckland

BUILDING WORK

The following building work is authorised by this building consent:

Demolition Of All Above Ground Bulk Petroleum Storage Tanks And Associated Equipment

CODE COMPLIANCE

The building consent authority named below is satisfied, on reasonable grounds, that:

☑ The building work complies with the building consent;

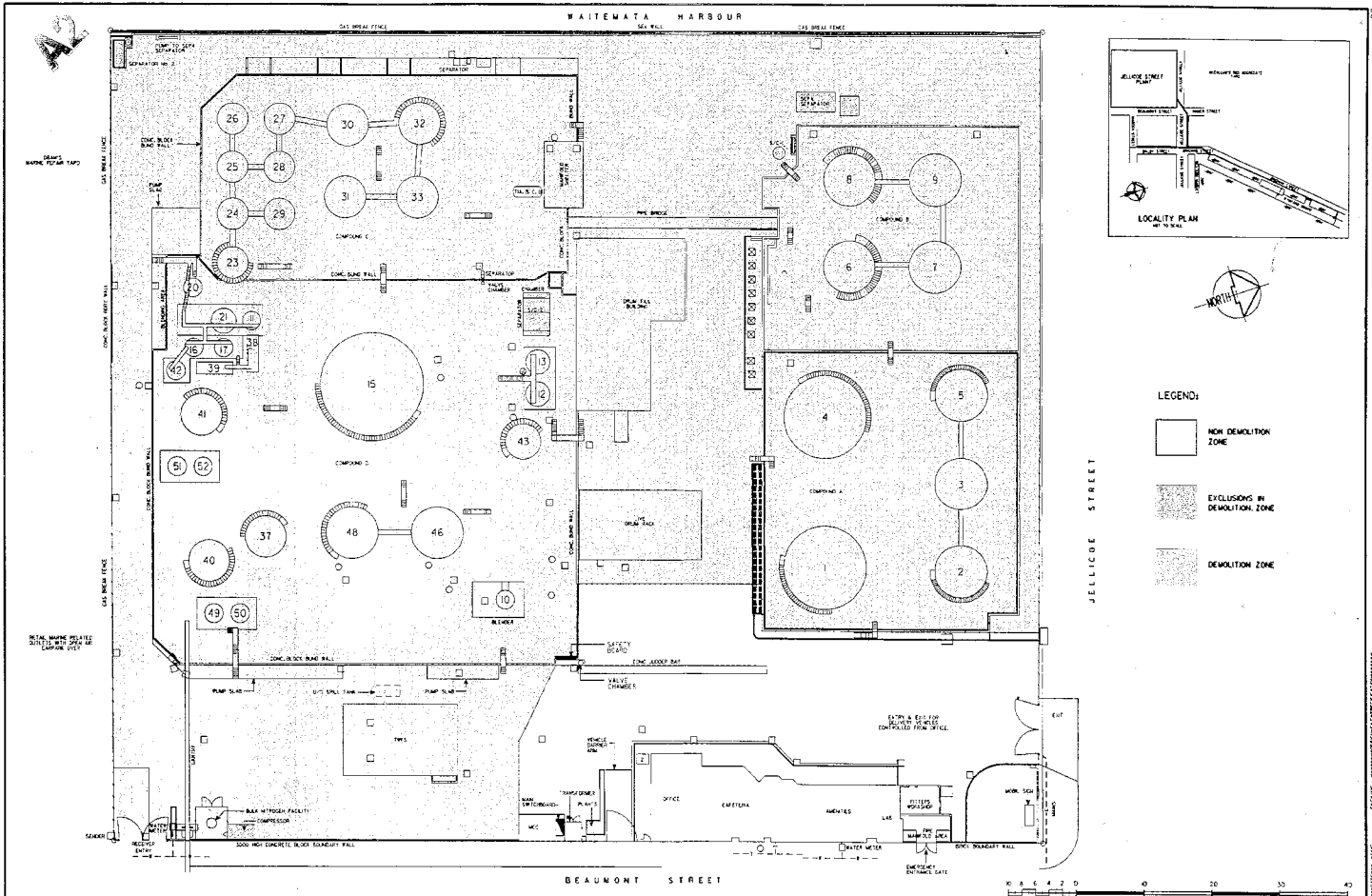
☐ The specified systems in the building are capable of performing to the performance standards set out in the building consent.

ATTACHMENTS

☐ Compliance schedule

On behalf of Auckland Council:		Date issued:	16-Mar-2011
Print name:	Ian McCormick		
Position:	Manager, Building Control		

Auckland Council, Private Bag 92300, Auckland 1142



REQUIRED DIMENSIONS TO BE USED IN PREFERENCE TO SCALED DIMENSIONS.

DIMENSIONS ARE IN MILLIMETRES U.N.O.

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON THE JOB

© COPYRIGHT MOBIL ENGINEERING OF MOBIL OIL NZ LTD & MOBIL OIL AUSTRALIA PTY LTD ARN 46 004 244 935

MUST NOT BE REPRODUCED WITHOUT PERMISSION.

CONTACT MOBIL ENGINEERING FOR LATEST ISSUE.

REV	ALTERATIONS	DRAWN	PROJECT ENGINEER	ENGINEERING MANAGER	APPROVED
A	FIRST ISSUE, ETS, No. 7542.	PSM 30-8-06	KS 30-8-06	TGP 04-9-06	JC 13-9-06

DEMOLITION LAYOUT FOR ASPT JELLICOE STREET PLANT AUCKLAND N.Z.

REFERENCE MOBIL ENGINEERING AS BUILT DRAWING No. 90-A-4-0079 SH.

STATUS APPROVED
ISSUED FOR TENDER
NOT FOR CONSTRUCTION

SCALE 1:250

Mobil Engineering

DRAWING No. P107/109/01 REV A

A1

PLOTTED BY: NICKNAME\Desktop\Jobs\ FILENAME: \\Mobilnz\Data\Projects\Auckland\Jellicoe\Drawings\P107109001.dgn

460798

Auckland City

Commercial application for project information memorandum and/or building consent

(Section 33 or section 45, Building Act 2004)

1 The application

I request that you issue a:

- ☐ project information memorandum
- ☑ building consent
- ☐ amendment to a building consent *(Original consent number):* .....
- ☐ project information memorandum already issued for this project *(PIM number)* .....

for the building work described in this application *(tick one or more, as applicable)*

For Office Use	
Date Lodged	21/09/2006
Consent number	20062165101
PIM number	
Receipt number	1314340

2 Building consent *(do not fill in this section if the application is for a project information memorandum only)*

Estimated value of the building work on which the building levy will be calculated *(including goods and services tax; state estimated value as defined in section 7 of the Building Act 2004)* $ TBA.

3 The building

Street address of building: *(for structures that do not have a street address, state the nearest street intersection and the distance and direction from that intersection)* 164 - 188 BEAUMONT STREET FREEMANS BAY AUCKLAND CENTRAL.

Legal description of land where building is located *(state legal description as at the date of application and, if the land is proposed to be subdivided, include details of relevant lot numbers and subdivision consent)* LOTS 2, 3 & 4 - DP 135460 (MAJOR WORKS)

Site area: *(if applicable)* ..... m²

Building name: (if applicable) MOBIL SPECIAL PRODUCTS TERMINAL **Level/unit number:** *(if applicable)* N/A.

Lot No: 2, 3 & 4 **DP:** 135460

Area: *(total floor area; indicate area affected by the building work if less than the total area)* ..... m²

Current lawful established use; *(include number of occupants per level & per use if more than 1 level)* DECOMMISSIONED REFINED PETROLEUM PRODUCTS TANK FARM AND DRUM FILLING TERMINAL.

Year first constructed: *(approximate date is acceptable e.g: c1920s or 1960-1970)* PRE 1930.

4 The owner

Name of owner: *(include preferred form of address, eg, Mr, Miss, Dr, if an individual)* MOBIL OIL NEW ZEALAND LTD. (GROUND LEASE FROM PORTS OF AUCKLAND LTD).

Contact person: *(insert n/a if the applicant is an individual)* MURRAY SHEPHERD.

Mailing address: *(insert mailing address)* P.O. Box 1709, AUCKLAND.

Street address/registered office: *(insert street address/registered office)* LEVEL 21, 157 LAMPTON QUAY, WELLINGTON.

Phone numbers: Home: N/A. Mobile: 021436704 Work: 09 302 4706

After hours: 09 425 6674 Facsimile number: 09 3024735.

Email address: murray.f.shepherd@exxonmobil.com Website: N/A.

The following evidence of ownership is attached to this application: *(i.e. copy of certificate of title, lease, agreement for sale and purchase, or other document showing full name of legal owner(s) of the building)*

- CURRENT CERTIFICATES OF TITLE.
- LAND OWNERS LETTER OF AUTHORISATION.

5 Fee Payee

Name and address for refunds/accounts: MOBIL OIL NEW ZEALAND LIMITED
PO Box 1709, AUCKLAND.

Phone: Business: 09 3024706 Home: N/A

Fax: 09 3024735 Email: murray.f.shepherd@exxonmobil.com

Signature of person responsible for payment of fees: pp MOBIL OIL NZ LTD.

Customer Account No: Date:

6 Financial Contribution and/or development contribution payments (where applicable)

Name and address for refunds/accounts: N/A

Phone: Business: Home:

Fax: Email:

Signature of person responsible for payment of financial contribution and/or development contribution:

Date:

Note: Some applications will be charged a financial contribution and/or development contribution or incur additional processing fees. For example, additional residential units on a site, may require a development contribution under the Local Government Act 2002 or additional floor area in some commercial buildings may require a financial contribution as set out in the District Plan. In these circumstances the name and address of the person responsible for the payment of the financial contribution, development contribution or further invoices must be included, and their signature provided in this section of the application form. **Please note that by signing this section of the application form you are agreeing to be responsible for payment of invoices or financial contribution or development contribution payments that may validly be charged. In addition to meeting the costs of financial contribution, development contribution and/or other invoices, you will be liable to pay all costs and expenses of debt recovery and/or legal costs incurred by the Council of and incidental to enforcement of any debt.**

7 The agent

Name of agent: *(only required if application is being made on behalf of the owner, delete if not applicable)*

Contact person: *(insert n/a if the applicant is an individual)*

Mailing address: *(insert mailing address)* N/A

Street address/registered office: *(insert street address/registered office)*

Phone numbers: Home: Mobile: Work:

After hours: Facsimile number:

Email address: Website:

Relationship to owner: *(state details of the authorisation from the owner to make the application on the owner's behalf)*

8 Signature

Signature of owner/agent on behalf of and with the authority of the owner *(delete one)* pp MOBIL OIL NZ LTD

Name of person signing *(please print)* MURRAY SHEPHERD Date: 12.9.06

9 The project

Description of the building work: *(provide sufficient description of building work to enable scope of work to be fully understood; continue on a separate page if necessary, or refer to an attached document setting out the description)* THE DEMOLITION OF ALL ABOVE GROUND BULK PETROLEUM STORAGE TANKS AND ASSOCIATED EQUIPMENT, APART FROM THE FOLLOWING EXCEPTIONS: SECURITY FENCING, ADMINISTRATION BUILDING AND ASSOCIATED ELECTRICAL BUILDING AS SHOWN ON PLAN. NOTE: NO DISTURBANCE OR DISRUPTION TO SITE UTILITY SERVICES OR ANY BELOW GROUND DRAINAGE/WATER TREATMENT SYSTEM.

Will the building work result in a change of use of the building? ☑ Yes ☐ No

If yes, provide details of new use: ALL TANKS AND EQUIPMENT BEING DEMOLLISHED TO ABOVE GRADE.

Intended life of the building if less than 50 years: *(number of years)* N/A

List previous building consents previously issued for this project *(if any):(list who issued the consent, the date of issue and the consent number)*

N/A

10 Project information memorandum

(Do not fill in this section if the application is for a building consent only)

The following matters are involved in the project: *(tick the matters relevant to the project)*

- ☐ Subdivision
- ☐ Alterations to land contours
- ☐ New or altered connections to public utilities
- ☐ New or altered locations and/or external dimensions of buildings
- ☐ New or altered access for vehicles
- ☐ Building work over or adjacent to any road or public place
- ☐ Disposal of stormwater and wastewater
- ☐ Building work over any existing drains or sewers or in close proximity to wells or water mains
- ☐ Other matters known to the applicant that may require authorisations from the territory authority: *(specify)*

N/A

11 Compliance schedule

(Do not fill in this section if this an application for a project information memorandum only) **Tick appropriately:**

The specified systems for the building are as follows: *(specified systems are defined in regulations; if you are not sure whether your building has specified systems, talk to the building consent authority, designer or your architect)*

- ☐ Automatic systems for fire suppression (for example, sprinkler systems)
- ☐ Automatic and manual emergency warning systems for fire or other dangers (other than a warning system for fire that is entirely within a household unit and serves only that unit)
- ☐ Electromagnetic or automatic doors or windows, including those that close on fire alarm activation
- ☐ Emergency lighting systems
- ☐ Escape route pressurisation systems
- ☐ Riser mains for fire service use
- ☐ Automatic back-flow preventers connected to a potable water supply in order to avoid possible contamination
- ☐ Lifts, escalators, or travelators or other systems for moving people or goods within buildings
- ☐ Mechanical ventilation or air conditioning systems
- ☐ Building maintenance units that are used for providing access to the exterior and interior walls of buildings
- ☐ Laboratory fume cupboards
- ☐ Systems that assist people with visual or hearing disabilities
- ☐ Smoke control systems
- ☐ Emergency power systems for any of the systems specified above
- ☐ Signs that form part of any of the systems specified above.

N/A

Where a compliance schedule is required for the purposes listed in (1) above, it shall also include, where appropriate, systems or features relating to -

- ☐ Means of escape from fire; and
- ☐ Safety barriers; and
- ☐ Means of access and facilities for use by persons with disabilities which meet the requirements of section 118 of the Building Act 2004; and
- ☐ Hand-held hose reels for fire fighting; and
- ☐ Such signs as are required by -
  - (i) The Building Code; or
  - (ii) Section 120 of the Building Act 2004 in respect of the systems specified above, and systems and features in this section

☑ The following specified systems are being altered, added to, or removed in the course of the building work: (insert n/a if not applicable) (DEMOLITION). THE FOLLOWING ARE DECOMMISSIONED: FOAM/WATER DELUGE AND SPRINKLER FIRE PROTECTION TO DEMOLITION AREAS ONLY.

☐ There are no specified systems in the building. ADMINISTRATION BUILDING IS UNAFFECTED)

12 Building consent compliance

The building work will comply with the building code as follows: *(if you're not sure which clauses are applicable, talk to the building consent authority, designer or your architect)*

Clause *(tick relevant clause numbers of building code)*	Means of compliance *(refer to the relevant compliance document(s) or detail of alternative solution in the plans and specifications; if not appicable, put n/a)*	Waiver/modification required *(state nature of waiver or modification of building code required; if not applicable, put n/a)*
☐ B1 Structure		
☐ B2 Durability		
☐ C1 Outbreak of fire		
☐ C2 Means of escape		
☐ C3 Spread of fire		
☐ C4 Structural stability \ during fire		
☐ D1 Access routes		
☐ D2 Mechanical installations for access		
☐ E1 Surface water		
☐ E2 External moisture		
☐ E3 Internal moisture		
☑ F1 Hazardous agents on site	ALL HAZARDOUS PRODUCTS REMOVED FROM SITE. SITE WILL BE GAS FREE PRIOR TO DEMOLITION.	
☐ F2 Hazardous building materials		
☐ F3 Hazardous substances and processes		
☐ F4 Safety from falling		
☑ F5 Construction and demolition hazards	ALL COMPONENTS OF THIS CODE ARE MET WITH IN THE "SCOPE OF WORKS" AND/OR MOBIL'S OPERATIONS MANAGEMENT SYSTEM	
☐ F6 Lighting for emergency		
☐ F7 Warning systems		
☐ F8 Signs		
☐ G1 Personal hygiene		
☐ G2 Laundering		

Engineering

SCOPE OF WORKS

DEMOLITION OF SPECIAL PRODUCTS TERMINAL

AUCKLAND

Attachment 1 of Exhibit A

SPECIFICATION NO. 7042-01

Version 1 - 31/08/2006
Issued for Tender

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A3.3 Contact Numbers for Mobil Personnel / Contacts 10

A1. SCOPE OF WORKS

This project involves all works associated with the demolition of the Auckland Special Products Terminal. It is intended that all facilities, with the exception of specified items as detailed, shall be demolished down to concrete and bitumen level but excluding the removal of ground level concrete and bitumen.

The Principal will arrange for all tanks and pipe lines to be cleaned and gas freed prior to demolition.

A1.1 Detailed Scope Of Works

The scope of work includes all work detailed or inferred within this specification.

Note: The drawings listed within this document are to be considered part of the specification. The scope of work involves the demolition of all facilities shown in the demolition zone on these drawings unless specifically excluded in this scope.

The scope of this demolition project involves the following:

1. Preliminaries
2. Works Control
3. Unloading of Equipment on Site
4. Above Ground Storage Tanks
5. Pipe Lines
6. Tank Truck Fill Stand
7. Pumps
8. Services/Utilities
9. Fire Fighting Systems
10. Buildin gs & Structures
11. Oil y Water Separation Systems
12. Miscella neous

A1.1.1 Preliminaries

The Contractor shall need to provide some site amenities required as the facilities at site will be insufficient to cater for the Contractor's personnel.

The Contractor shall arrange, if necessary, for approval to establish temporary facilities near the work site.

The Contractor should allow for the following as deemed necessary by the Contractor

- Site office for Contractor supervisor / permit writer
- Lunch shed
- Container or workshop facilities as required
- Temporary fencing / signage to meet security and safety requirements.
- Installation of temporary services to these facilities.
- Security of Contractor's facilities

The existing Mobil toilet/shower are available for use by the Contractor. However access times are to be agreed with Mobil so as to avoid conflict with Mobil personnel.

Prior to any works beginning on site, the Contractor must supply to Mobil a Site Safety Management Plan specific to the project, including a detailed Inspection and Test Plan, and a Safety Method Statement detailing the proposed risk control methods for stages of the site works. The Contractor's Site Safety Management Plan shall be required to demonstrate a system of controlling hazards associated with all tasks including the use of JSA's and safe work

procedures. The Safety Method Statement and the documented system of control must be accepted by Mobil before any works can commence.

All work is to be carried out according to the Contractor's Safety Health and Environmental Management plan and Quality Manual, copies are to be kept on site at all times.

During demolition works temporary fencing and barricading may be required to prevent public or unauthorised access to certain areas. This fencing/barricading shall be provided by the Contractor

Mobil shall be responsible for applying for the Demolition Certificate from the appropriate authorities prior to the commencement of demolition.

The Contractor will be responsible for applying for any other permits associated with the demolition of the facilities, eg permits for wastewater and stormwater disposal.

The use of mobile (cell) phone is allowed in the demolition area

A1.1.2 Works Control

The demolition will take place within an ex hazardous area that has contained flammable and combustible liquids. All tanks will be declared gas free by Mobil prior to demolition and all pipes drained free of product. The pipes will be marked with a spray paint colour code to indicate that they are drained and gas free. However the Contractor shall exercise caution during demolition in case there are pockets of trapped product. The Contractor shall plan and carry out the work in such a way that ensures that there is no spillage to ground or water.

The Contractor shall work in accordance with Mobil Work Control Procedures (WCP) which allows the use of written procedures (Refer to section 2.1 of the Mobil WCP for details) as an alternative to the use of Mobil WCP documentation. These Safe Work Procedures shall be reviewed and approved by Mobil prior to the start of the project. The requirement is that the procedures will have provision for the daily review of hazards relative to that days tasks' and the controls to mitigate such hazards, to be discussed, recorded and signed off by all persons involved.

If any tasks occur during the work that are not covered by Safe Work Procedures then Mobil's WCP documentation shall apply.

If the scope of work involves "naked flame" work (oxy cutting, welding, grinding) in other than a Designated Site Construction Area a Fire Watch will be required. Provision of a fire watch for "naked flame" works will rest with the Contractor. The Fire Watch will have to be trained in accordance with Mobil's procedures which involve reading and understanding the duties of a Fire Watch (refer Section A2.2).

Control of the site and works will rest with the Contractor and Sub-Contractors to the Contractor shall be required to work under the Contractor's control and safety management system and site controls whilst on site.

A1.1.3 Unloading of Equipment on Site

The following free issue items shall be delivered to site by the principal, to be unloaded by the Contractor.

Nil

The Contractor is responsible for meeting all regulations for the transport and unloading of their equipment.

A1.1.4 Above Ground Storage Tanks

The demolition of tanks shall include the following items

- Demolition and scrapping of 39 vertical above ground product tanks.
- Demolition and scrapping of 1 horizontal 16kl vapour recovery tank.

- Demolition and scrapping of 1 foam bladder tank.
- Removal and scrapping of 2 stainless steel tanks (approx. 1000 litres each) in pits in drum fill building.
- Demolition of the bund walls with the exception of the wall along the front that supports the fence.

A1.1.5 Pipe Lines

The pipes will be marked with a spray paint colour code to indicate that they are drained and gas free. However the Contractor shall exercise caution during demolition in case there are pockets of trapped product. The Contractor shall plan and carry out the work in such a way that ensures that there is no spillage to ground or water.

The demolition and scrapping of pipe lines involves the following works.

- Removal and scrapping of all above ground pipes and fittings including valves, filters, relaxation chambers and support structures. Note that this includes fire, foam, air and nitrogen pipes as well as product pipes.
- Removal and scrapping of pipe supports, where they are integral with concrete slabs, to grade level.
- Removal and scrapping of pipe supports complete with concrete footings, where they are in earth, and backfill to grade to make safe.
- All underground pipes are to be cut and capped at ground level to seal and make safe.
- All unbroken flange joints are to be considered as containing asbestos gaskets and are to be cut on both sides of the flange, as close as possible to the flange, for segregation and declaration to the scrap metal processors.
- Flange joints already broken by others prior to demolition may also have contained asbestos gaskets. These gaskets shall be placed in a lined drum marked "asbestos waste" by Mobil for disposal by the demolition Contractor using approved asbestos disposal processes.

A1.1.6 Tank Truck Fill Stand (TTFS)

The demolition of the following:

- Demolition and scrapping of the TTFS structure.
- Demolition and scrapping of all above ground pipes and all associated equipment.
- Removal and scrapping of all above ground electrical cables.
- The concrete plinths under the TTFS shall remain and may be used by the Contractor to create a wheel wash without onus on the Principal.

Note: Asbestos exists on the TTFS structure. The Contractor shall remove all asbestos and carry out asbestos monitoring in accordance with government regulations.

A1.1.7 Pumps

The demolition of the following:

- Removal and scrapping of all electrical and air powered product pumps.
- Removal and scrapping of all other pumps excluding those detailed in Section A1.2.4.

A1.1.8 Services/Utilities

The demolition of the following:

- Removal and scrapping of all cables and electrical equipment including switchboards, junction boxes, electronics, controls and support structures excluding site security controls as nominated.

- Demolition and scrapping of all equipment associated with water, air and nitrogen pipe lines.
- Demolition and scrapping of all data and communication cables.
- Refer to Exclusions Section A1.2.4.

A1.1.9 Fire Fighting Systems

The demolition of the following:

- Foam bladder tank and associated valving.
- All foam pipe lines and associated sprinkler system.
- All water lines including cooling rings and sprinklers.
- Fire system test pump equipment.
- All hydrant points and all hose and extinguisher boxes.
- Refer exclusions A1.2.4.

A1.1.10 Buildings and Structures

The demolition of the following:

- Live drum rack.
- Drum fill building including all line conveyors, drum filling equipment, palletiser and any other assorted equipment.
- Manifold shelter.
- Covered storage adjacent to Compound A.
- Pipe gantry across Beaumont Street in to Compound D.
- Pipe bridge between Compound B and Compound C.
- Light poles and lights.

A1.1.11 Oily Water Separation System

The following applies to the oily water separation system:

- These items are listed in the Exclusions Section A1.2.4
- It is the intent that the oily water separator system remains operable during and after demolition.
- Note that the Contractor shall ensure that no debris that impairs the operation of the system is allowed to enter the catchment/separation pits.

A1.1.12 Miscellaneous

The following shall be removed and scrapped:

- All items stored in the "Graveyard" area.
- All itinerant items in the demolition zone are to be removed and scrapped.
- All equipment, plant, building, concrete and associated items inside the Non demolition Zone including the fence and the section of bund wall that the fence sits on are specifically excluded from the demolition.

A1.2 Supply Of Materials And Equipment

A1.2.1 Works by the Principal.

The Principal shall carry out the following works prior to the start of the demolition contract:

- Isolation of all electrics within the demolition area with the exception of electrical power to the items shown in Section A1.2.4.
- Cleaning of all tanks in accordance with Mobil standards.

- Draining, gas freeing and colour marking of all pipe lines as per Section A1.1.5.
- Mark all monitoring wells with fluorescent highlighting paint. These are to be left in place undamaged and accessible during and after demolition. Any damage is to be reported immediately to Mobil.
- Colour mark electrical cables and pipes that have to remain in place along boundaries.

A1.2.2 Works by the Contractor

The Contractor shall supply all materials and equipment required to complete this project, except for the works, materials and equipment listed in Section A1.2.1. The Tender Lump Sum Price shall be based on assured sources of supply and disposal. The price shall include all necessary duties and taxes as applicable, freight and other charges.

The Contractor shall be responsible for supplying fire protection equipment to suit their needs. A fire hydrant will be available near the main office and the Contractor shall have to provide fire hoses and protect them from vehicular traffic when in use across the Mobil parking area.

The Contractor shall ensure that contamination which is transported off site shall be in accordance with regulations and that the appropriate environmental controls are in place to prevent spillage and environmental damage e.g. wheel washing. Loads shall be covered and tailgates sealed if transporting in wet conditions.

The Contractor shall demolish the tanks using a shear on an excavator. Limited use of oxy cutting at ground level will be approved for cutting steel that is too thick for the shear. Demolition of tanks shall be on concrete. The smaller tanks may be removed to a concrete area for cutting up.

A1.2.3 Disposal of Equipment and Scrap by the Contractor

The Contractor shall dispose of all steel from the tanks and pipes by smelting. Parties involved in handling the steel should be made aware of the origin and the fact that the steel could contain lead. Full traceability records shall be kept of all steel sent for smelting and passed on to Mobil at the completion of demolition.

The Contractor shall nominate the share basis for any items not scrapped but salvaged for on sale.

A1.2.4 Exclusions from the Demolition

The following items are excluded from the demolition:

- All equipment, plant, building, concrete and associated items inside the Non Demolition Zone including the fence and the section of bund wall that the fence sits on.
- The SEPA Separator and associated slops tank shown on the demolition plan.
- Catchment pit S/C-1 and associated pump.
- Separator No 2 and pump to SEPA separator shown on the demolition plan.
- Separator Chamber S/C-2 shown on the demolition plan.
- All concrete and bitumen areas at grade level and below.
- Below grade services including waste water and stormwater pipes.
- All extinguishers shall be removed from the demolition zone prior to the start of demolition.
- Air compressors and shed as well as electrics to the compressors.
- Foam chambers on Tanks 1 to 9 inclusive are to be recovered and made available to Mobil free issue by the Contractor.

A2. DOCUMENTS / DRAWINGS

Works shall be carried out in accordance with the technical specifications and drawings.
The drawing numbers and titles of the Contract Drawings and Reference Drawings are listed below:

A2.1 Contract Documents

Technical specifications.
The following relevant technical specifications have been attached.

- D1. DEMOLITION / SITE PREPARATION

A2.2 Reference Documents

Reference documents included for the Contractor's information.

- MEF-EV33 Contractor Work Safety Process
- MEF-G518 Contractor Assessment Form
- MEW-F230 Safety Method Statement Instruction Guide
- ANZ-DIF-0013 Safety Method Statement form
- GP 77-77-07
- Mobil Fire Watch Training OIM-0061
- Mobil PPE Policy & Procedure - Minimum Requirements ANZ-DIP-0023
- S & D SHE Incident Notification Guidelines ANZ-SDC-0001

A2.3 Contract Drawings

Drawing No.	Rev.	Drawing Title
• P107/109/01	0	Demolition Layout
• AUDI-IG01	0	General Layout
• AUDI-IH01	0	Hazardous Area Layout
• AUDI-IF01	0	Fire Fighting/Manifest Layout
• AUDI-ID01	0	Drainage Layout
• AUDI-IR01	0	Piping Route Layout

A2.4 Reference Drawings

Drawing No.	Rev.	Drawing Title

Nil

A3. SAFETY, HEALTH AND ENVIRONMENT

The following requirements are in addition to Safety, Health and Environment Articles in the Principle Document.
As a guide contractors can refer to the Safe Work Practices Manual ANZ-DIM-0005.

A3.1 Site Security

A3.1.1 Non Operating Sites

Mobil shall provide security fencing to ensure the demolition area is cordoned off to prevent unauthorised entry. The security fence shall be to a minimum of 1830mm high Cyclone wire mesh with steel posts to achieve a safe secure site.

It shall be the responsibility of the Contractor to maintain the integrity of the Principal's site security and make good any damage caused by demolition activities.

Access to the site shall be through openings capable of being closed to prevent access during non working periods.

It shall be the responsibility of the Contractor to control access to the Demolition Zone and ensure only authorised personnel enter.

Any entry to the site shall carry signage identifying the area as a demolition site with warning against unauthorised entry.

The Contractor shall maintain a written log to Mobil's satisfaction of all personnel who enter and exit the Demolition Zone.

The Demolition Zone shall be barricaded off to prevent accidental entry to the works area.

Any open excavations shall be barricaded to prevent accidental entry.

A3.1.2 Operating Sites

Not Applicable

A3.2 Site Safety Requirements

A3.2.1 Electrical Leads

Only electrical leads equipped with earth leakage devices and inspection tags shall be used on site. Electrical leads shall be kept clear of the ground at all times.

In the event a suspended lead obstructs access to a work area it shall be placed through a steel conduit on the ground.

Under no circumstances shall vehicles be driven over unprotected electrical leads.

A3.2.2 Rubbish

The Contractor is responsible for maintaining the site in a clean and safe condition.

During demolition the Contractor shall endeavour to remove all debris promptly.

Debris on site shall be mounded into tidy heaps in order to maintain clear access to the area keep the demolition zone as hazard free as possible.

A3.2.3 Signs

The Contractor shall install and maintain, as applicable to work scope, the following safety / warning signs on the site - similar to the following "W. H. Brady" designs.

Safety Helmet Area - On all access gates.

Danger - Demolition Site, Unauthorised Persons Keep Out - At entry to work area.

Danger - Keep Out No Access - on free standing frames or on barricades on all visible public approaches to Demolition Zone.

Emergency Contact Numbers - one per gate and one in the office and a minimum of 1000mm by 600mm in size detailing emergency contact numbers as per contractors safety management plan.

Other Signage - any other signage required under NZ regulatory requirements.

A3.2.4 Angle Grinders

The maximum size angle grinder allowed on Mobil sites is 7 inch and must be fitted with a double acting switch. . They shall only be used for grinding. Cutting with angle grinders is not allowed. Angle grinders must have all guards in place and current inspection and test tag attached.

During grinding all of the following Safety equipment is used at all times;

- Eye protection (full-face shield and glasses *or* goggles).
- Hearing protection (ear plugs or muffs).
- No loose fitting or flammable clothing is to be worn.
- *The use of welding shields alone is not permitted*

A3.2.5 PPE Requirements

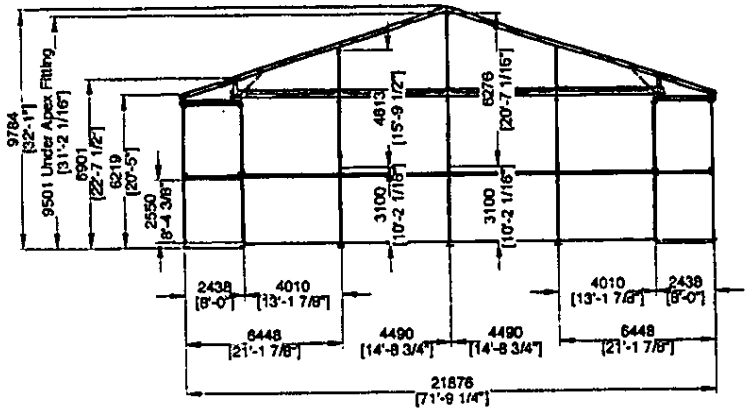
The contractor shall supply and maintain on Site the following Personal Protective Equipment for the exclusive use of visitors.

Personal Protection Equipment	Number required on Site
Hard hats	3
Eye Protection	3
High Visibility Vests	3
Ear Protection	3

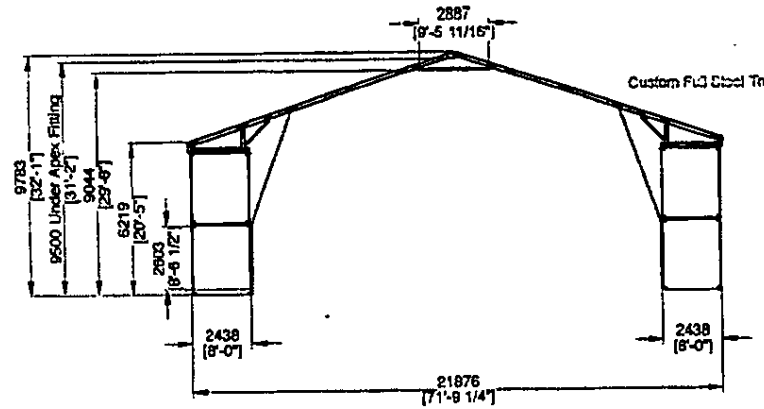
A3.3 Contact Numbers for Mobil Personnel / Contacts

Contact Position	Name	Work Hours	After Hours
Superintendent	John Stevenson	006173268 5368	0061408822 983
Site Manager	Murray Shepherd	09 302 4706	02 143 6704
SHE Representative	Murray Shepherd	09 302 4706	02 143 6704

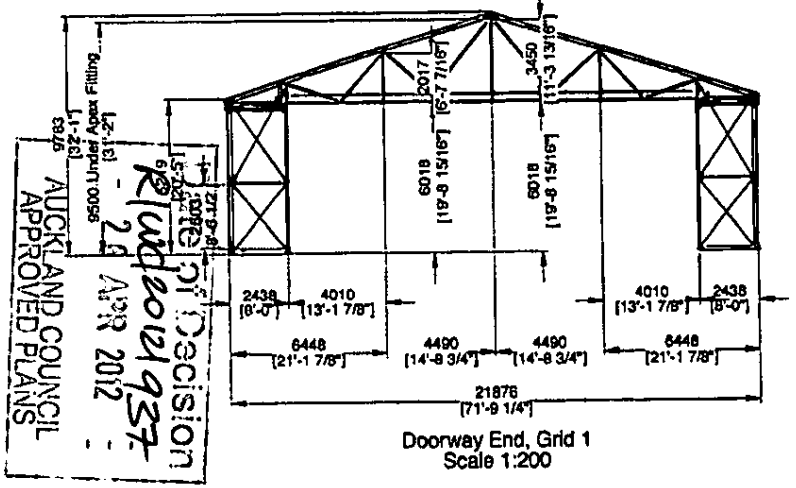
Appendix 1
R/LUC/2012/937
Plans to be Approved



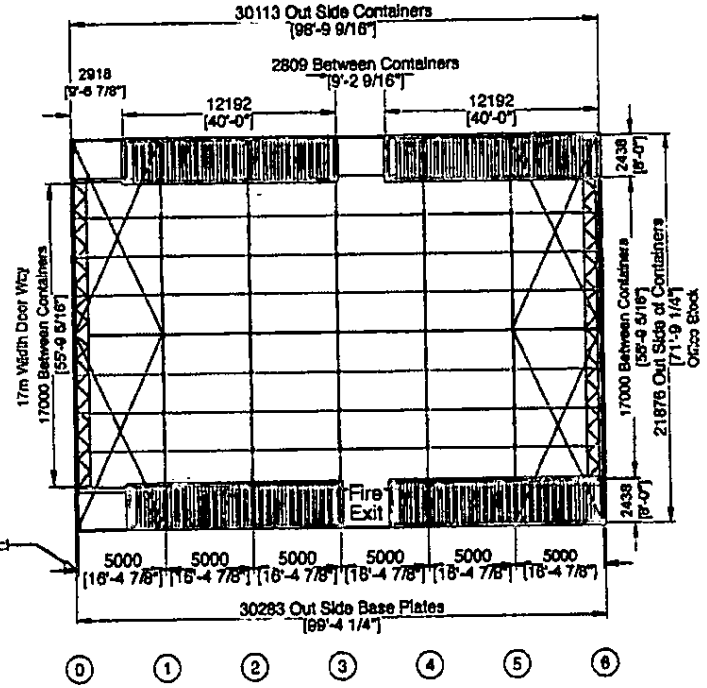
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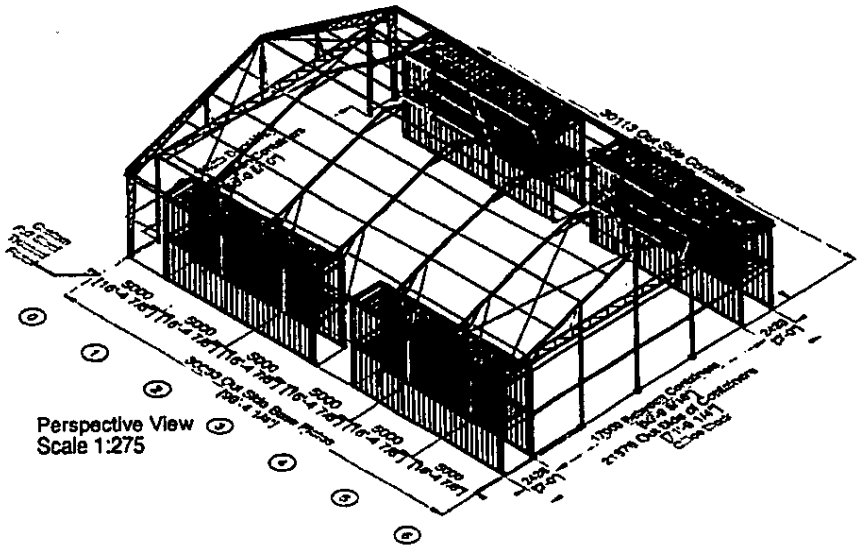
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Doorway End, Grid 1
Scale 1:200



Plan View
Scale 1:275



Perspective View
Scale 1:275

Baytex Custom AllSpan

AC72 Syndicate Team Base

Note:
All dimensions in mm.
All dimensions have tolerances of ± 0.5mm unless otherwise stated.
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A3 Orig | 3rd Angle Proj

Scale: 1:250 | Drawing Type:

Job Title:
Baytex Custom AllSpan
AC72 Syndicate Team Base

Drawing Title:
22m x 30m Container Complex Version F

Plan Views

Model No.:

Part No.:

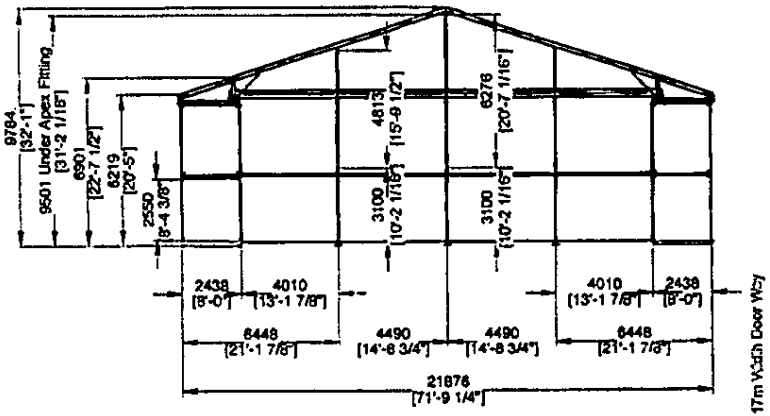
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Date: 15.02.12

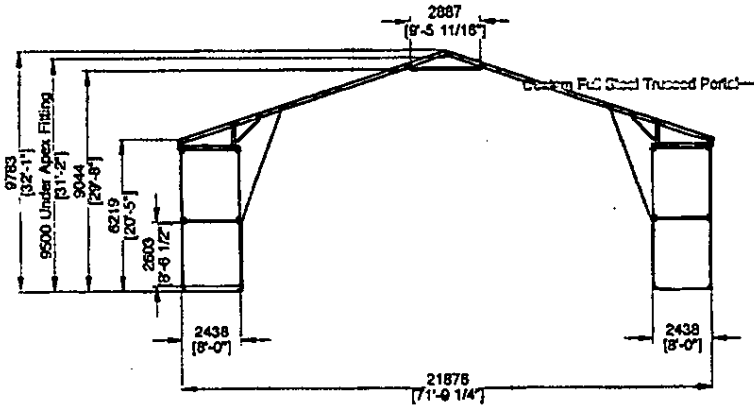
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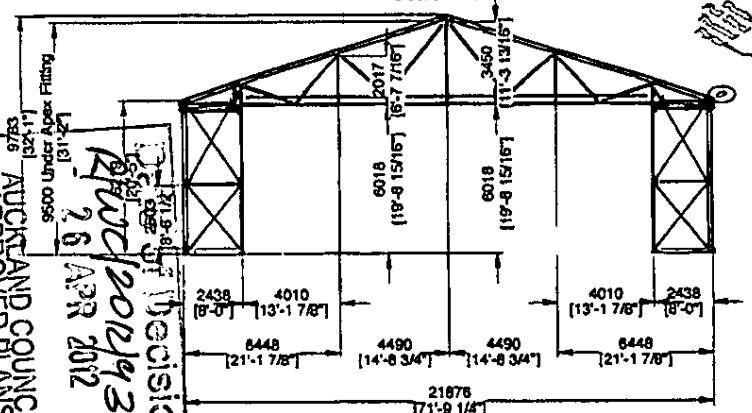
AUCKLAND COUNCIL
APPROVED PLANS
Resource Consent
LUC60291937
23 APR 2012



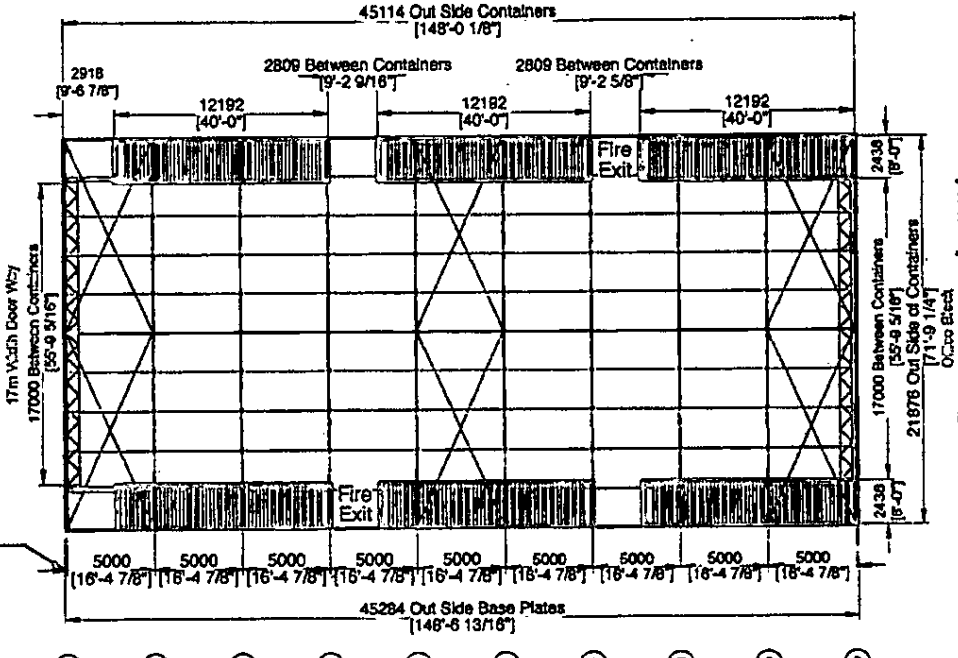
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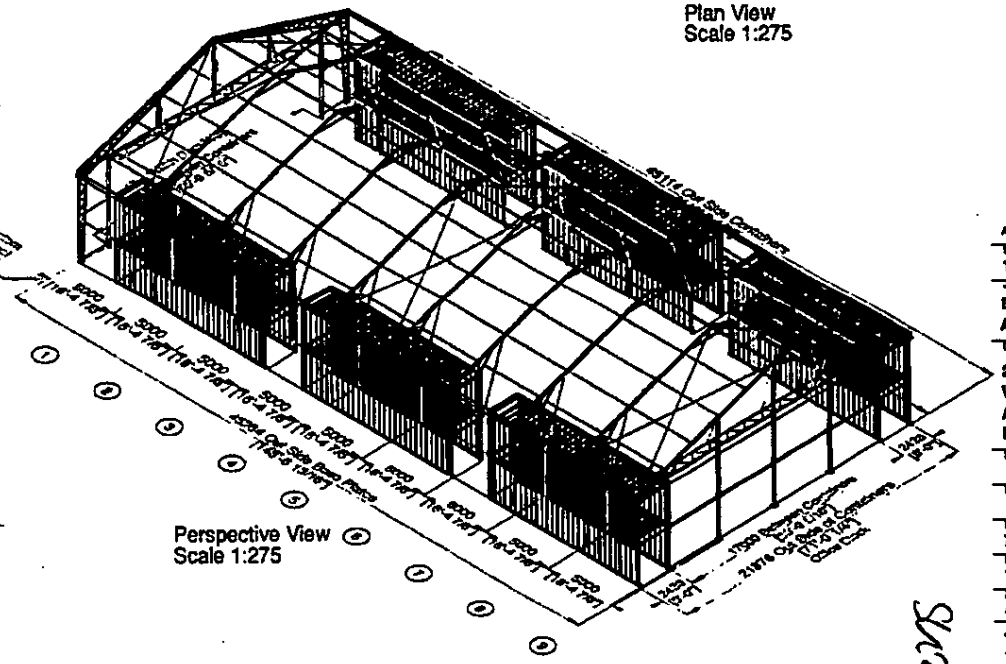
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Doorway End, Grid 1
Scale 1:200



Plan View
Scale 1:275



Perspective View
Scale 1:275

Baytex Custom AllSpan

AC72 Syndicate Team Base

Note:
All dimensions in mm.
All dimensions have tolerances of ± 0.5mm unless otherwise stated.
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Scale 1:250

Drawing Type

Baytex Custom AllSpan
AC72 Syndicate Team Base

Drawing Title
22m x 45m Container Complex
Version F
AC72 45m & 30m Base
Plan Views

Sheet No.

Part No.

Drawing No. 73.038.120

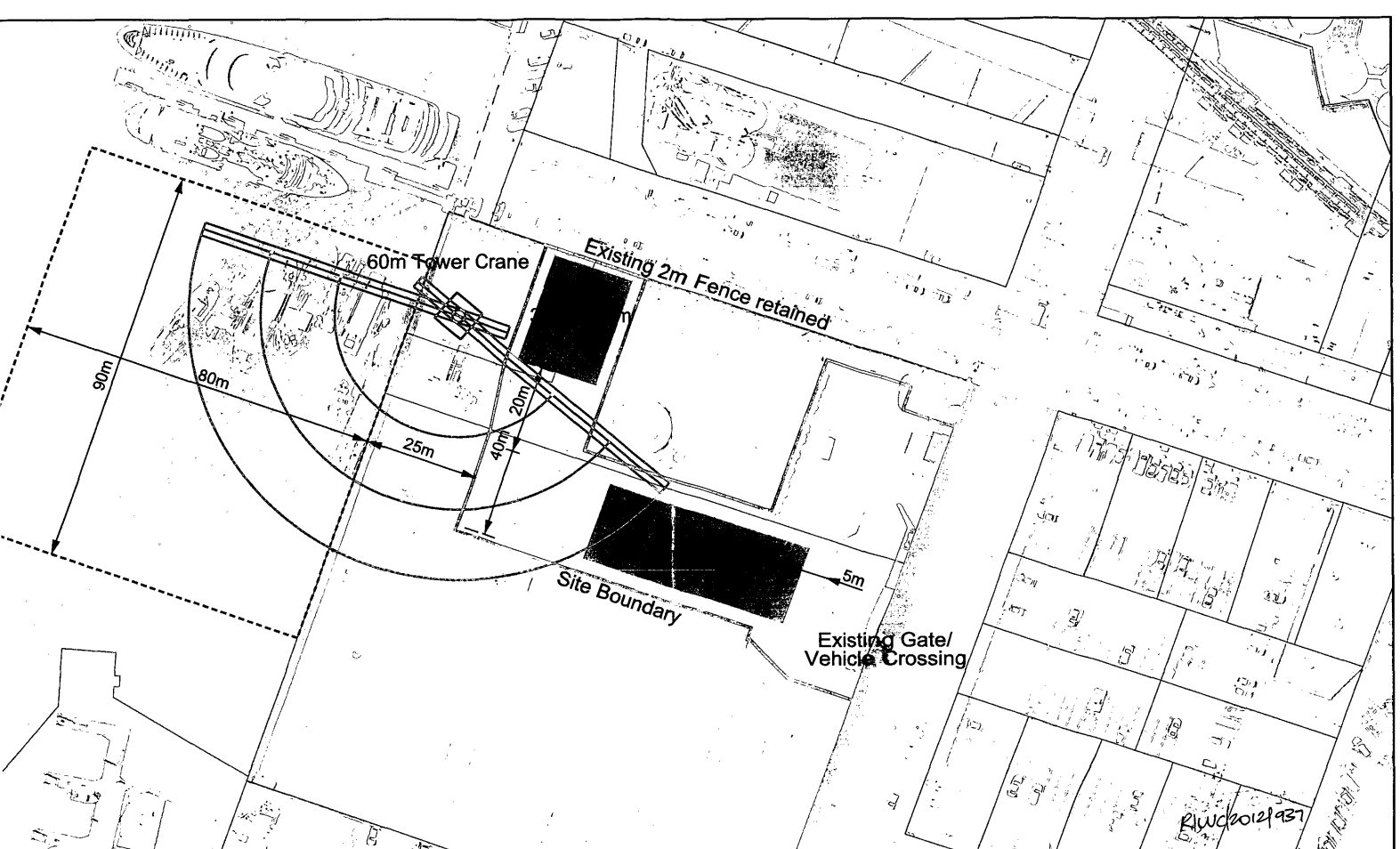
Revision No.

Date 15.02.12

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AUCKLAND COUNCIL
APPROVED PLANS
Resource consent decision
RMA/2012/24
26 APR 2012



RMC/2012/937

AUCKLAND COUNCIL
APPROVED PLANS

Luna Rossa Base Site

Version 3

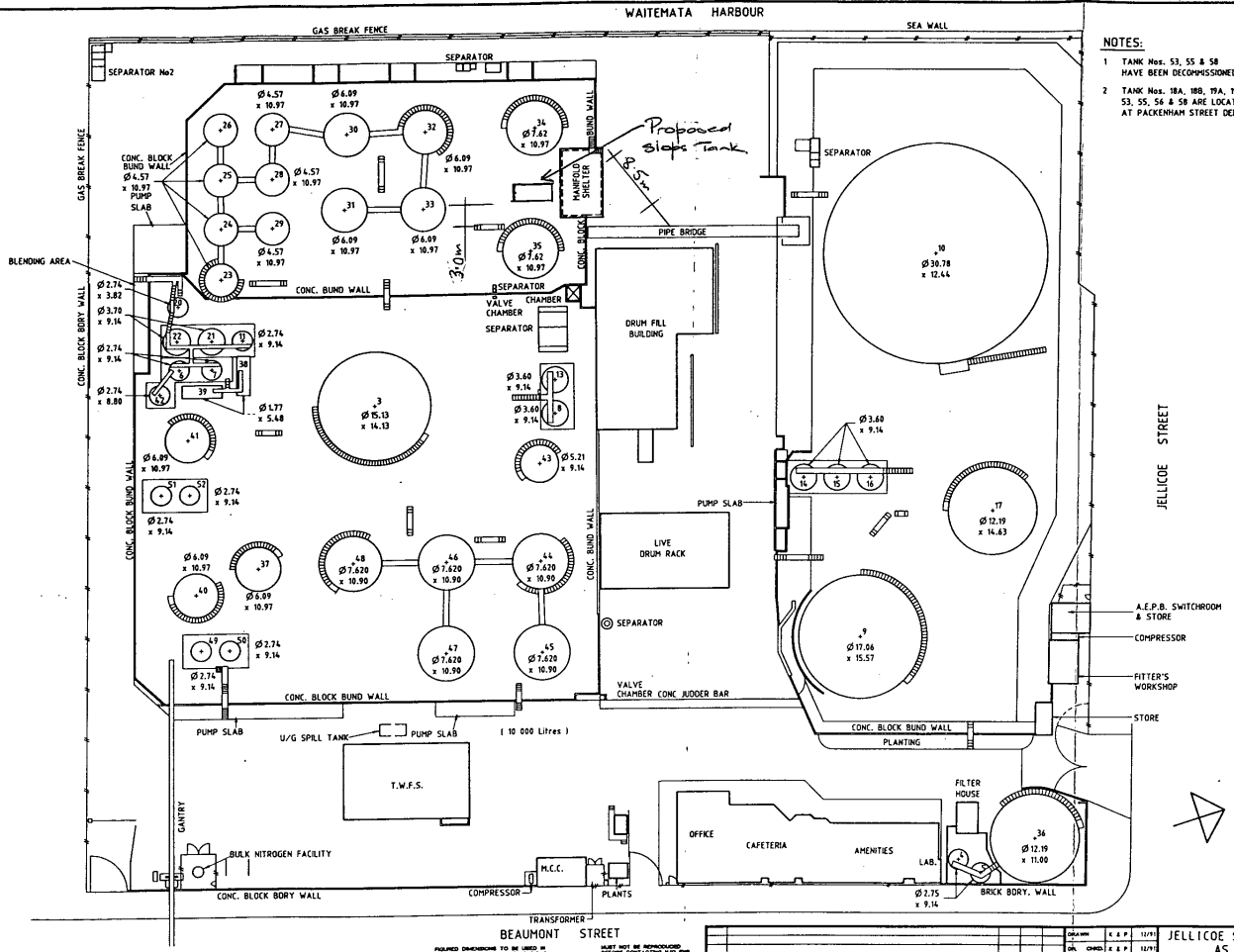
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2012 Orthophotography

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NOTES:

1 TANK Nos. 53, 55 & 58 HAVE BEEN DECOMMISSIONED

2 TANK Nos. 18A, 18B, 19A, 19B, 53, 55, 56 & 58 ARE LOCATED AT PACKENHAM STREET DEPOT

JELLICOE ST. TANKS

TANK No.	CAPACITY (Litres)	PRODUCT
3	2 435 000	AVGAS 100
4	52 800	STOCK 632
5	52 800	STOCK 632
6	51 300	IPA
7	51 300	IPA
8	87 400	P.M.S.-SLOPS
9	3 492 000	PETROPINE
10	5 825 000	EMPTY
11	51 000	PEGASOL 600
13	87 500	STOCK 2697
14	89 200	DELVAC 1330
15	89 200	MOBILOIL 30/40
16	89 200	SUPER XHP OIL
17	1 648 000	DRYCLEANER
20	22 600	BLENDER
21	70 800	LP.A.
22	86 100	N BUTANOL
23	178 800	P.C.E.
24	179 200	PEGASOL R100
25	179 200	ACETONE
26	172 100	N.B.A.
27	172 300	S.D.A. 3A
28	172 600	G 3440 SP
29	172 800	METHS 95WP
30	319 800	TOLUOL
31	306 800	M.E.K.
32	320 700	B.A.
33	319 200	B.A.
34	681 900	M.M.A.
35	450 500	V.A.M.
36	1 251 500	STOCK 632
37	316 600	WHITEREX 307
38	13 600	AVGAS SLOPS
39	13 600	STOCK 5601
40	303 600	PEGASOL R150
41	305 000	WHITEREX 334
42	48 700	SOLV BLEND 64T
43	201 700	M.I.B.K.
44	466 400	PEGASOL AA
45	466 900	PEGASOL AA
46	467 600	XYLOL
47	467 800	XYLOL
48	465 500	KEROSINE
49	50 000	DIESEL
50	50 000	METHANOL
51	50 000	STOCK 5613
52	50 000	JET A1

PACKENHAM ST. TANKS

TANK No.	CAPACITY	PRODUCT
18A	33 000	MOBILGARD 324
18B	20 600	DELVAC 1310
19A	32 500	DELVAC SUPER 1
19B	20 600	20/50
53	3 533 000	DECOMMISSIONED
55	2 672 000	DECOMMISSIONED
56	2 296 000	A.D.O.
58	467 000	DECOMMISSIONED

FIGURED DIMENSIONS TO BE USED IN PREFERENCE TO SCALED DIMENSIONS

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON THE JOB

MUST NOT BE REPRODUCED BEFORE CONTACTING M/O CML FOR LATEST ISSUE

DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE

ISSUE	ALTERATIONS	DRAWN	DATE	APPD
2	REDRAWN & UPDATED		12/93	

DRAWN K & P 12/93
CHKD K & P 12/93
ENG. APPD.
APPROVED
SCALE 1:250

JELLICOE STREET PLANT AS BUILT

TANK & PRODUCT STORAGE DETAILS

Mobil

DRAWING No. K16253 P107-100/03

ISSUE 2

THIS DRAWING WAS PRODUCED BY KERSJAKE AND PARTNERS. DRAWING REFERENCES ARE W22727 DWG. No. M107-695 AB3

AUCKLAND *CITY*

Licence No. 2185

DANGEROUS GOODS LICENCE
DANGEROUS GOODS ACT 1974

This licence authorises the holder to store dangerous goods in quantities and containers not exceeding those scheduled hereunder and only under any conditions set out overleaf, or otherwise imposed by the Licensing Authority.

Licensee:	MOBIL OIL NZ LTD. P.O. BOX 1709 AUCKLAND			
Location:	164-168 BEAUMONT STREET			
Class 2 Gases	**Class 2(a)i**	**Class 2(a)ii**	**Class 2(b)**	**Class 2(c)**
	Class 2(d)	**Class 2(e)**	**Class 2(f)**	**Class 2(g)**

Class 3a Flammable Liquids (litres)	**Underground Tanks**	**Aboveground Tanks**	**Mobile Tanks**
		11,131,600	
	Containers over 60L	**Containers below 60L**	**Workroom Containers**
	600,000	15,000	72,000
Class 3b Flammable Liquids (Litres)	**Underground Tanks**	**Aboveground Tanks**	**Mobile Tanks**
		10,500,205	
	Containers over 60L	**Containers below 60L**	**Workroom Containers**
	250,000	10,000	25,000
Class 3c Flammable Liquids (Litres)	**Underground Tanks**	**Aboveground Tanks**	**Mobile Tanks**
		1,961,335	
	Containers over 60L	**Containers below 60L**	**Workroom Containers**
	25,000	5,000	

Fuel Pumps		**Total U/G Tank**		**Oilburners**		
Class 4 Flammable Solids	**4.1a**		**4.2a**		**4.3a**	
	4.1b		**4.2b**		**4.3b**	
	4.1c				**4.3c**	
Class 5a Oxidisers			**Class 5b Oxidisers**			

Unless sooner surrendered or revoked, this licence shall remain in force until ***31 March 1996****, and may be renewed annually thereafter.*

Signed on behalf of Auckland City Council ..... *Dated 10/7/95*

Inspector of Dangerous Goods

City Environments, Licensing Section, 386 Manukau Road, Epsom, Private Bag 92814 Penrose
Telephone (09) 623-4303 Facsimile (09) 623-6999

AUCKLAND *CITY*

Licence No. 2185

DANGEROUS GOODS LICENCE
DANGEROUS GOODS ACT 1974

This licence authorises the holder to store dangerous goods in quantities and containers not exceeding those scheduled hereunder and only under any conditions set out overleaf, or otherwise imposed by the Licensing Authority.

Licensee:	MOBIL OIL NZ LTD. P.O. BOX 1709 AUCKLAND			
Location:	164-180 162 BEAUMONT STREET			
Class 2 Gases	**Class 2(a)i**	**Class 2(a)ii**	**Class 2(b)**	**Class 2(c)**
	M^3	M^3	M^3	M^3
	Class 2(d)	**Class 2(e)**	**Class 2(f)**	**Class 2(g)**
	Kg	Kg	L	Kg

Class 3a Flammable Liquids (litres)	**Underground Tanks**	**Aboveground Tanks**	**Mobile Tanks**
	L	10,055,039 L	L
	Containers over 60L	**Containers below 60L**	**Workroom Containers**
	600,000 L	15,000 L	72,000 L
Class 3b Flammable Liquids (Litres)	**Underground Tanks**	**Aboveground Tanks**	**Mobile Tanks**
	L	11,576,766 L	L
	Containers over 60L	**Containers below 60L**	**Workroom Containers**
	250,000 L	10,000 L	25,000 L
Class 3c Flammable Liquids (Litres)	**Underground Tanks**	**Aboveground Tanks**	**Mobile Tanks**
	L	1,961,335 L	L
	Containers over 60L	**Containers below 60L**	**Workroom Containers**
	25,000 L	5,000 L	L

Fuel Pumps		**Total U/G Tank**		**Oilburners**		
Class 4 Flammable Solids	**4.1a**	kg	**4.2a**	kg	**4.3a**	kg
	4.1b	kg	**4.2b**	kg	**4.3b**	kg
	4.1c	kg			**4.3c**	kg
Class 5a Oxidisers		kg	**Class 5b Oxidisers**			kg

*Unless sooner surrendered or revoked, this licence shall remain in force until **31 March 1995**, and may be renewed annually thereafter.*

Signed on behalf of Auckland City Council ..... *Dated* **18/3/94**

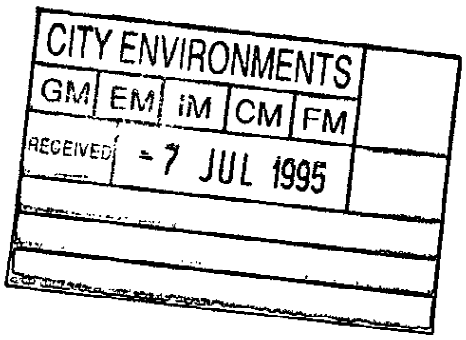
Inspector of Dangerous Goods

City Environments, Licensing Section, 386 Manukau Road, Epsom, Private Bag 92814 Penrose
Telephone (09) 623-4303 Facsimile (09) 623-6999

Mobil Oil New Zealand Limited

CNR BEAUMONT & JELLICOE STS
P.O. BOX 1709 AUCKLAND
TELEPHONE (09) 302-4700

6 July 1995



Mr J Heaton
City Environments
Private Bag 26701
AUCKLAND

Dear Sir

DANGEROUS GOODS LICENCE 2185

We are required to order some of our products in larger parcel sizes and to accommodate this I request that our present permit be altered as follows:-

	PRESENT	PROPOSED
Class 3A Aboveground Tanks	10,055,039	11,131,600
Class 3B Aboveground Tanks	11,576,766	10,500,205

All other quantities and classes to remain as per the present licence.

Should you have any queries please contact me.

Yours faithfully

G C Smith
PLANT MANAGER

GCS:jh

10.7.95

THIS APPLICATION MUST BE ACCOMPANIED BY PLANS & ELEVATIONS IN DUPLICATE, AS REQUIRED.

JN: 325769

AUCKLAND CITY
Dangerous Goods Permit
(Not valid until signed by Dangerous Goods Inspector)

Address of Property: BP Oil NZ Ltd Hamer St AK Lot No.: DP No.:

Owner of Land: Address: 164 Beaumont St

Owner of Building: Address:

Name of Occupier: Address:

Name of Builder: Address:

Name of Contractor: Address:

Name of Gasfitter: Reg'n No: Address:

Present Use of Premises & Occupier:

Proposed Use of Premises & Occupier:

DESCRIPTION OF PROPOSED WORK *(see below: tick appropriate box)*

OFFICE USE

Install Underground/Aboveground Tank ☐ D.G. Class Capacity* No.

Install Dispensing Pump ☐ D.G. Class Number

Remove Underground/Aboveground Tank ☐ D.G. Class Capacity* No.

Remove Dispensing Pump ☐ D.G. Class Number

Repair Underground/Aboveground Tank ☐ Description of Work

D.G. Class Capacity* No.

Refix Dispensing Pump ☐ D.G. Class Number

Pipework Connection/Disconnection ☐ Description of Work

D.G. Class

Bulk Pipeline Installation/Repair ☐ Description of Work

No. tests required D.G. Class

Bulk Tank Installation/Repair ☑ Description of Work 4,000 TONI Tank FB20

D.G. Class Capacity* No.

Oilburning Equipment Installation/Repair ☐ Description of Work

CNG Installation: Cascades ☐ Dispensing Pump ☐ Cascade Capacity No. Pumps

CNG/LPG Repair or Addition: Pump/Pipework/Tank/Cascade/Equipment ☐ D.G. Class

Description of Work

Other Gas Installation/Repair ☐ Description of Work

D.G. Class No. Cylinders

Other Work: Description

D.G. Class

CONDITION OF PERMIT ISSUE

TOTAL 89.00

Approved to Issue Date 1.2.95

NOTES: 1. This application does not authorise work to be done until approved by a Dangerous Goods Inspector.

2. * Capacity of LPG tanks must be given as 'actual' water capacity.

3. All the preceeding work requires notifiable inspections.

OFFICE USE ONLY

Refer B.P. No. Dated Receipt No. Permit No. Date

INSPECTION FIELD SHEET

DATE	TYPE OF INSPECTION	REMARKS
1-2-85	Tank Test & Soap Test.	OK.

Completed: 1-2-85 Date:

Signed:

Appendix F: Council Contamination Enquiry

Lucy Hine

From:	Fiona Rudsits <fiona.rudsits@aucklandcouncil.govt.nz> on behalf of RECContamination <reccontamination@aklc.govt.nz>
Sent:	Tuesday, 19 June 2018 4:04 p.m.
To:	Melody Robyns
Subject:	RE: contamination information relating to 164-188 Beaumont Street Auckland Central

Hi Melody,

This email is in response to your recent enquiry requesting available site contamination information that was held within the Environmental Health Unit of the Licensing and Compliance Services Department (LCS).

Council's regulatory records indicate that there could be historic, and/or current, land use activities on or adjacent to this site that falls within the Hazardous Activities and Industries List (HAIL) published by the Ministry for the Environment.

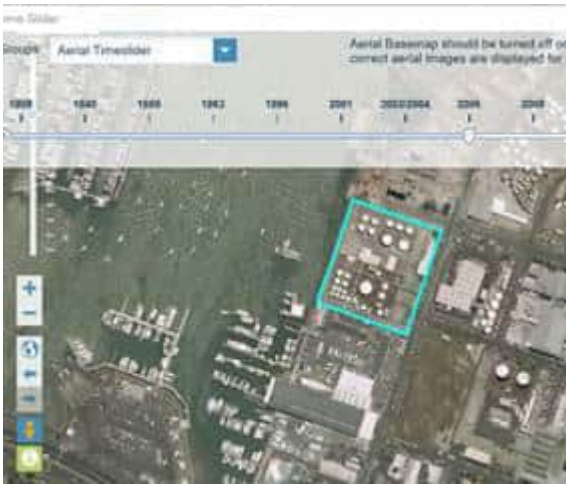
Our records indicate past activities including a Bulk Hydrocarbon Product Storage Facility from 1940 until at least 2006 (as shown below). There is also the potential for the site to be on reclaimed land classified as Filled/Weak Ground in our GIS data base.



1940



2001


2006

Please note that only council's soil contamination records within the LCS department and GIS map have been checked. There may be other soil contamination information held within:

1. Contaminated Site Enquiry team: ContaminatedSites@aucklandcouncil.govt.nz

2. Property File for viewing reports or all relevant information relating to the property -Requested from the local service centre, by phone, 09 3010101.

Kind Regards,

Fiona Rudsits | Specialist – Contamination, Air & Noise
Specialist Unit | Resource Consents Department
Mob (021) 195 9969 | Email: fiona.rudsits@aucklandcouncil.govt.nz
Auckland Council, Level 2 (East), 35 Graham Street, Private Bag 92 300, Auckland 1142
Visit our website: www.aucklandcouncil.govt.nz

From: Melody Robyns <MRobyns@tonkintaylor.co.nz>
Sent: Friday, 15 June 2018 4:11 PM
To: RECContamination <reccontamination@aklc.govt.nz>
Subject: contamination information relating to 164-188 Beaumont Street Auckland Central

Hi there,

Can I please request all contamination files/information relating to 164-188 Beaumont Street Auckland Central Auckland (legal descriptions: Lot 2 DP 135460, Lot 3 DP 135460, Lot 4 DP 135460).

Cheers,

Melody

Ngā Mihi | Kind regards,

Melody Robyns | Contaminated Land Consultant
Tonkin + Taylor - *Exceptional thinking together*
Level 4, 2 Hunter Street, Wellington 6011, PO Box 2083, Wellington
T +64 4 806 4967 M +64 275 530 546

Tonkin+Taylor

To send me large files you can use the following link:

https://transfer.tonkinandtaylorgroup.com/filedrop/mrobyns@tonkintaylor.co.nz

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CAUTION: This email message and any attachments contain information that may be confidential and may be LEGALLY PRIVILEGED. If you are not the intended recipient, any use, disclosure or copying of this message or attachments is strictly prohibited. If you have received this email message in error please notify us immediately and erase all copies of the message and attachments. We do not accept responsibility for any viruses or similar carried with our email, or any effects our email may have on the recipient computer system or network. Any views expressed in this email may be those of the individual sender and may not necessarily reflect the views of Council.

20 June 2018

Tonkin & Taylor Limited
PO Box 5271
Wellesley Street
Auckland 1141

Attention: M Robyns

Dear M Robyns

Site Contamination Enquiry – *164-188 Beaumont Street, Auckland Central*

This letter is in response to your enquiry requesting available site contamination information for the above site. The following details are based on information available from the former Auckland Regional Council records system and information currently held by the Auckland Council Natural Resources and Specialist Input Unit. The details provided below exclude any property information held by the former district/city councils.

The general catchment file and site visit file for the catchment (5-42 -SV) were not searched. These files contain pollution incidents where the source of pollution was not traced to a particular site, site visits where no follow-up correspondence was required and some information from archived files.

If the above site is coastal or beside a river, it is possible that historic, unconsented reclamation may have occurred. The Auckland Council Specialists Unit Coastal Team may be able to provide further information.

The records reviewed as part of this Site Contamination Enquiry search do not identify individual horticultural sites in the region. However, there is a possibility that horticultural activities may have occurred at the site. The local Auckland Council customer service centre, specific to the area of the site may be able to provide relevant information where former horticultural sites have been mapped.

If you are concerned that a historic land use (such as filling) may have caused the underlying soils to become contaminated, it is recommended that you obtain an independent environmental assessment of the site. Staff from the Auckland Council Earthworks and Contaminated Land Team can provide advice on the results of any evaluation in terms of site remediation and/or potential consent requirements.

The former Auckland Regional Council and current databases were searched for records of closed landfills, bores, air discharge, industrial and trade process consents, contaminated site discharge consents, and environmental assessments within approximately 200 metres of the site. Relevant details of the pollution incidents and identified consents are appended to this letter as an excel spreadsheet. **Please refer to the column labelled 'Property Address' and Incident/Consent/Bored ID (where applicable) on the attached spreadsheet to aid in identifying corresponding data on the map.**

The details provided are in accordance with the obligation to make information publicly available upon request. While the Auckland Council has carried out the search using its best practical endeavours, it does not warrant its completeness or accuracy and disclaims any responsibility or liability in respect of the information. If you or any other person wishes to act or to rely on this information, or make any financial commitment based upon it, it is recommended that you seek appropriate technical and/or professional advice.

In addition, further site specific pollution incidents may be held at area office below. It is recommended that you contact the local customer service centre of the Auckland Council, specific to the site being investigated: 35 Graham Street, Auckland Central as they also may hold files with further relevant information.

I trust that this answers your query. If you wish to discuss the matter further, please contact Andrew Kalbarczyk on 301 0101. Should you wish to request any of the files listed above for viewing, please contact the Auckland Council Call Centre on 301 0101 and note you are requesting former Auckland Regional Council records (the records department requires three working days' notice to ensure files will be available).

Please note: the Auckland Council cost recovers officer's time for all site enquiries. A basic enquiry takes approximately 1 - 2.5 hours to search the files and databases in which information is held. As such an invoice for the time involved in this enquiry will follow shortly.

Yours sincerely



Jared Osman
Team Leader – Contaminated Air, Noise
Specialist Unit | Resource Consents

Please refer to the column labelled 'Property Address' and Incident/Consent/Bored ID (where applicable) on the attached spreadsheet to aid in identifying corresponding data on the map.



Table of applications

APPLICATION_NUMBER	37874	35948	35949	36238	36285	36478	23435	28508
FILE_REFERENCE	C512-12-4619	20695	20696	15872	20855	17017	14468	17017
ACTIVITY	Bore	Contaminated Site Discharge	Contaminated Site Discharge	Contaminated Site Discharge	Contaminated Site Discharge	Contaminated Site Discharge	Contaminated Site Discharge	Contaminated Site Discharge
APPLICANT	Sea + City Projects Limited c/- AWDAL	Mobil Oil NZ Limited F&L CS Contract Team	Mobil Oil NZ Limited F&L CS Contract Team	Z Energy Limited	***USE 7711***Shell Oil NZ Limited Ross Young			BP Oil New Zealand Limited Attn: Asset Administrator
APPLICATION_STATUS	Withdrawn	No Longer Required	No Longer Required	Withdrawn	Withdrawn	No Longer Required	Withdrawn	No Longer Required
LODGED_DATE	20100330			20080901	20080912		19991118	
PROCESSING_OFFICER	Reginald Samuel	_Johanna Taylor	_Johanna Taylor	Andrew Kalbarczyk	Andrew Kalbarczyk	Rebecca Cleghorn	_Ray Scoble	Rebecca Cleghorn
PURPOSE	To authorise the construction of 4 groundwater monitoring wells. 3 of the wells will be located in Lots 4, 5 and 6 DP 74831, the fourth well will be installed in the Jellicoe Street road reserve outside the property of 188 Beaumont Street. The bores are							
WORKS_DESCRIPTION	The construction of four 50mm diameter bores to an approximate depth of 6m with casing depth of 6m. Installation of grade PNIZ PVC casing material to depth to top of screen 1.5m and depth to bottom of screen 6m. Proposed grouting length of 1m (bentonite							
EASTING	1756434	1756430	1756540	1756500	1756500	1756500	1756300	1756500
NORTHING	5921438	5921340	5921150	5921200	5921200	5921320	5921600	5921320
ACTIVITY_ID	23595	20943	20944	20053	20973	20103	20025	20103
ACTIVITY_STATUS	Proposed			Occurring				
ACTIVITY_DESCRIPTION	To authorise the construction of 4 groundwater monitoring wells. 3 of the wells will be located in Lots 4, 5 and 6 DP 74831, the fourth well will be installed in the Jellicoe Street road reserve outside the property of 188 Beaumont Street. The bores are	prelodgement set up for wbs - file made up and with PO	prelodgement set up for wbs - file made up and with PO	This new appl. 0/9/08 - long term discharge of contaminants from soil and groundwater. Orig appl 25850 20-Sep-2001 for remediation activities - surrendered 30-Aug-2007	Remediation of Shell Block 3Long term dishcharge on appl 36238	DO NOT USE till advised by RebeccaC/JohTResetting up new prelodgement no. as a CoC was lodged and not rejected and asked to apply for a consent. 31/10/08setting up wbs for pre-lodgmentCnr Beaumont and Jellicoe		DO NOT USE till advised by RebeccaC/JohTResetting up new prelodgement no. as a CoC was lodged and not rejected and asked to apply for a consent. 31/10/08setting up wbs for pre-lodgmentCnr Beaumont and Jellicoe
SITE_NAME	Sea City Projects Limited (2 Hamer & Jellicoe St)	Mobil Beaumont St	Mobil - Pakenham St West	Shell Block 3	Shell Block 3	BP Auckland Production Centre	Vos & Brij Shipyard Ltd	BP Auckland Production Centre
SITE_DESCRIPTION		In rates 164 Beaumont St on map covers the 180-188 Beaumont St & 96 Jellicoe site	141-171 Pakenham St West	Corner Beaumont & Madden St, Auckland City		68-90 Jellicoe St, Auckland	38-56 Hamer Street Freemans Bay	68-90 Jellicoe St, Auckland
PROPERTY_ADDRESS	65 Jellicoe St Auckland Central Auckland Central	164 Beaumont St Auckland Central Auckland Central	Pakenham Street West Auckland Central Auckland C	143 Beaumont St Auckland Central Auckland Central	143 Beaumont St Auckland Central Auckland Central	37 Madden St Auckland Central Auckland Central	38-56 Hamer Street Auckland City	37 Madden St Auckland Central Auckland Central
LOC_TYP	Point	Point	Point	Point	Point	Point	Area	Point

Table of bores

CONSENT_NUMBER	FILE_REFERENCE	CONSENT_HOLDER	BORE_ID	GRANTED_DATE	EXPIRY_DATE	CONSENT_STATUS	PROCESSING_OFFICER	PURPOSE	WORKS_DESCRIPTION	EASTING	NORTHING	ACTIVITY_STATUS	BORE_USE	ACTIVITY_DESCRIPTION	SITE_NAME	SITE_DESCRIPTION	MAIN_AQUIFER	AQUIFER	TOTAL_DEPTH
28801	C512-12-3239*	Auckland Regional Council	22041	20040129	20050129	Expired	_Amy Boulton	To authorise the construction of up to 8 bores for groundwater monitoring purposes.	Construction of up to 8 bores to a depth of approximately 5m and diameter of 50mm.	1756582	5921336	Proposed	Observation / Piezo	To authorise the construction of up to 8 bores for groundwater monitoring purposes		22/32 Jellicoe St., Auckland (Ports of Auckland)			
21627	C512-12-2226	Maunsell Limited	20327	19980721	19990709	Expired	_Gillian Crowcroft	Authorise the construction of a bore for groundwater level and/or chemistry monitoring.	Construction of a 50mm diameter bore to a depth of approximately 6m. Installation of PVC casing to 0.5m depth and PVC screen from 0.5-6m depth.	1756480	5921520	Drilled	Observation / Piezo	Water monitoring bore		14 Hamer St, City	Other		6
20656	C512-12-2086*	AECOM Consulting Services (NZ) Ltd	20063	19971202	19981203	Expired	_Gillian Crowcroft	Authorise the construction of bores for groundwater level and/or chemistry monitoring.	Construction of four (4) 100mm diameter bores to a depth of approximately 4m. Installation of PVC casing to 4m depth and PVC screen from 1.5-4m or as required. Permit modified 20-Aug-1998 to allow the drilling of a futher seven monitoring bores.	1756500	5921200	Drilled	Observation / Piezo			Shell block 3, corner of Beamont and Madden St, Auckland	Sand		4.2
52170	C512-12-4411*		23356	20090417		Assessment Completed	Reginald Samuel	To authorise the construction of nie bores for contaminated site investigation.	The construction of nine 50mm diameter bores to a maximum depth of 6m. Installation of casing to an approximate depth of 6m.	1756480	5921255	Proposed	Water Quality	To authorise the construction of nie bores for contaminated site investigation.	Shell NZ Ltd				
52533	C512-12-4763		27810	20101217		Assessment Completed	Reginald Samuel	To authorise 8 bores to conduct consent compliance monitoring and contaminated site investigation.	The construction of a 50mm diameter bore to a maximum depth of 5m.	1756380	5921425	Proposed	Water Quality	To authorise 8 bores to conduct consent compliance monitoring and contaminated site investigation.	Auckland Waterfront Development				
52391	C512-12-4619		23595	20100407		Assessment Completed	Reginald Samuel	To authorise the construction of 4 groundwater monitoring wells. 3 of the wells will be located in Lots 4, 5 and 6 DP 74831, the fourth well will be installed in the Jellicoe Street road reserve outside the property of 188 Beaumont Street. The bores are	The construction of four 50mm diameter bores to a maximum depth of 6m. Installation of PVC casing material to an approximate depth of 6m.	1756434	5921438	Proposed	Other	To authorise the construction of 4 groundwater monitoring wells. 3 of the wells will be located in Lots 4, 5 and 6 DP 74831, the fourth well will be installed in the Jellicoe Street road reserve outside the property of 188 Beaumont Street. The bores are	Sea City Projects Limited (2 Hamer & Jellicoe St)				
52400	C512-12-4630		23606	20100415		Assessment Completed	Reginald Samuel	To authorise construction of a bore for groundwater investigation and contaminated site investigation.	The construction of four 50mm diameter bores to a maximum depth of 6m. Installation of PVC casing material to an approximate depth of 6m.	1756634	5921374	Proposed	Observation / Piezo	To authorise construction of a bore for groundwater investigation and contaminated site investigation.	Jellicoe Street, Westhaven				
0			29711							1756561	5921148	Drilled	Geotechnical		28 Madden Street, Auckland Central		Waitemata	North Shore Waitemata	12.8
0			29713							1756531	5921143	Drilled	Geotechnical		28 Madden Street, Auckland Central		Waitemata	Auckland Isthmus Waitemata	15.14
0			29715							1756516	5921134	Drilled	Geotechnical		141 Pakenham St West, Auckland Central		Alluvium		4.95
53159	C512-12-5464*		29421	20141014		Assessment Completed	Reginald Samuel	The construction of three bores for geological, geotechnical and groundwater investigation purposes.	The construction of three 120mm diameter bores to an approximate depth of 5-6m. Installation of casing material to an approximate depth of 5-6m.	1756508	5921125	Drilled	Geological	The construction of three bores for geological, geotechnical and groundwater investigation purposes.	Tonkin & Taylor Ltd on behalf of Waterfront Auck		Waitemata	Auckland Isthmus Waitemata	22.57
22954	C512-12-2444*	AECOM Consulting Services (NZ) Ltd	20946	19990812	20000812	Expired	_Gillian Crowcroft	Authorise the construction of bores for groundwater level and/or chemistry monitoring.	Construction of two 100mm diameter bores to a depth of approximately 4m. Installation of PVC casing to 2m depth and PVC screen from 2-4m depth.	1756350	5921250	xpired And Never Drille	Observation / Piezo	Groundwater monitoring	Orams Marine	150-160 Beaumont St, Westhaven			
23092	C512-12-2463*	Pattle Delamore Partners Limited	21024	19990924	20000925	Expired	_Gillian Crowcroft	Authorise the construction of bores for groundwater level and/or chemistry monitoring.	Construction of up to 34 100mm diameter bores to a depth of 4.5m. Installation of PVC casing to 1m depth and PVC screen from 1-4.5m depth.	1756530	5921140	Drilled	Observation / Piezo	37 bores of identical construction.	Mobil Oil site	171 Pakenham St West , Auckland	Other		4.5
23171	C512-12-2474*	Pattle Delamore Partners Limited	21044	19991011	20001011	Expired	_Gillian Crowcroft	Authorise the construction of bores for groundwater level and/or chemistry monitoring.	Construction of up to thirty nine 50mm diameter bores to a depth of 4.5m. Installation of PVC casing to 1.5m depth and PVC screen from 1.5-4.5m depth.	1756380	5921340	Drilled	Observation / Piezo	44 Bores all of identical construction.	Caltex Tank Farm	180 - 188 Beaumont St			4.5
24504	C512-12-2637*	BP Oil New Zealand Limited Attn: Asset Administrator	21290	20001019	20011019	Expired	_Gillian Crowcroft	Authorise the construction of seven (7) bores for groundwater quality and/or level monitoring.	Construction of seven (7) 50mm diameter bores to a depth of approximately 5m. Installation of PVC casing to a depth of approximately 1m and PVC screens from 1m to 5m.	1756500	5921320	Proposed	Observation / Piezo	Groundwater quality/level monitoring	BP Auckland Production Centre	Site bordered by Jellicoe, Beaumont, Madden & Daldy St	Other		
24573	C512-12-2651	Mobil Oil NZ Ltd DO NOT USE - USE CUST. 3745	21305	20001113	20011113	Expired	_Gillian Crowcroft	Authorise the construction of three bores for environmental monitoring.	Construction of three 50mm diameter bores to a depth of approximately 4.5m. Installation of PVC casing to a depth of approximately 4.5m.	1756530	5921140	Drilled	Observation / Piezo	3 bores	Mobil Pakenham Street	141-171 Pakenham Street, Auckland	Other		4.5
26321	C512-12-2841*	Z Energy Limited	21602	20020121	20030121	Expired	Roger Bannister	Authorise the construction of up to twenty four (24) bores for site remediation purposes.	Construction of up to twenty four (24) 50mm diameter bores to a depth of approximately 4.5m. Installation of UPVC casing to a depth of approximately 1.5m.	1756500	5921200	Proposed		24 bores to take100cmpd for site remediation	Shell Oil	Packenham/Beaumont/Madden Streets	Other		
37874	C512-12-4619	Sea + City Projects Limited c/- AWDAL	23595	20100428		Withdrawn	Reginald Samuel	To authorise the construction of 4 groundwater monitoring wells. 3 of the wells will be located in Lots 4, 5 and 6 DP 74831, the fourth well will be installed in the Jellicoe Street road reserve outside the property of 188 Beaumont Street. The bores are	The construction of four 50mm diameter bores to an approximate depth of 6m with casing depth of 6m. Installation of grade PNIZ PVC casing material to depth to top of screen 1.5m and depth to bottom of screen 6m. Proposed grouting length of 1m (bentonite	1756434	5921438	Proposed	Other	To authorise the construction of 4 groundwater monitoring wells. 3 of the wells will be located in Lots 4, 5 and 6 DP 74831, the fourth well will be installed in the Jellicoe Street road reserve outside the property of 188 Beaumont Street. The bores are	Sea City Projects Limited (2 Hamer & Jellicoe St)				
35134	C512-12-4123*	Mobil Oil NZ Limited F&L CS Contract Team	23035	20071119	20081114	Expired	Reginald Samuel	To authorise the construction of nine bores for groundwater quality monitoring.	The construction of nine 50mm diameter bores to an approximate depth of 6m. Installation of Grade D uPVC casing material to an approximate depth of 6m. Proposed grouting to 0.5m.	1756600	5921211	Proposed	Observation / Piezo	To authorise the construction of nine bores for groundwater quality monitoring.	Mobil Oil New Zealand				
35135	C512-12-4124*	Mobil Oil NZ Limited F&L CS Contract Team	23036	20071119	20081115	Expired	Reginald Samuel	To authorise the construction of eight bores for groundwater monitoring purposes.	The construction of nine 50mm diameter bores to an approximate depth of 6m. Installation of Grade D uPVC casing material to an approximate depth of 6m. Proposed grouting to 0.5m.	1756360	5921320	Proposed	Observation / Piezo	To authorise the construction of eight bores for groundwater monitoring purposes.	Mobil Oil NZ ltd				
35152	C512-12-4130*	BP Oil New Zealand Limited *use 567*	23042	20071122	20081121	Expired	Reginald Samuel	To authorise the construction of three bores for groundwater investigation.	The construction of a three 100mm diameter bores to an approximate depth of 3.0m. Installation of uPVC casing material to an approximate depth of 3.0m. Proposed grouting to 0.2m.	1756500	5921370	Proposed	Observation / Piezo	To authorise the construction of three bores for groundwater investigation.	BP Oil New Zealand				
34731	C512-12-4053*	Akld Regional Hldgs c/- *use 22197 Sea and City Projects Limited	22955	20070823	20080826	Expired	Reginald Samuel	To authorise the construction of twenty five bores for environmental monitoring.	A construction of twenty five 50mm diameter bores to an approximate depth of 4m. Installation of Class V PVC casing material to an approximate depth of 4m. Proposed grouting to 1m.	1756620	5921380	Proposed	Observation / Piezo	To authorise the construction of twenty five bores for environmental monitoring.	Beca Infrastructure Ltd	Jellicoe st & northeren Beaumont st Road Reserves			
34732	C512-12-4054*	Akld Regional Hldgs c/- *use 22197 Sea and City Projects Limited	22956	20070823	20080826	Expired	Reginald Samuel	To authorise the construction of fifteen bores for environmental monitoring.	A construction of fifteen 50mm diameter bores to an approximate depth of 4m. Installation of Class V PVC casing material to an approximate depth of 4m. Proposed grouting to 1m.	1756520	5921460	Proposed	Observation / Piezo	To authorise the construction of fifteen bores for environmental monitoring.	Ports of Auckland	Jellicoe, Brigham & Beaumont Streets			
34733	C512-12-4055*	Akld Regional Hldgs c/- *use 22197 Sea and City Projects Limited	22957	20070823	20080826	Expired	Reginald Samuel	To authorise the construction of fifteen bores for the purpose of Environmental Monitoring.		1756620	5921380	Proposed	Observation / Piezo	To authorise the construction of fifteen bores for the purpose of Environmental Monitoring.	Ports of Auckland				
12965	C512-12-1326*	BP Oil New Zealand Limited Attn: Asset Administrator	1425	19940726	19950726	Expired	_Gillian Crowcroft	Authorize the construction of two (2) bores for groundwater level and/or Chemistry investigations	Construction of two (2) 100mm dia. bores to approx 5m depth. Installation of PVC casing to approx 5m and PVC screen from approx. 2.5m to 5m if required.	1756610	5921520	Proposed	Observation / Piezo	2 monitoring bores		BP site, 51 Hamer Street, Freemans Bay	Other		
12344	14/17/1166	Kingston Morrison Limited	1207	19940225	19950225	Expired	_Ray Scoble	Authorize the construction of up to fifteen (15) piezometers for groundwater level and/or Chemistry investigations	Construction up to fiftenn (15) piezometers of 100mm dia. to approx. 6m depth and installation of PVC casing and screen to 6m.	1756500	5921200	Proposed	Observation / Piezo	Up to 15 piezometers		143 BEAUMONT ST, FREEMANS BAY, AUCKLAND	Other		
11881	14/17/1063*	Mobil Oil NZ Ltd DO NOT USE - USE CUST. 3745	1090	19931011	19941011	Expired	_Gillian Crowcroft	Authorize the construction of ten (10) bore for groundwater level and/or Chemistry investigations. ARC bore codes 1081-1090.	Construction of ten (10) 100mm dia. bores to approx 4.5m depth. Installation of PVC casing to approx 4.5m and PVC screen from approx. 4.5m to 1m if required.	1756410	5921380	Drilled		Construction of ten (10) 100mm dia. bores to approx 4.5m depth. Installation of PVC casing to approx 4.5m and PVC screen from approx. 4.5m to 1m if required.		188 BEAUMONT STREET, AUCKLAND CITY,	Other		4.5

Table of consents

CONSENT_NUMBER	FILE_REFERENCE	ACTIVITY	CONSENT_HOLDER	CONSENT_STATUS	GRANTED_DATE	REVIEW_DATE	EXPIRY_DATE	PROCESSING_OFFICER	PURPOSE	WORKS_DESCRIPTION	EASTING	NORTHING	ACTIVITY_ID	ACTIVITY_STATUS	ACTIVITY_DESCRIPTION	SITE_NAME	SITE_DESCRIPTION	PROPERTY_ADDRESS	LOC_TYP	MONITORING_OFFICER	PREVIOUS_INSPECTION_DATE	NEXT_INSPECTION_DATE
38949	22331	Contaminated Site Discharge	Panuku Development Auckland Development Auckland Limited t/as	Issued	20110315	20120315	20451231	Jack Turner	to undertake the long term passive discharge of contaminants to land and/or water from 2-20 Jellicoe Street and 138 Halsey Street, known as Sites 22, 23 and 24 in Wynyard Quarter, Auckland Central, being Lots 1, 2 and 3 DP 111348.		1756623	5921394	21186	Occurring	Ongoing passive discharge of ground water from a contaminated site.	Jellicoe Street & Halsey Street	Lot 1, Lot 2, Lot 3 DP 111348	138 Halsey St Auckland Central Auckland Central	Area	Andrew Kalbarczyk	7/10/2013	31/12/2013
46454	27060	Contaminated Site Discharge	Auckland Transport (for regional consents)	Issued	20160905		20210630	Aaron Graham	To discharge contaminants to land and water from the earthworks associated with the redevelopment of a contaminated site, in specific an interim cycleway in the Wynyard Quarter area.		1756403	5921196.3	21859	Occurring	To constuct an interim cycleway on early reclaimed land known to contain incinerator ash, gasworks waste, demolition debris and contamination from petrochemical spills.	Beaumont Street,Westhaven Drive, Gaunt Street		Beaumont Street, Westhaven Drive, Gaunt Streets Auckland Auckland Central	Point	Aaron Graham	Nil	Nil
39833	22844	Contaminated Site Discharge	Panuku Development Auckland Development Auckland Limited t/as	Issued	20120801		20170802	David Hampson	Controlled Activity to discharge contaminants to land or water during a ground stabilisation trial to be completed within one day		1756556	5921226	21262	Occurring	To undertake a trial of both in-situ and ex-situ soil stabilisation methodologies with respect to the works proposed as part of the Daldy and Halsey Street urban realm redevelopments.	141-171 Pakenham St West, Auckland	â€œLinear Parkâ€, between Jellicoe Street and Pakenham Street WestHalsey Street road reserve, north of Pakenham Street West	141 Pakenham Street West Auckland Central Auckland Central	Point	Andrew Kalbarczyk	Nil	Nil
40686	23265	Discharge To Air	Panuku Development Auckland Development Auckland Limited t/as	Issued	20130118		20180121	Paul Crimmins	To upgrade the Daldy Street public realm between Jellicoe Street and Pakenham Street West including the construction of a new portion of Daldy Street, between Madden Street and Pakenham Street West and including its intersection with Madden Street. This u		1756518	5921201	20534	Proposed	To undertake public realm & network utility service works (including the construction of a new section of Dadly street)	Daldy Street, Wynyard Quarter	Works along Daldy St	Madden Street Auckland Central Auckland City	Point	Paul Crimmins	19/01/2015	1/08/2015
40687	23266	Contaminated Site Discharge	Panuku Development Auckland Development Auckland Limited t/as	Issued	20130118		20180121	Rob Burden	To upgrade the Daldy Street public realm between Jellicoe Street and Pakenham Street West including the construction of a new portion of Daldy Street, between Madden Street and Pakenham Street West and including its intersection with Madden Street. This u		1756518	5921201	21311	Occurring	To undertake public realm & network utility service works (including the construction of a new section of Dadly street)	Daldy Street, Wynyard Quarter		Madden Street Auckland Central Auckland City	Point	Andrew Kalbarczyk	Nil	Nil
44583	25725	Contaminated Site Discharge	Watercare Services Limited	Issued	20151023		20201027	Marguerite Nakielski	To discharge contaminants to land and water from the earthworks associated with the establishment of a new pump station.		1756488	5921081.9	21654	Occurring	Discharge associated with a Wastewater pump station and storage tank on Wynyard common, rising main on Halsey Street	31-79 Daldy Street		31 Daldy St Auckland Central Auckland Central	Point	Marguerite Nakielski	Nil	Nil
44138	25414	Contaminated Site Discharge	Panuku Development Auckland Development Auckland Limited t/as	Issued	20150302		20200303	Rob Burden	The upgrade of the Madden Street and Pakenham Street West public realm between Halsey Street in the east and Beaumont Street in the west. This includes the road and all associated above and below ground infrastructure, street furniture, tree removals, wor		1756550	5921116	21595		Upgrade of the existing roads along Madden Street and Pakenham Street West, including installation of new stormwater controls and rain-garden treatment for stormwater runoff from the road, installation of new street furniture, tree removal and new landsca			141 Pakenham Street West Auckland Central Auckland Central	Point	Andrew Kalbarczyk	Nil	Nil
44139	25415	Contaminated Site Discharge	Auckland Transport (for regional consents)	Issued	20150224		20200225	Rob Burden	Discharge from disturbance of contaminated land.		1756577	5921227	21596		Potential discharges of contaminants from the disturbance of contaminated soils as part of road upgrades.	Halsey St, Gaunt St and Viaduct		38 Gaunt St Auckland Central Auckland Central	Point	Andrew Kalbarczyk	Nil	Nil
8262	AIR918010	Discharge To Air	BP Oil New Zealand Limited Attn: Asset Administrator	Replaced	19910725		19940331		To control the discharge of contaminants to air.	Manufacturing facility for grease and for blending oil. Major equipment comprises storage tanks, natural gas thermal fluid heater, autoclave, kettle, and packed bed scrubber.	1756500	5921320	3167	Occurring	Manufacturing facility for grease and for blending oil.Block bounded by Beaumont, Jellicoe, Daldy and Madden streets.	Lubes Plant		37 Madden St Auckland Central Auckland Central	Point			Nil	Nil
12344	14/17/1166	Bore	Kingston Morrison Limited	Expired	19940225		19950225	_Ray Scoble	Authorize the construction of up to fifteen (15) piezometers for groundwater level and/or Chemistry investigations	Construction up to fiftenn (15) piezometers of 100mm dia. to approx. 6m depth and installation of PVC casing and screen to 6m.	1756500	5921200	1207	Proposed	Up to 15 piezometers		143 BEAUMONT ST, FREEMANS BAY, AUCKLAND		Point		Nil	Nil
11878	8010	Discharge To Air	aland Limited Attn: Asset	Replaced	19940419	19990201	20040430	_Wes Smith	TO CONTROL THE DISCHARGE OF CONTAMINANTS TO AIR	MANUFACTURING FACILITY FOR GREASE AND BLENDING OIL. MAJOR EQUIPMENT COMPRISES STORAGE TANKS, NATURAL GAS THERMAL FLUID HEATER, AUTOCLAVE, KETTLE, AND PACKED BED SCRUBBER.	1756500	5921320	3167	Occurring	Manufacturing facility for grease and for blending oil.Block bounded by Beaumont, Jellicoe, Daldy and Madden streets.	Lubes Plant		37 Madden St Auckland Central Auckland Central	Point	_Vivian Tothill	5/11/2002	1/10/2003
11881	14/17/1063*	Bore	Mobil Oil NZ Ltd DO NOT USE - USE CUST. 3745	Expired	19931011		19941011	_Gillian Crowcroft	Authorize the construction of ten (10) bore for groundwater level and/or Chemistry investigations. ARC bore codes 1081-1090.	Construction of ten (10) 100mm dia. bores to approx 4.5m depth. Installation of PVC casing to approx 4.5m and PVC screen from approx. 4.5m to 1m if required.	1756410	5921380	1090	Drilled	Construction of ten (10) 100mm dia. bores to approx 4.5m depth. Installation of PVC casing to approx 4.5m and PVC screen from approx. 4.5m to 1m if required.		188 BEAUMONT STREET, AUCKLAND CITY,		Point		Nil	Nil
12965	C512-12-1326*	Bore	BP Oil New Zealand Limited Attn: Asset Administrator	Expired	19940726		19950726	_Gillian Crowcroft	Authorize the construction of two (2) bores for groundwater level and/or Chemistry investigations	Construction of two (2) 100mm dia. bores to approx 5m depth. Installation of PVC casing to approx 5m and PVC screen from approx. 2.5m to 5m if required.	1756610	5921520	1425	Proposed	2 monitoring bores		BP site, 51 Hamer Street, Freemans Bay		Point		Nil	Nil
20656	C512-12-2086*	Bore	AECOM Consulting Services (NZ) Ltd	Expired	19971202		19981203	_Gillian Crowcroft	Authorise the construction of bores for groundwater level and/or chemistry monitoring.	Construction of four (4) 100mm diameter bores to a depth of approximately 4m. Installation of PVC casing to 4m depth and PVC screen from 1.5-4m or as required. Permit modified 20-Aug-1998 to allow the drilling of a futher seven monitoring bores.	1756500	5921200	20063	Drilled			Shell block 3, corner of Beamont and Madden St, Auckland	143 Beaumont St Auckland Central Auckland Central	Point		Nil	Nil
21627	C512-12-2226	Bore	Maunsell Limited	Expired	19980721		19990709	_Gillian Crowcroft	Authorise the construction of a bore for groundwater level and/or chemistry monitoring.	Construction of a 50mm diameter bore to a depth of approximately 6m. Installation of PVC casing to 0.5m depth and PVC screen from 0.5-6m depth.	1756480	5921520	20327	Drilled	Water monitoring bore		14 Hamer St, City	14 Hamer St Auckland Central Auckland Central	Point		Nil	Nil
23092	C512-12-2463*	Bore	Pattle Delamore Partners Limited	Expired	19990924		20000925	_Gillian Crowcroft	Authorise the construction of bores for groundwater level and/or chemistry monitoring.	Construction of up to 34 100mm diameter bores to a depth of 4.5m. Installation of PVC casing to 1m depth and PVC screen from 1-4.5m depth.	1756530	5921140	21024	Drilled	37 bores of identical construction.	Mobil Oil site	171 Pakenham St West , Auckland	0000 * PAKENHAM ST * *	Point		Nil	Nil
22954	C512-12-2444*	Bore	AECOM Consulting Services (NZ) Ltd	Expired	19990812		20000812	_Gillian Crowcroft	Authorise the construction of bores for groundwater level and/or chemistry monitoring.	Construction of two 100mm diameter bores to a depth of approximately 4m. Installation of PVC casing to 2m depth and PVC screen from 2-4m depth.	1756350	5921250	20946	pired And Never Drill	Groundwater monitoring	Orams Marine	150-160 Beaumont St, Westhaven	0160 * BEAUMONT ST * *	Point		Nil	Nil
23171	C512-12-2474*	Bore	Pattle Delamore Partners Limited	Expired	19991011		20001011	_Gillian Crowcroft	Authorise the construction of bores for groundwater level and/or chemistry monitoring.	Construction of up to thirty nine 50mm diameter bores to a depth of 4.5m. Installation of PVC casing to 1.5m depth and PVC screen from 1.5-4.5m depth.	1756380	5921340	21044	Drilled	44 Bores all of identical construction.	Caltex Tank Farm	180 - 188 Beaumont St	0162 -188 BEAUMONT ST * *	Point		Nil	Nil
24504	C512-12-2637*	Bore	BP Oil New Zealand Limited Attn: Asset Administrator	Expired	20001019		20011019	_Gillian Crowcroft	Authorise the construction of seven (7) bores for groundwater quality and/or level monitoring.	Construction of seven (7) 50mm diameter bores to a depth of approximately 5m. Installation of PVC casing to a depth of approximately 1m and PVC screens from 1m to 5m.	1756500	5921320	21290	Proposed	Groundwater quality/level monitoring	BP Auckland Production Centre	Site bordered by Jellicoe, Beaumont, Madden & Daldy St	69-90 JELLICOE ST CITY * *	Point		Nil	Nil
24573	C512-12-2651	Bore	Mobil Oil NZ Ltd DO NOT USE - USE CUST. 3745	Expired	20001113		20011113	_Gillian Crowcroft	Authorise the construction of three bores for environmental monitoring.	Construction of three 50mm diameter bores to a depth of approximately 4.5m. Installation of PVC casing to a depth of approximately 4.5m.	1756530	5921140	21305	Drilled	3 bores	Mobil Pakenham Street	141-171 Pakenham Street, Auckland	141-171 Pakenham St West St Marys Bay Auckland City	Point	_David Parkinson	Nil	Nil
25850	15872	Contaminated Site Discharge	Z Energy Limited	Surrendered	20020403	20040930	20090501	_Mary Manastyrski	To authorise the taking of ground water and discharge of contaminated ground water onto or into ground and ground water on an oil industry storage facility in accordance with Section 15 (b) of the Resource Management Act 1991.		1756500	5921200	20053	Occurring	This new appl. 0/9/08 - long term discharge of contaminants from soil and groundwater. Orig appl 25850 20-Sep-2001 for remediation activities - surrendered 30-Aug-2007	Shell Block 3	Corner Beaumont & Madden St, Auckland City	143 Beaumont St Auckland Central Auckland Central	Point	_Sarah Pinkerton	Nil	Nil
26321	C512-12-2841*	Bore	Z Energy Limited	Expired	20020121		20030121	Roger Bannister	Authorise the construction of up to twenty four (24) bores for site remediation purposes.	Construction of up to twenty four (24) 50mm diameter bores to a depth of approximately 4.5m. Installation of UPVC casing to a depth of approximately 1.5m.	1756500	5921200	21602	Proposed	24 bores to take100cmpd for site remediation	Shell Oil	Packenham/Beaumont/Madden Streets	143 Beaumont St Auckland Central Auckland Central	Point		Nil	Nil
26507	16142	Industrial or Trade Process	Panuku Development Auckland Development Auckland Limited t/as	Surrendered	20020930	20090801	20220531	_Clive Couldwell	To authorise the diversion and/or discharge of; stormwater: and contaminated stormwater from an industrial or trade premise listed as high risk in Schedule 3 of the Proposed Auckland Regional Plan: Air, Land and Water (PARP:ALW) (product storage or handli		1756400	5921400	12	Proposed	Bulk Hydrocarbon Product Storage Facility	Auckland Special Products Term		164 Beaumont St Auckland Central Auckland Central	Point	_Jacqueline Anthony	29/08/2006	30/11/2006
28801	C512-12-3239*	Bore	Auckland Regional Council	Expired	20040129		20050129	_Amy Boulton	To authorise the construction of up to 8 bores for groundwater monitoring purposes.	Construction of up to 8 bores to a depth of approximately 5m and diameter of 50mm.	1756582	5921336	22041	Proposed	To authorise the construction of up to 8 bores for groundwater monitoring purposes		22/32 Jellicoe St., Auckland (Ports of Auckland)	32 Jellicoe St Auckland Auckland City	Point		Nil	Nil
29197	8010	Discharge To Air	BP Oil New Zealand Limited *use 567*	Surrendered	20041213	20061130	20141213	_Vivian Tothill	To authorise the discharge of contaminants to air from a grease lubricant manufacturing and blending plant and associated processes, in accordance with Section 15(1)(c) of the Resource Management Act 1991.		1756500	5921320	3167	Occurring	Manufacturing facility for grease and for blending oil.Block bounded by Beaumont, Jellicoe, Daldy and Madden streets.	Lubes Plant		37 Madden St Auckland Central Auckland Central	Point	_Vivian Tothill	Nil	Nil
29477	17100	Discharge To Air	Golden Bay Cement	Surrendered	19980325		20130331	_Auckland City Council	To discharge contaminants to air from the pneumatic conveyance, bulk storage and bagging of cementicious materials.		1756524	5921436	20136	Occurring		Golden Bay Cement	HO/98/810	65 Jellicoe St Auckland Central Auckland Central	Point	Marijana Jovanovic	29/06/2006	13/09/2007
30468	17099	Discharge To Air	Firth Industries A Division of Fletcher Concrete & Infrastructure Limited	Surrendered	20000517		20130331	_Auckland City Council	To authorise the discharge of contaminants to air from the storage of aggregates in excess of 500 tonnes but not in excess of 10,000 tonnes.		1756458	5921450	20268	Occurring		Winstone Aggregates & Firth	AA/00/01822	4 Hamer St Auckland Central Auckland Central	Point	Marijana Jovanovic	Nil	Nil
34731	C512-12-4053*	Bore	Akld Regional Hldgs c/- *use 22197 Sea and City Projects Limited	Expired	20070823		20080826	Reginald Samuel	To authorise the construction of twenty five bores for environmental monitoring.	A construction of twenty five 50mm diameter bores to an approximate depth of 4m. Installation of Class V PVC casing material to an approximate depth of 4m. Proposed grouting to 1m.	1756620	5921380	22955	Proposed	To authorise the construction of twenty five bores for environmental monitoring.	Beca Infrastructure Ltd	Jellicoe st & northeren Beaumont st Road Reserves	Jellicoe Street Auckland Central Auckland City	Point		12/02/2008	Nil
34732	C512-12-4054*	Bore	Akld Regional Hldgs c/- *use 22197 Sea and City Projects Limited	Expired	20070823		20080826	Reginald Samuel	To authorise the construction of fifteen bores for environmental monitoring.	A construction of fifteen 50mm diameter bores to an approximate depth of 4m. Installation of Class V PVC casing material to an approximate depth of 4m. Proposed grouting to 1m.	1756520	5921460	22956	Proposed	To authorise the construction of fifteen bores for environmental monitoring.	Ports of Auckland	Jellicoe, Brigham & Beaumont Streets	Jellicoe Street Auckland Central Auckland City	Point		Nil	Nil
34733	C512-12-4055*	Bore	Akld Regional Hldgs c/- *use 22197 Sea and City Projects Limited	Expired	20070823		20080826	Reginald Samuel	To authorise the construction of fifteen bores for the purpose of Environmental Monitoring.		1756620	5921380	22957	Proposed	To authorise the construction of fifteen bores for the purpose of Environmental Monitoring.	Ports of Auckland		Jellicoe Street Auckland Central Auckland City	Point		Nil	Nil
35134	C512-12-4123*	Bore	Mobil Oil NZ Limited F&L CS Contract Team	Expired	20071119		20081114	Reginald Samuel	To authorise the construction of nine bores for groundwater quality monitoring.	The construction of nine 50mm diameter bores to an approximate depth of 6m. Installation of Grade D uPVC casing material to an approximate depth of 6m. Proposed grouting to 0.5m.	1756600	5921211	23035	Proposed	To authorise the construction of nine bores for groundwater quality monitoring.	Mobil Oil New Zealand		141 Pakenham Street West Auckland Central Auckland Central	Point		Nil	Nil
35135	C512-12-4124*	Bore	Mobil Oil NZ Limited F&L CS Contract Team	Expired	20071119		20081115	Reginald Samuel	To authorise the construction of eight bores for groundwater monitoring purposes.	The construction of nine 50mm diameter bores to an approximate depth of 6m. Installation of Grade D uPVC casing material to an approximate depth of 6m. Proposed grouting to 0.5m.	1756360	5921320	23036	Proposed	To authorise the construction of eight bores for groundwater monitoring purposes.	Mobil Oil NZ ltd		164 Beaumont St Auckland Central Auckland Central	Point		Nil	Nil
35152	C512-12-4130*	Bore	BP Oil New Zealand Limited *use 567*	Expired	20071122		20081121	Reginald Samuel	To authorise the construction of three bores for groundwater investigation.	The construction of a three 100mm diameter bores to an approximate depth of 3.0m. Installation of uPVC casing material to an approximate depth of 3.0m. Proposed grouting to 0.2m.	1756500	5921370	23042	Proposed	To authorise the construction of three bores for groundwater investigation.	BP Oil New Zealand		37 Madden St Auckland Central Auckland Central	Point		Nil	Nil
37425	21583	Contaminated Site Discharge	Panuku Development Auckland Development Auckland Limited t/as	Expired	20100531	20100831	20150602	_Euan Williams	A discharge permit to authorise the discharge of contaminants to land or water arising from the land disturbance and construction works		1756381	5921458	21089		Application for the discharge of contaminants to land associated with an amenity and infrastructure upgrade of the Jellicoe Road reserve and the creation of a complementary public open space environment.	Sea + City Projects-Jellicoe St West		39 Jellicoe St Auckland Central Auckland Central	Point	Rob Burden	Nil	Nil
37699	21725	Discharge To Air	Sea + City Projects Limited c/- AWDAL	Surrendered	20100323	20100531	20150325	_Euan Williams	To discharge contaminants to air arising from the proposed contaminated land disturbance works and earthworks.		1756640	5921371	20444	Proposed	Application to discharge contaminants to air associated with excavations to facilitate the construction of concrete foundation pads and rainwater tanks.	Wynyard Quarter - Site 14		39 Jellicoe St Auckland Central Auckland Central	Point	Marijana Jovanovic	29/02/2012	31/03/2012
37615	21708	Discharge To Air	Sea + City Projects Limited c/- AWDAL	Surrendered	20100531	20100930	20150602	_Euan Williams	To discharge of contaminants to air arising from the proposed earthworks.		1756396	5921472	20439	Proposed	Application to discharge contaminants to air associated with an amenity and infrastructure upgrade of the Jellicoe Road reserve and the creation of a complementary public open space environment.	Wynyard Quarter - Jellicoe West		39 Jellicoe St Auckland Central Auckland Central	Point	Marijana Jovanovic	29/02/2012	31/03/2012
37145	21438	Contaminated Site Discharge	Sea + City Projects Limited c/- AWDAL	Expired (Not Replaced)	20090729	20100731	20101231	Andrew Kalbarczyk	Discharge of contaminants to land or water associated with land disturbance during a proposed investigation for separate phase hydrocarbons contamination identified in the subsurface soils within the site at 39 Jellicoe Street, Auckland Central and withi		1756595	5921381	21074	Occurring	To conduct drilling investigations at the cnr of Jellicoe and Bringham Streets.	Sea + City Projects Ltd		39 Jellicoe St Auckland Central Auckland Central	Point	Andrew Kalbarczyk	Nil	Nil

Table of incidents

INCIDENTNUMBER	10/1969.	11/2081.	11/3729.		11/1143
XCOORD	1756573	1756435.03	1756370	1756480.4	1756343.63
YCOORD	5921362	5921131.1	5921439	5921524.7	5921392.02
NZTMXCOORD	1756573	1756435.03	1756370	1756480.4	1756343.63
NZTMYCOORD	5921362	5921131.1	5921439	5921524.7	5921392.02
LOCATION	Jellicoe street	143-159 Beaumont Street	Jellicoe Wharf	14 Hamer St	Jellicoe Wharf
SUBURB	Auckland	Auckland	City	Freemans Bay	Central City
CATCHMENTCODE	542	542	542	542	542
POLLUTANTTYPE	Dirt / Inert Minerals / Sediment	Dirt / Inert Minerals / Sediment	Food / Beverage Wastes		Wastewater - Commercial Process
RECIEVED	Hotline	Hotline	Hotline	Other	Hotline
REPORT	Contaminated land dropped on road	Sediment on road could go to s/w	Molasses/syrup (sugar) entered harbour	Sandblasting dust on ground	Waterblasting into harbour
INCIDENTTYPE	Water / Land Pollution	Potential Water/Land Pollution	Spill	Water / Land Pollution	Potential Water/Land Pollution
ACTIONEDBY	Glenn Riddell	Aaron Graham	Simon Greening	Thomas Harre	Natalie James
IMPACT	Land Only	Land Only	Land Only		Potential
VOLUME	10-200 litres	Potential	10-200 litres		N/A
PROBLEMFOUND	YES	YES	YES	YES	YES
CULPRITTRACED	YES	YES	NO	YES	YES
RECORDDATE	9/06/2010	27/04/2011	16/09/2011	12/08/2009	28/03/2011
INVESTIGATIONDATE	9/06/2010	27/04/2011	16/09/2011	12/08/2009	28/03/2011

Table of permitted activities

PERMITTED_ACTIVITY_ID	52391	52400	52533	51509	52170	51936	53159
FILE_REFERENCE	C512-12-4619	C512-12-4630	C512-12-4763	5-42-3662	C512-12-4411*	17017	C512-12-5464*
PERMITTED_ACTIVITY_HOLDER				Auckland City Council		BP Oil New Zealand Limited *use 567*	
PERMITTED_ACTIVITY_TYPE	Bore	Bore	Bore	Contaminated Site Discharge	Bore	Contaminated Site Discharge	Bore
ACTIVITY	Bore	Bore	Bore	Contaminated Site Discharge	Bore	Contaminated Site Discharge	Bore
CONSENT_STATUS	Assessment Completed	Assessment Completed	Assessment Completed	Assessment Completed	Assessment Completed	Under Assessment	Assessment Completed
GRANTED_DATE							
PROCESSING_OFFICER	Reginald Samuel	Reginald Samuel	Reginald Samuel	Rebecca Cleghorn	Reginald Samuel	Andrew Gysberts	Reginald Samuel
PURPOSE	To authorise the construction of 4 groundwater monitoring wells. 3 of the wells will be located in Lots 4, 5 and 6 DP 74831, the fourth well will be installed in the Jellicoe Street road reserve outside the property of 188 Beaumont Street. The bores are	To authorise construction of a bore for groundwater investigation and contaminated site investigation.	To authorise 8 bores to conduct consent compliance monitoring and contaminated site investigation.	To authorise remediation works to allow for the resurfacing and refurbishment of Beaumont St north of Fanshawe St	To authorise the construction of nie bores for contaminated site investigation.		The construction of three bores for geological, geotechnical and groundwater investigation purposes.
WORKS_DESCRIPTION	The construction of four 50mm diameter bores to a maximum depth of 6m. Installation of PVC casing material to an approximate depth of 6m.	The construction of four 50mm diameter bores to a maximum depth of 6m. Installation of PVC casing material to an approximate depth of 6m.	The construction of a 50mm diameter bore to a maximum depth of 5m.	Investigation of soil quality carried out only to the extent required for the works. Soil and groundwater below this probably contaminated as well.	The construction of nine 50mm diameter bores to a maximum depth of 6m. Installation of casing to an approximate depth of 6m.	PO Rob Burden	The construction of three 120mm diameter bores to an approximate depth of 5-6m. Installation of casing material to an approximate depth of 5-6m.
EASTING	1756434	1756634	1756380	1756375	1756480	1756500	1756508
NORTHING	5921438	5921374	5921425	5921109	5921255	5921320	5921125
ACTIVITY_ID	23595	23606	27810	20612	23356	20103	29421
ACTIVITY_STATUS	Proposed	Proposed	Proposed	Completed	Proposed		Drilled
ACTIVITY_DESCRIPTION	To authorise the construction of 4 groundwater monitoring wells. 3 of the wells will be located in Lots 4, 5 and 6 DP 74831, the fourth well will be installed in the Jellicoe Street road reserve outside the property of 188 Beaumont Street. The bores are	To authorise construction of a bore for groundwater investigation and contaminated site investigation.	To authorise 8 bores to conduct consent compliance monitoring and contaminated site investigation.	Soil contamination prevalent exceeding statutory criteria for Ni, As, Pb, Cn, BaP and other SVOCs	To authorise the construction of nie bores for contaminated site investigation.	DO NOT USE till advised by RebeccaC/JohTResetting up new prelodgement no. as a CoC was lodged and not rejected and asked to apply for a consent. 31/10/08setting up wbs for pre-lodgmentCnr Beaumont and Jellicoe	The construction of three bores for geological, geotechnical and groundwater investigation purposes.
SITE_NAME	Sea City Projects Limited (2 Hamer & Jellicoe St)	Jellicoe Street, Westhaven	Auckland Waterfront Development	Beaumont Street road area	Shell NZ Ltd	BP Auckland Production Centre	Tonkin & Taylor Ltd on behalf of Waterfront Auck
SITE_DESCRIPTION				Auckland City Council road reserve		68-90 Jellicoe St, Auckland	
PROPERTY_ADDRESS	65 Jellicoe St Auckland Central Auckland Central	1 Jellicoe St Auckland Central Auckland Central		Beaumont St Auckland Central Auckland City	Beaumont St Freemans Bay Auckland City	37 Madden St Auckland Central Auckland Central	144 Pakenham Street Freemans Bay Auckland
LOC_TYP	Point	Point	Point	Point	Point	Point	Point

Appendix G: Other Information

- Fire and Emergency Service information.
- RigPro product storage list.

Contains		Page :
Acetone	20 litres per year	1
Aerosil A200		2
Anti-seize Nickel Compound	500ml x 2	3
Ardrox 9D1B Aerosol	powder 100gm.	4
Ardrox 9PR50C Aerosol		5
Brake Cleaner 500ML		6
Brake Cleaner Plus 500ML	Aerosil cans x 12 per 6 months	7
Duralac Jointing Compound	115ml tube x 3 per 6-8 months	8
Epoxy hardener HPR5B	5.3kg	9
Epoxy Resin HPR5A	4kg	10
West System hardener Z205	10 Ltrs	11
West System Epoxy Resin Z105	10 ltrs	12
Epoxy Pigment Paste	125ml.	13
Equipment Enamel	2 ltr	14
Flawfinder Dye Penetrant Spray	250-300gm aerosil cans x 6	15
Formulashell motor oil SAE 10W-40		16
FreKote Releasing Interface		17
Hand Cleaner –Wurth	4000ml 2 per year	18
Inox- mx3	2 litres	19
Isopropyl Alcohol		20
Loctite High Strength Threadlock (red)	50ml (4 tube) per year	21
Loctite High Strength Threadlock (blue)	50ml (4 tubes) per year	22

Contains	Page :
LPG forklift gas x 3	23
Maxiproof Matt	24
Methylated Spirts 1 litre	25
407 MircoBallons 500gm	26
Mineral Turpentine 1 litre	27
Morey's Air Tool oil 500ml	28
OXYGEN Compressed	29
Paint Thinner	30
Plexus 380ml x 2	31
RAPC 400 Reducer Normal 1 litre	32
Rope Coat 1 litre bottles x 8 per year	33
567 Pipe Sealant 125 ml.	34
SailKote Aerosol	35
Snow White Paint	36
Spartite SP-2000 Part A 20 litres	37
Spartite SP-2000 Part B	38
Spray Converter/Thinner	39
Spray Urethanes	40
Tef-Gel 28g tube x 4	41
Ultracut 250 Plus 40ml	42
Wax and Grease Remover 1 litre	43

Region 1 (Auckland Office)
2 Poynton Terrace, Newton 1010
P O Box 68-444, Wellesley Street,
Auckland 1141
New Zealand

Phone +64 9 354 5100

25 June 2018

Melody Robyns
Tonkin and Taylor

By email: mrobyns@tonkintaylor.co.nz

Dear Madam

Information Request – Incidents Relating to 164-188 Beaumont Street, Auckland Central

I refer to your official information request dated 20 June 2018 regarding Incidents Relating to 164-188 Beaumont Street, Auckland Central.

In accordance with the provisions of the Official Information Act 1982, I *enclose* the information you requested.

Yours sincerely

Gary Williamson
PP Kerry Gregory
Fire Region Manager

encl.

SMS Incident Report

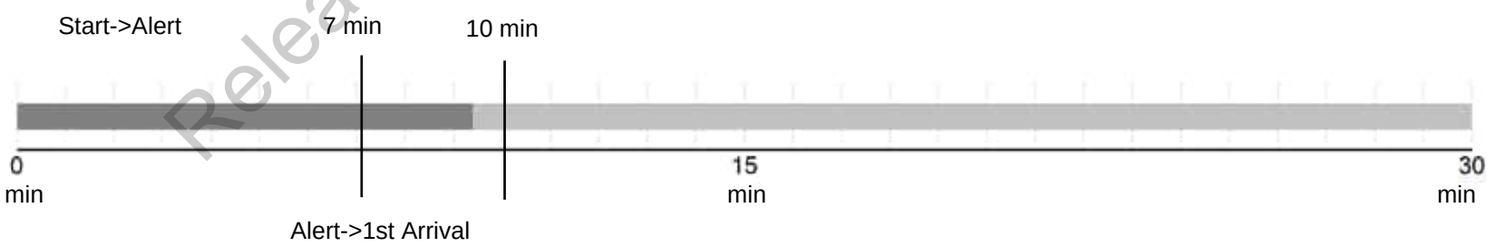
20/06/2018 15:22:54

Summary

CAD Number	A503666	**Status**	Closed
Station	Grey Lynn Station		
Incident Started	24/01/2005 14:20:46	**Incident Ended**	24/01/2005 14:40:33
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	MOBIL SPECIAL PRODUCTS		
Address	180-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114956		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	24/01/2005 16:13:30		
Report Completed			

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
PONS261	P1	14:22:23 24 Jan 2005	14:23:44 24 Jan 2005	14:26:51 24 Jan 2005	14:41:22 24 Jan 2005
AUCK207	PR	14:22:16 24 Jan 2005	14:23:36 24 Jan 2005	14:27:02 24 Jan 2005	14:38:16 24 Jan 2005
PONS2613	FT	14:22:23 24 Jan 2005	14:23:40 24 Jan 2005	14:27:57 24 Jan 2005	14:39:44 24 Jan 2005
PARN251	P1	14:22:16 24 Jan 2005	14:23:42 24 Jan 2005	14:28:20 24 Jan 2005	14:41:46 24 Jan 2005
BIRK821	P1	14:22:26 24 Jan 2005	14:23:26 24 Jan 2005	14:31:24 24 Jan 2005	14:36:33 24 Jan 2005
AUCK206	HPNP	14:22:16 24 Jan 2005	14:23:35 24 Jan 2005	14:38:13 24 Jan 2005	14:45:25 24 Jan 2005



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
PONS261	00:01:37	00:04:28	00:06:05	00:20:36

Released under the Official Information Act

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AUCK207	00:01:30	00:04:46	00:06:16	00:17:30
PONS2613	00:01:37	00:05:34	00:07:11	00:18:58
PARN251	00:01:30	00:06:04	00:07:34	00:21:00
BIRK821	00:01:40	00:08:58	00:10:38	00:15:47
AUCK206	00:01:30	00:15:57	00:17:27	00:24:39

Message Log

Time	Message
14:20:47	AL: 114956 14:20:46 INITIAL - AL
14:20:47	Contact: PFA: FIRE SECURITY SERVICES, phone -
14:20:47	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
14:20:48	** Event A503666 was viewed at: 20050124142048ND
14:21:24	** Recommended unit AUCK206 (2.38 km)
14:21:24	** Recommended unit PONS2613 (1.92 km)
14:21:24	** Recommended unit PONS261 (1.92 km)
14:21:24	** Recommended unit AUCK207 (2.38 km)
14:21:24	** Recommended unit PARN251 (2.38 km)
14:22:04	** Recommended unit BIRK821 (8.53 km)
14:23:27	Unit BIRK821 [K1 : PROCEEDING TO INCIDENT]
14:23:35	Unit AUCK206 [K1 : PROCEEDING TO INCIDENT]
14:23:37	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
14:23:40	Unit PONS2613 [K1 : PROCEEDING TO INCIDENT]
14:23:43	Unit PARN251 [K1 : PROCEEDING TO INCIDENT]
14:23:44	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
14:26:51	Unit PONS261 [K77 : NOTHING SHOWING]
14:27:02	Unit AUCK207 [K2 : IN ATTENDANCE AT INCIDENT]
14:27:25	Unit PONS261 [KC : UNIT CALLING]
14:27:57	Unit PONS261 [K77 : NOTHING SHOWING] SO SCHULTE
14:27:57	Unit PONS2613 [K2 : IN ATTENDANCE AT INCIDENT]
14:28:15	Unit PONS261 [KC : UNIT CALLING]
14:28:20	Unit PARN251 [K2 : IN ATTENDANCE AT INCIDENT]
14:28:38	Unit PONS261 [SITREP :] IPS LIVE RACKING DRUM STORAGE
14:28:46	Unit PONS261 [SITREP :] INV FURTHER
14:31:24	Unit BIRK821 [K2 : IN ATTENDANCE AT INCIDENT]
14:36:33	Unit BIRK821 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
14:38:13	Unit AUCK206 [K2 : IN ATTENDANCE AT INCIDENT]
14:38:16	Unit AUCK207 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
14:39:44	Unit PONS2613 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]

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14:40:10	Unit PONS261 [KC : UNIT CALLING]
14:40:33	Unit PONS261 [K46-3 : STOP MESSAGE: FALSE ALARM DEFECTIVE APPARATUS]
14:41:22	Unit PONS261 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
14:41:46	Unit PARN251 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
14:45:25	Unit AUCK206 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
16:13:30	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
16:13:30	Qualifier 2:

Incident

CAD Number	A503666
Incident Reporter	Dave Woon
Incident Controller	schulte
Distance Travelled (km)	3
Delay In Receiving Call	

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SMS Incident Report

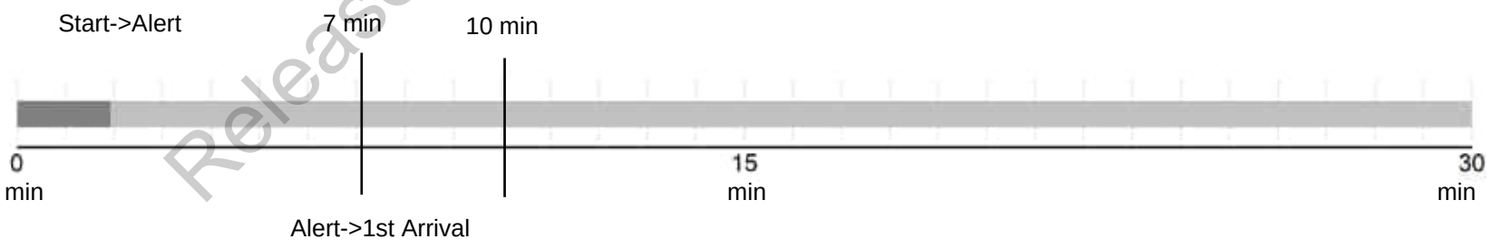
20/06/2018 15:29:50

Summary

CAD Number	A525218	**Status**	Closed
Station	Auckland City Station		
Incident Started	26/04/2005 06:39:59	**Incident Ended**	26/04/2005 07:00:01
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	MOBIL SPECIAL PRODUCTS		
Address	180-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	26/04/2005 07:11:50		
Report Completed			

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
AUCK207	PR	06:40:21 26 Apr 2005	06:41:31 26 Apr 2005	06:45:27 26 Apr 2005	07:00:30 26 Apr 2005
REMU211	P1	06:40:21 26 Apr 2005	06:41:47 26 Apr 2005	06:45:39 26 Apr 2005	07:00:57 26 Apr 2005
AUCK205	HPNP	06:40:21 26 Apr 2005	06:41:41 26 Apr 2005	06:45:41 26 Apr 2005	06:56:23 26 Apr 2005
PONS2613	FT	06:40:24 26 Apr 2005	06:42:44 26 Apr 2005	06:47:43 26 Apr 2005	07:05:57 26 Apr 2005
PONS261	P1	06:40:24 26 Apr 2005	06:43:15 26 Apr 2005	06:48:49 26 Apr 2005	07:07:41 26 Apr 2005



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
AUCK207	00:00:22	00:05:06	00:05:28	00:20:31
REMU211	00:00:22	00:05:18	00:05:40	00:20:58

Released under the Official Information Act

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AUCK205	00:00:22	00:05:20	00:05:42	00:16:24
PONS2613	00:00:25	00:07:19	00:07:44	00:25:58
PONS261	00:00:25	00:08:25	00:08:50	00:27:42

Message Log

Time	Message
06:40:00	AL: 114957 06:39:59 INITIAL - AL
06:40:00	Contact: PFA: FIRE SECURITY SERVICES, phone -
06:40:00	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
06:40:04	** Event A525218 was viewed at: 20050426064004NS
06:40:13	** Recommended unit AUCK205 (2.62 km)
06:40:13	** Recommended unit PONS2613 (1.92 km)
06:40:13	** Recommended unit PONS261 (1.92 km)
06:40:13	** Recommended unit AUCK207 (2.62 km)
06:40:13	** Recommended unit REMU211 (2.62 km)
06:41:31	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
06:41:41	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
06:41:47	Unit REMU211 [K1 : PROCEEDING TO INCIDENT]
06:42:44	Unit PONS2613 [K1 : PROCEEDING TO INCIDENT]
06:43:15	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
06:45:27	Unit AUCK207 [K77 : NOTHING SHOWING]
06:45:34	Unit AUCK207 [K77 : NOTHING SHOWING]
06:45:39	Unit REMU211 [K2 : IN ATTENDANCE AT INCIDENT]
06:45:41	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
06:45:47	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
06:45:54	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
06:46:24	Unit AUCK207 [KC : UNIT CALLING]
06:46:39	Unit AUCK207 [SITREP :] SSO FOX IPS DEFECT INV
06:46:49	//OIC AUCK207 SSO FOX//
06:47:43	Unit PONS2613 [K2 : IN ATTENDANCE AT INCIDENT]
06:48:50	Unit PONS261 [K2 : IN ATTENDANCE AT INCIDENT]
06:56:23	Unit AUCK205 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
06:59:51	Unit AUCK207 [KC : UNIT CALLING]
07:00:02	Unit AUCK207 [K46-3 : STOP MESSAGE: FALSE ALARM DEFECTIVE APPARATUS]
07:00:30	Unit AUCK207 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
07:00:58	Unit REMU211 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
07:05:57	Unit PONS2613 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
07:07:42	Unit PONS261 [K7 : AT NORMAL STATION]

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07:11:50	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
07:11:50	Qualifier 2:

Incident

CAD Number	A525218
Incident Reporter	Barry Fox
Incident Controller	SSO FOX
Distance Travelled (km)	2
Delay In Receiving Call	

Released under the Official Information Act

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SMS Incident Report

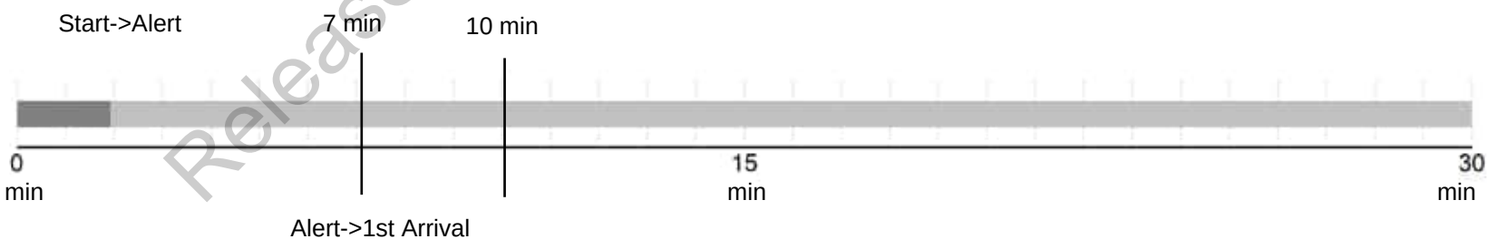
20/06/2018 15:29:50

Summary

CAD Number	A525218	**Status**	Closed
Station	Auckland City Station		
Incident Started	26/04/2005 06:39:59	**Incident Ended**	26/04/2005 07:00:01
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	MOBIL SPECIAL PRODUCTS		
Address	180-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	26/04/2005 07:11:50		
Report Completed			

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
AUCK207	PR	06:40:21 26 Apr 2005	06:41:31 26 Apr 2005	06:45:27 26 Apr 2005	07:00:30 26 Apr 2005
REMU211	P1	06:40:21 26 Apr 2005	06:41:47 26 Apr 2005	06:45:39 26 Apr 2005	07:00:57 26 Apr 2005
AUCK205	HPNP	06:40:21 26 Apr 2005	06:41:41 26 Apr 2005	06:45:41 26 Apr 2005	06:56:23 26 Apr 2005
PONS2613	FT	06:40:24 26 Apr 2005	06:42:44 26 Apr 2005	06:47:43 26 Apr 2005	07:05:57 26 Apr 2005
PONS261	P1	06:40:24 26 Apr 2005	06:43:15 26 Apr 2005	06:48:49 26 Apr 2005	07:07:41 26 Apr 2005



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
AUCK207	00:00:22	00:05:06	00:05:28	00:20:31
REMU211	00:00:22	00:05:18	00:05:40	00:20:58

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AUCK205	00:00:22	00:05:20	00:05:42	00:16:24
PONS2613	00:00:25	00:07:19	00:07:44	00:25:58
PONS261	00:00:25	00:08:25	00:08:50	00:27:42

Message Log

Time	Message
06:40:00	AL: 114957 06:39:59 INITIAL - AL
06:40:00	Contact: PFA: FIRE SECURITY SERVICES, phone -
06:40:00	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
06:40:04	** Event A525218 was viewed at: 20050426064004NS
06:40:13	** Recommended unit AUCK205 (2.62 km)
06:40:13	** Recommended unit PONS2613 (1.92 km)
06:40:13	** Recommended unit PONS261 (1.92 km)
06:40:13	** Recommended unit AUCK207 (2.62 km)
06:40:13	** Recommended unit REMU211 (2.62 km)
06:41:31	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
06:41:41	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
06:41:47	Unit REMU211 [K1 : PROCEEDING TO INCIDENT]
06:42:44	Unit PONS2613 [K1 : PROCEEDING TO INCIDENT]
06:43:15	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
06:45:27	Unit AUCK207 [K77 : NOTHING SHOWING]
06:45:34	Unit AUCK207 [K77 : NOTHING SHOWING]
06:45:39	Unit REMU211 [K2 : IN ATTENDANCE AT INCIDENT]
06:45:41	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
06:45:47	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
06:45:54	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
06:46:24	Unit AUCK207 [KC : UNIT CALLING]
06:46:39	Unit AUCK207 [SITREP :] SSO FOX IPS DEFECT INV
06:46:49	//OIC AUCK207 SSO FOX//
06:47:43	Unit PONS2613 [K2 : IN ATTENDANCE AT INCIDENT]
06:48:50	Unit PONS261 [K2 : IN ATTENDANCE AT INCIDENT]
06:56:23	Unit AUCK205 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
06:59:51	Unit AUCK207 [KC : UNIT CALLING]
07:00:02	Unit AUCK207 [K46-3 : STOP MESSAGE: FALSE ALARM DEFECTIVE APPARATUS]
07:00:30	Unit AUCK207 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
07:00:58	Unit REMU211 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
07:05:57	Unit PONS2613 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
07:07:42	Unit PONS261 [K7 : AT NORMAL STATION]

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07:11:50	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
07:11:50	Qualifier 2:

Incident

CAD Number	A525218
Incident Reporter	Barry Fox
Incident Controller	SSO FOX
Distance Travelled (km)	2
Delay In Receiving Call	

Released under the Official Information Act

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SMS Incident Report

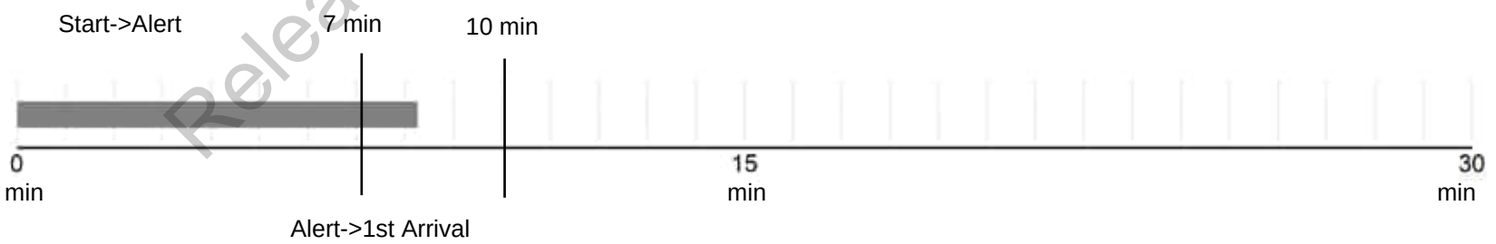
20/06/2018 15:31:52

Summary

CAD Number	A611839	**Status**	Closed
Station	Grey Lynn Station		
Incident Started	03/05/2006 22:24:01	**Incident Ended**	03/05/2006 22:38:02
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	MOBIL SPECIAL PRODUCTS		
Address	180-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	03/05/2006 22:59:03		
Report Completed			

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
PONS261	P1	22:25:23 03 May 2006	22:26:32 03 May 2006	22:29:52 03 May 2006	22:37:57 03 May 2006
AUCK207	PR	22:25:22 03 May 2006	22:26:38 03 May 2006	22:30:51 03 May 2006	22:35:18 03 May 2006
AUCK205	HPNP	22:25:22 03 May 2006	22:26:41 03 May 2006	22:30:56 03 May 2006	22:34:33 03 May 2006
PARN251	P1	22:25:25 03 May 2006	22:26:51 03 May 2006	22:31:02 03 May 2006	22:35:14 03 May 2006
BALM611	P1	22:25:27 03 May 2006	22:26:35 03 May 2006		22:35:09 03 May 2006
PONS2613	FT	22:25:23 03 May 2006			22:38:08 03 May 2006



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
PONS261	00:01:22	00:04:29	00:05:51	00:13:56

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AUCK207	00:01:21	00:05:29	00:06:50	00:11:17
AUCK205	00:01:21	00:05:34	00:06:55	00:10:32
PARN251	00:01:24	00:05:37	00:07:01	00:11:13
BALM611	00:01:26			00:11:08
PONS2613	00:01:22			00:14:07

Message Log

Time	Message
22:24:02	AL: 114957 22:24:01 INITIAL - AL
22:24:02	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
22:24:06	** Event A611839 was viewed at: 20060503222406NS
22:24:06	** Event A611839 was viewed at: 20060503222406NS
22:24:31	** Recommended unit AUCK205 for requirement PLATFM (>1.84 km)
22:24:31	** Recommended unit PONS2613 for requirement FOAM (>1.72 km)
22:24:31	** Recommended unit PONS261 for requirement PUMP (>1.72 km)
22:24:31	** Recommended unit AUCK207 for requirement PUMP (>1.84 km)
22:24:31	** Recommended unit PARN251 for requirement PUMP (>2.80 km)
22:25:13	** Recommended unit BALM611 for requirement PUMP (>5.17 km)
22:26:32	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
22:26:36	Unit BALM611 [K1 : PROCEEDING TO INCIDENT]
22:26:39	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
22:26:41	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
22:26:51	Unit PARN251 [K1 : PROCEEDING TO INCIDENT]
22:29:52	Unit PONS261 [K77 : NOTHING SHOWING] VERBAL
22:30:51	Unit AUCK207 [K2 : IN ATTENDANCE AT INCIDENT]
22:30:56	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
22:31:02	Unit PARN251 [K2 : IN ATTENDANCE AT INCIDENT]
22:31:46	Unit PONS261 [KC : UNIT CALLING]
22:32:13	Unit PONS261 [SITREP :] SO TRAVERS PS DRUM FILL AND DEFECT
22:32:18	Unit AUCK207 [KC : UNIT CALLING]
22:32:25	//OIC PONS261 SO TRAVERS//
22:32:57	Unit AUCK207 [SITREP :] ADV BALM RESPOND HALSEY ST
22:34:34	Unit AUCK205 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
22:35:10	Unit BALM611 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
22:35:14	Unit PARN251 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
22:35:19	Unit AUCK207 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
22:37:36	Unit PONS261 [KC : UNIT CALLING]
22:37:58	Unit PONS261 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]

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22:38:02	Unit PONS261 [K46-3 : STOP MESSAGE: FALSE ALARM DEFECTIVE APPARATUS]
22:38:02	UNDETERMINED
22:38:08	Unit PONS2613 [K7 : AT NORMAL STATION]
22:59:02	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
22:59:02	Qualifier 2:
22:59:03	BUSINESS RULE CHECKS SUCCESSFULLY COMPLETED AT
22:59:03	TERMINAL: D0191982

Incident

CAD Number	A611839
Incident Reporter	Gavin Travers
Incident Controller	
Distance Travelled (km)	
Delay In Receiving Call	

False Alarm

Detector Type	Manual call point
False Alarm Cause	Equipment | Unable to classify
Other Cause	Unknown

Property Details

Occupant	
Building Owner	
General Property Use	Storage, Warehousing
Special Property Use	Storage: Bulk flammable liquids
Purpose Group	WD - Working, Business or Storage High Fire Hazard

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SMS Incident Report

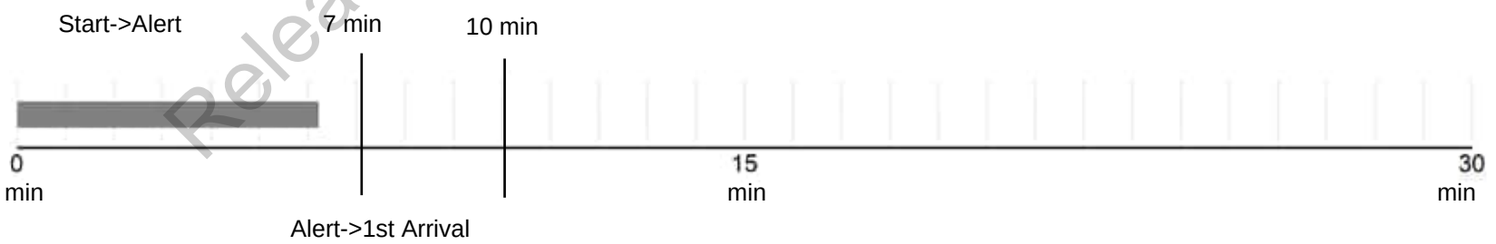
20/06/2018 15:33:42

Summary

CAD Number	A664263	**Status**	Closed
Station	Grey Lynn Station		
Incident Started	25/11/2006 14:44:44	**Incident Ended**	25/11/2006 14:55:17
Incident Type	7104: False Alarm: Accidental Operation K-46-2		
Common Name	MOBIL SPECIAL PRODUCTS		
Address	180-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	25/11/2006 15:23:18		
Report Completed			

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
PONS261	P1	14:45:47 25 Nov 2006	14:47:05 25 Nov 2006	14:49:46 25 Nov 2006	15:11:18 25 Nov 2006
AUCK207	PR	14:45:41 25 Nov 2006	14:47:03 25 Nov 2006	14:50:35 25 Nov 2006	14:55:17 25 Nov 2006
AUCK205	HPNP	14:45:41 25 Nov 2006	14:47:18 25 Nov 2006	14:51:01 25 Nov 2006	14:51:53 25 Nov 2006
PARN251	P1	14:45:50 25 Nov 2006	14:47:26 25 Nov 2006	14:51:29 25 Nov 2006	14:51:58 25 Nov 2006
PONS2613	FT	14:45:47 25 Nov 2006			14:52:37 25 Nov 2006
BALM611	P1	14:45:52 25 Nov 2006	14:47:11 25 Nov 2006		14:52:26 25 Nov 2006



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
PONS261	00:01:03	00:03:59	00:05:02	00:26:34

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AUCK207	00:00:57	00:04:54	00:05:51	00:10:33
AUCK205	00:00:57	00:05:20	00:06:17	00:07:09
PARN251	00:01:06	00:05:39	00:06:45	00:07:14
PONS2613	00:01:03			00:07:53
BALM611	00:01:08			00:07:42

Message Log

Time	Message
14:44:45	AL: 114957 14:44:44 INITIAL - AL
14:44:45	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
14:44:50	** Event A664263 was viewed at: 20061125144450ND
14:45:05	AL: 114957 14:45:05 UPDATE - AL
14:45:31	** Recommended unit AUCK205 for requirement PLATFM (>1.84 km)
14:45:31	** Recommended unit PONS2613 for requirement FOAM (>1.72 km)
14:45:31	** Recommended unit PONS261 for requirement PUMP (>1.72 km)
14:45:31	** Recommended unit AUCK207 for requirement PUMP (>1.84 km)
14:45:31	** Recommended unit PARN251 for requirement PUMP (>2.80 km)
14:45:31	** Recommended unit BALM611 for requirement PUMP (>5.17 km)
14:47:03	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
14:47:05	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
14:47:11	Unit BALM611 [K1 : PROCEEDING TO INCIDENT]
14:47:18	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
14:47:26	Unit PARN251 [K1 : PROCEEDING TO INCIDENT]
14:48:33	Duplicate Event:Location = 180-188 BEAUMONT ST,AUCKLAND CENTRAL,AUCKLAND CITY:
14:48:33	MOBIL OIL
14:48:33	ALARM SOUNDING
14:48:33	@MOBIL SPECIAL PRODUCTS, Type = MIN - MINOR, Caller Ph Number = 021 436 704,
14:48:33	TANK FARM IN BEAUMONT ST HAS BEEN DEMOLISHED
14:48:33	Call Source = 111
14:48:33	End of Duplicate Event data
14:48:33	CUTTING, HEAT
14:49:46	Unit PONS261 [K77 : NOTHING SHOWING]
14:49:56	Unit PONS261 [K77 : NOTHING SHOWING] VERBAL
14:50:35	Unit AUCK207 [K2 : IN ATTENDANCE AT INCIDENT]
14:51:01	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
14:51:09	Unit PONS261 [KC : UNIT CALLING]
14:51:28	Unit PONS261 [SITREP :] SO TRAVERS IPS DEFECT
14:51:29	Unit PARN251 [K2 : IN ATTENDANCE AT INCIDENT]

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14:51:43	//OIC PONS261 SO TRAVERS//
14:51:54	Unit AUCK205 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
14:51:58	Unit PARN251 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
14:51:59	Unit PONS261 [KC : UNIT CALLING]
14:52:18	Unit PONS261 [K28-1 : RETURN OTHER RESPONDING UNITS]
14:52:27	Unit BALM611 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
14:52:38	Unit PONS2613 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
14:54:54	Unit PONS261 [KC : UNIT CALLING]
14:55:17	Unit PONS261 [K46-2 : STOP MESSAGE: FALSE ALARM ACCIDENTAL] WELDING
14:55:17	Unit AUCK207 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
15:11:18	Unit PONS261 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
15:23:18	BUSINESS RULE CHECKS SUCCESSFULLY COMPLETED AT
15:23:18	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
15:23:18	Qualifier 2:
15:23:18	TERMINAL: D0191982

Incident

CAD Number	A664263
Incident Reporter	Craig Lampp
Incident Controller	
Distance Travelled (km)	
Delay In Receiving Call	

False Alarm

Detector Type	Smoke alarm (mains powered)
False Alarm Cause	Human Intervention | Accidential alarm activation by (b) contractor (not the service agent)
Other Cause	

Property Details

Occupant	
Building Owner	
General Property Use	Storage, Warehousing
Special Property Use	Storage: Bulk flammable liquids
Purpose Group	WM - Working, Business or Storage Moderate Fire Hazard

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SMS Incident Report

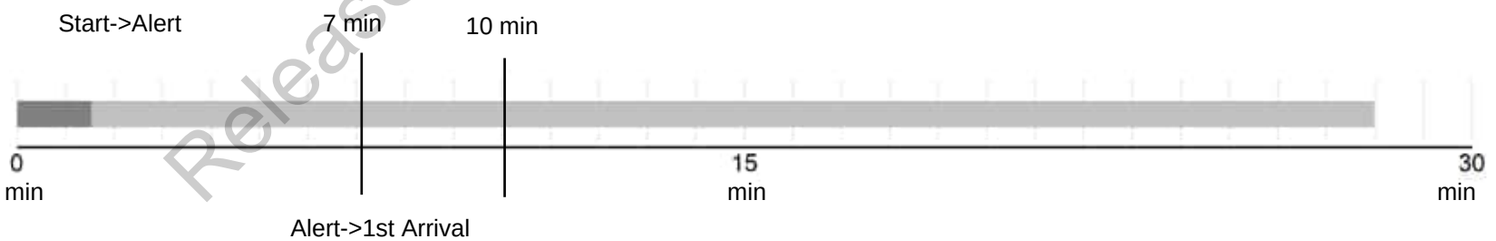
20/06/2018 15:44:11

Summary

CAD Number	F206234	**Status**	Closed
Station	Auckland City Station		
Incident Started	26/07/2008 21:03:10	**Incident Ended**	26/07/2008 21:13:21
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	MOBIL OIL NZ AUCKLAND TERMINAL		
Address	164-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	26/07/2008 21:14:52		
Report Completed	9:14, Sat 02 Aug 2008 by Paul Turner		

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
AUCK207	PR	21:03:26 26 Jul 2008	21:04:39 26 Jul 2008	21:07:41 26 Jul 2008	21:13:55 26 Jul 2008
AUCK205	HPNP	21:03:26 26 Jul 2008	21:04:44 26 Jul 2008	21:08:15 26 Jul 2008	21:10:38 26 Jul 2008
PONS261	P1	21:03:29 26 Jul 2008	21:04:59 26 Jul 2008	21:09:02 26 Jul 2008	21:12:38 26 Jul 2008
PONS2613	FT	21:03:29 26 Jul 2008	21:07:12 26 Jul 2008	21:09:19 26 Jul 2008	21:12:08 26 Jul 2008
PARN251	P1	21:03:32 26 Jul 2008	21:05:03 26 Jul 2008	21:09:32 26 Jul 2008	21:10:22 26 Jul 2008



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
AUCK207	00:00:16	00:04:15	00:04:31	00:10:45
AUCK205	00:00:16	00:04:49	00:05:05	00:07:28

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PONS261	00:00:19	00:05:33	00:05:52	00:09:28
PONS2613	00:00:19	00:05:50	00:06:09	00:08:58
PARN251	00:00:22	00:06:00	00:06:22	00:07:12

Message Log

Time	Message
21:03:07	AL: 114957 21:03:10 INITIAL - AL
21:03:07	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
21:03:13	** Event F206234 was viewed at: 20080726210313NS
21:03:19	** Recommended unit AUCK205 for requirement PLATFM (>1.84 km)
21:03:19	** Recommended unit PONS2613 for requirement FOAM (>1.72 km)
21:03:19	** Recommended unit PONS261 for requirement PUMP (>1.72 km)
21:03:19	** Recommended unit AUCK207 for requirement PUMP (>1.84 km)
21:03:19	** Recommended unit PARN251 for requirement PUMP (>2.80 km)
21:04:39	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
21:04:44	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
21:04:58	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
21:04:59	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
21:05:03	Unit PARN251 [K1 : PROCEEDING TO INCIDENT]
21:05:19	AL: 114957 21:05:23 UPDATE - AL
21:06:24	Unit PONS261 [COMCEN COM : MESSAGE] WILL YOU TAKE THE FOAM TENDER OR SHOULD I
21:06:24	SEND ANOTHER PUMP TO PICK IT UP
21:06:31	Unit PONS261 [SITREP :] WE WILL TAKE IT
21:07:12	Unit PONS2613 [K1 : PROCEEDING TO INCIDENT]
21:07:19	Unit PONS2613 [K1 : PROCEEDING TO INCIDENT]
21:07:41	Unit AUCK207 [K77 : NOTHING SHOWING]
21:08:15	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
21:09:02	Unit PONS261 [K2 : IN ATTENDANCE AT INCIDENT]
21:09:20	Unit PONS2613 [K2 : IN ATTENDANCE AT INCIDENT]
21:09:32	Unit PARN251 [K2 : IN ATTENDANCE AT INCIDENT]
21:10:22	Unit PARN251 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
21:10:39	Unit AUCK205 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
21:12:08	Unit PONS2613 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
21:12:38	Unit PONS261 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
21:12:52	Unit AUCK207 [KC : UNIT CALLING]
21:13:22	Unit AUCK207 [K46-3 : STOP MESSAGE: FALSE ALARM DEFECTIVE APPARATUS]
21:13:55	Unit AUCK207 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
21:14:52	BUSINESS RULE CHECKS SUCCESSFULLY COMPLETED AT

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21:14:52	** Assigned Result Code: STRU, Detailed Event Type: 1100, Qualifier 1: Q1,
21:14:52	Qualifier 2:
21:14:52	TERMINAL: D0191981

Incident

CAD Number	F206234
Incident Reporter	Paul Turner
Incident Controller	SSO Turner
Distance Travelled (km)	4
Delay In Receiving Call	

False Alarm

Detector Type	Smoke detector
False Alarm Cause	Equipment | Defect system wiring
Other Cause	

Property Details

Occupant	
Building Owner	
General Property Use	Storage, Warehousing
Special Property Use	Storage: Bulk flammable liquids
Purpose Group	WD - Working, Business or Storage High Fire Hazard

Comments

8/3/2008 10:53:01 PM **Reporter Comments**

System Account

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SMS Incident Report

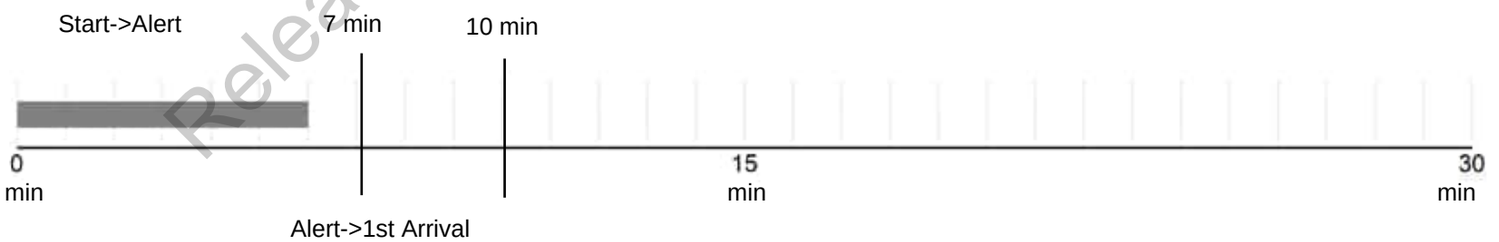
20/06/2018 15:46:20

Summary

CAD Number	F206325	**Status**	Closed
Station	Auckland City Station		
Incident Started	26/07/2008 22:11:09	**Incident Ended**	26/07/2008 22:20:29
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	MOBIL OIL NZ AUCKLAND TERMINAL		
Address	164-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	26/07/2008 22:21:02		
Report Completed	14:38, Sat 02 Aug 2008 by Rob Gunn		

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
AUCK207	PR	22:12:04 26 Jul 2008	22:13:30 26 Jul 2008	22:16:02 26 Jul 2008	22:20:51 26 Jul 2008
AUCK205	HPNP	22:12:04 26 Jul 2008	22:13:34 26 Jul 2008	22:16:25 26 Jul 2008	22:17:47 26 Jul 2008
PARN251	P1	22:12:10 26 Jul 2008	22:13:32 26 Jul 2008	22:17:17 26 Jul 2008	22:18:18 26 Jul 2008
BIRK821	P1	22:12:19 26 Jul 2008	22:13:54 26 Jul 2008		22:18:14 26 Jul 2008
MTRO621	P1	22:12:11 26 Jul 2008	22:14:02 26 Jul 2008		22:18:32 26 Jul 2008
PONS2613	FT	22:12:07 26 Jul 2008			22:18:07 26 Jul 2008



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
AUCK207	00:00:55	00:03:58	00:04:53	00:09:42

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AUCK205	00:00:55	00:04:21	00:05:16	00:06:38
PARN251	00:01:01	00:05:07	00:06:08	00:07:09
BIRK821	00:01:10			00:07:05
MTRO621	00:01:02			00:07:23
PONS2613	00:00:58			00:06:58

Message Log

Time	Message
22:11:05	AL: 114957 22:11:09 INITIAL - AL
22:11:06	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
22:11:12	** Event F206325 was viewed at: 20080726221112NS
22:11:20	** Recommended unit AUCK205 for requirement PLATFM (>1.84 km)
22:11:20	** Recommended unit PONS2613 for requirement FOAM (>1.72 km)
22:11:20	** Recommended unit AUCK207 for requirement PUMP (>1.84 km)
22:11:20	** Recommended unit PARN251 for requirement PUMP (>2.80 km)
22:11:20	** Recommended unit BIRK821 for requirement PUMP (>4.76 km)
22:13:30	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
22:13:32	Unit PARN251 [K1 : PROCEEDING TO INCIDENT]
22:13:34	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
22:13:54	Unit BIRK821 [K1 : PROCEEDING TO INCIDENT]
22:14:02	Unit MTRO621 [K1 : PROCEEDING TO INCIDENT]
22:16:02	Unit AUCK207 [K77 : NOTHING SHOWING]
22:16:25	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
22:17:12	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
22:17:17	Unit PARN251 [K2 : IN ATTENDANCE AT INCIDENT]
22:17:35	Unit AUCK207 [KC : UNIT CALLING]
22:17:47	Unit AUCK205 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
22:18:01	Unit AUCK207 [SITREP :] PS DEFECT K28-1
22:18:07	Unit PONS2613 [K7 : AT NORMAL STATION]
22:18:14	Unit BIRK821 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
22:18:18	Unit PARN251 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
22:18:32	Unit MTRO621 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
22:20:12	Unit AUCK207 [KC : UNIT CALLING]
22:20:29	Unit AUCK207 [K46-3 : STOP MESSAGE: FALSE ALARM DEFECTIVE APPARATUS]
22:20:52	Unit AUCK207 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
22:21:02	BUSINESS RULE CHECKS SUCCESSFULLY COMPLETED AT
22:21:02	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
22:21:02	Qualifier 2:

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22:21:02	TERMINAL: D0191986

Incident

CAD Number	F206325
Incident Reporter	Rob Gunn
Incident Controller	SSO Turner
Distance Travelled (km)	2
Delay In Receiving Call	

False Alarm

Detector Type	Sprinkler
False Alarm Cause	Equipment | Unable to classify
Other Cause	unknown

Property Details

Occupant	
Building Owner	
General Property Use	Storage, Warehousing
Special Property Use	Storage: Bulk flammable liquids
Purpose Group	WD - Working, Business or Storage High Fire Hazard

Comments

8/2/2008 2:38:01 PM **Reporter Comments**

Rob Gunn

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SMS Incident Report

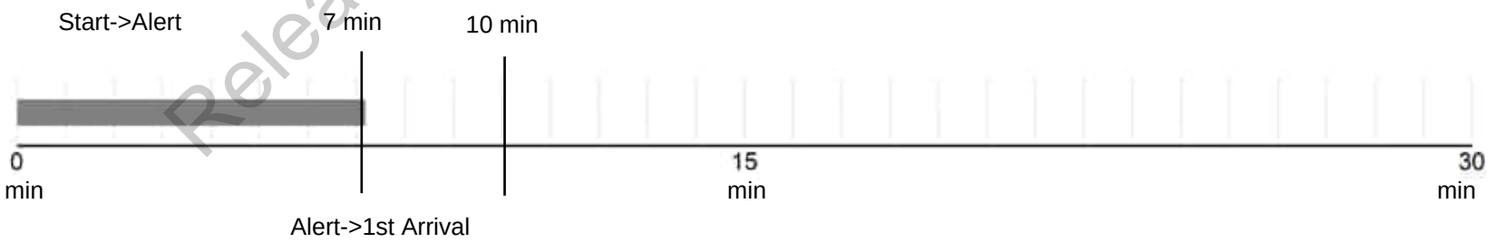
20/06/2018 15:48:17

Summary

CAD Number	F209467	**Status**	Closed
Station	Auckland City Station		
Incident Started	30/07/2008 10:59:54	**Incident Ended**	30/07/2008 11:14:27
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	MOBIL OIL NZ AUCKLAND TERMINAL		
Address	164-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	30/07/2008 11:21:42		
Report Completed	14:29, Wed 30 Jul 2008 by Chris Scott		

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
AUCK205	HPNP	11:00:31 30 Jul 2008	11:02:40 30 Jul 2008	11:05:17 30 Jul 2008	11:13:17 30 Jul 2008
AUCK207	PR	11:00:31 30 Jul 2008	11:01:56 30 Jul 2008	11:05:19 30 Jul 2008	11:15:05 30 Jul 2008
PONS261	P1	11:00:23 30 Jul 2008	11:01:49 30 Jul 2008	11:05:31 30 Jul 2008	11:13:27 30 Jul 2008
PARN251	P1	11:00:26 30 Jul 2008	11:02:20 30 Jul 2008	11:06:15 30 Jul 2008	11:14:28 30 Jul 2008
PONS2613	FT	11:00:34 30 Jul 2008	11:10:16 30 Jul 2008		11:10:31 30 Jul 2008
BALM611	P1	11:04:10 30 Jul 2008	11:04:17 30 Jul 2008		11:10:44 30 Jul 2008



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
AUCK205	00:00:37	00:04:46	00:05:23	00:13:23

Released under the Official Information Act

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AUCK207	00:00:37	00:04:48	00:05:25	00:15:11
PONS261	00:00:29	00:05:08	00:05:37	00:13:33
PARN251	00:00:32	00:05:49	00:06:21	00:14:34
PONS2613	00:00:40			00:10:37
BALM611	00:04:16			00:10:50

Notifications

Date	Time	Party Notified
30 Jul 2008	11:01:56	MOBIL NZ CONTROL ROOM

Message Log

Time	Message
10:59:53	AL: 114957 10:59:54 INITIAL - AL
10:59:53	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
10:59:58	** Event F209467 was viewed at: 20080730105958NS
11:00:04	** Recommended unit AUCK205 for requirement PLATFM (>1.84 km)
11:00:04	** Recommended unit PONS2613 for requirement FOAM (>612.68 km)
11:00:04	** Recommended unit PONS261 for requirement PUMP (>1.72 km)
11:00:04	** Recommended unit AUCK207 for requirement PUMP (>1.84 km)
11:00:04	** Recommended unit PARN251 for requirement PUMP (>2.80 km)
11:00:19	BOX NO: NO KEYS
11:00:26	AL: 114957 11:00:28 UPDATE - AL
11:00:45	AL: 114957 11:00:46 UPDATE - AL
11:00:51	AL: 114957 11:00:53 UPDATE - AL
11:01:00	AL: 114957 11:01:02 UPDATE - AL
11:01:21	AL: 114957 11:01:23 UPDATE - AL
11:01:47	Unit PARN251 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
11:01:47	.
11:01:49	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
11:01:50	AL: 114957 11:01:51 UPDATE - AL
11:01:54	Unit PONS261 [KC : UNIT CALLING]
11:01:56	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
11:02:11	Unit PONS261 [KC : UNIT CALLING]
11:02:14	AL: 114957 11:02:16 UPDATE - AL
11:02:17	CRITICAL INFORMATION:
11:02:20	Unit PARN251 [K1 : PROCEEDING TO INCIDENT]
11:02:24	AL: 114957 11:02:25 UPDATE - AL
11:02:25	4TH PUMP TO UPLIFT FOAM TENDER COMP FLOW C45
11:02:37	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]

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11:02:40	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
11:02:43	AL: 114957 11:02:45 UPDATE - AL
11:02:53	AL: 114957 11:02:55 UPDATE - AL
11:03:07	Unit PONS261 [SITREP :] RESPOND ANOTHER TO UPLIFT FT AS THIS IS OUR FIRST PUMP
11:03:07	AREA AND WE ARE RESPONDING AS A PUMP
11:03:08	AL: 114957 11:03:10 UPDATE - AL
11:03:18	AL: 114957 11:03:20 UPDATE - AL
11:03:55	** Recommended unit BALM611 for requirement PUMP (>5.17 km)
11:04:17	Unit BALM611 [K1 : PROCEEDING TO INCIDENT]
11:04:29	AL: 114957 11:04:30 UPDATE - AL
11:05:17	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
11:05:20	Unit AUCK207 [K77 : NOTHING SHOWING]
11:05:31	Unit PONS261 [K2 : IN ATTENDANCE AT INCIDENT]
11:06:15	Unit PARN251 [K2 : IN ATTENDANCE AT INCIDENT]
11:06:32	Unit PARN251 [K2 : IN ATTENDANCE AT INCIDENT]
11:06:39	AL: 114957 11:06:40 UPDATE - AL
11:08:40	AL: 114957 11:08:42 UPDATE - AL
11:09:15	Unit BALM611 [KC : UNIT CALLING]
11:10:10	Unit PONS261 [KC : UNIT CALLING]
11:10:16	Unit PONS2613 [K1 : PROCEEDING TO INCIDENT]
11:10:25	Unit PONS261 [SITREP :] SO OLSEN. K28-1
11:10:31	Unit PONS2613 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
11:10:45	Unit BALM611 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
11:10:52	AL: 114957 11:10:54 UPDATE - AL
11:11:01	AL: 114957 11:11:03 UPDATE - AL
11:11:35	AL: 114957 11:11:36 UPDATE - AL
11:11:44	AL: 114957 11:11:46 UPDATE - AL
11:11:50	AL: 114957 11:11:52 UPDATE - AL
11:12:20	AL: 114957 11:12:22 UPDATE - AL
11:12:29	Unit PONS261 [COMCEN COM : MESSAGE] BE ADVISED WE ARE RECEIVING MULTIPLE
11:12:29	ACTIVATIONS FROM THIS PFA.
11:13:17	Unit AUCK205 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
11:13:27	Unit PONS261 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
11:13:53	Unit AUCK207 [KC : UNIT CALLING]
11:14:26	Unit AUCK207 [K46-3 : STOP MESSAGE: FALSE ALARM DEFECTIVE APPARATUS] SSO SCOTT.
11:14:26	IPS DEFECT. NO ZONES INDICATED.
11:14:28	Unit PARN251 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
11:15:05	Unit AUCK207 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
11:21:42	BUSINESS RULE CHECKS SUCCESSFULLY COMPLETED AT
11:21:42	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,

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11:21:42	Qualifier 2:
11:21:42	TERMINAL: D0191985

Incident

CAD Number	F209467
Incident Reporter	Chris Scott
Incident Controller	SSO Scott C.
Distance Travelled (km)	4
Delay In Receiving Call	

False Alarm

Detector Type	Sprinkler
False Alarm Cause	Equipment | Defect fire alarm panel
Other Cause	

Property Details

Occupant	
Building Owner	
General Property Use	Storage, Warehousing
Special Property Use	Storage: Bulk flammable liquids
Purpose Group	WM - Working, Business or Storage Moderate Fire Hazard

Comments

8/5/2008 12:13:49 AM **Reporter Comments**

System Account

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SMS Incident Report

20/06/2018 15:50:48

Summary

CAD Number	F209725	**Status**	Closed
Station	Grey Lynn Station		
Incident Started	30/07/2008 12:00:05	**Incident Ended**	30/07/2008 12:07:24
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	MOBIL OIL NZ AUCKLAND TERMINAL		
Address	164-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	30/07/2008 12:10:34		
Report Completed	9:7, Thur 31 Jul 2008 by Shane Olsen		

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
PONS261	P1	12:00:57 30 Jul 2008	12:01:51 30 Jul 2008	12:04:12 30 Jul 2008	12:10:00 30 Jul 2008
AUCK207	PR	12:00:54 30 Jul 2008	12:02:10 30 Jul 2008	12:05:19 30 Jul 2008	12:05:35 30 Jul 2008
AUCK205	HPNP	12:00:54 30 Jul 2008	12:03:56 30 Jul 2008		12:05:24 30 Jul 2008
PONS2613	FT	12:00:57 30 Jul 2008			12:06:25 30 Jul 2008
BALM611	P1	12:01:00 30 Jul 2008	12:02:06 30 Jul 2008		12:05:17 30 Jul 2008



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
PONS261	00:00:52	00:03:15	00:04:07	00:09:55
AUCK207	00:00:49	00:04:25	00:05:14	00:05:30

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AUCK205	00:00:49			00:05:19
PONS2613	00:00:52			00:06:20
BALM611	00:00:55			00:05:12

Message Log

Time	Message
12:00:03	AL: 114957 12:00:05 INITIAL - AL
12:00:03	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
12:00:08	** Event F209725 was viewed at: 20080730120008NS
12:00:44	** Recommended unit AUCK205 for requirement PLATFM (>1.84 km)
12:00:44	** Recommended unit PONS2613 for requirement FOAM (>1.72 km)
12:00:44	** Recommended unit PONS261 for requirement PUMP (>1.72 km)
12:00:44	** Recommended unit AUCK207 for requirement PUMP (>1.84 km)
12:00:44	** Recommended unit BALM611 for requirement PUMP (>5.17 km)
12:01:51	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
12:01:56	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
12:02:04	Unit PONS261 [KC : UNIT CALLING]
12:02:06	Unit BALM611 [K1 : PROCEEDING TO INCIDENT]
12:02:10	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
12:02:48	Unit PONS261 [SITREP :] CAN YOU RESPOND BALM611 FOR UPLIFT THE FT
12:03:00	Unit BALM611 [SITREP :] RECEIVED
12:03:13	AL: 114957 12:03:15 UPDATE - AL
12:03:56	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
12:04:12	Unit PONS261 [K77 : NOTHING SHOWING]
12:05:17	Unit BALM611 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
12:05:19	Unit AUCK207 [K2 : IN ATTENDANCE AT INCIDENT]
12:05:24	Unit AUCK205 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
12:05:35	Unit AUCK207 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
12:05:57	Unit PONS261 [KC : UNIT CALLING]
12:06:21	Unit PONS261 [SITREP :] SO OLSEN. IPS DEFECT. K28-1
12:06:25	Unit PONS2613 [K7 : AT NORMAL STATION]
12:07:07	Unit PONS261 [KC : UNIT CALLING]
12:07:22	Unit PONS261 [K46-3 : STOP MESSAGE: FALSE ALARM DEFECTIVE APPARATUS]
12:10:00	Unit PONS261 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
12:10:34	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
12:10:34	BUSINESS RULE CHECKS SUCCESSFULLY COMPLETED AT
12:10:34	Qualifier 2:
12:10:34	TERMINAL: D0191985

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Incident

CAD Number	F209725
Incident Reporter	Shane Olsen
Incident Controller	olsens
Distance Travelled (km)	1
Delay In Receiving Call	

False Alarm

Detector Type	Sprinkler
False Alarm Cause	Equipment | Defect fire alarm panel
Other Cause	

Property Details

Occupant	
Building Owner	
General Property Use	Storage, Warehousing
Special Property Use	Storage: Bulk flammable liquids
Purpose Group	WL - Working, Business or Storage Light Fire Hazard

Comments

	8/5/2008 12:16:18 AM	**Reporter Comments**
		System Account

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SMS Incident Report

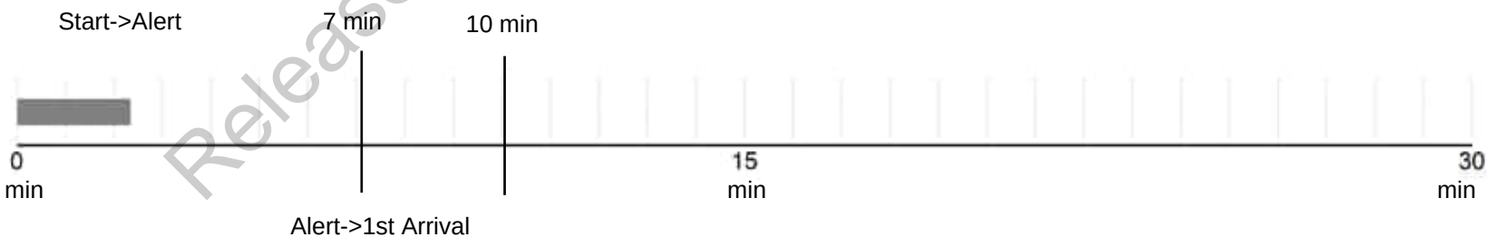
20/06/2018 15:52:24

Summary

CAD Number	F209932	**Status**	Closed
Station	Grey Lynn Station		
Incident Started	30/07/2008 12:49:54	**Incident Ended**	30/07/2008 12:56:21
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	MOBIL OIL NZ AUCKLAND TERMINAL		
Address	164-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	30/07/2008 12:57:36		
Report Completed	9:10, Thur 31 Jul 2008 by Shane Olsen		

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
PONS261	P1	12:50:18 30 Jul 2008	12:51:23 30 Jul 2008	12:53:24 30 Jul 2008	12:56:25 30 Jul 2008
AUCK205	HPNP	12:50:21 30 Jul 2008	12:53:00 30 Jul 2008		12:54:19 30 Jul 2008
PONS2613	FT	12:50:24 30 Jul 2008			12:56:27 30 Jul 2008
BALM611	P1	12:50:27 30 Jul 2008	12:51:28 30 Jul 2008		12:54:12 30 Jul 2008
AUCK207	PR	12:50:21 30 Jul 2008	12:51:33 30 Jul 2008		12:54:22 30 Jul 2008



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
PONS261	00:00:24	00:03:06	00:03:30	00:06:31
AUCK205	00:00:27			00:04:25

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PONS2613	00:00:30			00:06:33
BALM611	00:00:33			00:04:18
AUCK207	00:00:27			00:04:28

Message Log

Time	Message
12:49:52	AL: 114957 12:49:54 INITIAL - AL
12:49:52	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
12:49:58	** Event F209932 was viewed at: 20080730124958NS
12:50:06	** Recommended unit AUCK205 for requirement PLATFM (>1.84 km)
12:50:06	** Recommended unit PONS2613 for requirement FOAM (>1.72 km)
12:50:06	** Recommended unit PONS261 for requirement PUMP (>1.72 km)
12:50:06	** Recommended unit AUCK207 for requirement PUMP (>1.84 km)
12:50:06	** Recommended unit BALM611 for requirement PUMP (>5.17 km)
12:51:23	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
12:51:28	Unit BALM611 [K1 : PROCEEDING TO INCIDENT]
12:51:34	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
12:53:00	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
12:53:24	Unit PONS261 [K77 : NOTHING SHOWING]
12:53:48	AL: 114957 12:53:50 UPDATE - AL
12:53:57	Unit PONS261 [KC : UNIT CALLING]
12:54:13	Unit BALM611 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
12:54:16	Unit PONS261 [SITREP :] SO OLSEN. K28-1
12:54:19	Unit AUCK205 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
12:54:22	Unit AUCK207 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
12:55:03	BOX NO NO KEYS
12:55:35	CRITICAL INFORMATION:
12:55:44	4TH PUMP TO UPLIFT FOAM TENDER COMP FLOW C45
12:56:04	Unit PONS261 [KC : UNIT CALLING]
12:56:21	Unit PONS261 [K46-3 : STOP MESSAGE: FALSE ALARM DEFECTIVE APPARATUS]
12:56:26	Unit PONS261 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
12:56:27	Unit PONS2613 [K7 : AT NORMAL STATION]
12:57:36	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
12:57:36	BUSINESS RULE CHECKS SUCCESSFULLY COMPLETED AT
12:57:36	Qualifier 2:
12:57:36	TERMINAL: D0191985

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Incident

CAD Number	F209932
Incident Reporter	Shane Olsen
Incident Controller	olsens
Distance Travelled (km)	1
Delay In Receiving Call	

False Alarm

Detector Type	Sprinkler
False Alarm Cause	Equipment | Defect fire alarm panel
Other Cause	

Property Details

Occupant	
Building Owner	
General Property Use	Storage, Warehousing
Special Property Use	Storage: Bulk flammable liquids
Purpose Group	WL - Working, Business or Storage Light Fire Hazard

Comments

	8/5/2008 12:17:14 AM	**Reporter Comments**
		System Account

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SMS Incident Report

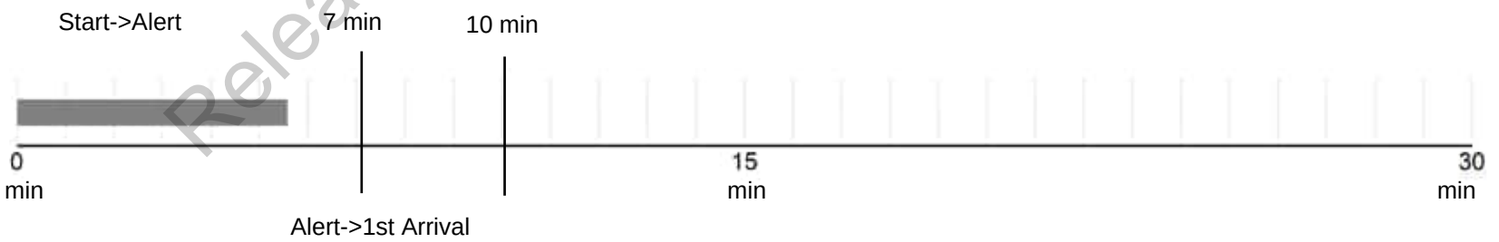
20/06/2018 15:53:57

Summary

CAD Number	F209955	**Status**	Closed
Station	Parnell Station		
Incident Started	30/07/2008 12:58:20	**Incident Ended**	30/07/2008 13:32:18
Incident Type	7106: False Alarm: Nothing on Indicator Panel K-46-6		
Common Name	MOBIL OIL NZ AUCKLAND TERMINAL		
Address	164-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	30/07/2008 13:32:18		
Report Completed	15:1, Fri 01 Aug 2008 by Philip Thorogood		

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
PARN251	P1	12:58:55 30 Jul 2008	13:00:20 30 Jul 2008	13:03:53 30 Jul 2008	13:05:36 30 Jul 2008
PONS261	P1	13:00:41 30 Jul 2008	13:05:28 30 Jul 2008	13:05:42 30 Jul 2008	13:24:08 30 Jul 2008
BALM611	P1	12:58:58 30 Jul 2008	12:59:08 30 Jul 2008		13:00:23 30 Jul 2008
AUCK207	PR	12:58:52 30 Jul 2008	13:00:00 30 Jul 2008		13:00:36 30 Jul 2008
AUCK205	HPNP	12:59:03 30 Jul 2008			13:05:19 30 Jul 2008
PONS2613	FT	12:59:06 30 Jul 2008			13:05:20 30 Jul 2008



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
PARN251	00:00:35	00:04:58	00:05:33	00:07:16

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PONS261	00:02:21	00:05:01	00:07:22	00:25:48
BALM611	00:00:38			00:02:03
AUCK207	00:00:32			00:02:16
AUCK205	00:00:43			00:06:59
PONS2613	00:00:46			00:07:00

Message Log

Time	Message
12:58:18	AL: 114957 12:58:20 INITIAL - AL
12:58:18	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
12:58:24	** Event F209955 was viewed at: 20080730125824NS
12:58:43	** Recommended unit AUCK205 for requirement PLATFM (>1.84 km)
12:58:43	** Recommended unit PONS2613 for requirement FOAM (>1.72 km)
12:58:43	** Recommended unit AUCK207 for requirement PUMP (>1.84 km)
12:58:43	** Recommended unit PARN251 for requirement PUMP (>612.68 km)
12:58:43	** Recommended unit BALM611 for requirement PUMP (>5.17 km)
12:59:04	AL: 114957 12:59:06 UPDATE - AL
12:59:08	Unit BALM611 [K1 : PROCEEDING TO INCIDENT]
13:00:01	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
13:00:20	Unit PARN251 [K1 : PROCEEDING TO INCIDENT]
13:00:24	Unit BALM611 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
13:00:36	Unit AUCK207 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
13:01:01	Unit PONS261 [SITREP :] WE ARE STILL IN ATT AT MOBIL. K28-1.
13:03:53	Unit PARN251 [K2 : IN ATTENDANCE AT INCIDENT]
13:05:19	Unit AUCK205 [K7 : AT NORMAL STATION]
13:05:20	Unit PONS2613 [K7 : AT NORMAL STATION]
13:05:28	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
13:05:36	Unit PARN251 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
13:05:42	Unit PONS261 [K77 : NOTHING SHOWING]
13:08:37	AL: 114957 13:08:39 UPDATE - AL
13:21:57	AL: 114957 13:21:59 UPDATE - AL
13:22:34	AL: 114957 13:22:36 UPDATE - AL
13:22:40	AL: 114957 13:22:42 UPDATE - AL
13:23:01	AL: 114957 13:23:03 UPDATE - AL
13:23:14	AL: 114957 13:23:16 UPDATE - AL
13:23:51	AL: 114957 13:23:53 UPDATE - AL
13:24:08	Unit PONS261 [K9 : OFF RT - STATE LOCATION]
13:32:18	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,

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13:32:18	INCIDENT STOP TIME [NULL] ADJUSTED TO 20080730133208NS
13:32:18	Qualifier 2:
13:32:18	TERMINAL: D0191985
13:32:19	BUSINESS RULE CHECKS SUCCESSFULLY COMPLETED AT
13:32:19	TERMINAL: D0191985

Incident

CAD Number	F209955
Incident Reporter	Philip Thorogood
Incident Controller	
Distance Travelled (km)	5
Delay In Receiving Call	

False Alarm

Detector Type	Thermal detector
False Alarm Cause	Other | Unable to classify
Other Cause	unable to classify

Property Details

Occupant	
Building Owner	
General Property Use	Storage, Warehousing
Special Property Use	Storage: Bulk flammable liquids
Purpose Group	WL - Working, Business or Storage Light Fire Hazard

Comments

8/5/2008 12:18:16 AM **Reporter Comments**

System Account

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SMS Incident Report

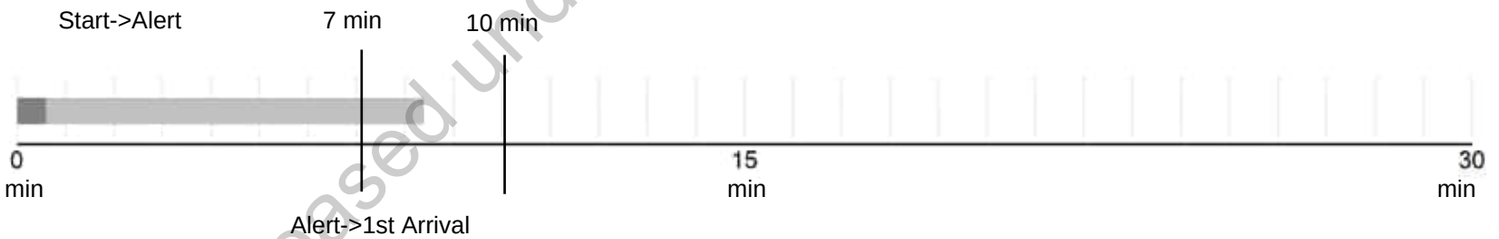
21/06/2018 08:29:26

Summary

CAD Number	F210030	**Status**	Closed
Station	Auckland City Station		
Incident Started	30/07/2008 13:24:14	**Incident Ended**	30/07/2008 13:34:51
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	MOBIL OIL NZ AUCKLAND TERMINAL		
Address	164-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Sprinkler PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	30/07/2008 13:51:42		
Report Completed	8:43, Thur 31 Jul 2008 by Chris Scott		

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
AUCK207	PR	13:24:50 30 Jul 2008	13:26:23 30 Jul 2008	13:32:38 30 Jul 2008	13:34:40 30 Jul 2008



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
AUCK207	00:00:36	00:07:48	00:08:24	00:10:26

Notifications

Date	Time	Party Notified
30 Jul 2008	13:31:42	FROM PONS261 -

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Message Log

Time	Message
13:24:13	AL: 114957 13:24:14 INITIAL - AL
13:24:13	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
13:24:18	** Event F210030 was viewed at: 20080730132418NS
13:24:38	AL: 114957 13:24:40 UPDATE - AL
13:24:46	AL: 114957 13:24:48 UPDATE - AL
13:25:14	AL: 114957 13:25:16 UPDATE - AL
13:26:23	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
13:28:01	AL: 114957 13:28:03 UPDATE - AL
13:28:47	CAN YOU ADVISE SSO SCOTT THAT I HAVE BEEN ON TO MANAGEMENT ONE 3 DIFFERENT
13:28:47	OCCASSION TO HAVE THEIR FIRE TECHS ISOLATE THEIR ALARM
13:28:48	AL: 114957 13:28:50 UPDATE - AL
13:29:11	Unit AUCK207 [COMCEN COM : MESSAGE] FURTHER DETAILS PASSED
13:31:45	CAN YOU ADVISE SSO SCOTT THAT I HAVE BEEN ON TO MANAGEMENT ONE 3 DIFFERENT
13:31:50	OCCASSION TO HAVE THEIR FIRE TECHS ISOLATE THEIR ALARM
13:32:38	Unit AUCK207 [K77 : NOTHING SHOWING]
13:32:51	Unit AUCK207 [COMCEN COM : MESSAGE] (VIA PHONE) FURTHER DETAILS PASSED FROM
13:32:51	PONS261
13:34:09	Unit AUCK207 [KC : UNIT CALLING]
13:34:40	Unit AUCK207 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
13:34:51	Unit AUCK207 [K46-3 : STOP MESSAGE: FALSE ALARM DEFECTIVE APPARATUS] ALARM
13:34:51	AGENT HAS NOW DISONNECTED SYSTEM
13:51:42	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
13:51:42	Qualifier 2:
13:51:43	BUSINESS RULE CHECKS SUCCESSFULLY COMPLETED AT
13:51:43	TERMINAL: D0191985

Incident

CAD Number	F210030
Incident Reporter	Chris Scott
Incident Controller	SSO Scott C.
Distance Travelled (km)	3
Delay In Receiving Call	

False Alarm

Detector Type	Sprinkler
False Alarm Cause	Equipment | Defect fire alarm panel

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Other Cause

Property Details

Occupant	
Building Owner	
General Property Use	Storage, Warehousing
Special Property Use	Storage: Bulk flammable liquids
Purpose Group	WM - Working, Business or Storage Moderate Fire Hazard

Comments

8/5/2008 12:19:05 AM	**Reporter Comments**
System Account	

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SMS Incident Report

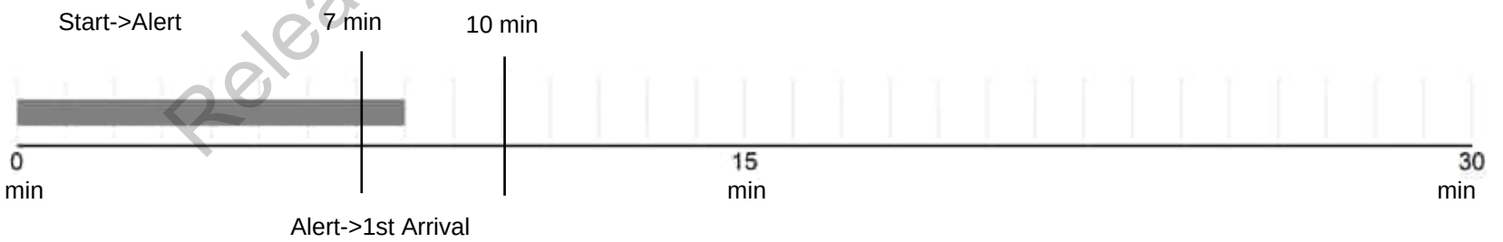
21/06/2018 08:34:51

Summary

CAD Number	F0443490	**Status**	Closed
Station	Grey Lynn Station		
Incident Started	10/06/2009 04:59:21	**Incident Ended**	10/06/2009 05:15:09
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	MOBIL OIL NZ AUCKLAND TERMINAL		
Address	164-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Automatic PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921355
First Caller		**First Caller Contact**	
Incident Closed	10/06/2009 05:16:31		
Report Completed	9:37, Tue 16 Jun 2009 by Shane Olsen		

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
PONS261	P1	05:00:16 10 Jun 2009	05:02:08 10 Jun 2009	05:04:44 10 Jun 2009	05:15:40 10 Jun 2009
AUCK205	HPNP	05:00:12 10 Jun 2009	05:02:10 10 Jun 2009	05:05:11 10 Jun 2009	05:07:38 10 Jun 2009
AUCK207	PR	05:00:13 10 Jun 2009	05:01:59 10 Jun 2009	05:05:15 10 Jun 2009	05:10:36 10 Jun 2009
PARN251	P1	05:00:19 10 Jun 2009	05:02:05 10 Jun 2009	05:07:17 10 Jun 2009	05:07:43 10 Jun 2009
BALM611	P1	05:02:50 10 Jun 2009	05:04:01 10 Jun 2009		05:07:50 10 Jun 2009
PONS2613	FT	05:00:16 10 Jun 2009			05:10:59 10 Jun 2009



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
PONS261	00:00:55	00:04:28	00:05:23	00:16:19

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AUCK205	00:00:51	00:04:59	00:05:50	00:08:17
AUCK207	00:00:52	00:05:02	00:05:54	00:11:15
PARN251	00:00:58	00:06:58	00:07:56	00:08:22
BALM611	00:03:29			00:08:29
PONS2613	00:00:55			00:11:38

Message Log

Time	Message
04:59:21	AL: 114957 04:59:21 INITIAL - AL
04:59:21	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
04:59:33	** Recommended unit AUCK205 for requirement PLATFM (>1.84 km)
04:59:33	** Recommended unit PONS2613 for requirement FOAM (>1.72 km)
04:59:33	** Recommended unit PONS261 for requirement PUMP (>1.72 km)
04:59:33	** Recommended unit AUCK207 for requirement PUMP (>1.84 km)
04:59:33	** Recommended unit PARN251 for requirement PUMP (>2.79 km)
04:59:41	BOX NO: NO KEYS
05:00:12	4TH PUMP TO UPLIFT FOAM TENDER COMP FLOW C45
05:01:59	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
05:02:05	Unit PARN251 [K1 : PROCEEDING TO INCIDENT]
05:02:08	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
05:02:10	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
05:02:23	Unit PONS261 [KC : UNIT CALLING]
05:04:02	Unit BALM611 [K1 : PROCEEDING TO INCIDENT]
05:04:44	Unit PONS261 [K77 : NOTHING SHOWING]
05:05:11	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
05:05:16	Unit AUCK207 [K2 : IN ATTENDANCE AT INCIDENT]
05:06:42	Unit PONS261 [KC : UNIT CALLING]
05:07:17	Unit PARN251 [K2 : IN ATTENDANCE AT INCIDENT]
05:07:27	Unit PONS261 [SITREP :] SO OLSEN IPS MCC SWITCH BOARD INV FURTHER K28-1
05:07:27	BALM611 WITH 2613
05:07:38	Unit AUCK205 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
05:07:43	Unit PARN251 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
05:07:51	Unit BALM611 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
05:10:36	Unit AUCK207 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
05:11:00	Unit PONS2613 [K7 : AT NORMAL STATION]
05:14:33	Unit PONS261 [KC : UNIT CALLING]
05:15:09	Unit PONS261 [K46-3 : STOP MESSAGE: FALSE ALARM DEFECTIVE APPARATUS] SECURITY
05:15:09	IN ATTENDANCE FORCED ENTRY OBTAINED TO SHUT DOWN VALVES

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05:15:40	Unit PONS261 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
05:16:31	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
05:16:31	Qualifier 2:

Incident

CAD Number	F0443490
Incident Reporter	Shane Olsen
Incident Controller	olsen
Distance Travelled (km)	1
Delay In Receiving Call	

False Alarm

Detector Type	Smoke detector
False Alarm Cause	Equipment | Defect fire alarm panel
Other Cause	

Property Details

Occupant	
Building Owner	
General Property Use	Vacant building, Section
Special Property Use	Vacant section
Purpose Group	WL - Working, Business or Storage Light Fire Hazard

Comments

6/16/2009 9:37:07 AM **Reporter Comments**

Shane Olsen

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SMS Incident Report

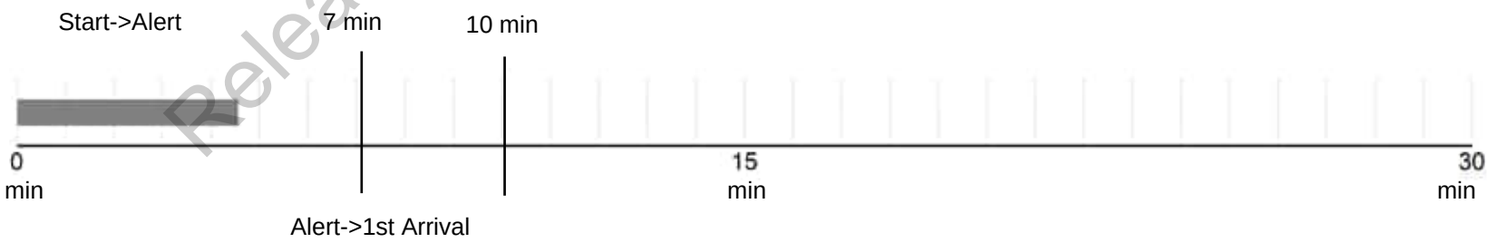
21/06/2018 08:36:16

Summary

CAD Number	F1446465	**Status**	Closed
Station	Grey Lynn Station		
Incident Started	22/08/2013 17:49:08	**Incident Ended**	22/08/2013 18:03:42
Incident Type	7106: False Alarm: Nothing on Indicator Panel K-46-6		
Common Name	MOBIL OIL NZ AUCKLAND TERMINAL		
Address	164-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Automatic PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921354
First Caller		**First Caller Contact**	
Incident Closed	22/08/2013 18:20:27		
Report Completed	22:21, Fri 23 Aug 2013 by Shane Olsen		

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
PONS261	P1	17:49:58 22 Aug 2013	17:51:31 22 Aug 2013	17:54:54 22 Aug 2013	18:04:16 22 Aug 2013
PARN251	P1	17:49:52 22 Aug 2013	17:52:35 22 Aug 2013	17:56:06 22 Aug 2013	18:01:09 22 Aug 2013
AUCK205	HPNP	17:49:55 22 Aug 2013	17:51:33 22 Aug 2013	17:56:45 22 Aug 2013	18:01:19 22 Aug 2013
MANU3013	FT	17:49:51 22 Aug 2013	17:51:58 22 Aug 2013		17:57:48 22 Aug 2013
MANU301	P1	17:49:51 22 Aug 2013	17:51:55 22 Aug 2013		17:57:48 22 Aug 2013
AUCK207	PR	17:49:55 22 Aug 2013	17:51:23 22 Aug 2013		18:02:01 22 Aug 2013



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
PONS261	00:00:50	00:04:56	00:05:46	00:15:08

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PARN251	00:00:44	00:06:14	00:06:58	00:12:01
AUCK205	00:00:47	00:06:50	00:07:37	00:12:11
MANU3013	00:00:43			00:08:40
MANU301	00:00:43			00:08:40
AUCK207	00:00:47			00:12:53

Notifications

Date	Time	Party Notified
22 Aug 2013	17:51:50	AAM COUNTIES RE FOAM TENDER

Message Log

Time	Message
17:49:08	AL: 114957 17:49:08 INITIAL - AL
17:49:08	** ELOI search completed at 22/08/13 17:49:08 - 1 result
17:49:08	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
17:49:17	** LOI search completed at 22/08/13 17:49:17
17:49:20	** Recommended unit MANU3013 for requirement FOAM (>24.2 km)
17:49:20	** Recommended unit AUCK205 for requirement AERIAL (>1.7 km)
17:49:20	** Recommended unit PONS261 for requirement PUMP (>1.7 km)
17:49:20	** Recommended unit AUCK207 for requirement PUMP (>1.8 km)
17:49:20	** Recommended unit PARN251 for requirement PUMP (>0.9 km)
17:49:26	NO ACCESS NUMBER
17:49:35	4TH PUMP TO UPLIFT FOAM TENDER COMP FLOW C45
17:51:23	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
17:51:31	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
17:51:33	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
17:51:55	Unit MANU301 [K1 : PROCEEDING TO INCIDENT]
17:51:59	Unit MANU3013 [K1 : PROCEEDING TO INCIDENT]
17:52:12	Unit MANU301 [K1 : PROCEEDING TO INCIDENT]
17:52:35	Unit PARN251 [K1 : PROCEEDING TO INCIDENT]
17:54:54	Unit PONS261 [K77 : NOTHING SHOWING]
17:55:31	Unit PONS261 [KC : UNIT CALLING]
17:56:03	Unit PONS261 [SITREP :] SO OLSEN PS FIRE AND DEFECT ADMIN BLOCK INVEST
17:56:06	Unit PARN251 [K2 : IN ATTENDANCE AT INCIDENT]
17:56:45	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
17:57:04	Unit AUCK207 [KC : UNIT CALLING]
17:57:31	Unit AUCK207 [SITREP :] SSO GRACE K28-1 MANU307 3013
17:57:46	Unit MANU3013 [K28 : UNIT IS TO RETURN TO STATION]
17:57:46	Unit MANU301 [K28 : UNIT IS TO RETURN TO STATION]

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17:57:48	Unit MANU301 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
17:57:49	Unit MANU3013 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
18:01:10	Unit PARN251 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
18:01:20	Unit AUCK205 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
18:02:01	Unit AUCK207 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
18:02:53	Unit PONS261 [KC : UNIT CALLING]
18:03:42	Unit PONS261 [K46-2 : STOP MESSAGE: FALSE ALARM ACCIDENTAL]
18:04:16	Unit PONS261 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
18:20:27	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
18:20:27	Qualifier 2:

Incident

CAD Number	F1446465
Incident Reporter	Shane Olsen
Incident Controller	olsens
Distance Travelled (km)	15
Delay In Receiving Call	

False Alarm

Detector Type	Smoke detector
False Alarm Cause	Other | No apparent cause
Other Cause	none

Property Details

Occupant	
Building Owner	
General Property Use	Vacant building, Section
Special Property Use	Vacant building
Purpose Group	WL - Working, Business or Storage Light Fire Hazard

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SMS Incident Report

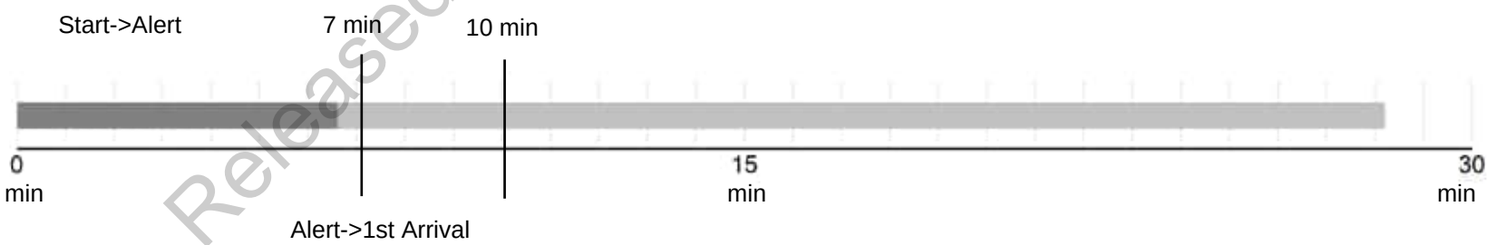
21/06/2018 08:37:55

Summary

CAD Number	F1631547	**Status**	Closed
Station	Grey Lynn Station		
Incident Started	11/06/2014 01:39:48	**Incident Ended**	11/06/2014 02:03:52
Incident Type	8105: Wind storm, Tornado, Cyclone etc		
Common Name	MOBIL OIL NZ AUCKLAND TERMINAL (OLD)		
Address	164-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Automatic PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921354
First Caller		**First Caller Contact**	
Incident Closed	11/06/2014 02:03:52		
Report Completed	9:23, Sun 15 Jun 2014 by Grant Reay		

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
PONS261	P1	01:41:23 11 Jun 2014	01:42:42 11 Jun 2014	01:45:41 11 Jun 2014	02:01:59 11 Jun 2014
PARN251	P1	01:41:48 11 Jun 2014	01:42:30 11 Jun 2014	01:46:32 11 Jun 2014	01:54:49 11 Jun 2014
AUCK205	HPNP	01:41:19 11 Jun 2014	01:43:15 11 Jun 2014	01:47:19 11 Jun 2014	01:53:18 11 Jun 2014
AUCK207	PR	01:41:19 11 Jun 2014	01:43:04 11 Jun 2014	01:47:53 11 Jun 2014	01:54:05 11 Jun 2014



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
PONS261	00:01:35	00:04:18	00:05:53	00:22:11
PARN251	00:02:00	00:04:44	00:06:44	00:15:01
AUCK205	00:01:31	00:06:00	00:07:31	00:13:30

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AUCK207	00:01:31	00:06:34	00:08:05	00:14:17

Message Log

Time	Message
01:39:48	AL: 114957 01:39:48 INITIAL - AL
01:39:48	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
01:39:49	** LOI search completed at 11/06/14 01:39:49
01:41:11	** Recommended unit MANU3013 for requirement FOAM (>24.2 km)
01:41:11	** Recommended unit AUCK205 for requirement AERIAL (>1.8 km)
01:41:11	** Recommended unit PONS261 for requirement PUMP (>1.7 km)
01:41:11	** Recommended unit AUCK207 for requirement PUMP (>1.8 km)
01:41:11	** Recommended unit PARN251 for requirement PUMP (>2.8 km)
01:42:31	Unit PARN251 [K1 : PROCEEDING TO INCIDENT]
01:42:42	Unit PONS261 [K55 : SPECIAL SERVICE EVENT]
01:42:47	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
01:43:04	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
01:43:15	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
01:46:14	Unit PONS261 [K77 : NOTHING SHOWING]
01:46:32	Unit PARN251 [K2 : IN ATTENDANCE AT INCIDENT]
01:47:20	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
01:47:54	Unit AUCK207 [K2 : IN ATTENDANCE AT INCIDENT]
01:53:19	Unit AUCK205 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
01:54:06	Unit AUCK207 [K3 : ON RT OUTSIDE NORMAL TURNOUT AREA]
01:54:34	Unit PARN251 [K77 : NOTHING SHOWING]
01:54:50	Unit PARN251 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
02:01:22	Unit PONS261 [KC : UNIT CALLING]
02:01:41	Unit PONS261 [STOP : MESSAGE] NO AREA INDICATED SITE SEARCHED NSOF
02:02:00	Unit PONS261 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
02:03:51	** Assigned Result Code: STRU, Detailed Event Type: 3100, Qualifier 1: Q1,
02:03:51	Qualifier 2:
02:03:52	UNIT PONS261 RESPONSE TIME [NULL] ADJUSTED TO

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Incident

CAD Number	F1631547
Incident Reporter	Grant Reay
Incident Controller	Grant Reay
Distance Travelled (km)	2

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Delay In Receiving Call

Property Details

Occupant

Building Owner

General Property Use Storage, Warehousing

Special Property Use Marina, Boat park, Boatshed

Purpose Group

Actions

Persons Reported Trapped No

Evacuation Status Not occupied at time of incident

Action Prior 1

Action Prior 2

Action Taken Investigation Only (Non-Fire related)

Civilians

Civilians Rescued 0

Civilians Extricated 0

Civilians Assisted 0

Civilians Evacuated

Origin

Location

Level

Equipment Used

Quantity	Equipment
1	No equipment used

Equipment Involved

Equipment Involved

Year

Make

Model

Comments

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	6/15/2014 9:23:00 AM	**Reporter Comments**
Storm damage most likely cause of alarm activation		
		Grant Reay

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SMS Incident Report

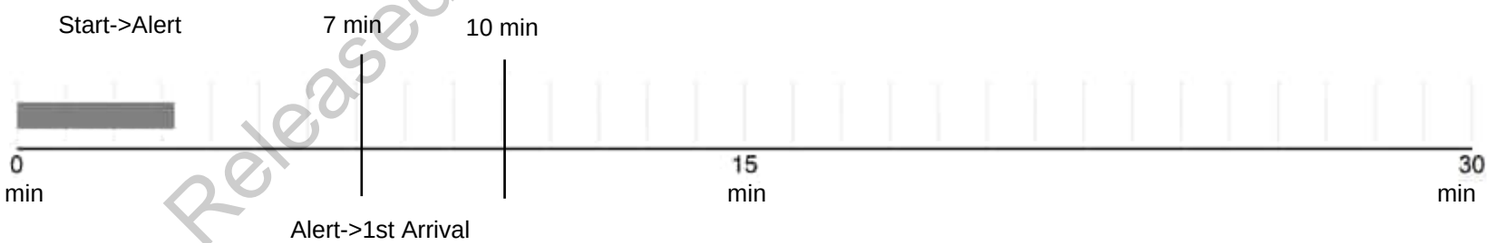
21/06/2018 08:39:41

Summary

CAD Number	F1731085	**Status**	Closed
Station	Auckland City Station		
Incident Started	20/11/2014 09:07:46	**Incident Ended**	20/11/2014 09:23:36
Incident Type	7103: False Alarm: Defective Apparatus K-46-3		
Common Name	37 SOUTH		
Address	164-188 BEAUMONT STREET AUCKLAND CENTRAL		
Alarm Method	Automatic PFA Call	**Alarm Level**	1
PFA Number	114957		
Zone	14260501		
Map Grid E	1756445	**Map Grid N**	5921354
First Caller		**First Caller Contact**	
Incident Closed	20/11/2014 11:01:33		
Report Completed	14:7, Thur 20 Nov 2014 by Phil Thomas		

Responses

Call Sign	Type	Station Alert	Enroute Time	Arrival Time	Departed
AUCK207	PR	09:08:32 20 Nov 2014	09:09:42 20 Nov 2014	09:11:43 20 Nov 2014	09:23:37 20 Nov 2014
PONS261	P1	09:08:39 20 Nov 2014	09:10:13 20 Nov 2014	09:12:31 20 Nov 2014	09:17:06 20 Nov 2014
AUCK205	HPNP	09:08:36 20 Nov 2014	09:10:04 20 Nov 2014	09:13:33 20 Nov 2014	09:17:01 20 Nov 2014
PARN251	P1	09:08:32 20 Nov 2014	09:11:17 20 Nov 2014		09:15:36 20 Nov 2014



Elapsed Times

Call Sign	Start To Alert	Alert To Arrival	Start To Arrival	Start To Departed
AUCK207	00:00:46	00:03:11	00:03:57	00:15:51
PONS261	00:00:53	00:03:52	00:04:45	00:09:20
AUCK205	00:00:50	00:04:57	00:05:47	00:09:15

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PARN251	00:00:46			00:07:50

Message Log

Time	Message
09:07:47	AL: 114957 09:07:46 INITIAL - AL
09:07:47	PANEL: ELECTRICAL SWITCH ROOM BESIDE FRONT ENTRANCE
09:07:48	** LOI search completed at 20/11/14 09:07:48
09:08:02	NO ACCESS
09:08:03	** Recommended unit AUCK205 for requirement AERIAL (>1.8 km)
09:08:03	** Recommended unit PONS261 for requirement PUMP (>1.7 km)
09:08:03	** Recommended unit AUCK207 for requirement PUMP (>1.4 km)
09:08:03	** Recommended unit PARN251 for requirement PUMP (>0.9 km)
09:08:03	** No recommendation for requirement FOAM
09:09:42	Unit AUCK207 [K1 : PROCEEDING TO INCIDENT]
09:10:04	Unit AUCK205 [K1 : PROCEEDING TO INCIDENT]
09:10:13	Unit PONS261 [K1 : PROCEEDING TO INCIDENT]
09:11:17	Unit PARN251 [K1 : PROCEEDING TO INCIDENT]
09:11:44	Unit AUCK207 [K77 : NOTHING SHOWING]
09:12:31	Unit PONS261 [K2 : IN ATTENDANCE AT INCIDENT]
09:13:33	Unit AUCK205 [K2 : IN ATTENDANCE AT INCIDENT]
09:14:19	Unit AUCK207 [KC : UNIT CALLING]
09:14:53	Unit AUCK207 [SITREP :] SSO LIND LIASING W BUILDING OCCUPTS BUILDING ATB DEAD
09:15:36	Unit PARN251 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
09:17:01	Unit AUCK205 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
09:17:06	Unit PONS261 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
09:20:25	Unit AUCK207 [K22-1 : UNIT AVAILABLE FOR A FURTHER EVENT]
09:22:33	Unit AUCK207 [KC : UNIT CALLING]
09:23:37	Unit AUCK207 [K46-6 : STOP MESSAGE: FALSE ALARM NOTHING SHOWING ON INDICATOR
09:23:37	PANEL]
09:23:38	Unit AUCK207 [K4 : ON RT INSIDE NORMAL TURNOUT AREA]
10:49:04	BUSINESS RULE CHECKS CANCELLED AT 20/11/14 10:49:04
11:01:33	** Assigned Result Code: STRU, Detailed Event Type: 7100, Qualifier 1: Q1,
11:01:33	Qualifier 2:

Incident

CAD Number	F1731085
Incident Reporter	Phil Thomas
Incident Controller	SSO Lind

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Distance Travelled (km)	3
Delay In Receiving Call	

False Alarm

Detector Type	Smoke detector
False Alarm Cause	Equipment | Defect system wiring
Other Cause	

Property Details

Occupant	
Building Owner	
General Property Use	Vacant building, Section
Special Property Use	Vacant section
Purpose Group	WL - Working, Business or Storage Light Fire Hazard

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Appendix H: Investigation Data for Oram's Current Facility

- Borelog logs.
- Laboratory transcripts – previous investigations.
- Laboratory transcripts – current groundwater investigation.

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ANALYSIS REPORT

Client:	Tonkin & Taylor	**Lab No:**	623289 SPv1
Contact:	O'Loan, Andrew	**Date Registered:**	15-Dec-2007
	c/o Tonkin & Taylor	**Date Reported:**	28-Dec-2007
	P O Box 5271	**Quote No:**	
	AUCKLAND	**Order No:**	24057.100
		Client Reference:	24057.100
		Submitted By:	Williamson, Wendi

Sample Type: Soil

Sample Name:	BH1 0.5 10-Dec-2007	BH1 2.5 10-Dec-2007	BH1 4 10-Dec-2007	BH2 0.25 11-Dec-2007	BH2 1.5 11-Dec-2007
Lab Number:	623289.2	623289.6	623289.8	623289.11	623289.14
Individual Tests					
Dry Matter g/100g as rcvd	-	70	-	88	-
Total Cyanide* mg/kg dry wt	< 0.021	< 0.026	-	< 0.019	1.6

Sample Name:	BH2 3 11-Dec-2007	BH2 4 11-Dec-2007	BH2 4.5 11-Dec-2007	BH2 5 11-Dec-2007	BH3 0.25 11-Dec-2007
Lab Number:	623289.17	623289.19	623289.20	623289.21	623289.22
Individual Tests					
Total Cyanide* mg/kg dry wt	-	-	< 0.024	-	-

Sample Name:	BH3 0.5 11-Dec-2007	BH3 1.5 11-Dec-2007	BH3 2.5 11-Dec-2007		
Lab Number:	623289.23	623289.25	623289.27		
Individual Tests					
Total Cyanide* mg/kg dry wt	2.3	-	-	-	-

Sample Name:	BH1 0.5 10-Dec-2007	BH1 2.5 10-Dec-2007	BH1 4 10-Dec-2007	BH2 0.25 11-Dec-2007	BH2 1.5 11-Dec-2007
Lab Number:	623289.2	623289.6	623289.8	623289.11	623289.14
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg					
Total Recoverable Arsenic mg/kg dry wt	-	3.3	-	-	96
Total Recoverable Cadmium mg/kg dry wt	-	< 0.10	-	-	6.5
Total Recoverable Chromium mg/kg dry wt	-	22	-	-	55
Total Recoverable Copper mg/kg dry wt	-	60	-	-	6800
Total Recoverable Lead mg/kg dry wt	-	39	-	-	15000
Total Recoverable Mercury mg/kg dry wt	-	0.47	-	-	58
Total Recoverable Nickel mg/kg dry wt	-	13	-	-	55
Total Recoverable Zinc mg/kg dry wt	-	110	-	-	7000

Sample Name:	BH2 3 11-Dec-2007	BH2 4 11-Dec-2007	BH2 4.5 11-Dec-2007	BH2 5 11-Dec-2007	BH3 0.25 11-Dec-2007
Lab Number:	623289.17	623289.19	623289.20	623289.21	623289.22
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg					
Total Recoverable Arsenic mg/kg dry wt	4.5	-	-	4.6	-
Total Recoverable Cadmium mg/kg dry wt	0.19	-	-	< 0.10	-
Total Recoverable Chromium mg/kg dry wt	19	-	-	18	-
Total Recoverable Copper mg/kg dry wt	51	-	-	17	-
Total Recoverable Lead mg/kg dry wt	28	-	-	27	-
Total Recoverable Mercury mg/kg dry wt	0.32	-	-	0.25	-
Total Recoverable Nickel mg/kg dry wt	16	-	-	18	-
Total Recoverable Zinc mg/kg dry wt	180	-	-	57	-

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

Sample Type: Soil						
Sample Name:		BH3 0.5 11-Dec-2007	BH3 1.5 11-Dec-2007	BH3 2.5 11-Dec-2007		
Lab Number:		623289.23	623289.25	623289.27		
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	-	9.2	7.2	-	-
Total Recoverable Cadmium	mg/kg dry wt	-	0.38	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	-	19	14	-	-
Total Recoverable Copper	mg/kg dry wt	-	41	45	-	-
Total Recoverable Lead	mg/kg dry wt	-	370	230	-	-
Total Recoverable Mercury	mg/kg dry wt	-	0.34	0.12	-	-
Total Recoverable Nickel	mg/kg dry wt	-	39	37	-	-
Total Recoverable Zinc	mg/kg dry wt	-	280	120	-	-

Sample Name:		BH1 0.5 10-Dec-2007	BH1 2.5 10-Dec-2007	BH1 4 10-Dec-2007	BH2 0.25 11-Dec-2007	BH2 1.5 11-Dec-2007
Lab Number:		623289.2	623289.6	623289.8	623289.11	623289.14
USEPA Priority Pollutants - Scrn Level, 13 metals						
Total Recoverable Antimony	mg/kg dry wt	6.6	-	-	-	-
Total Recoverable Arsenic	mg/kg dry wt	< 2.0	-	-	-	-
Total Recoverable Beryllium	mg/kg dry wt	< 0.20	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	7.0	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	9.4	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	2600	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	24	-	-	-	-
Total Recoverable Selenium	mg/kg dry wt	< 20	-	-	-	-
Total Recoverable Silver	mg/kg dry wt	< 0.40	-	-	-	-
Total Recoverable Thallium	mg/kg dry wt	< 0.20	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	85	-	-	-	-

Sample Name:		BH2 3 11-Dec-2007	BH2 4 11-Dec-2007	BH2 4.5 11-Dec-2007	BH2 5 11-Dec-2007	BH3 0.25 11-Dec-2007
Lab Number:		623289.17	623289.19	623289.20	623289.21	623289.22
USEPA Priority Pollutants - Scrn Level, 13 metals						
Total Recoverable Antimony	mg/kg dry wt	-	-	< 0.40	-	-
Total Recoverable Arsenic	mg/kg dry wt	-	-	7.0	-	-
Total Recoverable Beryllium	mg/kg dry wt	-	-	0.55	-	-
Total Recoverable Cadmium	mg/kg dry wt	-	-	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	-	-	12	-	-
Total Recoverable Copper	mg/kg dry wt	-	-	6.4	-	-
Total Recoverable Lead	mg/kg dry wt	-	-	8.2	-	-
Total Recoverable Mercury	mg/kg dry wt	-	-	0.13	-	-
Total Recoverable Nickel	mg/kg dry wt	-	-	17	-	-
Total Recoverable Selenium	mg/kg dry wt	-	-	< 20	-	-
Total Recoverable Silver	mg/kg dry wt	-	-	< 0.40	-	-
Total Recoverable Thallium	mg/kg dry wt	-	-	< 0.20	-	-
Total Recoverable Zinc	mg/kg dry wt	-	-	36	-	-

Sample Name:		BH3 0.5 11-Dec-2007	BH3 1.5 11-Dec-2007	BH3 2.5 11-Dec-2007		
Lab Number:		623289.23	623289.25	623289.27		
USEPA Priority Pollutants - Scrn Level, 13 metals						
Total Recoverable Antimony	mg/kg dry wt	3.9	-	-	-	-
Total Recoverable Arsenic	mg/kg dry wt	7.7	-	-	-	-
Total Recoverable Beryllium	mg/kg dry wt	2.4	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	1.6	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	49	-	-	-	-

Sample Type: Soil						
Sample Name:		BH3 0.5 11-Dec-2007	BH3 1.5 11-Dec-2007	BH3 2.5 11-Dec-2007		
Lab Number:		623289.23	623289.25	623289.27		
USEPA Priority Pollutants - Scrn Level, 13 metals						
Total Recoverable Copper	mg/kg dry wt	140	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	700	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	0.35	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	83	-	-	-	-
Total Recoverable Selenium	mg/kg dry wt	< 20	-	-	-	-
Total Recoverable Silver	mg/kg dry wt	< 0.40	-	-	-	-
Total Recoverable Thallium	mg/kg dry wt	< 0.20	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	620	-	-	-	-

Sample Name:		BH1 0.5 10-Dec-2007	BH1 2.5 10-Dec-2007	BH1 4 10-Dec-2007	BH2 0.25 11-Dec-2007	BH2 1.5 11-Dec-2007
Lab Number:		623289.2	623289.6	623289.8	623289.11	623289.14
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	82	-	-	-	72
Acenaphthene	mg/kg dry wt	< 0.029	-	-	-	0.37
Acenaphthylene	mg/kg dry wt	< 0.029	-	-	-	0.68
Anthracene	mg/kg dry wt	< 0.029	-	-	-	2.2
Benzo[a]anthracene	mg/kg dry wt	< 0.029	-	-	-	7.7
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.029	-	-	-	7.0
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.029	-	-	-	16
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.029	-	-	-	5.7
Benzo[k]fluoranthene	mg/kg dry wt	< 0.029	-	-	-	4.8
Chrysene	mg/kg dry wt	< 0.029	-	-	-	8.3
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.029	-	-	-	2.0
Fluoranthene	mg/kg dry wt	< 0.029	-	-	-	17
Fluorene	mg/kg dry wt	< 0.029	-	-	-	0.83
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.029	-	-	-	4.4
Naphthalene	mg/kg dry wt	< 0.15	-	-	-	0.92
Phenanthrene	mg/kg dry wt	< 0.029	-	-	-	9.8
Pyrene	mg/kg dry wt	< 0.029	-	-	-	16

Sample Name:		BH2 3 11-Dec-2007	BH2 4 11-Dec-2007	BH2 4.5 11-Dec-2007	BH2 5 11-Dec-2007	BH3 0.25 11-Dec-2007
Lab Number:		623289.17	623289.19	623289.20	623289.21	623289.22
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	77	-	71	70	-
Acenaphthene	mg/kg dry wt	< 0.029	-	< 0.032	< 0.032	-
Acenaphthylene	mg/kg dry wt	< 0.029	-	< 0.032	< 0.032	-
Anthracene	mg/kg dry wt	< 0.029	-	< 0.032	< 0.032	-
Benzo[a]anthracene	mg/kg dry wt	0.031	-	< 0.032	0.048	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.030	-	< 0.032	0.081	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.078	-	0.060	0.14	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.031	-	0.038	0.076	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.029	-	< 0.032	0.034	-
Chrysene	mg/kg dry wt	0.039	-	0.033	0.095	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.029	-	< 0.032	< 0.032	-
Fluoranthene	mg/kg dry wt	0.072	-	0.056	0.14	-
Fluorene	mg/kg dry wt	< 0.029	-	< 0.032	< 0.032	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.029	-	< 0.032	0.052	-
Naphthalene	mg/kg dry wt	< 0.15	-	< 0.16	< 0.16	-
Phenanthrene	mg/kg dry wt	0.048	-	< 0.032	0.052	-

Sample Type: Soil						
Sample Name:		BH2 3 11-Dec-2007	BH2 4 11-Dec-2007	BH2 4.5 11-Dec-2007	BH2 5 11-Dec-2007	BH3 0.25 11-Dec-2007
Lab Number:		623289.17	623289.19	623289.20	623289.21	623289.22
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Pyrene	mg/kg dry wt	0.075	-	0.066	0.15	-

Sample Name:		BH3 0.5 11-Dec-2007	BH3 1.5 11-Dec-2007	BH3 2.5 11-Dec-2007		
Lab Number:		623289.23	623289.25	623289.27		
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	-	72	71	-	-
Acenaphthene	mg/kg dry wt	-	< 0.031	0.050	-	-
Acenaphthylene	mg/kg dry wt	-	< 0.031	0.036	-	-
Anthracene	mg/kg dry wt	-	0.059	< 0.033	-	-
Benzo[a]anthracene	mg/kg dry wt	-	0.22	0.038	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	0.38	0.037	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	0.58	0.080	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	0.35	0.055	-	-
Benzo[k]fluoranthene	mg/kg dry wt	-	0.27	0.035	-	-
Chrysene	mg/kg dry wt	-	0.41	0.055	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	0.12	< 0.033	-	-
Fluoranthene	mg/kg dry wt	-	0.61	0.13	-	-
Fluorene	mg/kg dry wt	-	< 0.031	0.056	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	0.25	< 0.033	-	-
Naphthalene	mg/kg dry wt	-	< 0.16	< 0.17	-	-
Phenanthrene	mg/kg dry wt	-	0.23	0.13	-	-
Pyrene	mg/kg dry wt	-	0.72	0.12	-	-

Sample Name:		BH1 0.5 10-Dec-2007	BH1 2.5 10-Dec-2007	BH1 4 10-Dec-2007	BH2 0.25 11-Dec-2007	BH2 1.5 11-Dec-2007
Lab Number:		623289.2	623289.6	623289.8	623289.11	623289.14
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	-	-	82	-	-
C7 - C9	mg/kg dry wt	-	-	< 8.0	-	-
C10 - C14	mg/kg dry wt	-	-	< 20	-	-
C15 - C36	mg/kg dry wt	-	-	< 30	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	< 60	-	-

Sample Name:		BH2 3 11-Dec-2007	BH2 4 11-Dec-2007	BH2 4.5 11-Dec-2007	BH2 5 11-Dec-2007	BH3 0.25 11-Dec-2007
Lab Number:		623289.17	623289.19	623289.20	623289.21	623289.22
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	-	83	71	-	88
C7 - C9	mg/kg dry wt	-	< 8.0	< 9.4	-	< 8.0
C10 - C14	mg/kg dry wt	-	< 20	< 20	-	< 20
C15 - C36	mg/kg dry wt	-	< 30	< 30	-	< 30
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	< 60	< 60	-	< 60

Sample Name:		BH3 0.5 11-Dec-2007	BH3 1.5 11-Dec-2007	BH3 2.5 11-Dec-2007		
Lab Number:		623289.23	623289.25	623289.27		
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	87	-	-	-	-
C7 - C9	mg/kg dry wt	15	-	-	-	-
C10 - C14	mg/kg dry wt	1500	-	-	-	-
C15 - C36	mg/kg dry wt	9100	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	11000	-	-	-	-

Analyst's Comments

Appendix No.1 - Total Petroleum Hydrocarbon Chromatograms

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Samples
Environmental Solids Sample Preparation*	Air dried at 35°C and sieved, <2mm fraction.	-	2, 6, 14, 17, 20-21, 23, 25, 27
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg*	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	-	6, 14, 17, 21, 25, 27
USEPA Priority Pollutants - Scrn Level, 13 metals*	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	-	2, 20, 23
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis	-	2, 14, 17, 20-21, 25, 27
Total Petroleum Hydrocarbons in Soil*	Sonication extraction, Silica cleanup, GC-FID analysis	-	8, 19-20, 22-23
Dry Matter (Org)	Dried at 103°C (removes 3-5% more water than air dry), gravimetry.	0.10 g/100g as rcvd	2, 6, 8, 11, 14, 17, 19-23, 25, 27
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2	-	2, 6, 14, 17, 20-21, 23, 25, 27
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C & E 21st ed. 2005.	-	2, 6, 11, 14, 20, 23
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C & E 21st ed. 2005.	0.0020 mg/kg dry wt	2, 6, 11, 14, 20, 23

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

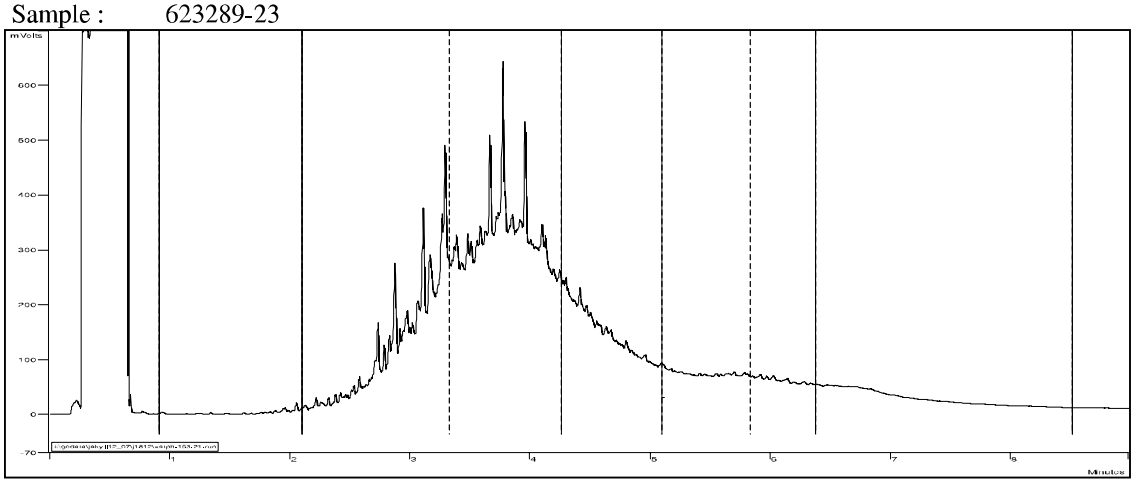
Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental Division

Sample : 623289-23



C7 C10 C15 C20 C25 C30 C34 C44

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ANALYSIS REPORT

Client:	Tonkin & Taylor	**Lab No:**	623897 SPv1
Contact:	O'Loan, Andrew	**Date Registered:**	18-Dec-2007
	c/o Tonkin & Taylor	**Date Reported:**	28-Dec-2007
	P O Box 5271	**Quote No:**	
	AUCKLAND	**Order No:**	24057.100
		Client Reference:	24057.100
		Submitted By:	O'Loan, Andrew

Sample Type: Soil

Sample Name:		BH4 0.25 15-Dec-2007	BH4 0.5 15-Dec-2007	BH4 2.5 15-Dec-2007	BH4 4.0 15-Dec-2007	BH4 5.5 15-Dec-2007
Lab Number:		623897.1	623897.2	623897.5	623897.8	623897.11
Individual Tests						
Dry Matter	g/100g as rcvd	57	-	-	-	-
Total Cyanide*	mg/kg dry wt	< 0.027	-	0.029	-	-

Sample Name:		BH4 6.0 15-Dec-2007	BH5 0.5 15-Dec-2007	BH5 1.0 15-Dec-2007	BH5 2.0 15-Dec-2007	BH5 3.5 15-Dec-2007
Lab Number:		623897.12	623897.17	623897.18	623897.20	623897.23
Individual Tests						
Dry Matter	g/100g as rcvd	-	87	-	-	-
Total Cyanide*	mg/kg dry wt	< 0.028	0.037	-	< 0.024	-

Sample Name:		BH4 0.25 15-Dec-2007	BH4 0.5 15-Dec-2007	BH4 2.5 15-Dec-2007	BH4 4.0 15-Dec-2007	BH4 5.5 15-Dec-2007
Lab Number:		623897.1	623897.2	623897.5	623897.8	623897.11
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	-	3.0	-	5.7	-
Total Recoverable Cadmium	mg/kg dry wt	-	< 0.10	-	0.14	-
Total Recoverable Chromium	mg/kg dry wt	-	17	-	21	-
Total Recoverable Copper	mg/kg dry wt	-	36	-	25	-
Total Recoverable Lead	mg/kg dry wt	-	31	-	49	-
Total Recoverable Mercury	mg/kg dry wt	-	0.98	-	0.87	-
Total Recoverable Nickel	mg/kg dry wt	-	22	-	22	-
Total Recoverable Zinc	mg/kg dry wt	-	63	-	110	-

Sample Name:		BH4 6.0 15-Dec-2007	BH5 0.5 15-Dec-2007	BH5 1.0 15-Dec-2007	BH5 2.0 15-Dec-2007	BH5 3.5 15-Dec-2007
Lab Number:		623897.12	623897.17	623897.18	623897.20	623897.23
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	5.3	4.9	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.12	0.17	-	-	-
Total Recoverable Chromium	mg/kg dry wt	15	22	-	-	-
Total Recoverable Copper	mg/kg dry wt	8.9	31	-	-	-
Total Recoverable Lead	mg/kg dry wt	8.1	20	-	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	0.28	-	-	-
Total Recoverable Nickel	mg/kg dry wt	6.9	30	-	-	-
Total Recoverable Zinc	mg/kg dry wt	28	130	-	-	-

Sample Name:	BH5 5.0 15-Dec-2007
Lab Number:	623897.26
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		BH5 5.0 15-Dec-2007				
Lab Number:		623897.26				
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	6.3	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.11	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	21	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	25	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	8.1	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	0.11	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	33	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	96	-	-	-	-

Sample Name:		BH4 0.25 15-Dec-2007	BH4 0.5 15-Dec-2007	BH4 2.5 15-Dec-2007	BH4 4.0 15-Dec-2007	BH4 5.5 15-Dec-2007
Lab Number:		623897.1	623897.2	623897.5	623897.8	623897.11
USEPA Priority Pollutants - Scrn Level, 13 metals						
Total Recoverable Antimony	mg/kg dry wt	< 0.40	-	< 0.40	-	< 0.40
Total Recoverable Arsenic	mg/kg dry wt	6.5	-	7.3	-	5.6
Total Recoverable Beryllium	mg/kg dry wt	0.78	-	0.46	-	0.42
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	-	< 0.10	-	< 0.10
Total Recoverable Chromium	mg/kg dry wt	13	-	14	-	13
Total Recoverable Copper	mg/kg dry wt	93	-	21	-	7.0
Total Recoverable Lead	mg/kg dry wt	21	-	7.6	-	7.4
Total Recoverable Mercury	mg/kg dry wt	0.34	-	< 0.10	-	< 0.10
Total Recoverable Nickel	mg/kg dry wt	34	-	19	-	6.3
Total Recoverable Selenium	mg/kg dry wt	< 20	-	< 20	-	< 20
Total Recoverable Silver	mg/kg dry wt	< 0.40	-	< 0.40	-	< 0.40
Total Recoverable Thallium	mg/kg dry wt	< 0.20	-	< 0.20	-	< 0.20
Total Recoverable Zinc	mg/kg dry wt	59	-	56	-	26

Sample Name:		BH4 6.0 15-Dec-2007	BH5 0.5 15-Dec-2007	BH5 1.0 15-Dec-2007	BH5 2.0 15-Dec-2007	BH5 3.5 15-Dec-2007
Lab Number:		623897.12	623897.17	623897.18	623897.20	623897.23
USEPA Priority Pollutants - Scrn Level, 13 metals						
Total Recoverable Antimony	mg/kg dry wt	-	-	< 0.40	-	-
Total Recoverable Arsenic	mg/kg dry wt	-	-	< 2.0	-	-
Total Recoverable Beryllium	mg/kg dry wt	-	-	0.94	-	-
Total Recoverable Cadmium	mg/kg dry wt	-	-	0.15	-	-
Total Recoverable Chromium	mg/kg dry wt	-	-	24	-	-
Total Recoverable Copper	mg/kg dry wt	-	-	31	-	-
Total Recoverable Lead	mg/kg dry wt	-	-	7.4	-	-
Total Recoverable Mercury	mg/kg dry wt	-	-	< 0.10	-	-
Total Recoverable Nickel	mg/kg dry wt	-	-	28	-	-
Total Recoverable Selenium	mg/kg dry wt	-	-	< 20	-	-
Total Recoverable Silver	mg/kg dry wt	-	-	< 0.40	-	-
Total Recoverable Thallium	mg/kg dry wt	-	-	< 0.20	-	-
Total Recoverable Zinc	mg/kg dry wt	-	-	95	-	-

Sample Name:		BH4 0.25 15-Dec-2007	BH4 0.5 15-Dec-2007	BH4 2.5 15-Dec-2007	BH4 4.0 15-Dec-2007	BH4 5.5 15-Dec-2007
Lab Number:		623897.1	623897.2	623897.5	623897.8	623897.11
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	-	67	83	70	-
Acenaphthene	mg/kg dry wt	-	< 0.037	< 0.028	< 0.034	-
Acenaphthylene	mg/kg dry wt	-	< 0.037	< 0.028	0.062	-
Anthracene	mg/kg dry wt	-	< 0.037	< 0.028	0.17	-
Benzo[a]anthracene	mg/kg dry wt	-	0.058	< 0.028	0.40	-

Sample Type: Soil						
Sample Name:		BH4 0.25 15-Dec-2007	BH4 0.5 15-Dec-2007	BH4 2.5 15-Dec-2007	BH4 4.0 15-Dec-2007	BH4 5.5 15-Dec-2007
Lab Number:		623897.1	623897.2	623897.5	623897.8	623897.11
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	0.10	< 0.028	0.76	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	0.12	< 0.028	0.92	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	0.11	< 0.028	0.72	-
Benzo[k]fluoranthene	mg/kg dry wt	-	0.070	< 0.028	0.51	-
Chrysene	mg/kg dry wt	-	0.13	< 0.028	0.81	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.037	< 0.028	0.21	-
Fluoranthene	mg/kg dry wt	-	0.20	< 0.028	1.4	-
Fluorene	mg/kg dry wt	-	< 0.037	< 0.028	< 0.034	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	0.065	< 0.028	0.52	-
Naphthalene	mg/kg dry wt	-	< 0.19	< 0.14	< 0.17	-
Phenanthrene	mg/kg dry wt	-	0.061	< 0.028	0.47	-
Pyrene	mg/kg dry wt	-	0.24	< 0.028	1.8	-

Sample Name:		BH4 6.0 15-Dec-2007	BH5 0.5 15-Dec-2007	BH5 1.0 15-Dec-2007	BH5 2.0 15-Dec-2007	BH5 3.5 15-Dec-2007
Lab Number:		623897.12	623897.17	623897.18	623897.20	623897.23
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	62	-	-	67	77
Acenaphthene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Acenaphthylene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Anthracene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Benzo[a]anthracene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Benzo[k]fluoranthene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Chrysene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Fluoranthene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Fluorene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Naphthalene	mg/kg dry wt	< 0.19	-	-	< 0.17	< 0.14
Phenanthrene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028
Pyrene	mg/kg dry wt	< 0.037	-	-	< 0.034	< 0.028

Sample Name:		BH5 5.0 15-Dec-2007				
Lab Number:		623897.26				
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	78	-	-	-	-
Acenaphthene	mg/kg dry wt	< 0.027	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.027	-	-	-	-
Anthracene	mg/kg dry wt	< 0.027	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.027	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.027	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.027	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.027	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.027	-	-	-	-
Chrysene	mg/kg dry wt	< 0.027	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.027	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.027	-	-	-	-

Sample Type: Soil						
Sample Name:		BH5 5.0 15-Dec-2007				
Lab Number:		623897.26				
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Fluorene	mg/kg dry wt	< 0.027	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.027	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.14	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.027	-	-	-	-
Pyrene	mg/kg dry wt	< 0.027	-	-	-	-

Sample Name:		BH4 6.0 15-Dec-2007	BH5 0.5 15-Dec-2007	BH5 1.0 15-Dec-2007	BH5 2.0 15-Dec-2007	BH5 3.5 15-Dec-2007
Lab Number:		623897.12	623897.17	623897.18	623897.20	623897.23
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	-	-	-	-	77
C7 - C9	mg/kg dry wt	-	-	-	-	< 8.4
C10 - C14	mg/kg dry wt	-	-	-	-	< 20
C15 - C36	mg/kg dry wt	-	-	-	-	< 30
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	-	-	< 60

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Samples**
Environmental Solids Sample Preparation*	Air dried at 35°C and sieved, <2mm fraction.	-	1-2, 5, 8, 11-12, 17-18, 26
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg*	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	-	2, 8, 12, 17, 26
USEPA Priority Pollutants - Scrn Level, 13 metals*	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	-	1, 5, 11, 18
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis	-	2, 5, 8, 12, 20, 23, 26
Total Petroleum Hydrocarbons in Soil*	Sonication extraction, Silica cleanup, GC-FID analysis	-	23
Dry Matter (Org)	Dried at 103°C (removes 3-5% more water than air dry), gravimetry.	0.10 g/100g as rcvd	1-2, 5, 8, 12, 17, 20, 23, 26
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2	-	1-2, 5, 8, 11-12, 17-18, 26
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C & E 21st ed. 2005.	-	1, 5, 12, 17, 20
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C & E 21st ed. 2005.	0.0020 mg/kg dry wt	1, 5, 12, 17, 20

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

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

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental Division

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ANALYSIS REPORT

Client:	Tonkin & Taylor	**Lab No:**	626135	SPv2
Contact:	O'Loan, Andrew	**Date Registered:**	14-Jan-2008	
	c/o Tonkin & Taylor	**Date Reported:**	07-Feb-2008	
	P O Box 5271	**Quote No:**		
	AUCKLAND	**Order No:**	24057.100	
		Client Reference:	24057.100	
		Submitted By:	O'Loan, Andrew	

Sample Type: Soil

Sample Name:		BH6 0.0 12-Jan-2008	BH6 0.25 12-Jan-2008	BH6 0.5 12-Jan-2008	BH6 1.0 12-Jan-2008	BH6 3.5 12-Jan-2008
Lab Number:		626135.1	626135.2	626135.3	626135.4	626135.5
USEPA Priority Pollutants - Scrn Level, 13 metals						
Total Recoverable Antimony	mg/kg dry wt	-	< 0.40	-	1.3	-
Total Recoverable Arsenic	mg/kg dry wt	-	3.6	-	8.6	-
Total Recoverable Beryllium	mg/kg dry wt	-	1.2	-	0.48	-
Total Recoverable Cadmium	mg/kg dry wt	-	0.11	-	0.55	-
Total Recoverable Chromium	mg/kg dry wt	-	26	-	94	-
Total Recoverable Copper	mg/kg dry wt	-	120	-	130	-
Total Recoverable Lead	mg/kg dry wt	-	35	-	1000	-
Total Recoverable Mercury	mg/kg dry wt	-	0.16	-	< 0.10	-
Total Recoverable Nickel	mg/kg dry wt	-	110	-	210	-
Total Recoverable Selenium	mg/kg dry wt	-	< 20	-	< 20	-
Total Recoverable Silver	mg/kg dry wt	-	< 0.40	-	< 0.40	-
Total Recoverable Thallium	mg/kg dry wt	-	< 0.20	-	< 0.20	-
Total Recoverable Zinc	mg/kg dry wt	-	95	-	1300	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	-	82	-	84	-
Acenaphthene	mg/kg dry wt	-	< 0.028	-	< 0.028	-
Acenaphthylene	mg/kg dry wt	-	< 0.028	-	< 0.028	-
Anthracene	mg/kg dry wt	-	< 0.028	-	< 0.028	-
Benzo[a]anthracene	mg/kg dry wt	-	< 0.028	-	< 0.028	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	< 0.028	-	< 0.028	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	0.033	-	< 0.028	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	< 0.028	-	< 0.028	-
Benzo[k]fluoranthene	mg/kg dry wt	-	0.028	-	< 0.028	-
Chrysene	mg/kg dry wt	-	< 0.028	-	< 0.028	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.028	-	< 0.028	-
Fluoranthene	mg/kg dry wt	-	0.042	-	< 0.028	-
Fluorene	mg/kg dry wt	-	< 0.028	-	< 0.028	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	< 0.028	-	< 0.028	-
Naphthalene	mg/kg dry wt	-	< 0.14	-	< 0.14	-
Phenanthrene	mg/kg dry wt	-	< 0.028	-	< 0.028	-
Pyrene	mg/kg dry wt	-	0.052	-	< 0.028	-
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	-	82	-	-	-
C7 - C9	mg/kg dry wt	-	< 8.4	-	-	-

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		BH6 0.0 12-Jan-2008	BH6 0.25 12-Jan-2008	BH6 0.5 12-Jan-2008	BH6 1.0 12-Jan-2008	BH6 3.5 12-Jan-2008
Lab Number:		626135.1	626135.2	626135.3	626135.4	626135.5
Total Petroleum Hydrocarbons in Soil						
C10 - C14	mg/kg dry wt	-	< 20	-	-	-
C15 - C36	mg/kg dry wt	-	< 30	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	< 60	-	-	-

Sample Name:		BH6 4.5 12-Jan-2008	BH7 0.0 12-Jan-2008	BH7 0.25 12-Jan-2008	BH7 0.5 12-Jan-2008	BH7 1.0 12-Jan-2008
Lab Number:		626135.6	626135.7	626135.8	626135.9	626135.10
Individual Tests						
Dry Matter	g/100g as rcvd	91	-	-	-	-
Total Cyanide*	mg/kg dry wt	< 0.10	-	< 0.10	-	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	4.3	-	< 2.0	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	-	0.28	-	-
Total Recoverable Chromium	mg/kg dry wt	24	-	58	-	-
Total Recoverable Copper	mg/kg dry wt	25	-	170	-	-
Total Recoverable Lead	mg/kg dry wt	56	-	530	-	-
Total Recoverable Mercury	mg/kg dry wt	2.2	-	0.53	-	-
Total Recoverable Nickel	mg/kg dry wt	19	-	210	-	-
Total Recoverable Zinc	mg/kg dry wt	64	-	170	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	-	-	-	-	70
Acenaphthene	mg/kg dry wt	-	-	-	-	< 0.031
Acenaphthylene	mg/kg dry wt	-	-	-	-	< 0.031
Anthracene	mg/kg dry wt	-	-	-	-	< 0.031
Benzo[a]anthracene	mg/kg dry wt	-	-	-	-	0.037
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	-	0.061
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	-	-	0.037
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	-	0.065
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	-	0.032
Chrysene	mg/kg dry wt	-	-	-	-	0.039
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	-	< 0.031
Fluoranthene	mg/kg dry wt	-	-	-	-	0.042
Fluorene	mg/kg dry wt	-	-	-	-	< 0.031
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	-	0.043
Naphthalene	mg/kg dry wt	-	-	-	-	0.23
Phenanthrene	mg/kg dry wt	-	-	-	-	< 0.031
Pyrene	mg/kg dry wt	-	-	-	-	0.052
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	-	-	94	-	70
C7 - C9	mg/kg dry wt	-	-	190	-	< 9.2
C10 - C14	mg/kg dry wt	-	-	950	-	< 20
C15 - C36	mg/kg dry wt	-	-	1700	-	< 30
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	2800	-	< 60
BTEX in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	-	94	-	-
Benzene	mg/kg dry wt	-	-	0.31	-	-
Toluene	mg/kg dry wt	-	-	0.17	-	-
Ethylbenzene	mg/kg dry wt	-	-	1.7	-	-
m&p-Xylene	mg/kg dry wt	-	-	2.1	-	-
o-Xylene	mg/kg dry wt	-	-	0.11	-	-
Halogenated Aliphatics in VOC Soils by Purge&Trap GC-MS						

Sample Type: Soil						
Sample Name:		BH6 4.5 12-Jan-2008	BH7 0.0 12-Jan-2008	BH7 0.25 12-Jan-2008	BH7 0.5 12-Jan-2008	BH7 1.0 12-Jan-2008
Lab Number:		626135.6	626135.7	626135.8	626135.9	626135.10
Halogenated Aliphatics in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	-	94	-	-
Bromomethane	mg/kg dry wt	-	-	< 1.0	-	-
Carbon tetrachloride	mg/kg dry wt	-	-	< 0.20	-	-
Chloroethane	mg/kg dry wt	-	-	< 1.0	-	-
Chloromethane	mg/kg dry wt	-	-	< 1.0	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	-	< 1.0	-	-
1,2-Dibromoethane (ethylene dibromide)	mg/kg dry wt	-	-	< 1.0	-	-
Dibromomethane	mg/kg dry wt	-	-	< 1.0	-	-
Dichlorodifluoromethane	mg/kg dry wt	-	-	< 1.0	-	-
1,1-Dichloroethane	mg/kg dry wt	-	-	< 0.40	-	-
1,2-Dichloroethane	mg/kg dry wt	-	-	< 1.0	-	-
1,1-Dichloroethene	mg/kg dry wt	-	-	< 0.40	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	-	-	< 0.20	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	-	-	< 0.40	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	-	-	< 1.0	-	-
1,2-Dichloropropane	mg/kg dry wt	-	-	< 1.0	-	-
1,3-Dichloropropane	mg/kg dry wt	-	-	< 1.0	-	-
2,2-Dichloropropane	mg/kg dry wt	-	-	< 0.20	-	-
1,1-Dichloropropene	mg/kg dry wt	-	-	< 0.20	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	-	-	< 1.0	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	-	-	< 1.0	-	-
Hexachlorobutadiene	mg/kg dry wt	-	-	< 0.20	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	-	< 0.20	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	-	< 1.0	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	-	< 1.0	-	-
1,1,1-Trichloroethane	mg/kg dry wt	-	-	< 0.20	-	-
1,1,2-Trichloroethane	mg/kg dry wt	-	-	< 1.0	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	-	< 0.20	-	-
Trichlorofluoromethane	mg/kg dry wt	-	-	< 0.40	-	-
1,2,3-Trichloropropane	mg/kg dry wt	-	-	< 1.0	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	-	< 1.0	-	-
Vinyl chloride	mg/kg dry wt	-	-	< 1.0	-	-
Haloaromatics in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	-	94	-	-
Bromobenzene	mg/kg dry wt	-	-	< 0.20	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	-	< 0.20	-	-
2-Chlorotoluene	mg/kg dry wt	-	-	< 0.20	-	-
4-Chlorotoluene	mg/kg dry wt	-	-	< 0.20	-	-
1,2-Dichlorobenzene	mg/kg dry wt	-	-	< 0.20	-	-
1,3-Dichlorobenzene	mg/kg dry wt	-	-	< 0.20	-	-
1,4-Dichlorobenzene	mg/kg dry wt	-	-	< 0.20	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	-	-	< 0.20	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	-	-	< 0.20	-	-
Monoaromatic Hydrocarbons in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	-	94	-	-
n-Butylbenzene	mg/kg dry wt	-	-	4.8	-	-

Sample Type: Soil						
Sample Name:		BH6 4.5 12-Jan-2008	BH7 0.0 12-Jan-2008	BH7 0.25 12-Jan-2008	BH7 0.5 12-Jan-2008	BH7 1.0 12-Jan-2008
Lab Number:		626135.6	626135.7	626135.8	626135.9	626135.10
Monoaromatic Hydrocarbons in VOC Soils by Purge&Trap GC-MS						
tert-Butylbenzene	mg/kg dry wt	-	-	< 0.20	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	-	-	3.7	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	-	0.99	-	-
n-Propylbenzene	mg/kg dry wt	-	-	9.0	-	-
sec-Butylbenzene	mg/kg dry wt	-	-	2.5	-	-
Styrene	mg/kg dry wt	-	-	< 0.20	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	-	-	25	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	-	-	3.7	-	-
Ketones in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	-	94	-	-
Acetone	mg/kg dry wt	-	-	< 22	-	-
2-Butanone (MEK)	mg/kg dry wt	-	-	< 6.0	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	-	< 1.0	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	-	< 10	-	-
Trihalomethanes in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	-	94	-	-
Bromodichloromethane	mg/kg dry wt	-	-	< 0.20	-	-
Bromoform (tribromomethane)	mg/kg dry wt	-	-	< 1.0	-	-
Chloroform (trichloromethane)	mg/kg dry wt	-	-	< 0.20	-	-
Dibromochloromethane	mg/kg dry wt	-	-	< 0.20	-	-
Other VOC in Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	-	94	-	-
Carbon disulphide	mg/kg dry wt	-	-	< 0.40	-	-
Naphthalene	mg/kg dry wt	-	-	3.7	-	-
System monitoring Compounds for VOC - % Recovery						
Dry Matter	g/100g as rcvd	-	-	94	-	-
4-Bromofluorobenzene	%	-	-	110	-	-
Toluene-d8	%	-	-	100	-	-

Sample Name:		BH7 1.5 12-Jan-2008	BH7 2.0 12-Jan-2008	BH7 2.5 12-Jan-2008	BH7 3.0 12-Jan-2008	BH7 3.5 12-Jan-2008
Lab Number:		626135.11	626135.12	626135.13	626135.14	626135.15
Individual Tests						
Total Cyanide*	mg/kg dry wt	-	-	< 0.10	-	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	-	-	4.3	-	-
Total Recoverable Cadmium	mg/kg dry wt	-	-	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	-	-	24	-	-
Total Recoverable Copper	mg/kg dry wt	-	-	33	-	-
Total Recoverable Lead	mg/kg dry wt	-	-	16	-	-
Total Recoverable Mercury	mg/kg dry wt	-	-	< 0.10	-	-
Total Recoverable Nickel	mg/kg dry wt	-	-	20	-	-
Total Recoverable Zinc	mg/kg dry wt	-	-	74	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	-	-	76	-	-
Acenaphthene	mg/kg dry wt	-	-	< 0.031	-	-
Acenaphthylene	mg/kg dry wt	-	-	< 0.031	-	-
Anthracene	mg/kg dry wt	-	-	< 0.031	-	-
Benzo[a]anthracene	mg/kg dry wt	-	-	< 0.031	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	< 0.031	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	-	-	< 0.031	-	-

Sample Type: Soil						
	Sample Name:	BH7 1.5 12-Jan-2008	BH7 2.0 12-Jan-2008	BH7 2.5 12-Jan-2008	BH7 3.0 12-Jan-2008	BH7 3.5 12-Jan-2008
	Lab Number:	626135.11	626135.12	626135.13	626135.14	626135.15
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	< 0.031	-	-
Benzo[k]fluoranthene	mg/kg dry wt	-	-	< 0.031	-	-
Chrysene	mg/kg dry wt	-	-	< 0.031	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	< 0.031	-	-
Fluoranthene	mg/kg dry wt	-	-	< 0.031	-	-
Fluorene	mg/kg dry wt	-	-	< 0.031	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	< 0.031	-	-
Naphthalene	mg/kg dry wt	-	-	0.25	-	-
Phenanthrene	mg/kg dry wt	-	-	0.042	-	-
Pyrene	mg/kg dry wt	-	-	< 0.031	-	-
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	75	-	76	-	-
C7 - C9	mg/kg dry wt	42	-	< 9.1	-	-
C10 - C14	mg/kg dry wt	< 20	-	26	-	-
C15 - C36	mg/kg dry wt	< 30	-	< 30	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 60	-	< 60	-	-

	Sample Name:	BH7 4.0 12-Jan-2008	BH7 4.5 12-Jan-2008	BH7 5.5 12-Jan-2008	BH7 6.0 12-Jan-2008	BH8 0.0 12-Jan-2008
	Lab Number:	626135.16	626135.17	626135.18	626135.19	626135.20
Individual Tests						
Total Cyanide*	mg/kg dry wt	< 0.10	-	-	-	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	4.8	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.15	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	23	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	34	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	12	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	27	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	100	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	75	-	-	-	-
C7 - C9	mg/kg dry wt	< 8.7	-	-	-	-
C10 - C14	mg/kg dry wt	< 20	-	-	-	-
C15 - C36	mg/kg dry wt	< 30	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 60	-	-	-	-

	Sample Name:	BH8 0.25 12-Jan-2008	BH8 0.5 12-Jan-2008	BH8 1.0 12-Jan-2008	BH8 1.5 12-Jan-2008	BH8 2.0 12-Jan-2008
	Lab Number:	626135.21	626135.22	626135.23	626135.24	626135.25
Individual Tests						
Total Cyanide*	mg/kg dry wt	-	-	1.3	0.10	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	-	-	42	< 2.0	-
Total Recoverable Cadmium	mg/kg dry wt	-	-	1.5	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	-	-	15	8.7	-
Total Recoverable Copper	mg/kg dry wt	-	-	260	12	-
Total Recoverable Lead	mg/kg dry wt	-	-	4600	33	-
Total Recoverable Mercury	mg/kg dry wt	-	-	9.4	< 0.10	-
Total Recoverable Nickel	mg/kg dry wt	-	-	17	22	-
Total Recoverable Zinc	mg/kg dry wt	-	-	1300	87	-

Sample Type: Soil						
Sample Name:		BH8 0.25 12-Jan-2008	BH8 0.5 12-Jan-2008	BH8 1.0 12-Jan-2008	BH8 1.5 12-Jan-2008	BH8 2.0 12-Jan-2008
Lab Number:		626135.21	626135.22	626135.23	626135.24	626135.25
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	-	-	-	81	-
Acenaphthene	mg/kg dry wt	-	-	-	< 0.029	-
Acenaphthylene	mg/kg dry wt	-	-	-	< 0.029	-
Anthracene	mg/kg dry wt	-	-	-	< 0.029	-
Benzo[a]anthracene	mg/kg dry wt	-	-	-	0.17	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	0.26	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	-	0.26	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	0.24	-
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	0.10	-
Chrysene	mg/kg dry wt	-	-	-	0.18	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	0.090	-
Fluoranthene	mg/kg dry wt	-	-	-	0.40	-
Fluorene	mg/kg dry wt	-	-	-	0.15	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	0.23	-
Naphthalene	mg/kg dry wt	-	-	-	< 0.15	-
Phenanthrene	mg/kg dry wt	-	-	-	0.32	-
Pyrene	mg/kg dry wt	-	-	-	0.40	-
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	-	78	49	81	-
C7 - C9	mg/kg dry wt	-	< 8.6	70	52	-
C10 - C14	mg/kg dry wt	-	< 20	420	970	-
C15 - C36	mg/kg dry wt	-	< 30	3000	430	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	< 60	3500	1500	-

Sample Name:		BH8 2.5 12-Jan-2008	BH8 3.0 12-Jan-2008	BH8 3.5 12-Jan-2008	BH8 4.0 12-Jan-2008	BH8 4.5 12-Jan-2008
Lab Number:		626135.26	626135.27	626135.28	626135.29	626135.30
Individual Tests						
Total Cyanide*	mg/kg dry wt	-	< 0.10	-	-	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	-	4.6	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	-	0.11	-	-	-
Total Recoverable Chromium	mg/kg dry wt	-	14	-	-	-
Total Recoverable Copper	mg/kg dry wt	-	27	-	-	-
Total Recoverable Lead	mg/kg dry wt	-	8.7	-	-	-
Total Recoverable Mercury	mg/kg dry wt	-	< 0.10	-	-	-
Total Recoverable Nickel	mg/kg dry wt	-	21	-	-	-
Total Recoverable Zinc	mg/kg dry wt	-	79	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	-	74	-	-	-
Acenaphthene	mg/kg dry wt	-	< 0.033	-	-	-
Acenaphthylene	mg/kg dry wt	-	< 0.033	-	-	-
Anthracene	mg/kg dry wt	-	< 0.033	-	-	-
Benzo[a]anthracene	mg/kg dry wt	-	< 0.033	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	< 0.033	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	< 0.033	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	< 0.033	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	-	< 0.033	-	-	-
Chrysene	mg/kg dry wt	-	< 0.033	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.033	-	-	-

Sample Type: Soil						
Sample Name:		BH8 2.5 12-Jan-2008	BH8 3.0 12-Jan-2008	BH8 3.5 12-Jan-2008	BH8 4.0 12-Jan-2008	BH8 4.5 12-Jan-2008
Lab Number:		626135.26	626135.27	626135.28	626135.29	626135.30
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Fluoranthene	mg/kg dry wt	-	< 0.033	-	-	-
Fluorene	mg/kg dry wt	-	< 0.033	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	< 0.033	-	-	-
Naphthalene	mg/kg dry wt	-	< 0.17	-	-	-
Phenanthrene	mg/kg dry wt	-	< 0.033	-	-	-
Pyrene	mg/kg dry wt	-	< 0.033	-	-	-
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	-	74	-	-	-
C7 - C9	mg/kg dry wt	-	< 9.7	-	-	-
C10 - C14	mg/kg dry wt	-	< 20	-	-	-
C15 - C36	mg/kg dry wt	-	< 30	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	< 60	-	-	-

Sample Name:		BH9 0.5 12-Jan-2008	BH9 1.0 12-Jan-2008	BH9 1.5 12-Jan-2008	BH9 2.0 12-Jan-2008	BH9 2.5 12-Jan-2008
Lab Number:		626135.36	626135.37	626135.38	626135.39	626135.40
Individual Tests						
Total Cyanide*	mg/kg dry wt	0.12	-	< 0.10	-	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	3.9	-	< 2.0	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.20	-	0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	43	-	35	-	-
Total Recoverable Copper	mg/kg dry wt	310	-	87	-	-
Total Recoverable Lead	mg/kg dry wt	130	-	11	-	-
Total Recoverable Mercury	mg/kg dry wt	0.21	-	< 0.10	-	-
Total Recoverable Nickel	mg/kg dry wt	150	-	160	-	-
Total Recoverable Zinc	mg/kg dry wt	170	-	54	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	88	-	-	-	75
Acenaphthene	mg/kg dry wt	< 0.024	-	-	-	< 0.034
Acenaphthylene	mg/kg dry wt	< 0.024	-	-	-	< 0.034
Anthracene	mg/kg dry wt	0.038	-	-	-	< 0.034
Benzo[a]anthracene	mg/kg dry wt	0.17	-	-	-	< 0.034
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.20	-	-	-	< 0.034
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.20	-	-	-	< 0.034
Benzo[g,h,i]perylene	mg/kg dry wt	0.19	-	-	-	< 0.034
Benzo[k]fluoranthene	mg/kg dry wt	0.12	-	-	-	< 0.034
Chrysene	mg/kg dry wt	0.18	-	-	-	< 0.034
Dibenzo[a,h]anthracene	mg/kg dry wt	0.10	-	-	-	< 0.034
Fluoranthene	mg/kg dry wt	0.35	-	-	-	< 0.034
Fluorene	mg/kg dry wt	< 0.024	-	-	-	< 0.034
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.18	-	-	-	< 0.034
Naphthalene	mg/kg dry wt	< 0.12	-	-	-	< 0.17
Phenanthrene	mg/kg dry wt	0.10	-	-	-	< 0.034
Pyrene	mg/kg dry wt	0.41	-	-	-	< 0.034
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	88	-	89	-	-
C7 - C9	mg/kg dry wt	< 8.0	-	< 8.3	-	-
C10 - C14	mg/kg dry wt	< 20	-	< 20	-	-
C15 - C36	mg/kg dry wt	< 30	-	< 30	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 60	-	< 60	-	-

Sample Type: Soil						
Sample Name:		BH9 0.5 12-Jan-2008	BH9 1.0 12-Jan-2008	BH9 1.5 12-Jan-2008	BH9 2.0 12-Jan-2008	BH9 2.5 12-Jan-2008
Lab Number:		626135.36	626135.37	626135.38	626135.39	626135.40
Sample Name:		BH9 3.0 12-Jan-2008	BH9 3.5 12-Jan-2008	BH9 4.0 12-Jan-2008	BH9 4.5 12-Jan-2008	BH9 5.0 12-Jan-2008
Lab Number:		626135.41	626135.42	626135.43	626135.44	626135.45
Individual Tests						
Total Cyanide*	mg/kg dry wt	-	-	-	< 0.10	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	-	-	-	7.1	-
Total Recoverable Cadmium	mg/kg dry wt	-	-	-	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	-	-	-	23	-
Total Recoverable Copper	mg/kg dry wt	-	-	-	18	-
Total Recoverable Lead	mg/kg dry wt	-	-	-	12	-
Total Recoverable Mercury	mg/kg dry wt	-	-	-	0.14	-
Total Recoverable Nickel	mg/kg dry wt	-	-	-	20	-
Total Recoverable Zinc	mg/kg dry wt	-	-	-	62	-
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	-	-	-	80	-
C7 - C9	mg/kg dry wt	-	-	-	< 8.1	-
C10 - C14	mg/kg dry wt	-	-	-	< 20	-
C15 - C36	mg/kg dry wt	-	-	-	< 30	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	-	< 60	-

Sample Name:		BH9 5.5 12-Jan-2008	BH9 6.0 12-Jan-2008	BH10 0.0 12-Jan-2008	BH10 0.25 12-Jan-2008	BH10 0.5 12-Jan-2008
Lab Number:		626135.46	626135.47	626135.48	626135.49	626135.50
Individual Tests						
Total Cyanide*	mg/kg dry wt	-	-	-	< 0.10	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	-	-	-	4.3	-
Total Recoverable Cadmium	mg/kg dry wt	-	-	-	0.13	-
Total Recoverable Chromium	mg/kg dry wt	-	-	-	7.3	-
Total Recoverable Copper	mg/kg dry wt	-	-	-	8.4	-
Total Recoverable Lead	mg/kg dry wt	-	-	-	16	-
Total Recoverable Mercury	mg/kg dry wt	-	-	-	< 0.10	-
Total Recoverable Nickel	mg/kg dry wt	-	-	-	13	-
Total Recoverable Zinc	mg/kg dry wt	-	-	-	170	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dry Matter	g/100g as rcvd	-	-	-	73	-
Acenaphthene	mg/kg dry wt	-	-	-	< 0.033	-
Acenaphthylene	mg/kg dry wt	-	-	-	< 0.033	-
Anthracene	mg/kg dry wt	-	-	-	< 0.033	-
Benzo[a]anthracene	mg/kg dry wt	-	-	-	< 0.033	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	< 0.033	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	-	-	-	< 0.033	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	< 0.033	-
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	< 0.033	-
Chrysene	mg/kg dry wt	-	-	-	< 0.033	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	< 0.033	-
Fluoranthene	mg/kg dry wt	-	-	-	< 0.033	-
Fluorene	mg/kg dry wt	-	-	-	< 0.033	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	< 0.033	-
Naphthalene	mg/kg dry wt	-	-	-	< 0.17	-
Phenanthrene	mg/kg dry wt	-	-	-	< 0.033	-

Sample Type: Soil						
Sample Name:		BH9 5.5 12-Jan-2008	BH9 6.0 12-Jan-2008	BH10 0.0 12-Jan-2008	BH10 0.25 12-Jan-2008	BH10 0.5 12-Jan-2008
Lab Number:		626135.46	626135.47	626135.48	626135.49	626135.50
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Pyrene	mg/kg dry wt	-	-	-	< 0.033	-
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	-	-	-	73	-
C7 - C9	mg/kg dry wt	-	-	-	< 9.9	-
C10 - C14	mg/kg dry wt	-	-	-	< 20	-
C15 - C36	mg/kg dry wt	-	-	-	< 30	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	-	< 60	-

Sample Name:		BH10 1.0 12-Jan-2008	BH10 1.5 12-Jan-2008	BH10 2.0 12-Jan-2008	BH10 2.5 12-Jan-2008	BH10 3.0 12-Jan-2008
Lab Number:		626135.51	626135.52	626135.53	626135.54	626135.55
Individual Tests						
Total Cyanide*	mg/kg dry wt	< 0.10	-	-	-	< 0.10
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	< 2.0	-	-	-	9.2
Total Recoverable Cadmium	mg/kg dry wt	0.16	-	-	-	0.17
Total Recoverable Chromium	mg/kg dry wt	12	-	-	-	20
Total Recoverable Copper	mg/kg dry wt	13	-	-	-	22
Total Recoverable Lead	mg/kg dry wt	5.7	-	-	-	7.4
Total Recoverable Mercury	mg/kg dry wt	0.13	-	-	-	0.13
Total Recoverable Nickel	mg/kg dry wt	8.4	-	-	-	38
Total Recoverable Zinc	mg/kg dry wt	210	-	-	-	64
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	76	78	-	-	79
C7 - C9	mg/kg dry wt	< 8.6	340	-	-	< 8.7
C10 - C14	mg/kg dry wt	< 20	3500	-	-	< 20
C15 - C36	mg/kg dry wt	< 30	1100	-	-	< 30
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 60	5000	-	-	< 60
BTEX in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	78	-	-	-
Benzene	mg/kg dry wt	-	< 0.10	-	-	-
Toluene	mg/kg dry wt	-	< 0.10	-	-	-
Ethylbenzene	mg/kg dry wt	-	< 0.10	-	-	-
m&p-Xylene	mg/kg dry wt	-	< 0.10	-	-	-
o-Xylene	mg/kg dry wt	-	< 0.10	-	-	-
Halogenated Aliphatics in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	78	-	-	-
Bromomethane	mg/kg dry wt	-	< 1.0	-	-	-
Carbon tetrachloride	mg/kg dry wt	-	< 0.20	-	-	-
Chloroethane	mg/kg dry wt	-	< 1.0	-	-	-
Chloromethane	mg/kg dry wt	-	< 1.0	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 1.0	-	-	-
1,2-Dibromoethane (ethylene dibromide)	mg/kg dry wt	-	< 1.0	-	-	-
Dibromomethane	mg/kg dry wt	-	< 1.0	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	-	< 1.0	-	-	-
1,1-Dichloroethane	mg/kg dry wt	-	< 0.40	-	-	-
1,2-Dichloroethane	mg/kg dry wt	-	< 1.0	-	-	-
1,1-Dichloroethene	mg/kg dry wt	-	< 0.40	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.20	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.40	-	-	-

Sample Type: Soil						
Sample Name:		BH10 1.0 12-Jan-2008	BH10 1.5 12-Jan-2008	BH10 2.0 12-Jan-2008	BH10 2.5 12-Jan-2008	BH10 3.0 12-Jan-2008
Lab Number:		626135.51	626135.52	626135.53	626135.54	626135.55
Halogenated Aliphatics in VOC Soils by Purge&Trap GC-MS						
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 1.0	-	-	-
1,2-Dichloropropane	mg/kg dry wt	-	< 1.0	-	-	-
1,3-Dichloropropane	mg/kg dry wt	-	< 1.0	-	-	-
2,2-Dichloropropane	mg/kg dry wt	-	< 0.20	-	-	-
1,1-Dichloropropene	mg/kg dry wt	-	< 0.20	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 1.0	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 1.0	-	-	-
Hexachlorobutadiene	mg/kg dry wt	-	< 0.20	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.20	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	2.7	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 1.0	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.20	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	-	< 1.0	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.20	-	-	-
Trichlorofluoromethane	mg/kg dry wt	-	< 0.40	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	-	< 1.0	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 1.0	-	-	-
Vinyl chloride	mg/kg dry wt	-	< 1.0	-	-	-
Haloaromatics in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	78	-	-	-
Bromobenzene	mg/kg dry wt	-	< 0.20	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.20	-	-	-
2-Chlorotoluene	mg/kg dry wt	-	0.23	-	-	-
4-Chlorotoluene	mg/kg dry wt	-	0.23	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.20	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.20	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.20	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.20	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.20	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	78	-	-	-
n-Butylbenzene	mg/kg dry wt	-	2.1	-	-	-
tert-Butylbenzene	mg/kg dry wt	-	0.48	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	-	2.0	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	< 0.20	-	-	-
n-Propylbenzene	mg/kg dry wt	-	3.9	-	-	-
sec-Butylbenzene	mg/kg dry wt	-	5.9	-	-	-
Styrene	mg/kg dry wt	-	< 0.20	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	-	< 0.20	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	-	< 0.20	-	-	-
Ketones in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	78	-	-	-
Acetone	mg/kg dry wt	-	< 22	-	-	-
2-Butanone (MEK)	mg/kg dry wt	-	< 6.0	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 1.0	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 10	-	-	-
Trihalomethanes in VOC Soils by Purge&Trap GC-MS						

Sample Type: Soil						
Sample Name:		BH10 1.0 12-Jan-2008	BH10 1.5 12-Jan-2008	BH10 2.0 12-Jan-2008	BH10 2.5 12-Jan-2008	BH10 3.0 12-Jan-2008
Lab Number:		626135.51	626135.52	626135.53	626135.54	626135.55
Trihalomethanes in VOC Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	78	-	-	-
Bromodichloromethane	mg/kg dry wt	-	< 0.20	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	-	< 1.0	-	-	-
Chloroform (trichloromethane)	mg/kg dry wt	-	< 0.20	-	-	-
Dibromochloromethane	mg/kg dry wt	-	< 0.20	-	-	-
Other VOC in Soils by Purge&Trap GC-MS						
Dry Matter	g/100g as rcvd	-	78	-	-	-
Carbon disulphide	mg/kg dry wt	-	< 0.40	-	-	-
Naphthalene	mg/kg dry wt	-	0.38	-	-	-
System monitoring Compounds for VOC - % Recovery						
Dry Matter	g/100g as rcvd	-	78	-	-	-
4-Bromofluorobenzene	%	-	120	-	-	-
Toluene-d8	%	-	93	-	-	-

Sample Name:		BH10 3.5 12-Jan-2008	BH10 4.0 12-Jan-2008	BH10 4.5 12-Jan-2008	BH10 5.0 12-Jan-2008	BH10 5.5 12-Jan-2008
Lab Number:		626135.56	626135.57	626135.58	626135.59	626135.60
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	-	-	79	-	-
C7 - C9	mg/kg dry wt	-	-	< 9.5	-	-
C10 - C14	mg/kg dry wt	-	-	< 20	-	-
C15 - C36	mg/kg dry wt	-	-	< 30	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	< 60	-	-

Analyst's Comments

Appendix No.1 - Total Petroleum Hydrocarbon Chromatograms

Appendix No.2 - Total Petroleum Hydrocarbon Chromatograms

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Samples**
Environmental Solids Sample Preparation*	Air dried at 35°C and sieved, <2mm fraction.	-	2, 4, 6, 8, 13, 16, 23-24, 27, 36, 38, 44, 49, 51, 55
TPH Oil Industry Profile + PAHscreen*	Sonication extraction, SPE cleanup, GC-FID & GC-MS analysis	-	2, 10, 13, 24, 27, 36, 49
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg*	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	-	6, 8, 13, 16, 23-24, 27, 36, 38, 44, 49, 51, 55
USEPA Priority Pollutants - Scrn Level, 13 metals*	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	-	2, 4
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis	-	2, 4, 10, 13, 24, 27, 36, 40, 49
Total Petroleum Hydrocarbons in Soil*	Sonication extraction, Silica cleanup, GC-FID analysis	-	2, 8, 10-11, 13, 16, 22-24, 27, 36, 38, 44, 49, 51-52, 55, 58

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Samples**
Volatile Organic Carbon Screening in Soil by Purge&Trap GC-M*	Sonication extraction, Purge & Trap, GC-MS FS analysis	-	8, 52
BTEX in VOC Soils by Purge&Trap GC-MS*	Methanol sonication extraction, Purge & Trap, GC-MS FS analysis	-	8, 52
Halogenated Aliphatics in VOC Soils by Purge&Trap GC-MS*	Methanol sonication extraction, Purge & Trap, GC-MS FS analysis	-	8, 52
Haloaromatics in VOC Soils by Purge&Trap GC-MS*	Methanol sonication extraction, Purge & Trap, GC-MS FS analysis	-	8, 52
Monoaromatic Hydrocarbons in VOC Soils by Purge&Trap GC-MS*	Methanol sonication extraction, Purge & Trap, GC-MS FS analysis	-	8, 52
Ketones in VOC Soils by Purge&Trap GC-MS*	Methanol sonication extraction, Purge & Trap, GC-MS FS analysis	-	8, 52
Trihalomethanes in VOC Soils by Purge&Trap GC-MS*	Methanol sonication extraction, Purge & Trap, GC-MS FS analysis	-	8, 52
Other VOC in Soils by Purge&Trap GC-MS*	Methanol sonication extraction, Purge & Trap, GC-MS FS analysis	-	8, 52
System monitoring Compounds for VOC - % Recovery*	Methanol sonication extraction, Purge & Trap, GC-MS FS analysis	-	8, 52
Dry Matter (Org)	Dried at 103°C (removes 3-5% more water than air dry), gravimetry.	0.10 g/100g as rcvd	2, 4, 6, 8, 10-11, 13, 16, 22-24, 27, 36, 38, 40, 44, 49, 51-52, 55, 58
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2	-	2, 4, 6, 8, 13, 16, 23-24, 27, 36, 38, 44, 49, 51, 55
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C & E 21st ed. 2005.	-	6, 8, 13, 16, 23-24, 27, 36, 38, 44, 49, 51, 55
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C & E 21st ed. 2005.	0.10 mg/kg dry wt	6, 8, 13, 16, 23-24, 27, 36, 38, 44, 49, 51, 55

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

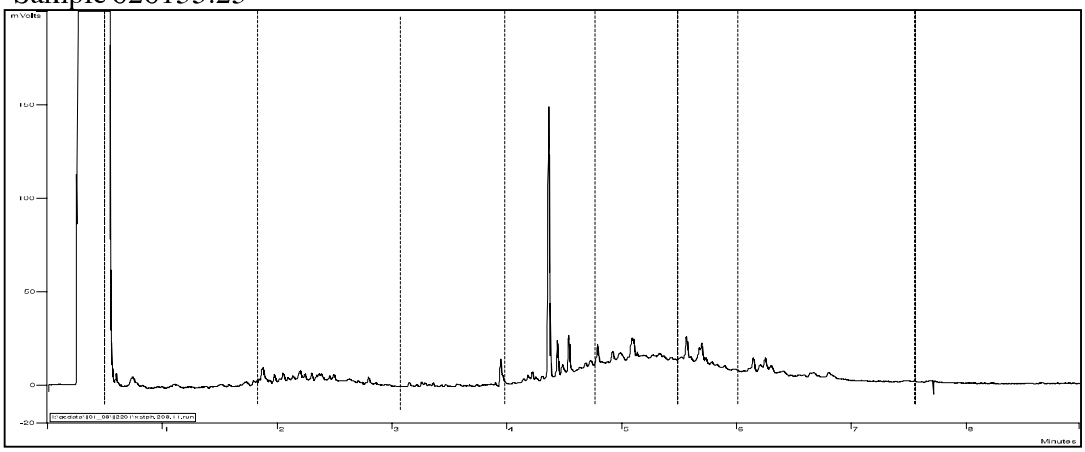
Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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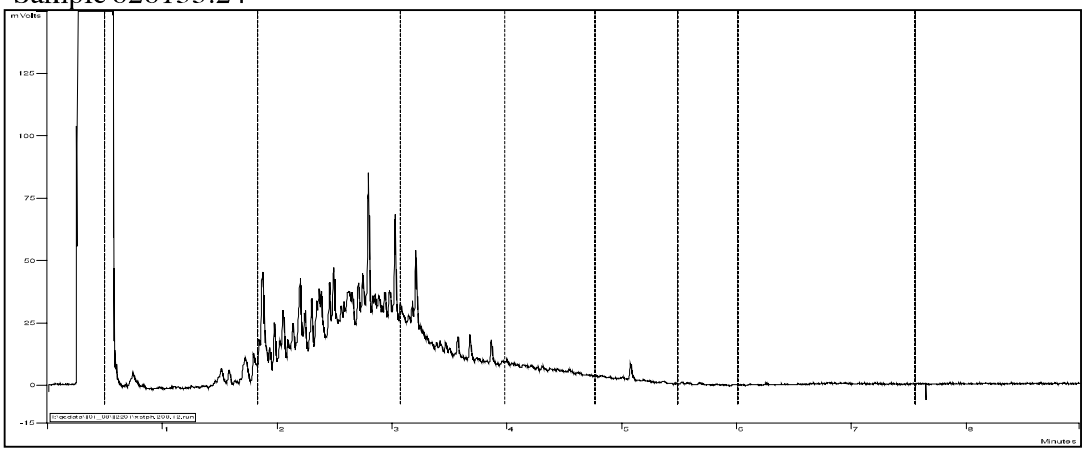


Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental Division

Sample 626135.23

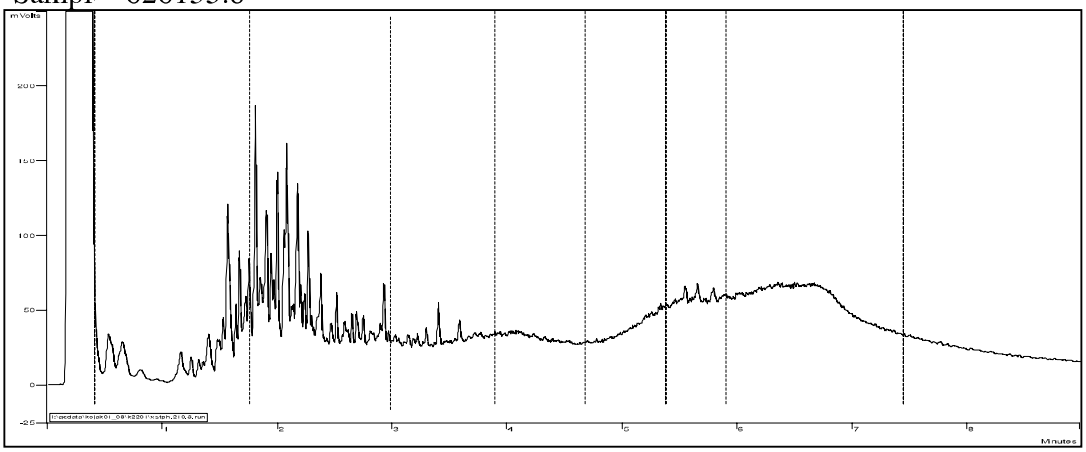


Sample 626135.24

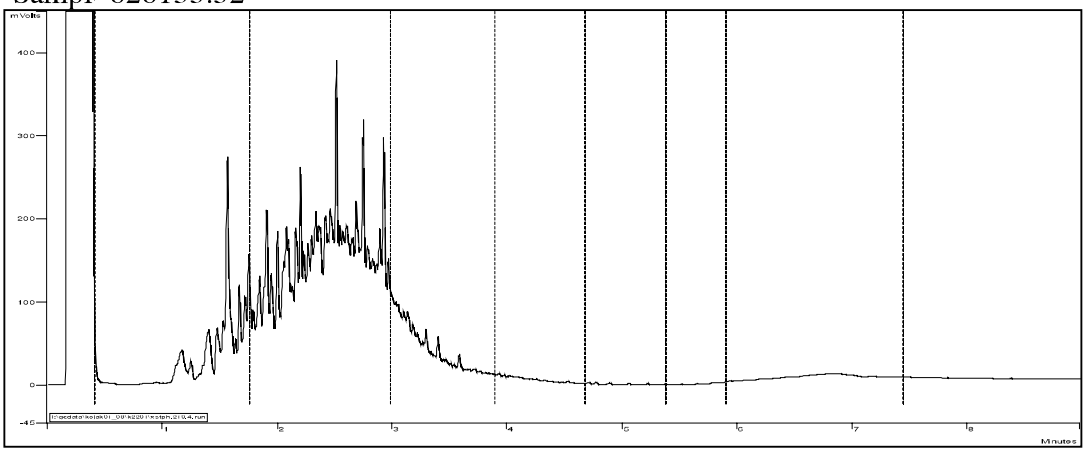


C7 C10 C15 C20 C25 C30 C34 C44

Sampl 626135.8



Sampl 626135.52



C7 C10 C15 C20 C25 C30 C34 C44

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ANALYSIS REPORT

Client:	Tonkin & Taylor	**Lab No:**	627008 SPv1
Contact:	O'Loan, Andrew c/o Tonkin & Taylor P O Box 5271 AUCKLAND	**Date Registered:**	22-Jan-2008
		Date Reported:	01-Feb-2008
		Quote No:	
		Order No:	24057.100
		Client Reference:	24057.100
		Submitted By:	O'Loan, Andrew

- 7 FEB 2008

Sample Type: Saline

Sample Name:		MW1 20-Jan-2008	MW2 20-Jan-2008	MW3 20-Jan-2008	MW4 20-Jan-2008	Dup 20-Jan-2008
Lab Number:		627008.1	627008.2	627008.3	627008.4	627008.5
Individual Tests						
Dissolved Arsenic	g/m³	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040
Dissolved Cadmium	g/m³	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020
Dissolved Chromium	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved Copper	g/m³	< 0.0010	< 0.0010	< 0.0010	0.0025	< 0.0010
Dissolved Lead	g/m³	0.0056	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved Mercury	g/m³	< 0.000080	< 0.000080	< 0.000080	< 0.000080	< 0.000080
Dissolved Nickel	g/m³	< 0.0060	0.036	< 0.0060	0.012	0.034
Dissolved Zinc	g/m³	< 0.0040	0.10	< 0.0040	0.024	0.11
Total Cyanide	g/m³	0.0029	0.0019	0.0040	0.0045	0.0015
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m³	0.27	< 0.20	1.0	< 0.20	< 0.20
C15 - C36	g/m³	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m³	< 0.70	< 0.70	1.0	< 0.70	< 0.70
BTEX in VOC Water by Purge&Trap GC-MS						
Benzene	g/m³	< 0.0050	< 0.0050	0.0066	< 0.0050	< 0.0050
Toluene	g/m³	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Ethylbenzene	g/m³	0.0098	0.0064	0.0082	< 0.0050	< 0.0050
m&p-Xylene	g/m³	0.013	0.0077	0.0062	0.0055	< 0.0050
o-Xylene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Halogenated Aliphatics in VOC Water by Purge&Trap GC-MS						
Bromomethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Carbon tetrachloride	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Chloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Chloromethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,2-Dibromo-3-chloropropane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,2-Dibromoethane (ethylene dibromide)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Dibromomethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Dichlorodifluoromethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,1-Dichloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,2-Dichloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,1-Dichloroethene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
cis-1,2-Dichloroethene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
trans-1,2-Dichloroethene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Saline						
Sample Name:		MW1 20-Jan-2008	MW2 20-Jan-2008	MW3 20-Jan-2008	MW4 20-Jan-2008	Dup 20-Jan-2008
Lab Number:		627008.1	627008.2	627008.3	627008.4	627008.5
Halogenated Aliphatics in VOC Water by Purge&Trap GC-MS						
Dichloromethane (methylene chloride)	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1,2-Dichloropropane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,3-Dichloropropane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
2,2-Dichloropropane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,1-Dichloropropene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
cis-1,3-Dichloropropene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
trans-1,3-Dichloropropene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Hexachlorobutadiene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,1,1,2-Tetrachloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,1,2,2-Tetrachloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,1,1-Trichloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,1,2-Trichloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Trichloroethene (trichloroethylene)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Trichlorofluoromethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,2,3-Trichloropropane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Vinyl chloride	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Haloaromatics in VOC Water by Purge&Trap GC-MS						
Bromobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Chlorobenzene (monochlorobenzene)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
2-Chlorotoluene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
4-Chlorotoluene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,2-Dichlorobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,3-Dichlorobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,4-Dichlorobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,2,3-Trichlorobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,2,4-Trichlorobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Monoaromatic Hydrocarbons in VOC Water by Purge&Trap GC-MS						
n-Butylbenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
tert-Butylbenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Isopropylbenzene (Cumene)	g/m³	0.019	< 0.0050	0.17	< 0.0050	< 0.0050
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
n-Propylbenzene	g/m³	0.041	< 0.0050	0.22	< 0.0050	< 0.0050
sec-Butylbenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Styrene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,2,4-Trimethylbenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
1,3,5-Trimethylbenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Ketones in VOC Water by Purge&Trap GC-MS						
Acetone	g/m³	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Butanone (MEK)	g/m³	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Methyl tert-butylether (MTBE)	g/m³	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
4-Methylpentan-2-one (MIBK)	g/m³	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Trihalomethanes in VOC Water by Purge&Trap GC-MS						
Bromodichloromethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Bromoform (tribromomethane)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Chloroform (trichloromethane)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Dibromochloromethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Other VOC in Water by Purge&Trap GC-MS						
Carbon disulphide	g/m³	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050

Sample Type: Saline						
Sample Name:		MW1 20-Jan-2008	MW2 20-Jan-2008	MW3 20-Jan-2008	MW4 20-Jan-2008	Dup 20-Jan-2008
Lab Number:		627008.1	627008.2	627008.3	627008.4	627008.5
Other VOC in Water by Purge&Trap GC-MS						
Naphthalene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
System monitoring Compounds for VOC - % Recovery						
4-Bromofluorobenzene	%	86	81	85	84	86
Toluene-d8	%	110	100	100	100	100

Analyst's Comments

Appendix No.1 - Total Petroleum Hydrocarbon Chromatograms

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Samples**
Total Petroleum Hydrocarbons in Water*	Solvent extraction, GC-FID analysis	-	1-5
Volatile Organic Carbon Screening in Water by Purge&Trap GC-*	Purge & Trap, GC-MS FS analysis	-	1-5
BTEX in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-5
Halogenated Aliphatics in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-5
Haloaromatics in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-5
Monoaromatic Hydrocarbons in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-5
Ketones in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-5
Trihalomethanes in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-5
Other VOC in Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-5
System monitoring Compounds for VOC - % Recovery*	Purge & Trap, GC-MS FS analysis	-	1-5
Total Cyanide Distillation	Distillation following the addition of sulphuric acid, alkaline trapping solution. APHA 4500-CN^- C & E 21st ed. 2005.	-	1-5
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 21st ed. 2005.	-	1-5
Dissolved Arsenic	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 21st ed. 2005.	0.0040 g/m³	1-5
Dissolved Cadmium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 21st ed. 2005.	0.00020 g/m³	1-5
Dissolved Chromium	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-5
Dissolved Copper	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-5
Dissolved Lead	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-5
Dissolved Mercury	Filtered sample. Permanganate / Persulphate digestion. Analysis by FIMS.	0.000080 g/m³	1-5
Dissolved Nickel	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 21st ed. 2005.	0.0060 g/m³	1-5
Dissolved Zinc	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 21st ed. 2005.	0.0040 g/m³	1-5
Total Cyanide	Distillation, colorimetry. APHA 4500-CN^- C & E 21st ed. 2005.	0.0010 g/m³	1-5

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

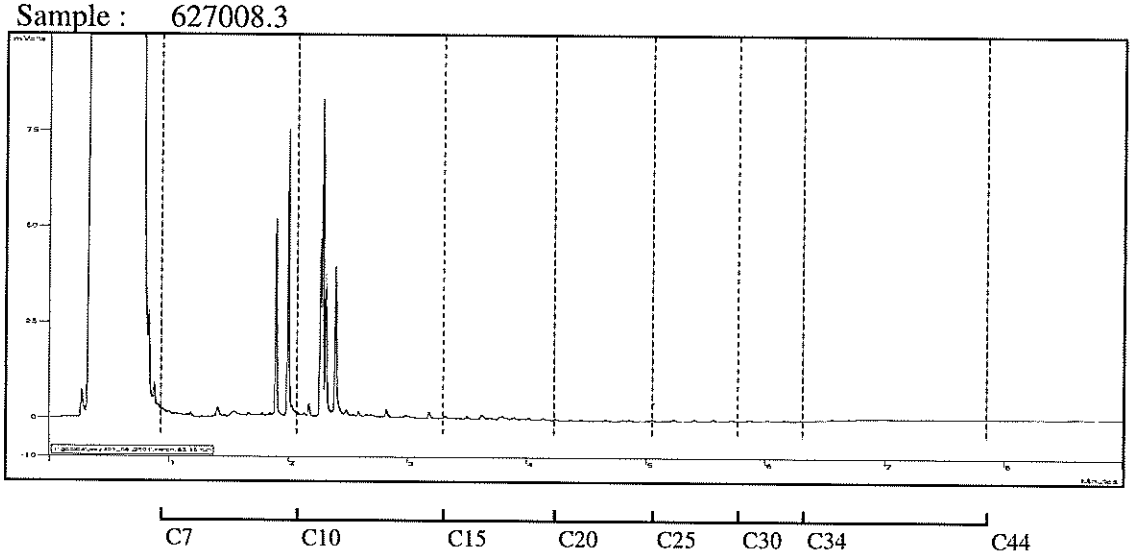
Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental Division

Sample : 627008.3



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ANALYSIS REPORT

Client:	Tonkin & Taylor	**Lab No:**	633709	SPv1
Contact:	O'Loan, Andrew	**Date Registered:**	08-Mar-2008	
	c/o Tonkin & Taylor	**Date Reported:**	19-Mar-2008	
	P O Box 5271	**Quote No:**		
	AUCKLAND	**Order No:**	24057.100	
		Client Reference:	24057.100	
		Submitted By:	O'Loan, Andrew	

Sample Type: Clean waters

Sample Name:		MW1 07-Mar-2008	MW2 07-Mar-2008	MW3 07-Mar-2008	Dup 07-Mar-2008	
Lab Number:		633709.1	633709.2	633709.3	633709.4	
Individual Tests						
Dissolved Arsenic	g/m³	< 0.0040	< 0.0040	< 0.0040	< 0.0040	-
Dissolved Cadmium	g/m³	< 0.00020	< 0.00020	< 0.00020	< 0.00020	-
Dissolved Chromium	g/m³	< 0.0010	< 0.0010	0.0043	< 0.0010	-
Dissolved Copper	g/m³	< 0.0010	0.0023	< 0.0010	< 0.0010	-
Dissolved Lead	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Dissolved Mercury	g/m³	< 0.000080	< 0.000080	< 0.000080	< 0.000080	-
Dissolved Nickel	g/m³	< 0.0060	0.035	< 0.0060	0.034	-
Dissolved Zinc	g/m³	0.0085	0.13	< 0.0040	0.14	-
Total Cyanide	g/m³	0.0042	0.0029	0.065	0.0033	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	-
C10 - C14	g/m³	0.26	< 0.20	0.33	< 0.20	-
C15 - C36	g/m³	< 0.40	< 0.40	< 0.40	< 0.40	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.70	< 0.70	< 0.70	< 0.70	-
BTEX in VOC Water by Purge&Trap GC-MS						
Benzene	g/m³	< 0.0050	< 0.0050	0.010	< 0.0050	-
Toluene	g/m³	< 0.010	< 0.010	< 0.010	< 0.010	-
Ethylbenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
m&p-Xylene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
o-Xylene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Halogenated Aliphatics in VOC Water by Purge&Trap GC-MS						
Bromomethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Carbon tetrachloride	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Chloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Chloromethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,2-Dibromoethane (ethylene dibromide)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Dibromomethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Dichlorodifluoromethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,1-Dichloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,2-Dichloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,1-Dichloroethene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
cis-1,2-Dichloroethene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
trans-1,2-Dichloroethene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-

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

Sample Type: Clean waters						
Sample Name:		MW1 07-Mar-2008	MW2 07-Mar-2008	MW3 07-Mar-2008	Dup 07-Mar-2008	
Lab Number:		633709.1	633709.2	633709.3	633709.4	
Halogenated Aliphatics in VOC Water by Purge&Trap GC-MS						
Dichloromethane (methylene chloride)	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	-
1,2-Dichloropropane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,3-Dichloropropane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
2,2-Dichloropropane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,1-Dichloropropene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
cis-1,3-Dichloropropene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
trans-1,3-Dichloropropene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Hexachlorobutadiene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,1,1-Trichloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,1,2-Trichloroethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Trichloroethene (trichloroethylene)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Trichlorofluoromethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,2,3-Trichloropropane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.050	< 0.050	< 0.050	< 0.050	-
Vinyl chloride	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Haloaromatics in VOC Water by Purge&Trap GC-MS						
Bromobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
2-Chlorotoluene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
4-Chlorotoluene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,2-Dichlorobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,3-Dichlorobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,4-Dichlorobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,2,3-Trichlorobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,2,4-Trichlorobenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Monoaromatic Hydrocarbons in VOC Water by Purge&Trap GC-MS						
n-Butylbenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
tert-Butylbenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Isopropylbenzene (Cumene)	g/m³	0.025	< 0.0050	0.14	< 0.0050	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
n-Propylbenzene	g/m³	0.059	< 0.0050	0.094	< 0.0050	-
sec-Butylbenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Styrene	g/m³	0.012	< 0.0050	< 0.0050	< 0.0050	-
1,2,4-Trimethylbenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
1,3,5-Trimethylbenzene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Ketones in VOC Water by Purge&Trap GC-MS						
Acetone	g/m³	< 0.50	< 0.50	< 0.50	< 0.50	-
2-Butanone (MEK)	g/m³	< 0.050	< 0.050	< 0.050	< 0.050	-
Methyl tert-butylether (MTBE)	g/m³	< 0.050	< 0.050	< 0.050	< 0.050	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.050	< 0.050	< 0.050	< 0.050	-
Trihalomethanes in VOC Water by Purge&Trap GC-MS						
Bromodichloromethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Bromoform (tribromomethane)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Chloroform (trichloromethane)	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Dibromochloromethane	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
Other VOC in Water by Purge&Trap GC-MS						

Sample Type: Clean waters						
Sample Name:		MW1 07-Mar-2008	MW2 07-Mar-2008	MW3 07-Mar-2008	Dup 07-Mar-2008	
Lab Number:		633709.1	633709.2	633709.3	633709.4	
Other VOC in Water by Purge&Trap GC-MS						
Carbon disulphide	g/m³	< 0.050	< 0.050	< 0.050	< 0.050	-
Naphthalene	g/m³	< 0.0050	< 0.0050	< 0.0050	< 0.0050	-
System monitoring Compounds for VOC - % Recovery						
4-Bromofluorobenzene	%	85	85	93	87	-
Toluene-d8	%	100	98	98	99	-

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Clean waters			
Test	**Method Description**	**Default Detection Limit**	**Samples**
Total Petroleum Hydrocarbons in Water*	Solvent extraction, GC-FID analysis	-	1-4
Volatile Organic Carbon Screening in Water by Purge&Trap GC-*	Purge & Trap, GC-MS FS analysis	-	1-4
BTEX in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-4
Halogenated Aliphatics in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-4
Haloaromatics in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-4
Monoaromatic Hydrocarbons in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-4
Ketones in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-4
Trihalomethanes in VOC Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-4
Other VOC in Water by Purge&Trap GC-MS*	Purge & Trap, GC-MS FS analysis	-	1-4
System monitoring Compounds for VOC - % Recovery*	Purge & Trap, GC-MS FS analysis	-	1-4
Total Cyanide Distillation	Distillation following the addition of sulphuric acid, alkaline trapping solution. APHA 4500-CN^- C & E 21st ed. 2005.	-	1-4
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 21st ed. 2005.	-	1-4
Dissolved Arsenic	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 21st ed. 2005.	0.0040 g/m³	1-4
Dissolved Cadmium	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 21st ed. 2005.	0.00020 g/m³	1-4
Dissolved Chromium	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-4
Dissolved Copper	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-4
Dissolved Lead	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-4
Dissolved Mercury	Filtered sample. Permanganate / Persulphate digestion. Analysis by FIMS.	0.000080 g/m³	1-4
Dissolved Nickel	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 21st ed. 2005.	0.0060 g/m³	1-4
Dissolved Zinc	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 21st ed. 2005.	0.0040 g/m³	1-4
Total Cyanide	Distillation, colorimetry. APHA 4500-CN^- C & E 21st ed. 2005.	0.0010 g/m³	1-4

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

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

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental Division

Appendix I: Borehole and Test Pit Logs - Site 18

- Bore logs and test pit logs.

EXCAVATION LOG

Excavation Id.: **TP101**

SHEET: 1 OF 1

PROJECT: Orams Site 18 | LOCATION: Orams Site 18, Beaumont St, Auckland | JOB No.: 30881.2000_1000

CO-ORDINATES: (NZTM2000)	5921319.70 mN 1756409.29 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	29/06/2018
		EQUIPMENT:	14T Excavator	EXCAV. FINISHED:	29/06/2018
R.L.:	2.70m	OPERATOR:	CLL	LOGGED BY:	SJTI
DATUM:	NZVD2016	DIMENSIONS:	4m by 1m	CHECKED BY:	MHU

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
1 2 3			Sample TP101-.1-.3m @ 0.1m ACM/ HCO/ INORG Sample TP101-.1-1m-B @ 0.1m		2	0.5		0.00m: Sandy GRAVEL; reddish brown. 0.10m: Sandy GRAVEL; brown. Loosely packed; moist; gravel, fine to coarse, subrounded to subangular, scoria; sand, fine to coarse; Fill material includes; rebar, bricks, concrete, earthenware, pipes.			10 25 50 100 200		Fill
			Sample TP101-.5m @ 0.5m ACM/ HCO/ INORG 0.7ppm					0.50m: Sandy GRAVEL, with minor silt; brown. Loosely packed; moist; gravel, fine to coarse; trace shell material, asbestos board.					
			Sample TP101-1-1.1m @ 1.0m ACM/ HCO/ INORG Sample TP101-1m @ 1.0m ACM/ HCO/ INORG 0.2ppm			1.0		0.80m: Sandy GRAVEL, with minor silt; dark grey with some orange staining. Loose; moist; gravel, scoria. 1.00m: SAND, with some gravel; black. Loosely packed; moist; sand, fine to medium; strong hydrocarbon odour.					
			Sample TP101-1.1-1.2m @ 1.1m ACM/ HCO/ INORG 1.1ppm			1.5		1.10m: Shelly SAND; light grey. Loosely packed; moist; sand, fine to medium. Faint hydrocarbon odour. [Hydraulic Fill] 1.1 - 1.5m: some 0.1m lenses of clayey SILT; grey; firm; moist; moderate plasticity					
		29/06/2018	Sample TP101-1.5-2m-B @ 1.5m Sample TP101-1.6m @ 1.6m ACM/ HCO/ INORG 6.5ppm		1			1.50m: Shelly silty SAND; grey. Soft; moist; sand, fine. Strong hydrocarbon odour. [Hydraulic Fill]					
			Sample DUP1 @ 1.6m HCO/ INORG			2.0							
								2.1m:					
					0	2.5							

SKETCH / PHOTO:



TP101

COMMENTS: Terminated at groundwater table

Hole Depth 2.1m

Scale 1:25

Rev.: A

Excavation - 24/08/2018 5:10:10 p.m. - Produced with Core-GS by GeRoc

EXCAVATION LOG

Excavation Id.: **TP102**

SHEET: 1 OF 1

PROJECT: Orams Site 18

LOCATION: Orams Site 18, Beaumont St, Auckland JOB No.: 30881.2000_1000

CO-ORDINATES: (NZTM2000)	5921318.85 mN 1756365.01 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	29/06/2018
		EQUIPMENT:	14T Excavator	EXCAV. FINISHED:	29/06/2018
R.L.:	2.70m	OPERATOR:	CLL	LOGGED BY:	SJTI
DATUM:	NZVD2016	DIMENSIONS:	4m by 1m	CHECKED BY:	MHU

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3			Sample TP102-0-0.6m @ 0.1m Sample TP102-.1-.3m @ 0.1m ACM/ HCO/ INORG 1.0ppm Sample TP102-.6m @ 0.6m ACM/ HCO/ INORG 8.4ppm		2 1 0	0.5 1.0 1.5 2.0 2.5		0.00m: Topsoil 0.05m: Sandy GRAVEL; reddish brown. Loosely packed; moist; gravel, fine to coarse, subrounded to subangular, basalt, greywacke, brick, sandstone and earthenware. 0.6m: Vapour blanket 0.60m: SAND; grey. Tightly packed; moist; sand, fine; Strong hydrocarbon odour. 1m: Refusal			10 25 50 100 200		Fill

SKETCH / PHOTO:



COMMENTS: Refusal on concrete pad

Hole Depth 1m

Scale 1:25

Rev.: A

Excavation - 24/08/2018 5:10:10 p.m. - Produced with Core-GS by GeRoc

EXCAVATION LOG

Excavation Id.: **TP103**

SHEET: 1 OF 1

PROJECT: Orams Site 18 | LOCATION: Orams Site 18, Beaumont St, Auckland | JOB No.: 30881.2000_1000

CO-ORDINATES: (NZTM2000)	5921310.90 mN 1756336.00 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	29/06/2018
		EQUIPMENT:	14T Excavator	EXCAV. FINISHED:	29/06/2018
R.L.:	2.70m	OPERATOR:	CLL	LOGGED BY:	SJTI
DATUM:	NZVD2016	DIMENSIONS:	4m by 1m	CHECKED BY:	MHU

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3			Sample TP103-0-0.5m-B @ 0.0m Sample TP103-.1-.3m @ 0.1m ACM/ HCO/ INORG 1.5ppm					0.00m: Sandy GRAVEL, with some cobbles. Gravel, scoria. 0.10m: Sandy GRAVEL, with minor cobbles; brown. Loosely packed; moist; gravel, basalt, greywacke, sandstone and brick fragments; cobbles, up to 100mm.			10 25 50 100 200		
		◀	Sample TP103-.7m @ 0.7m ACM/ HCO/ INORG 168ppm		2	0.5 1.0		0.70m: Sandy GRAVEL, with minor cobbles. Loosely packed; moist; gravel, scoria and mudstone; cobbles, up to 100mm; Strong hydrocarbon odour.					Fill
			Sample TP103-1.3m @ 1.3m ACM/ HCO/ INORG 270ppm Sample TP103-1.4-1.7m-B @ 1.4m ● 126/- kPa		1	1.5		1.20m: Silty GRAVEL, with minor clay; brownish grey. Loosely packed; wet; gravel, fine to coarse, subangular to subrounded, major brick component with some mudstone and basalt. [Hydraulic Fill] 1.40m: Sandy SILT, with some clay, with minor gravel; grey. Very stiff; high plasticity; moist; sand, fine; gravel, fine to medium, mudstone and basalt; some .3m long pods of black hydrocarbon material. [Hydraulic Fill]					
					0	2.0 2.5							

SKETCH / PHOTO:



COMMENTS: Terminated at groundwater table

Hole Depth 1.7m

Scale 1:25

Rev.: A

Excavation - 24/08/2018 5:10:10 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH101

SHEET: 1 OF 6

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921399.03 mN, 1756349.14 mE (NZTM2000)
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.14m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 23/07/2018
FINISH DATE: 24/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)
Fill	0.00m: Concrete
	0.10m: Cobbly GRAVEL, with some sand, with minor clay and silt; dark reddish brown. Loosely packed; wet; gravel, subrounded to subangular, basalt; cobbles, up to 100mm.
	0.24m: Concrete
	0.40m: Cobbly GRAVEL, with some sand, with minor silt; dark reddish brown. Loosely packed; wet; gravel, subangular to subrounded, basalt; cobbles, up to 100mm.
	1.5m: Core loss
	1.80m: Sandy GRAVEL, with some clay and silt; dark reddish brown. Loosely packed; moist; gravel, fine to coarse, subangular to subrounded, BRICK with some basalt; sand, fine to coarse.
	2.3m: Core loss
	2.75m: Sandy GRAVEL, with some silt and cobbles. Loosely packed; gravel, subrounded to subangular, BRICK with subord scoria basalt ; cobbles, up to 100mm.
	3.00m: Core loss
	3.90m: GRAVEL, with some silt and sand. Loosely packed; gravel, medium to coarse, subrounded to subangular, vesiclar basalt. Single shard of glass
	4.00m: Core loss
Fill	

Depth (m)	RL (m)	Sampling Method	Core Recovery (%)	Testing	Graphic Log
0.5	3	HVAC	33	GBH101-.15-.2m @ 0.2m 0.1ppm	
1.0	2			GBH101-.45.5m @ 0.5m 0.1ppm	
1.5	1			GBH101-.9-1m @ 0.9m 0.4ppm	
2.0	0	PQTT	31	GBH101 -1.4-1.45m @ 1.4m 0.4ppm	
2.5	-1	PQTT	35	GBH101-2 -2.3m @ 2.0m 8.1ppm	
3.0		PQTT	10		
3.5		PQTT	50		
4.0		PQTT	70		
4.5					

ROCK DEFECTS: Defect Log; Fracture Spacing (mm) (2000, 600, 200, 60, 20); RQD (%); Description & Additional Observations

Fluid Loss (%) (25, 50, 75); Water Level; Casing; Installation; Core Box No

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 27.09m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:31 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH101

SHEET: 2 OF 6

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921399.03 mN 1756349.14 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.14m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 23/07/2018
FINISH DATE: 24/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	4.85m [Cont'd]: COBBLES, with some gravel; dark reddish brown. Loosely packed; cobbles, subrounded to subangular, up to 200mm, vesicular basalt.			PQTT	33		-2	5.5										
	5.50m: Core loss			PQTT	0													
				SPT	0	3/2 2/2 1/1 **N=6**	-3	6.0										
Marine Sediments	6.45m: SILT, with some clay and shell fragments, with trace sand; dark greenish grey. Soft; low plasticity; moist; sand, fine. Strong sulphur odour.			PQTT	100	DUP19 @ 6.5m GBH101 -6.5- 7.05m @ 6.5m 0.1ppm		6.5										
	7.05m: SILT, with minor clay, sand and shell fragments; dark greenish grey. Soft; low plasticity; moist; sand, fine.						-4	7.0										
						22/5 kPa In barrel		7.5										
	7.50m: Core loss			SPT	31	0/0 0/1 0/1 **N=2**												
	7.80m: SILT, with minor clay, sand and shell fragments, with trace fibrous organic material ; dark greenish grey. Firm; low plasticity; moist; sand, fine.			PQTT	100	GBH101 -8.5- 8.7m @ 8.5m 0.1ppm	-5	8.0										
	8.60m: Silty SAND, with minor clay and shell fragments; dark greenish grey. Loosely packed; low plasticity; moist; sand, fine to medium.							8.5										
Tauranga Group	8.70m: Clayey SILT, minor fibrous organic material; light grey. Stiff; high plasticity; moist. *8.80 - 8.90m:* gravel sized wood fragments					GBH101-8.8-9m @ 8.8m 0.2ppm 73/25 kPa In barrel												
				SPT	100	0/0 1/1 2/2 **N=6**	-6	9.0										
								9.5										

Box 1, 0.0-7.4m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 27.09m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:32 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH101

SHEET: 3 OF 6

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921399.03 mN, 1756349.14 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.14m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM

CHECKED: MHU

START DATE: 23/07/2018

FINISH DATE: 24/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	10.30m: Silty SAND, with minor clay, with trace fibrous organic material; light grey with yellow staining. Very loose to loose; low plasticity; moist; sand, fine to medium.			PQTT	100		-7	10.5										
	10.50m: Core loss																	
	10.65m: Clayey SILT, with trace fibrous organic material; light greenish grey. Stiff; high plasticity; moist.			SPT	66	1/2 2/1 1/1 **N=5**												
				PQTT	85	● 98/28 kPa In barrel	-8	11.0										
	12.30m: SILT, with some clay, with minor wood fragments; light greyish brown. Stiff; low plasticity; moist.			SPT	100	1/1 1/2 1/2 **N=6**		11.5										
	12.75m: SILT, with some clay, with trace amorphous organic material; light greyish green. Stiff; low plasticity; moist.			PQTT	89		-9	12.0										
	13.30m: Sandy SILT, with minor clay, with trace amorphous organic material; light greyish green. Stiff to very stiff; non-plastic; moist; sand, fine. *13.40 - 13.55m:* Silty SAND, with minor clay; light greyish green. Loose; non-plastic; moist; sand, fine.			SPT	100	1/0 1/2 3/4 **N=10**		12.5										
				PQTT	98		-10	13.0										
								13.5										
							-11	14.0										
								14.5										

Box 3, 10.1-12.9m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 27.09m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:32 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH101

SHEET: 4 OF 6

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921399.03 mN 1756349.14 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.14m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 23/07/2018
FINISH DATE: 24/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	16.00m: SILT, with some clay, with minor sand, with trace amorphous organic material; greenish grey. Stiff to very stiff; low plasticity; moist; sand, fine.			SPT	77	1/2 3/4 5/5 N=17	-12	15.5										Box 4, 12.9-15.3m
	16.25m: Clayey SILT with thinly interbedded organic leaf material; brownish green. Stiff to very stiff; high plasticity; moist.			PQTT	91		-13	16.0										
	16.50m: Core loss			SPT	13	3/4 5/5 5/5 N=20		16.5										
	16.89m: Sandy SILT, with some fibrous leaf material, with minor clay; dark greenish grey. Stiff; low plasticity; moist; sand, fine. *17.00m:* 50mm wood fragments at 17m and 17.15m			PQTT	100		-14	17.0										
	17.17m: Clayey SILT, with minor amorphous organic material; light greenish grey. Very stiff; high plasticity; moist.							17.5										
				SPT	84	● 120/28 kPa In barrel 0/1 2/2 2/3 N=9	-15	18.0										
	18.45m: Sandy SILT, with some clay, with trace amorphous organic material; light greenish grey. Very stiff; low plasticity; moist; sand, fine.			PQTT	100			18.5										Box 5, 15.3-17.9m
							-16	19.0										
				SPT	100	● 123/28 kPa In barrel 1/3 4/4 4/5 N=17		19.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 27.09m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:32 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH101

SHEET: 5 OF 6

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921399.03 mN 1756349.14 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.14m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 23/07/2018
FINISH DATE: 24/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	19.90m [Cont'd]: SILT, with some clay and sand; greenish grey. Stiff; high plasticity; moist; sand, fine.						-17											
	20.30m: Sandy SILT, with minor clay; greenish grey. Stiff to very stiff; low plasticity; moist; sand, fine.			PQTT	91			20.5										Box 6, 17.9-20.4m
				SPT	88	2/2 4/6 7/9 **N=26**	-18	21.0										
	21.35m: Silty SAND, with minor clay; greenish grey. Medium dense; low plasticity; moist; sand, fine.			PQTT	95			21.5										
	22.20m: Gravelly SAND, with some silt, with minor clay; dark greenish grey. Medium dense; moist; sand, coarse; gravel, fine to medium, subrounded to subangular.						-19	22.0										
	22.50m: SAND, with some silt, with minor clay; dark greenish grey. Medium dense; non-plastic; moist; sand, fine to medium.			SPT	77	3/4 6/6 7/8 **N=27**		22.5										
	22.80m: Sandy SILT, with minor clay; greenish grey. Very stiff; low plasticity; moist; sand, fine.						-20	23.0										Box 7, 20.4-23.0m
	23.40m: Clayey SILT, trace amorphous organic material; light greenish grey. Very stiff; high plasticity; moist.			PQTT	93			23.5										
East Coast Bays Formation	23.50m: Sandy SILT, with minor clay; dark greenish grey. Hard; low plasticity; moist; sand, fine.																	
	23.70m: Slightly weathered; dark greenish grey; massive; SILTSTONE; very weak.							24.0										
	24.00m: Slightly weathered; dark greenish grey; massive; SANDSTONE; very weak.			SPT	100	6/9 15/19 17 for 50mm **N>=50**	-21											
	24.20m: Slightly weathered; dark greenish grey; , bedded, gently inclined, thin; SILTSTONE; very weak.							24.5				92						

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 27.09m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:32 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH101

SHEET: 6 OF 6

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921399.03 mN 1756349.14 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.14m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 23/07/2018
FINISH DATE: 24/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00 - 25.10m:* Slightly weathered; dark greenish grey; SANDSTONE; very weak.			HQTT	92		-22	25.5				92						Box 8, 23.0-25.5m
	25.40m: Unweathered; dark greenish grey; massive; SANDSTONE; weak.			SPT	0	38/12 for 20mm **N>=50** Solid												
	25.80m: Unweathered; dark grey; massive; SANDSTONE; weak.						-23	26.0										
	26.20m: Unweathered; dark greenish grey; , bedded, gently inclined, thin; SILTSTONE; weak.			HQTT	96			26.5				96						Box 9, 25.5-27.0m
				SPT	0	39/11 for 15mm **N>=50** Solid		27.0										
							-24	27.5										
								28.0										
							-25	28.5										
								29.0										
							-26	29.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 27.09m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:32 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH102P

SHEET: 1 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921398.43 mN, 1756416.41 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.07m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 10/07/2018

FINISH DATE: 12/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	0.00m: Asphalt																	
	0.05m: Sandy GRAVEL, with some silt; reddish brown. Loosely packed; dry; gravel, fine to coarse, subrounded to subangular, basalt; sand, coarse.				10	GBH102-0.05-.15m @ 0.1m 4.9ppm												
	0.35m: Gravelly SILT, with some clay, with minor sand; dark greenish brown. Firm to stiff; low plasticity; moist; gravel, fine to coarse, subangular to subrounded, brick and basalt; sand, fine.					GBH012-.4-.5m @ 0.4m 10.7ppm		0.5										
	0.50m: Sandy GRAVEL, with some silt; reddish brown. Loosely packed; dry; gravel, fine to coarse, subrounded to subangular, scoria basalt; sand, fine to coarse.			PQTT	96	GBH102-.8-1m @ 0.8m 62.2ppm		1.0										
	0.70m: Silty GRAVEL, with some clay and sand; light green. Loosely packed; high plasticity fines; moist; gravel, fine to coarse, subangular to subrounded, basalt scoria and minor brick; sand, fine.					GBH102 -1.3-1.5m @ 1.3m 11.8ppm		1.5										
	0.80m: Gravelly SAND, with some silt; greenish black. Loosely packed; moist; sand, fine to coarse; gravel, fine to coarse, subangular to subrounded; hydrocarbon odour.					GBH102 -1.5-1.6m @ 1.5m 8.6ppm												
	1.00m: Sandy GRAVEL, with some silt; black. Loosely packed; wet; gravel, fine to coarse, subrounded to subangular, basalt scoria, mudstone, steel scree, gas works waste; strong hydrocarbon odour.					GBH102 1.6-1.7m @ 1.6m												
	1.0m: Sandy SILT, with some shell fragments; grey. Firm, wet, low plasticity. [Hydraulic Fill]					GBH102-1.9-2.0 @ 1.9m 400.8ppm		2.0										Box 1, 0.0-2.0m
				PQTT	66	GBH102 -2.4-2.5M @ 2.4m 1305.0ppm												
	2.5m: Core loss							2.5										
	3.0m: Sandy SILT, with some shell fragments; grey. Firm, wet, low plasticity. [Hydraulic Fill]			SPT	100	1/2 1/2 2/2 **N=7**		3.0										
	3.45m: Core loss							3.5										
	3.75m: Sandy SILT, with some shell fragments and thin layers of silty fine to medium sand; grey. Firm, wet, low plasticity. [Hydraulic Fill]			PQTT	71	GBH102-3.75-3.85m @ 3.8m 66.7ppm		4.0										
	4.4m: Silty CLAY; grey. Firm, wet, high plasticity. [Hydraulic Fill]					● 33/13 kPa In barrel												
	4.5m: Core loss			SPT	0	1/0 1/0 1/1 **N=3**		4.5										

Water Level: 03/08/2018

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.07-8.07m and packed with K2 sand.

Hole Depth 31.61m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:32 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH102P

SHEET: 2 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921398.43 mN 1756416.41 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.07m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 10/07/2018

FINISH DATE: 12/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)
Fill	4.95m [Cont'd]: CLAY, minor fine to medium sub angular gravel, minor fine sand; grey. Firm, wet, high plasticity.					
	5.25m: Fine to medium SAND, minor fine to coarse gravel, pocket of CLAY, minor fine sand at 5.3-5.35m; 5.35-5.5m: COBBLE; grey. Loose, wet. Gravel is fine to medium sandstone	PQTT	52	GBH102 -5.0- 5.1m @ 5.0m 395.2ppm	-2	5.5
	5.5m: Core loss			GBH102 -5.9- 6.0m @ 5.4m 9.2ppm		
Marine Sediments	6.0m: Sandy shelly SILT; grey. 6.15m-6.25m: CLAY; grey. Firm, wet, high plasticity; 6.25m-6.45m: Fine to medium SAND; grey	SPT	100	0/1 0/0 1/0 **N=2**	-3	6.0
	6.45m: Organic CLAY, minor fine to medium sand, trace silt, trace pockets of silty fine sand; dark grey. Firm, wet, high plasticity	PQTT	100			6.5
	6.75m: CLAY, some fine to medium sand, minor shell, trace organic specs; grey. Firm, wet, high plasticity			GBH102- 6.75-6.85 @ 6.8m 2.9ppm	-4	7.0
	7.5m: CLAY, minor fine to medium sand, trace shell and organic material; grey. Firm, wet, high plasticity	SPT	0	30/11 kPa In barrel 0/0 0/0 0/0 **N=0**		7.5
		PQTT	100	GBH102 -8.0- 8.1m @ 8.0m	-5	8.0
	9.0m: Core loss	SPT	0	0/0 0/1 1/1 **N=3**	-6	8.5 9.0
Tauranga Group	9.45m: CLAY, trace specks of amorphous organic matter; light brown mottled orange brown. Stiff, wet, high plasticity					9.5

ROCK DEFECTS: Defect Log; Fracture Spacing (mm) (2000, 600, 200, 60, 20); RQD (%); Description & Additional Observations

Graphic Log; Fluid Loss (%) (25, 50, 75); Water Level; Casing; Installation; Core Box No

Box 2, 2.0-6.5m

Box 3, 6.5-9.0m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.07-8.07m and packed with K2 sand.

Hole Depth 31.61m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH102P

SHEET: 3 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921398.43 mN, 1756416.41 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.07m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 10/07/2018

FINISH DATE: 12/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	10.0m: Core loss			PQTT	100		-7	10.5										
	10.5m: Sandy SILT, trace clay; grey mottled greenish grey, trace streaks of organic matter (decomposing rootlets). Stiff, wet, low plasticity			SPT	100	2/3 5/5 5/6 N=21												
	10.80m: Becomes sandy SILT						-8	11.0										
	11.60m: Becomes light brownish grey			PQTT	100			11.5										
	11.95m: Wood fragment			SPT	100	1/2 3/3 4/5 N=15	-9	12.0										Box 4, 9.0-12.0m
	12.65m: Grades to sandy SILT; greenish grey mottled grey, trace dark grey mottles			PQTT	100			12.5										
	13.90m: Becomes bluish grey			SPT	100	2/3 4/4 5/6 N=19	-10	13.0										
	14.2m: Fine to medium SAND, minor silt; bluish grey. Medium dense, wet							13.5										
	14.35m: Fine SAND, minor silt; grey. Medium dense, wet			PQTT	100		-11	14.0										Box 5, 12.0-14.3m
	14.30 - 14.35m: Some laminae of grey CLAY and dark grey fine to medium SAND							14.5										
	14.7m: Fine to coarse SAND, some organic matter, trace silt; grey with dark brown streaks. Medium dense, wet																	
	14.85m: Trace organic material																	

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.07-8.07m and packed with K2 sand.

Hole Depth 31.61m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH102P

SHEET: 4 OF 7

PROJECT: Orams Site 18	CO-ORDINATES: (NZTM2000) 5921398.43 mN 1756416.41 mE	R.L. GROUND: 3.07m
JOB No.: 30881.2000_1000		R.L. COLLAR:
LOCATION: Orams Site 18, Beaumont St, Auckland	DIRECTION: 0°	DATUM: NZVD2016
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed
DRILLED BY: James		
LOGGED BY: JASM / DSA		
CHECKED: MHU		
START DATE: 10/07/2018		
FINISH DATE: 12/07/2018		
CONTRACTOR: DCN		

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	15.0m: SILT, minor fine sand, trace clay; brownish grey. Very stiff, wet, low plasticity			SPT	100	3/3 3/4 4/5 **N=16**	-12	15.0										
	15.3m: SILT, some clay, some fine sand; bluish grey. Very stiff, wet, low plasticity			PQTT	100			15.5										
							-13	16.0										
				SPT	100	0/1 2/3 3/3 **N=11**		16.5										Box 6, 14.3-17.0m
				PQTT	100		-14	17.0										
								17.5										
	18.0m: Sandy SILT; grey, minor white specs. Medium dense, wet. Sand; fine to coarse.			SPT	0	1/2 3/3 4/5 **N=15**	-15	18.0										
				PQTT	100			18.5										
							-16	19.0										
	19.3m: Grades to silty fine to medium SAND; grey. Medium dense, wet			SPT	100	2/3 4/5 5/6 **N=20**		19.5										Box 7, 17.0-20.0m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.07-8.07m and packed with K2 sand.

Hole Depth 31.61m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH102P

SHEET: 5 OF 7

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921398.43 mN 1756416.41 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.07m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM / DSA
CHECKED: MHU
START DATE: 10/07/2018
FINISH DATE: 12/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (FS, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	20.0m: Silty fine SAND; grey. Medium dense, wet.			PQTT	100		-17	20.5										
				SPT	100	3/4 5/5 6/7 **N=23**	-18	21.0										
				PQTT	100		-19	21.5 22.0										
				SPT	100	3/4 7/7 9/11 **N=34**		22.5										Box 8, 20.0-23.0m
	22.95m: Core loss			HQTT	0		-20	23.0 23.5										
	24.0m: Silty fine SAND; grey, minor brownish grey mottles. Dense, wet			SPT	100	2/3 7/8 8/8 **N=31**	-21	24.0										
	24.45m: Core loss							24.5										
	24.7m: Sandy SILT, trace organic matter; grey minor black streaks. Very stiff to hard; wet.																	
	24.85m: Fine to medium SAND; grey. Very dense, moist																	

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.07-8.07m and packed with K2 sand.

Hole Depth 31.61m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH102P

SHEET: 6 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921398.43 mN 1756416.41 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.07m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 10/07/2018

FINISH DATE: 12/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	24.85m [Cont'd]: Fine to medium SAND; grey. Very dense, moist			HQTT	100		-22											
	25.5m: SILT, minor fine sand. Very stiff to hard, moist, low plasticity			SPT	100	5/8 14/15 21 for 75mm N>=50		25.5										
	25.65m: Fine to medium SAND, minor silt. Very dense, moist																	
	25.8m: SILT; grey. Very stiff to hard, moist, low plasticity																	
	25.9m: Fine SAND, trace silt; grey. Very dense, moist *26.20 - 26.30m:* Silty fine SAND						-23	26.0										
	26.3m: Core loss			HQTT	64			26.5										
	26.7m: Fine SAND, minor silt; grey. Very dense, moist *26.90 - 27.00m:* Carbonaceous *26.98m:* Lense of light grey, strongly cemented SILTSTONE			SPT	100	14/17 23/27 for 55mm N>=50	-24	27.0										
	26.45m: Fine to medium SAND, trace coarse SAND; grey. Very dense, wet							27.5										
	27.7m: Core loss			HQTT	86													
	27.85m: Fine SAND, trace silt; grey. Very dense, moist																	
	27.9m: Fine to medium, trace coarse SAND; grey. Very dense, wet						-25	28.0										
	28.0m: Fine SAND, trace silt; grey. Very dense, wet *28.40 - 28.50m:* Minor carbonaceous material and brown organic streaks																	
	28.55m: Clayey SILT; grey. Very stiff to hard, moist, non plastic, fissile			SPT	100	14/20 26/24 for 60mm N>=50		28.5										
	28.7m: Fine SAND, minor to some silt; grey. Very dense, wet																	
	28.95m: Slightly weathered, light grey becoming grey from 29.02m, SILTSTONE. Moderately to strongly cemented												*29.00m:* Calcite vein, VN, 40 deg dip					
	29.05m: Fine SAND, minor light whitish grey medium to coarse sand [pumice?]; grey. Very dense, moist *29.10 - 29.15m:* Lense of silty fine SAND with some brown organic streaks and black carbonaceous specks *29.50 - 29.55m:* Light grey SILT, becomes grey from 29.44m *29.55 - 29.57m:* Trace brown organic streaks			HQTT	100		-26	29.0										
								29.5										

Box 9, 23.0-27.9m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.07-8.07m and packed with K2 sand.

Hole Depth 31.61m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH102P

SHEET: 7 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921398.43 mN, 1756416.41 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.07m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 10/07/2018

FINISH DATE: 12/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	30.0m: Fine to medium SAND, minor light whitish grey medium to coarse sand [pumice?]; grey. Very dense, moist			SPT	0	22/28 for 65mm **N>=50** Solid	-27	30.5										
East Coast Bays Formation	30.75m: Unweathered, interbedded, grey, fine to medium SANDSTONE and SILTSTONE. Uncemented to weakly cemented. Beds are thin to moderately thin (20mm to 120mm). *30.95 - 30.97m:* Lense light grey SILTSTONE			HQTT	100		-28	31.0										Box 10, 27.9-30.9m
	31.1m: Unweathered, grey, carbonaceous SILTSTONE, with thin bed of fine SANDSTONE from 31.21m to 31.23m. Uncemented																	
	31.3m: Unweathered, grey, fine SANDSTONE. Weakly cemented					26/24 for 35mm **N>=50** Solid												Box 11, 30.9-31.6m
	31.5m: No Recovery (Solid Cone SPT)			SPT	0		-29	31.5										
								32.0										
								32.5										
							-30	33.0										
								33.5										
							-31	34.0										
								34.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.07-8.07m and packed with K2 sand.

Hole Depth 31.61m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH103P

SHEET: 1 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921387.66 mN, 1756445.97 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.84m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM

CHECKED: MHU

START DATE: 04/07/2018

FINISH DATE: 06/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)
Fill	0.00m: Concrete							
	0.15m: Sandy GRAVEL, with some cobbles, with trace silt; reddish brown. Loosely packed; moist; gravel, basalt scoria.					GBH103_.15-.25m @ 0.2m 3.8ppm		
	0.70m: Shelly SILT, with minor sand, with trace clay; greenish brown. Firm; low plasticity; moist. *0.70 - 1.30m:* Minor clay SILT lenses - dark greenish brown.			HVAC	96	GBH103_.5-.6m @ 0.5m 6.6ppm; GBH103_.7-.95m @ 0.7m 5.3ppm		0.5; 1.0
	1.30m: Silty SAND; dark grey. Loosely packed; moist; shell rich. Strong hydrocarbon odour. [Hydraulic Fill]					GBH103_1.3-1.55m @ 1.3m 738ppm; DUP6 @ 1.3m		1.5
	1.55m: Core loss							
	2.15m: Shelly silty SAND; dark grey. Loosely packed; moist. Strong hydrocarbon odour. [Hydraulic Fill]			PQTT	58			2.0
	2.30m: Sandy SILT; dark grey with black lenses. Very loose; moist. Strong hydrocarbon odour. [Hydraulic Fill]					GBH03_2.35-2.6m @ 2.4m 886ppm		2.5
	2.60m: Shelly silty SAND, with trace clay; dark greenish grey. Very loose; moist. Hydrocarbon odour. [Hydraulic Fill]							
	3.00m: Core loss			SPT	48	1/1 1/1 1/1 **N=4**		3.0
	3.23m: Silty SAND, with trace clay; dark greenish grey. Very loose; moist; shell rich sand. Hydrocarbon odour. [Hydraulic Fill]							
	3.45m: Core loss							3.5
	3.85m: Shelly silty SAND, with trace clay; dark greenish grey. Loosely packed; moist. Hydrocarbon odour. [Hydraulic Fill]			PQTT	61			
	4.10m: Sandy SILT, with minor clay, gravel and shell fragments; dark grey. Firm; low plasticity; moist; gravel, Mudstone. Hydrocarbon odour. [Hydraulic Fill]					GBH03_4.-4.5m @ 4.1m 760ppm		4.0
	4.50m: Core loss			SPT	55	1/1 0/1 1/1 **N=3**		4.5
	4.75m: Sandy SILT, with minor clay, gravel and shell fragments; dark grey. Firm; low plasticity; moist; gravel, Mudstone. Hydrocarbon odour. [Hydraulic Fill]							

ROCK DEFECTS: Defect Log; Fracture Spacing (mm) (2000, 600, 200, 60, 20); RQD (%); Description & Additional Observations

Fluid Loss (%) (25, 50, 75)

Water Level: 03/08/2018

Casing

Installation: Box 1, 0.0-0.4m; Box 2, 0.4-0.7m; Box 3, 0.7-1.3m; Box 4, 1.3-1.6m

Core Box No

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.08-5.58m and packed with K2 sand.

Hole Depth 30.07m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH103P

SHEET: 2 OF 7

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921387.66 mN 1756445.97 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.84m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 04/07/2018
FINISH DATE: 06/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)
Fill	4.95m: Sandy SILT, with some clay, with minor gravel and shell fragments; dark greenish grey. Soft to firm; low plasticity; moist; gravel, subangular, Mudstone. Hydrocarbon odour. [Hydraulic Fill]	PQTT	95	GBH103_5.45-5.7m @ 5.5m 8.4ppm	-3	5.5
	4.95 - 6.00m: Minor silty SAND lenses					
	5.90 - 5.95m: shell rich lense					
	6.00m: Core loss	SPT	11	0/0 1/0 1/0 **N=2**		6.0
Marine Sediments	6.40m: Clayey SILT, with some shell fragments, with minor sand; dark greenish grey. Soft to firm; low plasticity; moist.	PQTT	100	GBH103_6.55-6.75m @ 6.6m 7.5ppm	-4	6.5
				● 28/6 kPa In barrel		7.0
	7.5m: Core loss	SPT	11	0/0 0/0 0/0 **N=0**	-5	7.5
	7.90m: Clayey SILT, with some shell fragments, with minor sand; dark greenish grey. Soft to firm; low plasticity; moist.	PQTT	80	GBH103_8.15-8.5m @ 8.2m 8.4ppm		8.0
	8.50m: Sandy SILT, with some clay, with minor shell fragments, with trace amorphous organic material; dark greenish grey. Soft to firm; moist.					8.5
Tauranga Group	8.80m: Silty CLAY, with minor amorphous organic material; light grey. Firm to stiff; high plasticity; moist.			● 47/6 kPa In barrel	-6	9.0
		SPT	100	0/1 1/1 2/2 **N=6**		
	9.45m: Clayey SILT, with trace sand; light greyish green. Stiff to very stiff; low plasticity; moist.	PQTT		GBH103_9.45-9.75m @ 9.5m 5.7ppm	-7	9.5

ROCK DEFECTS: Defect Log; Fracture Spacing (mm) (2000, 600, 200, 60, 20); RQD (%); Description & Additional Observations

Fluid Loss (%) (25, 50, 75); Water Level; Casing; Installation; Core Box No

Box 5, 1.6-5.3m

Box 6, 5.3-8.5m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.08-5.58m and packed with K2 sand.

Hole Depth 30.07m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH103P

SHEET: 3 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921387.66 mN, 1756445.97 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.84m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM

CHECKED: MHU

START DATE: 04/07/2018

FINISH DATE: 06/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	10.10m: Clayey SILT, with trace sand; greenish grey. Very stiff to hard; low plasticity; moist.			PQTT	100			10.5										
				SPT	100	4/6 8/9 10/12 N=39	-8											
	10.95m: Core loss							11.0										
	11.25m: Clayey SILT, with trace sand, with minor fibrous organic leaf material; greenish grey. Hard; high plasticity; moist.			PQTT	71			11.5										
				SPT	100	4/5 7/9 9/10 N=35	-9	12.0										
	12.45m: Core loss			HQTT	42			12.5										
	13.05m: Clayey SILT, with trace sand, with minor fibrous organic leaf material; greenish grey. Hard; high plasticity; moist.							13.0										
	13.20m: Clayey SILT, with minor sand and amorphous organic material; light greenish grey. Hard; high plasticity; moist.																	
	13.50m: Core loss			SPT	17	4/4 4/6 6/7 N=23	-10	13.5										
	13.87m: Clayey SILT, with minor sand and amorphous organic material; light greenish grey. Hard; high plasticity; moist.																	
	13.95m: Core loss							14.0										
	14.12m: Clayey SILT, with minor sand and amorphous organic material; light greenish grey. Hard; high plasticity; moist.			HQTT	83		-11											
	14.65m: Clayey SILT, with some fibrous leaf material; dark greenish grey. Firm to stiff; high plasticity; moist.							14.5										
	14.95m: Silty SAND, with minor clay; dark greenish						-12											

Box 7, 8.5-11.0m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.08-5.58m and packed with K2 sand.

Hole Depth 30.07m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH103P

SHEET: 4 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921387.66 mN 1756445.97 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.84m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM

CHECKED: MHU

START DATE: 04/07/2018

FINISH DATE: 06/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*15.00 - 15.05m:* wood fragment			SPT	77	1/3 3/4 5/6 **N=18**	-13	15.5										
	15.45m: Core loss																	
	15.80m: Clayey SILT, with minor amorphous organic material; grey; bedded. Stiff to very stiff; low plasticity; moist; Very thin bedding.			HQTT	66			16.0					16.00 - 16.40m: B, 15° dip, VN					
	16.40m: Clayey SILT, with some sand, with trace amorphous organic material and 5mm diameter white pods; greenish grey. Very stiff; high plasticity; moist.			SPT	100	3/3 4/5 6/6 **N=21**	-14	16.5										
	17.45m: Clayey SILT, with minor sand; greenish grey. Stiff to very stiff; high plasticity; moist.			HQTT	95			17.0										
	17.95m: Clayey SILT, with trace sand, with minor amorphous organic material; greenish grey. Firm to stiff; high plasticity; moist.			SPT	100	1/2 2/2 2/3 **N=9**	-15	17.5										
				HQTT	90			18.0										
								18.5										
						● 50/6 kPa In barrel	-16	19.0										
	19.50m: Core loss			SPT	66	0/0 0/0 0/2 **N=2**		19.5										
	19.65m: Clayey SILT, with trace sand, with minor amorphous organic material; greenish grey. Firm to stiff; high plasticity; moist.						-17											

Box 8, 11.0-15.8m

Box 9, 15.8-18.9m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.08-5.58m and packed with K2 sand.

Hole Depth 30.07m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH103P

SHEET: 5 OF 7

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921387.66 mN 1756445.97 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.84m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 04/07/2018
FINISH DATE: 06/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*20.55m:* 20mm black wood fragment			HQTT	99			20.5										
	20.80m: Clayey SILT, with trace sand, with minor amorphous organic material; greenish grey. Firm; high plasticity; moist.						-18											
	21.00m: Core loss			SPT	0	0/0 0/1 2/2 **N=5**		21.0										
	21.45m: Clayey SILT, with trace sand, with minor amorphous organic material; greenish grey. Firm; high plasticity; moist.			HQTT	100			21.5										
	21.85m: Clayey SILT, with minor sand; light greenish grey. Firm; moist; sand, fine.						-19											
	[Cont'd]: Clayey SILT, with minor sand; light greenish grey. Firm; moist; sand, fine.							22.0										Box 10, 18.9-22.4m
	22.50m: Core loss							22.5										
	22.65m: Silty SAND, with minor clay; greenish grey. Medium dense; moist; sand, fine to coarse.			SPT	66	2/3 5/8 8/9 **N=30**	-20											
	22.95m: Core loss			HQTT	0			23.0										
	22.65m: Silty SAND, with minor clay; greenish grey. Medium dense; moist; sand, fine to coarse.			SPT	44	3/5 5/5 6/7 **N=23**	-21	23.5										
	24.45m: Core loss							24.0										
								24.5										
							-22											

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.08-5.58m and packed with K2 sand.

Hole Depth 30.07m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH103P

SHEET: 6 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921387.66 mN 1756445.97 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.84m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM

CHECKED: MHU

START DATE: 04/07/2018

FINISH DATE: 06/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	25.70m: Silty SAND, with some gravel, with trace clay; dark greenish grey. Medium dense to dense; moist; gravel, fine, quartz and mudstone.			HQTT	0			25.5										
				SPT	55	4/6 7/7 8/11 **N=33**	-23											
	25.95m: Core loss			HQTT	34			26.0										
	26.60m: Sandy SILT, with minor clay; greenish grey. Firm; moist; sand, fine to coarse.							26.5										
East Coast Bays Formation	26.65m: Silty SAND; greenish grey. Loosely packed; moist; sand, fine to coarse.						-24											
	26.75m: Silty SAND, with minor clay; dark greenish grey. Tightly packed; moist; sand, fine.							27.0										
	26.85m: Unweathered; dark greenish grey; SANDSTONE; very weak.			SPT	0	36/14 for 45mm **N>=50** Solid												
	27.00m: Core loss							27.5										
	27.60: Unweathered; dark greenish grey; SANDSTONE; very weak.			HQTT	64		-25					64						
	28.45m: Unweathered; dark grey; bedded, sub-horizontal, laminated; SILTSTONE; weak.							28.0										
	28.50m: No recovery			SPT	0	50 for 70mm **N>=50** Solid		28.5										
	28.77m: Unweathered; dark grey; bedded, sub-horizontal, laminated; SILTSTONE; weak.						-26						28.70 - 28.75m: BF, 5° dip, VN					
	29.20m: Unweathered; dark greenish grey; massive; SANDSTONE; weak.			HQTT	85			29.0				85						Box 11, 22.4-29.5m
	29.50 - 29.55m: Unweathered; dark grey; , bedded, sub-horizontal, laminated; SILTSTONE; weak.							29.5										
	29.75m: Unweathered; dark grey; bedded, sub-horizontal, very thin; SILTSTONE; weak.						-27											Box 12, 29.5-30.0m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.08-5.58m and packed with K2 sand.

Hole Depth 30.07m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH103P

SHEET: 7 OF 7

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921387.66 mN 1756445.97 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.84m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 04/07/2018
FINISH DATE: 06/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
						50 for 65mm **N>=50** Solid	-28	30.5										
								31.0										
								31.5										
							-29	32.0										
								32.5										
							-30	33.0										
								33.5										
							-31	34.0										
								34.5										
							-32											

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.08-5.58m and packed with K2 sand.

Hole Depth 30.07m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH104P

SHEET: 1 OF 6

Tonkin+Taylor

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921367.17 mN, 1756367.75 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.89m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM

CHECKED: MHU

START DATE: 02/07/2018

FINISH DATE: 03/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, CW, DW)	Rock Strength (ES, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	0.00m: Concrete			PQTT	100		2	0.5										
	0.25m: Sandy GRAVEL, with some silt; dark reddish grey. Loosely packed; moist; gravel, scoria; strong hydrocarbon odour.			PQTT	48	GBH104_.3-.7m @ 0.3m 4.7ppm	1	1.0										
				PQTT	40			1.5										
	0.70m: Silty GRAVEL, with some cobbles, with minor sand and thin black silt [hydrocarbon rich]; dark orangish brown. Tightly packed; moist; gravel, scoria and greywacke gravels; Hydrocarbon odour.			PQTT	70		0	2.0										
				PQTT	82	GBH104_.8-1.2m @ 0.8m 208ppm		2.5										
	1.20m: Silty GRAVEL, with some sand; dark orangish grey. Tightly packed; low plasticity; moist; gravel, Brick fragments.			PQTT	80	GBH104_1.2-1.7m @ 1.2m DUP3 @ 1.2m	-1	3.0										
	1.5m: Core loss			PQTT	38			3.5										
	2.50m: Clayey SILT, with some gravel, with minor moderately thin lenses of black glossy sands and gravels [gas works coke]; light greyish yellow. Firm to stiff; high plasticity; moist.																	
	3.00m: Core loss			PQTT	30		-2	4.0								04/07/2018 03/07/2018		
	4.05m: Gravelly SILT; dark grey. Firm to stiff; high plasticity; moist. [Hydraulic Fill]							4.5										
	4.10m: Silty SAND, with some shell fragments; dark grey. Firm; low plasticity; moist. [Hydraulic Fill]																	
	4.50m: Core loss					GBH104_4.5-5m @ 4.5m 211ppm												Box 1, 0.0-1.4m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.09-5.51m and packed with K2 sand.

Hole Depth 28.57m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH104P

SHEET: 2 OF 6

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921367.17 mN, 1756367.75 mE (NZTM2000)
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.89m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 02/07/2018
FINISH DATE: 03/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	4.70m [Cont'd]: Clayey SILT, with some gravel, with minor fibrous root material; dark greenish grey. Soft to firm; high plasticity; moist; gravel, greywacke. Light hydrocarbon odour. Orange and black staining. [Hydraulic Fill]																	
	5.40m: Shelly silty SAND; dark grey. Soft; low plasticity; moist; sand.[Hydraulic Fill]			PQTT	86	GBH104_5.5-5.8 @ 5.5m		5.5										
Marine Sediments	5.90m: Sandy SILT, with some gravel and cobbles; dark greenish grey. Firm; low plasticity; moist; gravel, sandstone.						-3											
	6.00m: Core loss					GBH104_6-7 @ 6.0m 20ppm		6.0										
	6.65m: Sandy SILT, with some gravel and cobbles; dark greenish grey. Firm; low plasticity; moist; gravel, sandstone.			PQTT	56			6.5										
	7.25m: Clayey SILT, with minor shell fragments; light greenish grey. Soft to firm; low plasticity; moist.						-4	7.0										
				SPT	100	0/0 0/0 0/0 **N=0**		7.5										
				PQTT	104	GBH104_8-8.5 @ 8.0m 9ppm	-5	8.0										
								8.5										
						13/3 kPa In barrel	-6											
				SPT	100	1/1 1/1 1/2 **N=5**		9.0										
	9.45m: Core loss							9.5										
Tauranga Group	9.75m: Clayey SILT, minor amorphous organic material; light greenish grey. Stiff to very stiff; high plasticity; moist.						-7											

Box 2, 1.4-5.8m
Box 3, 5.8-8.7m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.09-5.51m and packed with K2 sand.

Hole Depth 28.57m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:34 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH104P

SHEET: 3 OF 6

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921367.17 mN, 1756367.75 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.89m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM

CHECKED: MHU

START DATE: 02/07/2018

FINISH DATE: 03/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	[Cont'd]: Clayey SILT, minor amorphous organic material; light greenish grey. Stiff to very stiff; high plasticity; moist.	UW SW MW HW CW	FS VS S MS W VW EW	PQTT	71	GBH104_10-10.5 @ 10.0m 9.5ppm >40 kPa In barrel	-8	10.5										
				SPT	100	0/0 0/1 1/1 **N=3**		11.0										
				PQTT	100		-9	11.5										Box 4, 8.7-11.5m
	11.60m: Clayey SILT, with minor fibrous leaf material; greenish grey. Firm; low plasticity; moist.					● 28/6 kPa In barrel		12.0										
				SPT	100	0/0 0/0 0/0 **N=0**		12.5										
				PQTT	100		-10	13.0										
	13.00m: Clayey SILT, minor fibrous organic material; dark greenish grey. Firm; low plasticity; moist. *13.00 - 14.10m:* minor moderately thin sand lenses.					● 39/13 kPa In barrel		13.5										Box 5, 11.5-13.5m
				SPT	100	0/0 1/1 1/1 **N=4**	-11	14.0										
	14.10m: Clayey SILT, minor fibrous wood fragments; greenish grey. Firm to stiff; high plasticity; moist.			PQTT	100			14.5										
	14.60m: Clayey SILT, with minor fibrous organic material; light greenish grey. Stiff; high plasticity; moist.					● 101/28 kPa In barrel	-12											

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.09-5.51m and packed with K2 sand.

Hole Depth 28.57m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH104P

SHEET: 4 OF 6

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921367.17 mN 1756367.75 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.89m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 02/07/2018
FINISH DATE: 03/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	[Cont'd]: Clayey SILT, with minor fibrous organic material; light greenish grey. Stiff; high plasticity; moist.			SPT	100	0/1 1/2 2/2 **N=7**	-13	15.5										
	15.90m: Sandy SILT, with minor fibrous wood fragments, with trace clay; grey. Firm to stiff; low plasticity; moist.			PQTT	100			16.0										
	16.70m: Sandy SILT, with minor clay and fibrous wood fragments up to 50mm in diameter; dark grey. Stiff to very stiff; low plasticity; moist.			SPT	100	1/2 2/3 4/4 **N=13**	-14	16.5										Box 6, 13.5-16.7m
				PQTT	100			17.0										
								17.5										Box 7, 16.7-17.9m
						● 107/22 kPa In barrel	-15											
	18.10m: Silty SAND, with some clay, with minor fibrous wood fragments; dark grey. Stiff to very stiff; low plasticity; moist. *18.50 - 18.75m:* black wood fragments up to .08m thick			SPT	88	2/4 5/6 7/8 **N=26**		18.0										
				PQTT	100		-16	18.5										
	19.10m: Clayey SILT; light greenish grey. Very stiff to hard; high plasticity; moist.							19.0										
						● 126/25 kPa In barrel												
	19.50m: Clayey SILT, with minor sand, thin bedded sand lenses; dark greenish grey. Stiff to very stiff; high plasticity; moist.			SPT	100	1/1 2/2 3/3 **N=10**	-17	19.5										Box 8, 17.9-20.0m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.09-5.51m and packed with K2 sand.

Hole Depth 28.57m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH104P

SHEET: 5 OF 6

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921367.17 mN, 1756367.75 mE (NZTM2000)
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.89m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 02/07/2018
FINISH DATE: 03/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	19.95m [Cont'd]: Clayey SILT, with trace sand; dark greenish grey. Stiff to very stiff; high plasticity; moist; sand, fine.			PQTT	99		-18	20.5										
	21.00m: Core loss			SPT	0	0/0 0/2 2/2 **N=6**		21.0										
	21.45m: Clayey SILT, with trace sand; dark greenish grey. Stiff to very stiff; high plasticity; moist; sand, fine. *22.30 - 22.35m:* black wood fragment			PQTT	100	● 136/41 kPa In barrel	-19	21.5 22.0										
	22.50m: Core loss			SPT	0	0/1 2/2 3/3 **N=10**	-20	22.5										Box 9, 20.0-23.1m
	22.95m: Clayey SILT, with trace sand; dark greenish grey. Stiff to very stiff; high plasticity; moist; sand, fine.							23.0										
	23.20m: Silty SAND, with minor clay and gravel; dark greenish grey. Very dense; low plasticity; moist; well graded; gravel, fine, subrounded to subangular.			PQTT	100		-21	23.5										
East Coast Bays Formation	24.35m: Slightly weathered; dark greenish grey; SILTSTONE; very weak.			SPT	100	2/4 15/11 15/17 **N>=50**		24.0										
	24.45m: Core loss							24.5				76						
	24.70m: Slightly weathered; dark greenish grey; SILTSTONE; very weak.						-22											

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.09-5.51m and packed with K2 sand.

Hole Depth 28.57m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH104P

SHEET: 6 OF 6

PROJECT: Orams Site 18	CO-ORDINATES: (NZTM2000) 5921367.17 mN 1756367.75 mE	R.L. GROUND: 2.89m
JOB No.: 30881.2000_1000		R.L. COLLAR:
LOCATION: Orams Site 18, Beaumont St, Auckland	DIRECTION: 0°	DATUM: NZVD2016
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 02/07/2018
FINISH DATE: 03/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	[Cont'd]: Slightly weathered; dark greenish grey; SILTSTONE; very weak.			HQTT	76							76						
	25.50m: No recovery			SPT	0	26/24 35 for 75mm **N>=50** Solid	-23	25.5										
	25.72m: Unweathered; dark greenish grey; massive; SANDSTONE; weak.																	
	26.00m: Unweathered; dark grey; SILTSTONE; very weak.							26.0										
	26.30m: Unweathered; dark greenish grey; SANDSTONE; weak.			HQTT	100							100						
	27.00m: No recovery			SPT	0	21/12 13/30 2 for 5mm **N>=50** Solid	-24	26.5 27.0										
	27.30m: Unweathered; dark greenish grey; SILTSTONE; weak.			HQTT	100			27.5				100	27.80m: J, 45° dip, , VN				Box 10, 23.1-27.7m	
	27.95m: Unweathered; dark greenish grey; SANDSTONE; weak.						-25	28.0					28.00m: J, 75° dip, VN				Box 11, 27.7-28.2m	
	28.15m: Unweathered; dark greenish grey; SILTSTONE; weak.					50 for 65mm **N>=50** Solid		28.5									Box 12, 28.2-28.5m	
							-26	29.0										
							-27	29.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.09-5.51m and packed with K2 sand.

Hole Depth 28.57m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH105

SHEET: 1 OF 7

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921363.21 mN 1756438.16 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 06/07/2018
FINISH DATE: 10/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)
Fill	0.00m: Concrete
	0.15m: Sandy GRAVEL, with minor silt and cobbles; reddish brown. Loosely packed; moist; gravel, subrounded to subangular, basalt; cobbles, up to 100mm.
	0.50m: Silty SAND, with minor gravel; dark greenish grey. Loosely packed; wet; gravel, subrounded to subangular; strong hydrocarbon odour. [Hydraulic Fill]
	1.50 - 1.55m: Clayey SILT; light greenish grey.
	1.50m: Silty SAND, with minor gravel; blackish grey. Loosely packed; saturated; gravel, subrounded to subangular. Dark hydrocarbon fluids and strong hydrocarbon odour. [Hydraulic Fill]
	1.65m: Core loss
	2.40m: Silty SAND, with minor gravel; blackish grey. Loosely packed; saturated; gravel, subrounded to subangular; Dark fluid. Strong hydrocarbon odour. [Hydraulic Fill]
	2.60m: Shelly silty SAND, with trace clay; dark greenish grey. Loosely packed; non plastic; moist; sand, fine to coarse; strong hydrocarbon odour. [Hydraulic Fill]
	3.00m: Core loss
	2.85 - 2.88m: Sandy SILT, with minor clay; light greenish grey. Soft; moist.
	2.93 - 2.97m: Sandy SILT, with minor clay; light greenish grey. Soft; moist.
	3.50m: Shelly silty SAND, with trace clay; dark greenish grey. Loosely packed; dilatant; moist; sand, fine to coarse; strong hydrocarbon odour. [Hydraulic Fill]
	4.20m: Silty SAND, with minor clay; dark greenish grey. Loosely packed; moist; sand, fine, Quartz. [Hydraulic Fill]
	4.40m: SILT, with some clay, with trace sand; dark greenish grey. Soft to firm; low plasticity; moist; sand, fine. [Hydraulic Fill]
	4.50m: Core loss
	4.90m: Shelly sandy SILT, with some clay and gravel; dark grey. Very soft; low plasticity; wet; sand, fine; gravel, fine to coarse, subangular. [Hydraulic

Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
		HVAC	90	GBH105 -.15-.25 m @ 0.2m .4ppm	2	0.5										Box 1, 0.2-0.5m
				GBH105-.5-1m @ 0.5m 630ppm	1	1.0										Box 2, 0.5-1.3m
		PQTT	44	GBH105-1.55-1.65m @ 1.6m 1797ppm	0	1.5										Box 3, 1.3-1.7m
				GBH105-2.7-3m @ 2.7m 1340ppm	-1	2.0										
		PQTT	33	GBH105 -4.2-4.5m @ 4.2m 32.6ppm	-2	2.5										
				21/1 kPa In barrel		3.0										
		SPT	11	0/0 1/1 2/2 **N=6**		3.5										
						4.0										
						4.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 30.06m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH105

SHEET: 2 OF 7

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921363.21 mN 1756438.16 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 06/07/2018
FINISH DATE: 10/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	4.95m [Cont'd]: Core loss																	
Fill	5.2m: Shelly sandy SILT, with some clay and gravel; dark grey. Very soft; low plasticity; wet; sand, fine; gravel, fine to coarse, subangular, Mudstone. [Hydraulic Fill]			PQTT	76	GBH105 -5.3- 5.65m @ 5.3m 5ppm	-3	5.5										
Fill	6.00m: Core loss			SPT	11	0/1 0/0 1/1 **N=2**		6.0										
Fill	6.40m: Shelly sandy SILT, with some clay and gravel; dark grey. Very soft; low plasticity; wet; sand, fine; gravel, fine to coarse, subangular, Mudstone. [Hydraulic Fill]							6.5										Box 4, 1.7-6.5m
Marine Sediments	6.65m: Clayey SILT, with some shell fragments, with trace sand; dark greenish grey. Soft; low plasticity; moist; sand, fine.			PQTT	100	GBH105-6.85-7.25m @ 6.9m 4.9ppm	-4	7.0										
Marine Sediments	7.50m: Core loss			SPT	0	0/0 0/0 0/0 **N=0**		7.5										
Marine Sediments	7.95m: Clayey SILT, with some shell fragments, with trace sand; dark greenish grey. Soft; low plasticity; moist; sand, fine.			PQTT	90	GBH105-8.25-8.45m @ 8.3m 7.1ppm	-5	8.0										
Tauranga Group	8.45m: Clayey SILT, with minor fibrous organic material, with trace sand; light greenish grey. Stiff; moist; sand, fine.					GBH105 -8.5- 8.9m @ 8.5m 6.6ppm	-6	8.5										
Tauranga Group	9.00m: Core loss			SPT	66	54/25 kPa In barrel 1/1 1/2 2/2 **N=7**		9.0										
Tauranga Group	9.15m: Clayey SILT, with minor fibrous organic material, with trace sand; light greenish grey. Stiff; moist; sand, fine.						-7	9.5										Box 5, 6.5-9.7m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 30.06m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH105

SHEET: 3 OF 7

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921363.21 mN 1756438.16 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 06/07/2018
FINISH DATE: 10/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	[Cont'd]: Clayey SILT, with minor fibrous organic material, with trace sand; light greenish grey. Stiff; moist; sand, fine.			PQTT	88	● 98/24 kPa In barrel		10.5										
				SPT	100	1/1 1/2 2/2 **N=7**	-8											
	10.80m: Clayey SILT; greenish grey. Stiff; high plasticity; moist.							11.0										
	10.95m: Core loss																	
	11.26m: Clayey SILT; greenish grey. Very stiff; high plasticity; moist.			PQTT	70			11.5										
				SPT	100	● 115/22 kPa In barrel 1/1 2/2 3/3 **N=10**	-9	12.0										Box 6, 9.7-12.5m
	12.65m: SILT, with some fibrous wood fragments up to 50mm in diameter; greenish white; bedded. Stiff to very stiff; low plasticity; moist.			PQTT	100		-10	12.5										
	13.05m: Clayey SILT, with minor amorphous organic material; light greenish grey. Stiff to very stiff; high plasticity; moist.							13.0										
				SPT	88	● >221 kPa In barrel 3/4 5/6 7/7 **N=25**	-11	13.5										
	13.70m: Clayey SILT; greyish green. Very stiff; high plasticity; moist.																	
	13.95m: Core loss							14.0										
	14.18m: Clayey SILT; greyish green. Very stiff; high plasticity; moist.			PQTT	78			14.5										
	14.85m: Interbedded sandy SILT and silty SAND, with minor fibrous organic material; greyish green. Stiff to very stiff; low plasticity; moist; sand, fine to medium.						-12											

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 30.06m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH105

SHEET: 4 OF 7

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921363.21 mN 1756438.16 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 06/07/2018
FINISH DATE: 10/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	15.00m: Core loss			SPT	33	2/3 5/5 6/6 **N=22**	-13	15.5										Box 7, 12.5-15.5m
	15.30m: Sandy SILT, with minor fibrous organic material; moderately thin interbedded sandy SILT to silty SAND; greyish green. Stiff to very stiff; low plasticity; moist; sand, fine to medium.																	
	15.50m: Silty SAND, with some fibrous organic material - leaves and wood fragments; dark greyish green; bedded.Tightly packed; moist; sand, fine to medium; thin to moderately thin bedded.			PQTT	100			16.0										
	15.85m: Clayey SILT, with trace sand; light greenish grey. Very stiff; high plasticity; moist; sand, fine.																	
				SPT	100	3/3 5/7 8/9 **N=29**	-14	16.5										
	16.95m: Core loss							17.0										
	17.10m: Clayey SILT, with trace sand; light greenish grey. Very stiff; high plasticity; moist; sand, fine.			PQTT	85			17.5										Box 8, 15.5-17.7m
						● 161/38 kPa In barrel	-15											
				SPT	100	2/2 3/4 5/8 **N=20**		18.0										
	18.45m: Core loss			PQTT	33		-16	18.5										
	19.20m: Very strong light green layer [rhyolite?]							19.0										
	19.15m: Gravelly SILT, with minor clay; light brown. Firm; high plasticity; moist; gravel, fine to coarse, subrounded																	
	19.35m: Clayey SILT, with minor sand; dark green. Firm; high plasticity; moist; sand, fine.					● 38/19 kPa In barrel												
	19.50m: Core loss			SPT	0	2/3 4/4 4/3 **N=15**	-17	19.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 30.06m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH105

SHEET: 5 OF 7

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921363.21 mN 1756438.16 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 06/07/2018
FINISH DATE: 10/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	19.95m [Cont'd]: SILT, with some clay, with trace sand; greenish grey. Stiff to very stiff; high plasticity; moist; sand, fine. *20.45 - 20.55m:* Sandy SILT, with minor clay; greenish grey. Stiff to very stiff; low plasticity; moist; sand, fine. *20.55 - 20.60m:* wood fragment			HQTT	90	● 110/16 kPa In barrel	-18	20.5										
				SPT	100	1/1 1/2 3/3 **N=9**		21.0										Box 9, 17.7-21.5m
	21.45m: SILT, with some clay, with minor amorphous organic material, with trace sand; greenish grey. Very stiff to hard; low plasticity; moist; sand, fine.			HQTT	100		-19	21.5										
								22.0										
	22.50m: Core loss			SPT	0	2/3 5/5 7/7 **N=24**	-20	22.5										
	22.95m: SILT, with some clay, with trace sand; light greenish grey. Very stiff to hard; low plasticity; moist; sand, fine.			HQTT	100			23.0										
							-21	23.5										
	24.10m: Sandy SILT, with minor clay; greenish grey. Very stiff to hard; low plasticity; moist; sand, fine to medium.			SPT	100	4/6 7/7 9/12 **N=35**		24.0										
	24.45m: Core loss							24.5										
							-22											

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 30.06m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH105

SHEET: 6 OF 7

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921363.21 mN 1756438.16 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 06/07/2018
FINISH DATE: 10/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	24.95m [Cont'd]: Sandy SILT, with minor clay; greenish grey. Very stiff to hard; low plasticity; moist; sand, fine to medium.			HQTT	52													Box 10, 21.5-25.5m
	25.50m: Core loss			SPT	0	3/4 6/9 9/11 **N=35**	-23	25.5										
	25.95m: Gravelly SILT, with some sand; greenish grey. Moist; gravel, subrounded to subangular, Black; strong to very strong basalt; sand, fine.							26.0										
	26.05m: Core loss			HQTT	4													
East Coast Bays Formation	27.00m: Slightly weathered; greenish grey; , bedded, gently inclined, thin; SILTSTONE; very weak.			SPT	58	5/10 20/14 16 for 40mm **N>=50**	-24	26.5										
	27.65 - 27.70m: Slightly weathered; dark greenish grey; coarse fabric; SANDSTONE; very weak.							27.0										
	27.95m: Unweathered; dark greenish grey; massive; SANDSTONE; very weak; fine to medium sand.			HQTT	79			27.5				79	27.85m: BF, 15° dip, VN					
	28.35m: Unweathered; greenish grey; bedded, gently inclined, very thin; SILTSTONE; very weak.						-25	28.0										
	28.50m: No recovery			SPT	0	21/24 26/24 for 50mm **N>=50**		28.5				0						
	28.77m: Core loss					Solid	-26											
	29.20m: Unweathered; greenish grey; bedded, gently inclined, very thin; SILTSTONE; very weak.			HQTT	60			29.0				60						
	29.25m: Unweathered; dark greenish grey; massive; SANDSTONE; weak.																	
	29.50m: Unweathered; dark greenish grey; bedded, gently inclined, very thin; SILTSTONE; weak.							29.5										
	29.68m: Unweathered; dark greenish grey; massive; SANDSTONE; weak.						-27											Box 11, 25.5-30.0m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 30.06m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH105

SHEET: 7 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921363.21 mN, 1756438.16 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM

CHECKED: MHU

START DATE: 06/07/2018

FINISH DATE: 10/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
	29.89m [Cont'd]: Unweathered; dark greenish grey; bedded, gently inclined, thin; SILTSTONE; weak.				0	50 for 65mm **N>=50** Solid	-28	30.5										
								31.0										
							-29	31.5										
								32.0										
							-30	32.5										
								33.0										
							-31	33.5										
								34.0										
							-32	34.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 30.06m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH106P

SHEET: 1 OF 4

Tonkin+Taylor

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921351.23 mN, 1756383.79 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.90m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: JASM

CHECKED: MHU

START DATE: 24/07/2018

FINISH DATE: 26/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)
Fill	0.00m: Concrete							
	0.50m: Silty GRAVEL, with some cobbles, with minor sand; darn brown. Loosely packed; moist; gravel, fine to coarse, subangular, basalt; cobbles, up to 80mm; sand, coarse.			SNC	81	GBH106-5-.8m @ 0.5m 0.8ppm		0.5
	0.80m: GRAVEL, with some silt and sand and cobbles; dark brown. Loosely packed; moist; gravel, fine to coarse, subangular, basalt and brick fragments; cobbles, up to 150mm.							
	1.10m: GRAVEL, with some silt and sand; dark brown. Loosely packed; moist; gravel, fine to coarse, subangular, basalt. *1.20m:* Vapor barrier HDPE black sheet			HVAC	85	GBH106 -1.2-1.4m @ 1.2m 11.3ppm		1.0
	1.50m: Core loss			SNC	10	GBH106-1.5-2m @ 1.5m 5.5ppm	2	1.5
	1.95m: SILT & GRAVEL, with some clay and sand; dark brown. Loosely packed; saturated; gravel, fine to medium, subangular; Faint hydrocarbon odour.							
	2.00m: Core loss			SNC	21			2.0
	2.55m: Gravelly SILT, with some sand, with minor clay; dark greenish grey with orange staining. Soft; low plasticity; wet; gravel, fine to coarse, subangular, Mudstone and sandstone; sand, fine to coarse. Hydrocarbon odour. [Hydraulic Fill]			SNC	100	GBH106-2.7-3m @ 2.7m 122ppm	1	2.5
	3.00m: Piston sample			PT	80	PT1 @ 3.0m		3.0
	3.50m: Core loss						0	3.5
	3.91m: Gravelly SILT, with some sand, with minor clay; dark greenish grey. Soft; low plasticity; wet; gravel, fine to coarse, subangular, Mudstone and sandstone; sand, fine to coarse. Hydrocarbon odour. Orange staining. [Hydraulic Fill]			SNC	59	GBH106 -4.1-4.3m @ 4.1m 4.6ppm DUP20 @ 4.1m		4.0
	4.40m: Clayey SILT, with trace sand; light grey. Soft; high plasticity; moist; sand, fine. [Hydraulic Fill]					19/5 kPa In barrel PT2 @ 4.5m	-1	4.5
	4.50m: Piston sample			PT	100			
							-2	

ROCK DEFECTS: Defect Log; Fracture Spacing (mm) (2000, 600, 200, 60, 20); RQD (%); Description & Additional Observations

Fluid Loss (%) (25, 50, 75)

Water Level: ▼ 01/08/2018

Casing

Installation: Box 1, 0.0-3.0m

Core Box No

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.10-4.29m and packed with K2 sand.

Hole Depth 15.45m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH106P

SHEET: 2 OF 4

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921351.23 mN 1756383.79 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.90m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: JASM

CHECKED: MHU

START DATE: 24/07/2018

FINISH DATE: 26/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, CW, DW)	Rock Strength (FS, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	5.00m: Core loss																	
	5.40m: SILT, with minor clay, with trace sand; dark grey. Soft; low plasticity; moist; sand, fine; Hydrocarbon odour. [Hydraulic Fill]			SNC	60	GBH106 @ 5.4m 1ppm	-3	5.5										
	5.70m: Shelly SAND, with some silt, with minor clay; dark grey. Loosely packed; low plasticity; wet; sand, fine to coarse. [Hydraulic Fill]							6.0										
	6.00m: Piston sample dropped out of tube			PT	0													
	6.50m: Core loss							6.5										
Marine Sediments	6.75m: SILT, with some clay, with minor sand, shell and wood fragments; dark greenish grey. Soft to firm; low plasticity; moist; sand, fine.			SNC	75	GBH106-6.85-7.15m @ 6.9m 0.2ppm DUP21 @ 6.9m 23/4 kPa In barrel	-4	7.0										Box 2, 3.0-7.4m
	7.50m: Piston sample			PT	100			7.5										
	8.00m: Core loss						-5	8.0										
	8.40m: SILT, with minor clay, with trace sand and shell fragments; dark greenish grey. Soft to firm; low plasticity; moist; sand, fine.			SNC	60	GBH106 -8.4-8.8m @ 8.4m 0.3ppm		8.5										
	9.00m: Piston sample			PT	100		-6	9.0										
	9.50m: Core loss							9.5										
Tauranga Group	9.70m: Clayey SILT, with minor amorphous organic material; light brownish grey. Firm to stiff; high plasticity; moist.					GBH106 -9.7-10.3m @ 9.7m	-7											

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.10-4.29m and packed with K2 sand.

Hole Depth 15.45m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH106P

SHEET: 3 OF 4

PROJECT: Orams Site 18	CO-ORDINATES: (NZTM2000) 5921351.23 mN 1756383.79 mE	R.L. GROUND: 2.90m
JOB No.: 30881.2000_1000	DIRECTION: 0°	R.L. COLLAR:
LOCATION: Orams Site 18, Beaumont St, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: NZVD2016
		SURVEY: Total Station\Surveyed

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 24/07/2018
FINISH DATE: 26/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	[Cont'd]: Clayey SILT, with minor amorphous organic material; light brownish grey. Firm to stiff; high plasticity; moist.			SNC	80	● 57/13 kPa In barrel	-8	10.5										Box 3, 7.4-10.3m
				SPT	100	0/0 0/0 0/0 N=0		11.0										
	11.10m: Clayey SILT, with trace sand, with minor organic material; light greenish grey. Soft to firm; low plasticity; moist; sand, fine. *11.20m:* wood fragment and white sandy SILT pod *11.80m:* 50mm wood fragment			SNC	93			11.5										
	11.90m: SILT, with some clay, with trace sand and amorphous organic material; dark greenish grey. Firm; low plasticity; moist; sand, fine.			SNC	100	● 35/6 kPa In barrel 0/0 0/0 0/0 N=0	-9	12.0										
	13.35 - 13.37m: Sandy SILT; greenish grey. *13.45 - 13.46m:* Sandy SILT.			SNC	100	● 28/6 kPa In barrel	-10	12.5 13.0										Box 4, 10.3-13.0m
	14.15m: SILT, with some clay, with trace amorphous organic material; light grey. Stiff; low plasticity; moist.			SNC	100		-11	13.5 14.0										
	14.60m: SILT, with some clay; greenish grey. Very stiff; low plasticity; moist.							14.5										
							-12											

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.10-4.29m and packed with K2 sand.

Hole Depth 15.45m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH106P

SHEET: 4 OF 4

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921351.23 mN 1756383.79 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.90m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: JASM

CHECKED: MHU

START DATE: 24/07/2018

FINISH DATE: 26/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	[Cont'd]: SILT, with some clay; greenish grey. Very stiff; low plasticity; moist.			SPT	77	4/5 7/8 9/13 **N=37**												Box 5, 13.0-15.5m
	15.45m: Refusal						-13 -14 -15 -16 -17	15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.10-4.29m and packed with K2 sand.

Hole Depth 15.45m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH107P

SHEET: 1 OF 4

Tonkin+Taylor

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921314.34 mN, 1756431.39 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.74m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: DSA

CHECKED: MHU

START DATE: 10/07/2018

FINISH DATE: 10/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)
Fill	0.0m: Concrete
	0.13m: Fine to coarse SAND, minor fine to medium gravel, trace pottery; dark greenish grey. Loosely packed, wet. Gravel sub-angular to rounded. Hydrocarbon odour.
	0.35m: Fine to medium SAND, trace fine gravel; light brown to yellowish brown. Loosely packed, wet
	1.0m: Shelly fine to medium SAND, minor silt; brown. Tightly packed, moist. [Hydraulic Fill]
	1.3m: Shelly SILT, some fine to medium sand; grey. Firm to stiff, wet, low to moderate plasticity. [Hydraulic Fill]
	1.6m: No recovery (core loss). Slight Hydrocarbon odour.
	2.0m: Fine to medium SAND, some fine to coarse gravel; dark grey. Loosely packed, wet. [Hydraulic Fill]
	2.1m: No recovery (core loss)
	2.00m: Thin (2mm) black plastic sheet [inferred vapor barrier]
	3.0m: Silty fine to medium SAND, minor pockets of light brown clay; grey. Loosely packed, wet. [Hydraulic Fill]
	3.2m: CLAY, minor fine to medium sand; grey. Firm to stiff, wet, high plasticity. [Hydraulic Fill]
	3.55m: Silty fine to coarse SAND, some shell, minor pockets of light grey clay; grey. Loosely packed, wet. [Hydraulic Fill]
	3.7m: Sandy SILT, trace pockets of light grey clay. Stiff, wet, non plastic to low plasticity. Sand is fine to medium. [Hydraulic Fill]
	4.65m: Some pockets of light brown and grey CLAY, trace organic matter
	4.90m: Becomes trace pockets of light brown and grey CLAY, trace organic matter

Depth (m)	RL (m)	Sampling Method	Core Recovery (%)	Testing	Description & Additional Observations
0.5	2	SNC	100	GBH107 0.13-0.2 @ 0.1m	*0.13 - 0.20m:* PID = 3.4 ppm
				GBH107 0.35-0.5 @ 0.4m	*0.35 - 0.50m:* PID= 2.4 ppm
1.0		SNC	100		
1.5	1	SNC	60	GBH107 1.0-1.3 @ 1.0m	*1.00 - 1.30m:* PID= 5.3 ppm
2.0				GBH107 1.6-2.0 @ 1.6m	*1.60 - 2.00m:* PID= 8.2 ppm
2.5	0	SNC	10		
3.0		SNC	100	GBH107 3.0-3.5 @ 3.0m	*3.00 - 3.50m:* PID = 0.1 ppm.
3.5	-1			GBH107 3.5-3.7 @ 3.5m	*3.50 - 3.70m:* PID = 0.0 ppm.
				GBH107 3.7-4.0 @ 3.7m	*3.70 - 4.00m:* PID = 0.0 ppm.
4.5	-2			52/28 kPa In situ	

Water Level: 01/08/2018

Installation: 112mm Casing to 14.0 m; Box 1, 0.0-3.5m

COMMENTS: Drilled using Sonic Rig EP.26. Shear vane No. 111. Presented shear vane values have been corrected. 50mm piezometer installed, screened 1m - 4.5m

Hole Depth 15.45m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH107P

SHEET: 2 OF 4

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921314.34 mN 1756431.39 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.74m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: DSA

CHECKED: MHU

START DATE: 10/07/2018

FINISH DATE: 10/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	5.0m: Silty fine SAND; grey. Loose, wet. [Hydraulic Fill]																	
	5.1m: CLAY, minor fine to medium sand, trace shell and organic matter. Stiff, wet, high plasticity. [Hydraulic Fill]			SNC	100	GBH107 5.1-5.3 @ 5.1m		5.5					*5.10 - 5.30m:* PID = 0.2 ppm.					
	5.65m: Pocket of light brownish grey CLAY																	
	5.7m: Sandy SILT, trace clay, trace shell; grey. Stiff, wet, low plasticity. [Hydraulic Fill]					GBH107 5.7-6.0 @ 5.7m	-3						*5.70 - 6.00m:* PID = 0.1 ppm.					
Marine Sediments	6.0m: CLAY, trace fine to medium sand, trace shell, trace organic matter; grey. Firm, wet, high plasticity					6[illegible] kPa [illegible] @ 6.0m		6.0					*6.00 - 6.20m:* PID = 0.3 ppm.					Box 2, 3.5-6.0m
	7.2m: Sandy SILT, minor shell, trace organic matter; grey. Firm to stiff, wet, low plasticity			SNC	100	GBH107 7.2-7.5 @ 7.2m	-4	6.5 7.0					*7.20 - 7.50m:* PID = 0.4 ppm.					
Marine	7.50m: Core loss			SPT	0	0/0 0/0 0/0 **N=0**	-5	7.5										
	7.5m: CLAY, minor to some fine sand, some organic matter, minor shell; grey. Firm, wet, high plasticity							8.0										
Tauranga Group	8.15m: CLAY, minor fine to medium sand, trace organic matter; brown. Firm, wet, high plasticity																	
	8.25m: Sandy SILT, minor pockets of silty fine sand; brownish grey becoming grey. Firm, wet, low plasticity			SNC	100	GBH107 8.45-8.75 @ 8.5m	-6	8.5					*8.45 - 8.75m:* PID = 0.3 ppm.					Box 3, 6.0-8.9m
	8.4m: CLAY, minor silt, trace organics; yellowish brown becoming light grey mottled yellowish brown from 8.65m. Stiff, wet, high plasticity					84/28 kPa In barrel		9.0										
	9.35m: Grey, trace brown mottles			SPT	100	1/1 1/1 2/1 **N=5**	-7	9.5								112mm Casing to 14.0 m		
	9.50 - 9.55m: Trace organic material *9.55 - 9.60m:* Sandy SILT; yellowish brown																	
	9.6m: CLAY, minor silt, trace fine sand; grey trace orange brown mottles. Firm, wet, high plasticity																	

COMMENTS: Drilled using Sonic Rig EP.26. Shear vane No. 111. Presented shear vane values have been corrected. 50mm piezometer installed, screened 1m - 4.5m

Hole Depth 15.45m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH107P

SHEET: 3 OF 4

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921314.34 mN 1756431.39 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.74m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: DSA

CHECKED: MHU

START DATE: 10/07/2018

FINISH DATE: 10/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	10.0m: CLAY, minor silt, minor fine sand; grey trace orange brown mottles. Firm, wet, high plasticity			SNC	100	22/8 kPa In barrel		10.5										
	10.5m: CLAY, minor silt; orange brown mottled grey, becoming grey minor orange brown mottles from 10.7m. Firm, wet, high plasticity			SPT	100	0/0 0/1 0/1 N=2	-8											
	10.95 - 11.05m: light orange brown mottled grey							11.0										
	11.05m: Becomes CLAY, minor silt, minor pockets of organic material and minor to some pockets of sandy SILT; grey with minor dark grey mottles			SNC	100			11.5										Box 4, 8.9-11.5m
	11.7m: Sandy CLAY, minor silt, minor organics at 11.7m; grey. Soft to firm, wet, moderate to high plasticity. Sand; fine to medium						-9											
	12.0m: Silty fine to medium SAND, trace organics; grey with trace brown mottles. Loose, wet			SPT	100	25/6 kPa In barrel 0/0 1/2 1/1 N=5		12.0										
	12.5m: SILT, some fine sand, minor clay, trace organics, some pockets of brown silty clay; grey. Firm, wet, low plasticity			SNC	100		-10	12.5										
	13.0m: Silty fine to medium SAND, some wood fragments; dark grey. Loosely packed, wet							13.0										
	13.3m: Becomes fine to medium, minor coarse SAND, trace organic matter; dark grey. Loose, wet			SPT	100	1/1 1/1 3/3 N=8	-11	13.5								112mm Casing to 14.0 m		
	13.50 - 13.60m: Minor lenses of organic brown CLAY							14.0										
	14.2m: Sandy SILT; grey. Very stiff, wet, low plasticity			SNC	100		-12	14.5										Box 5, 11.5-14.5m

COMMENTS: Drilled using Sonic Rig EP.26. Shear vane No. 111. Presented shear vane values have been corrected. 50mm piezometer installed, screened 1m - 4.5m

Hole Depth 15.45m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH107P

SHEET: 4 OF 4

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921314.34 mN 1756431.39 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.74m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: DSA

CHECKED: MHU

START DATE: 10/07/2018

FINISH DATE: 10/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW CDW)	Rock Strength (ES VS S MS M W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000 600 200 60 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	15.0m: Fine to medium SAND; grey. Dense, wet			SPT	100	2/5 7/9 11/14 **N=41**												
	15.25m: Sandy SILT, trace black carbonaceous material; grey. Very stiff, wet, low plasticity																	Box 6, 14.5-15.5m
	15.45m: Refusal						-13	15.5										
								16.0										
								16.5										
							-14											
								17.0										
								17.5										
							-15											
								18.0										
								18.5										
							-16											
								19.0										
								19.5										
							-17											

COMMENTS: Drilled using Sonic Rig EP.26. Shear vane No. 111. Presented shear vane values have been corrected. 50mm piezometer installed, screened 1m - 4.5m

Hole Depth 15.45m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH108P

SHEET: 1 OF 4

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921295.80 mN 1756395.49 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.07m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: DSA / MANR
CHECKED: MHU
START DATE: 06/07/2018
FINISH DATE: 09/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)
Fill	0.0m: Fine to coarse GRAVEL, trace coarse sand; brown. Loosely packed, moist
	0.4m: Concrete
	0.45m: Gravelly SILT, trace coarse sand and brick fragments; brown. Firm, dry, low plasticity. Gravel; fine to medium.
	0.80m: Minor rootlets
	0.85m: Shelly SAND; grey. Loosely packed, dry.
	1.00m: Brown
	1.3m: Gravelly SILT, trace sand; brown. Firm, dry.
	1.4m: Coarse SAND, minor shell; grey. Loosely packed, moist. [Hydraulic Fill]
	1.6m: Clayey SILT; orange brown mottled grey. Firm, moist, high plasticity. Strong hydrocarbon odour. [Hydraulic Fill]
	1.9m: SAND, trace silt, trace cobbles; grey. Loosely packed, moist. Strong hydrocarbon odour. [Hydraulic Fill]
	2.00m: Some orange brown mottling
	2.70m: Becomes saturated, some shell fragments
	3.0m: Clayey SILT, trace coarse sand, minor shell fragments; grey mottled orange brown. Stiff, moist, high plasticity. Hydrocarbon odour. [Hydraulic Fill]
	4.2m: SAND, minor silt; grey. Loosely packed, moist. [Hydraulic Fill]
	4.80m: SAND, minor silt, minor shell fragments

Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
SNC	100	GBH108 0.0-0.3 @ 0.0m	3	0.0					*0.00 - 0.30m:* PID = 1.8 ppm.					
SNC	100	GBH108 0.45-0.6 @ 0.5m	2	0.5					*0.45 - 0.60m:* PID = 6.5 ppm.					
SNC	100	GBH108 0.85-1.0 @ 0.9m		1.0					*0.85 - 1.00m:* PID = 1.7 ppm.					
SNC	100	GBH108 1.4-1.6 @ 1.4m		1.5					*1.40 - 1.60m:* PID = 175.0 ppm.					
SNC	83	GBH108 1.6-1.8 @ 1.6m	1						*1.60 - 1.80m:* PID = 128.3 ppm.		26/07/2018			Box 1, 0.0-1.8m
SNC	80	GBH108 1.9-2.1 @ 1.9m		2.0					*1.90 - 2.10m:* PID = 434.1 ppm.					
SNC	80	GBH108 2.7-3.0 @ 2.7m		2.5					*2.70 - 3.00m:* PID = 384.1 ppm.					
SNC	91	GBH108 3.0-3.2 @ 3.0m	0	3.0					*3.00 - 3.20m:* PID = 13.7 ppm.					
SNC	91	GBH108 4.2-4.5 @ 4.2m	-1	4.0					*4.20 - 4.50m:* PID = 1.2 ppm.			112mm Casing to 14.0 m		Box 2, 1.8-4.5m

COMMENTS: Drilled using Sonic Rig EP.26. Shear vane No. 111. Presented shear vane values have been corrected. 50mm piezometer installed, screened 1m - 4.5m

Hole Depth 15.25m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH108P

SHEET: 2 OF 4

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921295.80 mN 1756395.49 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.07m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: DSA / MANR
CHECKED: MHU
START DATE: 06/07/2018
FINISH DATE: 09/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	5.0m: SAND, minor silt and shell fragments; grey. Loosely packed, moist. [Hydraulic Fill] *5.10m:* Shelly SAND, minor silt becoming interbedded shelly sand with minor silt and silty SAND, trace shell			SNC	93	GBH108 5.1-5.3 @ 5.1m	-2	5.5					*5.10 - 5.30m:* PID = 0.0 ppm.					
	6.00m: Core loss			SPT	20	GBH108 6.0-6.5 @ 6.0m 0/0 **N=1** Solid	-3	6.0					*6.00 - 6.30m:* 0.1 ppm.					
Marine Sediments	6.36m: Sandy SILT; grey. Firm, moist, low plasticity. Sulphur odour			SNC	90		-4	6.5 7.0										Box 3, 4.5-7.3m
	7.3m: Clayey SILT, trace sand, trace shell fragments; grey. Firm, moist, high plasticity			SNC	94	GBH108 7.3-7.5 @ 7.3m 16/3 kPa In barrel	-5	7.5 8.0					*7.30 - 7.50m:* PID = 0.3 ppm.					
Tauranga Group	8.5m: Silty CLAY; grey mottled orange brown. Firm, moist, high plasticity							8.5										
	9.0m: Clayey SILT, trace decomposing rootlets; grey minor orange brown mottles. Stiff, wet, high plasticity			SPT	100	47/13 kPa In barrel 1/1 2/3 2/2 **N=9**	-6	9.0										Box 4, 7.3-9.5m
	9.6m: CLAY, minor fine sand, minor silt; brownish grey. Stiff, wet, high plasticity							9.5								112mm Casing to 14.0 m		

COMMENTS: Drilled using Sonic Rig EP.26. Shear vane No. 111. Presented shear vane values have been corrected. 50mm piezometer installed, screened 1m - 4.5m

Hole Depth 15.25m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH108P

SHEET: 3 OF 4

PROJECT: Orams Site 18	CO-ORDINATES: (NZTM2000) 5921295.80 mN 1756395.49 mE	R.L. GROUND: 3.07m
JOB No.: 30881.2000_1000		R.L. COLLAR:
LOCATION: Orams Site 18, Beaumont St, Auckland	DIRECTION: 0°	DATUM: NZVD2016
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: DSA / MANR
CHECKED: MHU
START DATE: 06/07/2018
FINISH DATE: 09/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW, CW)	Rock Strength (ES, VS, WS, MS, HW, UW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	10.0m: CLAY, minor fine sand, minor silt; brownish grey. Stiff, wet, high plasticity			SNC	100		-7	10.5										
	10.2m: CLAY, minor to some silt, trace fine sand and decomposing rootlets; grey minor orange brown mottles. Stiff, wet, high plasticity					● 57/13 kPa In barrel												
	10.5m: Sandy SILT, some clay, minor organic matter; greenish grey. Stiff, wet, low plasticity			SPT	100	0/1 1/1 2/2 **N=6**												
	10.95m: Sandy SILT, some pockets of silty fine SAND; greenish grey. Stiff, wet, non plastic to low plasticity			SNC	100		-8	11.0 11.5										Box 5, 9.5-12.0m
	12.0m: Sandy SILT; grey mottled greenish grey. Stiff, wet, low plasticity			SPT	100	● 63/14 kPa In barrel 1/2 3/4 4/6 **N=17**	-9	12.0										
	12.5m: Silty fine SAND; grey. Medium dense, wet			SNC	100		-10	12.5 13.0								112mm Casing to 14.0 m		
	13.0m: Sandy SILT; grey some greenish grey mottles from 13.2m to 13.7m. Very stiff, wet, non plastic to low plasticity			SPT	100	4/5 6/7 7/10 **N=30**		13.5										
	14.0m: Silty fine SAND; grey. Medium dense to dense, wet *14.20m:* Some fine to medium gravel size fragments of extremely weak, grey, fine SANDSTONE			SNC	100		-11	14.0 14.5									Box 6, 12.0-14.7m
	14.5m: Sandy SILT; grey. Very stiff, wet, non plastic to low plasticity																	
	14.7m: Silty fine SAND; grey. Dense, wet					4/6 8/8 9/13												

COMMENTS: Drilled using Sonic Rig EP.26. Shear vane No. 111. Presented shear vane values have been corrected. 50mm piezometer installed, screened 1m - 4.5m

Hole Depth 15.25m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:35 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH108P

SHEET: 4 OF 4

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921295.80 mN 1756395.49 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.07m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: DSA / MANR
CHECKED: MHU
START DATE: 06/07/2018
FINISH DATE: 09/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	14.7m [Cont'd]: Silty fine SAND; grey. Dense, wet	UW SW MW HW CW	ES VS S MS W VW EW	SPT	100	N=38	-12											Box 7, 14.7-15.3m
	15.25m: Refusal						-13	15.5 16.0 16.5										
							-14	17.0 17.5										
							-15	18.0 18.5										
							-16	19.0 19.5										

COMMENTS: Drilled using Sonic Rig EP.26. Shear vane No. 111. Presented shear vane values have been corrected. 50mm piezometer installed, screened 1m - 4.5m

Hole Depth 15.25m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:36 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH109P

SHEET: 1 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921312.94 mN 1756317.56 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.77m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James/ Lance

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 13/07/2018

FINISH DATE: 17/08/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW CS)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Fill	0.00m: Asphalt																	
	0.05m: GRAVEL, with some cobbles; brown. Dry; gravel, fine to coarse.					GBH109 0.3-0.4m @ 0.3m							*0.30 - 0.40m:* PID= 0.9ppm					
	0.50m: Silty GRAVEL; brown. Moist; gravel, fine to medium.			HVAC	93	GBH109 0.5-0.6 @ 0.5m	2	0.5					*0.50 - 0.60m:* PID=2.8ppm					
	1.00m: Silty GRAVEL; brown. Moist; gravel, fine to medium; Hydrocarbon odour. Contains brick fragments.					GBH109 1.0-1.1 @ 1.0m		1.0					*1.00 - 1.10m:* PID=1.1ppm					
	1.5m: Sandy SILT, some fine to coarse gravel, trace brick fragments; black to dark grey. Firm, wet, low plasticity [gasworks waste]					GBH109 -1.5-1.9m @ 1.5m 18.2ppm DUP16 @ 1.5m	1	1.5										
	1.9m: Core loss			RC	66			2.0										
	2.4m: SILT, minor fine sand, minor fine to coarse gravel, trace brick fragments; black to dark brown. Firm, wet, low plasticity [gasworks waste]					GBH109-2.5-2.9 @ 2.5m 582.4ppm	0	2.5							14/08/2018			
	3.0m: Silty fine to coarse SAND, some fine to coarse gravel; blackish grey. Very loose, saturated [gasworks waste]			SPT	66	0/0 1/0 1/0 **N=2**		3.0							06/08/2018			
	3.3m: Core loss																	
	3.45m: Vesicular basalt COBBLES, with some gravels; dark grey. Strong. *3.45 - 3.50m:* Cobbles comprising light brown fine to medium SANDSTONE						-1	3.5										
	3.65m: Silty fine SAND; grey. Loosely packed, moist. [Hydraulic Fill]																	
	3.7m: Core loss			RC	28			4.0										
	4.5m: Core loss			SPT	0	1/1 2/2 2/3 **N=9**	-2	4.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6-8m and packed with K2 sand.

Hole Depth 30.08m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:36 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH109P

SHEET: 2 OF 7

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921312.94 mN 1756317.56 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.77m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James/ Lance
LOGGED BY: JASM / DSA
CHECKED: MHU
START DATE: 13/07/2018
FINISH DATE: 17/08/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation
Fill	4.95m [Cont'd]: Silty fine SAND; grey. Loosely packed, wet [Hydraulic Fill]
	5.35m: Sandy SILT, minor shell, trace pockets of fine to medium sand; grey trace yellowish brown mottles. Stiff, wet, low plasticity. [Hydraulic Fill]
	5.5m: Fine SAND, trace to minor silt, trace shell; grey. Loosely packed, wet. [Hydraulic Fill]
	5.6m: Core loss
Marine Sediments	6.65m: SILT, with some clay, with minor sand, with trace gravels and shell fragments; greenish grey. Very soft to soft; low plasticity; moist; sand, fine; gravel, fine to medium, subrounded to subangular, Mudstone.
Tauranga Group	8.60m: Clayey SILT, with trace sand; light grey. Firm; high plasticity; moist; sand, fine; minor orange staining.
	9.20m: Sandy SILT, with minor clay, with trace pods of amorphous organic material; light greyish green. Firm; low plasticity; moist; sand, fine; minor dark green part.
	9.55m: Silty SAND, with some wood fragments, with minor clay; greenish grey. Firm; low plasticity; moist; sand, fine to medium. *9.80 - 9.85m:* Black wood fragment

Rock Weathering: UW, EW, HW, MW, HW, CW
Rock Strength: ES, VS, S, MS, M, W, VW, EW

Sampling Method	Core Recovery (%)	Testing
RC	61	GBH109 -5.0- 5.5m @ 5.0m
RC	56	GBH109- 6.85- 7.05m @ 6.9m 5.6ppm
		13/5 kPa In barrel
SPT	88	0/0 0/0 0/0 **N=0**
PQTT	100	GBH109 -7.8- 8.05m @ 7.8m 0.6ppm
		44/19 kPa In barrel
SPT	100	0/0 1/2 2/2 **N=7**
		GBH109 -9.5- 9.7m @ 9.5m 0.2ppm

RL (m): -3, -4, -5, -6, -7
Depth (m): 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5

ROCK DEFECTS: Defect Log; Fracture Spacing (mm) 2000, 600, 200, 60, 20; RQD (%)

Description & Additional Observations

Fluid Loss (%): 25, 50, 75

Water Level

Casing

Installation: Box 1, 0.0-6.0m; Box 2, 6.0-9.0m

Core Box No

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6-8m and packed with K2 sand.

Hole Depth 30.08m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:36 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH109P

SHEET: 3 OF 7

Tonkin+Taylor

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921312.94 mN, 1756317.56 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.77m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James/ Lance

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 13/07/2018

FINISH DATE: 17/08/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	10.00m: Clayey SILT, minor wood fragments; greenish grey. Very stiff; high plasticity; moist.			PQTT	100	● 118/32 kPa In barrel		10.5										
	10.80m: Decomposed blackish brown wood fragment			SPT	100	1/0 1/1 1/2 **N=5**	-8											
	10.95m: Core loss							11.0										
	11.25m: Decomposed blackish brown wood fragment			PQTT	71			11.5										Box 3, 9.0-11.9m
	11.60m: SILT, with minor wood fragments, with trace clay; light greenish grey. Stiff; non-plastic; moist.						-9											
	12.15m: SILT, with some clay, with trace wood fragments; greyish green. Very stiff; low plasticity; moist.			SPT	100	6/8 5/3 3/3 **N=14**		12.0										
				PQTT	100		-10	12.5										
	13.60m: SILT, with some clay, with trace amorphous organic material; greenish grey. Very stiff; low plasticity; moist.							13.0										
				SPT	100	2/3 4/6 6/6 **N=22**	-11	13.5										
				PQTT	100			14.0										Box 4, 11.9-14.1m
								14.5										
							-12											

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6-8m and packed with K2 sand.

Hole Depth 30.08m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:36 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH109P

SHEET: 4 OF 7

PROJECT: Orams Site 18	CO-ORDINATES: (NZTM2000) 5921312.94 mN 1756317.56 mE	R.L. GROUND: 2.77m
JOB No.: 30881.2000_1000		R.L. COLLAR:
LOCATION: Orams Site 18, Beaumont St, Auckland	DIRECTION: 0°	DATUM: NZVD2016
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: James/ Lance
LOGGED BY: JASM / DSA
CHECKED: MHU
START DATE: 13/07/2018
FINISH DATE: 17/08/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, CW, DW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	15.00m: Core loss																	
	15.15m: SILT, with some clay, with trace amorphous organic material; greenish grey. Very stiff; low plasticity; moist.			SPT	66	2/5 7/8 8/9 **N=32**	-13	15.5										
				PQTT	97			16.0										
	16.40m: Sandy SILT, with minor clay and amorphous organic material; greenish grey. Very stiff; low plasticity; moist; sand, fine.			SPT	100	2/4 6/8 8/9 **N=31**	-14	16.5										Box 5, 14.1-16.6m
	16.95m: Sandy SILT, with some clay; greenish grey. Hard; non-plastic; moist; sand, fine.			HQTT	93		-15	17.0 17.5										
	18.00m: Sandy SILT, with minor clay and amorphous organic material; greenish grey. Hard; low plasticity; moist; sand, fine.			SPT	100	3/5 6/7 9/10 **N=32**		18.0										
	18.45m: Core loss							18.5										
	18.60m: Silty SAND, with minor clay and amorphous peat lenses; greenish grey. Tightly packed; non-plastic; moist; sand, fine.			HQTT	85		-16	19.0										
	19.50m: Sandy SILT, with minor clay; greenish grey. Stiff; low plasticity; moist; sand, fine.			SPT	100	2/3 4/5 6/7 **N=22**	-17	19.5										Box 6, 16.6-19.7m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6-8m and packed with K2 sand.

Hole Depth 30.08m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:36 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH109P

SHEET: 5 OF 7

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921312.94 mN 1756317.56 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.77m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James/ Lance
LOGGED BY: JASM / DSA
CHECKED: MHU
START DATE: 13/07/2018
FINISH DATE: 17/08/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	19.95m: Core loss																	
	20.30m: Sandy SILT, with minor clay; greenish grey. Stiff; low plasticity; moist; sand, fine.			HQTT	66		-18	20.5										
	20.40m: Sandy SILT, with minor clay and amorphous organic material; greenish grey. Very stiff to hard; low plasticity; moist.																	
	21.00m: Core loss			SPT	55	3/4 4/5 5/5 N=19		21.0										
	21.20m: SAND, with some silt, with trace clay; dark greenish grey. Medium dense; non-plastic; moist; sand, fine to coarse; sand; sub rounded to subangular; quartz, basalt, mudstone.																	
	21.40m: SILT, with some sand, with minor clay; greenish grey. Stiff to very stiff; high plasticity; moist; sand, fine.							21.5										
	21.45m: Core loss			HQTT	11		-19											
	22.38m: SILT, with some sand, with minor clay; greenish grey. Stiff to very stiff; high plasticity; moist; sand, fine.							22.0										
	22.50m: Core loss							22.5										
	22.65m: SAND, with some silt; dark greenish grey. Dense; non-plastic; moist; sand, fine to coarse; sand: quartz, feldspar, basalt.			SPT	66	4/6 6/9 12/13 N=40	-20											
	22.80 - 22.86m: SAND, with some clay and silt; light greenish grey. Stiff; low plasticity; moist; sand, fine.																	
	22.95m: Core loss			HQTT	21			23.0										
								23.5										
	23.77m: Silty SAND, with minor clay, with trace gravel; greenish grey. Dense; non-plastic; moist; sand, fine to coarse, Quartz; gravel, fine, subrounded.						-21											
	24.00m: Core loss			SPT	66	3/4 4/6 9/10 N=29		24.0										
	24.15m: Silty SAND, with some gravel, with minor clay, with trace greenish brown clay pods; greenish grey. Medium dense; non-plastic; moist; sand, fine to coarse, Quartz; gravel, fine, subrounded to subangular; sand; quartz and basalt.																	
	24.45m: Core loss						-22	24.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6-8m and packed with K2 sand.

Hole Depth 30.08m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:36 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH109P

SHEET: 6 OF 7

Tonkin+Taylor

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921312.94 mN 1756317.56 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.77m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James/ Lance

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 13/07/2018

FINISH DATE: 17/08/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	25.35m: Sandy SILT, with some clay; light greenish grey. Very stiff; low plasticity; moist; sand, fine.			HQTT	19													Box 7, 19.7-25.5m
	25.50m: Core loss			SPT	100	2/3 5/10 33/7 for 5mm **N>=50**	-23	25.5										
	25.75m: Sandy SILT, with minor clay; dark greenish grey. Hard; low plasticity; moist; sand, fine.																	
	25.90m: Sandy GRAVEL, with some silt; reddish green. Dense to very dense; moist; gravel, medium to coarse, subrounded to subangular, slightly weathered.							26.0										
	26.05m: Slightly weathered; greyish green; SANDSTONE; weak; Parnell grit? Fine to coarse sandstone.			HQTT	87							70						
	26.70m: Unweathered; dark green; , bedded, gently inclined, very thin; SILTSTONE; weak.						-24	26.5					26.60m: BF, 10° dip, VN 26.70m: B, 15° dip, T					
	[Cont'd]: Unweathered; dark green; , bedded, gently inclined, very thin; SILTSTONE; weak.			SPT	0	18/32 for 65mm **N>=50** Solid		27.0										
	27.55m: Slightly weathered; dark greenish grey; SANDSTONE; weak.							27.5										
East Coast Bays Formation	27.70m: Slightly weathered; dark greenish grey; , bedded, gently inclined, very thin; SILTSTONE; weak. *27.95m:* Black carbonaceous material			HQTT	100		-25	28.0				72	27.65 - 27.70m: BF, 10° dip, MW 27.75m: BF, 10° dip, N 27.90m: B, 15° dip, T 28.20m: BF, 10° dip, MN 28.35m: BF, 15° dip, MN					Box 8, 25.5-28.5m
				SPT	0	16/34 for 70mm **N>=50** Solid		28.5										
	29.45m: Slightly weathered; dark greyish green; , bedded, gently inclined, moderately thin; SANDSTONE; weak.			HQTT	94		-26	29.0				94	29.10m: J, 75° dip, VN					
							-27	29.5										Box 9, 28.5-30.0m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6-8m and packed with K2 sand.

Hole Depth 30.08m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:36 p.m. - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: GBH109P

SHEET: 7 OF 7

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921312.94 mN 1756317.56 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.77m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James/ Lance

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 13/07/2018

FINISH DATE: 17/08/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (FS, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
				SPT	0	43/7 for 5mm **N>=50** Solid	-28	30.5										
								31.0										
							-29	31.5										
								32.0										
							-30	32.5										
								33.0										
							-31	33.5										
								34.0										
							-32	34.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6-8m and packed with K2 sand.

Hole Depth 30.08m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:36 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH110P

SHEET: 1 OF 5

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921271.00 mN 1756405.50 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.72m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 18/07/2018

FINISH DATE: 19/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	0.00m: Concrete							0.0										
	0.20m: Sandy GRAVEL, with minor silt; brown. Moist; gravel, fine to coarse.					GBH110 0.3-0.4 @ 0.3m 0.8ppm												
	0.60m: Clayey SILT, with some sand; orangish brown mottled grey. Soft; moist; Hydrocarbon odour.			HVAC	100	GBH110 0.6-0.8 @ 0.6m 331.3ppm	2	0.5										
	1.50m: Core loss			SPT	55	0/0 1/0 1/2 **N=4**	1	1.0										
	1.70m: Clayey SILT, with minor sand; dark greenish grey. Firm; high plasticity; moist; sand, fine.							1.5										
	1.75m: Sandy SILT, with minor clay; dark greenish grey. Firm; non-plastic; moist; sand, fine.														14/08/2018			
	1.80m: Sandy SILT, with some gravel, with minor clay; dark greenish grey. Soft; low plasticity; moist; sand, fine; gravel, fine to coarse, subrounded to subangular, Mudstone, sandstone and minor brick fragments.			PQTT	57	GBH110 -2.4- 2.65m @ 2.4m 32.5ppm	0	2.0							03/08/2018			
	1.95m: Core loss																	
	2.40m: Sandy SILT, with some gravel, with minor clay; dark greenish grey. Soft to firm; low plasticity; moist; sand, fine; gravel, fine to coarse, subrounded to subangular, Mudstone, sandstone and minor brick fragments.					● 27/19 kPa In barrel		2.5										
	2.50 - 2.55m: Clayey SILT, with trace sand; light greenish grey. Firm; high plasticity; moist; sand, fine.																	
	2.80 - 2.85m: Wood fragment in clayey SILT, light greyish green, firm, moist, high plasticity							3.0										
	3.30m: Silty SAND, with minor clay and shell fragments; dark greenish grey. Loosely packed; low plasticity; moist; sand, fine to medium. [Hydraulic Fill]			SPT	100		-1											
	3.45m: Core loss							3.5										
	3.67m: Sandy SILT, with some shell fragments, with minor clay, gravel and amorphous organic material; dark greenish grey. Soft; low plasticity; moist; sand, fine; gravel, fine to medium, subrounded to subangular, mudstone. [Hydraulic Fill]			PQTT	79	GBH110 -3.7- 4.1m @ 3.7m 0.3ppm DUP17 @ 3.7m		4.0										
	3.90m: Clayey SILT thinly interbedded with sandy SILT, with some shell fragments, minor wood fragments; dark greenish grey. Soft; low plasticity; moist; sand, fine. [Hydraulic Fill]					● 19/6 kPa In barrel	-2	4.5										
	4.50m: Core loss																	

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.09-7.86m and packed with K2 sand.

Hole Depth 24.09m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:36 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH110P

SHEET: 2 OF 5

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921271.00 mN 1756405.50 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.72m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM / DSA
CHECKED: MHU
START DATE: 18/07/2018
FINISH DATE: 19/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	4.98m [Cont'd]: Clayey SILT thinly interbedded with sandy SILT, with some shell fragments, minor wood fragments; dark greenish grey. Soft; low plasticity; moist; sand, fine. [Hydraulic Fill]			PQTT	68	GBH110-5-5.2m @ 5.0m 0.6ppm	-3	5.5										
	5.20m: Sandy SILT, with some shell fragments, with minor clay; dark greenish grey. Soft; low plasticity; moist; sand, fine. [Hydraulic Fill]																	
	5.60m: Sandy SILT, with minor clay and shell fragments; dark greenish grey. Soft to firm; low plasticity; moist; sand, fine. [Hydraulic Fill]					36/6 kPa In barrel												
	6.00m: Core loss							6.0										
Marine Sediments	6.53m: Sandy SILT, with minor clay and shell fragments; dark greenish grey. Soft to firm; low plasticity; moist; sand, fine. *6.60m:* strong sulphur smell			PQTT	64	GBH110-6.5-6.8m @ 6.5m 0.3ppm	-4	6.5										
	7.20m: Clayey SILT, with minor sand and shell fragments, with trace wood fragments; dark greenish grey. Firm; high plasticity; moist; sand, fine.					25/6 kPa In barrel		7.0										
	7.50m: Core loss						-5	7.5										
	7.78m: Clayey SILT, with minor sand and shell fragments, with trace wood fragments; dark greenish grey. Firm; high plasticity; moist; sand, fine.			PQTT	81	GBH110-7.9-8.15m @ 7.9m 0.2ppm		8.0										Box 2, 5.2-8.3m
Tauranga Group	8.60m: Clayey SILT, with minor wood fragments; light greenish grey. Stiff; high plasticity; moist.					GBH110-8.65-8.9m @ 8.7m 0.1ppm	-6	8.5										
						71/41 kPa In barrel		9.0										
	9.25m: Clayey SILT, trace wood fragments; light greyish green. Stiff; high plasticity; moist.			SPT	100	0/1 1/2 2/2 **N=7**												
	9.45m: Core loss						-7	9.5										
	9.85m: Clayey SILT, trace wood fragments; light greyish green. Stiff; high plasticity; moist.																	

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.09-7.86m and packed with K2 sand.

Hole Depth 24.09m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH110P

SHEET: 3 OF 5

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921271.00 mN 1756405.50 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.72m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 18/07/2018

FINISH DATE: 19/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	[Cont'd]: Clayey SILT, trace wood fragments; light greyish green. Stiff; high plasticity; moist.			PQTT	61	● 79/25 kPa In barrel												
	10.50m: Core loss			SPT	0	0/0 0/1 0/0 **N=1**	-8	10.5										
	10.95m: SILT, with some amorphous organic material and clay; light brown. Firm; low plasticity; moist.							11.0										Box 3, 8.3-11.3m
	11.15m: Clayey SILT, with trace fibrous organic material; light greyish green. Stiff; high plasticity; moist.			PQTT	100		-9	11.5										
	11.80m: SILT, with some clay and sand, with trace amorphous organic material; greyish green. Very stiff to hard; low plasticity; moist; sand, fine.							12.0										
	12.00m: Core loss			SPT	66	3/3 4/5 7/8 **N=24**												
	12.15m: SILT, with some clay and sand, with trace amorphous organic material; greyish green. Very stiff to hard; low plasticity; moist; sand, fine.			PQTT	100		-10	12.5										
								13.0										
				SPT	88	3/3 4/5 6/7 **N=22**	-11	13.5										Box 4, 11.3-14.0m
	13.80m: Sandy SILT, with minor clay; greyish green. Very dense; low plasticity; moist; sand, fine.			PQTT	100			14.0										
							-12	14.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.09-7.86m and packed with K2 sand.

Hole Depth 24.09m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH110P

SHEET: 4 OF 5

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921271.00 mN 1756405.50 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.72m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM / DSA

CHECKED: MHU

START DATE: 18/07/2018

FINISH DATE: 19/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	15.20m: Silty SAND, with trace clay and amorphous organic material; light brownish green. Very dense; non-plastic; moist; sand, fine.			SPT	114	6/10 15/20 15 for 50mm N>=50	-13	15.5										
East Coast Bays Formation	16.00m: SILT, with some sand, with minor clay, with trace gravel; greyish green. Hard; low plasticity; moist; sand, fine; gravel, fine, subrounded.			PQTT	91			16.0										Box 5, 14.0-16.3m
				SPT	100	16/19 27/23 for 65mm N>=50	-14	16.5										
	16.75m: Slightly weathered; dark greenish grey; bedded, moderately inclined, thin; SILTSTONE; weak.			HQTT	86			17.0				86						
	17.45m: Slightly weathered; dark greenish grey; massive; SANDSTONE; weak.						-15	17.5										
	17.90m: Slightly weathered; dark greenish grey; bedded, gently inclined, moderately thin; fine grained SANDSTONE with subordinate silt; very weak.			SPT	86	25/29 for 75mm N>=50		18.0										
	18.15m: Core loss *18.80 - 18.85m:* Thinly bedded bands for black wood material. Scraping wood shows a dark reddish brown colour			HQTT	59		-16	18.5				51						
	18.70m: Slightly weathered; dark greenish grey; bedded, gently inclined, moderately thin; fine grained SANDSTONE with subordinate silt; very weak.							19.0					19.20m: DD, 0° dip					Box 6, 16.3-19.5m
	18.90: Slightly weathered; dark greenish grey; massive; SANDSTONE; very weak; fine to coarse grained.																	
	19.25m: Unweathered; dark greenish grey; , bedded, gently inclined, thin; SILTSTONE; weak.																	
	19.45m: Unweathered; dark greenish grey; , bedded, gently inclined, moderately thick; SANDSTONE; weak; fine to coarse grains.			SPT	78	19/31 for 65mm N>=50	-17	19.5				95						

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.09-7.86m and packed with K2 sand.

Hole Depth 24.09m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH110P

SHEET: 5 OF 5

PROJECT: Orams Site 18	CO-ORDINATES: (NZTM2000) 5921271.00 mN 1756405.50 mE	R.L. GROUND: 2.72m
JOB No.: 30881.2000_1000		R.L. COLLAR:
LOCATION: Orams Site 18, Beaumont St, Auckland	DIRECTION: 0°	DATUM: NZVD2016
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM / DSA
CHECKED: MHU
START DATE: 18/07/2018
FINISH DATE: 19/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.05 - 20.10m:* coarse sand layer			HQTT	95		-18	20.5				95	20.00m: J, 80° dip, T 20.25m: J, 80° dip, T					
	20.60m: Unweathered; greenish grey; , bedded, gently inclined, very thin; SILTSTONE; weak; very thin bed of black amorphous organic material. Dark reddish brown colur when freshly cut.																	
	20.65m: Unweathered; dark greenish grey; massive; SANDSTONE; very weak.			SPT	0	44/6 for 5mm **N>=50** Solid		21.0										
	20.85m: Unweathered; light grey; SILTSTONE; very weak.																	
	20.90m: Unweathered; dark greenish grey; massive; SANDSTONE; weak.																	
	21.00m: No recovery																	
	21.08m: Core loss *20.95m:* steeply inclined white calcite vein. 5mm thick			HQTT	35		-19	21.5				35						
	22.00m: Unweathered; dark greenish grey; massive; SANDSTONE; weak.							22.0					21.95m: J, 80° dip, N, calcite infill					
	22.50m: Unweathered; dark greenish grey; massive; SANDSTONE; weak; poorly sorted with minor fine to medium gravels.			SPT	0	50 for 60mm **N>=50** Solid		22.5										
	22.65m: Unweathered; dark greenish grey; , bedded, gently inclined, thin; SANDSTONE; very weak; interbedded layers of black amorphous organic material - dark reddish brown colour when cut.						-20	23.0										
	22.85m: Unweathered; dark greenish grey; , bedded, gently inclined, thin; SILTSTONE; weak.			HQTT	99							99						
	23.25m: Unweathered; greenish grey; massive; SANDSTONE; very weak; trace white specks.																Box 7, 19.5-23.5m	
	23.40m: Unweathered; dark greenish grey; bedded, gently inclined, thin; SILTSTONE; weak.							23.5										
	23.55m: Unweathered; dark greenish grey; massive; SANDSTONE; very weak.						-21											
	23.65m: Unweathered; dark greenish grey; , bedded, gently inclined, thinly laminated; SILTSTONE; weak.																Box 8, 23.5-24.0m	
	23.75m: Thin black organic layer *23.84 - 23.96m:* Thin to very thin interbedded layers of black organic material and siltstone					36/14 for 10mm **N>=50** Solid		24.0										
								24.5										
							-22											

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC pipe. Slotted 6.09-7.86m and packed with K2 sand.

Hole Depth 24.09m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH111P

SHEET: 1 OF 6

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921388.32 mN, 1756344.38 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM

CHECKED: MHU

START DATE: 19/07/2018

FINISH DATE: 23/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (FS, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	0.00m: Concrete							0										
	0.15m: GRAVEL, with minor silt and sand; greyish brown. Loosely packed; dry; Some brick fragments.							0.5										
	0.55m: Gravelly SILT, with minor clay; black mottled orange brown. Loosely packed; moist.			HVAC	100		2											
	1.00m: Clayey SILT, with minor gravel; black mottled orange brown. Moist; gravel, fine, brick fragments.							1.0										
	1.50m: No recovery				0		1	1.5										
	2.10m: BOULDERS, with some cobbles; dark reddish brown. Loosely packed; dry; boulders, subangular, up to 500mm.			OB	88		0	2.0							01/08/2018			
	3.00m: Core loss							2.5										
	3.55m: BOULDERS, with some cobbles; dark reddish brown. Loosely packed; dry; boulders, subangular, up to 500mm.			PQTT	63		-1	3.0							06/08/2018			
								3.5										
								4.0										
								4.5										
							-2											

COMMENTS: Hole was originally planned as CPT103 but because of basalt boulders at surface was changed to a borehole. Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC. Slotted 6.11-8.07m and packed with K2 sand.

Hole Depth 28.62m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH111P

SHEET: 2 OF 6

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921388.32 mN 1756344.38 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM

CHECKED: MHU

START DATE: 19/07/2018

FINISH DATE: 23/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)
Fill	[Cont'd]: BOULDERS, with some cobbles; dark reddish brown. Loosely packed; dry; boulders, subangular, up to 500mm.
	5.30m: Core Loss
	6.20m: Fine SAND; grey. Loose, moist.
Marine Sediments	6.45m: SILT with minor clay and fine sand, with trace shell fragments; grey. Very soft, wet, low plasticity.
	6.90m: SILT with minor clay; grey. Soft, wet, low plasticity.
	8.50m: Fine sandy SILT, with some shell fragments, with trace clay. Grey, Stiff, moist low plasticity.
Tauranga Group	8.70m: Silty CLAY; grey with mottled brown. Stiff, moist, high plasticity.
	9.45m: Core loss
	9.68m: Silty CLAY; grey with mottled brown. Stiff, moist, high plasticity.

Rock Weathering: UW, EW, HW, MW, HW, CW

Rock Strength: ES, VS, S, MS, M, W, VW, EW

Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)
PQTT	20			5.5
SPT	55	4/3 3/1 1/2 **N=7**	-3	6.0
PQTT	95	CPT103-6.45-6.60 @ 6.5m 0.5ppm		6.5
		CPT103-7.40-7.50 @ 7.4m	-4	7.0
		19/5 kPa In barrel		7.5
SPT	100	0/0 0/0 0/0 **N=0**	-5	
PQTT	100	DUP18 @ 8.4m CPT103 -8.4-8.7m @ 8.4m 0.4ppm		8.0
		CPT103-8.7-9m @ 8.7m 0.3ppm	-6	8.5
		66/35 kPa In barrel		9.0
SPT	100			9.5
			-7	

ROCK DEFECTS: Defect Log; Fracture Spacing (mm): 2000, 600, 200, 60, 20; RQD (%)

Description & Additional Observations

Fluid Loss (%): 25, 50, 75

Water Level

Casing

Installation: Box 1, 2.1-6.5m; Box 2, 6.5-9.0m

Core Box No

COMMENTS: Hole was originally planned as CPT103 but because of basalt boulders at surface was changed to a borehole. Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC. Slotted 6.11-8.07m and packed with K2 sand.

Hole Depth 28.62m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH111P

SHEET: 3 OF 6

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921388.32 mN 1756344.38 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: James

LOGGED BY: JASM

CHECKED: MHU

START DATE: 19/07/2018

FINISH DATE: 23/07/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log
Tauranga Group	10.20m: Clayey SILT; light grey. Stiff; high plasticity; moist; some orange staining.			PQTT	68	● 66/35 kPa In barrel			
				SPT	100	0/0 1/1 1/2 **N=5**	10.5	-8	
	10.95m: Core loss						11.0		
	11.17m: Clayey SILT; light grey. Stiff; high plasticity; moist; some orange staining.								
	11.30m: Clayey SILT, with trace sand; light greyish green. Stiff; high plasticity; moist; sand, fine. *11.40 - 11.45m:* Lense of black organic clay			PQTT	79		11.5		
				SPT	100	● 60/19 kPa In barrel 0/1 2/1 2/2 **N=7**	12.0	-9	
	12.80m: Sandy SILT, with minor clay; light greyish green. Firm; low plasticity; moist; sand, fine.			PQTT	100		12.5		
	13.00m: Silty SAND, with minor clay; light greyish green. Loose; low plasticity; moist; sand, fine.						13.0	-10	
				SPT	100	0/0 1/1 1/2 **N=5**	13.5		
	13.70m: Silty SAND, with minor clay; light greyish green. Loose; low plasticity; moist; sand, fine.						14.0	-11	
				PQTT	90		14.5		
								-12	

ROCK DEFECTS					Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations		(25, 50, 75)			Box 3, 9.0-11.8m Box 4, 11.8-14.3m	

COMMENTS: Hole was originally planned as CPT103 but because of basalt boulders at surface was changed to a borehole. Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC. Slotted 6.11-8.07m and packed with K2 sand.

Hole Depth 28.62m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH111P

SHEET: 4 OF 6

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921388.32 mN, 1756344.38 mE (NZTM2000)
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 19/07/2018
FINISH DATE: 23/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	15.00m: Core loss			SPT	55	0/1 0/1 1/2 **N=4**		15.5										
	15.20m: Silty SAND, with minor clay; light greyish green. Loose; low plasticity; moist; sand, fine.																	
	15.45m: Core loss			PQTT	70		-13	16.0										
	15.76m: Silty SAND, with minor clay; light greyish green. Loose; low plasticity; moist; sand, fine.																	
	16.00m: SAND, with some wood fragments and silt, with minor clay; greyish green. Loose; non-plastic; moist; sand, fine to coarse. *16.00 - 17.50m:* Moderately thin interbedded sand and fibrous black wood fragments up to 50mm thick			SPT	95	1/0 1/1 2/3 **N=7**	-14	16.5 17.0										Box 5, 14.3-17.1m
	17.50m: Clayey SILT, with trace amorphous organic material; light greyish green. Very stiff; high plasticity; moist.			PQTT	95		-15	17.5										
	18.10m: SAND, with some silt, with minor clay; greenish grey. Loose to medium dense; non-plastic; moist; sand, fine to medium.			SPT	88	2/2 2/3 3/4 **N=12**		18.0										
	18.20m: Sandy SILT, with minor clay, with trace amorphous organic material lenses and spots; greyish green. Medium dense to dense; low plasticity; moist; sand, fine.			PQTT	100		-16	18.5 19.0										
				SPT	100	2/3 5/6 8/9 **N=28**	-17	19.5										Box 6, 17.1-19.9m

COMMENTS: Hole was originally planned as CPT103 but because of basalt boulders at surface was changed to a borehole. Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC. Slotted 6.11-8.07m and packed with K2 sand.

Hole Depth 28.62m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH111P

SHEET: 5 OF 6

PROJECT: Orams Site 18	CO-ORDINATES: 5921388.32 mN, 1756344.38 mE (NZTM2000)	R.L. GROUND: 2.82m
JOB No.: 30881.2000_1000	DIRECTION: 0°	R.L. COLLAR:
LOCATION: Orams Site 18, Beaumont St, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: NZVD2016
		SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 19/07/2018
FINISH DATE: 23/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	20.00m: Sandy SILT, with minor clay, with trace amorphous organic material lenses and spots; greyish green. Medium dense to dense; low plasticity; moist; sand, fine.			PQTT	95		-18	20.5										
	21.00m: Core loss			SPT	66	2/3 4/5 7/8 **N=24**		21.0										
	21.15m: Silty SAND, with minor clay; greyish green. Medium dense; low plasticity; moist to wet; sand, fine.							21.5										
	22.00m: Sandy SILT, with minor clay, with trace amorphous organic material; greyish green. Stiff; low plasticity; moist; sand, fine.			PQTT	95		-19	22.0										Box 7, 19.9-22.5m
						● 69/25 kPa In barrel		22.5										
				SPT	100	3/4 5/7 8/9 **N=29**	-20											
	23.52 - 23.53m: Black fibrous wood fragment			PQTT	100			23.0										
							-21	23.5										
				SPT	77	2/3 4/5 5/5 **N=19**		24.0										
								24.5										
							-22											

COMMENTS: Hole was originally planned as CPT103 but because of basalt boulders at surface was changed to a borehole. Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC. Slotted 6.11-8.07m and packed with K2 sand.

Hole Depth 28.62m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH111P

SHEET: 6 OF 6

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921388.32 mN 1756344.38 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.82m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: JASM
CHECKED: MHU
START DATE: 19/07/2018
FINISH DATE: 23/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW CDW)	Rock Strength (FS VS S MS M W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000 600 200 60 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	25.25m: SAND, with some silt, with minor clay; dark greyish green. Tightly packed; non-plastic; moist; sand, fine to coarse.			PQTT	95			25.5										Box 8, 22.5-25.3m
East Coast Bays Formation	25.34m: Clayey SILT; greyish green. Very stiff to hard; high plasticity; moist.			SPT	100	8/12 19/31 for 70mm **N>=50**	-23											
	25.46m: Slightly weathered; dark greenish grey; , bedded, gently inclined, very thin; SILTSTONE; very weak.																	
	25.50m: Slightly weathered; dark greenish grey; massive; SANDSTONE; very weak.							26.0										
	25.65m: Slightly weathered; dark greenish grey; SILTSTONE with trace plastic peat; very weak.																	
	26.20m: Unweathered; dark greenish grey; massive; SANDSTONE; weak.			HQTT	91							91						
	26.40m: Unweathered; dark greenish grey; , bedded, gently inclined, thin; SILTSTONE with trace layers of amorphous peat; very weak.							26.5										
				SPT	0	32/18 for 20mm **N>=50** Solid	-24	27.0										
	27.20m: Unweathered; dark greenish grey; massive; SANDSTONE; weak.			HQTT	96			27.5										
	27.65m: Unweathered; dark greenish grey; , bedded, gently inclined, thin; SILTSTONE; very weak. *27.90 - 27.95m:* SANDSTONE.						-25	28.0				96						Box 9, 25.3-28.3m
	28.30m: Unweathered; dark greenish grey; massive; SANDSTONE; weak.			SPT	0	29/21 for 45mm **N>=50** Solid		28.5										Box 10, 28.3-28.5m
							-26	29.0										
								29.5										
							-27											

COMMENTS: Hole was originally planned as CPT103 but because of basalt boulders at surface was changed to a borehole. Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted. Standpipe piezometer installed. 50mm PVC. Slotted 6.11-8.07m and packed with K2 sand.

Hole Depth 28.62m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH301

SHEET: 1 OF 4

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921407.91 mN 1756336.26 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -6.58m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 27/07/2018
FINISH DATE: 30/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Depth (m)	RL (m)
Marine Sediments	0.00m: Core loss		
	0.30m: SILT, with minor clay, sand, shell fragments and amorphous organic material; dark greenish grey. Very soft to soft; low plasticity; wet; sand, fine.	0.5	-7
Tauranga Group	0.75m: Clayey SILT, with trace amorphous organic material (black and orange colour); light greenish grey. Firm to stiff; high plasticity; moist.	1.0	
	1.25m: SILT, with minor clay and amorphous organic material, with trace sand; light greenish grey. Stiff; low plasticity; moist; sand, fine.	1.5	-8
	2.55m: Clayey SILT with trace amorphous organic material; light greenish grey. Very stiff; high plasticity; moist.	2.5	-9
	3.00m: SILT, with some clay and amorphous organic material; dark brown. Firm; low plasticity; moist.	3.0	
	3.35m: Sandy SILT, with minor clay, with trace amorphous organic material; light greenish gey. Very stiff; low plasticity; moist; sand, fine.	3.5	-10
	3.75m: Core loss	4.0	
		4.5	-11

Sampling Method	Core Recovery (%)	Testing
OB	87	GBH301-.3-.4m @ 0.3m 0ppm GBH301-.5-.6m @ 0.5m 0ppm GBH301-.6-.7m @ 0.6m 0.6ppm GBH301 -.85-1.05m @ 0.9m 0ppm GBH301-1.45 @ 1.3m 1.8ppm ● 79/22 kPa In barrel
HQTT	87	GBH301-2.25-2.45m @ 2.3m 1.1ppm ● 132/50 kPa In barrel GBH301 -3.1-3.3m @ 3.1m 0.7ppm
HQTT	48	GBH301-4.5-5m @ 4.5m 0.6ppm

ROCK DEFECTS: Defect Log; Fracture Spacing (mm) (2000, 600, 200, 60, 20); RQD (%)

Description & Additional Observations

Fluid Loss (%) (25, 50, 75); Water Level; Casing; Installation; Core Box No

Box 1, 0.0-2.8m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 19.33m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH301

SHEET: 2 OF 4

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921407.91 mN, 1756336.26 mE (NZTM2000)
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -6.58m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 27/07/2018
FINISH DATE: 30/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	[Cont'd]: Core loss			HQTT	26		-12	5.5										
	5.6m: SAND, with some silt, with minor clay; greenish grey. Loose to medium dense; non-plastic; wet to saturated; uniformly graded; sand, fine to medium.			SPT	88	GBH301-5.6-6m @ 5.6m 0.6ppm; 1/2 1/2 2/6 **N=11**		6.0										
	6.45m: Core loss			HQTT	53	GBH301-6.45-6.85m @ 6.5m 0.2ppm	-13	6.5										
	6.94m: SAND, with some silt, with minor clay; greenish grey. Loosely packed; non-plastic; wet to saturated; uniformly graded; sand, fine to medium.							7.0										
	7.40m: Clayey SILT with trace organic material; light greenish grey. Very stiff; high plasticity; moist; uniformly graded. *7.40 - 7.50m:* Wood fragment			SPT	100	1/2 2/2 2/3 **N=9**	-14	7.5										Box 2, 2.8-8.0m
				HQTT	100		-15	8.0										
	8.90m: SILT, with some sand, with minor clay; light greenish grey. Stiff; low plasticity; moist; well graded; sand, fine.			SPT	100	1/2 3/3 4/4 **N=14**		8.5										
							-16	9.0										
								9.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 19.33m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH301

SHEET: 3 OF 4

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921407.91 mN, 1756336.26 mE (NZTM2000)
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -6.58m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 27/07/2018
FINISH DATE: 30/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	10.00m: Sandy SILT, with minor clay; light greenish grey. Stiff; low plasticity; moist; sand, fine.			HQTT	95		-17	10.5										Box 3, 8.0-10.6m
	10.60m: Core loss			SPT	55	4/4 5/8 10/11 **N=34**												
	10.80m: Silty SAND, with trace clay; light greenish grey. Medium dense to dense; non-plastic; moist; sand, fine to medium.							11.0										
	11.05m: Core Loss			HQTT	0		-18	11.5										
	12.00m: Silty SAND, with minor clay and gravel; light greenish grey. Medium dense; non-plastic; moist; sand, fine to coarse; gravel, fine, subrounded to rounded.			SPT	44	2/2 4/5 7/8 **N=24**		12.0										
	12.60m: Sandy SILT, with minor clay and wood fragments; light greenish grey. Stiff; low plasticity; moist; sand, fine.			HQTT	72		-19	12.5										
	13.00m: Core loss			SPT	0	13/11 10/10 6/6 **N=32** Solid		13.0										
East Coast Bays Formation	13.45m: Slightly weathered; greenish grey; SILTSTONE; very weak.			HQTT	22		-20	13.5										
	13.55m: Core loss																	
	13.90m: Slightly weathered; dark greenish grey; SILTSTONE; very weak.			SPT	18	5/8 9/11 16/14 for 60mm **N>=50** Solid		14.0										
	13.98m: Core loss						-21	14.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 19.33m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH301

SHEET: 4 OF 4

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921407.91 mN 1756336.26 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -6.58m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 27/07/2018
FINISH DATE: 30/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, SW, DW)	Rock Strength (ES, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	15.20m: Slightly weathered; greenish grey; SILTSTONE; very weak. 15.26m: Core loss			HQTT SPT	0 100	37/13 for 10mm **N>=50** Solid	-22	15.5										
	16.50m: Unweathered; dark greenish grey; , bedded, gently inclined, thin; SILTSTONE; very weak. 16.56m: Core loss			HQTT SPT	0 46	22/28 for 60mm **N>=50** Solid	-23	16.0 16.5										
	17.70m: Unweathered; dark greenish grey; , bedded, gently inclined, thin; SILTSTONE; very weak. 18.05m: Unweathered; dark greenish grey; massive; SANDSTONE; very weak.			HQTT	0 100		-24	17.0 17.5				100	18.10 - 19.10m: J, 80° dip, T, no infill					Box 4, 10.6-18.0m Box 5, 18.0-19.2m
				SPT	0	29/21 for 55mm **N>=50** Solid	-25 -26	18.0 18.5 19.0 19.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 19.33m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH302

SHEET: 1 OF 5

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921367.32 mN, 1756320.89 mE (NZTM2000)
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -5.88m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 26/07/2018
FINISH DATE: 27/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Marine Sediments	0.00m: Core loss			OB	66	GBH302-0 -1m @ 0.0m 0.3ppm	-6	0.5										
	0.50m: SILT, with some sand, with minor clay; dark grey. Very soft; non-plastic; saturated; sand, fine.							1.0										
Tauranga Group	1.05m: SILT, with minor clay and fibrous organic material, with trace sand; light grey. Soft; low plasticity; moist; sand, fine.					GBH302-1.05-1.2m @ 1.1m 1.9ppm	-7											
						● 15/- kPa In barrel		1.5										
	1.55m: SILT, with minor clay, with trace sand and amorphous organic material; greenish grey. Soft; low plasticity; moist; sand, fine. *1.80 - 1.95m:* Sandy SILT, with minor clay; greenish grey. Soft; low plasticity; moist; sand, fine.			SPT	100	0/0 0/0 0/0 **N=0**												
	1.95m: Core loss			HQTT	0		-8	2.0										
								2.5										
	3.00m: SILT, with minor clay, with trace sand and amorphous organic material; greenish grey. Soft; low plasticity; moist; sand, fine.			SPT	100	1/0 1/0 1/0 **N=2**	-9	3.0										
	3.45m: SILT, with some clay, with minor amorphous organic material specks, with trace sand; greenish grey. Very soft to soft; low plasticity; moist to wet; sand, fine.			HQTT	95	GBH302-3.65-4.2m @ 3.7m 0.6ppm		3.5										
						● 12/1 kPa In barrel	-10	4.0										
	4.50m: Core loss							4.5										Box 1, 0.0-4.5m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 20.12m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH302

SHEET: 2 OF 5

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921367.32 mN 1756320.89 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -5.88m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 26/07/2018
FINISH DATE: 27/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	6.00m: SILT, with some clay, with trace sand and amorphous organic material spots; greenish grey. Soft to firm; low plasticity; moist; sand, fine.			HQTT	0		-11	5.5										
				SPT	100	1/1 1/1 1/0 **N=3**	-12	6.0										
				HQTT	90	GBH302-6.45-6.95m @ 6.5m 0.4ppm		6.5										
	7.40m: Sandy SILT, with minor clay; greenish grey. Firm; low plasticity; moist; sand, fine.						-13	7.0										
	7.65m: Silty SAND, with minor clay; greenish grey. Medium dense; non-plastic; moist; sand, fine to medium.			SPT	88	40/4 kPa In barrel 2/3 4/6 8/8 **N=26**		7.5										
	7.95m: Core loss							8.0										
	8.25m: Sandy SILT, with minor clay, with trace amorphous organic material; greenish grey. Firm; low plasticity; moist; sand, fine.			HQTT	71		-14	8.5										
	8.40m: Silty SAND, with some wood fragments, with minor clay; dark greenish grey. Medium dense; non-plastic; moist; sand, fine to medium.																	
	8.60m: Sandy SILT, with minor clay, trace amorphous organic material; greenish grey. Stiff; low plasticity; moist; sand, fine.					66/9 kPa In barrel												
	9.00m: Silty SAND, with minor clay; greenish grey. Loose; non-plastic; moist; sand, fine.			SPT	100	2/3 2/2 3/3 **N=10**	-15	9.0										Box 2, 4.5-9.4m
	9.35m: Clayey SILT, with trace sand; greenish grey. Stiff; high plasticity; moist; sand, fine.							9.5										
	9.45m: SAND, with some silt, with minor clay; dark greenish grey. Loosely packed; non-plastic; moist; sand, fine.																	

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 20.12m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH302

SHEET: 3 OF 5

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921367.32 mN 1756320.89 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -5.88m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 26/07/2018
FINISH DATE: 27/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	10.10m: Sandy SILT, with minor clay; greenish grey. Stiff; low plasticity; moist; sand, fine.			HQTT	95		-16	10.5										
	10.50m: Silty SAND, with minor clay; dark greenish grey. Medium dense; non-plastic; moist; sand, fine to medium.			SPT	100	2/2 3/2 4/4 N=13												
	10.60m: Clayey SILT, with trace fibrous organic material; light greenish grey. Stiff to very stiff; high plasticity; moist.																	
	10.95m: Core loss			HQTT	38		-17	11.0										
	11.60m: Silty SAND, with minor clay; dark greenish grey. Tightly packed; non-plastic; moist; sand, fine.							11.5										
	11.70m: Clayey SILT; light greenish grey. Stiff; high plasticity; moist.																	
	11.90m: SAND, with some silt, with minor clay; greenish grey. Medium dense; non-plastic; moist; sand, fine to medium.			SPT	88	3/4 5/6 8/8 N=27	-18	12.0										
	12.45m: Core loss			HQTT	38		-19	12.5										
	13.60m: SAND, with some silt, with minor clay; greenish grey. Tightly packed; non-plastic; moist; sand, fine to medium.							13.0										
	13.75m: Sandy SILT, with minor clay; greenish grey. Tightly packed; low plasticity; moist; sand, fine.							13.5										
	14.45m: Silty SAND, with minor clay; greenish grey. Dense; non-plastic; moist; sand, fine to coarse.			SPT	100	2/2 4/6 8/13 N=31	-20	14.0										Box 3, 9.4-14.0m
	14.45m: Core loss							14.5										
	14.85m: Sandy SILT, with minor clay; greenish grey. Tightly packed; low plasticity; moist to wet; sand, fine																	

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 20.12m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH302

SHEET: 4 OF 5

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921367.32 mN 1756320.89 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -5.88m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 26/07/2018
FINISH DATE: 27/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	15.10m: SILT, with some clay; greenish grey. Very stiff to hard; low plasticity; moist.			HQTT	61		-21											
East Coast Bays Formation	15.40m: Slightly weathered; dark grey; SANDSTONE; weak. 15.50m: Core loss			SPT	0	21/29 for 30mm **N>=50** Solid		15.5											
				HQTT	7		-22	16.0				7						
								16.5										
	16.90m: Slightly weathered; dark grey; SANDSTONE; very weak. 17.00m: No recovery			SPT	0	23/27 for 55mm **N>=50** Solid		17.0										
	17.13m: Slightly weathered; dark greenish grey; , bedded, gently inclined; SILTSTONE; very weak. *17.15 - 17.16m:* Amorphous black organic layer. Freshly scraped has reddish brown colour [Cont'd]: Core loss			HQTT	14		-23	17.5				14						
								18.0										
	17.43m: Core loss			SPT	0	14/36 for 35mm **N>=50** Solid		18.5										
	18.60m: Slightly weathered; greenish grey; SILTSTONE; very weak.			HQTT	100							100						
	18.78m: Core loss			HQTT	6		-24	19.0				6						Box 4, 14.0-20.0m
							-25	19.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 20.12m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: GBH302

SHEET: 5 OF 5

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921367.32 mN, 1756320.89 mE (NZTM2000)
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -5.88m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 26/07/2018
FINISH DATE: 27/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW, CW)	Rock Strength (FS, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
				SPT	0	15/35 for 40mm **N>=50** Solid	-26	20.5										
							-27	21.0										
								21.5										
							-28	22.0										
								22.5										
							-29	23.0										
								23.5										
							-30	24.0										
								24.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 20.12m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH303

SHEET: 1 OF 4

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921350.95 mN 1756243.99 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -7.58m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 31/07/2018
FINISH DATE: 31/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation
Marine Sediments	0.00m: Core loss
	0.33m: Clayey SILT, with trace sand; dark green. Very soft to soft; low plasticity; saturated; uniformly graded; sand, fine.
Tauranga Group	1.30m: Clayey SILT; light greenish grey. Stiff; high plasticity; moist; uniformly graded. *1.30 - 1.40m:* Two 30mm thick lenses of soft dark green mineral [chlorite]
	1.75m: Clayey SILT, with trace amorphous organic material; light brown. Stiff; high plasticity; moist; uniformly graded.
	2.60m: Clayey SILT, with minor amorphous organic material specks; light brown. Very stiff; high plasticity; moist; uniformly graded. *4.25 - 4.28m:* wood fragment
	4.20m: SILT, with minor clay and organic material; brownish green. Very stiff; low plasticity; moist; uniformly graded.

Rock Weathering: UW, EW, HW, MW, HW, CW
Rock Strength: ES, VS, S, MS, M, W, VW, EW
Sampling Method: OB
Core Recovery (%): 79, 100, 100
Testing: GBH303-.2-.4m @ 0.2m 0.9ppm; GBH303-.6-.8m @ 0.6m 1.3ppm; GBH303-1-1.2m @ 1.0m 1ppm; GBH303-1.3-1.5m @ 1.3m 0.1ppm; 76/25 kPa In barrel; GBH303-1.85-2.1m @ 1.9m 0.4ppm; 73/22 kPa In barrel; GBH303-3-3.2m @ 3.0m 1.5ppm; 132/28 kPa In barrel; GBH303-4.2-4.4m @ 4.2m 1.4ppm
RL (m): -8, -9, -10, -11, -12
Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5
Graphic Log
ROCK DEFECTS: Defect Log; Fracture Spacing (mm): 2000, 600, 200, 60, 20; RQD (%)
Description & Additional Observations
Fluid Loss (%): 25, 50, 75
Water Level
Casing
Installation
Core Box No: Box 1, 0.0-2.3m; Box 2, 2.3-4.5m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 18.14m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH303

SHEET: 2 OF 4

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921350.95 mN 1756243.99 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -7.58m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 31/07/2018
FINISH DATE: 31/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	5.10m: SILT, with some clay; light brownish green. Very stiff; low plasticity; moist; uniformly graded.			OB	100	GBH303 -5.3- 5.5m @ 5.3m 0.8ppm; 173/38 kPa In barrel	-13	5.5										
	5.50m: Core loss																	
	5.67m: SILT, with minor clay; brownish green. Very stiff; low plasticity; moist; uniformly graded. *6.00 - 6.03m:* Silty SAND, with minor clay; green. Low plasticity; well graded; sand, fine.			OB	88	GBH303 -6.6- 6.8m @ 6.6m 1.6ppm; >221 kPa In barrel	-14	6.0 6.5										Box 3, 4.5-7.0m
	7.00m: SILT, with some sand, with minor clay; brownish green. Stiff to very stiff; low plasticity; moist; sand, fine.			SPT	88	4/4 5/6 7/10 **N=28**	-15	7.0										
	7.45m: Core loss			HQTT	35			7.5										
	8.00m: SILT, with some sand, with minor clay; brownish green. Stiff to very stiff; low plasticity; moist; sand, fine.			SPT	91	4/4 4/4 4/5 **N=17**	-16	8.0 8.5										
	9.00m: SILT, with some clay, minor amorphous organic material; brownish green. Stiff to very stiff; low plasticity; moist; uniformly graded.			HQTT	91		-17	9.0										
	9.20m: SILT, with minor clay and sand, with trace amorphous organic material; brownish green. Stiff; low plasticity; moist; uniformly graded; sand, fine.							9.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 18.14m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH303

SHEET: 3 OF 4

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921350.95 mN 1756243.99 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -7.58m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 31/07/2018
FINISH DATE: 31/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	[Cont'd]: SILT, with minor clay and sand, with trace amorphous organic material; brownish green. Stiff; low plasticity; moist; uniformly graded; sand, fine.			SPT	100	2/2 2/3 2/3 **N=10**	-18	10.5										
	10.50m: SILT, with minor clay, with trace sand and amorphous organic material; brownish green. Stiff to very stiff; low plasticity; moist; uniformly graded; sand, fine.			HQTT	92			11.0										Box 4, 7.0-10.6m
	11.00m: SILT, with minor clay and sand, with trace amorphous organic material; brownish green. Stiff to very stiff; moist; uniformly graded; sand, fine; moderate plasticity.						-19											
	11.45m: SILT, with some clay; brownish green. Stiff; moist; moderate plasticity.			SPT	100	2/2 3/3 3/4 **N=13**		11.5										
	11.95m: Core loss			HQTT	60			12.0										
	12.17m: SILT, with some clay; brownish green. Stiff; moist; moderate plasticity.						-20											
	12.45m: SAND, with some silt and gravel, with minor clay; greyish green. Medium dense; non-plastic; wet; well graded; sand, fine to coarse; gravel, fine, subrounded to rounded.							12.5										
	12.50m: Core loss																	
	12.80m: SAND, with some silt and gravel, with minor clay; greyish green. Medium dense; non-plastic; wet; well graded; sand, fine to coarse; gravel, fine, subrounded to rounded. *13.25 - 13.35m:* Black wood fragment			HQTT	62			13.0										
East Coast Bays Formation	13.60m: Slightly weathered; dark greenish grey; SILTSTONE; very weak.						-21	13.5										
	13.80m: Core loss			HQTT	36			14.0										
	14.80m: Slightly weathered; dark greenish grey; SILTSTONE; very weak.			SPT	100	12/38 for 40mm	-22	14.5										Box 5, 10.6-14.8m

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 18.14m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH303

SHEET: 4 OF 4

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921350.95 mN 1756243.99 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -7.58m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 31/07/2018
FINISH DATE: 31/07/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, SW, DW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	15.10m: Unweathered; greyish white; SILTSTONE; very strong.			HQTT	62	N>=50	-23	15.5										
	15.20m: Unweathered; dark greenish grey; SILTSTONE; very weak. Rhyolite ash layer?																	
	15.30m: Unweathered; dark greenish grey; massive; SANDSTONE; very weak.																	
	15.40m: Unweathered; dark greenish grey; SILTSTONE with trace amorphous peat; very weak.																	
	15.65m: Unweathered; dark greenish grey; SANDSTONE; very weak.			HQTT	95			16.0										
	15.80m: Unweathered; dark greenish grey; , bedded, gently inclined, very thin; SILTSTONE; very weak.																	
	15.85m: Unweathered; dark greenish grey; massive; SANDSTONE; very weak. *15.85 - 15.90m:* Very thin interbedded organic layers. Gently inclined			SPT	0	28/22 for 35mm N>=50 Solid	-24	16.5										
	16.90m: Unweathered; dark greenish grey; , bedded, gently inclined, thin; SILTSTONE; very weak.			HQTT	96			17.0										
	17.30m: Unweathered; dark greenish grey; massive; SANDSTONE; very weak.						-25	17.5										
				SPT	0	26/24 for 60mm N>=50 Solid		18.0										Box 6, 14.8-18.0m
							-26	18.5										
								19.0										
							-27	19.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 18.14m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH304

SHEET: 1 OF 5

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: 5921332.82 mN, 1756299.60 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: -3.68m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Handheld GPS

DRILLED BY: Lance

LOGGED BY: JASM

CHECKED: MHU

START DATE: 31/07/2018

FINISH DATE: 01/08/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Marine Sediments	0.00m: Core loss																	
	0.35m: Clayey SILT, with minor shells, with trace sand; greyish green. Very soft; low plasticity; wet; uniformly graded; sand, fine.			OB	79	GBH304 -.35-.55 m @ 0.4m 0.1ppm GBH304-.6-.8m @ 0.6m 0.1ppm GBH304-1 -1.2m @ 1.0m 0.1ppm GBH304 -1.5-1.7m @ 1.5m 0.1ppm 11/1 kPa In barrel	-4 -5	0.5 1.0 1.5									
	1.90m: Clayey SILT, with minor shells, with trace sand; light brownish green. Soft; low plasticity; wet; uniformly graded; sand, fine.																	
Tauranga Group	2.45m: Clayey SILT, with minor amorphous organic material; light grey. Soft; low plasticity; moist; uniformly graded.			OB	92	GBH304-2.45-2.65m @ 2.5m 0.1ppm	-6	2.0 2.5										Box 1, 0.0-2.7m
	2.85m: Clayey SILT, with minor organic material; light grey, with some orange staining. Firm; high plasticity; moist; uniformly graded.					38/6 kPa In barrel	-7	3.0										
	3.50m: Silty SAND, with some wood fragments and amorphous organic material, with minor clay; greenish grey. Loose to medium dense; low plasticity; moist; well graded; sand, fine to medium.			OB	100	GBH304 -3.5-3.7ppm @ 3.5m 0.1ppm		3.5 4.0										
	4.25m: SILT, with some sand, wood fragments and fibrous peat, with trace clay; greenish. Firm to stiff; low plasticity; moist; gap graded; sand, fine to medium.						-8											
	4.50m: Clayey SILT; light greyish green. Stiff; moist; uniformly graded; moderate plasticity.					GBH304 -4.5-4.7m @ 4.5m 0.1ppm		4.5										Box 2, 2.7-4.8m
	4.70m: Clayey SILT, with minor wood fragments; light greyish green. Very stiff; moist; uniformly graded; moderate plasticity.					142/44 kPa In barrel												

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 24.58m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH304

SHEET: 2 OF 5

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921332.82 mN 1756299.60 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -3.68m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 31/07/2018
FINISH DATE: 01/08/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, SW, DW)	Rock Strength (FS, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*4.25 - 4.30m:* Silty SAND, with minor clay. Loose to medium dense; low plasticity; moist; sand, fine to medium. *4.45 - 4.50m:* Silty SAND, with minor clay. Loose to medium dense; low plasticity; moist; sand, fine to medium; some fibrous peat and wood fragments. *5.60 - 5.64m:* Stiff lense			OB	100	GBH304 -5.4- 5.9m @ 5.4m 0.5ppm	-9	5.5										
				SPT	100	2/2 3/4 5/5 N=17	-10	6.0										
	6.45m: Core loss							6.5										
	6.70m: Clayey SILT, with minor wood fragments; light greyish green. Very stiff; moist; uniformly graded; moderate plasticity. 6.80m: SILT, with some clay, with minor sand and fibrous peat; greenish brown. Very stiff; low plasticity; moist; uniformly graded; sand, fine.			HQTT	76	GBH304 -6.9- 7.3m @ 6.9m 0.5ppm	-11	7.0										Box 3, 4.8-7.3m
						● 145/28 kPa In barrel		7.5										
	7.50m: Core loss							8.0										
	8.50m: Clayey SILT, with minor sand and fibrous peat; greenish brown. Firm to stiff; high plasticity; moist; uniformly graded; sand, fine. 8.65m: SILT, with some clay and fibrous peat; brown. Stiff to very stiff; moist; uniformly graded.			HQTT	37		-12	8.5										
						● 126/25 kPa In barrel		9.0										
	9.40m: Sandy SILT, with minor clay and wood fragments; greenish brown. Medium dense; non-plastic; moist; sand, fine to medium.						-13	9.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 24.58m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH304

SHEET: 3 OF 5

Tonkin+Taylor

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921332.82 mN 1756299.60 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -3.68m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 31/07/2018
FINISH DATE: 01/08/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	9.75m [Cont'd]: SILT, with minor clay, with trace sand and amorphous peat; light greenish grey. Stiff to very stiff; moist; uniformly graded; sand, fine; moderate plasticity.			HQTT	93	GBH9.9 5-10.25m @ 10.0m 0.9ppm 208/50 kPa In barrel	-14	10.5										
				HQTT	97	110/19 kPa In barrel	-15	11.0										Box 4, 7.3-10.9m
				SPT	100	1/2 2/2 2/3 N=9	-16	11.5										
				HQTT	100		-17	12.0										
	13.50m: Core loss			SPT	55	1/2 2/4 4/4 N=14		12.5										Box 5, 10.9-13.5m
	13.75m: SILT, with minor clay, with trace sand and amorphous peat; light greenish grey. Stiff to very stiff; moist; uniformly graded; sand, fine; moderate plasticity.						-18	13.0										
	13.95m: Core loss							13.5										
	14.15m: SILT, with minor clay, with trace sand and amorphous peat; light greenish grey. Stiff to very stiff; moist; uniformly graded; sand, fine; moderate plasticity.							14.0										
	14.70m: SILT, with some sand, with minor clay, with trace fibrous peat; light greenish grey. Stiff; low plasticity; moist; uniformly graded; sand, fine.							14.5										

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 24.58m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: GBH304

SHEET: 4 OF 5

Tonkin+Taylor

PROJECT: Orams Site 18

JOB No.: 30881.2000_1000

LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921332.82 mN 1756299.60 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: -3.68m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Handheld GPS

DRILLED BY: Lance

LOGGED BY: JASM

CHECKED: MHU

START DATE: 31/07/2018

FINISH DATE: 01/08/2018

CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	[Cont'd]: SILT, with some sand, with minor clay, with trace fibrous peat; light greenish grey. Stiff; low plasticity; moist; uniformly graded; sand, fine.			HQTT	82													
	15.30m: Sandy SILT, with minor clay and fibrous peat; greenish grey. Firm to stiff; low plasticity; moist; sand, fine.			SPT	100	2/3 2/3 4/4 **N=13**	-19	15.5										
	15.55m: Core loss																	
	16.05m: Sandy SILT, with minor clay and fibrous peat; greenish grey. Firm to stiff; low plasticity; moist; sand, fine.			HQTT	52		-20	16.0 16.5										
	16.60m: SAND, with some silt, with minor clay and shell fragments, with trace gravel; dark greenish grey. Dense; non-plastic; wet; sand, fine to coarse; gravel, fine.			SPT	88	3/5 7/10 11/14 **N=42**		17.0										
	17.05m: Core loss																	
	17.25m: SAND, with some silt, with minor clay and shell fragments, with trace gravel; dark greenish grey. Dense; non-plastic; wet; sand, fine to coarse; gravel, fine.			HQTT	82		-21	17.5										Box 6, 13.5-17.7m
	17.70m: Clayey SILT, with trace amorphous peat spots; light greyish green. Very stiff to hard; high plasticity; moist; uniformly graded.							18.0										
	18.20m: Core loss			SPT	11	5/7 7/8 10/14 **N=39**	-22	18.5										
Tauranga Group	18.60m: Silty SAND, with minor clay, gravel, amorphous peat and shell fragments; green. Loose; low plasticity; moist; sand, fine to coarse; gravel, fine.			HQTT	6													
	18.65m: Core loss						-23	19.0 19.5										
				SPT	0	15/35 for 30mm **N>=50** Solid												

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 24.58m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: GBH304

SHEET: 5 OF 5

PROJECT: Orams Site 18
JOB No.: 30881.2000_1000
LOCATION: Orams Site 18, Beaumont St, Auckland

CO-ORDINATES: (NZTM2000) 5921332.82 mN 1756299.60 mE
DIRECTION: 0°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: -3.68m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Handheld GPS

DRILLED BY: Lance
LOGGED BY: JASM
CHECKED: MHU
START DATE: 31/07/2018
FINISH DATE: 01/08/2018
CONTRACTOR: DCN

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	[Cont'd]: Core loss			HQTT	13		-24	20.5										
East Coast Bays Formation	20.85m: Unweathered; light greenish grey; SILTSTONE; very strong. 21.00m: Unweathered; greenish grey; massive; SILTSTONE with trace amorphous peat; weak.			HQTT	82		-25	21.0 21.5										
	21.65m: Unweathered; dark greenish grey; , cross-bedded, moderately inclined, very thin; SANDSTONE; weak. 21.90m: Unweathered; greenish grey; massive; SILTSTONE with trace amorphous peat; weak. 22.25m: Unweathered; dark greenish grey; massive; SANDSTONE with trace amorphous peat; weak.							22.0										
	22.40m: Core loss			SPT	0	50 for 60mm **N>=50** Solid	-26	22.5										Box 7, 17.7-22.9m
	22.70m: Unweathered; dark greenish grey; massive; SANDSTONE with trace amorphous peat; weak.			HQTT	81			23.0										
	23.10m: Unweathered; dark greenish grey; massive; SILTSTONE; very weak. 23.36m: Core loss						-27	23.5										
	23.50m: Unweathered; dark greenish grey; massive; SILTSTONE; very weak. *24.10 - 24.20m:* Brown staining bands with irregular shape			SPT HQTT	0 83	22/28 for 25mm **N>=50** Solid 50 for 75mm **N>=50** Solid	-28	24.0 24.5										Box 8, 22.9-24.5m
	24.35m: Core loss			SPT	0													

COMMENTS: Peak and remoulded shear strength measured using shear vane SV111. Presented shear vane values have been corrected. All shear vane measurements taken from within core barrel unless over-wise indicted.

Hole Depth 24.58m

Scale 1:25

Rev.: A

General Log - 24/08/2018 5:09:37 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: CBH201

SHEET: 1 OF 2

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921385.35 mN, 1756398.32 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.05m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 06/07/2018

FINISH DATE: 06/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Depth (m)
Fill	0.00m: Asphalt.	0
	0.04m: Silty GRAVEL with minor sand; brown. Moist; gravel, fine to coarse.	
	0.30m: HDPE Plastic.	0.3
	0.35m: Silty GRAVEL with minor sand; brown. Moist; gravel, fine.	
	0.70m: Silty GRAVEL; brown. Wet; gravel, fine to coarse.	0.7
	1.10m: Clayey SILT with trace gravel; grey mottled brownish orange. Firm, moist. Hydrocarbon odour.	1.1
	1.50m: Silty SAND some shells; grey. Moist; sand fine. Slight hydrocarbon odour.	1.5
	1.80m: Strong hydrocarbon odour.	1.8
	2.00m: Silty GRAVEL with minor sand; brown. Saturated. Hydrocarbon odour.	2.0
	2.10m: SAND with minor gravel and shells; grey mottled black. Wet. Strong hydrocarbon odour.	2.1
	3.00 - 3.60m: Saturated, intermittent fine sand layers.	3.0
	3.60 - 3.65m: Sandy SILT; grey. Soft, moist.	3.6
	3.65m: SAND with minor gravel and shells; grey mottled black. Wet. Hydrocarbon odour.	3.65
	4.00m: Sandy SILT, minor shells; grey. Soft, wet. Hydrocarbon odour.	4.0
	4.50m: Silty SAND, minor shells. Firm, wet.	4.5

Rock Weathering: UW, EW, HW, MW, HW, CW

Rock Strength: ES, VS, S, MS, M, W, VW, EW

Sampling Method: SNC

Core Recovery (%)

Testing / RL (m):

- CBH201 0.05-0.3 @ 0.1m — RL 3
- CBH201 0.7-1.0 @ 0.7m — RL 2
- CBH201 1.1-1.3 @ 1.1m
- CBH201 1.5-1.7 @ 1.5m — RL 1
- CBH201 1.8-2.0 @ 1.8m
- CBH201 2.0-2.1 @ 2.0m
- DUP10 CBH201 2.1-2.6 @ 2.1m — RL 0
- CBH201 3.0-3.3 @ 3.0m
- CBH201 3.65-3.8 @ 3.7m — RL -1
- CBH201 4.0-4.2 @ 4.0m
- CBH201 4.5-4.8 @ 4.5m

Graphic Log

ROCK DEFECTS: Defect Log; Fracture Spacing (mm): 2000, 600, 200, 60, 20; RQD (%)

Description & Additional Observations:

- *0.05 - 0.30m:* PID = 0.7 ppm.
- *0.30 - 0.70m:* PID = 1.1 ppm.
- *0.70 - 1.00m:* PID = 1.2 ppm.
- *1.10 - 1.30m:* PID = 5.5 ppm.
- *1.50 - 1.70m:* PID = 422.9 ppm.
- *1.80 - 2.00m:* PID = 306.6 ppm.
- *2.00 - 2.10m:* PID = 86.0 ppm.
- *2.10 - 2.60m:* PID = 799.1 ppm.
- *3.00 - 3.30m:* PID = 242.0 ppm.
- *3.65 - 3.80m:* PID = 37.1 ppm.
- *4.00 - 4.20m:* PID = 10.4 ppm.
- *4.50 - 4.80m:* PID = 54.3 ppm.

Fluid Loss (%): 25, 50, 75

Water Level: 25/07/2018

Casing

Installation

Core Box No

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.00-4.50 m BGL and packed with K2 sand. SWL 1.95 m BGL 25/07/2018 1100.

Hole Depth 6m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:29 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH201

SHEET: 2 OF 2

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: (NZTM2000) 5921385.35 mN 1756398.32 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.05m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 06/07/2018

FINISH DATE: 06/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	5.00m: Clayey SILT; grey. Firm, wet, faint hydrocarbon odour. 5.20m: Silty SAND; grey. Firm, wet, hydrocarbon odour.			SNC		CBH201 5.0-5.2 @ 5.0m CBH201 5.2-5.5 @ 5.2m	-2 -3 -4 -5 -6	5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5					*5.00 - 5.20m:* PID = 9.9 ppm. *5.20 - 5.50m:* PID = 3.9 ppm.					
	6m: END OF BOREHOLE																	

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.00-4.50 m BGL and packed with K2 sand. SWL 1.95 m BGL 25/07/2018 1100.

Hole Depth 6m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH202

SHEET: 1 OF 2

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: (NZTM2000) 5921383.85 mN 1756351.75 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.84m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 29/06/2018

FINISH DATE: 04/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation
Fill	0.00m: Concrete.
	0.20m: GRAVEL, with minor silt and sand; brown. Hard; gravel, fine to coarse.
	0.50m: Silty GRAVEL, with some sand; dark brown. "Loosely packed", moist; gravel, fine to medium.
	1.00m: GRAVEL, with minor silt; brown. "Tightly packed", wet; gravel, fine to coarse.
	1.10m: Coreloss.
	3.70m: Gravelly SILT, with trace clay; black. Moist; Strong hydrocarbon odour.
	4.10m: SILT, with trace clay and sand; brownish orange with grey mottling. Firm, moist. Hydrocarbon odour.
	4.40m: SAND, with trace silt; grey. Soft, moist. Strong hydrocarbon odour.

Rock Weathering: UW, EW, HW, MW, HW, CW

Rock Strength: ES, VS, S, MS, M, W, VW, EW

Sampling Method: HVAC; SNC

Core Recovery (%)

Testing:
- CBH202 0.5 @ 0.5m
- CBH202 1.0 @ 1.0m
- CBH202 3.7 - 3.9 @ 3.7m
- CBH202 4.1-4.3 @ 4.1m
- CBH202 4.4-4.5 @ 4.4m

RL (m) / Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5; RL: 2, 1, 0, -1, -2

Graphic Log

ROCK DEFECTS

Defect Log

Fracture Spacing (mm): 2000, 600, 200, 60, 20

RQD (%)

Description & Additional Observations

- *0.50 - 0.50m:* PID = 2.9 ppm.
- *1.00 - 1.00m:* PID = 4.8 ppm.
- *3.70 - 3.90m:* PID = 2.5 ppm.
- *4.10 - 4.30m:* PID = 3.0 ppm.
- *4.40 - 4.50m:* PID = 431.6 pmm.

Fluid Loss (%): 25, 50, 75

Water Level: 06/08/2018

Casing

Installation

Core Box No

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 0.90-3.90 m BGL and packed with K2 sand. SWL 3.51 m BGL 6/08/2018 1010.

Hole Depth 10m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH202

SHEET: 2 OF 2

Tonkin+Taylor

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921383.85 mN, 1756351.75 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.84m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 29/06/2018

FINISH DATE: 04/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering (UW, EW, HW, MW, HW, CW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	5.00m: [CONT] SAND, with trace silt; grey. Soft, moist. Strong hydrocarbon odour.			SNC			-3	5.5										
	5.50 - 6.00m: Minor cobbles.					DUP7 CBH202 5.5-5.6 @ 5.5m							*5.50 - 4.60m:* PID = 18.7 ppm.					
	6.00 - 7.00m: Saturated, no cobbles.					CBH202 6.0-6.1 @ 6.0m	-4	6.0					*6.00 - 6.10m:* PID = 312.9 ppm.					
								6.5										
Marine Sediments	7.00m: Clayey SILT, with some shell fragments, trace sand; grey. Soft, moist;					CBH202 7.0-7.1 @ 7.0m	-5	7.0					*7.00 - 7.10m:* PID = 21.1 ppm.					
								7.5										
	8.00m: Silty CLAY, grey with orange mottling. Firm, moist. Hydrocarbon odour.					CBH202 8.0-8.1 @ 8.0m	-6	8.0					*8.00 - 8.10m:* PID = 29.6 ppm.					
								8.5										
								9.0										
	9.50m: SILT, with minor sand; grey with black mottling. Firm. Faint hydrocarbon odour.					CBH202 9.5-9.6 @ 9.5m	-7	9.5					*9.50 - 9.60m:* PID = 20.9 ppm.					
	9.80m: Silty SAND, with trace clay; grey. Moist.																	
	10m: END OF BOREHOLE																	

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 0.90-3.90 m BGL and packed with K2 sand. SWL 3.51 m BGL 6/08/2018 1010.

Hole Depth 10m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH203A

SHEET: 1 OF 2

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921367.35 mN, 1756339.15 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.54m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 11/07/2018

FINISH DATE: 11/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)
Fill	0.00m: Concrete.
	0.17m: Silty GRAVEL with minor sand, trace brick fragments; greyish brown. "Tightly packed".
	0.80m: Gravelly SILT, trace brick fragments; brown mottled black and orange. Soft, wet.
	1.50m: Trace organics and minor gas works waste.
	1.70m: Sandy GRAVEL; black. Soft, wet; gravel fine to medium. Hydrocarbon odour. [Gasworks Waste]
	3.20m: Clayey SILT; greyish orange with minor black mottling. Soft.
	4.00m: turning grey mottled orange and black. Soft. Brick fragments and organic matter.
	4.70m: SAND with minor shells; grey. Soft, saturated.

Rock Weathering: UW, EW, HW, MW, HW, CW

Rock Strength: ES, VS, S, MS, M, W, VW, EW

Sampling Method: HVAC; SNC

Core Recovery (%)

Testing:
- CBH203 A 0.2-0.42 @ 0.2m
- CBH203 A 0.9-1.2 @ 0.9m
- CBH203 A 1.5-1.7 @ 1.5m
- CBH203 A 1.7-2.0 @ 1.7m
- CBH203 A 3.2-3.4 @ 3.2m
- CBH203 A 4.0-4.2 @ 4.0m
- CBH203 A 4.7-4.9 @ 4.7m

RL (m): 2, 1, 0, -1, -2

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Graphic Log

ROCK DEFECTS

Defect Log

Fracture Spacing (mm): 2000, 600, 200, 60, 20

RQD (%)

Description & Additional Observations:
- *0.20 - 0.42m:* PID = 0.5 ppm.
- *0.90 - 1.20m:* PID = 0.6 ppm.
- *1.50 - 1.70m:* PID = 14.3 ppm.
- *1.70 - 2.00m:* PID = 44.2 ppm.
- *3.20 - 3.40m:* PID = 1.2 ppm.
- *4.00 - 4.20m:* PID = 0.9 ppm.
- *4.70 - 4.90m:* PID = 1.5 ppm.

Fluid Loss (%): 25, 50, 75

Water Level: 26/07/2018

Casing

Installation

Core Box No

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.00-4.50 m BGL and packed with K2 sand. SWL 2.44 m BGL 26/07/2018 1035.

Hole Depth 10m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH203A

SHEET: 2 OF 2

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921367.35 mN, 1756339.15 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.54m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 11/07/2018

FINISH DATE: 11/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	5.00m: [CONT] SAND with minor shells; grey. Soft, saturated.			SNC		CBH203 A 5.7-5.9 @ 5.7m	-3	5.5					*5.70 - 5.90m:* PID = 2.7 ppm.					
Marine Sediments	6.20m: SILT with trace sand; grey. Soft, wet.					CBH203 A 6.3-6.5 @ 6.3m	-4	6.0 6.5					*6.30 - 6.50m:* PID = 0.4 ppm.					
	8.60m: Minor shell fragments, becoming sandy silt.					CBH203 A 8.6-8.8 @ 8.6m	-5 -6	7.0 7.5 8.0 8.5					*8.60 - 8.80m:* PID = 0.3 ppm.					
Tauranga Group	9.20m: Clayey SILT; grey mottled orange. Firm, moist.					CBH203 A 9.2-9.4 @ 9.2m	-7	9.0 9.5					*9.20 - 9.40m:* PID = 0.4 ppm.					
	10m: END OF BOREHOLE																	

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.00-4.50 m BGL and packed with K2 sand. SWL 2.44 m BGL 26/07/2018 1035.

Hole Depth 10m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH204

SHEET: 1 OF 2

PROJECT: Site 18	CO-ORDINATES: 5921341.30 mN (NZTM2000) 1756327.98 mE	R.L. GROUND: 2.64m
JOB No.: 30881.2000.2000		R.L. COLLAR:
LOCATION: Orams Site 18, Beaumont Street, Auckland	DIRECTION: 0°	DATUM: NZVD2016
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Lance
LOGGED BY: MANR
CHECKED: MHU
START DATE: 29/06/2018
FINISH DATE: 04/07/2018
CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, SW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	0.00m: Asphalt. 0.05m: GRAVEL, with minor silt and sand; greyish brown. Firm; gravel, fine to coarse. *0.70 - 0.85m:* Wet, minor brick fragments. . 0.85m: Gravelly SILT, with trace clay; black with grey mottling. Moist. Brick fragments. [Gasworks Waste]. 1.50m: Coreloss 1.80m: Silty GRAVEL; dark grey. Wet; gravel, fine. Strong hydrocarbon odour, product globules present, brick fragments. *2.80 - 3.80m:* Trace clay, absent of brick fragments 3.80m: SILT, with trace clay and gravel; orange brown. Wet; gravel, fine. Hydrocarbon odour. [Hydraulic Fill] 4.50m SAND, with minor gravel; grey. Moist; gravel, fine to coarse. Faint hydrocarbon odour. [Hydraulic Fill]			HVAC SNC		CBH204 0.05 @ 0.1m CBH204 0.4 - 0.5 @ 0.4m CBH204 0.9 @ 0.9m CBH204 1.8 - 2.0 @ 1.8m CBH204 2.8 - 3.0 @ 2.8m CBH204 3.8- 4.0 @ 3.8m CBH204 4.8 - 5.0 @ 4.8m	2 1 0 -1 -2	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5						*0.05m:* PID = 0.8 ppm. *0.50m:* PID = 2.4 ppm. *0.70 - 0.90m:* PID = 6.0 ppm. *0.90m:* PID = 211.2 ppm. *1.80 - 2.00m:* PID = 596.6 ppm. *2.80 - 3.00m:* PID = 396.5 pmm. *3.80 - 4.00m:* PID = 433.8 ppm. *4.50 - 4.80m:* PID = 29.8 ppm. *4.80 - 5.00m:* PID = 11.6 ppm.		27/07/2018			

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.00-4.50 m BGL and packed with K2 sand. SWL 2.53 m BGL 27/07/2018 1400.

Hole Depth 10m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH204

SHEET: 2 OF 2

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921341.30 mN, 1756327.98 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.64m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 29/06/2018

FINISH DATE: 04/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	5.00m: [CONT] SAND, with minor gravel; grey. Moist; gravel, fine to coarse. Faint hydrocarbon odour. [Hydraulic Fill] *5.80 - 6.00m:* Trace rootlets, faint hydrocarbon odour.			SNC		CBH204 5.8 - 6.0 @ 5.8m	-3	5.5 6.0 6.5										
Marine Sediments	6.80m: SILT, with trace shells; grey. Saturated. Organic odour.					CBH204 6.8 - 7.0 @ 6.8m CBH204 7.8 - 8.0 @ 7.8m	-4 -5	7.0 7.5					*6.80 - 7.00m:* PID = 0.1 ppm. *7.80 - 8.00m:* PID = 2.7 ppm.					
	8.00m-10.00m: Coreloss.						-6	8.0 8.5										
	10m: END OF BOREHOLE						-7	9.0 9.5										

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.00-4.50 m BGL and packed with K2 sand. SWL 2.53 m BGL 27/07/2018 1400.

Hole Depth 10m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: CBH205

SHEET: 1 OF 2

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921324.77 mN, 1756354.14 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.18m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 02/07/2018

FINISH DATE: 02/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation
Fill	0.00m: GRAVEL.
	0.05m: Silty GRAVEL, with some sand, minor brick fragments and shells; blackish brown. Firm, moist; gravel, fine to coarse; sand, coarse.
	0.50 - 0.70m: Rootlets, brick fragments and hessian.
	0.70m: Clayey SILT, with some brick fragments and gravel; orange brown. Firm, moist.
	0.80m: Silty GRAVEL, some sand, brick fragments; blackish brown. Firm, moist; gravel, fine to medium; sand, coarse.
	0.90m: Gravelly SILT, minor clay; orange brown. Moist.
	1.00m: Concrete
	1.30m: Silty SAND, with trace clay; grey mottled orange and brown. Firm, wet. (Hydraulic Fill)
	2.00 - 2.20m: Hydrocarbon odour.
	4.40 - 4.60m: Minor gravel; grey. Gravel, coarse; Strong hydrocarbon odour. .

Rock Weathering: UW, EW, HW, MW, HW, CW

Rock Strength: ES, VS, S, MS, M, W, VW, EW

Sampling Method: HVAC, SNC

Core Recovery (%)

Testing:
- CBH205 0.0 - 0.2 @ 0.0m
- CBH205 0.5 - 0.6 @ 0.5m
- CBH205 0.7 - 0.8 @ 0.7m
- CBH205 0.9 - 1.0 @ 0.9m
- CBH205 1.3 - 1.5 @ 1.3m
- CBH205 2.0 - 2.2 @ 2.0m
- CBH205 3.0 - 3.2 @ 3.0m
- CBH205 4.0 - 4.3 @ 4.0m
- CBH205 4.4 - 4.7 @ 4.4m

RL (m): 3, 2, 1, 0, -1

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Graphic Log

ROCK DEFECTS

Defect Log

Fracture Spacing (mm): 2000, 600, 200, 60, 20

RQD (%)

Description & Additional Observations

- *0.00 - 0.20m:* PID = 4.9 ppm.
- *0.50 - 0.60m:* PID = 0.9 ppm.
- *0.70 - 0.80m:* PID = 1.1 ppm.
- *0.90 - 1.00m:* PID = 1.9 ppm.
- *1.30 - 1.50m:* PID = 4.9 ppm.
- *2.00 - 2.20m:* PID = 366.5 ppm.
- *3.00 - 3.20m:* PID = 128.9 ppm.
- *4.00 - 4.30m:* PID = 8.6 ppm.
- *4.40 - 4.70m:* PID = 204.8 ppm.

Fluid Loss (%): 25, 50, 75

Water Level: 30/07/2018

Casing

Installation

Core Box No

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 2.00-5.50 m BGL and packed with K2 sand. SWL 2.77 m BGL 30/07/2018 0900.

Hole Depth 6m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH205

SHEET: 2 OF 2

Tonkin+Taylor

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921324.77 mN, 1756354.14 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.18m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 02/07/2018

FINISH DATE: 02/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, LW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	5.00m: SAND, with minor shells and gravel; dark grey. Saturated; gravel, coarse; Hydrocarbon odour.			SNC		CBH205 5.0 - 5.2 @ 5.0m	-2	5.5					*5.00 - 5.20m:* PID = 48.1 ppm.					
						DUP4 CBH205 5.8 - 6.0 @ 5.8m							*5.80 - 6.00m:* PID = 4.6 ppm.					
	6m: END OF BOREHOLE						-3	6.0										
								6.5										
							-4	7.0										
								7.5										
								8.0										
							-5	8.5										
								9.0										
							-6	9.5										

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 2.00-5.50 m BGL and packed with K2 sand. SWL 2.77 m BGL 30/07/2018 0900.

Hole Depth 6m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH206

SHEET: 1 OF 3

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: (NZTM2000) 5921295.68 mN 1756340.48 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.66m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 05/07/2018

FINISH DATE: 05/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	0.00m: Concrete.																	
	0.17m: Sandy GRAVEL; black. Gravel, fine. Absent of odour. [Gasworks Waste].					CBH206 0.2 - 0.6 @ 0.2m		0.5					*0.20 - 0.60m:* PID = 3.9 ppm.					
	0.60m: Silty GRAVEL, with trace clay; grey with some light grey mottling. Moist; gravel, fine to medium. Hydrocarbon odour.					CBH206 0.6 - 0.8 @ 0.6m	2						*0.60 - 0.80m:* PID = 6.2 ppm.					
	0.80m: Sandy SILT, with brick fragments and minor gravel; brownish. Moist; gravel, fine.					CBH206 0.9 - 1.1 @ 0.9m		1.0					*0.90 - 1.10m:* PID = 1.5 ppm.					
	0.90m: Gravelly SILT, with brick fragments, trace clay; orange brown with grey and brown mottling. Firm. *1.50 - 1.80m:* Some black mottling.					CBH206 1.5 - 1.8 @ 1.5m	1	1.5					*1.50 - 1.80m:* PID = 37.7 ppm.					
	1.80m: Coreloss.			SNC				2.0							01/08/2018			
	3.00m: Sandy SILT, with trace organics and cobbles; grey. Soft, moist. Strong hydrocarbon odour.					CBH206 3.0 - 3.2 @ 3.0m	0	2.5					*3.00 - 3.20m:* PID = 131 ppm.					
	3.20m: SILT, with minor sand; greyish brown with some orange mottling. Firm, moist. *3.50 - 4.20m:* Saturated. *3.80 - 4.20m:* shell fragments					DUP8 CBH206 3.2 - 3.6 @ 3.2m	-1	3.0 3.5					*3.20 - 3.60m:* PID = 4.3 ppm.					
	4.20m: SAND, with minor silt and shells; grey. Moist. Hydrocarbon odour.					CBH206 4.2 - 4.5 @ 4.2m	-2	4.0 4.5					*4.20 - 4.50m:* PID = 7.9 ppm.					

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.50-4.50 m BGL and packed with K2 sand. SWL 2.18 m BGL 1/08/2018 1330.

Hole Depth 10.1m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: CBH206

SHEET: 2 OF 3

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921295.68 mN, 1756340.48 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.66m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 05/07/2018

FINISH DATE: 05/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW, CDW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	5.00m:[CONT] SAND, with minor silt and shells; grey. Moist. Hydrocarbon odour.			SNC		CBH206 5.2 - 5.5 @ 5.2m	-3	5.5					*5.20 - 5.50m:* PID = 8.2 ppm.					
	5.70m: SILT, with some shells, trace sand; grey. Soft, wet. Sulphur odour.					CBH206 5.7 - 6.0 @ 5.7m							*5.70 - 6.00m:* PID = 8.6 ppm.					
Marine Sediments	6.00m: Clayey SILT, with minor shells; grey. Soft, moist. Sulphur odour.					CBH206 6.0 - 6.3 @ 6.0m	-4	6.0					*6.00 - 6.30m:* PID = 3.3 ppm.					
	8.10m: Silty CLAY, with some organics; grey with orange mottling. Firm.					CBH206 8.1 - 8.4 @ 8.1m	-5	7.0					*8.10 - 8.40m:* PID = 1.1 ppm.					
	8.90 - 10.00m: Very stiff to firm; no mottling.						-6	8.0										
							-7	9.0										

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.50-4.50 m BGL and packed with K2 sand. SWL 2.18 m BGL 1/08/2018 1330.

Hole Depth 10.1m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH206

SHEET: 3 OF 3

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921295.68 mN, 1756340.48 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.66m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 05/07/2018

FINISH DATE: 05/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, SW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
	10.1m: END OF BOREHOLE						-8 -9 -10 -11 -12	10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5										

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.50-4.50 m BGL and packed with K2 sand. SWL 2.18 m BGL 1/08/2018 1330.

Hole Depth 10.1m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH207

SHEET: 1 OF 2

PROJECT: Site 18	CO-ORDINATES: (NZTM2000) 5921277.74 mN 1756392.64 mE	R.L. GROUND: 2.89m
JOB No.: 30881.2000.2000	DIRECTION: 0°	R.L. COLLAR:
LOCATION: Orams Site 18, Beaumont Street, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: NZVD2016
		SURVEY: Total Station\Surveyed

DRILLED BY: Lance
LOGGED BY: MANR
CHECKED: MHU
START DATE: 05/07/2018
FINISH DATE: 05/07/2018
CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Depth (m)	Sampling Method	Testing	Description & Additional Observations
Fill	0.00m: Concrete.	0			
	0.17m: Silty sandy GRAVEL with minor cobbles; brown. Loose, moist; gravel, fine to coarse.			CBH207 0.2 - 0.4 @ 0.2m	*0.20 - 0.40m:* PID 35.9 ppm.
	0.50 - 0.60m: Trace shells and clay.	0.5			
	0.60m: SILT, minor sand and gravel; grey with some black and blue mottling. Soft, moist; gravel, fine. Strong hydrocarbon odour.		HVAC	CBH207 0.6 - 0.9 @ 0.6m	*0.60 - 0.90m:* PID = 366.7 ppm.
		1.0			
	1.10m: Silty SAND, minor gravel; grey with some blue and red mottling. Gravel, fine to coarse. Hydrocarbon odour.			CBH207 1.1 - 1.4 @ 1.1m	*1.10 - 1.40m:* PID = 694.4 ppm.
		1.5			
	2.00m: SILT, with minor sand; grey. Soft, saturated. Strong hydrocarbon odour.	2.0		CBH207 2.0 - 2.2 @ 2.0m	*2.00 - 2.20m:* PID = 454.4 pmm.
	2.50m: Gravelly SILT, minor sand; grey. Soft, moist. Hydrocarbon odour.	2.5		CBH207 2.5 - 2.7 @ 2.5m	*2.50 - 2.70m:* PID = 402.8 ppm.
	2.80m: SILT, trace clay; grey with orange mottling. Firm, saturated. Hydrocarbon odour.			CBH207 2.8 - 3.0 @ 2.8m	*2.80 - 3.00m:* PID = 323.6 ppm.
	3.20m: SILT, minor clay; grey. Soft, wet.	3.0	SNC	DUP 9 CBH 3.2 - 3.5 @ 3.2m	*3.20 - 3.50m:* PID = 4.5 ppm.
		3.5			
	4.20 - 5.00m: Black mottling. Intermittent sand layers. Hydrocarbon odour. shell fragments.	4.0		CBH207 4.2 - 4.5 @ 4.2m	*4.20 - 4.50m:* PID = 6.1 ppm.
		4.5			

ROCK DEFECTS: Defect Log; Fracture Spacing (mm) (2000, 600, 200, 60, 20); RQD (%)

Fluid Loss (%) (25, 50, 75)

Water Level: 26/07/2018

Casing

Installation

Core Box No

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.50-4.50 m BGL and packed with K2 sand. SWL 1.54 m BGL 26/07/2018 1218.

Hole Depth 6m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:30 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH207

SHEET: 2 OF 2

Tonkin+Taylor

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921277.74 mN, 1756392.64 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 2.89m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 05/07/2018

FINISH DATE: 05/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000, 600, 200, 60, 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	5.00m: Silty SAND, some shells, trace clay; grey. Soft, wet.			SNC		CBH207 5.0 - 5.2 @ 5.0m	-3	5.5					*5.00 - 5.20m:* PID = 22.8 ppm.					
						CBH207 5.8 - 6.0 @ 5.8m							*5.80 - 6.00m:* PID = 1.7 ppm.					
	6m: END OF BOREHOLE						-4	6.0										
								6.5										
							-5	7.0										
								7.5										
							-6	8.0										
								8.5										
							-7	9.0										
								9.5										

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.50-4.50 m BGL and packed with K2 sand. SWL 1.54 m BGL 26/07/2018 1218.

Hole Depth 6m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:31 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: CBH208

SHEET: 1 OF 2

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921313.61 mN, 1756374.07 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.47m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 03/07/2018

FINISH DATE: 03/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation
Fill	0.00m: Sandy GRAVEL, minor silt; brown with grey mottling. Moist.
	0.20 - 0.80m: Some brick fragments.
	0.80 - 1.00m: Some gravel; mottling of suspected gasworks waste. Gravel, Black.
	1.00m: Black HDPE.
	1.01m: Sandy GRAVEL; black. Moist; gravel, fine to coarse; Hydrocarbon odour.
	1.20m: Sandy SILT, some shells, minor gravel; brown with white grey and orange mottling. Firm, moist; gravel, fine to coarse.
	1.30m: Silty GRAVEL, with some brick fragments, minor sand; brown. Moist.
	1.40m: Sandy SILT, with trace clay; orange brown with white grey and black mottling . Moist.
	2.00m: Silty SAND; grey. Firm, wet, hydrocarbon odour.
	3.00m: With trace clay, strong hydrocarbon odour.

Rock Weathering: UW, EW, HW, MW, HW, CW

Rock Strength: ES, VS, S, MS, W, VW, EW

Sampling Method: HVAC, SNC

Core Recovery (%)

Testing:
- CBH208 0.0 - 0.2 @ 0.0m
- DUP5 CBH208 0.2 - 0.6 @ 0.2m
- CBH208 0.8 - 1.0 @ 0.8m
- CBH208 1.0 - 1.2 @ 1.0m
- CBH208 1.2 - 1.3 @ 1.2m
- CBH208 1.4 - 1.6 @ 1.4m
- CBH208 2.0 - 2.2 @ 2.0m
- CBH208 3.0 - 3.2 @ 3.0m
- CBH208 4.0 - 4.2 @ 4.0m

RL (m): 3, 2, 1, 0, -1

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Graphic Log

ROCK DEFECTS

Defect Log

Fracture Spacing (mm): 2000, 600, 200, 60, 20

RQD (%)

Description & Additional Observations:
- *0.00 - 0.20m:* PID = 4.3 ppm.
- *0.20 - 0.60m:* PID = 8.8 ppm.
- *0.80 - 1.00m:* PID = 2.8 ppm.
- *1.00 - 1.20m:* PID = 90.8 ppm.
- *1.20 - 1.30m:* PID = 8.1 ppm.
- *2.00 - 2.20m:* PID = 495.6 ppm.
- *3.00 - 3.20m:* PID - 493.8 ppm.
- *4.00 - 4.20m:* PID = 64.2 ppm.

Fluid Loss (%): 25, 50, 75

Water Level: 30/07/2018

Casing

Installation

Core Box No

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.50-4.50 m BGL and packed with K2 sand. SWL 2.05 m BGL 30/07/2018 1120.

Hole Depth 6m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:31 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH208

SHEET: 2 OF 2

PROJECT: Site 18	CO-ORDINATES: 5921313.61 mN, 1756374.07 mE (NZTM2000)	R.L. GROUND: 3.47m
JOB No.: 30881.2000.2000	DIRECTION: 0°	R.L. COLLAR:
LOCATION: Orams Site 18, Beaumont Street, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: NZVD2016
		SURVEY: Total Station\Surveyed

DRILLED BY: Lance
LOGGED BY: MANR
CHECKED: MHU
START DATE: 03/07/2018
FINISH DATE: 03/07/2018
CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	5.00m: SAND with minor silt; grey. Saturated, shell fragments.			SNC		CBH208 5.0 - 5.2 @ 5.0m	-2	5.5					*5.00 - 5.20m:* PID = 3.3 ppm.					
						CBH208 5.8 - 6.0 @ 5.8m							*5.80 - 6.00m:* PID = 0.9 ppm.					
	6m: END OF BOREHOLE						-3	6.0										
								6.5										
							-4	7.0										
								7.5										
							-5	8.0										
								8.5										
							-6	9.0										
								9.5										

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.50-4.50 m BGL and packed with K2 sand. SWL 2.05 m BGL 30/07/2018 1120.

Hole Depth 6m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:31 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: CBH209

SHEET: 1 OF 2

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: 5921376.28 mN, 1756434.59 mE (NZTM2000)

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 03/07/2018

FINISH DATE: 03/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)
Fill	0.00m: Concrete.
	0.17m: Silty GRAVEL, some shell fragments, trace sand; blackish brown. Hard, wet; sand, coarse. Hydrocarbon odour.
	0.70m: Concrete.
	0.90m: Silty GRAVEL, trace sand; blackish brown. Wet; gravel, fine to coarse.
	1.30m: Gravelly SAND, some shell fragments; grey with black mottling. Moist; sand, coarse; gravel, fine to medium. Strong hydrocarbon odour.
	2.80 - 4.20m: Saturated.
	4.20m-5.00m: Coreloss.

Rock Weathering: UW, EW, HW, MW, LW, CW, DW

Rock Strength: ES, VS, S, MS, M, W, VW, EW

Sampling Method: HVAC; SNC

Core Recovery (%)

Testing:
- CBH209 0.2 - 0.6 @ 0.2m
- CBH209 0.9 - 1.2 @ 0.9m
- CBH209 1.4 - 1.9 @ 1.4m
- CBH209 2.7 - 3.0 @ 2.7m
- CBH209 3.8 - 4.2 @ 3.8m

RL (m): 2, 1, 0, -1

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Graphic Log

ROCK DEFECTS

Defect Log

Fracture Spacing (mm): 2000, 600, 200, 60, 20

RQD (%)

Description & Additional Observations:
- *0.20 - 0.60m:* PID = 4.9 ppm.
- *0.90 - 1.20m:* PID = 3.8 ppm.
- *1.40 - 1.90m:* PID = 817 ppm.
- *2.70 - 3.00m:* PID = 1161 ppm.
- *3.80 - 4.20m:* PID = 37.5 ppm

Fluid Loss (%): 25, 50, 75

Water Level: 03/08/2018

Casing

Installation

Core Box No

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.50-4.50 m BGL and packed with K2 sand. SWL 1.95 m BGL 3/08/2018 0900.

Hole Depth 6m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:31 p.m. - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: CBH209

SHEET: 2 OF 2

Tonkin+Taylor

PROJECT: Site 18

JOB No.: 30881.2000.2000

LOCATION: Orams Site 18, Beaumont Street, Auckland

CO-ORDINATES: (NZTM2000) 5921376.28 mN 1756434.59 mE

DIRECTION: 0°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 3.00m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Lance

LOGGED BY: MANR

CHECKED: MHU

START DATE: 03/07/2018

FINISH DATE: 03/07/2018

CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW EW HW MW HW CW)	Rock Strength (ES VS S MS M W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Fill	5.00m: Sandy SILT, some shell fragments, trace gravel; greyish brown. Moist; gravel, fine to medium. Slight hydrocarbon odour.			SNC		CBH209 5.0 - 5.3 @ 5.0m		5.5					*5.00 - 5.30m:* PID = 12.4 pmm.					
	5.80m: Silty SAND, some shell fragments; grey with some black mottling. Moist; sand, coarse.					CBH209 5.8 - 6.0 @ 5.8m							*5.80 - 6.00m:* PID = 4.7 ppm.					
	6m: END OF BOREHOLE						-3	6.0										
								6.5										
							-4	7.0										
								7.5										
							-5	8.0										
								8.5										
							-6	9.0										
								9.5										

COMMENTS: Standpipe piezometer installed. 50mm PVC pipe. Slotted 1.50-4.50 m BGL and packed with K2 sand. SWL 1.95 m BGL 3/08/2018 0900.

Hole Depth 6m

Scale 1:25

Rev.: A

General Log - 23/08/2018 4:55:31 p.m. - Produced with Core-GS by GeRoc

BOREHOLE No: **BH01**

MACHINE BOREHOLE LOG

SHEET 1 of 3

PROJECT: Jellicoe to Madden Western Edge
JOB NUMBER: 3122212
SITE LOCATION: Jellicoe St
CLIENT: Auckland Waterfront Development

CIRCUIT: NZTM
COORDINATES: N 5,921,423.84 m
E 1,756,358.96 m
BOREHOLE LOCATION: see plan
R L: 4.6m CD m
DATUM:

DRILLING: FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	RQD	CASING	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	V.E									GW	D	Concrete.	FILL	
														Cuttings: fine to coarse GRAVEL, minor cobbles, trace sand, trace silt; greyish brown; dry, non plastic. Gravel: moderately strong, slightly weathered, sub-angular to sub-rounded basalt.		
		56 %	SPT					2 2 1 0 0 0 N=1		1		SW	M	Cuttings: gravelly fine to coarse SAND, minor cobbles, trace silt; light greyish brown; moist, non plastic. (Fill: concrete, bricks, basalt).		
		95 %	SONIC							2				1.65m: moderately thin bed of clayey SILT, some fine to coarse gravel, minor fine to coarse sand, trace shells; yellowish brown mottled orange; moist, highly plastic.		
												SM	W	1.8m: moderately thin bed of clayey SILT, some fine to coarse gravel, minor fine to coarse sand, trace shells; yellowish brown mottled orange; moist, highly plastic.		
														Very loose silty SAND, minor fine to coarse gravel; brownish green speckled orange; wet, non plastic. Gravel: moderately strong, slightly weathered, subangular basalt.		
												ML	M	Dark green mottled dark grey and mottled orange.		
		100 %	SPT					4 4 2 1 2 3 N=8		3		GW	M	Soft SILT, minor fine sand, minor clay, trace organics; green speckled brown; moist, low plasticity.		
		86 %	SONIC							4				Loosely packed COBBLES,some fine to coarse gravel, trace silt, trace sand; blackish grey; moist, non plastic. Cobbles/Gravel: moderately strong, slightly weathered, sub-angular to sub-rounded basaltic scoria. 3.15m: moderately thin bed of silty SAND, trace shells; greenish grey; wet, non plastic. (Strong presence/smell of hydrocarbons).		
		100 %	SPT					3 4 1 3 2 2 N=8		5						
		100 %	SONIC													
		22 %	SPT					0 2 8 4 1 0 N=13		6				No Recovery.		
		100 %	SONIC			10/0	16/0			7		ML	M	Very soft sandy SILT, trace clay, trace shells, trace organics; greyish green speckled brown; moist, low plasticity; green speckled brown; moist, low plasticity. Poor recovery in SPT.	Tauranga Group	
		100 %	SPT			12/2	20/3	0 0 0 0 0 0 N=0		8						
		100 %	SONIC									SM	W	Very loose silty SAND, trace shells; greyish green speckled white; wet, non plastic.		
		53 %	SPT					0 0 0 1 1 2 N=4		9		CH	M	Firm silty CLAY, some sand; brownish grey mottled orange; moist, highly plastic, sensitive.		
		100 %	SONIC													

DATE STARTED: 15/12/11
DATE FINISHED: 15/12/11
LOGGED BY: BGW
SHEAR VANE No: Geo613

DRILLED BY: Pro-drill (Auck) Ltd
EQUIPMENT: Super Sonic 1000
DRILL METHOD: Sonic
DRILL FLUID:
DIAMETER/INCLINATION: - / 90°

COMMENTS:
V.E = Vacuum Excavation. SC = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

MACHINE_BOREHOLE P:\3123\122212\TGE\JELLICOE TO MADDEN WESTERN EDGE.GPJ BECA_GINT 24/2/12

A4 Scale 1:50

Beca

BOREHOLE No: **BH01**

MACHINE BOREHOLE LOG

SHEET 2 of 3

PROJECT: Jellicoe to Madden Western Edge
JOB NUMBER: 3122212
SITE LOCATION: Jellicoe St
CLIENT: Auckland Waterfront Development A

CIRCUIT: NZTM
COORDINATES: N 5,921,423.84 m
E 1,756,358.96 m
BOREHOLE LOCATION: see plan
R L: 4.6m CD m
DATUM:

DRILLING: FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	ROD	CASING	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	SONIC			20/5	32/7	0				CH	M	Grey mottle orange.		
		100 %	SPT					0						Light brown speckled orange and dark purple.		
								0				CH	M	Firm sandy silty CLAY; light brownish grey mottled orange; moist, high plasticity.		
								1		11						
		95 %	SONIC					1				SM	W	Very loose silty SAND; greyish green; wet, non plastic.		
								0								
								N=2				MH	M	Stiff sandy SILT, some clay, trace organics; green speckled brown; moist, high plasticity.		
		100 %	SPT			50/25	80/38	0		12						
								0				SM	M	Loose silty SAND, trace organics, trace shells; greyish green speckled brown; moist, non plastic. Organics: amorphous.		
								1								
								2								
								1								
								N=4								
		100 %	SONIC							13						
								0								
		100 %	SPT					0								
								1								
								1								
								2		14						
		100 %	SONIC					N=5								
		0 %	SPT					1								
								1								
								1								
								3		15						
								3								
								4								
		100 %	SONIC					N=11						15.85m: moderately thin bed of fine to coarse SAND; dark grey.		
										16				Lensoid of fine to coarse SAND; dark grey.		
		0 %	SPT					1								
								1								
								3								
								3								
								4		17						
		100 %	SONIC					N=13								
		100 %	SPT			140+	140+	1				CH	M	Very stiff silty CLAY, trace sand; light green; moist, high plasticity. Light brown mottled dark brown. Trace fibrous organics.		
								2		18						
								3								
								3								
								3				SM	M	Medium dense silty SAND; greyish green speckled dark green and white, stained purple; moist, non plastic.		
								N=12								
		100 %	SONIC							19						
								1						Trace organics.		
		100 %	SPT					3								
								3								
								3								

Tauranga Group *(Contd.)*

DATE STARTED: 15/12/11
DATE FINISHED: 15/12/11
LOGGED BY: BGW
SHEAR VANE No: Geo613

DRILLED BY: Pro-drill (Auck) Ltd
EQUIPMENT: Super Sonic 1000
DRILL METHOD: Sonic
DRILL FLUID:
DIAMETER/INCLINATION: - / 90°

COMMENTS:
V.E = Vacuum Excavation. SC = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

MACHINE_BOREHOLE P:\3122\3122212\TGE\JELLICOE TO MADDEN WESTERN EDGE.GPJ BECA_2 24/2/12

A4 Scale 1:50

Beca

BOREHOLE No: **BH01**

MACHINE BOREHOLE LOG

SHEET 3 of 3

PROJECT: Jellicoe to Madden Western Edge
JOB NUMBER: 3122212
SITE LOCATION: Jellicoe St
CLIENT: Auckland Waterfront Development A

CIRCUIT: NZTM
COORDINATES: N 5,921,423.84 m
E 1,756,358.96 m
BOREHOLE LOCATION: see plan
R.L: 4.6m CD m
DATUM:

DRILLING: FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	RQD	CASING	IN-SITU TESTS: SV	T (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R.L (m)
		100 %	SONIC					4 5 N=15		21		SM	M	Medium dense silty SAND; greyish green speckled dark green and white, stained purple; moist, non plastic.	Tauranga Group (Contd.)	
		100 %	SPT					2 4 4 6 5 6 N=21						21.35m: moderately thin bed of fine to coarse silty fine gravelly SAND; grey; wet, non plastic.		
		100 %	SONIC									SM	W	Medium dense fine to coarse SAND, minor silt; greyish green; wet, non plastic.		
										22				21.8m: moderately thick bed of fine to coarse silty fine gravelly SAND; grey; wet, non plastic.		
		100 %	SPT					5 8 10 8 8 7 N=33				MH	M	Hard clayey SILT, trace sand; greyish green; moist, high plasticity.		
		100 %	SONIC							23				22.75m: moderately thin bed of fine to coarse SAND, minor silt; greyish green; wet, non plastic.		
		100 %	SPT					10 13 25 25 for 55mm N=50+		24		SW	M	Very dense fine to coarse SAND, some medium to coarse gravel, some silt; greenish grey; wet, non plastic.		
		100 %	SONIC							25						
		SC	SPT					23 27 for 75mm N=50+				MH	M	Hard clayey SILT, trace sand; greyish green; moist, high plasticity.		
		100 %	SONIC							26						
												SW	W	Trace amorphous organics. Speckled brown.		
														Very dense fine to coarse SAND, some silt; grey; wet, non plastic.	Waitemata Group	
		SC	SPT					12 15 22 28 for 75mm N=50+		27		ML	M	Hard clayey SILT, trace sand; greyish green; moist, high plasticity. Moderately thinly interbedded with dense fine to medium SAND. [Extremely weak SW-MW silstone and sandstone?].		
		100 %	SONIC							28						
		SC	SPT					18 32 for 70mm N=50+						END OF LOG @ 28.65 m		
										29						

DATE STARTED: 15/12/11
DATE FINISHED: 15/12/11
LOGGED BY: BGW
SHEAR VANE No: Geo613

DRILLED BY: Pro-drill (Auck) Ltd
EQUIPMENT: Super Sonic 1000
DRILL METHOD: Sonic
DRILL FLUID:
DIAMETER/INCLINATION: - / 90°

COMMENTS:
V.E = Vacuum Excavation. SC = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

A4 Scale 1:50

MACHINE_BOREHOLE P:\3123\3122212\TGE\ELLICOE TO MADDEN WESTERN EDGE.GPJ BECA_SGT 24/2/12

Beca

BOREHOLE No: **BH02**

MACHINE BOREHOLE LOG

SHEET 1 of 4

PROJECT:	Jellicoe to Madden Western Edge	JOB NUMBER:	3122212
SITE LOCATION:	Jellicoe St	CLIENT:	Auckland Waterfront Development A

CIRCUIT: NZTM
COORDINATES: N 5,921,372.38 m
E 1,756,336.47 m

BOREHOLE LOCATION: see plan
R L: 4.6m CD m
DATUM:

DRILLING: FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	RQD	CASING	IN-SITU TESTS: SV	T' (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	V.E							1				Concrete. No recovery. Vacuum extracted.	FILL	
		100 %	SPT					2 1 0 17				SP	M	Loosely packed gravelly SAND, minor silt; greenish brown; moist, non plastic.		
		100 %	SONIC					2 15 N=34		2		MH	M	Soft gravelly clayey SILT, minor sand; dark greenish brown; moist, high plasticity.		
		22 %	SPT					1 1 1 1 2 1 N=5		3		GP	W	Loosely packed fine to coarse sandy fine to medium GRAVEL, minor silt; dark grey; wet, non plastic. Brown.		
		100 %	SONIC							4		GW	W	Dense COBBLES, some fine to coarse gravel, trace silt, trace sand; dark grey; wet, non plastic. Minor wood fragments.		
		100 %	UT							5		MH	W	Soft SILT, some clay, minor sand; greenish dark grey, mottled black; wet, high plasticity. Some cobbles.		
		0 %	SPT					0 0 0 0 0 0 N=0		6		SW	W	Loose SAND, some silt, minor shells; greenish grey; wet, non plastic. Poor recovery in SPT. Undisturbed tube. No recovery in SPT.		
		100 %	SONIC			7/2	10/3			7		MH	W	Very soft clayey SILT, trace sand; greyish green; wet, high plasticity. Some sand.	Tauranga Group	
		33 %	SPT			8/2	13/3	0 1 0 1 0 0 N=1		8		ML	M	Very soft SILT, minor clay, trace organics, trace sand; grey mottled orange, speckled brown; moist, low plasticity. Organics: fibrous.		
		100 %	SONIC			24/4	38/7					MH	W	Firm clayey SILT, trace sand; greyish green; wet, high plasticity.		
		18 %	SPT			36/16	57/26	0 0 0 0 1 1 N=2		9				Poor recovery in SPT.		
		100 %	SONIC													

DATE STARTED: 16/12/11
DATE FINISHED: 16/12/11
LOGGED BY: BGW
SHEAR VANE No: Geo613

DRILLED BY: Pro-drill (Auck) Ltd
EQUIPMENT: Super Sonic 1000
DRILL METHOD: Sonic
DRILL FLUID:
DIAMETER/INCLINATION: - / 90°

COMMENTS:
V.E = Vacuum Excavation. SC = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

MACHINE_BOREHOLE P:\3122\3122212\TGE\JELLICOE TO MADDEN WESTERN EDGE.GPJ BECA_... 24/2/12

A4 Scale 1:50

BECA

BOREHOLE No: **BH02**

MACHINE BOREHOLE LOG

SHEET 2 of 4

PROJECT: Jellicoe to Madden Western Edge
JOB NUMBER: 3122212
SITE LOCATION: Jellicoe St
CLIENT: Auckland Waterfront Development

CIRCUIT: NZTM
COORDINATES: N 5,921,372.38 m
E 1,756,336.47 m
BOREHOLE LOCATION: see plan
R L: 4.6m CD m
DATUM:

DRILLING: FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	RQD	CASING	IN-SITU TESTS: SV	'T' (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	SONIC					1		11		MH	M	Very soft SILT, some clay, trace organics, trace sand; grey speckled brown; moist, high plasticity. Organics: fibrous.	Tauranga Group *(Contd.)*	
		58 %	SPT					1						Soft.		
								0								
								1								
		97 %	SONIC					2								
								N=4								
		100 %	SPT			10/5	16/7	0		12				Greyish brown speckled brown.		
								0								
								0								
								0								
								0								
		97 %	SONIC					N=0								
										13		MH	M	Firm sandy SILT, minor clay, trace organics; greyish green mottled green; moist, high plasticity. Organics: amorphous.		
		89 %	SPT					1				SM	M	Loose silty SAND, trace organics; greenish grey streaked brown; moist, non plastic. Organics: fibrous.		
								1								
								2								
		97 %	SONIC					2		14		SM	M	Medium dense SAND, some silt, trace organics; grey mottled green; wet, non plastic		
								3								
								N=8								
		0 %	SPT					2		15				No recovery in SPT.		
								3								
								4								
		100 %	SONIC					5				SM	M	Medium dense SAND, some silt, trace organics; grey mottled green; wet, non plastic		
								5								
								4								
								N=18		16						
												MH	W	Very stiff clayey SILT, trace sand; green; moist, high plasticity. Extremely closely spaced very thin beds of fine to coarse SAND, minor silt.		
		56 %	SPT					1				SM	M	Medium dense silty SAND, some organics; greyish green mottled dark brown; moist, non plastic. Organics: wood fragments. 16.48m: Thin beds of fine to coarse SAND.		
								2								
		100 %	SONIC					2		17				17.25m: moderately thin beds of clayey SILT, trace sand; green; moist, high plasticity.		
								3								
								3								
								4								
								N=12								
		22 %	SPT					1		18				Some wood fragments-semi decomposed. Loose; light greyish green speckled light brown. Trace amorphous organics. Poor recovery in SPT.		
								1								
		100 %	SONIC					2								
								2								
								1								
								1								
								N=6		19						
		0 %	SPT					1						No recovery in SPT.		
								2								
								2								
								3								

DATE STARTED: 16/12/11
DATE FINISHED: 16/12/11
LOGGED BY: BGW
SHEAR VANE No: Geo613

DRILLED BY: Pro-drill (Auck) Ltd
EQUIPMENT: Super Sonic 1000
DRILL METHOD: Sonic
DRILL FLUID:
DIAMETER/INCLINATION: - / 90°

COMMENTS:
V.E = Vacuum Excavation. SC = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

MACHINE_BOREHOLE P:\3123122212\TGE\JELLICOE TO MADDEN WESTERN EDGE.GPJ BECA_GST 24/2/12

A4 Scale 1:50

BOREHOLE No: **BH02**

SHEET 3 of 4

MACHINE BOREHOLE LOG

PROJECT: Jellicoe to Madden Western Edge — JOB NUMBER: 3122212

SITE LOCATION: Jellicoe St — CLIENT: Auckland Waterfront Development A

CIRCUIT: NZTM — BOREHOLE LOCATION: see plan

COORDINATES: N 5,921,372.38 m — R L: 4.6m CD m

E 1,756,336.47 m — DATUM:

DRILLING: FLUID LOSS	DRILLING: WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: RQD	DRILLING: CASING	IN-SITU TESTS: SV	IN-SITU TESTS: T (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	SONIC					3 3 N=11				SM	M	Medium dense silty SAND, some organics; greyish green mottled dark brown; moist, non plastic. Organics: wood fragments.		
		100 %	SPT					2 4 4 4 5 6 N=19		21		SW	W	Medium dense fine to coarse SAND, some silt; grey; wert, non plastic.		
		100 %	SONIC							22				22.15m: laminated beds of fine GRAVEL, trace silt.		
		0 %	SPT					1 2 4 4				SM	M	22.3m: laminated beds of fine GRAVEL, trace silt. Grades to medium dense silty fine SAND; greenish grey; moist, non plastic. Trace fibrous organics. Brownish grey streaked and speckled brown. No recovery in SPT.		
		95 %	SONIC					3 4 N=15		23		SM	M	Grades to medium dense silty fine SAND; greenish grey; moist, non plastic.		
		100 %	SPT					1 2 4 7 10 6 N=27		24		MH	M	Minor wood fragments. 24.2m: moderately thin bed of clayey SILT, trace sand; brownish green; moist, high plasticity. Hard clayey SILT, trace sand; brownish green; moist, high plasticity.	Tauranga Group *(Contd.)*	
		97 %	SONIC							25		ML	M	Very stiff SILT, minor clay, minor sand, trace organics; greyish green mottled brown; moist, low plasticity. Organics: amorphous.		
		100 %	SPT					4 7 4 9 12 12 N=37		26		MH	M	Hard clayey SILT, trace sand; brownish green; moist, high plasticity. 25.8m: moderately thin beds of fine to coarse SAND, some silt; grey; moist, non plastic. 25.9m: thin bed of fine to coarse SAND, some silt; grey; moist, non plastic. 26.3m: moderately thick bed of fine to coarse SAND, some silt; grey; moist, non plastic.		
		100 %	SONIC													
		96 %	SPT					8 15 25 25 for 70mm N=50+		27		SW	M	Very dense fine to coarse SAND, some silt; greenish grey; moist, non plastic.		
		100 %	SONIC							28		ML	M	Hard SILT, trace sand, trace mica, trace shell fragments; greenish grey; moist, low plasticity.		
		100 %	SPT					13 15 23 27 for 70mm N=50+		29						
		100 %	SONIC													

DATE STARTED: 16/12/11 — DRILLED BY: Pro-drill (Auck) Ltd

DATE FINISHED: 16/12/11 — EQUIPMENT: Super Sonic 1000

LOGGED BY: BGW — DRILL METHOD: Sonic

SHEAR VANE No: Geo613 — DRILL FLUID:

DIAMETER/INCLINATION: - / 90°

COMMENTS:
V.E = Vacuum Excavation. SC = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

MACHINE_BOREHOLE P:\3121\3122212\TGE\JELLICOE TO MADDEN WESTERN EDGE.GPJ BECA_SGT 24/2/12

A4 Scale 1:50

beca

BOREHOLE No: **BH02**

MACHINE BOREHOLE LOG

SHEET 4 of 4

PROJECT: Jellicoe to Madden Western Edge
JOB NUMBER: 3122212
SITE LOCATION: Jellicoe St
CLIENT: Auckland Waterfront Development

CIRCUIT: NZTM
COORDINATES: N 5,921,372.38 m
E 1,756,336.47 m
BOREHOLE LOCATION: see plan
R L: 4.6m CD m
DATUM:

DRILLING						IN-SITU TESTS									
FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	ROD	CASING	SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		SC	SPT					18 32 for 70mm N=50+				SW	M	Very dense fine to medium SAND, some silt; greenish grey; moist, non plastic.	Waitemata Group	
		100 %	SONIC							31		ML	M	Hard SILT, trace sand, trece shell fragments; greenish grey; moist, low plasticity. Gently inclined contact.		
		SC	SPT					30 20 for 45mm N=50+						END OF LOG @ 31.62 m		
										32						
										33						
										34						
										35						
										36						
										37						
										38						
										39						

DATE STARTED: 16/12/11
DATE FINISHED: 16/12/11
LOGGED BY: BGW
SHEAR VANE No: Geo613

DRILLED BY: Pro-drill (Auck) Ltd
EQUIPMENT: Super Sonic 1000
DRILL METHOD: Sonic
DRILL FLUID:
DIAMETER/INCLINATION: - / 90°

COMMENTS:
V.E = Vacuum Excavation. SC = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

MACHINE_BOREHOLE P:\3121\3122212\TGE\JELLICOE TO MADDEN WESTERN EDGE.GPJ BECA.GDT 24/2/12

A4 Scale 1:50

beca

BOREHOLE No: **BH03**

MACHINE BOREHOLE LOG

SHEET 1 of 4

PROJECT: Jellicoe to Madden Western Edge
JOB NUMBER: 3122212
SITE LOCATION: Jellicoe St
CLIENT: Auckland Waterfront Development A

CIRCUIT: NZTM
COORDINATES: N 5,921,325.42 m
E 1,756,318.61 m
BOREHOLE LOCATION: see plan
R L: 4.6m CD m
DATUM:

DRILLING: FLUID LOSS	DRILLING: WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: ROD	DRILLING: CASING	IN-SITU TESTS: SV	IN-SITU TESTS: 'T' (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		0 %	V.E											No recovery. Vacuum extracted.	FILL	
		100 %	SONIC					0 0 0 0 0 0 N=0		1		GP	W	Very loose sandy fine to medium GRAVEL, minor sand, trace silt; brownish black; wet, non plastic. Gravel: angular to sub-angular basaltic scoria. Hydrocarbon odour.		
		0 %	SPT													
		100 %	SONIC							2		ML	W	Very loose gravelly SILT, minor clay, minor sand, trace cobbles; yellowish brown; wet, non plastic.		
												CH	W	Soft silty CLAY, some fine gravel, trace sand; greyish brown; wet, high plasticity. Gravel: bricks.		
		100 %	SPT					0 1 0 0 0 0 N=1		3		GC GM	W	Very loose clayey silty GRAVEL, minor sand; greyish green mottled black and red; wet, non plastic. Gravel: extremely weak, slightly weathered, sub-angular to angular brick and basaltic scoria.		
		100 %	SONIC							4						
		44 %	SPT					1 1 1 1 2 1 N=5		5		SW	W	Loose fine to coarse SAND, some silt, minor shells; greyish green; wet, non plastic.	Tauranga Group	
		100 %	SONIC									SM	W	Loose silty SAND, minor shells; greyish green; wet, non plastic.		
		100 %	UT							6						
		0 %	SPT					0 0 0 0 0 0 N=0						No recovery in SPT.		
		100 %	SONIC							7		ML	W	Very soft clayey sandy SILT, minor shells, trace organics; greyish green; wet, high plasticity.		
		100 %	SPT			8/3	13/3	0 0 0 0 0 0								
						6/2	10/3	N=0		8		PT	W	Very soft organic sandy SILT, minor clay; brown speckled dark brown; wet, high plasticity.		
		100 %	SONIC			8/2	13/3					CH	M	Soft silty CLAY, trace sand, trace organics; greyish brown mottled orange; moist, high plasticity. Organics: amorphous.		
		100 %	UT			20/4	32/6			9						
		0 %	SPT					2 2 1 2				SM	W	Loose silty SAND, minor organics, trace clay; greyish green mottled dark brown; wet, non plastic		

DATE STARTED: 17/12/11
DATE FINISHED: 18/12/11
LOGGED BY: BGW
SHEAR VANE No: Geo613

DRILLED BY: Pro-drill (Auck) Ltd
EQUIPMENT: Super Sonic 1000
DRILL METHOD: Sonic
DRILL FLUID:
DIAMETER/INCLINATION: - / 90°

COMMENTS:
V.E = Vacuum Excavation. SC = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

MACHINE_BOREHOLE P:\3121\3122212\TGE\JELLICOE TO MADDEN WESTERN EDGE.GPJ BECA.GDT 24/2/12

A4 Scale 1:50

Beca

BOREHOLE No: **BH03**

MACHINE BOREHOLE LOG

SHEET 2 of 4

PROJECT: Jellicoe to Madden Western Edge — JOB NUMBER: 3122212

SITE LOCATION: Jellicoe St — CLIENT: Auckland Waterfront Development A

CIRCUIT: NZTM — BOREHOLE LOCATION: see plan

COORDINATES: N 5,921,325.42 m — R L: 4.6m CD m

E 1,756,318.61 m — DATUM:

DRILLING: FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	RQD	CASING	IN-SITU TESTS: SV	τ (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		100 %	SONIC					2 2 N=7				SM	W	Loose silty SAND, minor organics, trace clay; greyish green mottled dark brown; wet, non plastic		
		100 %	SPT			24/4	38/6	0 0 0 0 1 0 N=1		11		OH	M	Firm organic silty CLAY, minor organics, trace sand; brown speckled dark brown; moist, high plasticity. Organics: fibrous. 10.8m: moderately thick bed of silty CLAY, trace sand; green; moist, high plasticity.		
		100 %	SONIC			24/4	38/6					ML	W	Firm SILT, minor fine sand, trace organics; greyish white speckled brown; wet, non plastic. 11.9m: moderately thin bed of organic silty CLAY, minor fibrous organics; brown speckled dark brown; moist, high plasticity.		
		0 %	SPT			20/14	32/22	1 0 1 1 1 0 N=3		12						
		100 %	SONIC							13		ML	M	Very stiff SILT, minor clay, trace organics; greyish green speckled brown; moist, low plasticity. Organics: wood fragments.		
		100 %	SPT			UTP	UTP	1 3 3 4 4 4 N=15		14				Greyish green mottled dark green.		
		100 %	SONIC											Greenish grey speckled black.		
		100 %	SPT					1 1 2 2 2 1 N=7		15				15.0m: thin bed of fine to coarse SAND, minor silt; greyish green. Trace amorphous organics.		
		76 %	SONIC							16		SM	M	Grades to loose silty SAND, trace organics; greenish greyish brown speckled brown; moist, low plasticity. Organics: amorphous.	Tauranga Group *(Contd.)*	
		67 %	SPT					1 1 1 2 2 2 N=7		17		MH	M	Firm clayey SILT, trace sand, trace organics; greenish grey; moist, high plasticity. Organics: amorphous.		
		100 %	SONIC			38/6	59/10							Stiff.		
		100 %	SPT			38/10	59/16	1 2 1 2 2 3 N=8		18		MH	M	Grades to firm SILT, some clay, minor fine sand, trace organics; greenish grey; moist, high plasticity.		
		100 %	SONIC			18/4	29/6			19				Minor organics in thin beds. (Organics: charcoal fragments).		
		56 %	SPT					0 0 0 1								

DATE STARTED: 17/12/11 — DRILLED BY: Pro-drill (Auck) Ltd

DATE FINISHED: 18/12/11 — EQUIPMENT: Super Sonic 1000

LOGGED BY: BGW — DRILL METHOD: Sonic

SHEAR VANE No: Geo613 — DRILL FLUID:

DIAMETER/INCLINATION: - / 90°

COMMENTS:
V.E = Vacuum Excavation. SC = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

MACHINE_BOREHOLE P:\3123122212\TGE\JELLICOE TO MADDEN WESTERN EDGE.GPJ BECA_2A_1 24/2/12

A4 Scale 1:50

Beca

BOREHOLE No: **BH03**

MACHINE BOREHOLE LOG

SHEET 3 of 4

PROJECT: Jellicoe to Madden Western Edge — JOB NUMBER: 3122212

SITE LOCATION: Jellicoe St — CLIENT: Auckland Waterfront Development A

CIRCUIT: NZTM — BOREHOLE LOCATION: see plan

COORDINATES: N 5,921,325.42 m, E 1,756,318.61 m — R L: 4.6m CD m — DATUM:

DRILLING: FLUID LOSS	WATER LEVEL	CORE RECOVERY	METHOD	RQD	CASING	IN-SITU TESTS: SV	T (kPa)	SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		95 %	SONIC			30/10	47/16	1 1 N=3				OH	M	Firm organic silty CLAY, trace sand; brown speckled dark brown; moist, high plasticity.	Tauranga Group *(Contd.)*	
		96 %	SPT					0 1 2 3 4 5 N=14		21				21.0m: moderately thick bed of sandy SILT, minor clay, trace organics; greyish green speckled brown; wet, high plasticity.		
		95 %	SONIC							22		SM	W	Grades to medium dense silty SAND, trace shells, trace organics; greenish grey; wet, non plastic. Organics: amorphous.		
		56 %	SPT					1 1 2 2 4 4 N=12						22.2m: moderately thick bed of sandy SILT, minor clay, trace organics; greenish brown speckled, mottled dark brown; wet, high plasticity.		
		100 %	SONIC							23				23.55m: moderately thin bed of fine GRAVEL, trace silt.		
												MH	M	Stiff sandy clayey SILT, some fine to medium gravel; greenish grey; moist, high plasticity. Gravel: extremely weak, slightly weathered, sub-angular pumice.		
		89 %	SPT					1 3 3 4 4 4 N=15		24		SM	M	Medium dense silty SAND, trace gravel; greenish grey; moist, non plastic.		
												OH	M	Firm organic silty CLAY, trace organics, trace sand; brown speckled dark brown; moist, high plasticity. Organics: wood fragments.		
		95 %	SONIC							25		SM	W	Medium dense silty SAND, trace organics; greenish brown speckled dark brown; wet, non plastic.		
		100 %	SPT					1 2 4 9 6 7 N=26								
		95 %	SONIC							26		ML	M	Very stiff SILT, minor sand, minor clay; greenish grey; moist, low plasticity		
		89 %	SPT					6 8 9 11 21 9 for 35mm N=50+		27		SM	M	Medium dense silty fine SAND, trace mica; greyish green; moist, non plastic. Faint organic odour.		
		95 %	SONIC											27.2m: moderately thin bed of SILT, minor sand; dark green; moist, non plastic. Speckled brown. Greenish grey.		
										28				27.95m: moderately thin bed of SILT, minor sand, trace clay; greyish green; moist, low plasticity.		
	SC	SC	SPT					18 13 10 18 22 for 70mm N=50+				ML	M	Hard SILT, minor sand, trace clay; greyish green; moist, low plasticity.		
		95 %	SONIC							29				Minor pinkish brown clasts of highly weathered scoria. Very thin calcerous lenses on outer rim of core - drilling induced? Trace fine shell fragments.		
								16								

DATE STARTED: 17/12/11 — DRILLED BY: Pro-drill (Auck) Ltd

DATE FINISHED: 18/12/11 — EQUIPMENT: Super Sonic 1000

LOGGED BY: BGW — DRILL METHOD: Sonic

SHEAR VANE No: Geo613 — DRILL FLUID:

DIAMETER/INCLINATION: - / 90°

COMMENTS: V.E = Vacuum Excavation. SC = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

Revision A

MACHINE_BOREHOLE P:\3123\122212\TGE\JELLICOE TO MADDEN WESTERN EDGE.GPJ BECAcadT 24/2/12

A4 Scale 1:50

BOREHOLE No: **BH03**

MACHINE BOREHOLE LOG

SHEET 4 of 4

PROJECT: Jellicoe to Madden Western Edge — JOB NUMBER: 3122212

SITE LOCATION: Jellicoe St — CLIENT: Auckland Waterfront Development

CIRCUIT: NZTM — BOREHOLE LOCATION: see plan

COORDINATES: N 5,921,325.42 m, E 1,756,318.61 m — R L: 4.6m CD m — DATUM:

DRILLING: FLUID LOSS	DRILLING: WATER LEVEL	DRILLING: CORE RECOVERY	DRILLING: METHOD	DRILLING: RQD	DRILLING: CASING	IN-SITU TESTS: SV	IN-SITU TESTS: 'T' (kPa)	IN-SITU TESTS: SPT 'N'	SAMPLES	DEPTH (m)	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	R L (m)
		SC	SPT					21 21 23 6 for 20mm N=50+		31		ML	M	Hard SILT, minor sand, trace clay; greyish green; moist, low plasticity.	Waitemata Group	
		95 %	SONIC													
		SC	SPT					41 9 for 70mm N=50+						END OF LOG @ 31.58 m		
										32						
										33						
										34						
										35						
										36						
										37						
										38						
										39						

DATE STARTED: 17/12/11 — DRILLED BY: Pro-drill (Auck) Ltd

DATE FINISHED: 18/12/11 — EQUIPMENT: Super Sonic 1000

LOGGED BY: BGW — DRILL METHOD: Sonic

SHEAR VANE No: Geo613 — DRILL FLUID:

DIAMETER/INCLINATION: - / 90°

COMMENTS:
V.E = Vacuum Excavation. SC = Solid Cone SPT

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET

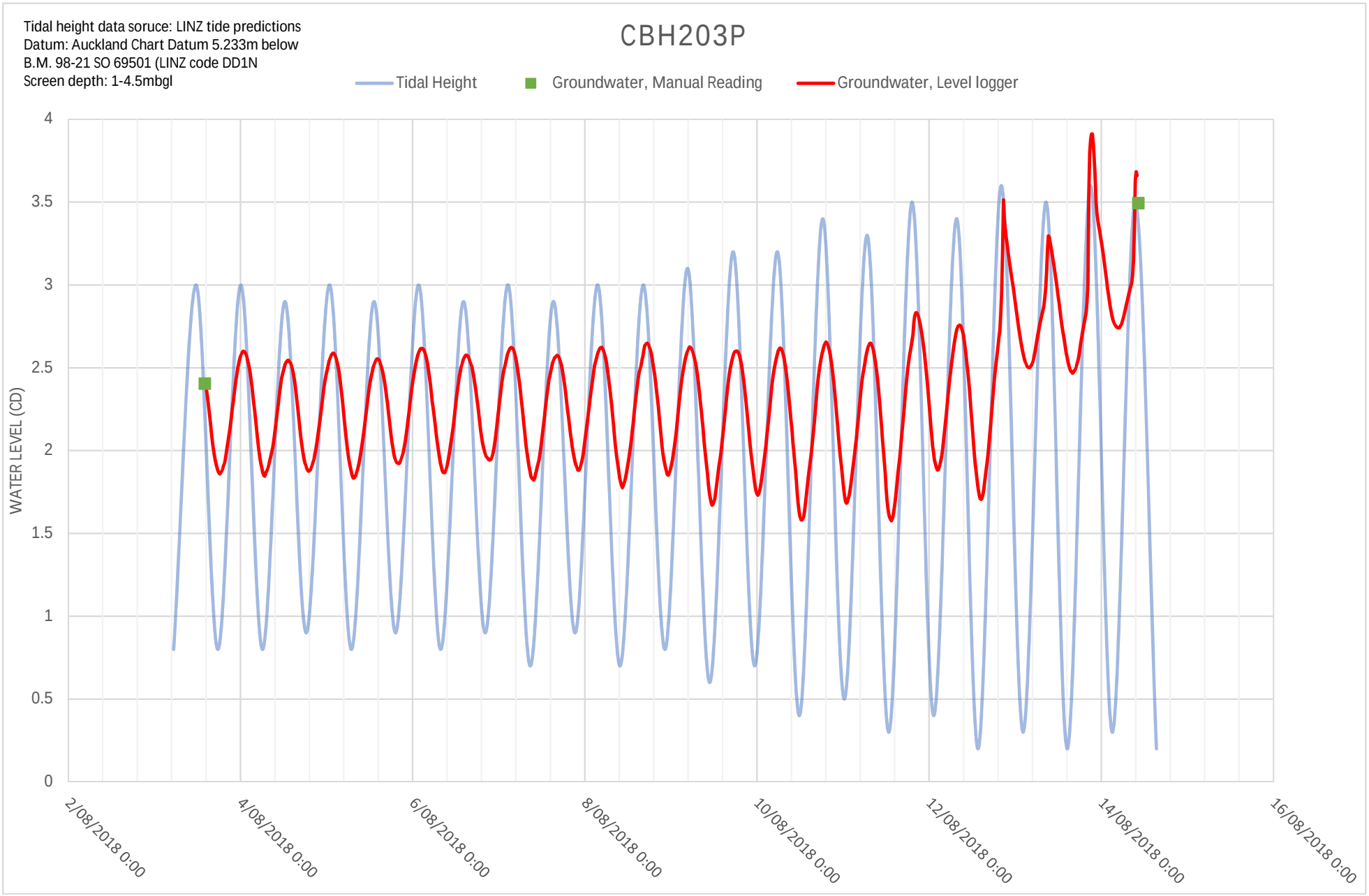
Revision A

A4 Scale 1:50

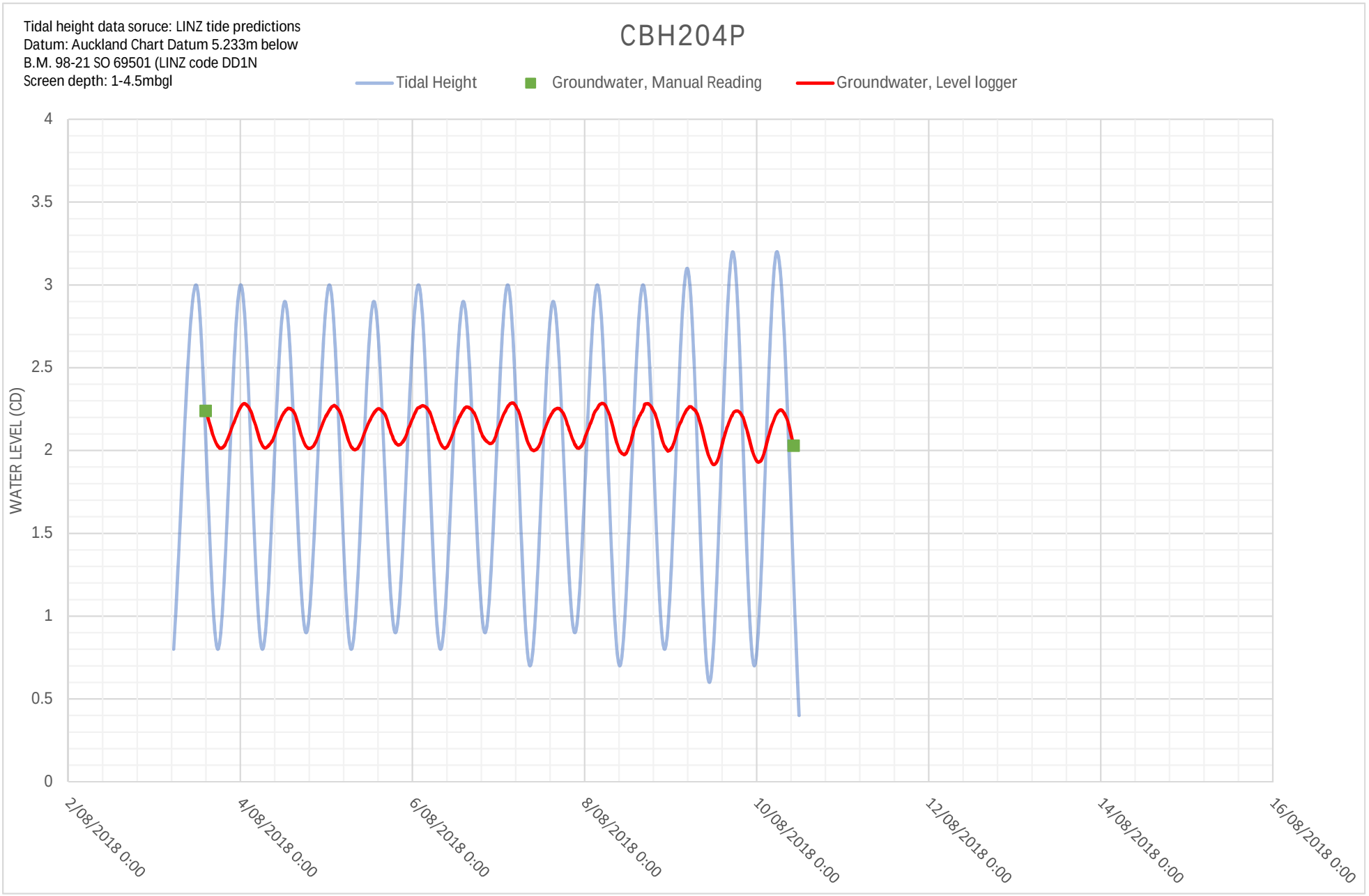
MACHINE_BOREHOLE P:\3123\122212\TGE\JELLICOE TO MADDEN WESTERN EDGE.GPJ BECA.GDT 24/2/12

Appendix J: Groundwater Monitoring Data and Tidal Variation Plots

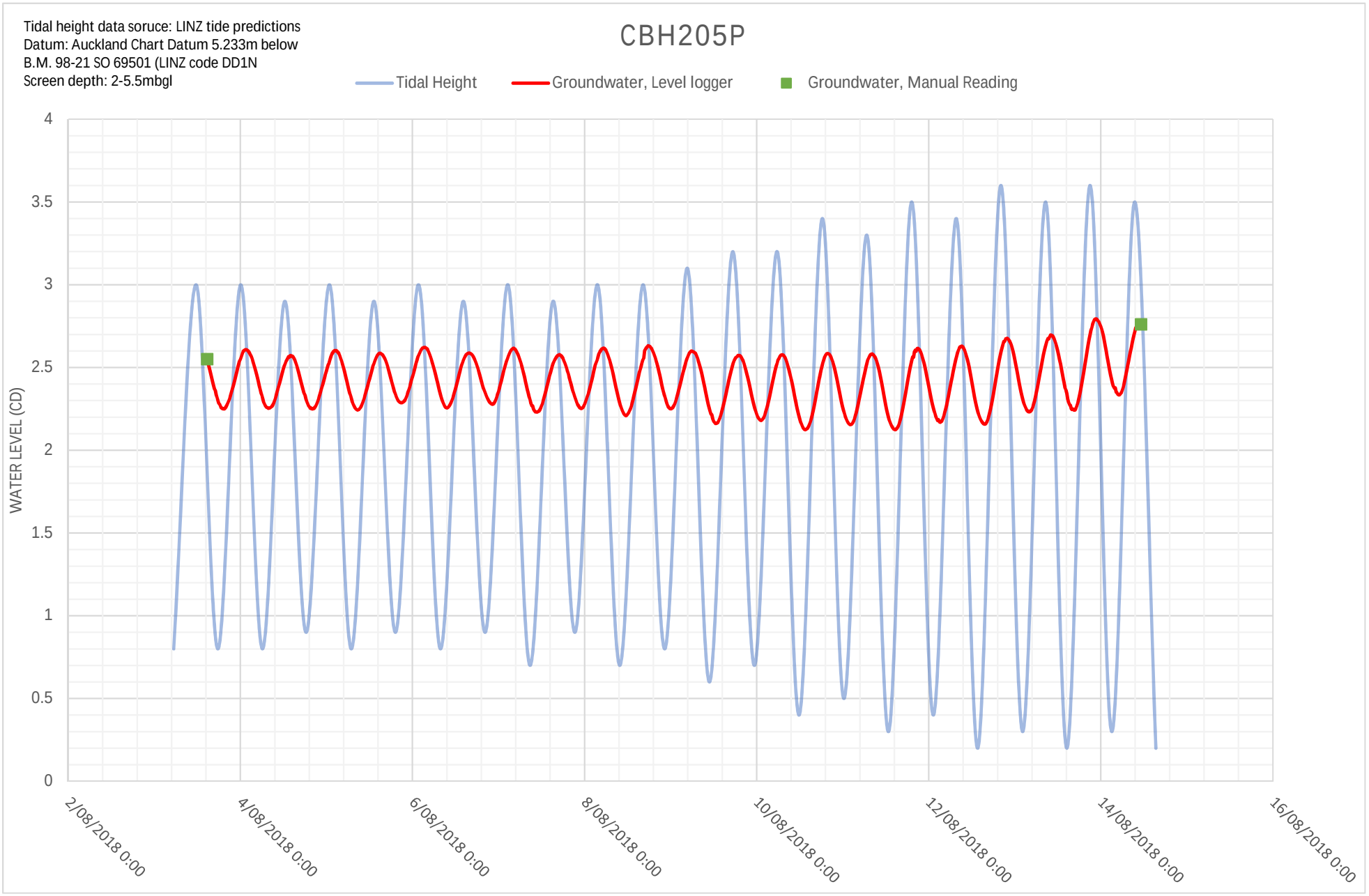
Tidal height data soruce: LINZ tide predictions
Datum: Auckland Chart Datum 5.233m below
B.M. 98-21 SO 69501 (LINZ code DD1N
Screen depth: 1-4.5mbgl



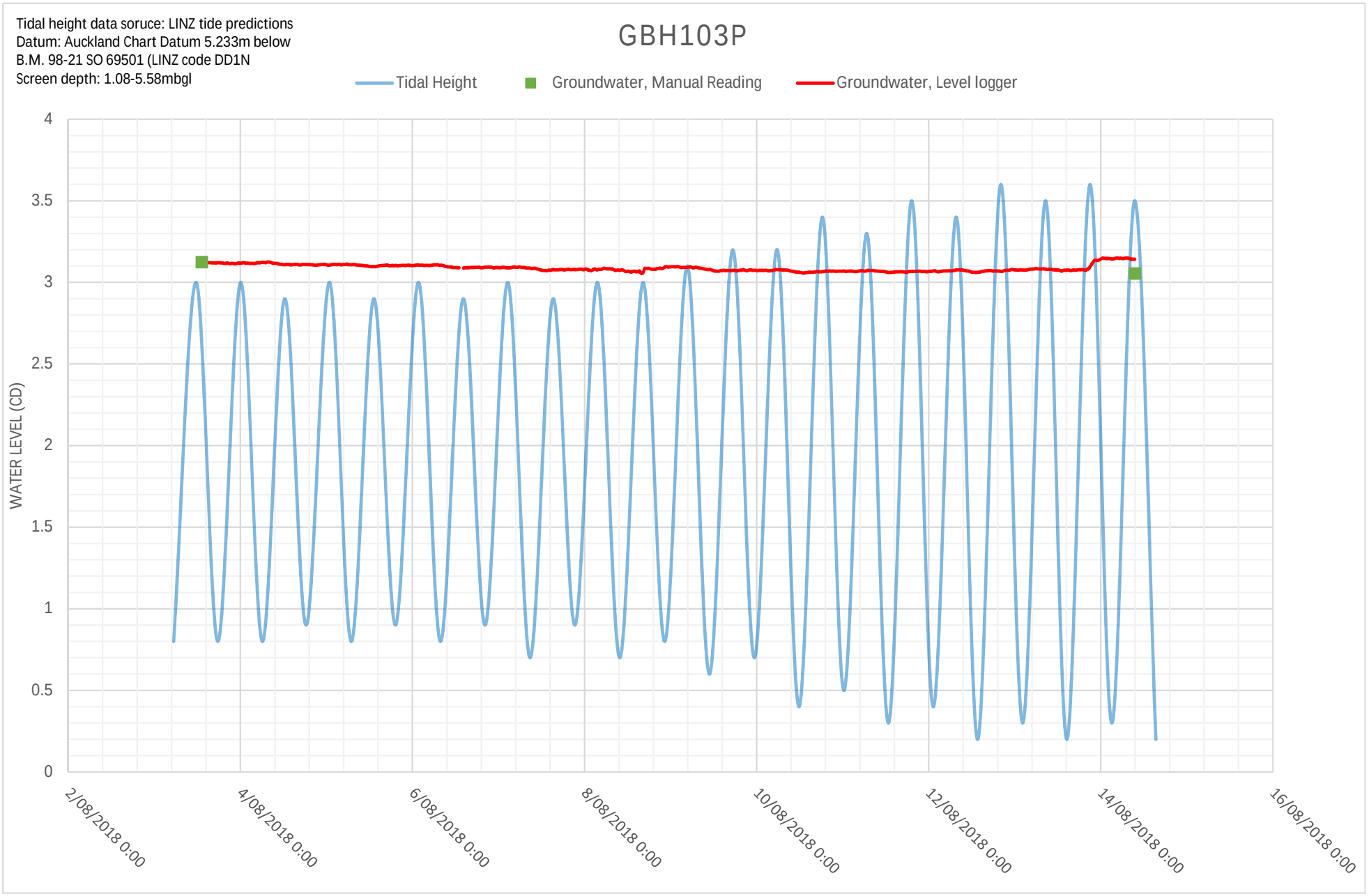
Tidal height data soruce: LINZ tide predictions
Datum: Auckland Chart Datum 5.233m below
B.M. 98-21 SO 69501 (LINZ code DD1N
Screen depth: 1-4.5mbgl



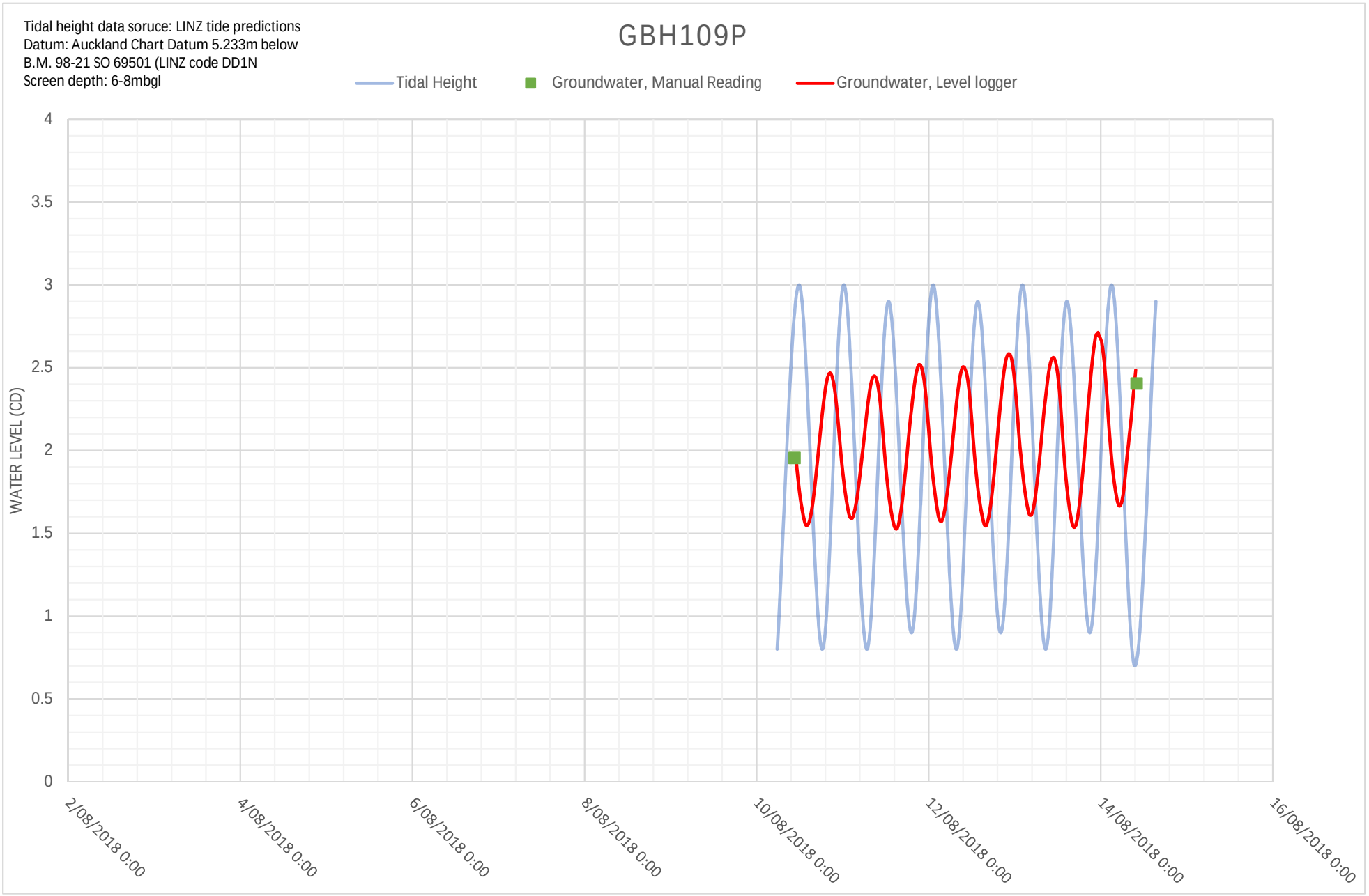
Tidal height data soruce: LINZ tide predictions
Datum: Auckland Chart Datum 5.233m below
B.M. 98-21 SO 69501 (LINZ code DD1N
Screen depth: 2-5.5mbgl



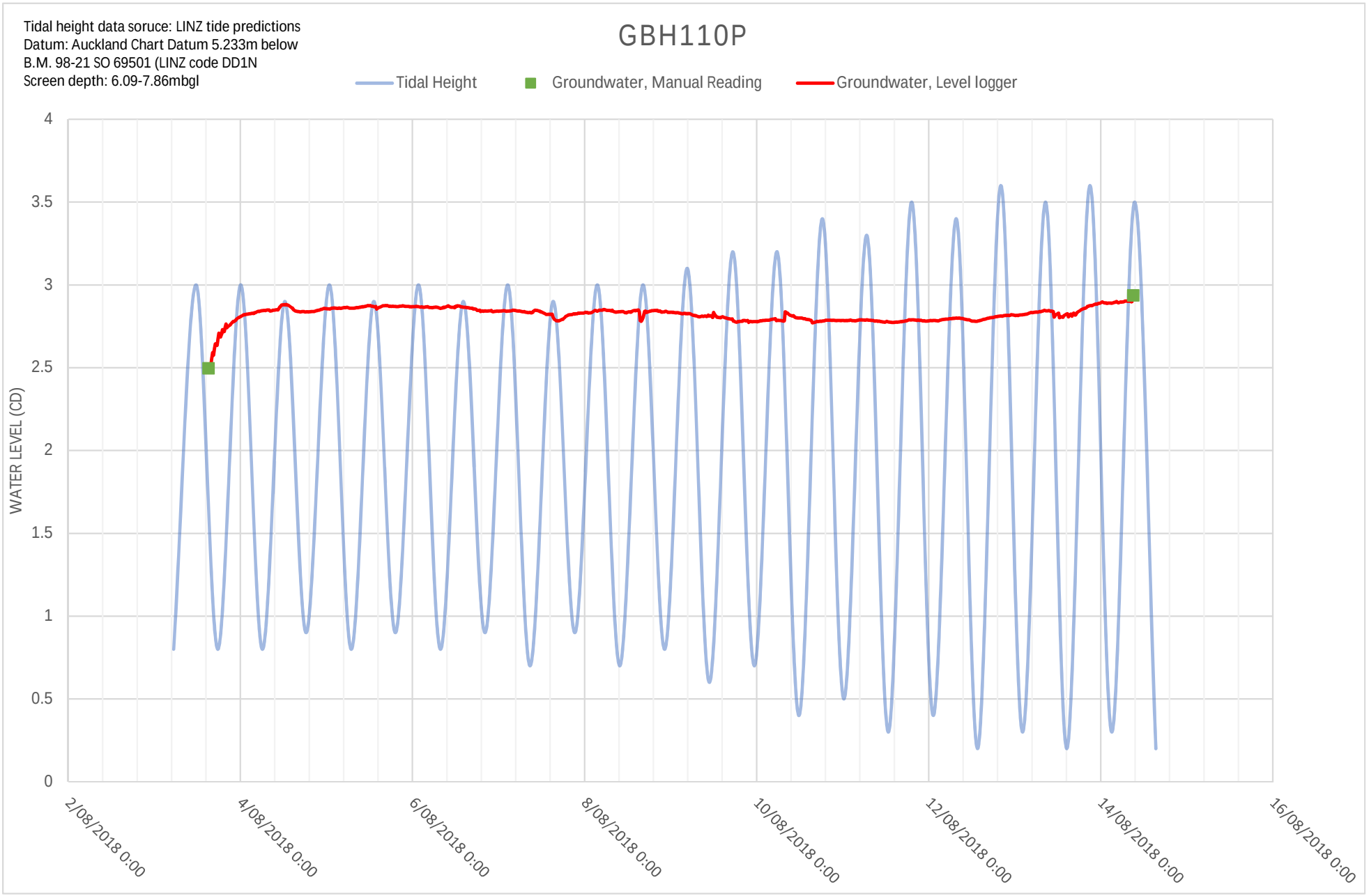
Tidal height data soruce: LINZ tide predictions
Datum: Auckland Chart Datum 5.233m below
B.M. 98-21 SO 69501 (LINZ code DD1N
Screen depth: 1.08-5.58mbgl



Tidal height data soruce: LINZ tide predictions
Datum: Auckland Chart Datum 5.233m below
B.M. 98-21 SO 69501 (LINZ code DD1N
Screen depth: 6-8mbgl



Tidal height data soruce: LINZ tide predictions
Datum: Auckland Chart Datum 5.233m below
B.M. 98-21 SO 69501 (LINZ code DD1N
Screen depth: 6.09-7.86mbgl



Tidal height data soruce: LINZ tide predictions
Ground Elevation: 4.91mRL
Datum: Auckland Chart Datum 5.233m below B.M. 98-21 SO 69501 (LINZ code DD1N)
Screen depth: 6.1-8.1mbgl

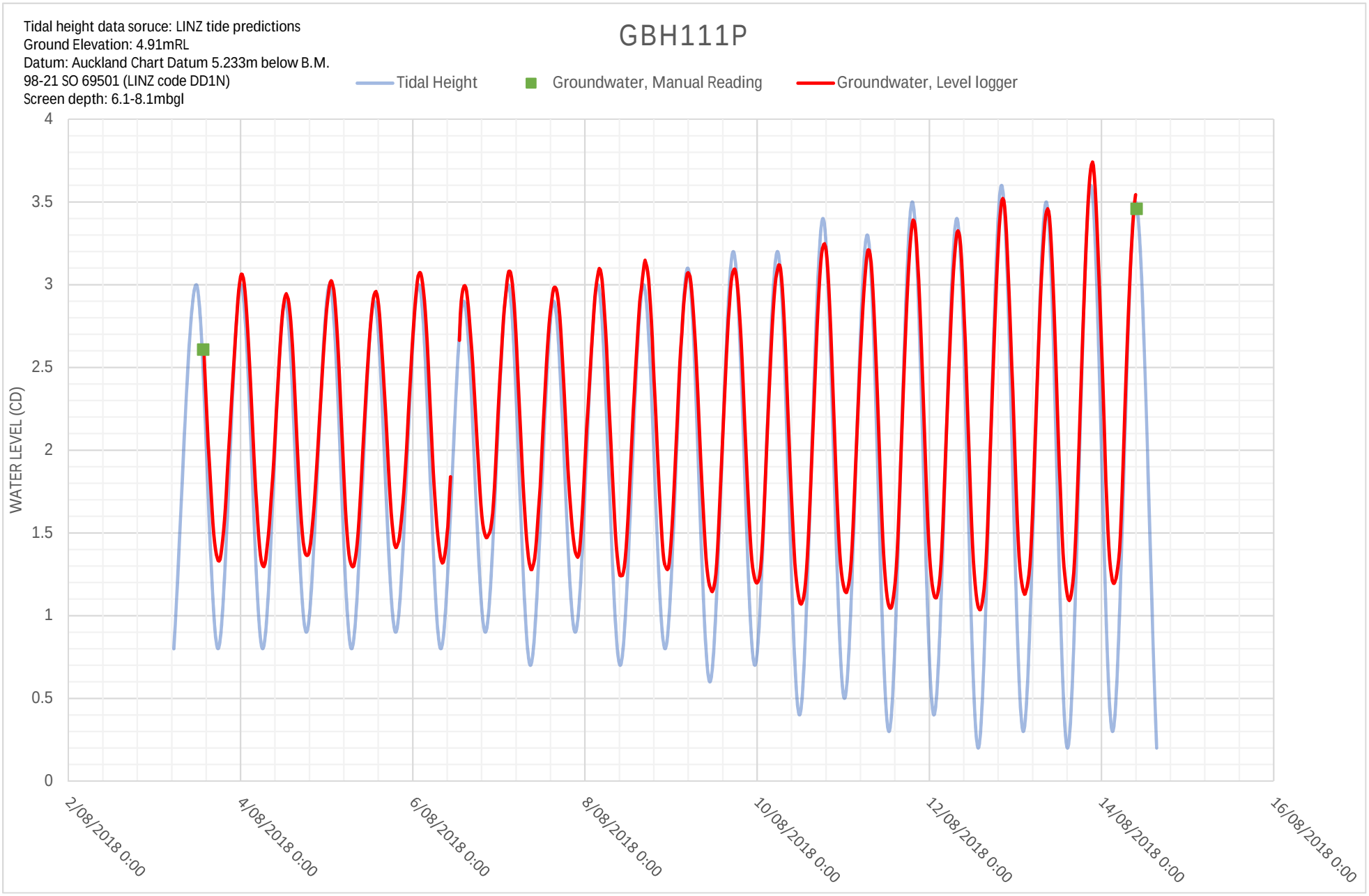


Table J. 1: Summary of groundwater observations

Monitoring well	Screen	TOC m RL	Date Gauged	Time	Head space (ppm)	LNAPL		DTW (btoc)	Water level (RL)	DTB (btoc)	Stabilised parameters						Observations during sampling
						Depth (m)	Thickness (m)				Temp (°C)	pH	EC (us/cm)	ORP	DO (mg/L)	Turbidity (NTU)	
CBH201	0.9-4.7	3.251	25/07/2018	11:00	350.2	-	-	1.82	1.431	4.01	18.2	7.23	1267	-121	1.30	0.0	Hydrocarbon odour.
CBH202	0.9-3.9	3.077	30/07/2018	13:00	259.6	Product noted	-	2.845	0.232	-	-	-	-	-	-	-	Not sampled at this time. Product thickness not measured.
			6/08/2018	10:10	172.0	3.10-3.425	0.325	3.425	-0.348	3.929	17.9	7.29	21,165	-74.1	4.37	-	-
CBH203	1.0-4.5	2.754	26/07/2018	10:35	247.6	-	-	2.332	0.422	4.135	18.4	7.13	31,217	-344.2	0.15	-	Strong fuel/hydrogen sulphide odour.
CBH204	1.0-4.5	2.894	27/07/2018	14:00	77.2	-	-	2.45	0.444	4.45	8.9	7.12	1013	-104.1	0.83	42.7	-
CBH205	2.0-5.5	3.429	30/07/2018	9:00	77	Globules	-	2.695	0.734	-	17.6	7.17	992	-134	2.94	19.7	Globules of product observed in water.
CBH206	1.5-4.5	2.904	26/07/2018	12:00	121.6	2.113-2.282	0.169	2.282	0.622	-	-	-	-	-	-	-	Not sampled.
			27/07/2018	8:30	62.9	2.06-2.07	0.01	2.09	0.814	-	18.3	6.75	4959	-157.6	0.31	0.0	Strong hydrocarbon odour. Globules in purged water. Sample broken by lab.
			1/08/2018	13:30	67.1	2.09-2.10	0.01	2.10	0.804	-	18.2	6.7	3971	-156	3.30	0.0	Resampled due to broken sample. Globules of product in purged water. Tubing stained yellow.
CBH207	1.5-4.5	3.158	26/07/2018	12:18	436	-	-	1.479	1.679	4.63	18.4	7.07	825	-159.0	0.39	1.0	Hydrocarbon odour noted.
CBH208	1.5-4.5	3.7	30/07/2018	11:20	51.2	-	-	1.955	1.745		17.4	7.2	1450	-141	2.82	7.0	Hydrocarbon odour noted.
CBH209	1.5-4.5	3.241	23/07/2018	-	180.8	-	-	1.74	1.501	4.45	-	-	-	-	-	-	Hydrocarbon odour noted. Not sampled at this time.
			3/08/2018	9:00	-	-	-	1.861	1.38	4.451	17.1	7.23	767	-106.4	0.61	-	Hydrocarbon odour noted, water was milky. No DNAPL noted in bailer sample.
GBH102	6.0-8.0	3.329	23/07/2018	-	0.6	-	-	2.44	0.889	8.085	-	-	-	-		-	Saline. Not sampled at this time.
			3/08/2018	13:00	-	-	-	2.385	0.944	8.102	19.6	7.65	13,759	-28.7	1	-	Saline.
GBH103	1.0-5.5	3.091	23/07/2018	-	40.3	-	-	1.595	1.496	5.4	-	-	-	-	-	-	Sediment in bottom. Hydrocarbon odour. Not sampled at this time.
			6/08/2018	13:20	-	-	-	1.739	1.352	5.178	19.2	6.95	1375	-106.6	9.00	36.8	-
GBH104	1.0-5.5	3.133	23/07/2018	-	54.3	2.53-2.85	0.32	2.85	0.283	5.505	-	-	-	-	-	-	Product was yellow. Not sampled at this time.
			3/08/2018	10:30	-	2.498-2.982	0.484	2.982	0.151	5.545	19.3	7.34	2765	-18.2	0.34	-	Product sampled by bailer. Saline
GBH106	1.0-4.2	3.133	1/08/2018	9:00	177.6	1.855-1.889	0.034	1.889	1.244	4.285	17.0	7.19	1068	-117.2	3.11	23.8	Hydrocarbon odour noted.
			14/08/2018	8:16	-	1.785-1.950	0.165	1.95	1.183	-	-	'-	-	-	-	-	-

Monitoring well	Screen	TOC m RL	Date Gauged	Time	Head space (ppm)	LNAPL		DTW (btoc)	Water level (RL)	DTB (btoc)	Stabilised parameters						Observations during sampling
						Depth (m)	Thickness (m)				Temp (°C)	pH	EC (us/cm)	ORP	DO (mg/L)	Turbidity (NTU)	
GBH107	1.0-4.5	3	1/08/2018	11:00	125.9	-	-	1.541	1.459	3.198	-	-	-	-	-	-	Well to be redeveloped due to sediment in bottom of well. Not sampled at this time.
			6/08/2018	15:00	-	-	-	1.586	1.414	4.045	18.6	6.4	1144	-66.5	9.04	39.9	Observable sheen on water
GBH108	1.0-4.5	3.304	26/07/2018	14:00	131.8	-	-	1.506	1.798	-	16.8	7.06	893	-139.8	0.37	4.4	-
GBH109	6.0-8.0	3.026	6/08/2018	15.1	65.0	-	-	2.922	0.104	7.948	19.7	7.75	9933	-12.5	6.88	-	Well purged dry. Recharge rate recorded. Probe detected NAPL at base of hole but bailer sample indicated the water was saline and no product present.
GBH110	6.0-8.0	2.961	31/07/2018	14:00	0.4	-	-	1.65	1.311	7.86	-	-	-	-		-	Saline. Not sampled at this time.
			3/08/2018	7:00	-	-	-	1.692	1.269	7.94	18.9	7.84	13382	-10.9	0.91	-	Saline water.
GBH111	6.0-8.0	3.047	1/08/2018	10:15	30.1	-	-	2	1.047	8.07	-	-	-	-	-	-	Saline, sampling abandoned to allow for re-developing due to sediment.
			6/08/2018	11:00	2.6	-	-	2.912	0.135	2.076	17.8	7.68	5847	-107.6	8.85	2.2	Saline
Existing MW 1			23/07/2018	-	-			2.285	0.642	4.23	-	-	-	-		-	Well cap not secure. Strong effluent smell.
		2.927	14/08/2018	11:48	-	-	-	1.76	1.167	4.245	17.4	7.21	25401	-233.1	16.2	-	Well purged dry. Strong sulphur odour. Sediment and product observed in purged water.
MW2 (Orams Facility)			23/08/2018	1430	0	-	-	2.131		4.56	19.3	6.45	18317	111.1	1.21	-	Conductivity did not stabilise. No odour observed during sampling.
MW3 (Orams Facility)			23/08/2018	1320	0	-	-	3.082		5.6	16.3	6.79	35268	-249.9	0.25	-	Hydrocarbon odour observed during sampling.
MW4 Orams Facility)			23/08/2018	1200	0	-	-	2.633		4.122	15.4	7.3	38998	196.3	2.55	-	No odour observed during sampling.

Appendix K: Vapour Monitoring Data – Site 18

- 2012 laboratory transcript
- 2018 laboratory transcript

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
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Hamilton 3240, New Zealand

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Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Tonkin & Taylor	**Lab No:**	998083	SPv1
Contact:	S Moore	**Date Registered:**	16-Apr-2012	
	C/- Tonkin & Taylor	**Date Reported:**	24-Apr-2012	
	PO Box 5271	**Quote No:**	47232	
	AUCKLAND 1141	**Order No:**	27370.019	
		Client Reference:	27370.019	
		Submitted By:	S Moore	

Sample Type: Air Sampling Canister 1.4 Litre

Sample Name:		VMP29s 12-Apr-2012 3:00 pm	VMP10s 13-Apr-2012 8:13 am	VMP23s 13-Apr-2012 10:22 am	QA1 13-Apr-2012 10:22 am	VMP14s 13-Apr-2012 1:01 pm
Lab Number:		998083.1	998083.2	998083.3	998083.4	998083.5
Whole Air Sampling Volatile Compounds						
1,1,1,2-Tetrachloroethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,1,1-Trichloroethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,1,2,2-Tetrachloroethane	ppbv	< 5	< 9	< 5	< 5	< 5
1,1,2-Trichloroethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,1-Dichloroethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,1-Dichloroethene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,2,4-Trichlorobenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,2,4-Trimethylbenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,2-Dibromoethane	ppbv	< 5	< 9	< 5	< 5	< 5
1,2-Dichlorobenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,2-Dichloroethane	ppbv	< 1.1	7	< 1.1	< 1.2	< 1.1
1,2-Dichloropropane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,3,5-Trimethylbenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,3-Butadiene	ppbv	< 5	< 9	< 5	< 5	< 5
1,3-Dichlorobenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,4-Dichlorobenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
1,4-Dioxane	ppbv	< 3	< 5	< 3	< 3	< 3
2,2,4-Trimethylpentane	ppbv	< 1.1	14,600	19.1	< 1.2	< 1.1
2-Butanone	ppbv	< 1.6	-	< 1.5	< 1.6	< 1.5
2-Chloroprene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
2-Chlorotoluene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
2-Hexanone	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
4-Ethyltoluene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
4-Methyl-2-pentanone	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Acetone	ppbv	< 5	-	5	< 5	5
Acetonitrile	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Acrolein	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Acrylonitrile	ppbv	< 1.1	-	< 1.1	< 1.2	< 1.1
Allyl chloride	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Benzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Benzyl chloride	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Bromodichloromethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Bromoethene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Bromoform	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Bromomethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Carbon disulfide	ppbv	< 3	< 5	4	4	< 3
Carbon tetrachloride	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1

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

Sample Type: Air Sampling Canister 1.4 Litre						
Sample Name:		VMP29s 12-Apr-2012 3:00 pm	VMP10s 13-Apr-2012 8:13 am	VMP23s 13-Apr-2012 10:22 am	QA1 13-Apr-2012 10:22 am	VMP14s 13-Apr-2012 1:01 pm
Lab Number:		998083.1	998083.2	998083.3	998083.4	998083.5
Whole Air Sampling Volatile Compounds						
Chlorobenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Chloroethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Chloroform	ppbv	< 1.1	< 3	3.0	< 1.2	< 1.1
Chloromethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
cis-1,2-Dichloroethene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
cis-1,3-Dichloropropene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Cyclohexane	ppbv	< 1.1	2,000	2.8	2.8	< 1.1
Dibromochloromethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Dichlorodifluoromethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Dichlorotetrafluoroethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Diisopropyl ether	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Ethyl acetate	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Ethylbenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Ethyl-tert-butyl ether	ppbv	< 1.3	< 3	< 1.3	< 1.4	< 1.3
Heptane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Hexachlorobutadiene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Hexane	ppbv	< 1.1	76	< 1.1	< 1.2	< 1.1
Cumene (Isopropylbenzene)	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Methyl methacrylate	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Methyl tert-butyl ether	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Methylene chloride	ppbv	< 7	< 13	< 7	< 7	< 7
Naphthalene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
n-Butylbenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
n-Propylbenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
o-Xylene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
m,p-Xylene	ppbv	< 1.3	< 3	< 1.3	< 1.4	< 1.3
Cymene (2-Isopropyltoluene)	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Propene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
sec-Butylbenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Styrene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
tert-Amyl methyl ether	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
tert-Butyl alcohol	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
tert-Butylbenzene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Tetrachloroethene	ppbv	10.9	< 3	1.1	< 1.2	< 1.1
Tetrahydrofuran	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Toluene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
trans-1,2-Dichloroethene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
trans-1,3-Dichloropropene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Trichloroethene	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Trichlorofluoromethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Trichlorotrifluoroethane	ppbv	< 1.1	< 3	< 1.1	< 1.2	< 1.1
Vinyl acetate	ppbv	< 5	-	< 5	< 5	< 5
Vinyl chloride	ppbv	< 1.3	< 3	< 1.3	< 1.4	< 1.3
Whole Air Sampling Volatile Compounds TPH						
C5 TPH referenced to *n*-heptane	ppbv	< 110	13,600	< 110	< 120	< 110
C6 TPH referenced to *n*-heptane	ppbv	< 300	26,000	< 300	< 300	< 300
C7 TPH referenced to *n*-heptane	ppbv	< 300	10,600	< 300	< 300	< 300
C8 TPH referenced to *n*-heptane	ppbv	< 300	1,580	< 300	< 300	< 300
C9 TPH referenced to *n*-heptane	ppbv	< 500	810	< 500	< 500	< 500
C10 TPH referenced to *n*-heptane	ppbv	< 300	< 500	< 300	< 300	< 300
C11 TPH referenced to *n*-heptane	ppbv	< 110	< 300	< 110	< 120	< 110
C12-C14 TPH referenced to *n*-heptane	ppbv	< 110	< 300	< 110	< 120	< 110
C7-C9 TPH referenced to *n*-heptane	ppbv	< 900	13,000	< 900	< 900	< 900
C10-C14 TPH referenced to *n*-heptane	ppbv	< 500	< 900	< 500	< 500	< 500

Sample Type: Air Sampling Canister 1.4 Litre						
Sample Name:		VMP29s 12-Apr-2012 3:00 pm	VMP10s 13-Apr-2012 8:13 am	VMP23s 13-Apr-2012 10:22 am	QA1 13-Apr-2012 10:22 am	VMP14s 13-Apr-2012 1:01 pm
Lab Number:		998083.1	998083.2	998083.3	998083.4	998083.5
Whole Air Sampling Volatile Compounds TPH ug/m³						
C5 TPH referenced to *n*-heptane	µg/m³	< 400	40,000	< 400	< 400	< 300
C6 TPH referenced to *n*-heptane	µg/m³	< 800	93,000	< 800	< 800	< 800
C7 TPH referenced to *n*-heptane	µg/m³	< 900	43,000	< 900	< 1,000	< 900
C8 TPH referenced to *n*-heptane	µg/m³	< 1,100	7,400	< 1,000	< 1,100	< 1,000
C9 TPH referenced to *n*-heptane	µg/m³	< 3,000	4,300	< 3,000	< 3,000	< 3,000
C10 TPH referenced to *n*-heptane	µg/m³	< 1,300	< 3,000	< 1,300	< 1,300	< 1,200
C11 TPH referenced to *n*-heptane	µg/m³	< 700	< 1,300	< 700	< 800	< 700
C12-C14 TPH referenced to *n*-heptane	µg/m³	< 900	< 1,600	< 800	< 900	< 800
C7-C9 TPH referenced to *n*-heptane	µg/m³	< 5,000	55,000	< 5,000	< 5,000	< 4,000
C10-C14 TPH referenced to *n*-heptane	µg/m³	< 3,000	< 6,000	< 3,000	< 3,000	< 3,000
Whole Air Sampling Volatile Compounds ug/m3						
1,1,1,2-Tetrachloroethane	µg/m³	< 8	< 14	< 8	< 8	< 7
1,1,1-Trichloroethane	µg/m³	< 6	< 11	< 6	< 7	< 6
1,1,2,2-Tetrachloroethane	µg/m³	< 30	< 60	< 30	< 40	< 30
1,1,2-Trichloroethane	µg/m³	< 6	< 11	< 6	< 7	< 6
1,1-Dichloroethane	µg/m³	< 5	< 9	< 5	< 5	< 5
1,1-Dichloroethene	µg/m³	< 5	< 8	< 5	< 5	< 5
1,2,4-Trichlorobenzene	µg/m³	< 8	< 15	< 8	< 9	< 8
1,2,4-Trimethylbenzene	µg/m³	< 6	< 10	< 6	< 6	< 5
1,2-Dibromoethane	µg/m³	< 40	< 70	< 40	< 40	< 40
1,2-Dichlorobenzene	µg/m³	< 7	< 13	< 7	< 7	< 7
1,2-Dichloroethane	µg/m³	< 5	27	< 5	< 5	< 5
1,2-Dichloropropane	µg/m³	< 5	< 10	< 5	< 6	< 5
1,3,5-Trimethylbenzene	µg/m³	< 6	< 10	< 6	< 6	< 5
1,3-Butadiene	µg/m³	< 10	< 18	< 10	< 10	< 9
1,3-Dichlorobenzene	µg/m³	< 7	< 13	< 7	< 7	< 7
1,4-Dichlorobenzene	µg/m³	< 7	< 13	< 7	< 7	< 7
1,4-Dioxane	µg/m³	< 8	< 15	< 8	< 8	< 8
2,2,4-Trimethylpentane	µg/m³	< 6	68,000	89	< 6	< 5
2-Butanone	µg/m³	< 5	-	< 5	< 5	< 5
2-Chloroprene	µg/m³	< 4	< 8	< 4	< 5	< 4
2-Chlorotoluene	µg/m³	< 6	< 11	< 6	< 6	< 6
2-Hexanone	µg/m³	< 5	< 9	< 5	< 5	< 5
4-Ethyltoluene	µg/m³	< 6	< 10	< 6	< 6	< 5
4-Methyl-2-pentanone	µg/m³	< 5	< 9	< 5	< 5	< 5
Acetone	µg/m³	< 11	-	11	< 11	13
Acetonitrile	µg/m³	< 2	< 4	< 2	< 2	< 2
Acrolein	µg/m³	< 3	< 5	< 3	< 3	< 3
Acrylonitrile	µg/m³	< 3	-	< 3	< 3	< 3
Allyl chloride	µg/m³	< 4	< 7	< 4	< 4	< 4
Benzene	µg/m³	< 4	< 7	< 4	< 4	< 4
Benzyl chloride	µg/m³	< 6	< 11	< 6	< 6	< 6
Bromodichloromethane	µg/m³	< 8	< 14	< 7	< 8	< 7
Bromoethene	µg/m³	< 5	< 9	< 5	< 5	< 5
Bromoform	µg/m³	< 12	< 30	< 11	< 12	< 11
Bromomethane	µg/m³	< 5	< 8	< 5	< 5	< 4
Carbon disulfide	µg/m³	< 7	< 13	11	11	< 7
Carbon tetrachloride	µg/m³	< 7	< 13	< 7	< 7	< 7
Chlorobenzene	µg/m³	< 5	< 10	< 5	< 6	< 5
Chloroethane	µg/m³	< 3	< 6	< 3	< 3	< 3
Chloroform	µg/m³	< 6	< 10	15	< 6	< 5
Chloromethane	µg/m³	< 3	< 5	< 3	< 3	< 3
cis-1,2-Dichloroethene	µg/m³	< 5	< 8	< 5	< 5	< 5
cis-1,3-Dichloropropene	µg/m³	< 5	< 10	< 5	< 6	< 5

Sample Type: Air Sampling Canister 1.4 Litre						
Sample Name:		VMP29s 12-Apr-2012 3:00 pm	VMP10s 13-Apr-2012 8:13 am	VMP23s 13-Apr-2012 10:22 am	QA1 13-Apr-2012 10:22 am	VMP14s 13-Apr-2012 1:01 pm
Lab Number:		998083.1	998083.2	998083.3	998083.4	998083.5
Whole Air Sampling Volatile Compounds ug/m3						
Cyclohexane	µg/m³	< 4	6,900	10	10	< 4
Dibromochloromethane	µg/m³	< 10	< 18	< 9	< 10	< 9
Dichlorodifluoromethane	µg/m³	< 6	< 10	< 6	< 6	< 6
Dichlorotetrafluoroethane	µg/m³	< 8	< 15	< 8	< 8	< 8
Diisopropyl ether	µg/m³	< 5	< 9	< 5	< 5	< 5
Ethyl acetate	µg/m³	< 4	< 8	< 4	< 4	< 4
Ethylbenzene	µg/m³	< 5	< 9	< 5	< 5	< 5
Ethyl-tert-butyl ether	µg/m³	< 6	< 11	< 6	< 6	< 6
Heptane	µg/m³	< 5	< 9	< 5	< 5	< 5
Hexachlorobutadiene	µg/m³	< 12	< 30	< 12	< 12	< 11
Hexane	µg/m³	< 4	270	< 4	< 4	< 4
Cumene (Isopropylbenzene)	µg/m³	< 6	< 10	< 6	< 6	< 5
Methyl methacrylate	µg/m³	< 5	< 9	< 5	< 5	< 5
Methyl tert-butyl ether	µg/m³	< 4	< 8	< 4	< 4	< 4
Methylene chloride	µg/m³	< 30	< 50	< 30	< 30	< 30
Naphthalene	µg/m³	< 6	< 11	< 6	< 6	< 6
n-Butylbenzene	µg/m³	< 6	< 12	< 6	< 7	< 6
n-Propylbenzene	µg/m³	< 6	< 10	< 6	< 6	< 5
o-Xylene	µg/m³	< 5	< 9	< 5	< 5	< 5
m,p-Xylene	µg/m³	< 12	< 30	< 11	< 12	< 11
Cymene (2-Isopropyltoluene)	µg/m³	< 6	< 12	< 6	< 7	< 6
Propene	µg/m³	< 2	< 4	< 2	< 2	< 2
sec-Butylbenzene	µg/m³	< 6	< 12	< 6	< 7	< 6
Styrene	µg/m³	< 5	< 9	< 5	< 5	< 5
tert-Amyl methyl ether	µg/m³	< 5	< 9	< 5	< 5	< 5
tert-Butyl alcohol	µg/m³	< 4	< 7	< 4	< 4	< 4
tert-Butylbenzene	µg/m³	< 6	< 12	< 6	< 7	< 6
Tetrachloroethene	µg/m³	74	< 14	7	< 8	< 7
Tetrahydrofuran	µg/m³	< 4	< 6	< 4	< 4	< 3
Toluene	µg/m³	< 5	< 8	< 4	< 5	< 4
trans-1,2-Dichloroethene	µg/m³	< 5	< 8	< 5	< 5	< 5
trans-1,3-Dichloropropene	µg/m³	< 5	< 9	< 5	< 5	< 5
Trichloroethene	µg/m³	< 6	< 11	< 6	< 6	< 6
Trichlorofluoromethane	µg/m³	< 7	< 12	< 6	< 7	< 6
Trichlorotrifluoroethane	µg/m³	< 9	< 16	< 8	< 9	< 8
Vinyl acetate	µg/m³	< 16	-	< 15	< 16	< 15
Vinyl chloride	µg/m³	< 4	< 7	< 4	< 4	< 4

Analyst's Comments

Acetone, acrylonitrile, vinyl acetate and 2-butanone could not be reported for sample 998083.2 (VMP10s) due to hydrocarbon interference.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Air Sampling Canister 1.4 Litre			
Test	**Method Description**	**Default Detection Limit**	**Samples**
Whole Air Sampling Volatile Compounds	Whole air analysed by active SPME-GC-MS. Sample diluted with zero air by a factor of 2. µ/m3 = (ppbv * Mr)/24.45. Assumes STP (25°C 1 atm pressure). US EPA TO-15.	-	1-5
Whole Air Sampling Volatile Compounds TPH	Whole air analysed by active SPME-GC-MS. Sample diluted with zero air by a factor of 2. µ/m3 = (ppbv * Mr)/24.45. Assumes STP (25°C 1 atm pressure). US EPA TO-15.	-	1-5

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

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

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Peter Robinson MSc (Hons), PhD, FNZIC
Client Services Manager - Environmental Division

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2023996 SPv1
Contact:	Lucy Hine	**Date Received:**	31-Jul-2018
	C/- Tonkin & Taylor	**Date Reported:**	10-Aug-2018
	PO Box 13055	**Quote No:**	93718
	Christchurch 8141	**Order No:**	30881.2000
		Client Reference:	30881.2000
		Add. Client Ref:	Sampled on: 31.7.18
		Submitted By:	Cherise Martin

Sample Type: Air Sampling Canister 1.4 Litre

Sample Name:		VP6 [10:?-10:06 222 2020730.5] 31-Jul-2018	VP5 [10:38-10:50 1333 2020730.6] 31-Jul-2018	VP4 [11:07-11:18 514 2020730.3] 31-Jul-2018	VP3 [11:33-11:44 507 2020730.2] 31-Jul-2018	VP2 [12:?-12:? 1337 2020730.4] 31-Jul-2018
Lab Number:		2023996.1	2023996.2	2023996.3	2023996.4	2023996.6
Whole Air Sampling Volatile Compounds						
Canister Sample Volume*	L	1.274	1.146	1.308	1.207	1.299
1,1,1-Trichloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,1,2,2-Tetrachloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,1,2-Trichloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,1-Dichloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,1-Dichloroethene	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,2,4-Trichlorobenzene	ppbv	< 110	< 1.1	< 12	< 3	< 3
1,2,4-Trimethylbenzene	ppbv	< 110	< 1.1	< 12	< 3	< 3
1,2-Dibromoethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,2-Dichlorobenzene	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,2-Dichloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,2-Dichloropropane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,3,5-Trimethylbenzene	ppbv	< 110	< 1.1	< 12	< 3	< 3
1,3-Dichlorobenzene	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,4-Dichlorobenzene	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,4-Dioxane	ppbv	< 5	< 3	< 30	< 5	< 5
2,2,4-Trimethylpentane	ppbv	15,900	125	510,000	8,300	5,400
2-Butanone	ppbv	< 4	< 1.5	< 17	< 4	< 4
2-Chlorotoluene	ppbv	< 3	< 1.1	< 12	< 3	< 3
2-Hexanone	ppbv	< 3	< 1.1	< 12	< 3	< 3
4-Ethyltoluene	ppbv	< 3	< 1.1	< 12	< 3	< 3
4-Methyl-2-pentanone	ppbv	< 3	< 1.1	< 12	< 3	< 3
Acetone	ppbv	< 9	< 5	< 50	< 10	< 10
Acrolein	ppbv	< 3	< 1.1	< 12	< 3	< 3
Allyl chloride	ppbv	< 3	< 1.1	< 12	< 3	< 3
Benzene	ppbv	3	< 1.1	< 12	< 3	< 3
Benzyl chloride	ppbv	< 3	< 1.1	< 12	< 3	< 3
Bromodichloromethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Bromoethene	ppbv	< 3	< 1.1	< 12	< 3	< 3
Bromoform	ppbv	< 3	< 1.1	< 12	< 3	< 3
Bromomethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Carbon disulfide	ppbv	16	< 3	< 30	< 5	< 5
Carbon tetrachloride	ppbv	< 3	< 1.1	< 12	< 3	< 3
Chlorobenzene	ppbv	< 3	< 1.1	< 12	< 3	< 3
Chloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Chloroform	ppbv	< 3	< 1.1	< 12	< 3	< 3

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Sample Type: Air Sampling Canister 1.4 Litre						
Sample Name:		VP6 [10:?-10:06 222 2020730.5] 31-Jul-2018	VP5 [10:38-10:50 1333 2020730.6] 31-Jul-2018	VP4 [11:07-11:18 514 2020730.3] 31-Jul-2018	VP3 [11:33-11:44 507 2020730.2] 31-Jul-2018	VP2 [12:?-12:? 1337 2020730.4] 31-Jul-2018
Lab Number:		2023996.1	2023996.2	2023996.3	2023996.4	2023996.6
Whole Air Sampling Volatile Compounds						
Chloromethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
cis-1,2-Dichloroethene	ppbv	< 3	< 1.1	26	< 3	< 3
cis-1,3-Dichloropropene	ppbv	< 3	< 1.1	< 12	< 3	< 3
Cyclohexane	ppbv	1,140	17.9	< 12	350	640
Dichlorodifluoromethane	ppbv	< 5	< 5	< 12	< 5	< 5
Dichlorotetrafluoroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Ethyl acetate	ppbv	< 3	< 1.1	< 12	< 3	< 3
Ethylbenzene	ppbv	< 3	< 1.1	< 12	< 3	< 3
Heptane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Hexachlorobutadiene	ppbv	< 110	< 1.1	< 12	< 3	< 3
Hexane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Cumene (Isopropylbenzene)	ppbv	< 110	3.2	97	6	4
Methyl methacrylate	ppbv	< 9	< 5	< 50	< 10	< 10
Methyl tert-butyl ether	ppbv	< 3	< 1.1	< 12	< 3	< 3
Methylene chloride	ppbv	< 14	< 7	< 70	< 15	< 14
Naphthalene	ppbv	< 110	< 1.1	< 12	< 3	< 3
n-Propylbenzene	ppbv	< 110	7.7	88	7	5
o-Xylene	ppbv	< 110	< 1.1	< 12	< 3	< 3
m,p-Xylene	ppbv	< 130	< 1.3	< 14	< 3	< 3
Propene	ppbv	310	2.3	< 12	< 3	< 3
Styrene	ppbv	< 3	4.6	< 12	< 3	3
tert-Butyl alcohol	ppbv	< 3	< 1.1	< 12	< 3	< 3
Tetrachloroethene	ppbv	< 3	1.6	440	77	11
Tetrahydrofuran	ppbv	< 3	< 1.1	< 12	< 3	< 3
Toluene	ppbv	55	64	< 12	25	29
trans-1,2-Dichloroethene	ppbv	< 3	< 1.1	< 12	< 3	< 3
trans-1,3-Dichloropropene	ppbv	< 3	< 1.1	< 12	< 3	< 3
Trichloroethene	ppbv	< 3	< 1.1	59	4	< 3
Trichlorofluoromethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Trichlorotrifluoroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Vinyl acetate	ppbv	< 3	< 1.1	< 12	< 3	< 3
Vinyl chloride*	ppbv	< 3	< 1.3	< 14	< 3	< 3
Whole Air Sampling Volatile Compounds TPH						
C5 TPH referenced to *n*-heptane	ppbv	26,000	1,240	42,000	6,600	4,900
C6 TPH referenced to *n*-heptane	ppbv	50,000	1,800	1,200,000	27,000	14,500
C7 TPH referenced to *n*-heptane	ppbv	68,000	2,100	700,000	41,000	16,700
C8 TPH referenced to *n*-heptane	ppbv	104,000	2,000	79,000	16,700	8,600
C9 TPH referenced to *n*-heptane	ppbv	98,000	2,900	66,000	21,000	13,200
C10 TPH referenced to *n*-heptane	ppbv	15,200	1,670	20,000	8,600	8,100
C11 TPH referenced to *n*-heptane	ppbv	1,550	710	1,600	1,600	1,850
C12-C14 TPH referenced to *n*-heptane	ppbv	300	400	< 1,200	370	430
C7-C9 TPH referenced to *n*-heptane	ppbv	270,000	7,000	850,000	79,000	39,000
C10-C14 TPH referenced to *n*-heptane	ppbv	17,100	2,800	22,000	10,600	10,300
Whole Air Sampling Volatile Compounds TPH ug/m³						
C5 TPH referenced to *n*-heptane	µg/m³	76,000	3,700	124,000	19,600	14,300
C6 TPH referenced to *n*-heptane	µg/m³	175,000	6,300	4,200,000	95,000	51,000
C7 TPH referenced to *n*-heptane	µg/m³	280,000	8,600	2,900,000	168,000	68,000
C8 TPH referenced to *n*-heptane	µg/m³	490,000	9,500	370,000	78,000	40,000
C9 TPH referenced to *n*-heptane	µg/m³	510,000	15,300	340,000	110,000	69,000
C10 TPH referenced to *n*-heptane	µg/m³	89,000	9,700	119,000	50,000	47,000
C11 TPH referenced to *n*-heptane	µg/m³	9,900	4,600	10,200	10,200	11,800
C12-C14 TPH referenced to *n*-heptane	µg/m³	2,300	3,000	< 9,000	2,800	3,200
C7-C9 TPH referenced to *n*-heptane	µg/m³	1,280,000	33,000	3,600,000	360,000	178,000
C10-C14 TPH referenced to *n*-heptane	µg/m³	101,000	17,300	129,000	63,000	62,000

Sample Type: Air Sampling Canister 1.4 Litre						
Sample Name:		VP6 [10:?-10:06 222 2020730.5] 31-Jul-2018	VP5 [10:38-10:50 1333 2020730.6] 31-Jul-2018	VP4 [11:07-11:18 514 2020730.3] 31-Jul-2018	VP3 [11:33-11:44 507 2020730.2] 31-Jul-2018	VP2 [12:?-12:? 1337 2020730.4] 31-Jul-2018
Lab Number:		2023996.1	2023996.2	2023996.3	2023996.4	2023996.6
Whole Air Sampling Volatile Compounds ug/m3						
1,1,1-Trichloroethane	µg/m³	< 13	< 6	< 70	< 13	< 13
1,1,2,2-Tetrachloroethane	µg/m³	< 16	< 8	< 80	< 17	< 16
1,1,2-Trichloroethane	µg/m³	< 13	< 6	< 70	< 13	< 13
1,1-Dichloroethane	µg/m³	< 10	< 5	< 50	< 10	< 10
1,1-Dichloroethene	µg/m³	< 9	< 5	< 50	< 10	< 10
1,2,4-Trichlorobenzene	µg/m³	< 800	< 8	< 90	< 18	< 18
1,2,4-Trimethylbenzene	µg/m³	< 500	< 6	< 60	< 12	< 12
1,2-Dibromoethane	µg/m³	< 18	< 9	< 90	< 18	< 18
1,2-Dichlorobenzene	µg/m³	< 14	< 7	< 70	< 15	< 14
1,2-Dichloroethane	µg/m³	< 10	< 5	< 50	< 10	< 10
1,2-Dichloropropane	µg/m³	< 11	< 5	< 60	< 11	< 11
1,3,5-Trimethylbenzene	µg/m³	< 500	< 6	< 60	< 12	< 12
1,3-Dichlorobenzene	µg/m³	< 14	< 7	< 70	< 15	< 14
1,4-Dichlorobenzene	µg/m³	< 14	< 7	< 70	< 15	< 14
1,4-Dioxane	µg/m³	< 17	< 8	< 90	< 17	< 17
2,2,4-Trimethylpentane	µg/m³	74,000	580	2,400,000	39,000	25,000
2-Butanone	µg/m³	< 10	< 5	< 50	< 10	< 10
2-Chlorotoluene	µg/m³	< 12	< 6	< 60	< 13	< 13
2-Hexanone	µg/m³	< 10	< 5	< 50	< 10	< 10
4-Ethyltoluene	µg/m³	< 11	< 6	< 60	< 12	< 12
4-Methyl-2-pentanone	µg/m³	< 10	< 5	< 50	< 10	< 10
Acetone	µg/m³	< 30	< 11	< 110	< 30	< 30
Acrolein	µg/m³	< 6	< 3	< 30	< 6	< 6
Allyl chloride	µg/m³	< 7	< 4	< 40	< 8	< 8
Benzene	µg/m³	8	< 4	< 40	< 8	< 8
Benzyl chloride	µg/m³	< 12	< 6	< 60	< 13	< 13
Bromodichloromethane	µg/m³	< 15	< 8	< 80	< 16	< 16
Bromoethene	µg/m³	< 10	< 5	< 60	< 11	< 11
Bromoform	µg/m³	< 30	< 11	< 120	< 30	< 30
Bromomethane	µg/m³	< 9	< 5	< 50	< 10	< 10
Carbon disulfide	µg/m³	51	< 7	< 80	< 15	< 15
Carbon tetrachloride	µg/m³	< 15	< 7	< 80	< 15	< 15
Chlorobenzene	µg/m³	< 11	< 5	< 60	< 11	< 11
Chloroethane	µg/m³	< 6	< 3	< 40	< 7	< 7
Chloroform	µg/m³	< 11	< 6	< 60	< 12	< 12
Chloromethane	µg/m³	< 5	< 3	< 30	< 5	< 5
cis-1,2-Dichloroethene	µg/m³	< 9	< 5	103	< 10	< 10
cis-1,3-Dichloropropene	µg/m³	< 11	< 5	< 60	< 11	< 11
Cyclohexane	µg/m³	3,900	62	< 40	1,200	2,200
Dichlorodifluoromethane	µg/m³	< 30	< 30	< 60	< 30	< 30
Dichlorotetrafluoroethane	µg/m³	< 16	< 8	< 90	< 17	< 17
Ethyl acetate	µg/m³	< 9	< 4	< 50	< 9	< 9
Ethylbenzene	µg/m³	< 10	< 5	< 50	< 11	< 11
Heptane	µg/m³	< 10	< 5	< 50	< 10	< 10
Hexachlorobutadiene	µg/m³	< 1,100	< 12	< 130	< 30	< 30
Hexane	µg/m³	< 8	< 4	< 50	< 9	< 9
Cumene (Isopropylbenzene)	µg/m³	< 500	16	480	30	21
Methyl methacrylate	µg/m³	< 40	< 18	< 190	< 40	< 40
Methyl tert-butyl ether	µg/m³	< 9	< 4	< 50	< 9	< 9
Methylene chloride	µg/m³	< 50	< 30	< 300	< 50	< 50
Naphthalene	µg/m³	< 600	< 6	< 70	< 13	< 13
n-Propylbenzene	µg/m³	< 500	38	430	37	27
o-Xylene	µg/m³	< 500	< 5	< 50	< 11	< 11
m,p-Xylene	µg/m³	< 1,100	< 11	< 120	< 30	< 30

Sample Type: Air Sampling Canister 1.4 Litre						
Sample Name:		VP6 [10:?-10:06 222 2020730.5] 31-Jul-2018	VP5 [10:38-10:50 1333 2020730.6] 31-Jul-2018	VP4 [11:07-11:18 514 2020730.3] 31-Jul-2018	VP3 [11:33-11:44 507 2020730.2] 31-Jul-2018	VP2 [12:?-12:? 1337 2020730.4] 31-Jul-2018
Lab Number:		2023996.1	2023996.2	2023996.3	2023996.4	2023996.6
Whole Air Sampling Volatile Compounds ug/m3						
Propene	µg/m³	530	4	< 20	< 5	< 4
Styrene	µg/m³	< 10	19	< 50	< 10	12
tert-Butyl alcohol	µg/m³	< 7	< 4	< 40	< 8	< 8
Tetrachloroethene	µg/m³	< 16	11	3,000	520	72
Tetrahydrofuran	µg/m³	< 7	< 4	< 40	< 7	< 7
Toluene	µg/m³	210	240	< 50	95	110
trans-1,2-Dichloroethene	µg/m³	< 9	< 5	< 50	< 10	< 10
trans-1,3-Dichloropropene	µg/m³	< 10	< 5	< 50	< 10	< 10
Trichloroethene	µg/m³	< 12	< 6	320	23	< 13
Trichlorofluoromethane	µg/m³	< 13	< 6	< 70	< 14	< 14
Trichlorotrifluoroethane	µg/m³	< 18	< 9	< 90	< 18	< 18
Vinyl acetate	µg/m³	< 8	< 4	< 50	< 9	< 9
Vinyl chloride*	µg/m³	< 7	< 4	< 40	< 8	< 8

Analyst's Comments

The detection limit for methyl methacrylate was increased to 2 ppbv. Dibromochloromethane and 1,3-butadiene could not be reported as they did not meet US EPA performance criteria.

Vinyl chloride met US EPA TO-15 performance criteria but did not meet in-house set calibration criteria so is reported as unaccredited.

Some detection limits reported for these samples are elevated. This is due to high levels of hydrocarbons observed in some samples that overloaded the instrument and interfered with internal standards used for quantification.

Helium results:

Laboratory air gave 0% full scale reading on the meter before and after sample analysis.
0.1% helium gave a positive reading of 19% and 25% full scale before and after sample analysis respectively.

Samples were tested after dilution with VOC free air on receipt at the laboratory.

VP6 [10:?-10:06 222 2020730.5] (2023996.1), gave a reading of 0% full scale which indicating a helium level of <0.2% helium.

VP5 [10:38-10:50 1333 2020730.6] (2023996.2), gave a negative reading of -10% full scale indicating the probable presence of CO2 in the sample.

VP4 [11:07-11:18 514 2020730.3] (2023996.3), gave a negative reading of -70% full scale indicating the probable presence of CO2 in the sample.

VP3 [11:33-11:44 507 2020730.2] (2023996.4), gave a negative reading of -60% full scale indicating the probable presence of CO2 in the sample.

VP2 [12:?-12:? 1337 2020730.4] (2023996.6), gave a negative reading of -35% full scale indicating the probable presence of CO2 in the sample.

Owing to the non-routine nature of the requested work, the method used was not validated using our standard validation process based on ISO Standard 17025 requirements. The results produced are supported by appropriate Quality Control. Details of the method used is available on request, as is all related Quality Control data. All results will be supplied on the basis that the customer assumes responsibility for approval of the fitness for purpose of the Quality Control prior to using the results for decision making purposes. Further validation work may be performed on request.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Air Sampling Canister 1.4 Litre			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Whole Air Sampling Volatile Compounds	Whole air analysed by active SPME-GC-MS. Sample diluted with zero air by a factor of 2. µ/m3 = (ppbv * Mr)/24.45. Assumes STP (25°C 1 atm pressure). US EPA TO-15.	-	1-4, 6

Sample Type: Air Sampling Canister 1.4 Litre			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Whole Air Sampling Volatile Compounds TPH	Whole air analysed by active SPME-GC-MS. Sample diluted with zero air by a factor of 2. µ/m3 = (ppbv * Mr)/24.45. Assumes STP (25°C 1 atm pressure). US EPA TO-15.	-	1-4, 6

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

Appendix L: Soil and Groundwater Testing Laboratory Transcripts – Site 18

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Hamilton 3240 New Zealand

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2006862	SPv2
Contact:	Lucy Hine	**Date Received:**	28-Jun-2018	
	C/- Tonkin & Taylor	**Date Reported:**	28-Aug-2018	**(Amended)**
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Sediment

Sample Name:		SS03 27-Jun-2018	SS04 27-Jun-2018			
Lab Number:		2006862.1	2006862.2			
Individual Tests						
Dry Matter	g/100g as rcvd	46	62	-	-	-
Total Cyanide*	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	10	9	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt	25	15	-	-	-
Total Recoverable Copper	mg/kg dry wt	96	17	-	-	-
Total Recoverable Lead	mg/kg dry wt	60	17.4	-	-	-
Total Recoverable Mercury	mg/kg dry wt	0.76	0.19	-	-	-
Total Recoverable Nickel	mg/kg dry wt	11	8	-	-	-
Total Recoverable Zinc	mg/kg dry wt	133	51	-	-	-
New Zealand Guidelines Semi Quantitative Asbestos in Soil						
As Received Weight	g	826.0	1,044.4	-	-	-
Dry Weight	g	480.2	689.7	-	-	-
Ashed Weight	g	399.6	648.2	-	-	-
Moisture	%	42	34	-	-	-
Dry Sample Fraction >10mm	g ashed wt	< 0.1	< 0.1	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	148.5	124.0	-	-	-
Sample Fraction <2mm	g ashed wt	249.2	522.3	-	-	-
<2mm Subsample Weight	g ashed wt	52.2	56.2	-	-	-
Asbestos Presence / Absence		Chrysotile (White Asbestos) detected.	Chrysotile (White Asbestos) detected.	-	-	-
Description of Asbestos Form		Loose Fibres	Loose Fibres	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	< 0.00001	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	< 0.00001	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	0.00005	0.00004	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-

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Sample Type: Sediment						
Sample Name:		SS03 27-Jun-2018	SS04 27-Jun-2018			
Lab Number:		2006862.1	2006862.2			
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.016	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.016	-	-	-
Perylene	mg/kg dry wt	< 0.03	0.030	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.06	0.16	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.06	0.16	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.016	-	-	-
Acenaphthene	mg/kg dry wt	< 0.03	< 0.016	-	-	-
Anthracene	mg/kg dry wt	< 0.03	0.016	-	-	-
Benzo[a]anthracene	mg/kg dry wt	0.07	0.167	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	0.113	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.08	0.179	-	-	-
Benzo[e]pyrene	mg/kg dry wt	0.08	0.106	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	0.047	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	0.045	-	-	-
Chrysene	mg/kg dry wt	0.09	0.187	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.016	-	-	-
Fluoranthene	mg/kg dry wt	0.16	0.35	-	-	-
Fluorene	mg/kg dry wt	< 0.03	< 0.016	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	0.028	-	-	-
Naphthalene	mg/kg dry wt	< 0.11	< 0.08	-	-	-
Phenanthrene	mg/kg dry wt	0.04	0.066	-	-	-
Pyrene	mg/kg dry wt	0.16	0.35	-	-	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	0.051	0.008	-	-	-
Monobutyltin (as Sn)	mg/kg dry wt	0.010	< 0.007	-	-	-
Tributyltin (as Sn)	mg/kg dry wt	0.039	0.009	-	-	-
Triphenyltin (as Sn)	mg/kg dry wt	0.020	< 0.003	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 14	< 10	-	-	-
C10 - C14	mg/kg dry wt	< 30	< 20	-	-	-
C15 - C36	mg/kg dry wt	< 60	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 100	< 70	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Toluene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.9	< 0.6	-	-	-
o-Xylene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Chloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Chloromethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Dibromomethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.5	< 0.3	-	-	-

Sample Type: Sediment						
Sample Name:		SS03 27-Jun-2018	SS04 27-Jun-2018			
Lab Number:		2006862.1	2006862.2			
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Styrene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 90	< 60	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 17	< 11	-	-	-
Acetone	mg/kg dry wt	< 90	< 60	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.5	< 0.3	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.09	< 0.06	-	-	-
Naphthalene	mg/kg dry wt	< 0.5	< 0.3	-	-	-

Analyst's Comments

It has been noted that the duplicate for TPhT on sample 2006862.1, was run as part of our in-house QC procedure and showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample.

Amended Report: This certificate of analysis replaces an earlier certificate issued on 06 Jul 2018 at 9:25 am
Reason for amendment: Asbestos by NZG has been added to both samples at the request of the client.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Sediment

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-2
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-2
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-2
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	1-2
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	1-2
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-2
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-2
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	1-2
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	1-2
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	1-2
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	1-2
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-2
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-2
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-2
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	1-2
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1-2
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1-2
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1-2

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1-2
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-2
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1-2
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-2
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1-2
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-2
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1-2
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-2
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-2

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2008130	SPv1
Contact:	Lucy Hine	**Date Received:**	29-Jun-2018	
	C/- Tonkin & Taylor	**Date Reported:**	12-Jul-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.1	
		Client Reference:	30881.1	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		CBH204 - 0.9 29-Jun-2018	CBH202 - 0.5 29-Jun-2018	DUP1 29-Jun-2018	TP101 - 0.5 29-Jun-2018	TP101 - 1.6 29-Jun-2018
Lab Number:		2008130.2	2008130.3	2008130.6	2008130.7	2008130.8
Individual Tests						
Dry Matter	g/100g as rcvd	81	94	72	91	75
Total Cyanide*	mg/kg dry wt	1.17	-	-	-	1.50
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	9	< 2	6	3	9
Total Recoverable Cadmium	mg/kg dry wt	0.18	< 0.10	< 0.10	0.22	< 0.10
Total Recoverable Chromium	mg/kg dry wt	32	42	6	43	5
Total Recoverable Copper	mg/kg dry wt	49	42	5	67	3
Total Recoverable Lead	mg/kg dry wt	200	2.0	8.9	165	8.5
Total Recoverable Mercury	mg/kg dry wt	0.57	< 0.10	0.35	0.51	0.11
Total Recoverable Nickel	mg/kg dry wt	47	190	7	177	13
Total Recoverable Zinc	mg/kg dry wt	197	42	183	210	250
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	0.021	< 0.011	-	< 0.011	< 0.013
2-Methylnaphthalene	mg/kg dry wt	< 0.013	< 0.011	-	< 0.011	< 0.013
Perylene	mg/kg dry wt	0.093	0.011	-	0.014	< 0.013
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.27	< 0.03	-	0.06	0.04
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.26	< 0.03	-	0.06	0.04
Acenaphthylene	mg/kg dry wt	0.019	< 0.011	-	0.012	< 0.013
Acenaphthene	mg/kg dry wt	< 0.013	< 0.011	-	< 0.011	< 0.013
Anthracene	mg/kg dry wt	0.016	< 0.011	-	< 0.011	< 0.013
Benzo[a]anthracene	mg/kg dry wt	0.154	0.014	-	0.041	0.043
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.189	< 0.011	-	0.037	0.028
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.198	< 0.011	-	0.052	0.037
Benzo[e]pyrene	mg/kg dry wt	0.135	< 0.011	-	0.049	0.026
Benzo[g,h,i]perylene	mg/kg dry wt	0.146	< 0.011	-	0.085	0.018
Benzo[k]fluoranthene	mg/kg dry wt	0.077	< 0.011	-	0.037	0.021
Chrysene	mg/kg dry wt	0.143	0.017	-	0.041	0.030
Dibenzo[a,h]anthracene	mg/kg dry wt	0.016	< 0.011	-	< 0.011	< 0.013
Fluoranthene	mg/kg dry wt	0.23	0.018	-	0.051	0.113
Fluorene	mg/kg dry wt	< 0.013	< 0.011	-	< 0.011	0.032
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.134	< 0.011	-	0.065	0.022
Naphthalene	mg/kg dry wt	< 0.07	< 0.06	-	< 0.06	< 0.07
Phenanthrene	mg/kg dry wt	0.096	< 0.011	-	0.017	< 0.013
Pyrene	mg/kg dry wt	0.29	0.031	-	0.057	0.185

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Soil						
Sample Name:		CBH204 - 0.9 29-Jun-2018	CBH202 - 0.5 29-Jun-2018	DUP1 29-Jun-2018	TP101 - 0.5 29-Jun-2018	TP101 - 1.6 29-Jun-2018
Lab Number:		2008130.2	2008130.3	2008130.6	2008130.7	2008130.8
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	-	-	-	-	< 0.005
Monobutyltin (as Sn)	mg/kg dry wt	-	-	-	-	< 0.007
Tributyltin (as Sn)	mg/kg dry wt	-	-	-	-	< 0.004
Triphenyltin (as Sn)	mg/kg dry wt	-	-	-	-	< 0.003
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	-	< 8	9
C10 - C14	mg/kg dry wt	59	< 20	-	< 20	220
C15 - C36	mg/kg dry wt	147	< 40	-	128	300
Total hydrocarbons (C7 - C36)	mg/kg dry wt	210	< 70	-	128	530
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Ethylbenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Toluene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
m&p-Xylene	mg/kg dry wt	-	-	< 0.5	-	< 0.5
o-Xylene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Carbon tetrachloride	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Chloroethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Chloromethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	-	< 0.5	-	< 0.5
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Dibromomethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,3-Dichloropropane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Dichlorodifluoromethane	mg/kg dry wt	-	-	< 0.5	-	< 0.5
1,1-Dichloroethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,2-Dichloroethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,1-Dichloroethene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
trans-1,2-Dichloroethene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	-	-	< 3	-	< 3
1,2-Dichloropropane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,1-Dichloropropene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
cis-1,3-Dichloropropene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Hexachlorobutadiene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Trichlorofluoromethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	-	-	< 0.5	-	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Vinyl chloride	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
4-Chlorotoluene	mg/kg dry wt	-	-	< 0.3	-	< 0.3

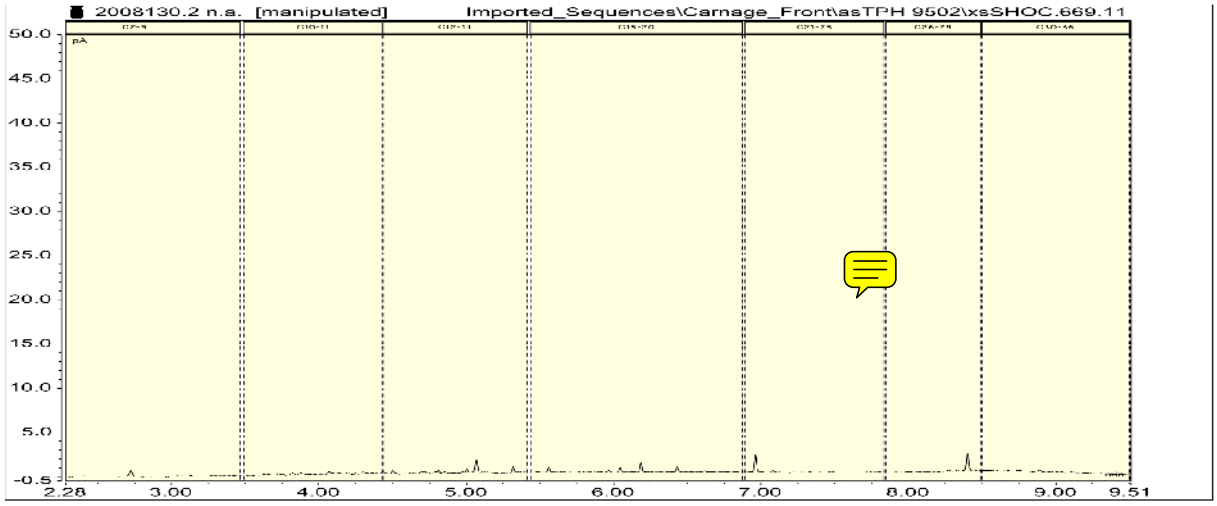
Sample Type: Soil						
Sample Name:		CBH204 - 0.9 29-Jun-2018	CBH202 - 0.5 29-Jun-2018	DUP1 29-Jun-2018	TP101 - 0.5 29-Jun-2018	TP101 - 1.6 29-Jun-2018
Lab Number:		2008130.2	2008130.3	2008130.6	2008130.7	2008130.8
Haloaromatics in VOC Soils by Headspace GC-MS						
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,2-Dichlorobenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
2-Chlorotoluene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,2,3-Trichlorobenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,2,4-Trichlorobenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
tert-Butylbenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	-	-	< 0.3	-	< 0.3
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	-	< 0.3	-	< 0.3
n-Propylbenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
sec-Butylbenzene	mg/kg dry wt	-	-	< 0.3	-	0.4
Styrene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	-	-	< 50	-	< 50
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	-	< 9	-	< 9
Acetone	mg/kg dry wt	-	-	< 50	-	< 50
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	-	-	< 0.5	-	< 0.5
Chloroform (Trichloromethane)	mg/kg as rcvd	-	-	< 0.3	-	< 0.3
Dibromochloromethane	mg/kg dry wt	-	-	< 0.3	-	< 0.3
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	-	-	< 0.05	-	< 0.05
Naphthalene	mg/kg dry wt	-	-	< 0.3	-	< 0.3

Sample Name:		TP102 - 0.6 29-Jun-2018	TP103 - 1.3 29-Jun-2018	TP103 - 0.7 29-Jun-2018		
Lab Number:		2008130.12	2008130.14	2008130.16		
Individual Tests						
Dry Matter	g/100g as rcvd	85	84	93	-	-
Total Cyanide*	mg/kg dry wt	-	-	< 0.10	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	9	6	< 2	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.25	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	4	18	48	-	-
Total Recoverable Copper	mg/kg dry wt	5	28	53	-	-
Total Recoverable Lead	mg/kg dry wt	23	66	10.6	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	0.34	< 0.10	-	-
Total Recoverable Nickel	mg/kg dry wt	6	39	168	-	-
Total Recoverable Zinc	mg/kg dry wt	54	121	64	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.012	3.3	1.78	-	-
2-Methylnaphthalene	mg/kg dry wt	0.012	3.0	1.33	-	-
Perylene	mg/kg dry wt	0.014	2.9	4.8	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	17.8	32	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	17.7	32	-	-
Acenaphthylene	mg/kg dry wt	< 0.012	0.53	0.86	-	-

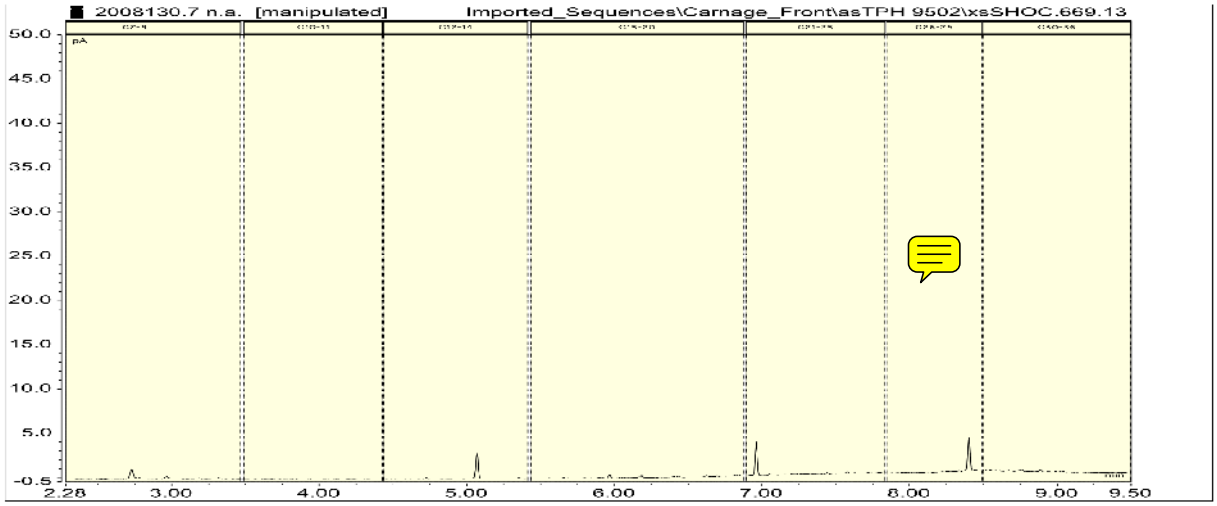
Sample Type: Soil						
Sample Name:		TP102 - 0.6 29-Jun-2018	TP103 - 1.3 29-Jun-2018	TP103 - 0.7 29-Jun-2018		
Lab Number:		2008130.12	2008130.14	2008130.16		
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.012	5.0	6.8	-	-
Anthracene	mg/kg dry wt	< 0.012	8.9	11.3	-	-
Benzo[a]anthracene	mg/kg dry wt	0.014	13.0	21	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	11.2	20	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.013	14.7	25	-	-
Benzo[e]pyrene	mg/kg dry wt	0.022	6.0	10.1	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.022	6.0	9.4	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	5.6	9.7	-	-
Chrysene	mg/kg dry wt	0.012	10.8	19.2	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	2.0	3.2	-	-
Fluoranthene	mg/kg dry wt	0.015	33	50	-	-
Fluorene	mg/kg dry wt	< 0.012	5.4	7.1	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.012	8.0	18.8	-	-
Naphthalene	mg/kg dry wt	< 0.06	0.44	0.22	-	-
Phenanthrene	mg/kg dry wt	0.014	26	34	-	-
Pyrene	mg/kg dry wt	0.054	30	47	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	13	< 8	-	-
C10 - C14	mg/kg dry wt	54	660	190	-	-
C15 - C36	mg/kg dry wt	570	2,600	2,400	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	620	3,200	2,600	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.17	< 0.18	< 0.15	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Toluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
m&p-Xylene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	-	-
o-Xylene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Chloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Chloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Dibromomethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	3.3	< 0.3	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	< 3	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	0.4	1.3	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-

Sample Type: Soil						
Sample Name:		TP102 - 0.6 29-Jun-2018	TP103 - 1.3 29-Jun-2018	TP103 - 0.7 29-Jun-2018		
Lab Number:		2008130.12	2008130.14	2008130.16		
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Styrene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 40	< 40	< 30	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 7	< 8	< 6	-	-
Acetone	mg/kg dry wt	< 40	< 40	< 30	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	< 0.3	< 0.3	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
Naphthalene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-

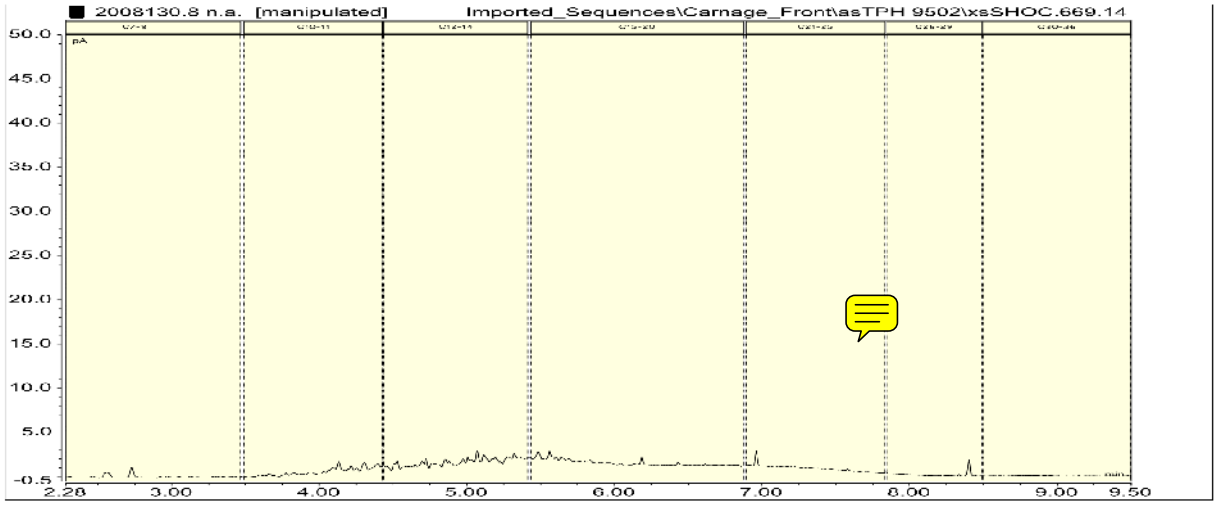
2008130.2
CBH204 - 0.9 29-Jun-2018
Client Chromatogram for TPH by FID



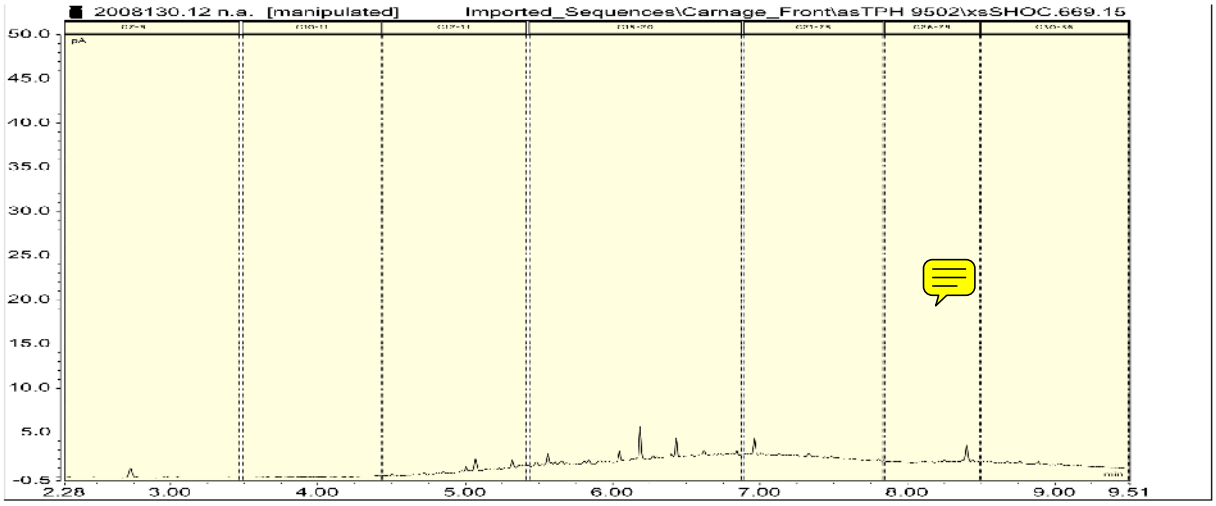
2008130.7
TP101 - 0.5 29-Jun-2018
Client Chromatogram for TPH by FID



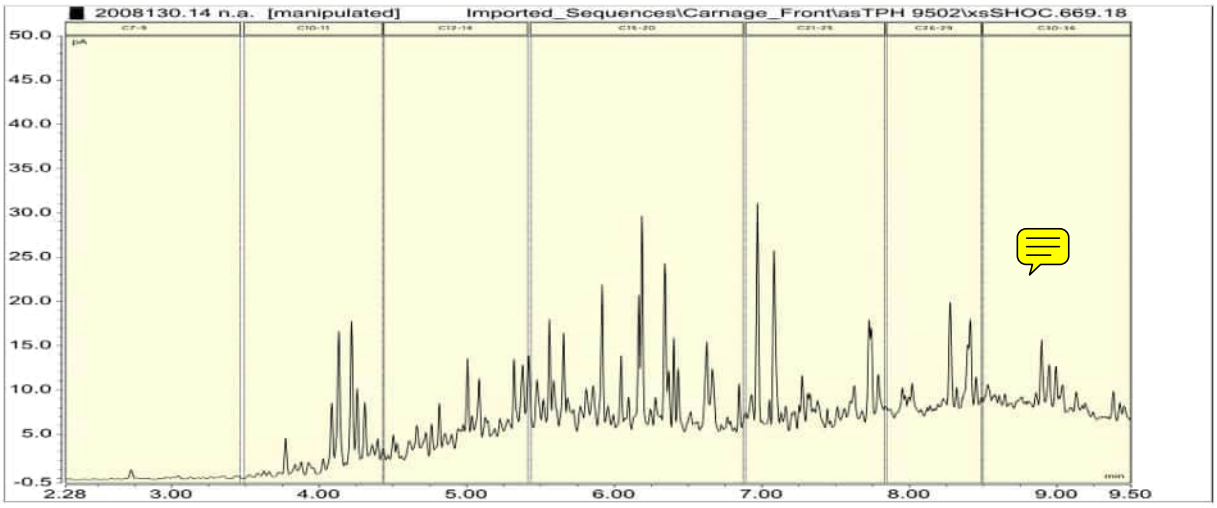
2008130.8
TP101 - 1.6 29-Jun-2018
Client Chromatogram for TPH by FID



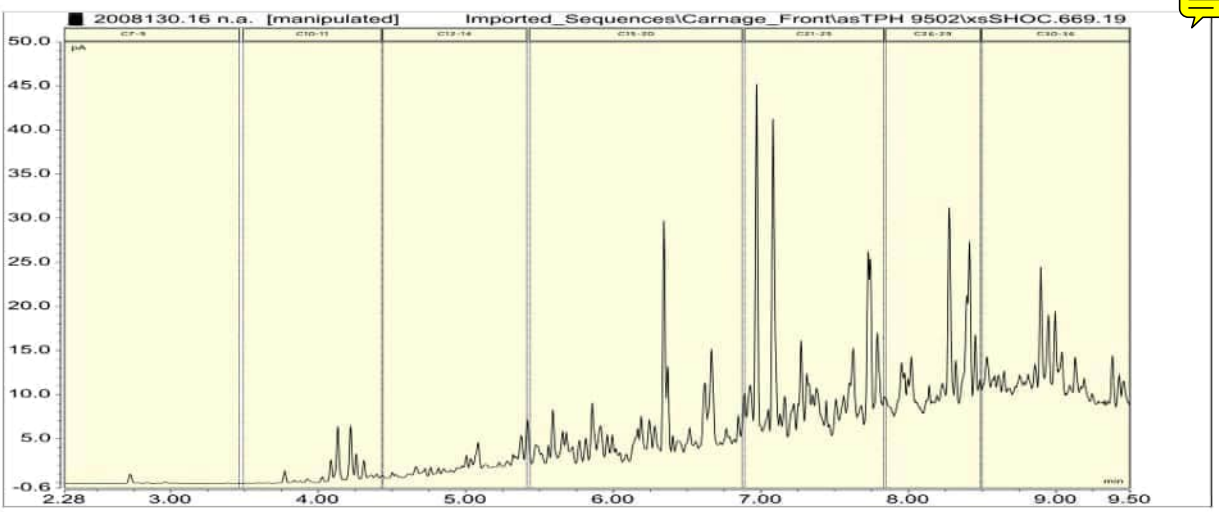
2008130.12
TP102 - 0.6 29-Jun-2018
Client Chromatogram for TPH by FID



2008130.14
TP103 - 1.3 29-Jun-2018
Client Chromatogram for TPH by FID



2008130.16
TP103 - 0.7 29-Jun-2018
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	2-3, 7-8, 12, 14, 16
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	2-3, 6-8, 12, 14, 16
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	8
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	6, 8, 12, 14, 16
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	2-3, 6-8, 12, 14, 16
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	2, 8, 16
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	2, 8, 16
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	2-3, 7-8, 12, 14, 16
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	2-3, 7-8, 12, 14, 16

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

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

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Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2008135	A2Pv1
Contact:	Lucy Hine	**Date Received:**	29-Jun-2018	
	C/- Tonkin & Taylor	**Date Reported:**	17-Jul-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	Melody Robyns	
		Client Reference:	30881.1	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		CBH202 - 0.5 29-Jun-2018	TP101 - 0.5 29-Jun-2018	TP102 - 0.6 29-Jun-2018	TP103 - 0.7 29-Jun-2018	
Lab Number:		2008135.3	2008135.7	2008135.12	2008135.16	
Asbestos Presence / Absence		Asbestos NOT detected.	Chrysotile (White Asbestos) detected.	Chrysotile (White Asbestos) detected.	Asbestos NOT detected.	-
Description of Asbestos Form		-	Loose Fibres	Loose Fibres	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	-
As Received Weight	g	1,160.7	995.4	951.9	1,057.3	-
Dry Weight	g	1,096.4	915.5	788.8	962.1	-
Ashed Weight	g	1,095.2	910.1	785.0	952.6	-
Moisture	%	6	8	17	9	-
Dry Sample Fraction >10mm	g ashed wt	175.5	282.8	13.6	391.2	-
Sample Fraction <10mm to >2mm	g ashed wt	576.2	313.0	13.9	418.1	-
Sample Fraction <2mm	g ashed wt	342.4	313.1	757.1	142.1	-
<2mm Subsample Weight	g ashed wt	54.1	52.1	55.3	57.5	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	< 0.00001	0.00114	0.00083	< 0.00001	-

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

The following assumptions have been made:

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

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	3, 7, 12, 16
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3, 7, 12, 16
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3, 7, 12, 16
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3, 7, 12, 16
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	3, 7, 12, 16
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3, 7, 12, 16
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3, 7, 12, 16
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3, 7, 12, 16
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	3, 7, 12, 16
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	3, 7, 12, 16
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3, 7, 12, 16
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3, 7, 12, 16
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3, 7, 12, 16
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3, 7, 12, 16
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3, 7, 12, 16
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3, 7, 12, 16
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3, 7, 12, 16

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

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2009174	SPv1
Contact:	Lucy Hine	**Date Received:**	02-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	16-Jul-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		CBH 205 - 0.5-0.6 02-Jul-2018	CBH 205 - 2.0-2.2 02-Jul-2018	CBH 205 - 5.0-5.2 02-Jul-2018	GBH 104 - 0.3-0.7 02-Jul-2018	GBH 104 - 1.2-1.7 02-Jul-2018
Lab Number:		2009174.2	2009174.7	2009174.11	2009174.15	2009174.17
Individual Tests						
Dry Matter	g/100g as rcvd	85	77	71	86	75
Total Cyanide*	mg/kg dry wt	-	0.48	-	-	1.05
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	3	-	3	3
Total Recoverable Cadmium	mg/kg dry wt	0.22	< 0.10	-	0.22	< 0.10
Total Recoverable Chromium	mg/kg dry wt	33	14	-	27	17
Total Recoverable Copper	mg/kg dry wt	52	8	-	113	27
Total Recoverable Lead	mg/kg dry wt	66	12.1	-	47	135
Total Recoverable Mercury	mg/kg dry wt	0.14	< 0.10	-	0.10	0.34
Total Recoverable Nickel	mg/kg dry wt	74	4	-	133	11
Total Recoverable Zinc	mg/kg dry wt	176	10	-	191	74
New Zealand Guidelines Semi Quantitative Asbestos in Soil						
As Received Weight	g	1,074.9	-	-	844.8	-
Dry Weight	g	959.9	-	-	744.2	-
Ashed Weight	g	952.5	-	-	742.0	-
Moisture	%	11	-	-	12	-
Dry Sample Fraction >10mm	g ashed wt	221.1	-	-	143.7	-
Sample Fraction <10mm to >2mm	g ashed wt	372.0	-	-	262.4	-
Sample Fraction <2mm	g ashed wt	357.7	-	-	332.9	-
<2mm Subsample Weight	g ashed wt	59.5	-	-	56.3	-
Asbestos Presence / Absence		Asbestos NOT detected.	-	-	Chrysotile (White Asbestos) detected.	-
Description of Asbestos Form		-	-	-	Loose Fibres	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	-	-	< 0.00001	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	-	-	< 0.001	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	-	-	< 0.00001	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	-	-	< 0.001	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	< 0.00001	-	-	0.00357	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	< 0.001	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	< 0.001	-

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Soil						
Sample Name:		CBH 205 - 0.5-0.6 02-Jul-2018	CBH 205 - 2.0-2.2 02-Jul-2018	CBH 205 - 5.0-5.2 02-Jul-2018	GBH 104 - 0.3-0.7 02-Jul-2018	GBH 104 - 1.2-1.7 02-Jul-2018
Lab Number:		2009174.2	2009174.7	2009174.11	2009174.15	2009174.17
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.012	0.20	-	0.036	< 0.014
2-Methylnaphthalene	mg/kg dry wt	< 0.012	0.040	-	0.036	< 0.014
Perylene	mg/kg dry wt	0.021	0.021	-	0.014	0.024
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.09	0.09	-	< 0.03	0.08
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.09	0.08	-	< 0.03	0.07
Acenaphthylene	mg/kg dry wt	0.013	< 0.013	-	< 0.012	< 0.014
Acenaphthene	mg/kg dry wt	< 0.012	< 0.013	-	< 0.012	< 0.014
Anthracene	mg/kg dry wt	0.012	0.059	-	< 0.012	0.020
Benzo[a]anthracene	mg/kg dry wt	0.061	0.115	-	0.032	0.070
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.064	0.059	-	0.013	0.051
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.082	0.068	-	0.019	0.067
Benzo[e]pyrene	mg/kg dry wt	0.050	0.048	-	0.021	0.044
Benzo[g,h,i]perylene	mg/kg dry wt	0.052	0.025	-	0.013	0.047
Benzo[k]fluoranthene	mg/kg dry wt	0.032	0.047	-	0.012	0.042
Chrysene	mg/kg dry wt	0.055	0.076	-	0.027	0.077
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.013	-	< 0.012	< 0.014
Fluoranthene	mg/kg dry wt	0.078	0.34	-	0.016	0.196
Fluorene	mg/kg dry wt	< 0.012	0.158	-	0.022	< 0.014
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.061	< 0.013	-	< 0.012	0.043
Naphthalene	mg/kg dry wt	< 0.06	< 0.07	-	< 0.06	< 0.07
Phenanthrene	mg/kg dry wt	0.016	0.37	-	0.046	0.041
Pyrene	mg/kg dry wt	0.071	0.41	-	0.063	0.21
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	88	< 9	29	< 8
C10 - C14	mg/kg dry wt	-	520	40	200	< 20
C15 - C36	mg/kg dry wt	-	490	< 40	430	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	1,090	< 70	660	< 70
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	-	< 0.2	< 0.3	< 0.17	< 0.3
Ethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Toluene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
m&p-Xylene	mg/kg dry wt	-	< 0.4	< 0.5	< 0.4	< 0.5
o-Xylene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Carbon tetrachloride	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Chloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Chloromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Dibromomethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,3-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Dichlorodifluoromethane	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 3	< 3	< 3	< 3
1,2-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3

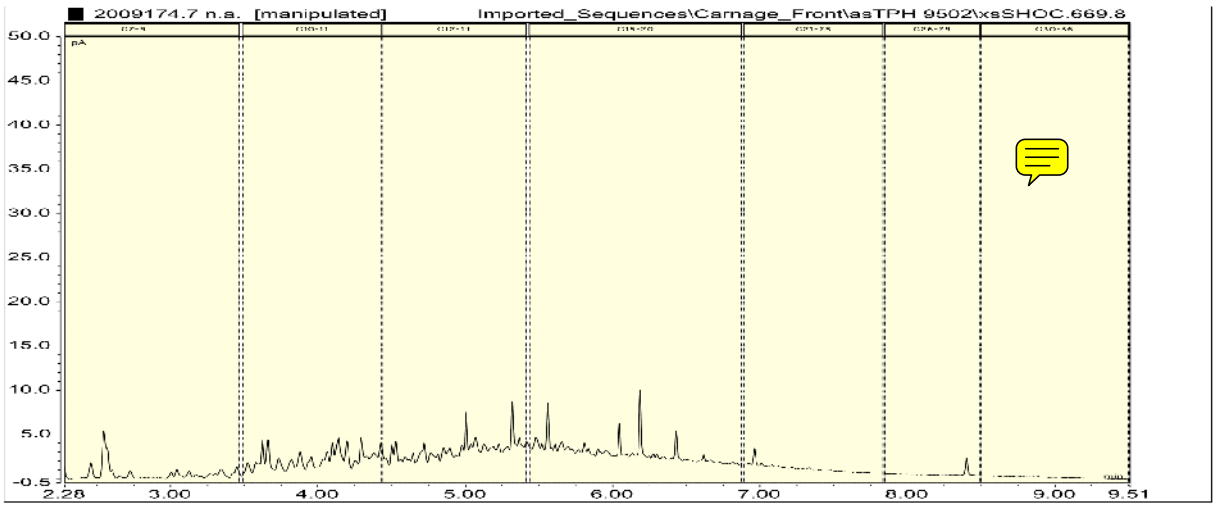
Sample Type: Soil						
Sample Name:		CBH 205 - 0.5-0.6 02-Jul-2018	CBH 205 - 2.0-2.2 02-Jul-2018	CBH 205 - 5.0-5.2 02-Jul-2018	GBH 104 - 0.3-0.7 02-Jul-2018	GBH 104 - 1.2-1.7 02-Jul-2018
Lab Number:		2009174.2	2009174.7	2009174.11	2009174.15	2009174.17
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Hexachlorobutadiene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Trichlorofluoromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Vinyl chloride	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
4-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
2-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	-	1.0	0.7	< 0.3	< 0.3
tert-Butylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	-	0.6	1.1	< 0.3	< 0.3
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
n-Propylbenzene	mg/kg dry wt	-	1.4	3.3	0.3	< 0.3
sec-Butylbenzene	mg/kg dry wt	-	1.7	< 0.3	< 0.3	< 0.3
Styrene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	-	< 40	< 50	< 40	< 50
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 8	< 10	< 7	< 9
Acetone	mg/kg dry wt	-	< 40	< 50	< 40	< 50
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	< 0.5
Chloroform (Trichloromethane)	mg/kg as rcvd	-	< 0.3	< 0.3	< 0.3	< 0.3
Dibromochloromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	-	< 0.05	< 0.05	< 0.05	< 0.05
Naphthalene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3

Sample Name:		GBH 104 - 4.5-5 02-Jul-2018				
Lab Number:		2009174.18				

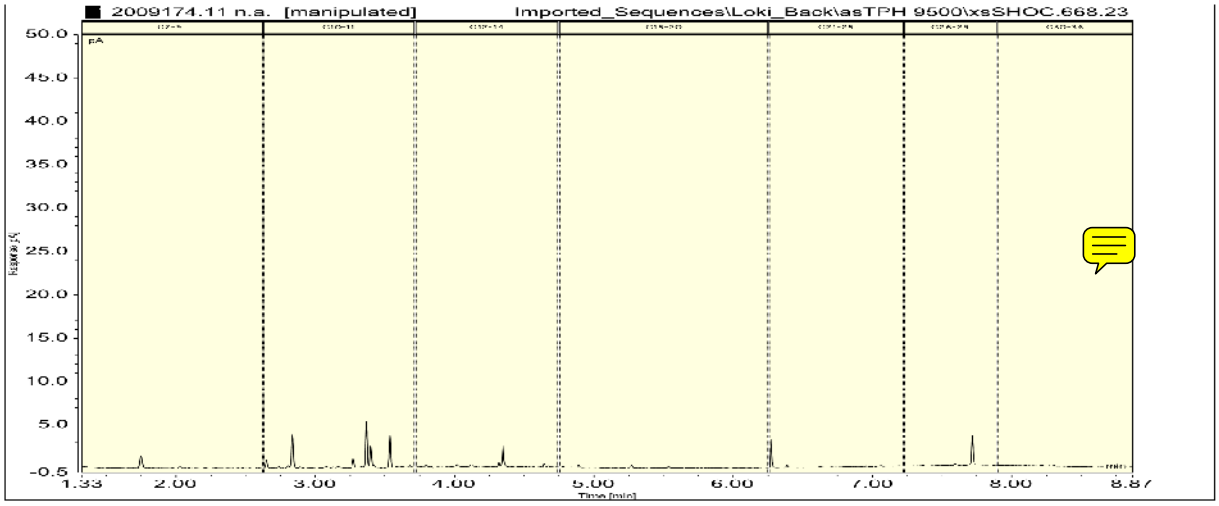
Sample Type: Soil						
Sample Name:		GBH 104 - 4.5-5 02-Jul-2018				
Lab Number:		2009174.18				
Individual Tests						
Dry Matter	g/100g as rcvd	66	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	12	-	-	-	-
C10 - C14	mg/kg dry wt	158	-	-	-	-
C15 - C36	mg/kg dry wt	99	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	270	-	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Toluene	mg/kg dry wt	< 0.3	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.6	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	-	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	-	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	-	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	-	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	-	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	-	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	-	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	-	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-

Sample Type: Soil						
Sample Name:		GBH 104 - 4.5-5 02-Jul-2018				
Lab Number:		2009174.18				
Haloaromatics in VOC Soils by Headspace GC-MS						
2-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	-	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	-	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Styrene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 60	-	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 11	-	-	-	-
Acetone	mg/kg dry wt	< 60	-	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	-	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	-	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	-	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.06	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	-	-	-	-

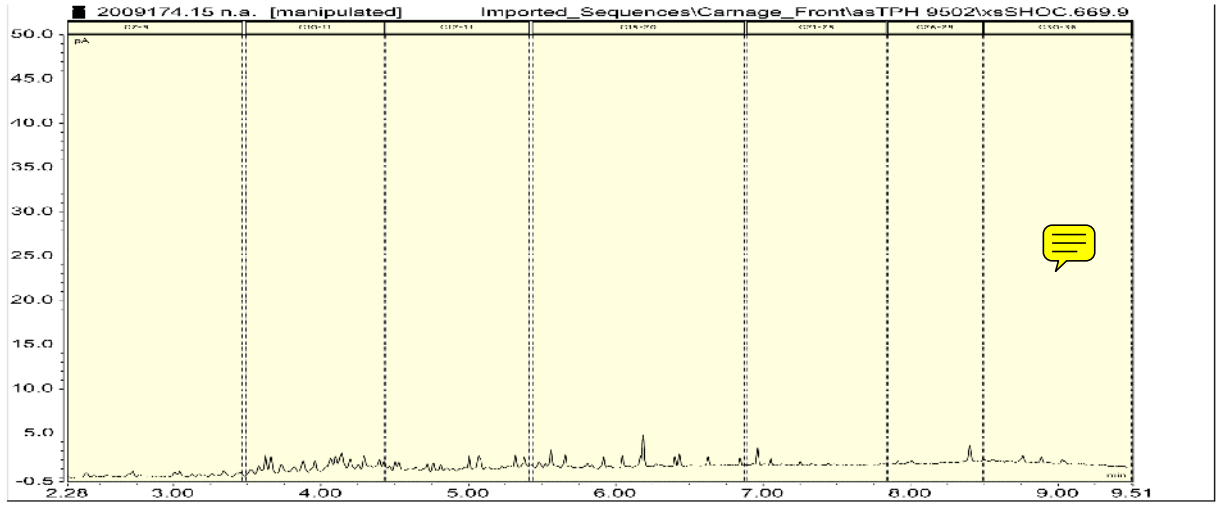
2009174.7
CBH 205 - 2.0-2.2 02-Jul-2018
Client Chromatogram for TPH by FID



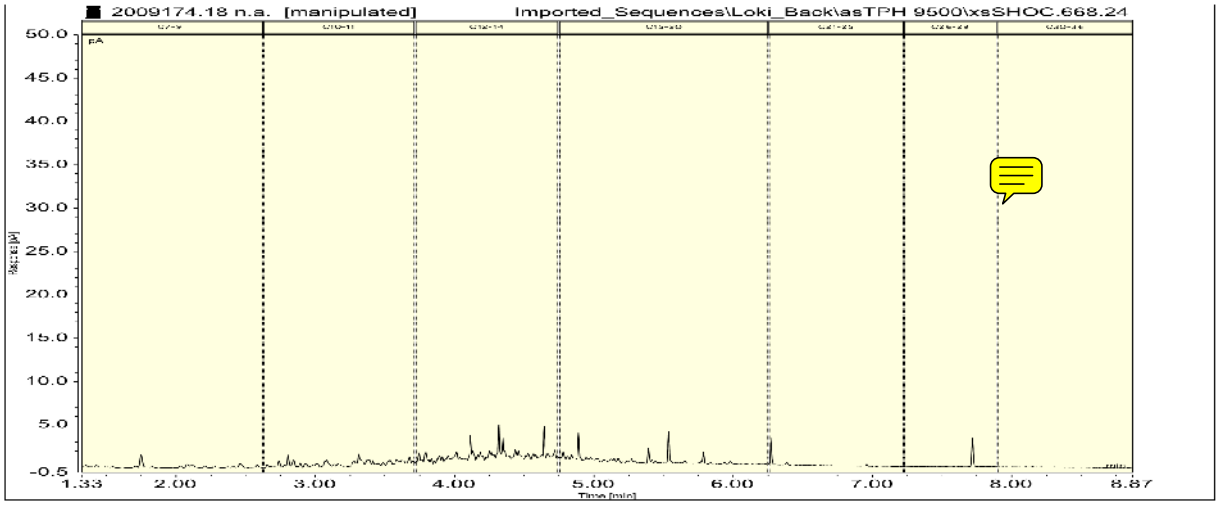
2009174.11
CBH 205 - 5.0-5.2 02-Jul-2018
Client Chromatogram for TPH by FID



2009174.15
GBH 104 - 0.3-0.7 02-Jul-2018
Client Chromatogram for TPH by FID



2009174.18
GBH 104 - 4.5-5 02-Jul-2018
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	2, 7, 11, 15, 17-18
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	7, 17
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	7, 17
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	2, 7, 15, 17
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	2, 7, 15, 17
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	7, 15, 17
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	2, 7, 15, 17
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	2, 15
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.05 mg/kg dry wt	2
Total Petroleum Hydrocarbons in Soil*	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	11, 18
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	7, 11, 15, 17-18
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2, 15
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2, 15
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2, 15
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	2, 15
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2, 15
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2, 15
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2, 15

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	2, 15
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	2, 15
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2, 15
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2, 15
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2, 15
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2, 15
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2, 15
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2, 15
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2, 15

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



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

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2009906	A2Pv1
Contact:	Lucy Hine	**Date Received:**	03-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	17-Jul-2018	
	PO Box 13055	**Quote No:**	80842	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		CBH209 0.2 - 0.6 03-Jul-2018	CBH209 1.4 - 1.9 03-Jul-2018	CBH208 0.2 - 0.6 03-Jul-2018	DUP 5 03-Jul-2018	CBH208 3.0 - 3.2 03-Jul-2018
Lab Number:		2009906.1	2009906.3	2009906.9	2009906.11	2009906.16
Asbestos Presence / Absence		-	-	Chrysotile (White Asbestos) detected.	-	-
Description of Asbestos Form		-	-	Loose Fibres	-	-
Asbestos in ACM as % of Total Sample*	% w/w	-	-	< 0.001	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	-	-	< 0.001	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	-	-	< 0.001	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	-	-	< 0.001	-	-
As Received Weight	g	-	-	910.4	-	-
Dry Weight	g	-	-	817.6	-	-
Ashed Weight	g	-	-	808.1	-	-
Moisture	%	-	-	10	-	-
Dry Sample Fraction >10mm	g ashed wt	-	-	265.1	-	-
Sample Fraction <10mm to >2mm	g ashed wt	-	-	305.1	-	-
Sample Fraction <2mm	g ashed wt	-	-	236.6	-	-
<2mm Subsample Weight	g ashed wt	-	-	53.6	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	-	-	< 0.00001	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	-	-	< 0.00001	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	-	-	0.00003	-	-
Dry Matter	g/100g as rcvd	85	80	85	79	71
Total Recoverable Arsenic	mg/kg dry wt	6	6	4	6	4
Total Recoverable Cadmium	mg/kg dry wt	0.12	< 0.10	0.21	0.29	< 0.10
Total Recoverable Chromium	mg/kg dry wt	23	5	26	28	18
Total Recoverable Copper	mg/kg dry wt	41	5	60	69	22
Total Recoverable Lead	mg/kg dry wt	135	23	195	340 #1	13.1
Total Recoverable Mercury	mg/kg dry wt	0.26	< 0.10	0.13	0.22	< 0.10
Total Recoverable Nickel	mg/kg dry wt	67	6	68	60	31
Total Recoverable Zinc	mg/kg dry wt	137	25	320	450	95
Total Cyanide*	mg/kg dry wt	-	-	3.8	-	-
1-Methylnaphthalene	mg/kg dry wt	0.081	22	< 0.012	0.039	0.48
2-Methylnaphthalene	mg/kg dry wt	0.104	1.69	< 0.012	0.065	0.069
Bromobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Benzene	mg/kg dry wt	-	< 0.19	< 0.17	-	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Soil						
Sample Name:		CBH209 0.2 - 0.6 03-Jul-2018	CBH209 1.4 - 1.9 03-Jul-2018	CBH208 0.2 - 0.6 03-Jul-2018	DUP 5 03-Jul-2018	CBH208 3.0 - 3.2 03-Jul-2018
Lab Number:		2009906.1	2009906.3	2009906.9	2009906.11	2009906.16
Bromodichloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
4-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
2-Butanone (MEK)	mg/kg dry wt	-	< 40	< 40	-	< 50
n-Butylbenzene	mg/kg dry wt	-	14.7	< 0.3	-	0.8
tert-Butylbenzene	mg/kg dry wt	-	0.5	< 0.3	-	< 0.3
Carbon disulphide	mg/kg dry wt	-	< 0.05	< 0.05	-	< 0.05
Carbon tetrachloride	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chloroform (Trichloromethane)	mg/kg as rcvd	-	< 0.3	< 0.3	-	< 0.3
Chloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 8	< 7	-	< 9
Acetone	mg/kg dry wt	-	< 40	< 40	-	< 50
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
Dibromochloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dibromomethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dibutyltin (as Sn)	mg/kg dry wt	-	-	0.005	-	-
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dichlorodifluoromethane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
1,1-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 3	< 3	-	< 3
1,2-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
2-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Ethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Hexachlorobutadiene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	-	20	< 0.3	-	1.1
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Monobutyltin (as Sn)	mg/kg dry wt	-	-	< 0.007	-	-
Perylene	mg/kg dry wt	0.069	0.060	0.013	0.034	< 0.014
n-Propylbenzene	mg/kg dry wt	-	62	< 0.3	-	3.7
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.22	0.19	0.07	0.10	< 0.04
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.22	0.19	0.07	0.09	< 0.04
sec-Butylbenzene	mg/kg dry wt	-	10.0	< 0.3	-	1.1
Styrene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Toluene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Tributyltin (as Sn)	mg/kg dry wt	-	-	< 0.004	-	-

Sample Type: Soil						
	Sample Name:	CBH209 0.2 - 0.6 03-Jul-2018	CBH209 1.4 - 1.9 03-Jul-2018	CBH208 0.2 - 0.6 03-Jul-2018	DUP 5 03-Jul-2018	CBH208 3.0 - 3.2 03-Jul-2018
	Lab Number:	2009906.1	2009906.3	2009906.9	2009906.11	2009906.16
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Trichlorofluoromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Triphenyltin (as Sn)	mg/kg dry wt	-	-	< 0.003	-	-
Vinyl chloride	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
m&p-Xylene	mg/kg dry wt	-	< 0.4	< 0.4	-	< 0.5
o-Xylene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
C7 - C9	mg/kg dry wt	< 8	2,200	-	-	23
C10 - C14	mg/kg dry wt	58	5,500	-	-	320
C15 - C36	mg/kg dry wt	360	2,900	-	-	84
Total hydrocarbons (C7 - C36)	mg/kg dry wt	420	10,600	-	-	430
Acenaphthylene	mg/kg dry wt	0.034	0.41	< 0.012	0.017	< 0.014
Acenaphthene	mg/kg dry wt	< 0.012	1.07	< 0.012	< 0.013	< 0.014
Anthracene	mg/kg dry wt	0.016	0.24	< 0.012	< 0.013	< 0.014
Benzo[a]anthracene	mg/kg dry wt	0.098	0.125	0.023	0.044	< 0.014
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.162	0.132	0.040	0.069	< 0.014
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.21	0.157	0.055	0.115	< 0.014
Benzo[e]pyrene	mg/kg dry wt	0.157	0.166	0.041	0.111	< 0.014
Benzo[g,h,i]perylene	mg/kg dry wt	0.188	0.188	0.059	0.091	< 0.014
Benzo[k]fluoranthene	mg/kg dry wt	0.059	0.045	0.023	< 0.013	< 0.014
Chrysene	mg/kg dry wt	0.107	0.070	0.018	0.038	< 0.014
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.014
Fluoranthene	mg/kg dry wt	0.20	0.50	0.051	0.104	0.015
Fluorene	mg/kg dry wt	< 0.012	1.36	< 0.012	< 0.013	0.027
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.157	0.130	0.064	0.082	< 0.014
Naphthalene	mg/kg dry wt	< 0.06	< 0.3	< 0.3	0.06	< 0.3
Phenanthrene	mg/kg dry wt	0.072	1.47	< 0.012	0.020	< 0.014
Pyrene	mg/kg dry wt	0.24	0.65	0.053	0.106	< 0.014

	Sample Name:	CBH208 5.8 - 6.0 03-Jul-2018	CBH202 4.4 - 4.5 03-Jul-2018			
	Lab Number:	2009906.19	2009906.24			
Dry Matter	g/100g as rcvd	69	75	-	-	-
Total Recoverable Arsenic	mg/kg dry wt	-	4	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	-	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt	-	18	-	-	-
Total Recoverable Copper	mg/kg dry wt	-	15	-	-	-
Total Recoverable Lead	mg/kg dry wt	-	9.2	-	-	-
Total Recoverable Mercury	mg/kg dry wt	-	< 0.10	-	-	-
Total Recoverable Nickel	mg/kg dry wt	-	47	-	-	-
Total Recoverable Zinc	mg/kg dry wt	-	78	-	-	-
Bromobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Benzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Bromodichloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	-	-	-

Sample Type: Soil						
Sample Name:		CBH208 5.8 - 6.0 03-Jul-2018	CBH202 4.4 - 4.5 03-Jul-2018			
Lab Number:		2009906.19	2009906.24			
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
2-Butanone (MEK)	mg/kg dry wt	< 50	< 50	-	-	-
n-Butylbenzene	mg/kg dry wt	< 0.3	0.7	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Carbon disulphide	mg/kg dry wt	< 0.05	< 0.05	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	< 0.3	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 10	< 9	-	-	-
Acetone	mg/kg dry wt	< 50	< 50	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	0.9	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	2.5	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	1.6	-	-	-
Styrene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Toluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-

Sample Type: Soil						
Sample Name:		CBH208 5.8 - 6.0 03-Jul-2018	CBH202 4.4 - 4.5 03-Jul-2018			
Lab Number:		2009906.19	2009906.24			
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.5	< 0.5	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
C7 - C9	mg/kg dry wt	< 9	120	-	-	-
C10 - C14	mg/kg dry wt	< 20	3,200	-	-	-
C15 - C36	mg/kg dry wt	< 40	1,550	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	4,900	-	-	-

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

The following assumptions have been made:

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

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

Analyst's Comments

#1 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. Replicate 1 = 690mg/kg, replicate 2 = 340mg/kg.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1, 3, 9, 11, 16, 19, 24
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	9
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	9
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1, 3, 9, 11, 16
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1, 3, 9, 11, 16
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	1, 3, 16
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1, 3, 9, 11, 16, 24
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	9

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.05 mg/kg dry wt	9, 11
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	9
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	19, 24
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	3, 9, 16, 19, 24
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	9
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	9
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	9
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	9
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	9
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	9
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	9
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	9
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	9
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	9
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	9
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	9
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	9
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	9
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	9
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	9

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

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TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2009906	SPv1
Contact:	Lucy Hine	**Date Received:**	03-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	17-Jul-2018	
	PO Box 13055	**Quote No:**	80842	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		CBH209 0.2 - 0.6 03-Jul-2018	CBH209 1.4 - 1.9 03-Jul-2018	CBH208 0.2 - 0.6 03-Jul-2018	DUP 5 03-Jul-2018	CBH208 3.0 - 3.2 03-Jul-2018
Lab Number:		2009906.1	2009906.3	2009906.9	2009906.11	2009906.16
Individual Tests						
Dry Matter	g/100g as rcvd	85	80	85	79	71
Total Cyanide*	mg/kg dry wt	-	-	3.8	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	6	4	6	4
Total Recoverable Cadmium	mg/kg dry wt	0.12	< 0.10	0.21	0.29	< 0.10
Total Recoverable Chromium	mg/kg dry wt	23	5	26	28	18
Total Recoverable Copper	mg/kg dry wt	41	5	60	69	22
Total Recoverable Lead	mg/kg dry wt	135	23	195	340 #1	13.1
Total Recoverable Mercury	mg/kg dry wt	0.26	< 0.10	0.13	0.22	< 0.10
Total Recoverable Nickel	mg/kg dry wt	67	6	68	60	31
Total Recoverable Zinc	mg/kg dry wt	137	25	320	450	95
New Zealand Guidelines Semi Quantitative Asbestos in Soil						
As Received Weight	g	-	-	910.4	-	-
Dry Weight	g	-	-	817.6	-	-
Ashed Weight	g	-	-	808.1	-	-
Moisture	%	-	-	10	-	-
Dry Sample Fraction >10mm	g ashed wt	-	-	265.1	-	-
Sample Fraction <10mm to >2mm	g ashed wt	-	-	305.1	-	-
Sample Fraction <2mm	g ashed wt	-	-	236.6	-	-
<2mm Subsample Weight	g ashed wt	-	-	53.6	-	-
Asbestos Presence / Absence		-	-	Chrysotile (White Asbestos) detected.	-	-
Description of Asbestos Form		-	-	Loose Fibres	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	-	-	< 0.00001	-	-
Asbestos in ACM as % of Total Sample*	% w/w	-	-	< 0.001	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	-	-	< 0.00001	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	-	-	< 0.001	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	-	-	0.00003	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	-	-	< 0.001	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	-	-	< 0.001	-	-

ilac-MRA IANZ ACCREDITED LABORATORY

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

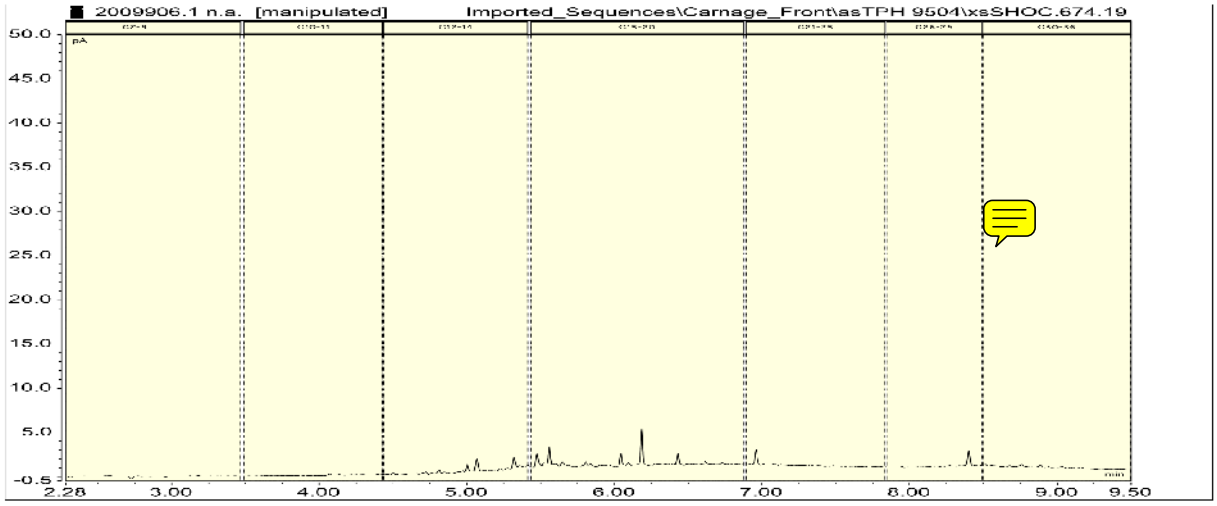
Sample Type: Soil						
Sample Name:		CBH209 0.2 - 0.6 03-Jul-2018	CBH209 1.4 - 1.9 03-Jul-2018	CBH208 0.2 - 0.6 03-Jul-2018	DUP 5 03-Jul-2018	CBH208 3.0 - 3.2 03-Jul-2018
Lab Number:		2009906.1	2009906.3	2009906.9	2009906.11	2009906.16
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	0.081	22	< 0.012	0.039	0.48
2-Methylnaphthalene	mg/kg dry wt	0.104	1.69	< 0.012	0.065	0.069
Perylene	mg/kg dry wt	0.069	0.060	0.013	0.034	< 0.014
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.22	0.19	0.07	0.10	< 0.04
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.22	0.19	0.07	0.09	< 0.04
Acenaphthylene	mg/kg dry wt	0.034	0.41	< 0.012	0.017	< 0.014
Acenaphthene	mg/kg dry wt	< 0.012	1.07	< 0.012	< 0.013	< 0.014
Anthracene	mg/kg dry wt	0.016	0.24	< 0.012	< 0.013	< 0.014
Benzo[a]anthracene	mg/kg dry wt	0.098	0.125	0.023	0.044	< 0.014
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.162	0.132	0.040	0.069	< 0.014
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.21	0.157	0.055	0.115	< 0.014
Benzo[e]pyrene	mg/kg dry wt	0.157	0.166	0.041	0.111	< 0.014
Benzo[g,h,i]perylene	mg/kg dry wt	0.188	0.188	0.059	0.091	< 0.014
Benzo[k]fluoranthene	mg/kg dry wt	0.059	0.045	0.023	< 0.013	< 0.014
Chrysene	mg/kg dry wt	0.107	0.070	0.018	0.038	< 0.014
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.014
Fluoranthene	mg/kg dry wt	0.20	0.50	0.051	0.104	0.015
Fluorene	mg/kg dry wt	< 0.012	1.36	< 0.012	< 0.013	0.027
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.157	0.130	0.064	0.082	< 0.014
Naphthalene	mg/kg dry wt	< 0.06	2.4	< 0.06	0.06	< 0.07
Phenanthrene	mg/kg dry wt	0.072	1.47	< 0.012	0.020	< 0.014
Pyrene	mg/kg dry wt	0.24	0.65	0.053	0.106	< 0.014
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	-	-	0.005	-	-
Monobutyltin (as Sn)	mg/kg dry wt	-	-	< 0.007	-	-
Tributyltin (as Sn)	mg/kg dry wt	-	-	< 0.004	-	-
Triphenyltin (as Sn)	mg/kg dry wt	-	-	< 0.003	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	2,200	-	-	23
C10 - C14	mg/kg dry wt	58	5,500	-	-	320
C15 - C36	mg/kg dry wt	360	2,900	-	-	84
Total hydrocarbons (C7 - C36)	mg/kg dry wt	420	10,600	-	-	430
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	-	< 0.19	< 0.17	-	< 0.3
Ethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Toluene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
m&p-Xylene	mg/kg dry wt	-	< 0.4	< 0.4	-	< 0.5
o-Xylene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Carbon tetrachloride	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dibromomethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dichlorodifluoromethane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
1,1-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3

Sample Type: Soil						
Sample Name:		CBH209 0.2 - 0.6 03-Jul-2018	CBH209 1.4 - 1.9 03-Jul-2018	CBH208 0.2 - 0.6 03-Jul-2018	DUP 5 03-Jul-2018	CBH208 3.0 - 3.2 03-Jul-2018
Lab Number:		2009906.1	2009906.3	2009906.9	2009906.11	2009906.16
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 3	< 3	-	< 3
1,2-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Hexachlorobutadiene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Trichlorofluoromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Vinyl chloride	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
4-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
2-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	-	14.7	< 0.3	-	0.8
tert-Butylbenzene	mg/kg dry wt	-	0.5	< 0.3	-	< 0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	-	20	< 0.3	-	1.1
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
n-Propylbenzene	mg/kg dry wt	-	62	< 0.3	-	3.7
sec-Butylbenzene	mg/kg dry wt	-	10.0	< 0.3	-	1.1
Styrene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	-	< 40	< 40	-	< 50
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 8	< 7	-	< 9
Acetone	mg/kg dry wt	-	< 40	< 40	-	< 50
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
Chloroform (Trichloromethane)	mg/kg as rcvd	-	< 0.3	< 0.3	-	< 0.3
Dibromochloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	-	< 0.05	< 0.05	-	< 0.05
Naphthalene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3

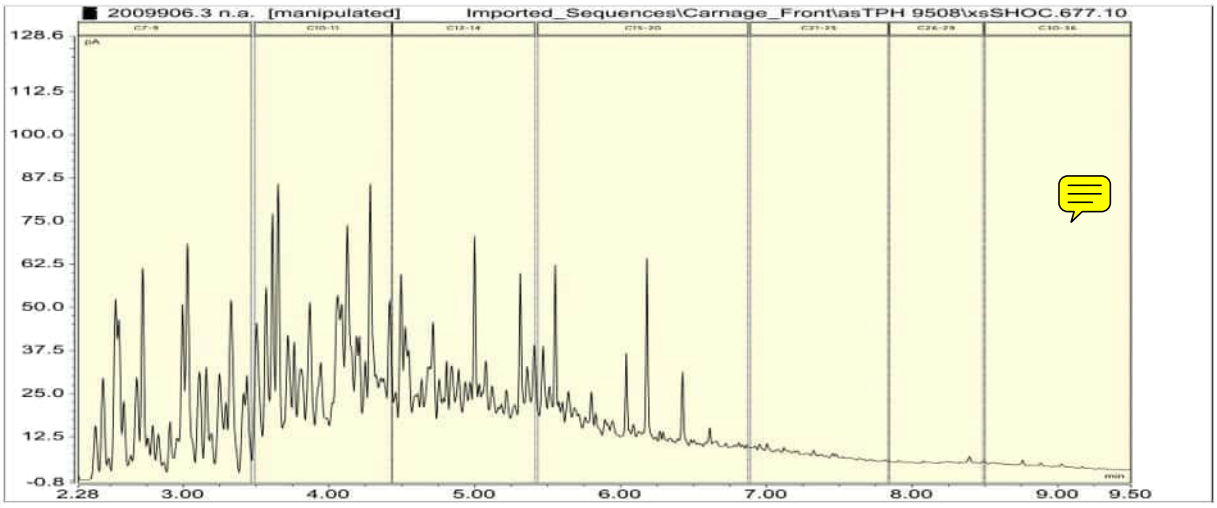
Sample Type: Soil						
Sample Name:		CBH208 5.8 - 6.0 03-Jul-2018	CBH202 4.4 - 4.5 03-Jul-2018			
Lab Number:		2009906.19	2009906.24			
Individual Tests						
Dry Matter	g/100g as rcvd	69	75	-	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	4	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	-	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt	-	18	-	-	-
Total Recoverable Copper	mg/kg dry wt	-	15	-	-	-
Total Recoverable Lead	mg/kg dry wt	-	9.2	-	-	-
Total Recoverable Mercury	mg/kg dry wt	-	< 0.10	-	-	-
Total Recoverable Nickel	mg/kg dry wt	-	47	-	-	-
Total Recoverable Zinc	mg/kg dry wt	-	78	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	120	-	-	-
C10 - C14	mg/kg dry wt	< 20	3,200	-	-	-
C15 - C36	mg/kg dry wt	< 40	1,550	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	4,900	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Toluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.5	< 0.5	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	< 0.3	-	-	-

Sample Type: Soil						
Sample Name:		CBH208 5.8 - 6.0 03-Jul-2018	CBH202 4.4 - 4.5 03-Jul-2018			
Lab Number:		2009906.19	2009906.24			
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Vinyl chloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	0.7	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	0.9	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	2.5	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	1.6	-	-	-
Styrene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 50	< 50	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 10	< 9	-	-	-
Acetone	mg/kg dry wt	< 50	< 50	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	< 0.3	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.05	< 0.05	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	< 0.3	-	-	-

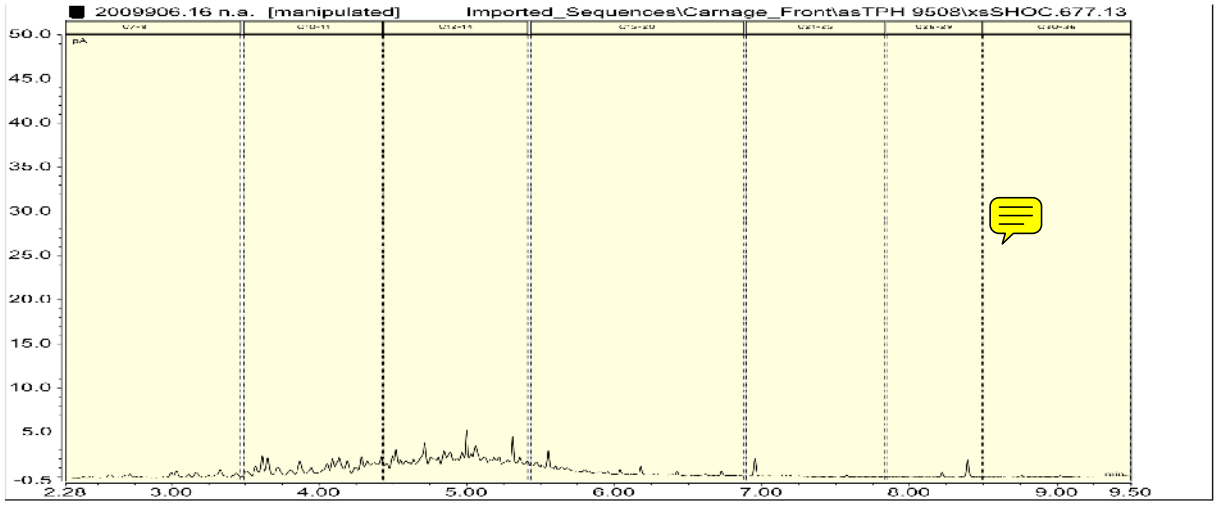
2009906.1
CBH209 0.2 - 0.6 03-Jul-2018
Client Chromatogram for TPH by FID



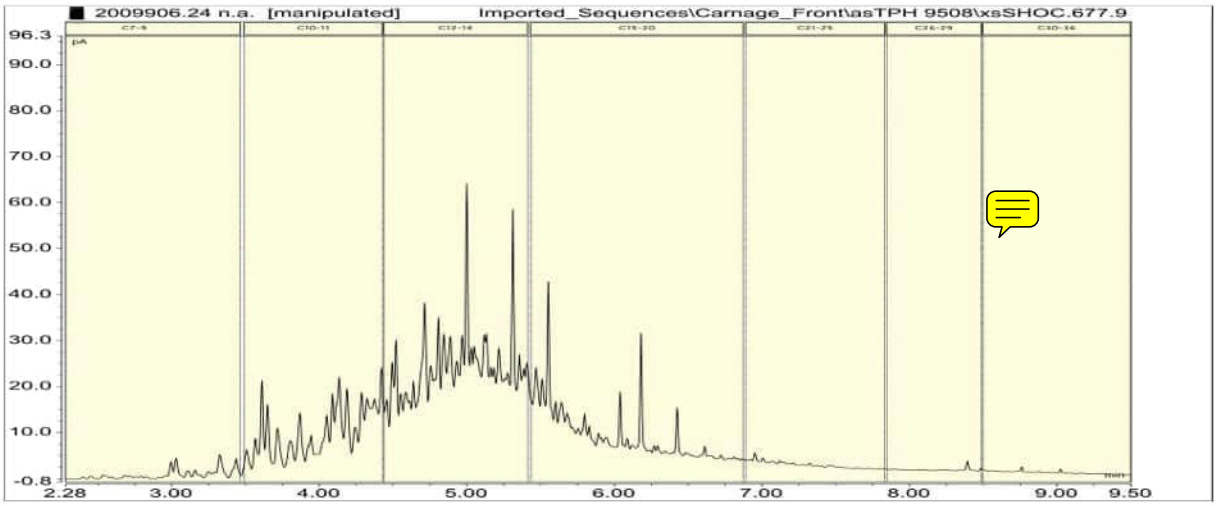
2009906.3
CBH209 1.4 - 1.9 03-Jul-2018
Client Chromatogram for TPH by FID



2009906.16
CBH208 3.0 - 3.2 03-Jul-2018
Client Chromatogram for TPH by FID



2009906.24
CBH202 4.4 - 4.5 03-Jul-2018
Client Chromatogram for TPH by FID



Analyst's Comments

#1 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. Replicate 1 = 690mg/kg, replicate 2 = 340mg/kg.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1, 3, 9, 11, 16, 19, 24
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	9
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	9
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1, 3, 9, 11, 16
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1, 3, 9, 11, 16
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	1, 3, 16
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1, 3, 9, 11, 16, 24
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	9
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.05 mg/kg dry wt	9, 11

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	9
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	19, 24
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	3, 9, 16, 19, 24
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	9
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	9
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	9
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	9
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	9
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	9
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	9
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	9
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	9
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	9
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	9
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	9
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	9
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	9
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	9
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	9

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

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

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2009907	A2Pv1
Contact:	Lucy Hine C/- Tonkin & Taylor PO Box 13055 Christchurch 8141	**Date Received:** **Date Reported:** **Quote No:** **Order No:** **Client Reference:** **Submitted By:**	03-Jul-2018 14-Jul-2018 88260 30881.2000 30881.2000 Melody Robyns	

Sample Type: Soil

Sample Name:		CBH209 - 0.2-0.6 03-Jul-2018				
Lab Number:		2009907.1				
Asbestos Presence / Absence		Chrysotile (White Asbestos) detected.	-	-	-	-
Description of Asbestos Form		Loose Fibres	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
As Received Weight	g	1,036.6	-	-	-	-
Dry Weight	g	918.0	-	-	-	-
Ashed Weight	g	905.3	-	-	-	-
Moisture	%	11	-	-	-	-
Dry Sample Fraction >10mm	g ashed wt	199.9	-	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	269.9	-	-	-	-
Sample Fraction <2mm	g ashed wt	433.7	-	-	-	-
<2mm Subsample Weight	g ashed wt	58.5	-	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	0.00004	-	-	-	-

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

The following assumptions have been made:

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

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	1
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	1
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1

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

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

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2010644	SPv2
Contact:	Lucy Hine	**Date Received:**	04-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	17-Aug-2018	**(Amended)**
	PO Box 13055	**Quote No:**	88260	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		CBH202 - 6.1-6.2 04-Jul-2018	CBH204 - 1.8-2.0 04-Jul-2018	CBH204 - 5.8-6.0 04-Jul-2018	GBH103 - 5.45-5.7 04-Jul-2018	GBH103 - 4.1-4.5 04-Jul-2018
Lab Number:		2010644.3	2010644.8	2010644.11	2010644.22	2010644.23
Individual Tests						
Dry Matter	g/100g as rcvd	76	75	79	58	79
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	5	-	-	6
Total Recoverable Cadmium	mg/kg dry wt	-	0.10	-	-	< 0.10
Total Recoverable Chromium	mg/kg dry wt	-	45	-	-	16
Total Recoverable Copper	mg/kg dry wt	-	51	-	-	15
Total Recoverable Lead	mg/kg dry wt	-	143	-	-	19.8
Total Recoverable Mercury	mg/kg dry wt	-	0.20	-	-	0.55
Total Recoverable Nickel	mg/kg dry wt	-	56	-	-	12
Total Recoverable Zinc	mg/kg dry wt	-	173	-	-	58
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	-	0.99	-	-	0.020
2-Methylnaphthalene	mg/kg dry wt	-	0.66	-	-	< 0.013
Perylene	mg/kg dry wt	-	< 0.13	-	-	0.070
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	-	< 0.4	-	-	0.23
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	-	< 0.4	-	-	0.23
Acenaphthylene	mg/kg dry wt	-	< 0.13	-	-	< 0.013
Acenaphthene	mg/kg dry wt	-	< 0.13	-	-	< 0.013
Anthracene	mg/kg dry wt	-	< 0.13	-	-	0.018
Benzo[a]anthracene	mg/kg dry wt	-	0.14	-	-	0.129
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	0.14	-	-	0.179
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	< 0.13	-	-	0.196
Benzo[e]pyrene	mg/kg dry wt	-	< 0.13	-	-	0.126
Benzo[g,h,i]perylene	mg/kg dry wt	-	0.13	-	-	0.104
Benzo[k]fluoranthene	mg/kg dry wt	-	< 0.13	-	-	0.055
Chrysene	mg/kg dry wt	-	< 0.13	-	-	0.129
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.13	-	-	< 0.013
Fluoranthene	mg/kg dry wt	-	0.16	-	-	0.27
Fluorene	mg/kg dry wt	-	< 0.13	-	-	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	0.16	-	-	0.112
Naphthalene	mg/kg dry wt	-	< 0.7	-	-	< 0.07
Phenanthrene	mg/kg dry wt	-	< 0.13	-	-	0.059
Pyrene	mg/kg dry wt	-	< 0.13	-	-	0.39

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Soil						
Sample Name:		CBH202 - 6.1-6.2 04-Jul-2018	CBH204 - 1.8-2.0 04-Jul-2018	CBH204 - 5.8-6.0 04-Jul-2018	GBH103 - 5.45-5.7 04-Jul-2018	GBH103 - 4.1-4.5 04-Jul-2018
Lab Number:		2010644.3	2010644.8	2010644.11	2010644.22	2010644.23
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	84	96	< 8	-	< 8
C10 - C14	mg/kg dry wt	1,230	2,100	< 20	-	< 20
C15 - C36	mg/kg dry wt	580	760	< 40	-	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	1,900	2,900	< 70	-	< 70
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	< 0.3	< 0.2	< 0.4	< 0.19
Ethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Toluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
m&p-Xylene	mg/kg dry wt	< 0.5	< 0.5	< 0.4	< 0.7	< 0.4
o-Xylene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Carbon tetrachloride	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Chloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Chloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Dibromomethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,3-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,2-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,1-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	< 3	< 3	< 3
1,2-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,1-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Hexachlorobutadiene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Trichlorofluoromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Vinyl chloride	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
4-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
2-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3

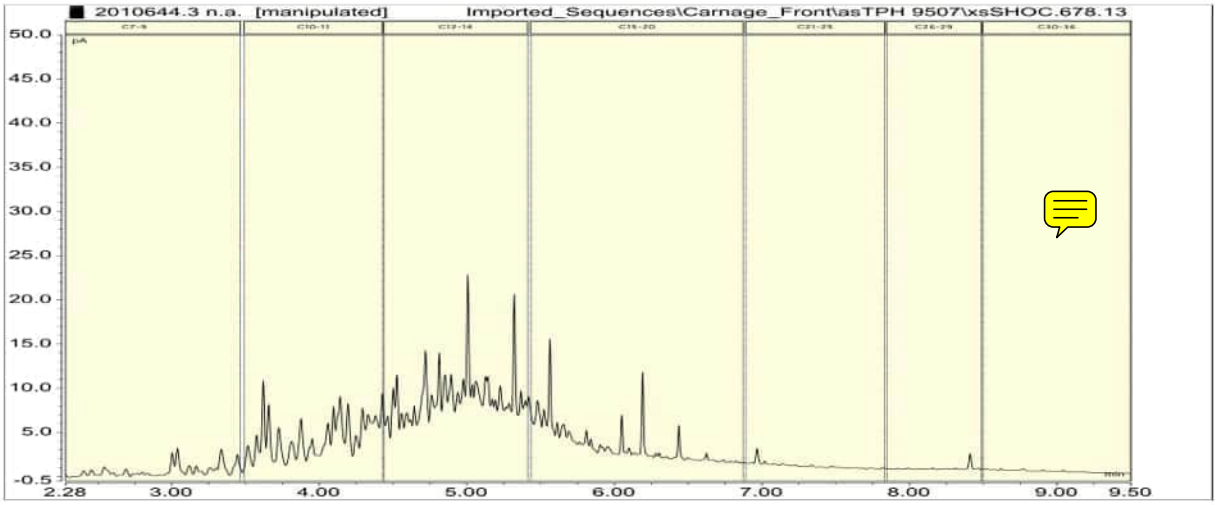
Sample Type: Soil						
Sample Name:		CBH202 - 6.1-6.2 04-Jul-2018	CBH204 - 1.8-2.0 04-Jul-2018	CBH204 - 5.8-6.0 04-Jul-2018	GBH103 - 5.45-5.7 04-Jul-2018	GBH103 - 4.1-4.5 04-Jul-2018
Lab Number:		2010644.3	2010644.8	2010644.11	2010644.22	2010644.23
Haloaromatics in VOC Soils by Headspace GC-MS						
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	0.7	10.2	< 0.3	< 0.4	< 0.3
tert-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	1.0	17.2	< 0.3	< 0.4	< 0.3
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
n-Propylbenzene	mg/kg dry wt	2.4	45	0.3	< 0.4	< 0.3
sec-Butylbenzene	mg/kg dry wt	1.4	2.6	< 0.3	< 0.4	< 0.3
Styrene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 50	< 50	< 40	< 70	< 40
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 9	< 9	< 8	< 13	< 8
Acetone	mg/kg dry wt	< 50	< 50	< 40	< 70	< 40
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Dibromochloromethane	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.05	< 0.05	< 0.05	< 0.07	< 0.05
Naphthalene	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3

Sample Name:		GBH103 - 1.3-1.55 04-Jul-2018				
Lab Number:		2010644.26				
Individual Tests						
Dry Matter	g/100g as rcvd	83	-	-	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	4	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	2	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	32	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	5	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	20	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	23	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	7.1	-	-	-	-
Perylene	mg/kg dry wt	0.030	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.26	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.26	-	-	-	-
Acenaphthylene	mg/kg dry wt	0.53	-	-	-	-
Acenaphthene	mg/kg dry wt	1.56	-	-	-	-
Anthracene	mg/kg dry wt	0.40	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	0.22	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.192	-	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	0.22	-	-	-	-

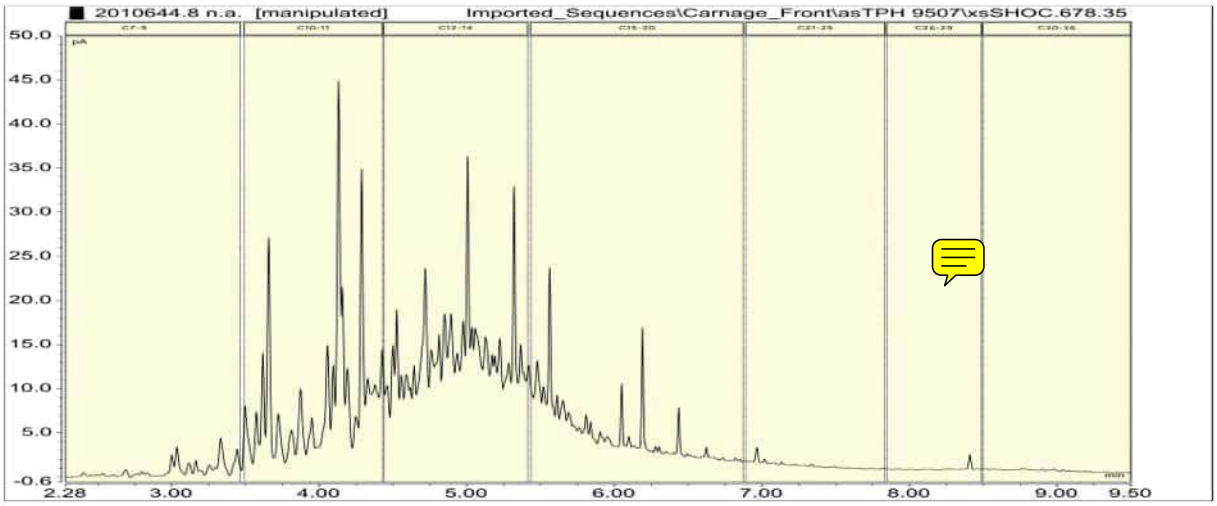
Sample Type: Soil						
Sample Name:		GBH103 - 1.3-1.55 04-Jul-2018				
Lab Number:		2010644.26				
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Benzo[e]pyrene	mg/kg dry wt	0.165	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.126	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	0.080	-	-	-	-
Chrysene	mg/kg dry wt	0.137	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	-	-	-	-
Fluoranthene	mg/kg dry wt	0.79	-	-	-	-
Fluorene	mg/kg dry wt	1.92	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.108	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.06	-	-	-	-
Phenanthrene	mg/kg dry wt	2.1	-	-	-	-
Pyrene	mg/kg dry wt	1.15	-	-	-	-
Polychlorinated Biphenyls Screening in Soil						
PCB-18	mg/kg dry wt	< 0.010	-	-	-	-
PCB-28	mg/kg dry wt	< 0.010	-	-	-	-
PCB-31	mg/kg dry wt	< 0.010	-	-	-	-
PCB-44	mg/kg dry wt	< 0.010	-	-	-	-
PCB-49	mg/kg dry wt	< 0.010	-	-	-	-
PCB-52	mg/kg dry wt	< 0.010	-	-	-	-
PCB-60	mg/kg dry wt	< 0.010	-	-	-	-
PCB-77	mg/kg dry wt	< 0.010	-	-	-	-
PCB-81	mg/kg dry wt	< 0.010	-	-	-	-
PCB-86	mg/kg dry wt	< 0.010	-	-	-	-
PCB-101	mg/kg dry wt	< 0.010	-	-	-	-
PCB-105	mg/kg dry wt	< 0.010	-	-	-	-
PCB-110	mg/kg dry wt	< 0.010	-	-	-	-
PCB-114	mg/kg dry wt	< 0.010	-	-	-	-
PCB-118	mg/kg dry wt	< 0.010	-	-	-	-
PCB-121	mg/kg dry wt	< 0.010	-	-	-	-
PCB-123	mg/kg dry wt	< 0.010	-	-	-	-
PCB-126	mg/kg dry wt	< 0.010	-	-	-	-
PCB-128	mg/kg dry wt	< 0.010	-	-	-	-
PCB-138	mg/kg dry wt	< 0.010	-	-	-	-
PCB-141	mg/kg dry wt	< 0.010	-	-	-	-
PCB-149	mg/kg dry wt	< 0.010	-	-	-	-
PCB-151	mg/kg dry wt	< 0.010	-	-	-	-
PCB-153	mg/kg dry wt	< 0.010	-	-	-	-
PCB-156	mg/kg dry wt	< 0.010	-	-	-	-
PCB-157	mg/kg dry wt	< 0.010	-	-	-	-
PCB-159	mg/kg dry wt	< 0.010	-	-	-	-
PCB-167	mg/kg dry wt	< 0.010	-	-	-	-
PCB-169	mg/kg dry wt	< 0.010	-	-	-	-
PCB-170	mg/kg dry wt	< 0.010	-	-	-	-
PCB-180	mg/kg dry wt	< 0.010	-	-	-	-
PCB-189	mg/kg dry wt	< 0.010	-	-	-	-
PCB-194	mg/kg dry wt	< 0.010	-	-	-	-
PCB-206	mg/kg dry wt	< 0.010	-	-	-	-
PCB-209	mg/kg dry wt	< 0.010	-	-	-	-
Mono-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.0010	-	-	-	-
Non-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.0013	-	-	-	-
Total PCB (Sum of 35 congeners)	mg/kg dry wt	< 0.4	-	-	-	-

Sample Type: Soil						
Sample Name:		GBH103 - 1.3-1.55 04-Jul-2018				
Lab Number:		2010644.26				
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	510	-	-	-	-
C10 - C14	mg/kg dry wt	6,200	-	-	-	-
C15 - C36	mg/kg dry wt	3,800	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	10,500	-	-	-	-

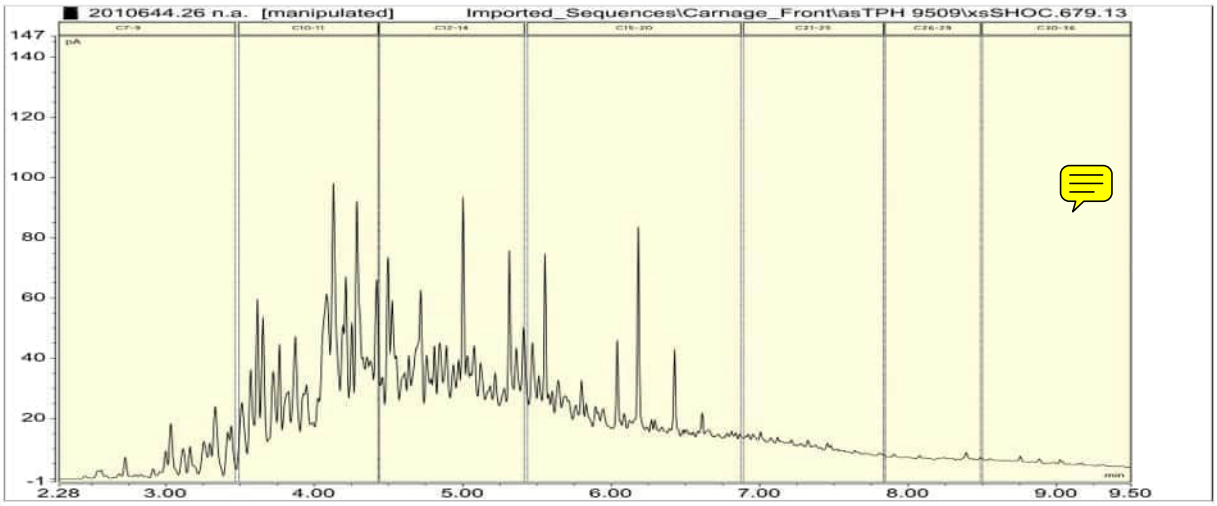
2010644.3
CBH202 - 6.1-6.2 04-Jul-2018
Client Chromatogram for TPH by FID



2010644.8
CBH204 - 1.8-2.0 04-Jul-2018
Client Chromatogram for TPH by FID



2010644.26
GBH103 - 1.3-1.55 04-Jul-2018
Client Chromatogram for TPH by FID



Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier certificate issued on 17 Jul 2018 at 3:08 pm
Reason for amendment: PCB added to sample GBH103 1.3-1.55.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	8, 23, 26
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	8, 23, 26
Polychlorinated Biphenyls Screening in Soil*	Sonication extraction, SPE cleanup, GC-MS analysis. Tested on dried sample	0.0010 - 0.2 mg/kg dry wt	26
Total Petroleum Hydrocarbons in Soil*	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	3, 11
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	3, 8, 11, 22-23
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	3, 8, 11, 22-23, 26
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	8, 23, 26
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	8, 23, 26

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2010645	A2Pv2
Contact:	Lucy Hine	**Date Received:**	04-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	30-Aug-2018	**(Amended)**
	PO Box 13055	**Quote No:**	88260	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		CBH204 -1.8-2.0 04-Jul-2018	GBH103 0.15-0.25 04-Jul-2018			
Lab Number:		2010645.1	2010645.3			
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	-	-	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
As Received Weight	g	1,060.5	1,076.0	-	-	-
Dry Weight	g	737.7	1,011.6	-	-	-
Ashed Weight	g	675.5	1,009.0	-	-	-
Moisture	%	30	6	-	-	-
Dry Sample Fraction >10mm	g ashed wt	20.1	789.7	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	180.5	90.3	-	-	-
Sample Fraction <2mm	g ashed wt	472.8	128.0	-	-	-
<2mm Subsample Weight	g ashed wt	56.4	50.3	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	< 0.00001	< 0.00001	-	-	-

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

The following assumptions have been made:

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

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

Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier certificate issued on 16 Jul 2018 at 4:30 pm
Reason for amendment: Additional testing added.

ilac-MRA IANZ ACCREDITED LABORATORY

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	1
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 3
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 3
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 3
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	1, 3
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1, 3
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1, 3
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1, 3
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1, 3
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1, 3
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 3
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 3
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 3
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Rhodri Williams BSc (Hons)
Section Manager - Asbestos

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2011331	A2Pv2
Contact:	Lucy Hine	**Date Received:**	05-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	30-Aug-2018	**(Amended)**
	PO Box 13055	**Quote No:**	80842	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

		Sample Name:	CBH206-0.2-0.6 05-Jul-2018	CBH207-0.6-0.9 05-Jul-2018			
		Lab Number:	2011331.1	2011331.3			
Asbestos Presence / Absence			Asbestos NOT detected.	Chrysotile (White Asbestos) detected.	-	-	-
Description of Asbestos Form			-	Loose Fibres	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w		< 0.001	< 0.001	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w		< 0.001	< 0.001	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w		< 0.001	< 0.001	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w		< 0.001	< 0.001	-	-	-
As Received Weight	g		752.4	988.3	-	-	-
Dry Weight	g		576.4	827.4	-	-	-
Ashed Weight	g		558.0	821.9	-	-	-
Moisture	%		23	16	-	-	-
Dry Sample Fraction >10mm	g ashed wt		23.3	294.0	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt		227.4	320.6	-	-	-
Sample Fraction <2mm	g ashed wt		305.6	206.5	-	-	-
<2mm Subsample Weight	g ashed wt		59.7	51.0	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt		< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt		< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt		< 0.00001	0.00005	-	-	-

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

The following assumptions have been made:

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

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

Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier certificate issued on 19 Jul 2018 at 1:01 pm
Reason for amendment: Additional testing added.

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New Zealand Guidelines Semi Quantitative Asbestos in Soil			
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Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 3
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 3
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	1, 3
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1, 3
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1, 3
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Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1, 3
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1, 3
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 3
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 3
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 3
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2011332	SPv2
Contact:	Lucy Hine	**Date Received:**	05-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	27-Aug-2018	**(Amended)**
	PO Box 13055	**Quote No:**	80842	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		CBH206 - 0.2-0.6 05-Jul-2018	CBH206 - 3.0-3.2 05-Jul-2018	CBH206 - 5.7-6.0 05-Jul-2018	CBH207 - 0.2-0.4 05-Jul-2018	CBH207 - 2.0-2.2 05-Jul-2018
Lab Number:		2011332.2	2011332.7	2011332.11	2011332.14	2011332.16
Individual Tests						
Dry Matter	g/100g as rcvd	79	76	72	84	75
Total Cyanide*	mg/kg dry wt	1.62	-	-	-	-
Total Organic Carbon*	g/100g dry wt	-	1.23	-	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	12	8	-	6	-
Total Recoverable Cadmium	mg/kg dry wt	0.57	0.10	-	0.17	-
Total Recoverable Chromium	mg/kg dry wt	32	31	-	39	-
Total Recoverable Copper	mg/kg dry wt	77	28	-	55	-
Total Recoverable Lead	mg/kg dry wt	210	169	-	191	-
Total Recoverable Mercury	mg/kg dry wt	4.3	0.49	-	0.47	-
Total Recoverable Nickel	mg/kg dry wt	72	35	-	104	-
Total Recoverable Zinc	mg/kg dry wt	340	124	-	135	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	0.062	1.33	-	0.015	-
2-Methylnaphthalene	mg/kg dry wt	0.066	1.48	-	< 0.012	-
Perylene	mg/kg dry wt	0.155	0.128	-	0.087	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.65	0.51	-	0.36	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.65	0.50	-	0.36	-
Acenaphthylene	mg/kg dry wt	0.123	0.072	-	0.019	-
Acenaphthene	mg/kg dry wt	0.031	0.178	-	< 0.012	-
Anthracene	mg/kg dry wt	0.103	0.179	-	< 0.012	-
Benzo[a]anthracene	mg/kg dry wt	0.41	0.32	-	0.125	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.44	0.34	-	0.29	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.75	0.49	-	0.30	-
Benzo[e]pyrene	mg/kg dry wt	0.50	0.30	-	0.25	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.42	0.40	-	0.26	-
Benzo[k]fluoranthene	mg/kg dry wt	0.26	0.160	-	0.097	-
Chrysene	mg/kg dry wt	0.48	0.29	-	0.144	-
Dibenzo[a,h]anthracene	mg/kg dry wt	0.017	0.018	-	< 0.012	-
Fluoranthene	mg/kg dry wt	1.05	1.00	-	0.172	-
Fluorene	mg/kg dry wt	0.035	0.23	-	< 0.012	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.39	0.39	-	0.23	-
Naphthalene	mg/kg dry wt	0.11	1.11	-	< 0.06	-
Phenanthrene	mg/kg dry wt	0.32	0.88	-	0.021	-
Pyrene	mg/kg dry wt	1.18	1.03	-	0.26	-

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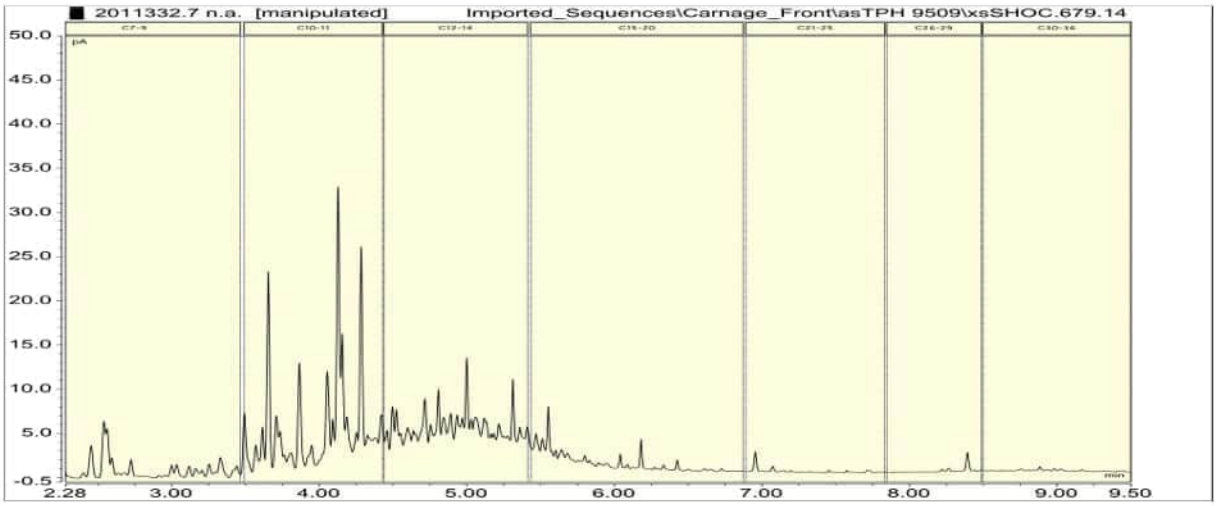
Sample Type: Soil						
Sample Name:		CBH206 - 0.2-0.6 05-Jul-2018	CBH206 - 3.0-3.2 05-Jul-2018	CBH206 - 5.7-6.0 05-Jul-2018	CBH207 - 0.2-0.4 05-Jul-2018	CBH207 - 2.0-2.2 05-Jul-2018
Lab Number:		2011332.2	2011332.7	2011332.11	2011332.14	2011332.16
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	109	< 9	-	200
C10 - C14	mg/kg dry wt	-	1,040	< 20	-	1,900
C15 - C36	mg/kg dry wt	-	340	< 40	-	640
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	1,490	< 70	-	2,700
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	-	0.9	< 0.3	-	< 0.3
Ethylbenzene	mg/kg dry wt	-	4.8	< 0.3	-	< 0.3
Toluene	mg/kg dry wt	-	0.4	< 0.3	-	< 0.3
m&p-Xylene	mg/kg dry wt	-	2.0	< 0.5	-	< 0.5
o-Xylene	mg/kg dry wt	-	0.6	< 0.3	-	< 0.3
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Carbon tetrachloride	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dibromomethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dichlorodifluoromethane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
1,1-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 3	< 3	-	< 3
1,2-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Hexachlorobutadiene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Trichlorofluoromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Vinyl chloride	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
4-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
2-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3

Sample Type: Soil						
Sample Name:		CBH206 - 0.2-0.6 05-Jul-2018	CBH206 - 3.0-3.2 05-Jul-2018	CBH206 - 5.7-6.0 05-Jul-2018	CBH207 - 0.2-0.4 05-Jul-2018	CBH207 - 2.0-2.2 05-Jul-2018
Lab Number:		2011332.2	2011332.7	2011332.11	2011332.14	2011332.16
Haloaromatics in VOC Soils by Headspace GC-MS						
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	-	22	< 0.3	-	0.6
tert-Butylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	-	44	< 0.3	-	1.5
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	0.8	< 0.3	-	< 0.3
n-Propylbenzene	mg/kg dry wt	-	117	0.3	-	4.4
sec-Butylbenzene	mg/kg dry wt	-	4.5	< 0.3	-	1.2
Styrene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	-	48	< 0.3	-	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	-	17.8	< 0.3	-	< 0.3
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	-	< 40	< 50	-	< 50
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 8	< 9	-	< 9
Acetone	mg/kg dry wt	-	< 40	< 50	-	< 50
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
Chloroform (Trichloromethane)	mg/kg as rcvd	-	< 0.3	< 0.3	-	< 0.3
Dibromochloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	-	< 0.05	< 0.05	-	< 0.05
Naphthalene	mg/kg dry wt	-	3.3	< 0.3	-	< 0.3

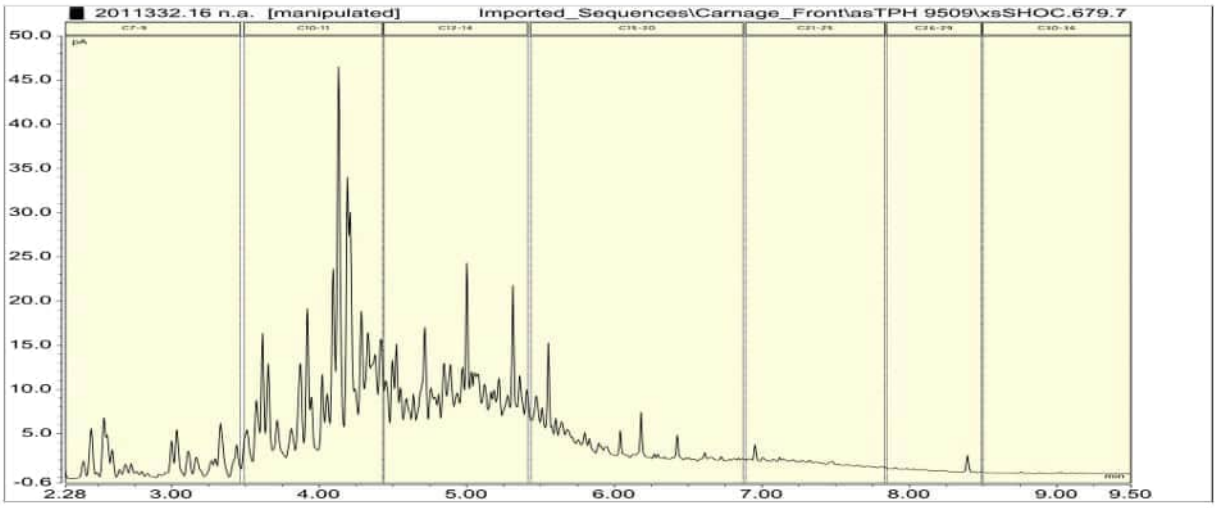
Sample Name:		CBH207 - 5.0-5.2 05-Jul-2018				
Lab Number:		2011332.22				
Individual Tests						
Dry Matter	g/100g as rcvd	76	-	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Toluene	mg/kg dry wt	< 0.3	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.5	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	-	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	-	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	-	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	-	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	-	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	-	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-

Sample Type: Soil						
Sample Name:		CBH207 - 5.0-5.2 05-Jul-2018				
Lab Number:		2011332.22				
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,1-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	-	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	-	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	-	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	-	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Styrene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 50	-	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 9	-	-	-	-
Acetone	mg/kg dry wt	< 50	-	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	-	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	-	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	-	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.05	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	-	-	-	-

2011332.7
CBH206 - 3.0-3.2 05-Jul-2018
Client Chromatogram for TPH by FID



2011332.16
CBH207 - 2.0-2.2 05-Jul-2018
Client Chromatogram for TPH by FID



Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier certificate issued on 16 Jul 2018 at 12:44 pm
Reason for amendment: TOC analysis has been added to sample 2011332.7 at the client's request.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	7
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	2, 7, 14
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.05 mg/kg dry wt	2, 14

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	11, 16
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	7, 11, 16, 22
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	2, 7, 11, 14, 16, 22
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	2
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	2
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	7
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	2, 7, 14
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	2, 7, 14

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2011994	SPv1
Contact:	Lucy Hine	**Date Received:**	06-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	18-Jul-2018	
	PO Box 13055	**Quote No:**	80842	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		CBH201_0.7-1.0 06-Jul-2018 3:00 pm	CBH201_2.1-2.6 06-Jul-2018 2:00 pm	CBH201_5.0-5.2 06-Jul-2018 2:00 pm	GBH108_0.45-0.6 06-Jul-2018 3:00 pm	GBH108_1.9-2.1 06-Jul-2018 2:00 pm
Lab Number:		2011994.3	2011994.9	2011994.14	2011994.16	2011994.20
Individual Tests						
Dry Matter	g/100g as rcvd	93	83	63	87	76
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	6	-	6	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	-	0.23	< 0.10
Total Recoverable Chromium	mg/kg dry wt	34	10	-	23	18
Total Recoverable Copper	mg/kg dry wt	44	17	-	240	20
Total Recoverable Lead	mg/kg dry wt	4.2	88	-	320	11.1
Total Recoverable Mercury	mg/kg dry wt	< 0.10	0.10	-	0.39	< 0.10
Total Recoverable Nickel	mg/kg dry wt	143	19	-	41	10
Total Recoverable Zinc	mg/kg dry wt	38	76	-	560	46
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.011	8.6	-	0.024	3.0
2-Methylnaphthalene	mg/kg dry wt	< 0.011	12.2	-	0.029	3.4
Perylene	mg/kg dry wt	< 0.011	< 0.012	-	0.013	0.018
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	0.08	-	< 0.03	< 0.04
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	0.08	-	< 0.03	< 0.04
Acenaphthylene	mg/kg dry wt	< 0.011	0.187	-	< 0.012	0.062
Acenaphthene	mg/kg dry wt	< 0.011	0.43	-	< 0.012	0.22
Anthracene	mg/kg dry wt	< 0.011	0.058	-	< 0.012	< 0.013
Benzo[a]anthracene	mg/kg dry wt	< 0.011	0.038	-	< 0.012	< 0.013
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.011	0.058	-	0.020	< 0.013
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.011	0.054	-	0.023	0.027
Benzo[e]pyrene	mg/kg dry wt	< 0.011	0.025	-	0.030	0.024
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.011	0.033	-	0.043	< 0.013
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	0.019	-	< 0.012	< 0.013
Chrysene	mg/kg dry wt	< 0.011	0.020	-	< 0.012	< 0.013
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.012	-	< 0.012	< 0.013
Fluoranthene	mg/kg dry wt	< 0.011	0.134	-	0.018	0.063
Fluorene	mg/kg dry wt	< 0.011	0.74	-	< 0.012	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.011	0.029	-	0.026	< 0.013
Naphthalene	mg/kg dry wt	< 0.06	0.85	-	< 0.06	0.46
Phenanthrene	mg/kg dry wt	< 0.011	0.64	-	< 0.012	0.128
Pyrene	mg/kg dry wt	< 0.011	0.160	-	0.026	0.088

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		CBH201_0.7-1.0 06-Jul-2018 3:00 pm	CBH201_2.1-2.6 06-Jul-2018 2:00 pm	CBH201_5.0-5.2 06-Jul-2018 2:00 pm	GBH108_0.45-0.6 06-Jul-2018 3:00 pm	GBH108_1.9-2.1 06-Jul-2018 2:00 pm
Lab Number:		2011994.3	2011994.9	2011994.14	2011994.16	2011994.20
Polychlorinated Biphenyls Screening in Soil						
PCB-18	mg/kg dry wt	< 0.010	-	-	-	-
PCB-28	mg/kg dry wt	< 0.010	-	-	-	-
PCB-31	mg/kg dry wt	< 0.010	-	-	-	-
PCB-44	mg/kg dry wt	< 0.010	-	-	-	-
PCB-49	mg/kg dry wt	< 0.010	-	-	-	-
PCB-52	mg/kg dry wt	< 0.010	-	-	-	-
PCB-60	mg/kg dry wt	< 0.010	-	-	-	-
PCB-77	mg/kg dry wt	< 0.010	-	-	-	-
PCB-81	mg/kg dry wt	< 0.010	-	-	-	-
PCB-86	mg/kg dry wt	< 0.010	-	-	-	-
PCB-101	mg/kg dry wt	< 0.010	-	-	-	-
PCB-105	mg/kg dry wt	< 0.010	-	-	-	-
PCB-110	mg/kg dry wt	< 0.010	-	-	-	-
PCB-114	mg/kg dry wt	< 0.010	-	-	-	-
PCB-118	mg/kg dry wt	< 0.010	-	-	-	-
PCB-121	mg/kg dry wt	< 0.010	-	-	-	-
PCB-123	mg/kg dry wt	< 0.010	-	-	-	-
PCB-126	mg/kg dry wt	< 0.010	-	-	-	-
PCB-128	mg/kg dry wt	< 0.010	-	-	-	-
PCB-138	mg/kg dry wt	< 0.010	-	-	-	-
PCB-141	mg/kg dry wt	< 0.010	-	-	-	-
PCB-149	mg/kg dry wt	< 0.010	-	-	-	-
PCB-151	mg/kg dry wt	< 0.010	-	-	-	-
PCB-153	mg/kg dry wt	< 0.010	-	-	-	-
PCB-156	mg/kg dry wt	< 0.010	-	-	-	-
PCB-157	mg/kg dry wt	< 0.010	-	-	-	-
PCB-159	mg/kg dry wt	< 0.010	-	-	-	-
PCB-167	mg/kg dry wt	< 0.010	-	-	-	-
PCB-169	mg/kg dry wt	< 0.010	-	-	-	-
PCB-170	mg/kg dry wt	< 0.010	-	-	-	-
PCB-180	mg/kg dry wt	< 0.010	-	-	-	-
PCB-189	mg/kg dry wt	< 0.010	-	-	-	-
PCB-194	mg/kg dry wt	< 0.010	-	-	-	-
PCB-206	mg/kg dry wt	< 0.010	-	-	-	-
PCB-209	mg/kg dry wt	< 0.010	-	-	-	-
Mono-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.0010	-	-	-	-
Non-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.0014	-	-	-	-
Total PCB (Sum of 35 congeners)	mg/kg dry wt	< 0.4	-	-	-	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	< 0.005	-	-	0.033	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	-	-	0.077	-
Tributyltin (as Sn)	mg/kg dry wt	< 0.004	-	-	0.025	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	-	-	< 0.003	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	670	< 10	< 8	84
C10 - C14	mg/kg dry wt	< 20	1,690	< 20	< 20	1,820
C15 - C36	mg/kg dry wt	< 40	1,010	< 40	1,000	880
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	3,400	< 70	1,000	2,800
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	-	0.60	< 0.3	-	< 0.3
Ethylbenzene	mg/kg dry wt	-	0.4	< 0.3	-	< 0.3
Toluene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3

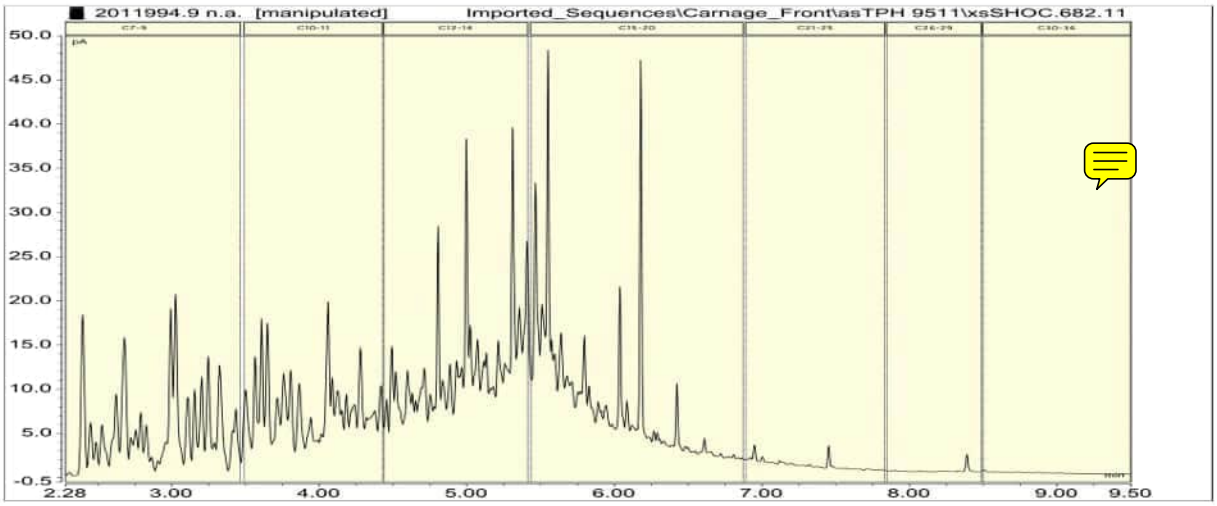
Sample Type: Soil						
Sample Name:		CBH201_0.7-1.0 06-Jul-2018 3:00 pm	CBH201_2.1-2.6 06-Jul-2018 2:00 pm	CBH201_5.0-5.2 06-Jul-2018 2:00 pm	GBH108_0.45-0.6 06-Jul-2018 3:00 pm	GBH108_1.9-2.1 06-Jul-2018 2:00 pm
Lab Number:		2011994.3	2011994.9	2011994.14	2011994.16	2011994.20
BTEX in VOC Soils by Headspace GC-MS						
m&p-Xylene	mg/kg dry wt	-	0.6	< 0.6	-	< 0.5
o-Xylene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Carbon tetrachloride	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dibromomethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dichlorodifluoromethane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
1,1-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 3	< 3	-	< 3
1,2-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Hexachlorobutadiene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Trichlorofluoromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Vinyl chloride	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
4-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
2-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	-	4.4	< 0.3	-	2.6
tert-Butylbenzene	mg/kg dry wt	-	0.3	< 0.3	-	0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	-	8.4	< 0.3	-	4.5
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	0.9	< 0.3	-	< 0.3
n-Propylbenzene	mg/kg dry wt	-	21	< 0.3	-	12.7

Sample Type: Soil						
Sample Name:		CBH201_0.7-1.0 06-Jul-2018 3:00 pm	CBH201_2.1-2.6 06-Jul-2018 2:00 pm	CBH201_5.0-5.2 06-Jul-2018 2:00 pm	GBH108_0.45-0.6 06-Jul-2018 3:00 pm	GBH108_1.9-2.1 06-Jul-2018 2:00 pm
Lab Number:		2011994.3	2011994.9	2011994.14	2011994.16	2011994.20
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
sec-Butylbenzene	mg/kg dry wt	-	3.3	< 0.3	-	3.7
Styrene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	-	0.6	< 0.3	-	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	-	< 40	< 60	-	< 50
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 7	< 11	-	< 9
Acetone	mg/kg dry wt	-	< 40	< 60	-	< 50
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	-	< 0.5	< 0.5	-	< 0.5
Chloroform (Trichloromethane)	mg/kg as rcvd	-	< 0.3	< 0.3	-	< 0.3
Dibromochloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	< 0.3
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	-	< 0.14	< 0.3	-	< 0.17
Naphthalene	mg/kg dry wt	-	< 0.6	< 0.6	-	< 0.6

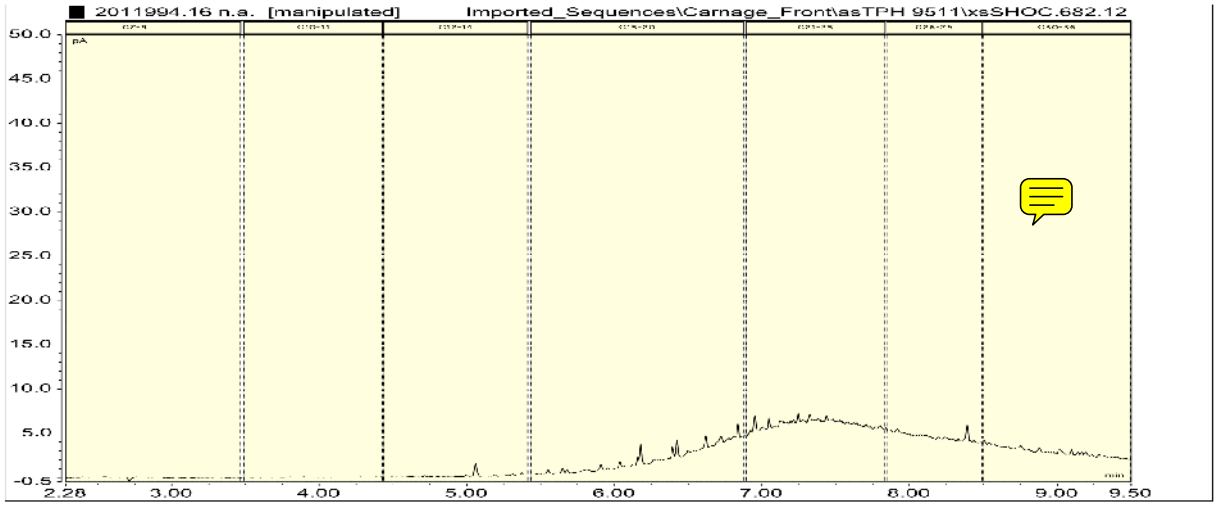
Sample Name:		GBH108_5.1-5.3 06-Jul-2018 2:00 pm				
Lab Number:		2011994.25				
Individual Tests						
Dry Matter	g/100g as rcvd	69	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	-	-	-	-
C10 - C14	mg/kg dry wt	< 20	-	-	-	-
C15 - C36	mg/kg dry wt	< 40	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	-	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Toluene	mg/kg dry wt	< 0.3	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.5	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	-	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	-	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	-	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	-	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	-	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	-	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-

Sample Type: Soil						
Sample Name:		GBH108_5.1-5.3 06-Jul-2018 2:00 pm				
Lab Number:		2011994.25				
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	-	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	-	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	-	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	-	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Styrene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 50	-	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 10	-	-	-	-
Acetone	mg/kg dry wt	< 50	-	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	-	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	-	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	-	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.19	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.6	-	-	-	-

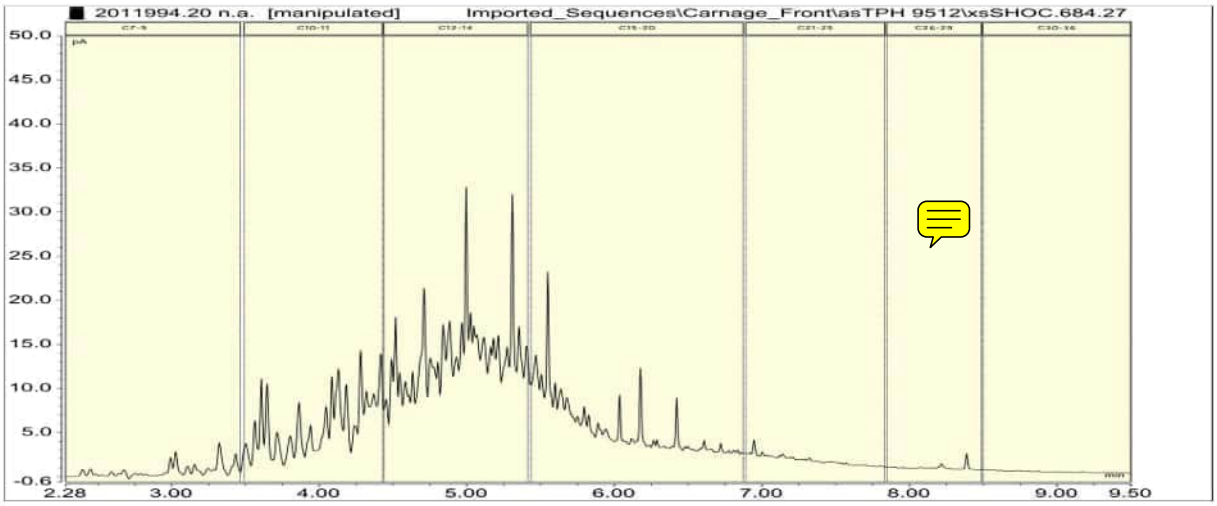
2011994.9
CBH201_2.1-2.6 06-Jul-2018 2:00 pm
Client Chromatogram for TPH by FID



2011994.16
GBH108_0.45-0.6 06-Jul-2018 3:00 pm
Client Chromatogram for TPH by FID



2011994.20
GBH108_1.9-2.1 06-Jul-2018 2:00 pm
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	3, 9, 16, 20
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	3, 9, 16, 20
Polychlorinated Biphenyls Screening in Soil*	Sonication extraction, SPE cleanup, GC-MS analysis. Tested on dried sample	0.0010 - 0.2 mg/kg dry wt	3
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	3, 16
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	14, 25
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	9, 14, 20, 25
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	3, 9, 14, 16, 20, 25
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	3, 9, 16, 20
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	3, 9, 16, 20

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

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

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Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2011995	A2Pv1
Contact:	Lucy Hine C/- Tonkin & Taylor PO Box 13055 Christchurch 8141	**Date Received:**	06-Jul-2018	
		Date Reported:	17-Jul-2018	
		Quote No:	80842	
		Order No:	Melody Robyns	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		CBH201-0.7-1.0 06-Jul-2018	GBH108-0.45-0.6 06-Jul-2018			
Lab Number:		2011995.3	2011995.4			
Asbestos Presence / Absence		Asbestos NOT detected.	Chrysotile (White Asbestos) detected.	-	-	-
Description of Asbestos Form		-	Loose Fibres	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
As Received Weight	g	543.4	973.6	-	-	-
Dry Weight	g	504.9	882.1	-	-	-
Ashed Weight	g	503.7	870.3	-	-	-
Moisture	%	7	9	-	-	-
Dry Sample Fraction >10mm	g ashed wt	267.8	286.7	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	166.4	307.4	-	-	-
Sample Fraction <2mm	g ashed wt	68.8	274.4	-	-	-
<2mm Subsample Weight	g ashed wt	68.8	51.4	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	< 0.00001	0.00012	-	-	-

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

The following assumptions have been made:

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

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	3-4
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3-4
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3-4
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3-4
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	3-4
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3-4
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3-4
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3-4
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	3-4
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	3-4
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3-4
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3-4
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3-4
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3-4
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3-4
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3-4
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3-4

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

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

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Section Manager - Asbestos

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2012478	A2Pv1
Contact:	Lucy Hine	**Date Received:**	09-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	18-Jul-2018	
	PO Box 13055	**Quote No:**	80842	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		GBH105 - 0.15-0.25m 06-Jul-2018 3:00 pm	GBH105 - 1.55 - 1.65m 06-Jul-2018 2:00 pm	GBH105 - 2.7 - 3.m 06-Jul-2018 2:00 pm		
Lab Number:		2012478.2	2012478.4	2012478.5		
Asbestos Presence / Absence		Asbestos NOT detected.	-	-	-	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
As Received Weight	g	1,183.7	-	-	-	-
Dry Weight	g	1,109.3	-	-	-	-
Ashed Weight	g	1,107.6	-	-	-	-
Moisture	%	6	-	-	-	-
Dry Sample Fraction >10mm	g ashed wt	706.4	-	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	169.7	-	-	-	-
Sample Fraction <2mm	g ashed wt	229.2	-	-	-	-
<2mm Subsample Weight	g ashed wt	50.5	-	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	< 0.00001	-	-	-	-
Dry Matter	g/100g as rcvd	90	78	75	-	-
Total Recoverable Arsenic	mg/kg dry wt	< 2	5	6	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	50	5	6	-	-
Total Recoverable Copper	mg/kg dry wt	63	3	3	-	-
Total Recoverable Lead	mg/kg dry wt	2.0	26	9.8	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	0.60	-	-
Total Recoverable Nickel	mg/kg dry wt	210	5	4	-	-
Total Recoverable Zinc	mg/kg dry wt	55	28	28	-	-
Total Cyanide*	mg/kg dry wt	-	0.6	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.011	9.3	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.011	2.2	-	-	-
Bromobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Benzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Soil						
Sample Name:		GBH105 - 0.15-0.25m 06-Jul-2018 3:00 pm	GBH105 - 1.55 - 1.65m 06-Jul-2018 2:00 pm	GBH105 - 2.7 - 3.m 06-Jul-2018 2:00 pm		
Lab Number:		2012478.2	2012478.4	2012478.5		
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Bromodichloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
4-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Bromoform (tribromomethane)	mg/kg dry wt	-	< 0.5	< 0.5	-	-
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
2-Butanone (MEK)	mg/kg dry wt	-	< 50	< 50	-	-
n-Butylbenzene	mg/kg dry wt	-	9.0	4.6	-	-
tert-Butylbenzene	mg/kg dry wt	-	0.3	0.3	-	-
Carbon disulphide	mg/kg dry wt	-	< 0.05	< 0.05	-	-
Carbon tetrachloride	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Chloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	-	< 0.3	< 0.3	-	-
Chloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 9	< 9	-	-
Acetone	mg/kg dry wt	-	< 50	< 50	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	-
Dibromochloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Dibromomethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Dibutyltin (as Sn)	mg/kg dry wt	< 0.005	-	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,3-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Dichlorodifluoromethane	mg/kg dry wt	-	< 0.5	< 0.5	-	-
1,1-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,1-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 3	< 3	-	-
1,2-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
2-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,1-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Ethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Hexachlorobutadiene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	-	7.9	5.2	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	-	-	-	-
Perylene	mg/kg dry wt	< 0.011	0.017	-	-	-
n-Propylbenzene	mg/kg dry wt	-	25	14.5	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	0.09	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	0.09	-	-	-
sec-Butylbenzene	mg/kg dry wt	-	5.1	3.1	-	-
Styrene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-

Sample Type: Soil						
Sample Name:		GBH105 - 0.15-0.25m 06-Jul-2018 3:00 pm	GBH105 - 1.55 - 1.65m 06-Jul-2018 2:00 pm	GBH105 - 2.7 - 3.m 06-Jul-2018 2:00 pm		
Lab Number:		2012478.2	2012478.4	2012478.5		
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Toluene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Tributyltin (as Sn)	mg/kg dry wt	< 0.004	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,1,2-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Trichlorofluoromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2,3-Trichloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	-	-	-	-
Vinyl chloride	mg/kg dry wt	-	< 0.3	< 0.3	-	-
m&p-Xylene	mg/kg dry wt	-	< 0.5	< 0.5	-	-
o-Xylene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
C7 - C9	mg/kg dry wt	-	1,030	520	-	-
C10 - C14	mg/kg dry wt	-	2,600	740	-	-
C15 - C36	mg/kg dry wt	-	1,170	105	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	4,800	1,370	-	-
Acenaphthylene	mg/kg dry wt	< 0.011	0.134	-	-	-
Acenaphthene	mg/kg dry wt	< 0.011	0.44	-	-	-
Anthracene	mg/kg dry wt	< 0.011	0.096	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.011	0.064	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.011	0.063	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.011	0.074	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.011	0.045	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.011	0.049	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	0.036	-	-	-
Chrysene	mg/kg dry wt	< 0.011	< 0.013	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.013	-	-	-
Fluoranthene	mg/kg dry wt	< 0.011	0.25	-	-	-
Fluorene	mg/kg dry wt	< 0.011	0.57	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.011	0.053	-	-	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.3	< 0.3	-	-
Phenanthrene	mg/kg dry wt	< 0.011	0.75	-	-	-
Pyrene	mg/kg dry wt	< 0.011	0.43	-	-	-

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

The following assumptions have been made:

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

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	2, 4-5
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	4
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	4
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	2, 4
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	2, 4
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	4
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	2, 4-5
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	2
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.05 mg/kg dry wt	2
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	2
Total Petroleum Hydrocarbons in Soil*	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	5
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	4-5
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	2
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	2
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	2
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

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TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2012478	SPv1
Contact:	Lucy Hine	**Date Received:**	09-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	18-Jul-2018	
	PO Box 13055	**Quote No:**	80842	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		GBH105 - 0.15-0.25m 06-Jul-2018 3:00 pm	GBH105 - 1.55 - 1.65m 06-Jul-2018 2:00 pm	GBH105 - 2.7 - 3.m 06-Jul-2018 2:00 pm		
Lab Number:		2012478.2	2012478.4	2012478.5		
Individual Tests						
Dry Matter	g/100g as rcvd	90	78	75	-	-
Total Cyanide*	mg/kg dry wt	-	0.6	-	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	5	6	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	50	5	6	-	-
Total Recoverable Copper	mg/kg dry wt	63	3	3	-	-
Total Recoverable Lead	mg/kg dry wt	2.0	26	9.8	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	0.60	-	-
Total Recoverable Nickel	mg/kg dry wt	210	5	4	-	-
Total Recoverable Zinc	mg/kg dry wt	55	28	28	-	-
New Zealand Guidelines Semi Quantitative Asbestos in Soil						
As Received Weight	g	1,183.7	-	-	-	-
Dry Weight	g	1,109.3	-	-	-	-
Ashed Weight	g	1,107.6	-	-	-	-
Moisture	%	6	-	-	-	-
Dry Sample Fraction >10mm	g ashed wt	706.4	-	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	169.7	-	-	-	-
Sample Fraction <2mm	g ashed wt	229.2	-	-	-	-
<2mm Subsample Weight	g ashed wt	50.5	-	-	-	-
Asbestos Presence / Absence		Asbestos NOT detected.	-	-	-	-
Description of Asbestos Form		-	-	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	-	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	< 0.00001	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-

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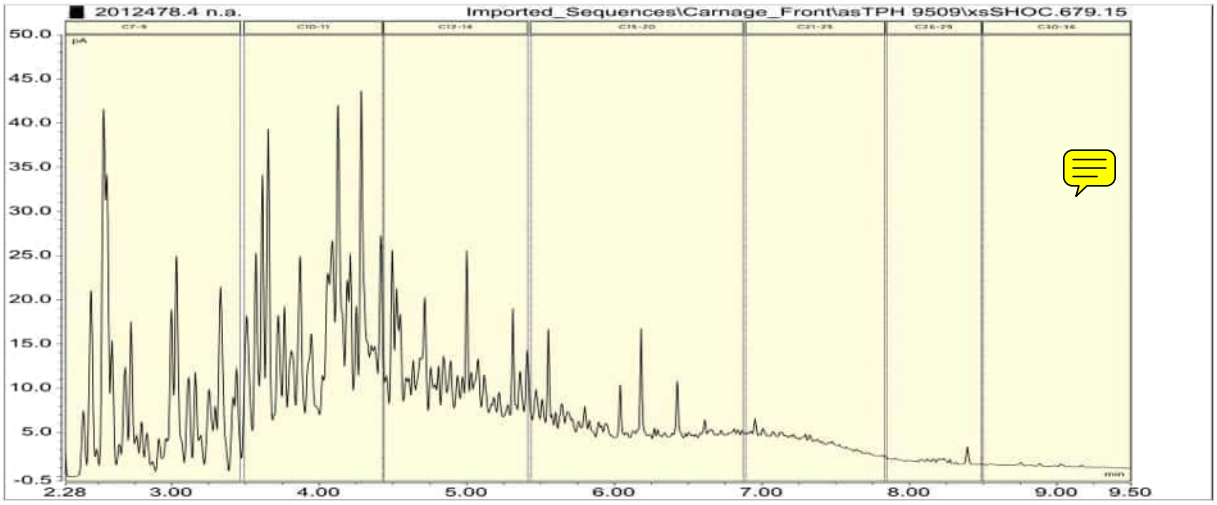
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Sample Type: Soil						
Sample Name:		GBH105 - 0.15-0.25m 06-Jul-2018 3:00 pm	GBH105 - 1.55 - 1.65m 06-Jul-2018 2:00 pm	GBH105 - 2.7 - 3.m 06-Jul-2018 2:00 pm		
Lab Number:		2012478.2	2012478.4	2012478.5		
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.011	9.3	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.011	2.2	-	-	-
Perylene	mg/kg dry wt	< 0.011	0.017	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	0.09	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	0.09	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.011	0.134	-	-	-
Acenaphthene	mg/kg dry wt	< 0.011	0.44	-	-	-
Anthracene	mg/kg dry wt	< 0.011	0.096	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.011	0.064	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.011	0.063	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.011	0.074	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.011	0.045	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.011	0.049	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	0.036	-	-	-
Chrysene	mg/kg dry wt	< 0.011	< 0.013	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.013	-	-	-
Fluoranthene	mg/kg dry wt	< 0.011	0.25	-	-	-
Fluorene	mg/kg dry wt	< 0.011	0.57	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.011	0.053	-	-	-
Naphthalene	mg/kg dry wt	< 0.06	1.03	-	-	-
Phenanthrene	mg/kg dry wt	< 0.011	0.75	-	-	-
Pyrene	mg/kg dry wt	< 0.011	0.43	-	-	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	< 0.005	-	-	-	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	-	-	-	-
Tributyltin (as Sn)	mg/kg dry wt	< 0.004	-	-	-	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	1,030	520	-	-
C10 - C14	mg/kg dry wt	-	2,600	740	-	-
C15 - C36	mg/kg dry wt	-	1,170	105	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	4,800	1,370	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Ethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Toluene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
m&p-Xylene	mg/kg dry wt	-	< 0.5	< 0.5	-	-
o-Xylene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Carbon tetrachloride	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Chloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Chloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Dibromomethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,3-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Dichlorodifluoromethane	mg/kg dry wt	-	< 0.5	< 0.5	-	-
1,1-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-

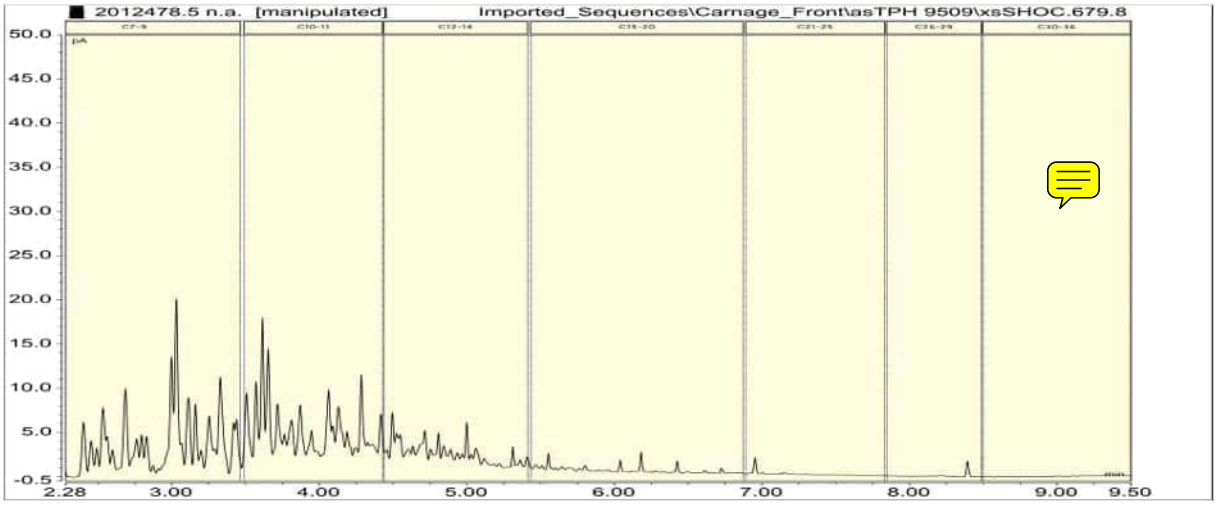
Sample Type: Soil						
Sample Name:		GBH105 - 0.15-0.25m 06-Jul-2018 3:00 pm	GBH105 - 1.55 - 1.65m 06-Jul-2018 2:00 pm	GBH105 - 2.7 - 3.m 06-Jul-2018 2:00 pm		
Lab Number:		2012478.2	2012478.4	2012478.5		
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,1-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 3	< 3	-	-
1,2-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,1-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Hexachlorobutadiene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,1,2-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Trichlorofluoromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2,3-Trichloropropane	mg/kg dry wt	-	< 0.5	< 0.5	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Vinyl chloride	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
4-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
2-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	-	9.0	4.6	-	-
tert-Butylbenzene	mg/kg dry wt	-	0.3	0.3	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	-	7.9	5.2	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
n-Propylbenzene	mg/kg dry wt	-	25	14.5	-	-
sec-Butylbenzene	mg/kg dry wt	-	5.1	3.1	-	-
Styrene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	-	< 50	< 50	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 9	< 9	-	-
Acetone	mg/kg dry wt	-	< 50	< 50	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Bromoform (tribromomethane)	mg/kg dry wt	-	< 0.5	< 0.5	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	-	< 0.3	< 0.3	-	-

Sample Type: Soil						
Sample Name:		GBH105 - 0.15-0.25m 06-Jul-2018 3:00 pm	GBH105 - 1.55 - 1.65m 06-Jul-2018 2:00 pm	GBH105 - 2.7 - 3.m 06-Jul-2018 2:00 pm		
Lab Number:		2012478.2	2012478.4	2012478.5		
Trihalomethanes in VOC Soils by Headspace GC-MS						
Dibromochloromethane	mg/kg dry wt	-	< 0.3	< 0.3	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	-	< 0.05	< 0.05	-	-
Naphthalene	mg/kg dry wt	-	< 0.3	< 0.3	-	-

2012478.4
GBH105 - 1.55 - 1.65m 06-Jul-2018 2:00 pm
Client Chromatogram for TPH by FID



2012478.5
GBH105 - 2.7 - 3.m 06-Jul-2018 2:00 pm
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	2, 4-5

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	4
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	4
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	2, 4
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	2, 4
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	4
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	2, 4-5
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	2
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.05 mg/kg dry wt	2
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	2
Total Petroleum Hydrocarbons in Soil*	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	5
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	4-5
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	2
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	2
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	2

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2013217	A2Pv1
Contact:	Lucy Hine C/- Tonkin & Taylor PO Box 13055 Christchurch 8141	**Date Received:**	10-Jul-2018	
		Date Reported:	23-Jul-2018	
		Quote No:	92235	
		Order No:	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		GBH107 - 0.13-0.2 10-Jul-2018	GBH107 - 3.0-3.5 10-Jul-2018			
Lab Number:		2013217.1	2013217.5			
Asbestos Presence / Absence		Asbestos NOT detected.	-	-	-	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
As Received Weight	g	850.4	-	-	-	-
Dry Weight	g	662.9	-	-	-	-
Ashed Weight	g	419.0	-	-	-	-
Moisture	%	22	-	-	-	-
Dry Sample Fraction >10mm	g ashed wt	68.5	-	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	132.4	-	-	-	-
Sample Fraction <2mm	g ashed wt	216.5	-	-	-	-
<2mm Subsample Weight	g ashed wt	53.8	-	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	< 0.00001	-	-	-	-
Dry Matter	g/100g as rcvd	68	75	-	-	-
Total Recoverable Arsenic	mg/kg dry wt	16	7	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt	300	15	-	-	-
Total Recoverable Copper	mg/kg dry wt	39	22	-	-	-
Total Recoverable Lead	mg/kg dry wt	850	11.1 #1	-	-	-
Total Recoverable Nickel	mg/kg dry wt	28	56 #1	-	-	-
Total Recoverable Zinc	mg/kg dry wt	80	60	-	-	-
1-Methylnaphthalene	mg/kg dry wt	2.6	< 0.013	-	-	-
2-Methylnaphthalene	mg/kg dry wt	1.57	< 0.013	-	-	-
Bromobenzene	mg/kg dry wt	-	< 0.3	-	-	-
Benzene	mg/kg dry wt	-	< 0.3	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
Bromodichloromethane	mg/kg dry wt	-	< 0.3	-	-	-
4-Chlorotoluene	mg/kg dry wt	-	< 0.3	-	-	-

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		GBH107 - 0.13-0.2 10-Jul-2018	GBH107 - 3.0-3.5 10-Jul-2018			
Lab Number:		2013217.1	2013217.5			
Bromoform (tribromomethane)	mg/kg dry wt	-	< 0.5	-	-	-
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	< 0.3	-	-	-
2-Butanone (MEK)	mg/kg dry wt	-	< 50	-	-	-
n-Butylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
tert-Butylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
Carbon disulphide	mg/kg dry wt	-	< 0.17	-	-	-
Carbon tetrachloride	mg/kg dry wt	-	< 0.3	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.3	-	-	-
Chloroethane	mg/kg dry wt	-	< 0.3	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	-	< 0.3	-	-	-
Chloromethane	mg/kg dry wt	-	< 0.3	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 9	-	-	-
Acetone	mg/kg dry wt	-	< 50	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 0.5	-	-	-
Dibromochloromethane	mg/kg dry wt	-	< 0.3	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	< 0.3	-	-	-
Dibromomethane	mg/kg dry wt	-	< 0.3	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
1,3-Dichloropropane	mg/kg dry wt	-	< 0.3	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	-	< 0.5	-	-	-
1,1-Dichloroethane	mg/kg dry wt	-	< 0.3	-	-	-
1,2-Dichloroethane	mg/kg dry wt	-	< 0.3	-	-	-
1,1-Dichloroethene	mg/kg dry wt	-	< 0.3	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 3	-	-	-
1,2-Dichloropropane	mg/kg dry wt	-	< 0.3	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
2-Chlorotoluene	mg/kg dry wt	-	< 0.3	-	-	-
1,1-Dichloropropene	mg/kg dry wt	-	< 0.3	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	-	-	-
Ethylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
Hexachlorobutadiene	mg/kg dry wt	-	< 0.3	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	-	< 0.3	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	< 0.3	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 0.3	-	-	-
PCB-18	mg/kg dry wt	< 0.010	-	-	-	-
PCB-28	mg/kg dry wt	0.013	-	-	-	-
PCB-31	mg/kg dry wt	< 0.010	-	-	-	-
PCB-44	mg/kg dry wt	< 0.010	-	-	-	-
PCB-49	mg/kg dry wt	< 0.010	-	-	-	-
PCB-52	mg/kg dry wt	< 0.010	-	-	-	-
PCB-60	mg/kg dry wt	< 0.010	-	-	-	-
PCB-77	mg/kg dry wt	< 0.010	-	-	-	-
PCB-81	mg/kg dry wt	< 0.010	-	-	-	-
PCB-86	mg/kg dry wt	< 0.010	-	-	-	-
PCB-101	mg/kg dry wt	< 0.010	-	-	-	-
PCB-105	mg/kg dry wt	< 0.010	-	-	-	-
PCB-110	mg/kg dry wt	< 0.010	-	-	-	-
PCB-114	mg/kg dry wt	< 0.010	-	-	-	-
PCB-118	mg/kg dry wt	< 0.010	-	-	-	-
PCB-121	mg/kg dry wt	< 0.010	-	-	-	-

Sample Type: Soil						
Sample Name:		GBH107 - 0.13-0.2 10-Jul-2018	GBH107 - 3.0-3.5 10-Jul-2018			
Lab Number:		2013217.1	2013217.5			
PCB-123	mg/kg dry wt	< 0.010	-	-	-	-
PCB-126	mg/kg dry wt	< 0.010	-	-	-	-
PCB-128	mg/kg dry wt	< 0.010	-	-	-	-
PCB-138	mg/kg dry wt	< 0.010	-	-	-	-
PCB-141	mg/kg dry wt	< 0.010	-	-	-	-
PCB-149	mg/kg dry wt	< 0.010	-	-	-	-
PCB-151	mg/kg dry wt	< 0.010	-	-	-	-
PCB-153	mg/kg dry wt	< 0.010	-	-	-	-
PCB-156	mg/kg dry wt	< 0.010	-	-	-	-
PCB-157	mg/kg dry wt	< 0.010	-	-	-	-
PCB-159	mg/kg dry wt	< 0.010	-	-	-	-
PCB-167	mg/kg dry wt	< 0.010	-	-	-	-
PCB-169	mg/kg dry wt	< 0.010	-	-	-	-
PCB-170	mg/kg dry wt	< 0.010	-	-	-	-
PCB-180	mg/kg dry wt	< 0.010	-	-	-	-
PCB-189	mg/kg dry wt	< 0.010	-	-	-	-
PCB-194	mg/kg dry wt	< 0.010	-	-	-	-
PCB-206	mg/kg dry wt	< 0.010	-	-	-	-
PCB-209	mg/kg dry wt	< 0.010	-	-	-	-
Mono-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.0010	-	-	-	-
Non-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.0014	-	-	-	-
Perylene	mg/kg dry wt	5.8	0.027	-	-	-
n-Propylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	48	< 0.04	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	47	< 0.04	-	-	-
sec-Butylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
Styrene	mg/kg dry wt	-	< 0.3	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 0.3	-	-	-
Toluene	mg/kg dry wt	-	< 0.3	-	-	-
Total PCB (Sum of 35 congeners)	mg/kg dry wt	< 0.4	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.3	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	-	< 0.3	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.3	-	-	-
Trichlorofluoromethane	mg/kg dry wt	-	< 0.3	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	-	< 0.5	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 0.3	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
Vinyl chloride	mg/kg dry wt	-	< 0.3	-	-	-
m&p-Xylene	mg/kg dry wt	-	< 0.5	-	-	-
o-Xylene	mg/kg dry wt	-	< 0.3	-	-	-
C7 - C9	mg/kg dry wt	270	< 8	-	-	-
C10 - C14	mg/kg dry wt	840	< 20	-	-	-
C15 - C36	mg/kg dry wt	3,600	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	4,700	< 70	-	-	-

Sample Type: Soil						
Sample Name:		GBH107 - 0.13-0.2 10-Jul-2018	GBH107 - 3.0-3.5 10-Jul-2018			
Lab Number:		2013217.1	2013217.5			
Acenaphthylene	mg/kg dry wt	3.1	< 0.013	-	-	-
Acenaphthene	mg/kg dry wt	4.1	< 0.013	-	-	-
Anthracene	mg/kg dry wt	7.1	< 0.013	-	-	-
Benzo[a]anthracene	mg/kg dry wt	65	0.016	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	10.6	< 0.013	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	89	0.021	-	-	-
Benzo[e]pyrene	mg/kg dry wt	48	< 0.013	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	48	0.021	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	35	< 0.013	-	-	-
Chrysene	mg/kg dry wt	77	< 0.013	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	10.7	< 0.013	-	-	-
Fluoranthene	mg/kg dry wt	260	0.074	-	-	-
Fluorene	mg/kg dry wt	1.13	< 0.013	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	45	0.017	-	-	-
Naphthalene	mg/kg dry wt	5.5	< 0.3	-	-	-
Phenanthrene	mg/kg dry wt	280	0.071	-	-	-
Pyrene	mg/kg dry wt	210	0.053	-	-	-

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

The following assumptions have been made:

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

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

Analyst's Comments

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1, 5
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1, 5
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1, 5
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	1, 5

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1, 5
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	1
Polychlorinated Biphenyls Screening in Soil*	Sonication extraction, SPE cleanup, GC-MS analysis. Tested on dried sample	0.0010 - 0.2 mg/kg dry wt	1
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	5
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	1
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2013217	SPv1
Contact:	Lucy Hine	**Date Received:**	10-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	23-Jul-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		GBH107 - 0.13-0.2 10-Jul-2018	GBH107 - 3.0-3.5 10-Jul-2018			
Lab Number:		2013217.1	2013217.5			
Individual Tests						
Dry Matter	g/100g as rcvd	68	75	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	16	7	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt	300	15	-	-	-
Total Recoverable Copper	mg/kg dry wt	39	22	-	-	-
Total Recoverable Lead	mg/kg dry wt	850	11.1 #1	-	-	-
Total Recoverable Nickel	mg/kg dry wt	28	56 #1	-	-	-
Total Recoverable Zinc	mg/kg dry wt	80	60	-	-	-
New Zealand Guidelines Semi Quantitative Asbestos in Soil						
As Received Weight	g	850.4	-	-	-	-
Dry Weight	g	662.9	-	-	-	-
Ashed Weight	g	419.0	-	-	-	-
Moisture	%	22	-	-	-	-
Dry Sample Fraction >10mm	g ashed wt	68.5	-	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	132.4	-	-	-	-
Sample Fraction <2mm	g ashed wt	216.5	-	-	-	-
<2mm Subsample Weight	g ashed wt	53.8	-	-	-	-
Asbestos Presence / Absence		Asbestos NOT detected.	-	-	-	-
Description of Asbestos Form		-	-	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	-	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	< 0.00001	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-

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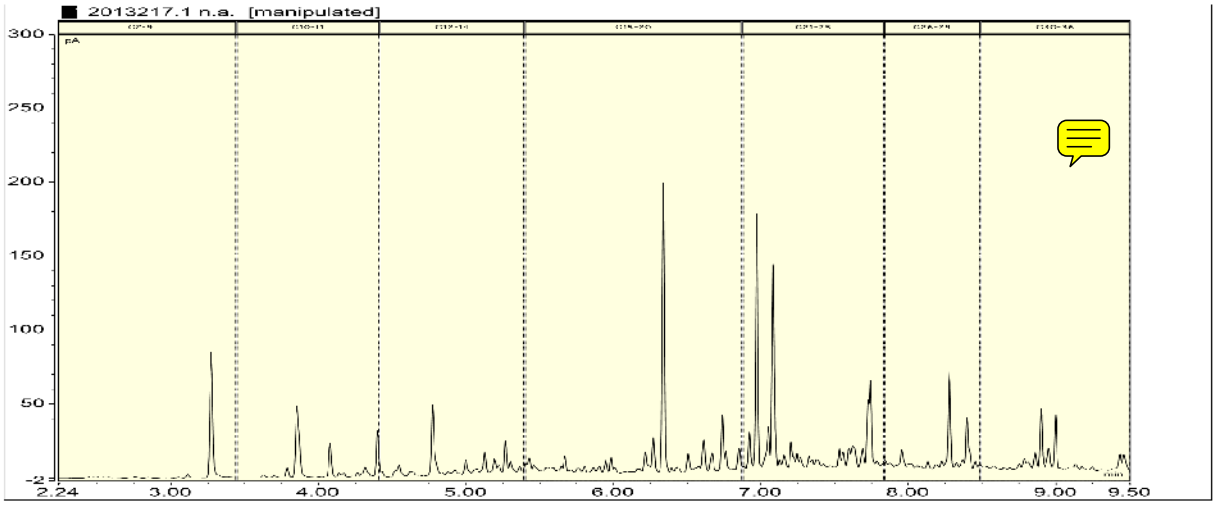
This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported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

Sample Type: Soil						
Sample Name:		GBH107 - 0.13-0.2 10-Jul-2018	GBH107 - 3.0-3.5 10-Jul-2018			
Lab Number:		2013217.1	2013217.5			
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	2.6	< 0.013	-	-	-
2-Methylnaphthalene	mg/kg dry wt	1.57	< 0.013	-	-	-
Perylene	mg/kg dry wt	5.8	0.027	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	48	< 0.04	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	47	< 0.04	-	-	-
Acenaphthylene	mg/kg dry wt	3.1	< 0.013	-	-	-
Acenaphthene	mg/kg dry wt	4.1	< 0.013	-	-	-
Anthracene	mg/kg dry wt	7.1	< 0.013	-	-	-
Benzo[a]anthracene	mg/kg dry wt	65	0.016	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	10.6	< 0.013	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	89	0.021	-	-	-
Benzo[e]pyrene	mg/kg dry wt	48	< 0.013	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	48	0.021	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	35	< 0.013	-	-	-
Chrysene	mg/kg dry wt	77	< 0.013	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	10.7	< 0.013	-	-	-
Fluoranthene	mg/kg dry wt	260	0.074	-	-	-
Fluorene	mg/kg dry wt	1.13	< 0.013	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	45	0.017	-	-	-
Naphthalene	mg/kg dry wt	5.5	< 0.07	-	-	-
Phenanthrene	mg/kg dry wt	280	0.071	-	-	-
Pyrene	mg/kg dry wt	210	0.053	-	-	-
Polychlorinated Biphenyls Screening in Soil						
PCB-18	mg/kg dry wt	< 0.010	-	-	-	-
PCB-28	mg/kg dry wt	0.013	-	-	-	-
PCB-31	mg/kg dry wt	< 0.010	-	-	-	-
PCB-44	mg/kg dry wt	< 0.010	-	-	-	-
PCB-49	mg/kg dry wt	< 0.010	-	-	-	-
PCB-52	mg/kg dry wt	< 0.010	-	-	-	-
PCB-60	mg/kg dry wt	< 0.010	-	-	-	-
PCB-77	mg/kg dry wt	< 0.010	-	-	-	-
PCB-81	mg/kg dry wt	< 0.010	-	-	-	-
PCB-86	mg/kg dry wt	< 0.010	-	-	-	-
PCB-101	mg/kg dry wt	< 0.010	-	-	-	-
PCB-105	mg/kg dry wt	< 0.010	-	-	-	-
PCB-110	mg/kg dry wt	< 0.010	-	-	-	-
PCB-114	mg/kg dry wt	< 0.010	-	-	-	-
PCB-118	mg/kg dry wt	< 0.010	-	-	-	-
PCB-121	mg/kg dry wt	< 0.010	-	-	-	-
PCB-123	mg/kg dry wt	< 0.010	-	-	-	-
PCB-126	mg/kg dry wt	< 0.010	-	-	-	-
PCB-128	mg/kg dry wt	< 0.010	-	-	-	-
PCB-138	mg/kg dry wt	< 0.010	-	-	-	-
PCB-141	mg/kg dry wt	< 0.010	-	-	-	-
PCB-149	mg/kg dry wt	< 0.010	-	-	-	-
PCB-151	mg/kg dry wt	< 0.010	-	-	-	-
PCB-153	mg/kg dry wt	< 0.010	-	-	-	-
PCB-156	mg/kg dry wt	< 0.010	-	-	-	-
PCB-157	mg/kg dry wt	< 0.010	-	-	-	-
PCB-159	mg/kg dry wt	< 0.010	-	-	-	-
PCB-167	mg/kg dry wt	< 0.010	-	-	-	-
PCB-169	mg/kg dry wt	< 0.010	-	-	-	-

Sample Type: Soil						
Sample Name:		GBH107 - 0.13-0.2 10-Jul-2018	GBH107 - 3.0-3.5 10-Jul-2018			
Lab Number:		2013217.1	2013217.5			
Polychlorinated Biphenyls Screening in Soil						
PCB-170	mg/kg dry wt	< 0.010	-	-	-	-
PCB-180	mg/kg dry wt	< 0.010	-	-	-	-
PCB-189	mg/kg dry wt	< 0.010	-	-	-	-
PCB-194	mg/kg dry wt	< 0.010	-	-	-	-
PCB-206	mg/kg dry wt	< 0.010	-	-	-	-
PCB-209	mg/kg dry wt	< 0.010	-	-	-	-
Mono-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.0010	-	-	-	-
Non-Ortho PCB Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.0014	-	-	-	-
Total PCB (Sum of 35 congeners)	mg/kg dry wt	< 0.4	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	270	< 8	-	-	-
C10 - C14	mg/kg dry wt	840	< 20	-	-	-
C15 - C36	mg/kg dry wt	3,600	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	4,700	< 70	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	-	< 0.3	-	-	-
Ethylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
Toluene	mg/kg dry wt	-	< 0.3	-	-	-
m&p-Xylene	mg/kg dry wt	-	< 0.5	-	-	-
o-Xylene	mg/kg dry wt	-	< 0.3	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	< 0.3	-	-	-
Carbon tetrachloride	mg/kg dry wt	-	< 0.3	-	-	-
Chloroethane	mg/kg dry wt	-	< 0.3	-	-	-
Chloromethane	mg/kg dry wt	-	< 0.3	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 0.5	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	< 0.3	-	-	-
Dibromomethane	mg/kg dry wt	-	< 0.3	-	-	-
1,3-Dichloropropane	mg/kg dry wt	-	< 0.3	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	-	< 0.5	-	-	-
1,1-Dichloroethane	mg/kg dry wt	-	< 0.3	-	-	-
1,2-Dichloroethane	mg/kg dry wt	-	< 0.3	-	-	-
1,1-Dichloroethene	mg/kg dry wt	-	< 0.3	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 3	-	-	-
1,2-Dichloropropane	mg/kg dry wt	-	< 0.3	-	-	-
1,1-Dichloropropene	mg/kg dry wt	-	< 0.3	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	-	-	-
Hexachlorobutadiene	mg/kg dry wt	-	< 0.3	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 0.3	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.3	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	-	< 0.3	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.3	-	-	-
Trichlorofluoromethane	mg/kg dry wt	-	< 0.3	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	-	< 0.5	-	-	-

Sample Type: Soil						
Sample Name:		GBH107 - 0.13-0.2 10-Jul-2018	GBH107 - 3.0-3.5 10-Jul-2018			
Lab Number:		2013217.1	2013217.5			
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 0.3	-	-	-
Vinyl chloride	mg/kg dry wt	-	< 0.3	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	-	< 0.3	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
4-Chlorotoluene	mg/kg dry wt	-	< 0.3	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.3	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
2-Chlorotoluene	mg/kg dry wt	-	< 0.3	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	-	< 0.3	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
tert-Butylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	-	< 0.3	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	< 0.3	-	-	-
n-Propylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
sec-Butylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
Styrene	mg/kg dry wt	-	< 0.3	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	-	< 0.3	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	-	< 50	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 9	-	-	-
Acetone	mg/kg dry wt	-	< 50	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 0.3	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	-	< 0.3	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	-	< 0.5	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	-	< 0.3	-	-	-
Dibromochloromethane	mg/kg dry wt	-	< 0.3	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	-	< 0.17	-	-	-
Naphthalene	mg/kg dry wt	-	< 0.3	-	-	-

2013217.1
GBH107 - 0.13-0.2 10-Jul-2018
Client Chromatogram for TPH by FID



Analyst's Comments

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1, 5
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1, 5
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1, 5
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	1, 5
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1, 5
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	1
Polychlorinated Biphenyls Screening in Soil*	Sonication extraction, SPE cleanup, GC-MS analysis. Tested on dried sample	0.0010 - 0.2 mg/kg dry wt	1
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	5
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	1
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2013973	SPv1
Contact:	Lucy Hine	**Date Received:**	11-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	24-Jul-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		CBH203A-0.2-0.4 11-Jul-2018	DUP 15 11-Jul-2018	CBH203A-1.7-2.0 11-Jul-2018	CBH203A-5.7-5.9 11-Jul-2018	GBH102-2.4-2.5 11-Jul-2018
Lab Number:		2013973.1	2013973.4	2013973.5	2013973.9	2013973.18
Individual Tests						
Dry Matter	g/100g as rcvd	93	66	66	73	81
Total Cyanide*	mg/kg dry wt	-	-	0.13	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	15	18	-	5
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.16	0.18	-	< 0.2
Total Recoverable Chromium	mg/kg dry wt	44	38	39	-	5
Total Recoverable Copper	mg/kg dry wt	63	53	71	-	< 4
Total Recoverable Lead	mg/kg dry wt	2.5	104	127	-	12.9
Total Recoverable Mercury	mg/kg dry wt	< 0.10	0.20	0.44	-	< 0.2
Total Recoverable Nickel	mg/kg dry wt	166	82	81	-	< 4
Total Recoverable Zinc	mg/kg dry wt	59	240	240	-	21
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.011	0.56	1.18	-	7.7
2-Methylnaphthalene	mg/kg dry wt	< 0.011	0.27	0.55	-	7.9
Perylene	mg/kg dry wt	< 0.011	0.043	0.078	-	< 0.013
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	0.22	0.40	-	0.03
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	0.22	0.40	-	0.03
Acenaphthylene	mg/kg dry wt	< 0.011	0.116	0.182	-	< 0.013
Acenaphthene	mg/kg dry wt	< 0.011	0.171	0.30	-	0.158
Anthracene	mg/kg dry wt	< 0.011	0.125	0.140	-	< 0.013
Benzo[a]anthracene	mg/kg dry wt	< 0.011	0.088	0.24	-	0.014
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.011	0.155	0.27	-	0.027
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.011	0.135	0.24	-	0.019
Benzo[e]pyrene	mg/kg dry wt	< 0.011	0.071	0.130	-	< 0.013
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.011	0.153	0.27	-	0.013
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	0.056	0.097	-	< 0.013
Chrysene	mg/kg dry wt	< 0.011	0.102	0.24	-	< 0.013
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	0.025	0.044	-	< 0.013
Fluoranthene	mg/kg dry wt	< 0.011	0.187	0.52	-	0.064
Fluorene	mg/kg dry wt	< 0.011	0.115	0.22	-	0.45
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.011	0.129	0.26	-	0.015
Naphthalene	mg/kg dry wt	< 0.06	0.36	0.80	-	0.32
Phenanthrene	mg/kg dry wt	< 0.011	0.22	0.60	-	0.48
Pyrene	mg/kg dry wt	< 0.011	0.24	0.59	-	0.078

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Soil						
Sample Name:		CBH203A-0.2-0.4 11-Jul-2018	DUP 15 11-Jul-2018	CBH203A-1.7-2.0 11-Jul-2018	CBH203A-5.7-5.9 11-Jul-2018	GBH102-2.4-2.5 11-Jul-2018
Lab Number:		2013973.1	2013973.4	2013973.5	2013973.9	2013973.18
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	< 0.005	-	-	-	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	-	-	-	-
Tributyltin (as Sn)	mg/kg dry wt	< 0.004	-	-	-	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	-	106	< 8	1,500
C10 - C14	mg/kg dry wt	-	-	5,600	26	1,500
C15 - C36	mg/kg dry wt	-	-	10,100	55	790
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	15,700	81	3,800
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.19
Ethylbenzene	mg/kg dry wt	-	0.3	0.3	< 0.3	< 0.3
Toluene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
m&p-Xylene	mg/kg dry wt	-	< 0.6	< 0.6	< 0.5	< 0.4
o-Xylene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Carbon tetrachloride	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Chloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Chloromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Dibromomethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,3-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Dichlorodifluoromethane	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 3	< 3	< 3	< 3
1,2-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Hexachlorobutadiene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Trichlorofluoromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Vinyl chloride	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
4-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3

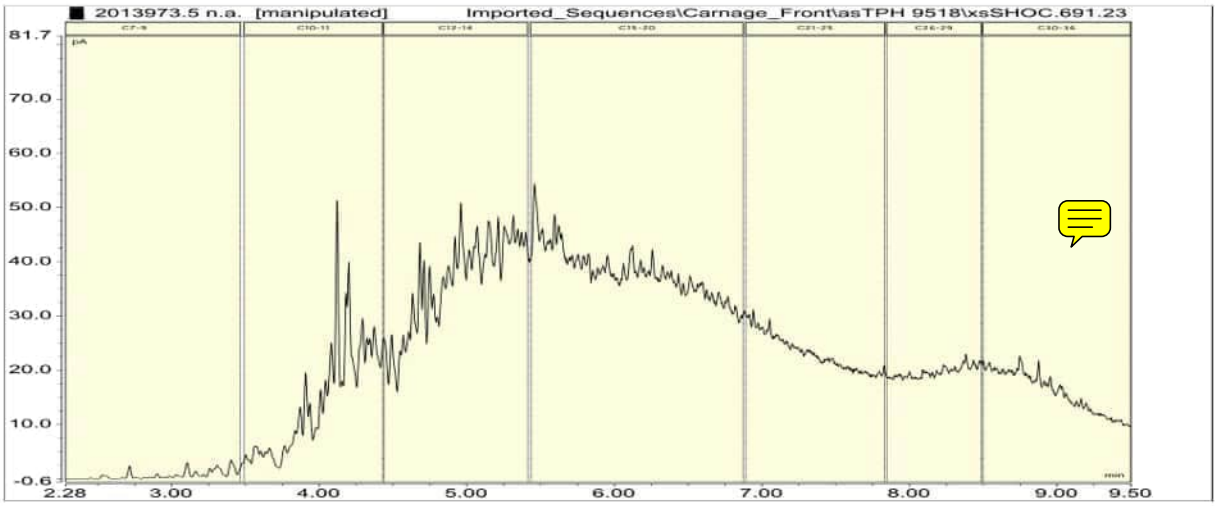
Sample Type: Soil						
Sample Name:		CBH203A-0.2-0.4 11-Jul-2018	DUP 15 11-Jul-2018	CBH203A-1.7-2.0 11-Jul-2018	CBH203A-5.7-5.9 11-Jul-2018	GBH102-2.4-2.5 11-Jul-2018
Lab Number:		2013973.1	2013973.4	2013973.5	2013973.9	2013973.18
Haloaromatics in VOC Soils by Headspace GC-MS						
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
2-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	2.0
tert-Butylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	3.6
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
n-Propylbenzene	mg/kg dry wt	-	< 0.3	0.3	0.3	7.1
sec-Butylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	1.8
Styrene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	-	< 60	< 60	< 50	< 40
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 11	< 11	< 9	< 8
Acetone	mg/kg dry wt	-	< 60	< 60	< 50	< 40
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	< 0.5
Chloroform (Trichloromethane)	mg/kg as rcvd	-	< 0.3	< 0.3	< 0.3	< 0.3
Dibromochloromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.19
Naphthalene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	< 0.3

Sample Name:		GBH102-5.0-5.1 11-Jul-2018	GBH102-0.8-1.0 11-Jul-2018			
Lab Number:		2013973.20	2013973.23			
Individual Tests						
Dry Matter	g/100g as rcvd	70	75	-	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	7	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	-	0.26	-	-	-
Total Recoverable Chromium	mg/kg dry wt	-	23	-	-	-
Total Recoverable Copper	mg/kg dry wt	-	69	-	-	-
Total Recoverable Lead	mg/kg dry wt	-	400	-	-	-
Total Recoverable Mercury	mg/kg dry wt	-	0.59	-	-	-
Total Recoverable Nickel	mg/kg dry wt	-	58	-	-	-
Total Recoverable Zinc	mg/kg dry wt	-	280	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	-	0.071	-	-	-
2-Methylnaphthalene	mg/kg dry wt	-	0.075	-	-	-
Perylene	mg/kg dry wt	-	0.034	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	-	0.22	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	-	0.22	-	-	-
Acenaphthylene	mg/kg dry wt	-	0.021	-	-	-
Acenaphthene	mg/kg dry wt	-	< 0.014	-	-	-

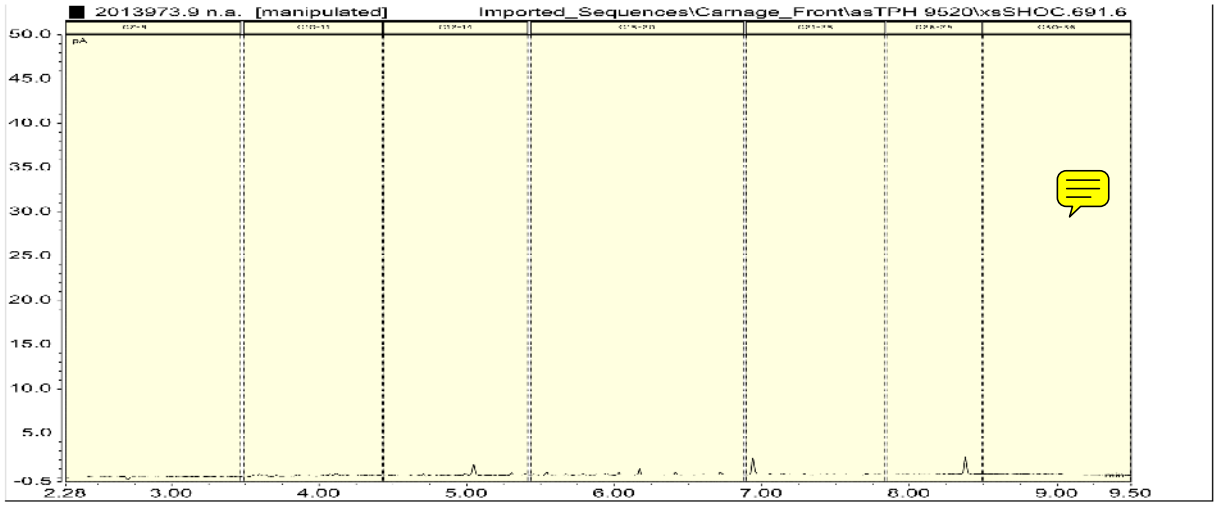
Sample Type: Soil						
Sample Name:		GBH102-5.0-5.1 11-Jul-2018	GBH102-0.8-1.0 11-Jul-2018			
Lab Number:		2013973.20	2013973.23			
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Anthracene	mg/kg dry wt	-	0.030	-	-	-
Benzo[a]anthracene	mg/kg dry wt	-	0.102	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	0.148	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	0.139	-	-	-
Benzo[e]pyrene	mg/kg dry wt	-	0.091	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	0.153	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	-	0.055	-	-	-
Chrysene	mg/kg dry wt	-	0.100	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	0.020	-	-	-
Fluoranthene	mg/kg dry wt	-	0.22	-	-	-
Fluorene	mg/kg dry wt	-	0.016	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	0.148	-	-	-
Naphthalene	mg/kg dry wt	-	< 0.07	-	-	-
Phenanthrene	mg/kg dry wt	-	0.108	-	-	-
Pyrene	mg/kg dry wt	-	0.22	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 8	-	-	-
C10 - C14	mg/kg dry wt	< 20	35	-	-	-
C15 - C36	mg/kg dry wt	< 40	780	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	810	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Toluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.5	< 0.5	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-

Sample Type: Soil						
Sample Name:		GBH102-5.0-5.1 11-Jul-2018	GBH102-0.8-1.0 11-Jul-2018			
Lab Number:		2013973.20	2013973.23			
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Styrene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 50	< 50	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 10	< 9	-	-	-
Acetone	mg/kg dry wt	< 50	< 50	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	< 0.3	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	< 0.3	-	-	-

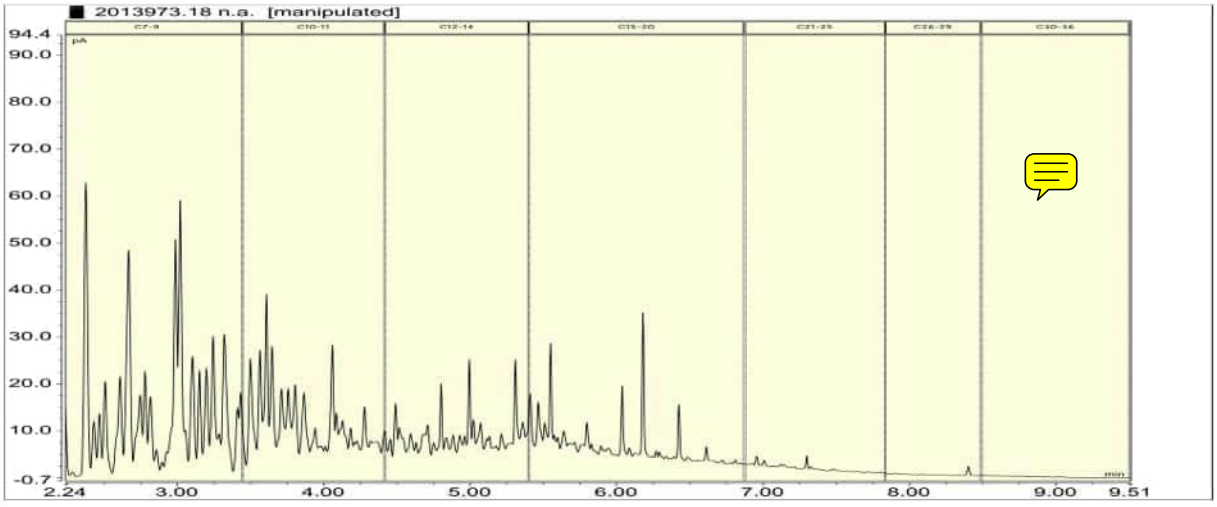
2013973.5
CBH203A-1.7-2.0 11-Jul-2018
Client Chromatogram for TPH by FID



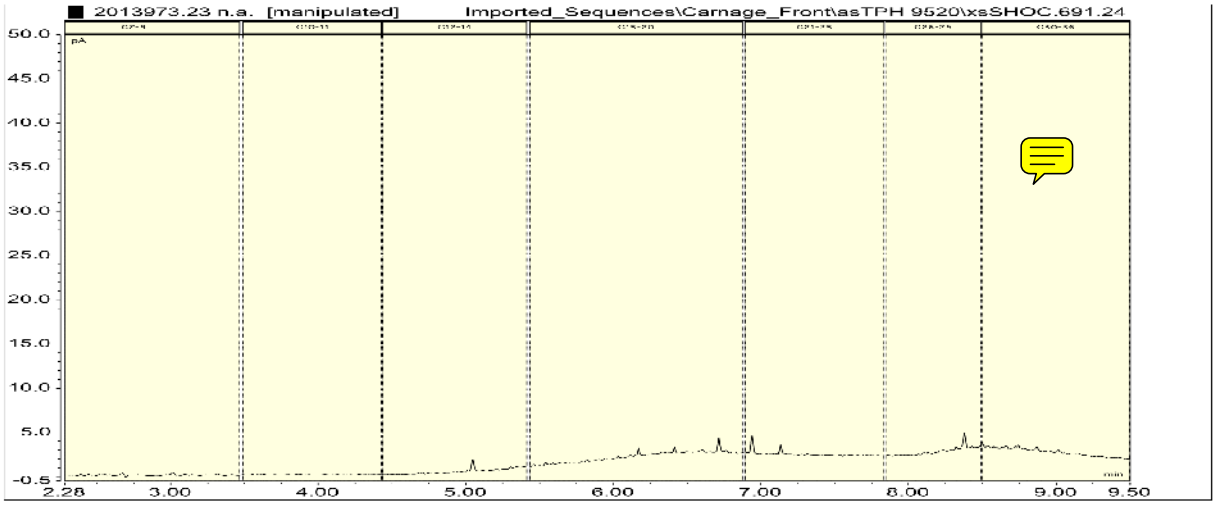
2013973.9
CBH203A-5.7-5.9 11-Jul-2018
Client Chromatogram for TPH by FID



2013973.18
GBH102-2.4-2.5 11-Jul-2018
Client Chromatogram for TPH by FID



2013973.23
GBH102-0.8-1.0 11-Jul-2018
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	5, 18, 23
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1, 4-5, 18, 23
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.05 mg/kg dry wt	1, 4
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	1
Total Petroleum Hydrocarbons in Soil*	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	9, 20
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	4-5, 9, 18, 20, 23
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1, 4-5, 9, 18, 20, 23
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	5
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	5
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1, 4-5, 18, 23
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1, 4-5, 18, 23

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

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

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Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2013984	A2Pv1
Contact:	Lucy Hine	**Date Received:**	11-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	25-Jul-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

		Sample Name:	CBH203A - 0.2-0.4 11-Jul-2018	GBH102 - 0.8-1.0 11-Jul-2018			
		Lab Number:	2013984.1	2013984.6			
Asbestos Presence / Absence			Asbestos NOT detected.	Chrysotile (White Asbestos) detected.	-	-	-
Description of Asbestos Form			-	Loose Fibres	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w		< 0.001	< 0.001	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w		< 0.001	< 0.001	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w		< 0.001	< 0.001	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w		< 0.001	< 0.001	-	-	-
As Received Weight	g		1,054.0	839.6	-	-	-
Dry Weight	g		981.6	664.1	-	-	-
Ashed Weight	g		979.0	635.1	-	-	-
Moisture	%		7	21	-	-	-
Dry Sample Fraction >10mm	g ashed wt		399.8	134.4	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt		363.4	256.2	-	-	-
Sample Fraction <2mm	g ashed wt		214.7	243.0	-	-	-
<2mm Subsample Weight	g ashed wt		55.5	58.8	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt		< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt		< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt		< 0.00001	0.00007	-	-	-

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

The following assumptions have been made:

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

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No

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

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	1, 6
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 6
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 6
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 6
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	1, 6
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1, 6
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1, 6
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1, 6
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1, 6
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1, 6
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 6
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 6
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 6
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 6
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 6
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 6
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 6

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

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

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Dexter Paguirigan Dip Chem Engineering Tech
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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2014707	SPv1
Contact:	Lucy Hine	**Date Received:**	12-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	16-Aug-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2	
		Client Reference:	30881.2	
		Submitted By:	Melody Robyns	

Sample Type: Soil

		Sample Name:	GBH109 - 1.0-1.1 12-Jul-2018	GBH110 - 0.6-0.8 12-Jul-2018			
		Lab Number:	2014707.3	2014707.5			
Individual Tests							
Dry Matter	g/100g as rcvd		74	73	-	-	-
Heavy Metals with Mercury, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		10	5	-	-	-
Total Recoverable Cadmium	mg/kg dry wt		0.36	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt		30	13	-	-	-
Total Recoverable Copper	mg/kg dry wt		94	12	-	-	-
Total Recoverable Lead	mg/kg dry wt		1,620	54	-	-	-
Total Recoverable Mercury	mg/kg dry wt		1.41	< 0.10	-	-	-
Total Recoverable Nickel	mg/kg dry wt		44	9	-	-	-
Total Recoverable Zinc	mg/kg dry wt		330	31	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil							
1-Methylnaphthalene	mg/kg dry wt		0.58	0.018	-	-	-
2-Methylnaphthalene	mg/kg dry wt		0.81	< 0.014	-	-	-
Perylene	mg/kg dry wt		2.7	< 0.014	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt		23	0.04	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt		23	0.04	-	-	-
Acenaphthylene	mg/kg dry wt		0.067	< 0.014	-	-	-
Acenaphthene	mg/kg dry wt		1.07	< 0.014	-	-	-
Anthracene	mg/kg dry wt		2.7	< 0.014	-	-	-
Benzo[a]anthracene	mg/kg dry wt		9.5	0.024	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt		17.8	0.031	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt		11.0	0.041	-	-	-
Benzo[e]pyrene	mg/kg dry wt		12.6	0.035	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt		12.0	< 0.014	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt		3.2	< 0.014	-	-	-
Chrysene	mg/kg dry wt		8.6	0.014	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt		1.89	< 0.014	-	-	-
Fluoranthene	mg/kg dry wt		6.1	0.029	-	-	-
Fluorene	mg/kg dry wt		0.72	< 0.014	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt		8.4	< 0.014	-	-	-
Naphthalene	mg/kg dry wt		1.88	< 0.07	-	-	-
Phenanthrene	mg/kg dry wt		9.0	< 0.014	-	-	-
Pyrene	mg/kg dry wt		16.5	0.044	-	-	-
Total of Reported PAHs in Soil*	mg/kg		127	< 0.4	-	-	-

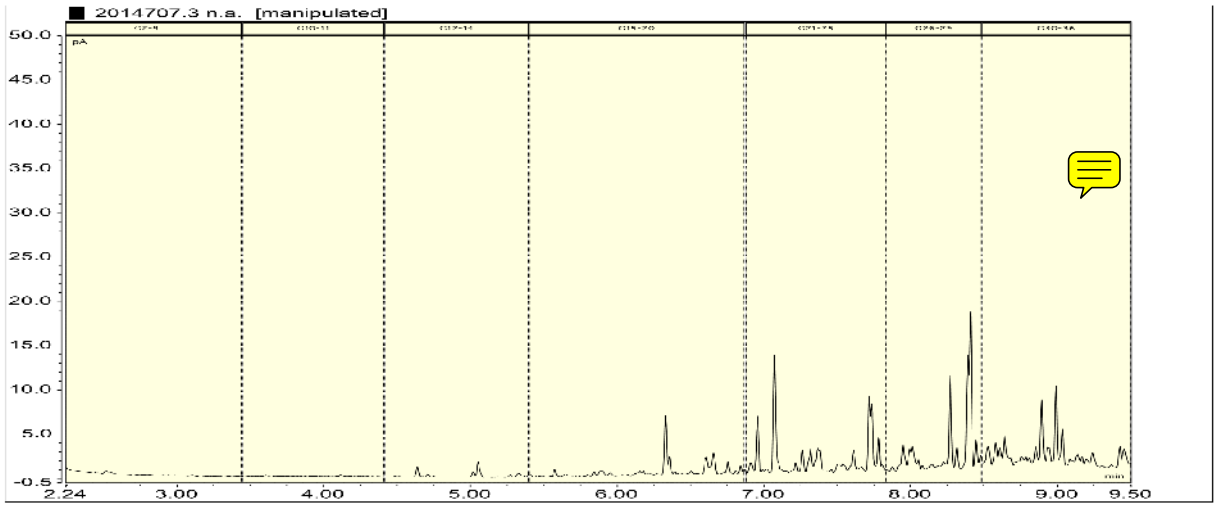
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Sample Type: Soil						
Sample Name:		GBH109 - 1.0-1.1 12-Jul-2018	GBH110 - 0.6-0.8 12-Jul-2018			
Lab Number:		2014707.3	2014707.5			
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 9	-	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	-	-	-
C15 - C36	mg/kg dry wt	440	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	440	< 70	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Toluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.5	< 0.5	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-

Sample Type: Soil						
Sample Name:		GBH109 - 1.0-1.1 12-Jul-2018	GBH110 - 0.6-0.8 12-Jul-2018			
Lab Number:		2014707.3	2014707.5			
Haloaromatics in VOC Soils by Headspace GC-MS						
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Styrene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 50	< 50	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 9	< 9	-	-	-
Acetone	mg/kg dry wt	< 50	< 50	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	< 0.3	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	< 0.3	-	-	-

2014707.3
GBH109 - 1.0-1.1 12-Jul-2018
Client Chromatogram for TPH by FID



Analyst's Comments

It was observed that the container for sample 2014707/3 was not completely filled. Volatile loss may have occurred due to the headspace created in the container.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	-	3, 5
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	3, 5
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	3, 5
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	3, 5
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	3, 5
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	3, 5
Total of Reported PAHs in Soil*	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg	3, 5

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

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

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Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2014713	A2Pv1
Contact:	Lucy Hine	**Date Received:**	12-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	22-Aug-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

		Sample Name:	GBH109-1.0-1.1 12-Jul-2018 3:00 pm	GBH110-0.6-0.8 12-Jul-2018 3:00 pm			
		Lab Number:	2014713.2	2014713.4			
Asbestos Presence / Absence			Chrysotile (White Asbestos) detected.	Asbestos NOT detected.	-	-	-
Description of Asbestos Form			Loose Fibres	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w		< 0.001	< 0.001	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w		0.001	< 0.001	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w		< 0.001	< 0.001	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w		0.001	< 0.001	-	-	-
As Received Weight	g		906.8	937.9	-	-	-
Dry Weight	g		685.7	708.3	-	-	-
Ashed Weight	g		651.8	704.4	-	-	-
Moisture	%		24	24	-	-	-
Dry Sample Fraction >10mm	g ashed wt		82.9	9.6	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt		282.6	379.5	-	-	-
Sample Fraction <2mm	g ashed wt		284.5	314.0	-	-	-
<2mm Subsample Weight	g ashed wt		56.3	57.4	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt		< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt		< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt		0.00986	< 0.00001	-	-	-

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

The following assumptions have been made:

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

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No

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Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2, 4
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2, 4
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2, 4
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	2, 4
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2, 4
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2, 4
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	2, 4
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	2, 4
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	2, 4
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2, 4
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2, 4
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2, 4
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2, 4
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	2, 4
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2, 4
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	2, 4

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

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

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2015346	SPv2
Contact:	Lucy Hine	**Date Received:**	13-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	15-Aug-2018	**(Amended)**
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

		Sample Name:	GBH109 - 2.5-2.9 13-Jul-2018 3:00 pm	GBH109 - 5.0-5.5 13-Jul-2018 2:00 pm			
		Lab Number:	2015346.3	2015346.8			
Individual Tests							
Dry Matter	g/100g as rcvd		66	82	-	-	-
Total Cyanide*	mg/kg dry wt		0.25	-	-	-	-
Heavy Metals with Mercury, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		11	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt		< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt		19	-	-	-	-
Total Recoverable Copper	mg/kg dry wt		72	-	-	-	-
Total Recoverable Lead	mg/kg dry wt		280	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt		0.62	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt		47	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt		200	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil							
1-Methylnaphthalene	mg/kg dry wt		3.6	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt		0.57	-	-	-	-
Perylene	mg/kg dry wt		0.107	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt		0.76	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt		0.75	-	-	-	-
Acenaphthylene	mg/kg dry wt		< 0.015	-	-	-	-
Acenaphthene	mg/kg dry wt		0.52	-	-	-	-
Anthracene	mg/kg dry wt		0.22	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt		0.57	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt		0.48	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt		0.62	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt		0.31	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt		0.31	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt		0.27	-	-	-	-
Chrysene	mg/kg dry wt		0.44	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt		0.068	-	-	-	-
Fluoranthene	mg/kg dry wt		1.72	-	-	-	-
Fluorene	mg/kg dry wt		0.78	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt		0.40	-	-	-	-
Naphthalene	mg/kg dry wt		1.07	-	-	-	-
Phenanthrene	mg/kg dry wt		1.67	-	-	-	-
Pyrene	mg/kg dry wt		1.56	-	-	-	-

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Sample Type: Soil						
Sample Name:		GBH109 - 2.5-2.9 13-Jul-2018 3:00 pm	GBH109 - 5.0-5.5 13-Jul-2018 2:00 pm			
Lab Number:		2015346.3	2015346.8			
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	104	< 8	-	-	-
C10 - C14	mg/kg dry wt	2,800	< 20	-	-	-
C15 - C36	mg/kg dry wt	1,730	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	4,700	< 70	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	< 0.18	-	-	-
Ethylbenzene	mg/kg dry wt	0.3	< 0.3	-	-	-
Toluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.6	< 0.4	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	1.1	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	17.4	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	2.4	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-

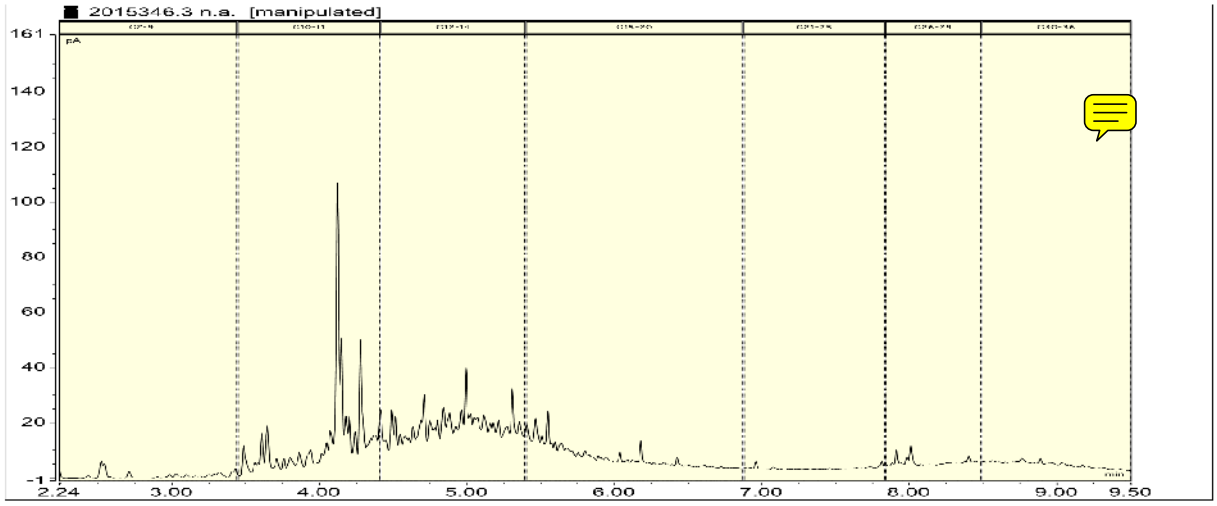
Sample Type: Soil						
Sample Name:		GBH109 - 2.5-2.9 13-Jul-2018 3:00 pm	GBH109 - 5.0-5.5 13-Jul-2018 2:00 pm			
Lab Number:		2015346.3	2015346.8			
Haloaromatics in VOC Soils by Headspace GC-MS						
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	10.4	< 0.3	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
n-Propylbenzene	mg/kg dry wt	5.5	< 0.3	-	-	-
sec-Butylbenzene	mg/kg dry wt	2.2	< 0.3	-	-	-
Styrene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	0.3	< 0.3	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	0.3	< 0.3	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 60	< 40	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 11	< 8	-	-	-
Acetone	mg/kg dry wt	< 60	< 40	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	< 0.3	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.18	-	-	-
Naphthalene	mg/kg dry wt	< 0.4	< 0.3	-	-	-

Sample Type: Sediment						
Sample Name:		SS01 13-Jul-2018 3:00 pm	SS02 13-Jul-2018 3:00 pm	SS05 13-Jul-2018 2:00 pm	SS06 13-Jul-2018 3:00 pm	
Lab Number:		2015346.4	2015346.5	2015346.6	2015346.7	
Individual Tests						
Dry Matter	g/100g as rcvd	48	47	65	71	-
Total Cyanide*	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Organic Carbon*	g/100g dry wt	1.22	1.06	0.45	0.44	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	10	12	14	13	-
Total Recoverable Cadmium	mg/kg dry wt	0.10	< 0.10	< 0.10	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	25	24	16	16	-
Total Recoverable Copper	mg/kg dry wt	60	88	123	113	-
Total Recoverable Lead	mg/kg dry wt	69	84	57	64	-
Total Recoverable Mercury	mg/kg dry wt	1.10	1.88	0.59	0.63	-
Total Recoverable Nickel	mg/kg dry wt	13	25	14	13	-
Total Recoverable Zinc	mg/kg dry wt	129	137	150	146	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.03	< 0.015	0.036	-
2-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.03	< 0.015	0.045	-
Perylene	mg/kg dry wt	0.13	0.10	0.029	0.133	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.60	0.40	0.17	0.72	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.60	0.40	0.17	0.71	-
Acenaphthylene	mg/kg dry wt	0.04	0.03	< 0.015	0.014	-
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.015	0.186	-
Anthracene	mg/kg dry wt	0.06	0.02	< 0.015	0.143	-
Benzo[a]anthracene	mg/kg dry wt	0.28	0.19	0.073	0.45	-

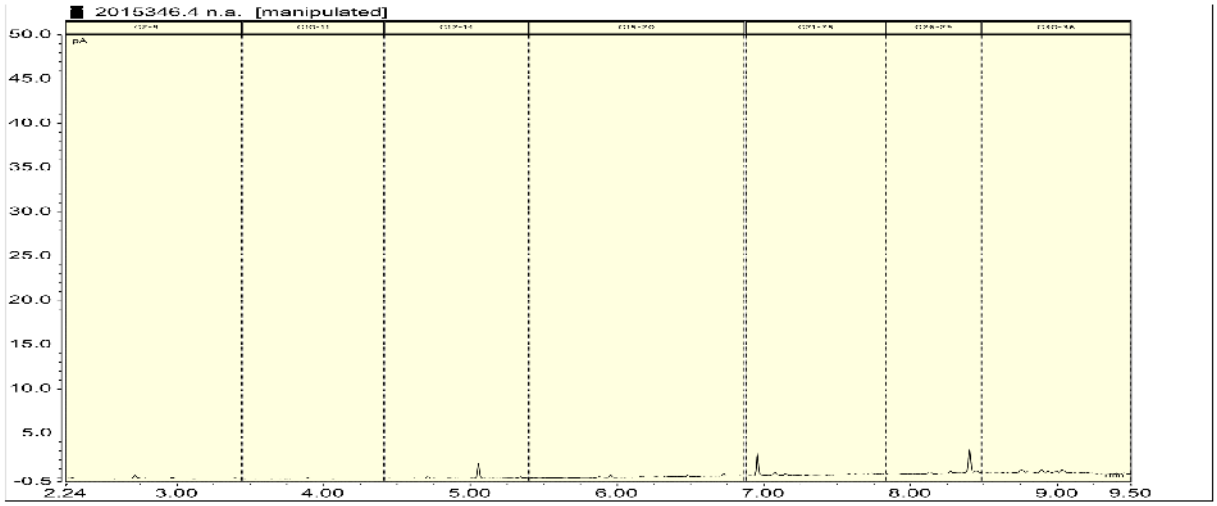
Sample Type: Sediment						
Sample Name:		SS01 13-Jul-2018 3:00 pm	SS02 13-Jul-2018 3:00 pm	SS05 13-Jul-2018 2:00 pm	SS06 13-Jul-2018 3:00 pm	
Lab Number:		2015346.4	2015346.5	2015346.6	2015346.7	
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.40	0.27	0.127	0.50	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.47	0.36	0.147	0.55	-
Benzo[e]pyrene	mg/kg dry wt	0.26	0.21	0.085	0.32	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.32	0.21	0.092	0.33	-
Benzo[k]fluoranthene	mg/kg dry wt	0.23	0.15	0.052	0.22	-
Chrysene	mg/kg dry wt	0.31	0.20	0.060	0.43	-
Dibenzo[a,h]anthracene	mg/kg dry wt	0.06	0.03	< 0.015	0.047	-
Fluoranthene	mg/kg dry wt	0.64	0.43	0.148	1.25	-
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.015	0.141	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.31	0.21	0.091	0.33	-
Naphthalene	mg/kg dry wt	< 0.11	< 0.11	< 0.08	< 0.07	-
Phenanthrene	mg/kg dry wt	0.23	0.11	0.044	0.81	-
Pyrene	mg/kg dry wt	0.71	0.45	0.147	1.18	-
Total of Reported PAHs in Soil*	mg/kg	-	-	1.1	7.2	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	0.028	0.007	0.055	0.029	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	< 0.007	0.014	0.011	-
Tributyltin (as Sn)	mg/kg dry wt	0.018	0.012	0.060	0.062	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	< 0.003	< 0.003	< 0.003	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 13	< 13	< 9	< 9	-
C10 - C14	mg/kg dry wt	< 30	< 30	< 20	< 20	-
C15 - C36	mg/kg dry wt	162	153	114	< 40	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	162	153	114	< 70	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Ethylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Toluene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
m&p-Xylene	mg/kg dry wt	< 0.8	< 0.8	< 0.6	< 0.5	-
o-Xylene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Carbon tetrachloride	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Chloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Chloromethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Dibromomethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,3-Dichloropropane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	-
1,1-Dichloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2-Dichloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,1-Dichloroethene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	< 3	< 3	-
1,2-Dichloropropane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,1-Dichloropropene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Hexachlorobutadiene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-

Sample Type: Sediment						
Sample Name:		SS01 13-Jul-2018 3:00 pm	SS02 13-Jul-2018 3:00 pm	SS05 13-Jul-2018 2:00 pm	SS06 13-Jul-2018 3:00 pm	
Lab Number:		2015346.4	2015346.5	2015346.6	2015346.7	
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Trichlorofluoromethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Vinyl chloride	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
4-Chlorotoluene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
2-Chlorotoluene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
tert-Butylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
n-Propylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
sec-Butylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Styrene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 80	< 80	< 60	< 50	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 16	< 16	< 11	< 10	-
Acetone	mg/kg dry wt	< 80	< 80	< 60	< 50	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.4	< 0.4	< 0.3	< 0.3	-
Dibromochloromethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	-
Naphthalene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-

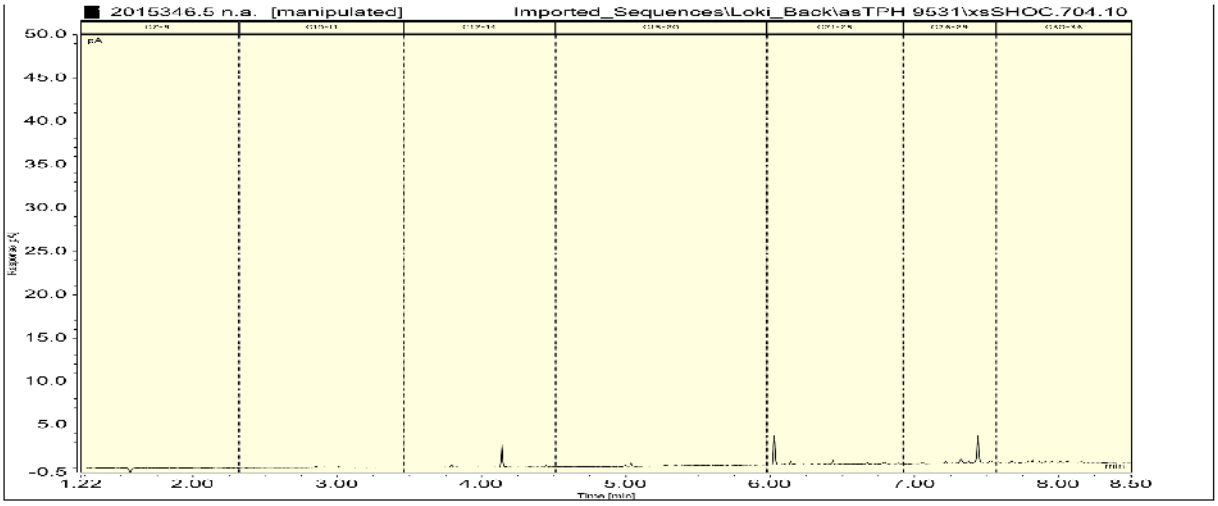
2015346.3
GBH109 - 2.5-2.9 13-Jul-2018 3:00 pm
Client Chromatogram for TPH by FID



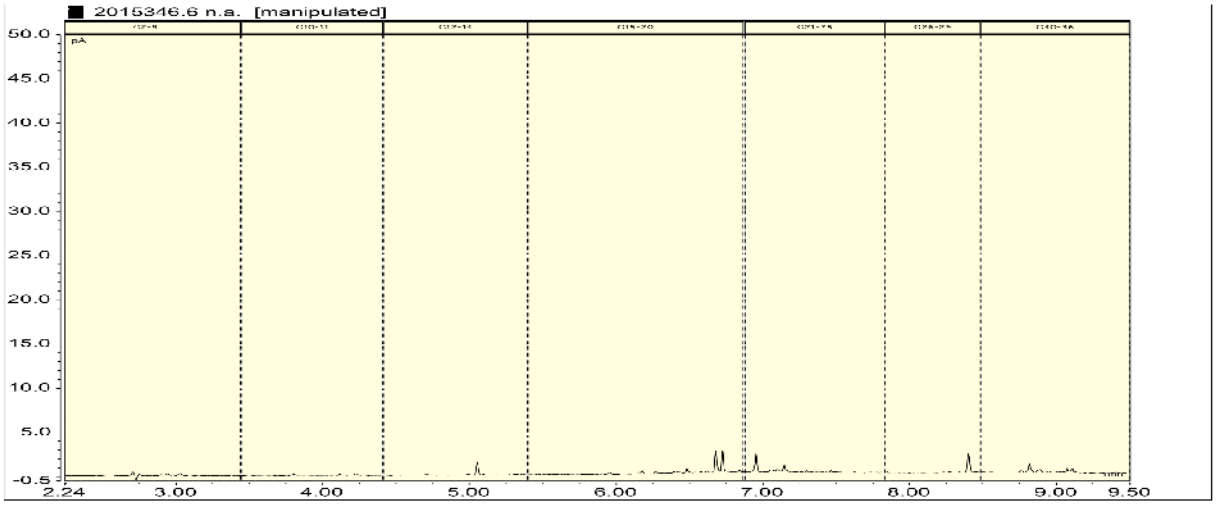
2015346.4
SS01 13-Jul-2018 3:00 pm
Client Chromatogram for TPH by FID



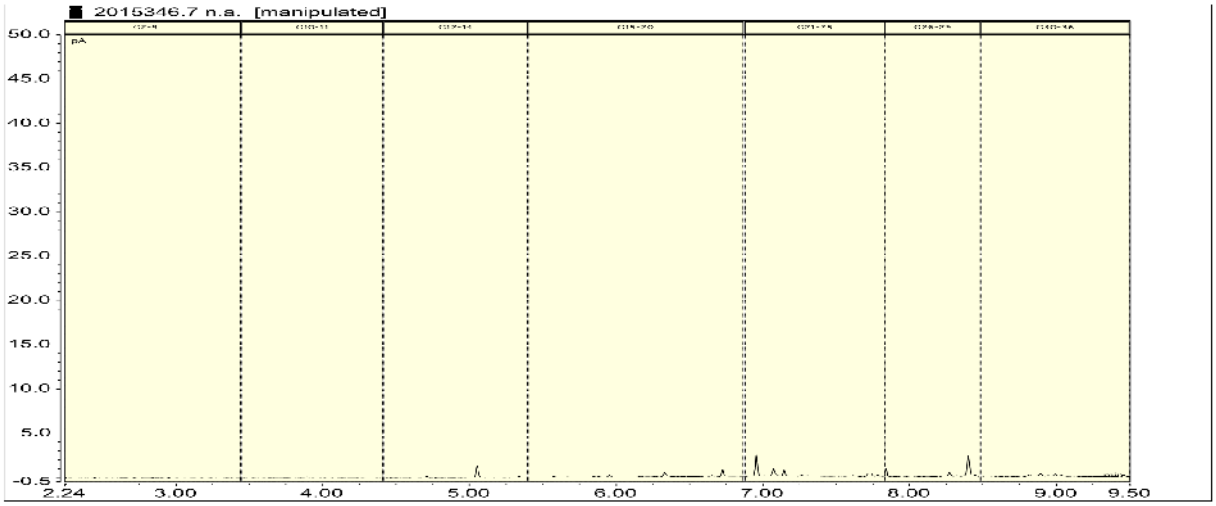
2015346.5
SS02 13-Jul-2018 3:00 pm
Client Chromatogram for TPH by FID



2015346.6
SS05 13-Jul-2018 2:00 pm
Client Chromatogram for TPH by FID



2015346.7
SS06 13-Jul-2018 3:00 pm
Client Chromatogram for TPH by FID



Analyst's Comments

It has been noted that the duplicate for TBT on sample 2015346.6, was run as part of our in-house QC procedure and showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample.

Amended Report: This certificate of analysis replaces an earlier certificate issued on 25 Jul 2018 at 1:04 pm
Reason for amendment: Additional testing added.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	2, 4-7
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	3-5
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	3

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	8
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	3-8
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	3-8
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	3-5
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	3
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	3-7
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	3-7

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	-	6-7
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	4-7
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	4-7
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	4-7
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN- C (modified) & Skalar Method I295-004(+P14). ISO 14403:2012(E).	0.10 mg/kg dry wt	4-5
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	4-7
Total of Reported PAHs in Soil*	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg	6-7

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



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Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2015346	SPv3
Contact:	Lucy Hine	**Date Received:**	13-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	30-Aug-2018	**(Amended)**
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

		Sample Name:	GBH109 - 2.5-2.9 13-Jul-2018 3:00 pm	GBH109 - 5.0-5.5 13-Jul-2018 2:00 pm			
		Lab Number:	2015346.3	2015346.8			
Individual Tests							
Dry Matter	g/100g as rcvd		66	82	-	-	-
Total Cyanide*	mg/kg dry wt		0.25	-	-	-	-
Total Organic Carbon*	g/100g dry wt		-	0.18	-	-	-
Heavy Metals with Mercury, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		11	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt		< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt		19	-	-	-	-
Total Recoverable Copper	mg/kg dry wt		72	-	-	-	-
Total Recoverable Lead	mg/kg dry wt		280	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt		0.62	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt		47	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt		200	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil							
1-Methylnaphthalene	mg/kg dry wt		3.6	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt		0.57	-	-	-	-
Perylene	mg/kg dry wt		0.107	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt		0.76	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt		0.75	-	-	-	-
Acenaphthylene	mg/kg dry wt		< 0.015	-	-	-	-
Acenaphthene	mg/kg dry wt		0.52	-	-	-	-
Anthracene	mg/kg dry wt		0.22	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt		0.57	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt		0.48	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt		0.62	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt		0.31	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt		0.31	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt		0.27	-	-	-	-
Chrysene	mg/kg dry wt		0.44	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt		0.068	-	-	-	-
Fluoranthene	mg/kg dry wt		1.72	-	-	-	-
Fluorene	mg/kg dry wt		0.78	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt		0.40	-	-	-	-
Naphthalene	mg/kg dry wt		1.07	-	-	-	-
Phenanthrene	mg/kg dry wt		1.67	-	-	-	-
Pyrene	mg/kg dry wt		1.56	-	-	-	-

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Soil						
Sample Name:		GBH109 - 2.5-2.9 13-Jul-2018 3:00 pm	GBH109 - 5.0-5.5 13-Jul-2018 2:00 pm			
Lab Number:		2015346.3	2015346.8			
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	104	< 8	-	-	-
C10 - C14	mg/kg dry wt	2,800	< 20	-	-	-
C15 - C36	mg/kg dry wt	1,730	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	4,700	< 70	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	< 0.18	-	-	-
Ethylbenzene	mg/kg dry wt	0.3	< 0.3	-	-	-
Toluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.6	< 0.4	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	1.1	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	17.4	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	2.4	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-

Sample Type: Soil						
Sample Name:		GBH109 - 2.5-2.9 13-Jul-2018 3:00 pm	GBH109 - 5.0-5.5 13-Jul-2018 2:00 pm			
Lab Number:		2015346.3	2015346.8			
Haloaromatics in VOC Soils by Headspace GC-MS						
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	10.4	< 0.3	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
n-Propylbenzene	mg/kg dry wt	5.5	< 0.3	-	-	-
sec-Butylbenzene	mg/kg dry wt	2.2	< 0.3	-	-	-
Styrene	mg/kg dry wt	< 0.3	< 0.3	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	0.3	< 0.3	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	0.3	< 0.3	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 60	< 40	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 11	< 8	-	-	-
Acetone	mg/kg dry wt	< 60	< 40	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	< 0.3	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.18	-	-	-
Naphthalene	mg/kg dry wt	< 0.4	< 0.3	-	-	-

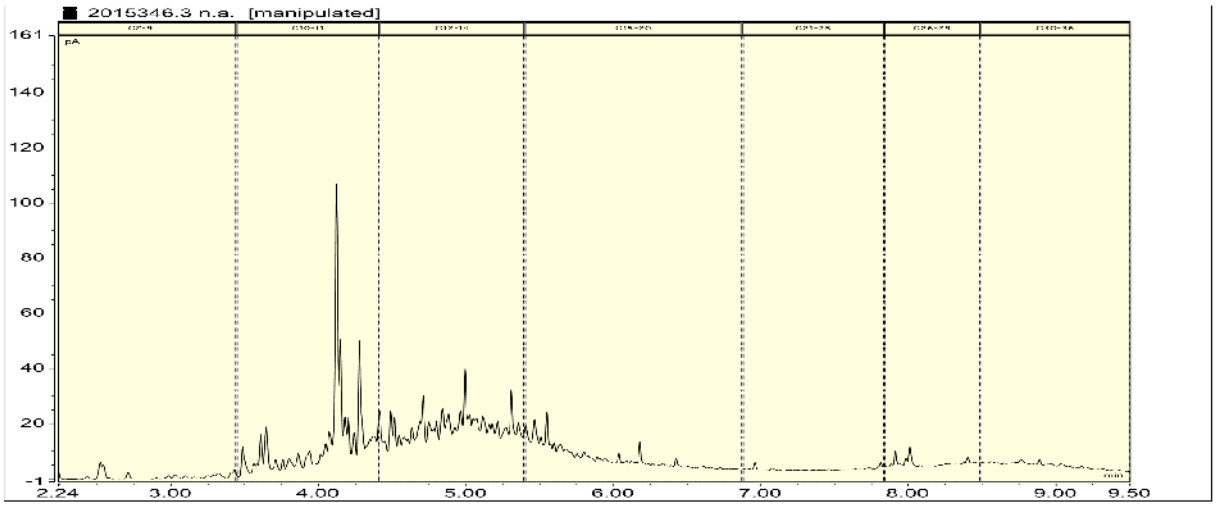
Sample Type: Sediment						
Sample Name:		SS01 13-Jul-2018 3:00 pm	SS02 13-Jul-2018 3:00 pm	SS05 13-Jul-2018 2:00 pm	SS06 13-Jul-2018 3:00 pm	
Lab Number:		2015346.4	2015346.5	2015346.6	2015346.7	
Individual Tests						
Dry Matter	g/100g as rcvd	48	47	65	71	-
Total Cyanide*	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Organic Carbon*	g/100g dry wt	1.22	1.06	0.45	0.44	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	10	12	14	13	-
Total Recoverable Cadmium	mg/kg dry wt	0.10	< 0.10	< 0.10	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	25	24	16	16	-
Total Recoverable Copper	mg/kg dry wt	60	88	123	113	-
Total Recoverable Lead	mg/kg dry wt	69	84	57	64	-
Total Recoverable Mercury	mg/kg dry wt	1.10	1.88	0.59	0.63	-
Total Recoverable Nickel	mg/kg dry wt	13	25	14	13	-
Total Recoverable Zinc	mg/kg dry wt	129	137	150	146	-
Semi Quantitative Asbestos in Soil						
As Received Weight	g	-	-	421.7	441.9	-
Dry Weight	g	-	-	246.0	292.5	-
Dry Sample Fraction >10mm	g ashed wt	-	-	24.1	14.3	-
Sample Fraction <10mm to >2mm	g ashed wt	-	-	38.7	59.4	-
Sample Fraction <2mm	g ashed wt	-	-	179.6	215.4	-
<2mm Subsample Weight	g ashed wt	-	-	51.7	52.5	-
Asbestos Presence / Absence		-	-	Asbestos NOT detected.	Asbestos NOT detected.	-
Description of Asbestos Form		-	-	-	-	-
Weight of Asbestos in >10mm Sample Fraction	g ashed wt	-	-	< 0.00001	< 0.00001	-

Sample Type: Sediment						
Sample Name:		SS01 13-Jul-2018 3:00 pm	SS02 13-Jul-2018 3:00 pm	SS05 13-Jul-2018 2:00 pm	SS06 13-Jul-2018 3:00 pm	
Lab Number:		2015346.4	2015346.5	2015346.6	2015346.7	
Semi Quantitative Asbestos in Soil						
Weight of Asbestos in <10mm to > 2mm Sample Fraction	g ashed wt	-	-	< 0.00001	< 0.00001	-
Weight of Asbestos in <2mm Sample Fraction	g ashed wt	-	-	< 0.00001	< 0.00001	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.03	< 0.015	0.036	-
2-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.03	< 0.015	0.045	-
Perylene	mg/kg dry wt	0.13	0.10	0.029	0.133	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.60	0.40	0.17	0.72	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.60	0.40	0.17	0.71	-
Acenaphthylene	mg/kg dry wt	0.04	0.03	< 0.015	0.014	-
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.015	0.186	-
Anthracene	mg/kg dry wt	0.06	0.02	< 0.015	0.143	-
Benzo[a]anthracene	mg/kg dry wt	0.28	0.19	0.073	0.45	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.40	0.27	0.127	0.50	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.47	0.36	0.147	0.55	-
Benzo[e]pyrene	mg/kg dry wt	0.26	0.21	0.085	0.32	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.32	0.21	0.092	0.33	-
Benzo[k]fluoranthene	mg/kg dry wt	0.23	0.15	0.052	0.22	-
Chrysene	mg/kg dry wt	0.31	0.20	0.060	0.43	-
Dibenzo[a,h]anthracene	mg/kg dry wt	0.06	0.03	< 0.015	0.047	-
Fluoranthene	mg/kg dry wt	0.64	0.43	0.148	1.25	-
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.015	0.141	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.31	0.21	0.091	0.33	-
Naphthalene	mg/kg dry wt	< 0.11	< 0.11	< 0.08	< 0.07	-
Phenanthrene	mg/kg dry wt	0.23	0.11	0.044	0.81	-
Pyrene	mg/kg dry wt	0.71	0.45	0.147	1.18	-
Total of Reported PAHs in Soil*	mg/kg	-	-	1.1	7.2	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	0.028	0.007	0.055	0.029	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	< 0.007	0.014	0.011	-
Tributyltin (as Sn)	mg/kg dry wt	0.018	0.012	0.060	0.062	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	< 0.003	< 0.003	< 0.003	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 13	< 13	< 9	< 9	-
C10 - C14	mg/kg dry wt	< 30	< 30	< 20	< 20	-
C15 - C36	mg/kg dry wt	162	153	114	< 40	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	162	153	114	< 70	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Ethylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Toluene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
m&p-Xylene	mg/kg dry wt	< 0.8	< 0.8	< 0.6	< 0.5	-
o-Xylene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Carbon tetrachloride	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Chloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Chloromethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Dibromomethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-

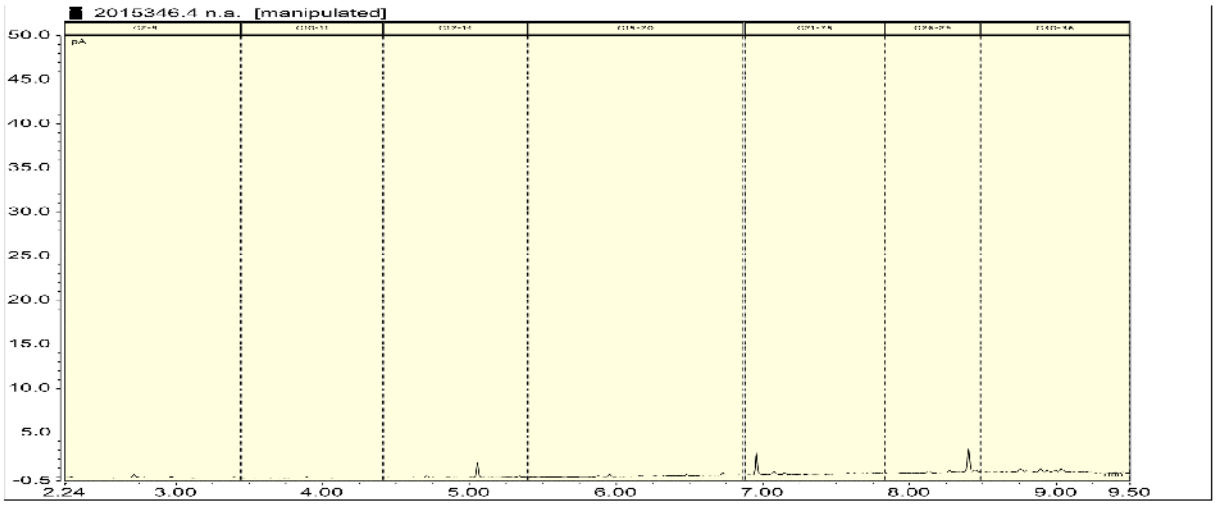
Sample Type: Sediment						
Sample Name:		SS01 13-Jul-2018 3:00 pm	SS02 13-Jul-2018 3:00 pm	SS05 13-Jul-2018 2:00 pm	SS06 13-Jul-2018 3:00 pm	
Lab Number:		2015346.4	2015346.5	2015346.6	2015346.7	
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,3-Dichloropropane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	-
1,1-Dichloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2-Dichloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,1-Dichloroethene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	< 3	< 3	-
1,2-Dichloropropane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,1-Dichloropropene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Hexachlorobutadiene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Trichlorofluoromethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Vinyl chloride	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
4-Chlorotoluene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
2-Chlorotoluene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
tert-Butylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
n-Propylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
sec-Butylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Styrene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 80	< 80	< 60	< 50	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 16	< 16	< 11	< 10	-
Acetone	mg/kg dry wt	< 80	< 80	< 60	< 50	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-

Sample Type: Sediment						
Sample Name:		SS01 13-Jul-2018 3:00 pm	SS02 13-Jul-2018 3:00 pm	SS05 13-Jul-2018 2:00 pm	SS06 13-Jul-2018 3:00 pm	
Lab Number:		2015346.4	2015346.5	2015346.6	2015346.7	
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.4	< 0.4	< 0.3	< 0.3	-
Dibromochloromethane	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	-
Naphthalene	mg/kg dry wt	< 0.4	< 0.4	< 0.3	< 0.3	-

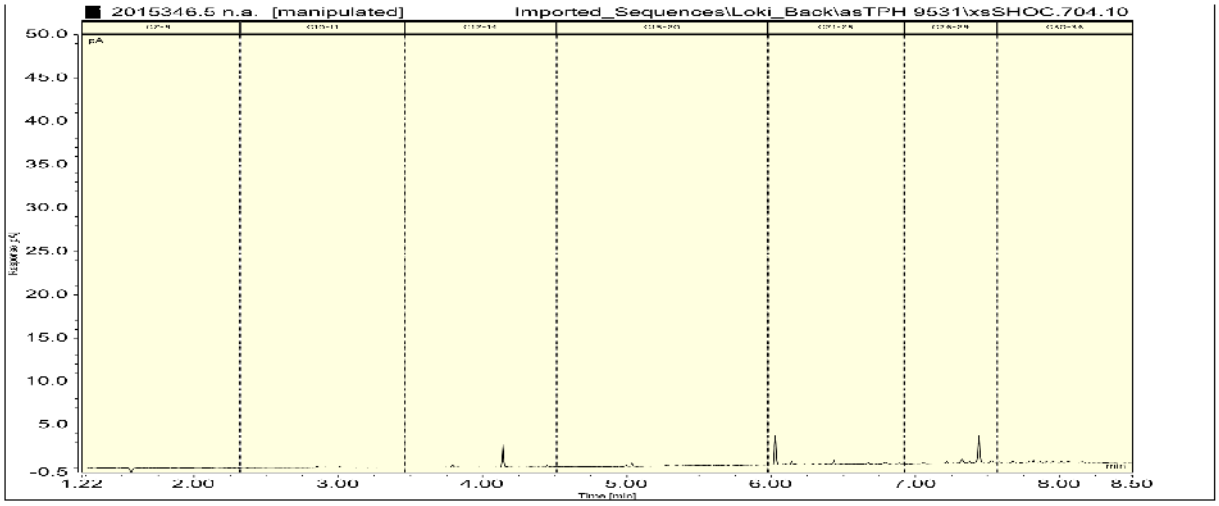
2015346.3
GBH109 - 2.5-2.9 13-Jul-2018 3:00 pm
Client Chromatogram for TPH by FID



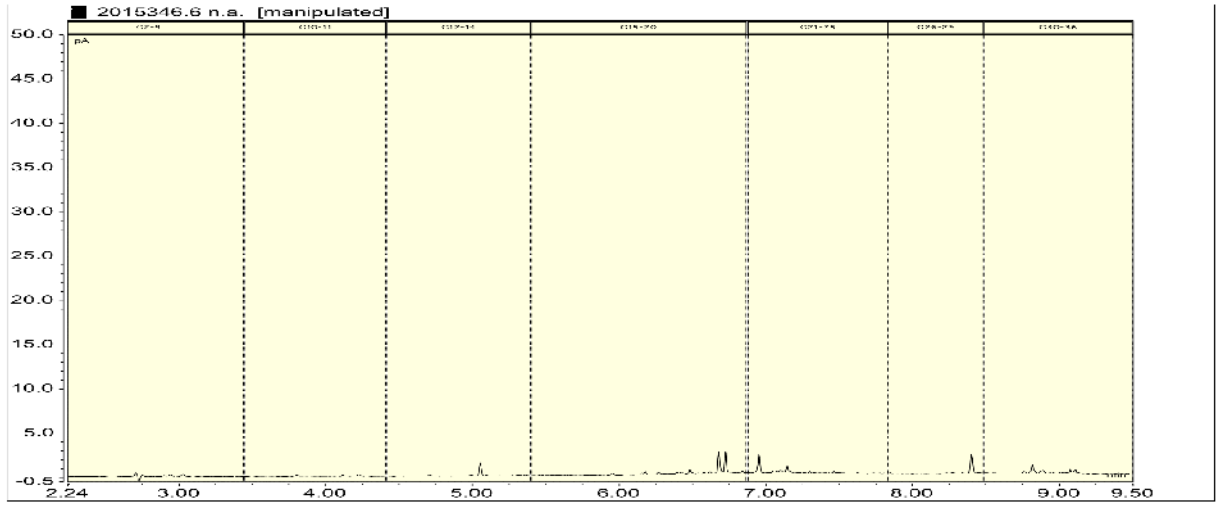
2015346.4
SS01 13-Jul-2018 3:00 pm
Client Chromatogram for TPH by FID



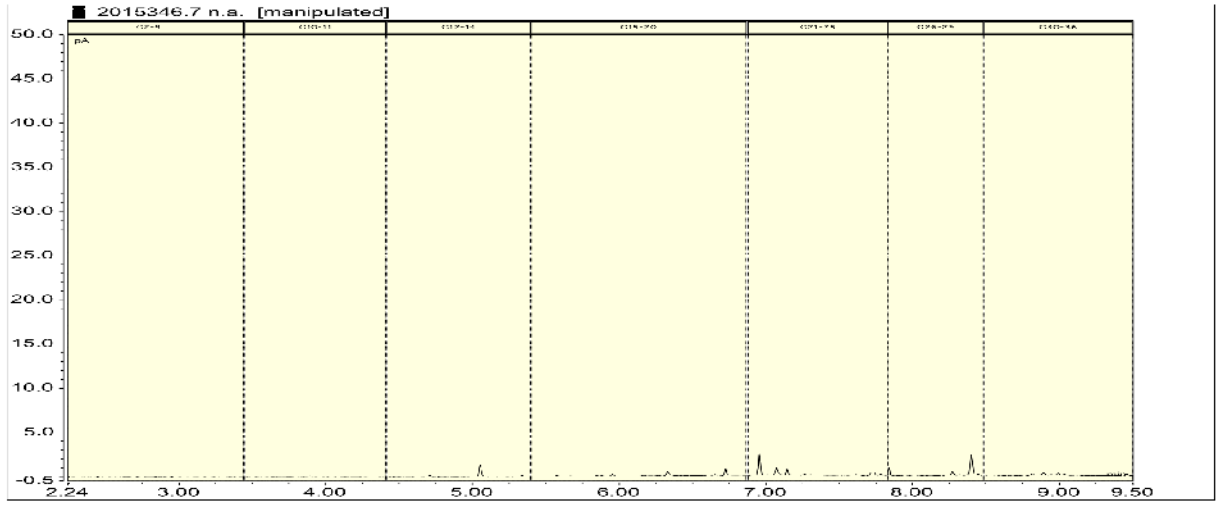
2015346.5
SS02 13-Jul-2018 3:00 pm
Client Chromatogram for TPH by FID



2015346.6
SS05 13-Jul-2018 2:00 pm
Client Chromatogram for TPH by FID



2015346.7
SS06 13-Jul-2018 3:00 pm
Client Chromatogram for TPH by FID



Analyst's Comments

A separate sample was not received for asbestos analysis. As such a portion of the sample was subsampled for asbestos analysis.
We cannot guarantee that the subsample represents the entire sample.
We recommend the client submits a separate sample for asbestos analysis.

It has been noted that the duplicate for TBT on sample 2015346.6, was run as part of our in-house QC procedure and showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample.

Amended Report: This certificate of analysis replaces an earlier certificate issued on 15 Aug 2018 at 3:26 pm
Reason for amendment: Asbestos analysis added to two samples. TOC added to sample 2015346.8

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	2, 4-8
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	3-8
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	3-5
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	3
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	3-7
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	3-7
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	3-5
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	3
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	8
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	3-8

Sample Type: Sediment

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	4-7
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN- C (modified) & Skalar Method I295-004(+P14). ISO 14403:2012(E).	0.10 mg/kg dry wt	4-5
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	4-8
Total of Reported PAHs in Soil*	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg	6-7

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	-	6-7
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	4-7
Semi Quantitative Asbestos in Soil	Based on approximately 100g of sample provided.	-	6-7
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	4-7
Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	6-7
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	6-7
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	6-7
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	6-7
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	6-7
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	6-7
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	6-7
Weight of Asbestos in >10mm Sample Fraction	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	6-7
Weight of Asbestos in <10mm to >2mm Sample Fraction	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	6-7
Weight of Asbestos in <2mm Sample Fraction	Measurement on analytical balance. Asbestos weight in <2mm subsample, if <2mm subsample weight is not "Entire Fraction". Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	6-7

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

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

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Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2015351	A2Pv1
Contact:	Lucy Hine	**Date Received:**	13-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	16-Aug-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2	
		Client Reference:	30881.2	
		Submitted By:	Melody Robyns	

Sample Type: Sediment

Sample Name:		SS01 13-Jul-2018	SS02 13-Jul-2018			
Lab Number:		2015351.3	2015351.4			
Asbestos Presence / Absence		Chrysotile (White Asbestos) detected.	Chrysotile (White Asbestos) detected.	-	-	-
Description of Asbestos Form		Loose Fibres	Loose Fibres	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	-	-	-
As Received Weight	g	942.3	913.6	-	-	-
Dry Weight	g	526.0	437.9	-	-	-
Ashed Weight	g	524.5	434.6	-	-	-
Moisture	%	44	52	-	-	-
Dry Sample Fraction >10mm	g ashed wt	< 0.1	< 0.1	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	195.2	162.2	-	-	-
Sample Fraction <2mm	g ashed wt	327.2	270.5	-	-	-
<2mm Subsample Weight	g ashed wt	51.8	52.4	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	< 0.00001	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	0.00070	0.00007	-	-	-

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

The following assumptions have been made:

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

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Sediment

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	3-4
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3-4
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3-4
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3-4
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	3-4
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3-4
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3-4
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3-4
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	3-4
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	3-4
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3-4
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3-4
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3-4
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3-4
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3-4
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3-4
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3-4

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

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

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2016128	SPv2
Contact:	Lucy Hine	**Date Received:**	16-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	30-Aug-2018	**(Amended)**
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		GBH109 6.85-7.05 16-Jul-2018				
Lab Number:		2016128.1				
Individual Tests						
Dry Matter	g/100g as rcvd	65	-	-	-	-
Total Organic Carbon*	g/100g dry wt	0.53	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	-	-	-	-
C10 - C14	mg/kg dry wt	< 20	-	-	-	-
C15 - C36	mg/kg dry wt	< 40	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	-	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Toluene	mg/kg dry wt	< 0.3	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.6	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	-	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	-	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	-	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	-	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	-	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	-	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		GBH109 6.85-7.05 16-Jul-2018				
Lab Number:		2016128.1				
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	-	-	-	-
Vinyl chloride	mg/kg dry wt	1.4	-	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	-	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	-	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Styrene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 60	-	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 11	-	-	-	-
Acetone	mg/kg dry wt	< 60	-	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	-	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	-	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	-	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	-	-	-	-

Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier certificate issued on 26 Jul 2018 at 3:43 pm
Reason for amendment: TOC analysis added to sample 2016128.1 at the client's request.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	1
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	1
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	1

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

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

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2017470	SPv1
Contact:	Lucy Hine C/- Tonkin & Taylor PO Box 13055 Christchurch 8141	**Date Received:**	18-Jul-2018	
		Date Reported:	08-Aug-2018	
		Quote No:	92235	
		Order No:	30881.2	
		Client Reference:	30881.2	
		Submitted By:	Lucy Hine	

Sample Type: Soil

Sample Name:		GBH110-2.4-2.65m 18-Jul-2018 9:00 am				
Lab Number:		2017470.1				
Individual Tests						
Dry Matter	g/100g as rcvd	68	-	-	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	< 2	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	13	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	12	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	7.4	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	16	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	46	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	0.176	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.015	-	-	-	-
Perylene	mg/kg dry wt	< 0.015	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.04	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.04	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.015	-	-	-	-
Acenaphthene	mg/kg dry wt	< 0.015	-	-	-	-
Anthracene	mg/kg dry wt	< 0.015	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.015	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.015	-	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.015	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.015	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.015	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.015	-	-	-	-
Chrysene	mg/kg dry wt	< 0.015	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.015	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.015	-	-	-	-
Fluorene	mg/kg dry wt	< 0.015	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.015	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.08	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.015	-	-	-	-
Pyrene	mg/kg dry wt	< 0.015	-	-	-	-
Total of Reported PAHs in Soil*	mg/kg	< 0.4	-	-	-	-

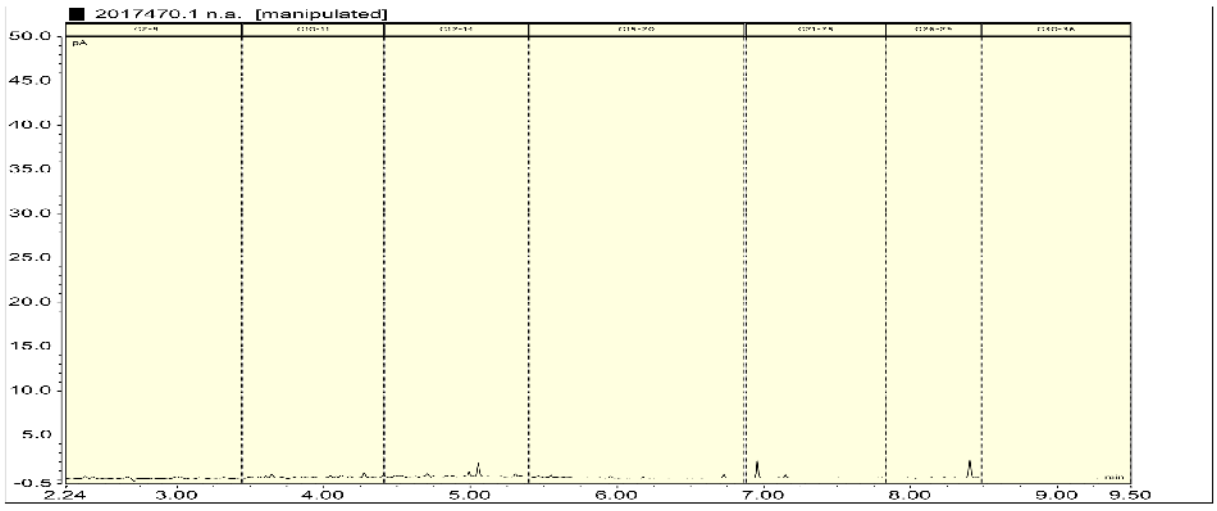
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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		GBH110-2.4-2.65m 18-Jul-2018 9:00 am				
Lab Number:		2017470.1				
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	-	-	-	-
C10 - C14	mg/kg dry wt	35	-	-	-	-
C15 - C36	mg/kg dry wt	< 40	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	-	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Toluene	mg/kg dry wt	< 0.3	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.5	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	-	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	-	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	-	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	-	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	-	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	-	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	-	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	-	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-

Sample Type: Soil						
Sample Name:		GBH110-2.4-2.65m 18-Jul-2018 9:00 am				
Lab Number:		2017470.1				
Haloaromatics in VOC Soils by Headspace GC-MS						
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	0.3	-	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	-	-	-	-
n-Propylbenzene	mg/kg dry wt	0.9	-	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Styrene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 50	-	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 10	-	-	-	-
Acetone	mg/kg dry wt	< 50	-	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	-	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	-	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	-	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	-	-	-	-

2017470.1
GBH110- 2.4-2.65m 18-Jul-2018 9:00 am
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	-	1
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	1
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1
Total of Reported PAHs in Soil*	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg	1

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

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

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2018088 SPv2
Contact:	Lucy Hine C/- Tonkin & Taylor PO Box 13055 Christchurch 8141	**Date Received:**	19-Jul-2018
		Date Reported:	02-Aug-2018
		Quote No:	92235
		Order No:	30881.2000
		Client Reference:	30881.2000
		Submitted By:	Melody Robyns

Sample Type: Sediment

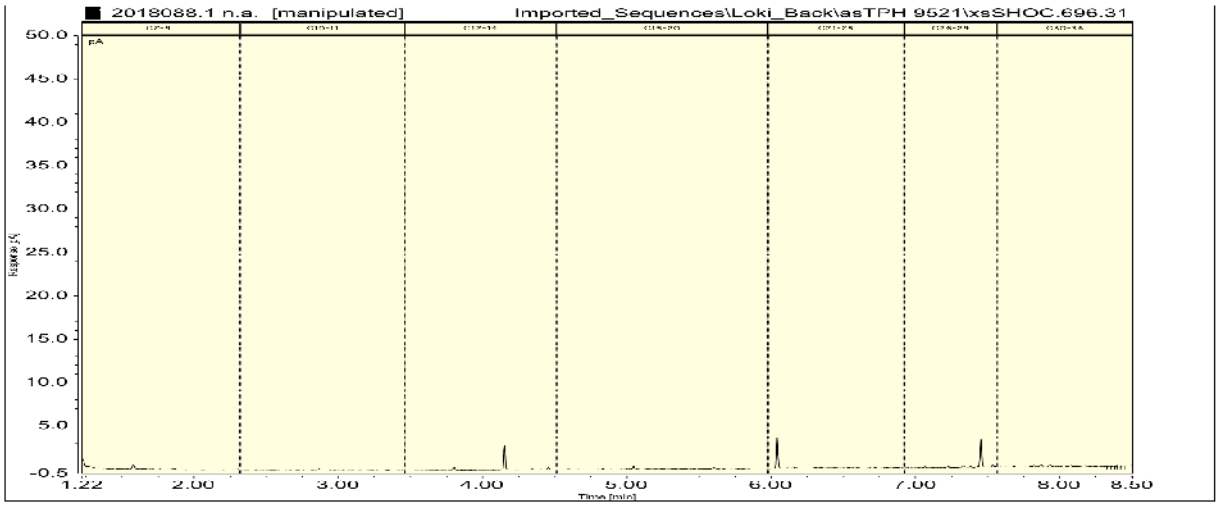
Sample Name:		SS101 19-Jul-2018				
Lab Number:		2018088.1				
Individual Tests						
Dry Matter	g/100g as rcvd	33	-	-	-	-
Total Organic Carbon*	g/100g dry wt	1.48	-	-	-	-
Antifouling cobiocides in sediment samples by LCMSMS						
Diuron*	mg/kg dry wt	< 0.010	-	-	-	-
Irgarol*	mg/kg dry wt	< 0.010	-	-	-	-
Isoproturon*	mg/kg dry wt	< 0.010	-	-	-	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	10	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	27	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	119	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	51	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	0.48	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	9	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	150	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.03	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.03	-	-	-	-
Perylene	mg/kg dry wt	0.07	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.27	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.26	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.03	-	-	-	-
Acenaphthene	mg/kg dry wt	< 0.03	-	-	-	-
Anthracene	mg/kg dry wt	< 0.03	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	0.11	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.20	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.27	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt	0.14	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.14	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	0.09	-	-	-	-
Chrysene	mg/kg dry wt	0.10	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	-	-	-	-
Fluoranthene	mg/kg dry wt	0.30	-	-	-	-
Fluorene	mg/kg dry wt	< 0.03	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.12	-	-	-	-

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Sample Type: Sediment						
Sample Name:		SS101 19-Jul-2018				
Lab Number:		2018088.1				
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Naphthalene	mg/kg dry wt	< 0.15	-	-	-	-
Phenanthrene	mg/kg dry wt	0.06	-	-	-	-
Pyrene	mg/kg dry wt	0.36	-	-	-	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	0.052	-	-	-	-
Monobutyltin (as Sn)	mg/kg dry wt	0.011	-	-	-	-
Tributyltin (as Sn)	mg/kg dry wt	0.054	-	-	-	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 18	-	-	-	-
C10 - C14	mg/kg dry wt	< 40	-	-	-	-
C15 - C36	mg/kg dry wt	86	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 130	-	-	-	-

2018088.1
SS101 19-Jul-2018
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Antifouling cobiocides in sediment samples by LCMSMS*		0.010 mg/kg dry wt	1
Antifouling cobiocides suite in sediment by LCMSMS*	Ethyl acetate extraction, SPE cleanup, determination by LCMSMS.	-	1
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	1
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	1
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	1
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	1
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2019525 SPv1
Contact:	Lucy Hine C/- Tonkin & Taylor PO Box 13055 Christchurch 8141	**Date Received:**	23-Jul-2018
		Date Reported:	31-Jul-2018
		Quote No:	92235
		Order No:	30881.2000
		Client Reference:	30881.2000
		Submitted By:	Melody Robyns

Sample Type: Soil

Sample Name:		GBH101 - 0.9-1.0m 23-Jul-2018				
Lab Number:		2019525.3				
Individual Tests						
Dry Matter	g/100g as rcvd	78	-	-	-	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	36	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.42	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	28	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	44	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	74	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	78	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	74	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	1.11	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	1.34	-	-	-	-
Perylene	mg/kg dry wt	5.0	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	23	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	24	-	-	-	-
Acenaphthylene	mg/kg dry wt	1.14	-	-	-	-
Acenaphthene	mg/kg dry wt	0.29	-	-	-	-
Anthracene	mg/kg dry wt	2.6	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	10.1	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	15.0	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	20	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt	12.0	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	16.3	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	8.4	-	-	-	-
Chrysene	mg/kg dry wt	13.1	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	2.5	-	-	-	-
Fluoranthene	mg/kg dry wt	20	-	-	-	-
Fluorene	mg/kg dry wt	0.59	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	18.7	-	-	-	-
Naphthalene	mg/kg dry wt	1.42	-	-	-	-
Phenanthrene	mg/kg dry wt	10.7	-	-	-	-
Pyrene	mg/kg dry wt	23	-	-	-	-

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Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	3
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.05 mg/kg dry wt	3
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	3
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	3
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	3

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2019526	A2Pv1
Contact:	Lucy Hine	**Date Received:**	23-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	30-Jul-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		GBH101-0.9-1.0 23-Jul-2018				
Lab Number:		2019526.3				
Asbestos Presence / Absence		Asbestos NOT detected.	-	-	-	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
As Received Weight	g	508.4	-	-	-	-
Dry Weight	g	412.0	-	-	-	-
Ashed Weight	g	404.3	-	-	-	-
Moisture	%	19	-	-	-	-
Dry Sample Fraction >10mm	g ashed wt	80.5	-	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	165.2	-	-	-	-
Sample Fraction <2mm	g ashed wt	157.9	-	-	-	-
<2mm Subsample Weight	g ashed wt	52.7	-	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	< 0.00001	-	-	-	-

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

The following assumptions have been made:

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

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			

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Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	3
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	3
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	3
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	3
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	3
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	3

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2020256	A2Pv1
Contact:	Lucy Hine C/- Tonkin & Taylor PO Box 13055 Christchurch 8141	**Date Received:**	24-Jul-2018	
		Date Reported:	09-Aug-2018	
		Quote No:	92235	
		Order No:	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	James Smith	

Sample Type: Soil

Sample Name:		GBH106-0.5-0.8 24-Jul-2018				
Lab Number:		2020256.1				
Asbestos Presence / Absence		Chrysotile (White Asbestos) detected.	-	-	-	-
Description of Asbestos Form		Loose Fibres	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	-	-	-	-
As Received Weight	g	899.9	-	-	-	-
Dry Weight	g	779.1	-	-	-	-
Ashed Weight	g	772.3	-	-	-	-
Moisture	%	13	-	-	-	-
Dry Sample Fraction >10mm	g ashed wt	226.3	-	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	265.3	-	-	-	-
Sample Fraction <2mm	g ashed wt	280.0	-	-	-	-
<2mm Subsample Weight	g ashed wt	50.4	-	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	0.00296	-	-	-	-

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

The following assumptions have been made:

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

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

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			

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Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
New Zealand Guidelines Semi Quantitative Asbestos in Soil*		-	1
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	1 %	1
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1

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Section Manager - Asbestos

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2020257	SPv1
Contact:	Lucy Hine	**Date Received:**	24-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	01-Aug-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	James Smith	

Sample Type: Soil

		Sample Name:	GBH101 6.5-7.05 24-Jul-2018	GBH106 0.5-0.8 24-Jul-2018			
		Lab Number:	2020257.4	2020257.5			
Individual Tests							
Dry Matter	g/100g as rcvd		67	85	-	-	-
Heavy Metals with Mercury, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		-	< 2	-	-	-
Total Recoverable Cadmium	mg/kg dry wt		-	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt		-	23	-	-	-
Total Recoverable Copper	mg/kg dry wt		-	46	-	-	-
Total Recoverable Lead	mg/kg dry wt		-	28	-	-	-
Total Recoverable Mercury	mg/kg dry wt		-	< 0.10	-	-	-
Total Recoverable Nickel	mg/kg dry wt		-	109	-	-	-
Total Recoverable Zinc	mg/kg dry wt		-	92	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil							
1-Methylnaphthalene	mg/kg dry wt		-	< 0.012	-	-	-
2-Methylnaphthalene	mg/kg dry wt		-	< 0.012	-	-	-
Perylene	mg/kg dry wt		-	0.027	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt		-	0.08	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt		-	0.08	-	-	-
Acenaphthylene	mg/kg dry wt		-	< 0.012	-	-	-
Acenaphthene	mg/kg dry wt		-	< 0.012	-	-	-
Anthracene	mg/kg dry wt		-	0.019	-	-	-
Benzo[a]anthracene	mg/kg dry wt		-	0.065	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt		-	0.061	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt		-	0.074	-	-	-
Benzo[e]pyrene	mg/kg dry wt		-	0.042	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt		-	0.037	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt		-	0.017	-	-	-
Chrysene	mg/kg dry wt		-	0.055	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt		-	< 0.012	-	-	-
Fluoranthene	mg/kg dry wt		-	0.154	-	-	-
Fluorene	mg/kg dry wt		-	< 0.012	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt		-	0.030	-	-	-
Naphthalene	mg/kg dry wt		-	< 0.06	-	-	-
Phenanthrene	mg/kg dry wt		-	0.045	-	-	-
Pyrene	mg/kg dry wt		-	0.161	-	-	-

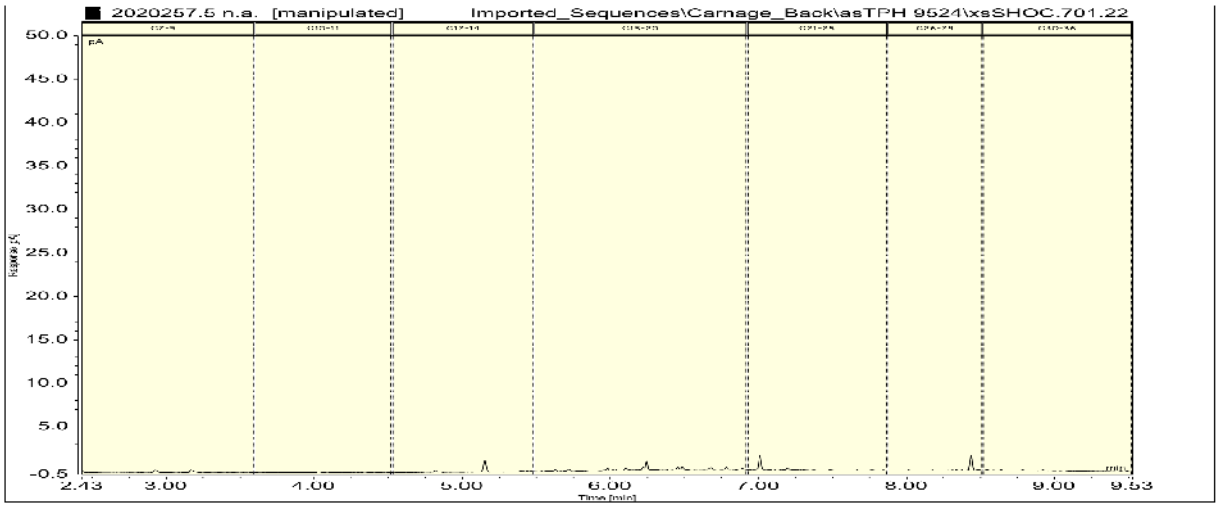
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Sample Type: Soil						
Sample Name:		GBH101 6.5-7.05 24-Jul-2018	GBH106 0.5-0.8 24-Jul-2018			
Lab Number:		2020257.4	2020257.5			
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 8	-	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	-	-	-
C15 - C36	mg/kg dry wt	< 40	75	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	75	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Toluene	mg/kg dry wt	< 0.3	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.5	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	-	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	-	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	-	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	-	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	-	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	-	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	-	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	-	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-

Sample Type: Soil							
Sample Name:		GBH101 6.5-7.05 24-Jul-2018	GBH106 0.5-0.8 24-Jul-2018			
Lab Number:		2020257.4	2020257.5			
Haloaromatics in VOC Soils by Headspace GC-MS						
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	-	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	-	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Styrene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 50	-	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 10	-	-	-	-
Acetone	mg/kg dry wt	< 50	-	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	-	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	-	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	-	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	-	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	-	-	-	-

2020257.5
GBH106 0.5-0.8 24-Jul-2018
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.002 - 60 mg/kg dry wt	5

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	5
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	4
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	4
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	4-5
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	5
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	5

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2021090	SPv2
Contact:	Lucy Hine	**Date Received:**	25-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	06-Aug-2018	**(Amended)**
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Soil

Sample Name:		GBH106 2.7-3.0 25-Jul-2018				
Lab Number:		2021090.5				
Individual Tests						
Dry Matter	g/100g as rcvd	74	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	133	-	-	-	-
C10 - C14	mg/kg dry wt	1,490	-	-	-	-
C15 - C36	mg/kg dry wt	1,430	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	3,100	-	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.3	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Toluene	mg/kg dry wt	< 0.3	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.5	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	-	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	-	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	-	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	-	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	-	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	-	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-

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Sample Type: Soil							
Sample Name:		GBH106 2.7-3.0 25-Jul-2018					
Lab Number:		2021090.5					
Halogenated Aliphatics in VOC Soils by Headspace GC-MS							
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-	
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-	
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-	
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-	
Trichlorofluoromethane	mg/kg dry wt	< 0.3	-	-	-	-	
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	-	-	-	-	
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	-	-	-	-	
Vinyl chloride	mg/kg dry wt	< 0.3	-	-	-	-	
Haloaromatics in VOC Soils by Headspace GC-MS							
Bromobenzene	mg/kg dry wt	< 0.3	-	-	-	-	
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-	
4-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-	
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	-	-	-	-	
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-	
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-	
2-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-	
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-	
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-	
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-	
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS							
n-Butylbenzene	mg/kg dry wt	1.1	-	-	-	-	
tert-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-	
Isopropylbenzene (Cumene)	mg/kg dry wt	1.3	-	-	-	-	
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	-	-	-	-	
n-Propylbenzene	mg/kg dry wt	2.0	-	-	-	-	
sec-Butylbenzene	mg/kg dry wt	1.1	-	-	-	-	
Styrene	mg/kg dry wt	< 0.3	-	-	-	-	
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-	
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-	
Ketones in VOC Soils by Headspace GC-MS							
2-Butanone (MEK)	mg/kg dry wt	< 50	-	-	-	-	
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 9	-	-	-	-	
Acetone	mg/kg dry wt	< 50	-	-	-	-	
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	-	-	-	-	
Trihalomethanes in VOC Soils by Headspace GC-MS							
Bromodichloromethane	mg/kg dry wt	< 0.3	-	-	-	-	
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	-	-	-	-	
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	-	-	-	-	
Dibromochloromethane	mg/kg dry wt	< 0.3	-	-	-	-	
Other VOC in Soils by Headspace GC-MS							
Carbon disulphide	mg/kg dry wt	< 0.3	-	-	-	-	
Naphthalene	mg/kg dry wt	< 0.3	-	-	-	-	

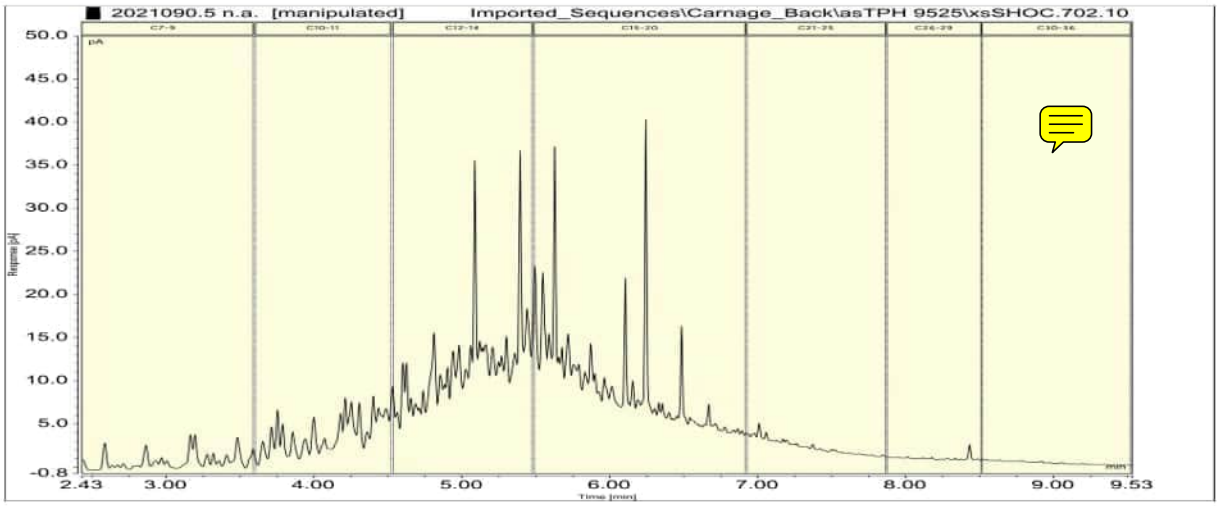
Sample Type: Aqueous						
Sample Name:		CBH201 25-Jul-2018 12:00 pm	CBH204 25-Jul-2018			
Lab Number:		2021090.9	2021090.10			
Individual Tests						
pH	pH Units	7.6	7.4	-	-	-
Electrical Conductivity (EC)	mS/m	183.9	139.4	-	-	-
Total Dissolved Solids (TDS)	g/m³	1,030	820	-	-	-
Dissolved Mercury	g/m³	< 0.00008	< 0.00008	-	-	-

Sample Type: Aqueous						
Sample Name:		CBH201 25-Jul-2018 12:00 pm	CBH204 25-Jul-2018			
Lab Number:		2021090.9	2021090.10			
Individual Tests						
Total Cyanide	g/m³	0.0062	0.029	-	-	-
Chloride	g/m³	300	145	-	-	-
Sulphate	g/m³	4.5	1.8	-	-	-
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m³	0.0013	< 0.0010	-	-	-
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	-	-	-
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	-	-	-
Dissolved Copper	g/m³	< 0.0005	0.0021	-	-	-
Dissolved Lead	g/m³	0.00061	< 0.00010	-	-	-
Dissolved Nickel	g/m³	< 0.0005	< 0.0005	-	-	-
Dissolved Zinc	g/m³	< 0.0010	0.0058	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq						
Acenaphthene	g/m³	0.00035	0.00014	-	-	-
Acenaphthylene	g/m³	< 0.00010	0.00010	-	-	-
Anthracene	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[a]anthracene	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[a]pyrene (BAP)	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[g,h,i]perylene	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[k]fluoranthene	g/m³	< 0.00010	< 0.00010	-	-	-
Chrysene	g/m³	< 0.00010	< 0.00010	-	-	-
Dibenzo[a,h]anthracene	g/m³	< 0.00010	< 0.00010	-	-	-
Fluoranthene	g/m³	< 0.00010	0.00012	-	-	-
Fluorene	g/m³	0.0007	0.0002	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.00010	< 0.00010	-	-	-
Naphthalene	g/m³	0.0007	0.0017	-	-	-
Phenanthrene	g/m³	< 0.0004	< 0.0004	-	-	-
Pyrene	g/m³	< 0.0002	< 0.0002	-	-	-
Polychlorinated Biphenyls Screening in Water, By Liq/Liq						
PCB-18	g/m³	-	< 0.00010	-	-	-
PCB-28	g/m³	-	< 0.00010	-	-	-
PCB-31	g/m³	-	< 0.00010	-	-	-
PCB-44	g/m³	-	< 0.00010	-	-	-
PCB-49	g/m³	-	< 0.00010	-	-	-
PCB-52	g/m³	-	< 0.00010	-	-	-
PCB-60	g/m³	-	< 0.00010	-	-	-
PCB-77	g/m³	-	< 0.00010	-	-	-
PCB-81	g/m³	-	< 0.00010	-	-	-
PCB-86	g/m³	-	< 0.00010	-	-	-
PCB-101	g/m³	-	< 0.00010	-	-	-
PCB-105	g/m³	-	< 0.00010	-	-	-
PCB-110	g/m³	-	< 0.00010	-	-	-
PCB-114	g/m³	-	< 0.00010	-	-	-
PCB-118	g/m³	-	< 0.00010	-	-	-
PCB-121	g/m³	-	< 0.00010	-	-	-
PCB-123	g/m³	-	< 0.00010	-	-	-
PCB-126	g/m³	-	< 0.00010	-	-	-
PCB-128	g/m³	-	< 0.00010	-	-	-
PCB-138	g/m³	-	< 0.00010	-	-	-
PCB-141	g/m³	-	< 0.00010	-	-	-
PCB-149	g/m³	-	< 0.00010	-	-	-
PCB-151	g/m³	-	< 0.00010	-	-	-
PCB-153	g/m³	-	< 0.00010	-	-	-

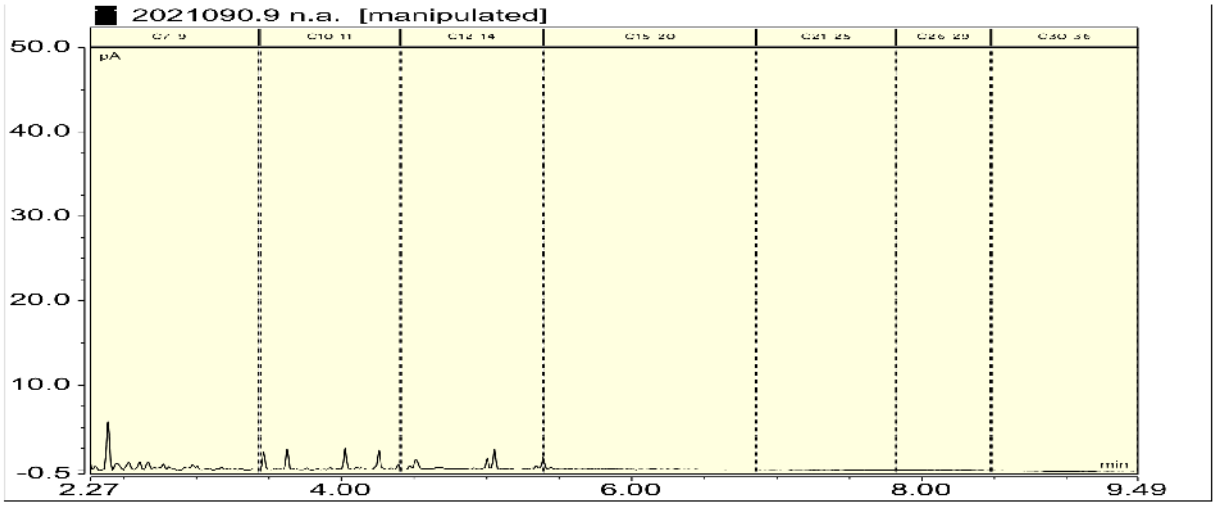
Sample Type: Aqueous						
Sample Name:		CBH201 25-Jul-2018 12:00 pm	CBH204 25-Jul-2018			
Lab Number:		2021090.9	2021090.10			
Polychlorinated Biphenyls Screening in Water, By Liq/Liq						
PCB-156	g/m³	-	< 0.00010	-	-	-
PCB-157	g/m³	-	< 0.00010	-	-	-
PCB-159	g/m³	-	< 0.00010	-	-	-
PCB-167	g/m³	-	< 0.00010	-	-	-
PCB-169	g/m³	-	< 0.00010	-	-	-
PCB-170	g/m³	-	< 0.00010	-	-	-
PCB-180	g/m³	-	< 0.00010	-	-	-
PCB-189	g/m³	-	< 0.00010	-	-	-
PCB-194	g/m³	-	< 0.00010	-	-	-
PCB-206	g/m³	-	< 0.00010	-	-	-
PCB-209	g/m³	-	< 0.00010	-	-	-
Total PCB (Sum of 35 congeners)	g/m³	-	< 0.005	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	1.05	0.06	-	-	-
C10 - C14	g/m³	0.4	1.2	-	-	-
C15 - C36	g/m³	< 0.4	< 0.4	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	1.4	1.3	-	-	-
BTEX in VOC Water by Headspace GC-MS						
Benzene	g/m³	0.029	< 0.003	-	-	-
Ethylbenzene	g/m³	< 0.005	0.007	-	-	-
Toluene	g/m³	< 0.003	< 0.003	-	-	-
m&p-Xylene	g/m³	< 0.005	< 0.005	-	-	-
o-Xylene	g/m³	< 0.003	< 0.003	-	-	-
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
Bromomethane (Methyl Bromide)	g/m³	< 0.003	< 0.003	-	-	-
Carbon tetrachloride	g/m³	< 0.003	< 0.003	-	-	-
Chloroethane	g/m³	< 0.003	< 0.003	-	-	-
Chloromethane	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003	< 0.003	-	-	-
Dibromomethane	g/m³	< 0.003	< 0.003	-	-	-
Dichlorodifluoromethane	g/m³	< 0.003	< 0.003	-	-	-
1,1-Dichloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dichloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,1-Dichloroethene	g/m³	< 0.003	< 0.003	-	-	-
cis-1,2-Dichloroethene	g/m³	< 0.003	< 0.003	-	-	-
trans-1,2-Dichloroethene	g/m³	< 0.003	< 0.003	-	-	-
Dichloromethane (methylene chloride)	g/m³	< 0.10	< 0.10	-	-	-
1,2-Dichloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,3-Dichloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,1-Dichloropropene	g/m³	< 0.003	< 0.003	-	-	-
cis-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	-	-	-
trans-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	-	-	-
Hexachlorobutadiene	g/m³	< 0.003	< 0.003	-	-	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	-	-	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003	< 0.003	-	-	-
1,1,1-Trichloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,1,2-Trichloroethane	g/m³	< 0.003	< 0.003	-	-	-
Trichloroethene (trichloroethylene)	g/m³	< 0.003	< 0.003	-	-	-
Trichlorofluoromethane	g/m³	< 0.003	< 0.003	-	-	-
1,2,3-Trichloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003	< 0.003	-	-	-

Sample Type: Aqueous						
Sample Name:		CBH201 25-Jul-2018 12:00 pm	CBH204 25-Jul-2018			
Lab Number:		2021090.9	2021090.10			
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
Vinyl chloride	g/m³	< 0.003	< 0.003	-	-	-
Haloaromatics in VOC Water by Headspace GC-MS						
Bromobenzene	g/m³	< 0.003	< 0.003	-	-	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003	< 0.003	-	-	-
2-Chlorotoluene	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,3-Dichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,4-Dichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
4-Chlorotoluene	g/m³	< 0.003	< 0.003	-	-	-
1,2,3-Trichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,3,5-Trichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
n-Butylbenzene	g/m³	< 0.005	0.026	-	-	-
tert-Butylbenzene	g/m³	< 0.003	< 0.003	-	-	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005	< 0.005	-	-	-
Isopropylbenzene (Cumene)	g/m³	0.014	0.29	-	-	-
n-Propylbenzene	g/m³	< 0.005	0.32	-	-	-
sec-Butylbenzene	g/m³	0.003	0.009	-	-	-
Styrene	g/m³	< 0.005	< 0.005	-	-	-
1,2,4-Trimethylbenzene	g/m³	< 0.003	< 0.003	-	-	-
1,3,5-Trimethylbenzene	g/m³	< 0.003	< 0.003	-	-	-
Ketones in VOC Water by Headspace GC-MS						
Acetone	g/m³	< 0.5	< 0.5	-	-	-
2-Butanone (MEK)	g/m³	< 0.5	< 0.5	-	-	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003	< 0.003	-	-	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10	< 0.10	-	-	-
Trihalomethanes in VOC Water by Headspace GC-MS						
Bromodichloromethane	g/m³	< 0.003	< 0.003	-	-	-
Bromoform (tribromomethane)	g/m³	< 0.003	< 0.003	-	-	-
Chloroform (Trichloromethane)	g/m³	< 0.003	< 0.003	-	-	-
Dibromochloromethane	g/m³	< 0.003	< 0.003	-	-	-
Other VOC in Water by Headspace GC-MS						
Carbon disulphide	g/m³	< 0.005	< 0.005	-	-	-
Naphthalene	g/m³	< 0.005	< 0.005	-	-	-

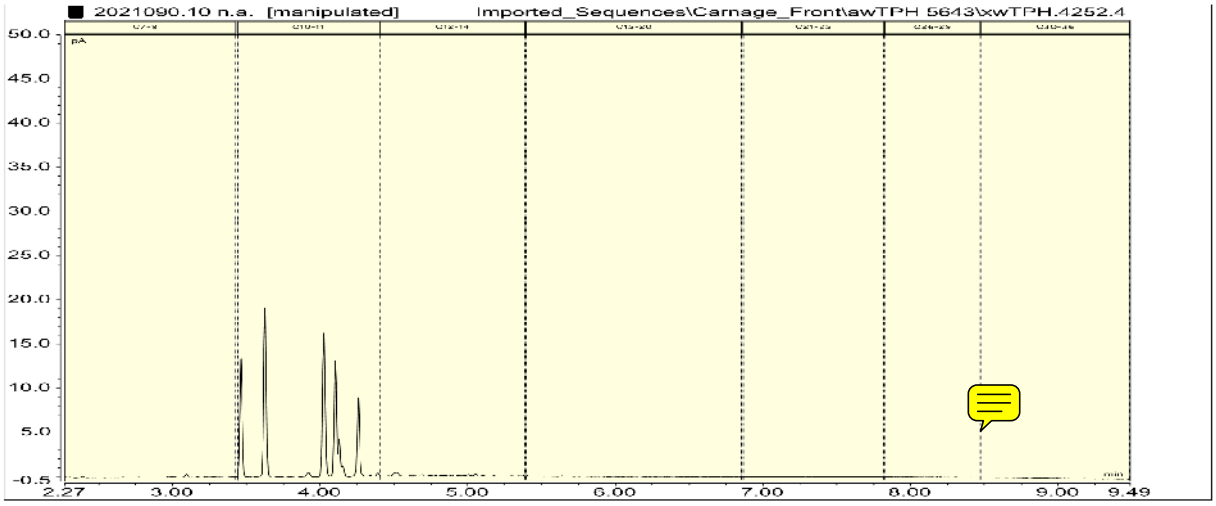
2021090.5
GBH106 2.7-3.0 25-Jul-2018
Client Chromatogram for TPH by FID



2021090.9
CBH201 25-Jul-2018 12:00 pm
Client Chromatogram for TPH by FID



2021090.10
CBH204 25-Jul-2018
Client Chromatogram for TPH by FID



Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier certificate issued on 02 Aug 2018 at 3:01 pm
Reason for amendment: Sample names corrected at clients request.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Total Petroleum Hydrocarbons in Soil*	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	5
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	5
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	5

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00005 - 0.0010 g/m^3	9-10
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.00010 - 0.0005 g/m^3	9-10
Polychlorinated Biphenyls Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS analysis	0.00010 - 0.005 g/m^3	10
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m^3	9-10
Volatile Organic Compounds Screening in Water by Headspace GC-MS	Headspace, GC-MS SIM analysis [KBIs:37857,37921]	0.003 - 0.5 g/m^3	9-10
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	9-10
Total Digestion	Nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	9-10
Total Cyanide Distillation	Distillation following the addition of sulphuric acid, alkaline trapping solution. APHA 4500-CN^- C (modified) 22nd ed. 2012.	-	9-10
pH	pH meter. APHA 4500-H^+ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	9-10
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	9-10
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	10 g/m^3	9-10
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	9-10
Dissolved Mercury	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m^3	9-10
Total Cyanide	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.0010 g/m^3	9-10
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	9-10
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	9-10
C7 - C9	Head Space, GCMS analysis.	0.06 g/m^3	9-10

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Martin Cowell - BSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2021746	SPv1
Contact:	Lucy Hine	**Date Received:**	26-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	08-Aug-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Sediment

Sample Name:		GBH302-0.0-1.0 26-Jul-2018	GBH302-3.65-4.2 26-Jul-2018			
Lab Number:		2021746.4	2021746.6			
Individual Tests						
Dry Matter	g/100g as rcvd	45	59	-	-	-
Total Cyanide*	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Organic Carbon*	g/100g dry wt	1.13	-	-	-	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	13	8	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt	20	13	-	-	-
Total Recoverable Copper	mg/kg dry wt	89	13	-	-	-
Total Recoverable Lead	mg/kg dry wt	77	9.6	-	-	-
Total Recoverable Mercury	mg/kg dry wt	1.57	< 0.10	-	-	-
Total Recoverable Nickel	mg/kg dry wt	19	10	-	-	-
Total Recoverable Zinc	mg/kg dry wt	140	36	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.017	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.03	< 0.017	-	-	-
Perylene	mg/kg dry wt	0.12	0.044	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.69	< 0.04	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.69	< 0.05	-	-	-
Acenaphthylene	mg/kg dry wt	0.08	< 0.017	-	-	-
Acenaphthene	mg/kg dry wt	< 0.03	< 0.017	-	-	-
Anthracene	mg/kg dry wt	0.06	< 0.017	-	-	-
Benzo[a]anthracene	mg/kg dry wt	0.28	< 0.017	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.48	< 0.017	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.58	< 0.017	-	-	-
Benzo[e]pyrene	mg/kg dry wt	0.32	< 0.017	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.39	< 0.017	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	0.25	< 0.017	-	-	-
Chrysene	mg/kg dry wt	0.28	< 0.017	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	0.06	< 0.017	-	-	-
Fluoranthene	mg/kg dry wt	0.61	< 0.017	-	-	-
Fluorene	mg/kg dry wt	0.03	< 0.017	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.36	< 0.017	-	-	-
Naphthalene	mg/kg dry wt	< 0.11	< 0.09	-	-	-
Phenanthrene	mg/kg dry wt	0.20	< 0.017	-	-	-
Pyrene	mg/kg dry wt	0.65	< 0.017	-	-	-

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Sediment						
Sample Name:		GBH302-0.0-1.0 26-Jul-2018	GBH302-3.65-4.2 26-Jul-2018			
Lab Number:		2021746.4	2021746.6			
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil*	mg/kg	4.8	< 0.4	-	-	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	0.010	-	-	-	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	-	-	-	-
Tributyltin (as Sn)	mg/kg dry wt	0.019	-	-	-	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 13	< 10	-	-	-
C10 - C14	mg/kg dry wt	< 30	< 20	-	-	-
C15 - C36	mg/kg dry wt	390	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	390	< 70	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Toluene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.9	< 0.6	-	-	-
o-Xylene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Chloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Chloromethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Dibromomethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-

Sample Type: Sediment						
Sample Name:		GBH302-0.0-1.0 26-Jul-2018	GBH302-3.65-4.2 26-Jul-2018			
Lab Number:		2021746.4	2021746.6			
Haloaromatics in VOC Soils by Headspace GC-MS						
4-Chlorotoluene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Styrene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 90	< 60	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 17	< 12	-	-	-
Acetone	mg/kg dry wt	< 90	< 60	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.5	< 0.3	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.5	< 0.3	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Naphthalene	mg/kg dry wt	< 0.5	< 0.3	-	-	-

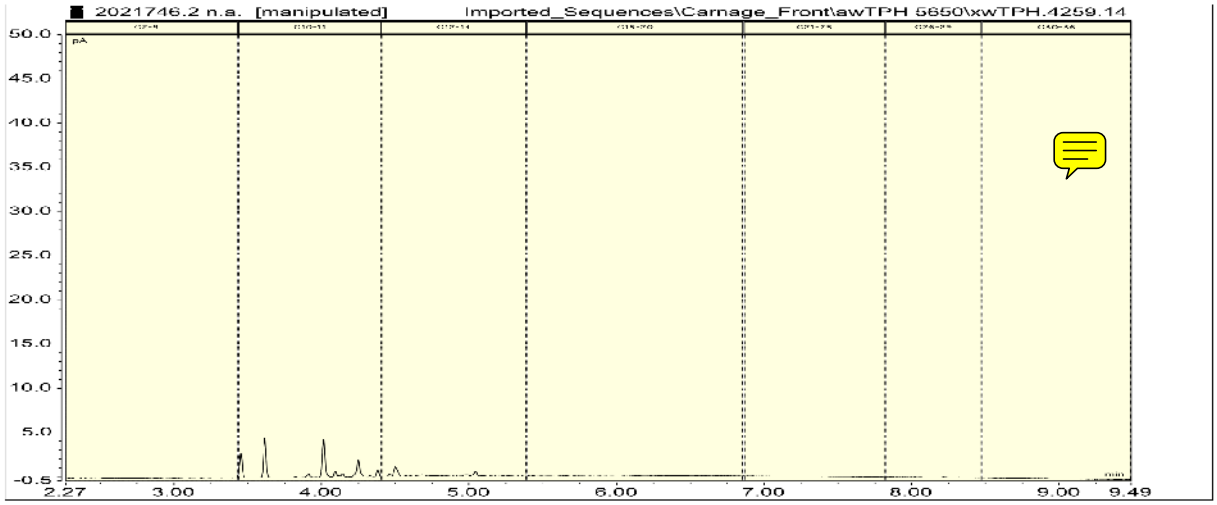
Sample Type: Aqueous						
Sample Name:		CBH203 26-Jul-2018	CBH207 26-Jul-2018	GBH108 26-Jul-2018		
Lab Number:		2021746.1	2021746.2	2021746.3		
Individual Tests						
pH	pH Units	7.6	7.0	7.1	-	-
Electrical Conductivity (EC)	mS/m	3,380	80.6	89.5	-	-
Total Dissolved Solids (TDS)	g/m³	23,000	480	520	-	-
Dissolved Mercury	g/m³	< 0.00008	< 0.00008	< 0.00008	-	-
Total Cyanide	g/m³	0.025 #1	0.0084	0.0084	-	-
Chloride	g/m³	10,600	44	44	-	-
Sulphate	g/m³	1,220	< 0.5	< 0.5	-	-
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m³	< 0.02	< 0.0010	< 0.0010	-	-
Dissolved Cadmium	g/m³	< 0.0010	< 0.00005	< 0.00005	-	-
Dissolved Chromium	g/m³	< 0.010	< 0.0005	< 0.0005	-	-
Dissolved Copper	g/m³	< 0.010	< 0.0005	< 0.0005	-	-
Dissolved Lead	g/m³	< 0.002	0.00016	< 0.00010	-	-
Dissolved Nickel	g/m³	< 0.010	< 0.0005	< 0.0005	-	-
Dissolved Zinc	g/m³	< 0.02	< 0.0010	< 0.0010	-	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq						
Acenaphthene	g/m³	< 0.00010	0.00023	0.00013	-	-

Sample Type: Aqueous						
Sample Name:		CBH203 26-Jul-2018	CBH207 26-Jul-2018	GBH108 26-Jul-2018		
Lab Number:		2021746.1	2021746.2	2021746.3		
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq						
Acenaphthylene	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Anthracene	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[a]anthracene	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[a]pyrene (BAP)	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[g,h,i]perylene	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[k]fluoranthene	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Chrysene	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Dibenzo[a,h]anthracene	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Fluoranthene	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Fluorene	g/m³	< 0.0002	0.0006	< 0.0002	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Naphthalene	g/m³	< 0.0005	< 0.0005	< 0.0005	-	-
Phenanthrene	g/m³	< 0.0004	< 0.0004	< 0.0004	-	-
Pyrene	g/m³	< 0.0002	< 0.0002	< 0.0002	-	-
Polychlorinated Biphenyls Screening in Water, By Liq/Liq						
PCB-18	g/m³	< 0.00010	-	-	-	-
PCB-28	g/m³	< 0.00010	-	-	-	-
PCB-31	g/m³	< 0.00010	-	-	-	-
PCB-44	g/m³	< 0.00010	-	-	-	-
PCB-49	g/m³	< 0.00010	-	-	-	-
PCB-52	g/m³	< 0.00010	-	-	-	-
PCB-60	g/m³	< 0.00010	-	-	-	-
PCB-77	g/m³	< 0.00010	-	-	-	-
PCB-81	g/m³	< 0.00010	-	-	-	-
PCB-86	g/m³	< 0.00010	-	-	-	-
PCB-101	g/m³	< 0.00010	-	-	-	-
PCB-105	g/m³	< 0.00010	-	-	-	-
PCB-110	g/m³	< 0.00010	-	-	-	-
PCB-114	g/m³	< 0.00010	-	-	-	-
PCB-118	g/m³	< 0.00010	-	-	-	-
PCB-121	g/m³	< 0.00010	-	-	-	-
PCB-123	g/m³	< 0.00010	-	-	-	-
PCB-126	g/m³	< 0.00010	-	-	-	-
PCB-128	g/m³	< 0.00010	-	-	-	-
PCB-138	g/m³	< 0.00010	-	-	-	-
PCB-141	g/m³	< 0.00010	-	-	-	-
PCB-149	g/m³	< 0.00010	-	-	-	-
PCB-151	g/m³	< 0.00010	-	-	-	-
PCB-153	g/m³	< 0.00010	-	-	-	-
PCB-156	g/m³	< 0.00010	-	-	-	-
PCB-157	g/m³	< 0.00010	-	-	-	-
PCB-159	g/m³	< 0.00010	-	-	-	-
PCB-167	g/m³	< 0.00010	-	-	-	-
PCB-169	g/m³	< 0.00010	-	-	-	-
PCB-170	g/m³	< 0.00010	-	-	-	-
PCB-180	g/m³	< 0.00010	-	-	-	-
PCB-189	g/m³	< 0.00010	-	-	-	-
PCB-194	g/m³	< 0.00010	-	-	-	-
PCB-206	g/m³	< 0.00010	-	-	-	-
PCB-209	g/m³	< 0.00010	-	-	-	-
Total PCB (Sum of 35 congeners)	g/m³	< 0.005	-	-	-	-

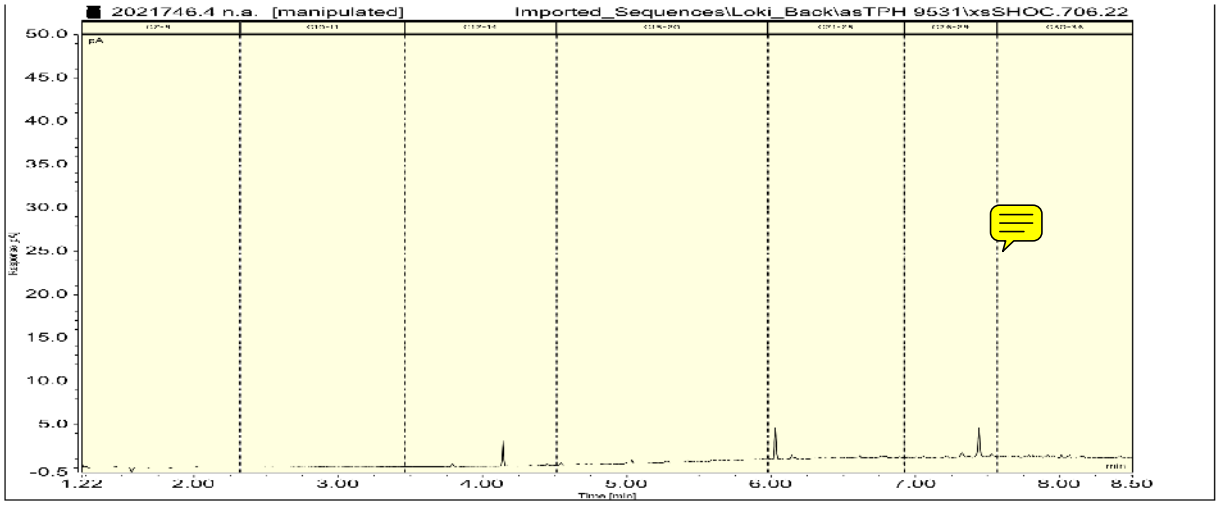
Sample Type: Aqueous						
Sample Name:		CBH203 26-Jul-2018	CBH207 26-Jul-2018	GBH108 26-Jul-2018		
Lab Number:		2021746.1	2021746.2	2021746.3		
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.06	0.13	< 0.06	-	-
C10 - C14	g/m³	< 0.2	0.5	< 0.2	-	-
C15 - C36	g/m³	< 0.4	< 0.4	< 0.4	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 0.7	< 0.7	-	-
BTEX in VOC Water by Headspace GC-MS						
Benzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Ethylbenzene	g/m³	< 0.005	< 0.005	< 0.005	-	-
Toluene	g/m³	< 0.003	< 0.003	< 0.003	-	-
m&p-Xylene	g/m³	< 0.005	< 0.005	< 0.005	-	-
o-Xylene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
Bromomethane (Methyl Bromide)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Carbon tetrachloride	g/m³	< 0.003	< 0.003	< 0.003	-	-
Chloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Chloromethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Dibromomethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Dichlorodifluoromethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1-Dichloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2-Dichloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1-Dichloroethene	g/m³	< 0.003	< 0.003	< 0.003	-	-
cis-1,2-Dichloroethene	g/m³	< 0.003	< 0.003	< 0.003	-	-
trans-1,2-Dichloroethene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Dichloromethane (methylene chloride)	g/m³	< 0.10	< 0.10	< 0.10	-	-
1,2-Dichloropropane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,3-Dichloropropane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1-Dichloropropene	g/m³	< 0.003	< 0.003	< 0.003	-	-
cis-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	< 0.005	-	-
trans-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	< 0.005	-	-
Hexachlorobutadiene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1,1-Trichloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1,2-Trichloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Trichloroethene (trichloroethylene)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Trichlorofluoromethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2,3-Trichloropropane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Vinyl chloride	g/m³	< 0.003	< 0.003	< 0.003	-	-
Haloaromatics in VOC Water by Headspace GC-MS						
Bromobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003	< 0.003	< 0.003	-	-
2-Chlorotoluene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,3-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,4-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
4-Chlorotoluene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2,3-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,3,5-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-

Sample Type: Aqueous						
Sample Name:		CBH203 26-Jul-2018	CBH207 26-Jul-2018	GBH108 26-Jul-2018		
Lab Number:		2021746.1	2021746.2	2021746.3		
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
n-Butylbenzene	g/m³	< 0.005	0.006	< 0.005	-	-
tert-Butylbenzene	g/m³	< 0.003	< 0.003	0.004	-	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005	< 0.005	< 0.005	-	-
Isopropylbenzene (Cumene)	g/m³	< 0.003	0.082	0.028	-	-
n-Propylbenzene	g/m³	< 0.005	0.157	0.027	-	-
sec-Butylbenzene	g/m³	< 0.003	0.014	0.010	-	-
Styrene	g/m³	< 0.005	< 0.005	< 0.005	-	-
1,2,4-Trimethylbenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,3,5-Trimethylbenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Ketones in VOC Water by Headspace GC-MS						
Acetone	g/m³	< 0.5	< 0.5	< 0.5	-	-
2-Butanone (MEK)	g/m³	< 0.5	< 0.5	< 0.5	-	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003	< 0.003	< 0.003	-	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10	< 0.10	< 0.10	-	-
Trihalomethanes in VOC Water by Headspace GC-MS						
Bromodichloromethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Bromoform (tribromomethane)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Chloroform (Trichloromethane)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Dibromochloromethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Other VOC in Water by Headspace GC-MS						
Carbon disulphide	g/m³	< 0.005	< 0.005	< 0.005	-	-
Naphthalene	g/m³	< 0.005	< 0.005	< 0.005	-	-

2021746.2
CBH207 26-Jul-2018
Client Chromatogram for TPH by FID



2021746.4
GBH302-0.0-1.0 26-Jul-2018
Client Chromatogram for TPH by FID



Analyst's Comments

#1 Severe matrix interferences required that a dilution be performed prior to analysis of this sample, resulting in a detection limit higher than that normally achieved for the Total Cyanide analysis.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Sediment

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	4, 6
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	-	4, 6
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	4, 6
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	4
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	4, 6
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	4, 6
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	4, 6
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN- C 22nd ed. 2012.	-	4, 6
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN- C (modified) & Skalar Method I295-004(+P14). ISO 14403:2012(E).	0.10 mg/kg dry wt	4, 6
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	4
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	4, 6

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	4, 6
Total of Reported PAHs in Soil*	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg	4, 6

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00005 - 0.0010 g/m^3	1-3
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.00010 - 0.0005 g/m^3	1-3
Polychlorinated Biphenyls Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS analysis	0.00010 - 0.005 g/m^3	1
Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m^3	1-3
Volatile Organic Compounds Screening in Water by Headspace GC-MS	Headspace, GC-MS SIM analysis [KBIs:37857,37921]	0.003 - 0.5 g/m^3	1-3
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3
Total Cyanide Distillation	Distillation following the addition of sulphuric acid, alkaline trapping solution. APHA 4500-CN$^-$ C (modified) 22nd ed. 2012.	-	1-3
pH	pH meter. APHA 4500-H$^+$ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	1-3
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	10 g/m^3	1-3
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	1-3
Dissolved Mercury	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m^3	1-3
Total Cyanide	Distillation, colorimetry. APHA 4500-CN$^-$ C (modified) & E (modified) 22nd ed. 2012.	0.0010 g/m^3	1-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1-3
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1-3
C7 - C9	Head Space, GCMS analysis.	0.06 g/m^3	1-3

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2022549	SPv1
Contact:	Lucy Hine	**Date Received:**	27-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	08-Aug-2018	
	PO Box 13055	**Quote No:**	80842	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Add. Client Ref:	Sampled on: 27.7.18	
		Submitted By:	Melody Robyns	

Sample Type: Soil

		Sample Name:	GBH301- 0.5-0.6 27-Jul-2018	GBH301- 1.25-1.45 27-Jul-2018			
		Lab Number:	2022549.4	2022549.7			
Individual Tests							
Dry Matter	g/100g as rcvd		59	73	-	-	-
Total Cyanide*	mg/kg dry wt		< 0.10	-	-	-	-
Total Organic Carbon*	g/100g dry wt		0.70	-	-	-	-
Heavy Metals with Mercury, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		9	< 2	-	-	-
Total Recoverable Cadmium	mg/kg dry wt		< 0.10	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt		20	7	-	-	-
Total Recoverable Copper	mg/kg dry wt		58	13	-	-	-
Total Recoverable Lead	mg/kg dry wt		41	2.6	-	-	-
Total Recoverable Mercury	mg/kg dry wt		0.16	< 0.10	-	-	-
Total Recoverable Nickel	mg/kg dry wt		10	< 2	-	-	-
Total Recoverable Zinc	mg/kg dry wt		83	5	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil							
1-Methylnaphthalene	mg/kg dry wt		0.034	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt		0.038	-	-	-	-
Perylene	mg/kg dry wt		0.120	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt		0.70	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt		0.70	-	-	-	-
Acenaphthylene	mg/kg dry wt		0.040	-	-	-	-
Acenaphthene	mg/kg dry wt		0.051	-	-	-	-
Anthracene	mg/kg dry wt		0.30	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt		0.46	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt		0.47	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt		0.52	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt		0.28	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt		0.28	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt		0.22	-	-	-	-
Chrysene	mg/kg dry wt		0.47	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt		0.068	-	-	-	-
Fluoranthene	mg/kg dry wt		1.38	-	-	-	-
Fluorene	mg/kg dry wt		0.135	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt		0.26	-	-	-	-
Naphthalene	mg/kg dry wt		< 0.09	-	-	-	-
Phenanthrene	mg/kg dry wt		1.49	-	-	-	-

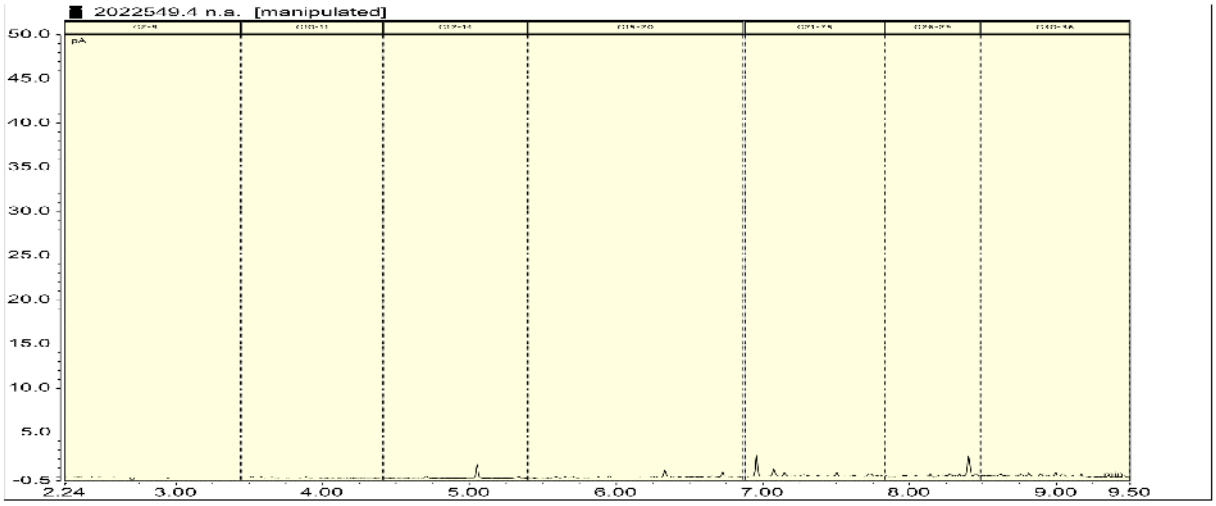
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Sample Type: Soil							
Sample Name:		GBH301- 0.5-0.6 27-Jul-2018	GBH301- 1.25-1.45 27-Jul-2018			
Lab Number:		2022549.4	2022549.7			
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Pyrene	mg/kg dry wt	1.38	-	-	-	-
Total of Reported PAHs in Soil*	mg/kg	8.1	-	-	-	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	0.020	-	-	-	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	-	-	-	-
Tributyltin (as Sn)	mg/kg dry wt	0.035	-	-	-	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 10	< 8	-	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	-	-	-
C15 - C36	mg/kg dry wt	69	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	-	-	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Toluene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.7	< 0.5	-	-	-
o-Xylene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Chloroethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Chloromethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Dibromomethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.4	< 0.3	-	-	-

Sample Type: Soil						
Sample Name:		GBH301- 0.5-0.6 27-Jul-2018	GBH301- 1.25-1.45 27-Jul-2018			
Lab Number:		2022549.4	2022549.7			
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.4	< 0.3	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.4	< 0.3	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Styrene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	< 70	< 50	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 13	< 9	-	-	-
Acetone	mg/kg dry wt	< 70	< 50	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.4	< 0.3	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.4	< 0.3	-	-	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.3	-	-	-
Naphthalene	mg/kg dry wt	< 0.4	< 0.3	-	-	-

2022549.4
GBH301- 0.5-0.6 27-Jul-2018
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	-	4
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	4, 7
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	4
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	7
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	4, 7
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	4, 7
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	4
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN- C (modified) & Skalar Method I295-004(+P14). ISO 14403:2012(E).	0.10 mg/kg dry wt	4
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	4
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	4
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	4
Total of Reported PAHs in Soil*	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg	4

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



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Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2023317	SPv1
Contact:	Lucy Hine	**Date Received:**	30-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	09-Aug-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Aqueous

Sample Name:		CBH205 30-Jul-2018	CBH208 30-Jul-2018			
Lab Number:		2023317.1	2023317.2			
Individual Tests						
pH	pH Units	7.2	7.3	-	-	-
Electrical Conductivity (EC)	mS/m	99.9	142.2	-	-	-
Total Dissolved Solids (TDS)	g/m³	620	920	-	-	-
Dissolved Mercury	g/m³	< 0.00008	< 0.00008	-	-	-
Total Cyanide	g/m³	0.015	0.015	-	-	-
Chloride	g/m³	50	66	-	-	-
Sulphate	g/m³	1.1	< 0.5	-	-	-
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m³	< 0.0010	0.0013	-	-	-
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	-	-	-
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	-	-	-
Dissolved Copper	g/m³	< 0.0005	< 0.0005	-	-	-
Dissolved Lead	g/m³	0.00019	0.00012	-	-	-
Dissolved Nickel	g/m³	< 0.0005	< 0.0005	-	-	-
Dissolved Zinc	g/m³	< 0.0010	0.0015	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq						
Acenaphthene	g/m³	0.00165	0.00027	-	-	-
Acenaphthylene	g/m³	0.00018	< 0.00010	-	-	-
Anthracene	g/m³	0.00029	< 0.00010	-	-	-
Benzo[a]anthracene	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[a]pyrene (BAP)	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[g,h,i]perylene	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[k]fluoranthene	g/m³	< 0.00010	< 0.00010	-	-	-
Chrysene	g/m³	< 0.00010	< 0.00010	-	-	-
Dibenzo[a,h]anthracene	g/m³	< 0.00010	< 0.00010	-	-	-
Fluoranthene	g/m³	0.00042	< 0.00010	-	-	-
Fluorene	g/m³	0.0020	0.0004	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.00010	< 0.00010	-	-	-
Naphthalene	g/m³	0.0012	0.0015	-	-	-
Phenanthrene	g/m³	0.0012	< 0.0004	-	-	-
Pyrene	g/m³	0.0004	< 0.0002	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.06	0.15	-	-	-
C10 - C14	g/m³	1.1	1.5	-	-	-
C15 - C36	g/m³	< 0.4	0.5	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	1.1	2.1	-	-	-

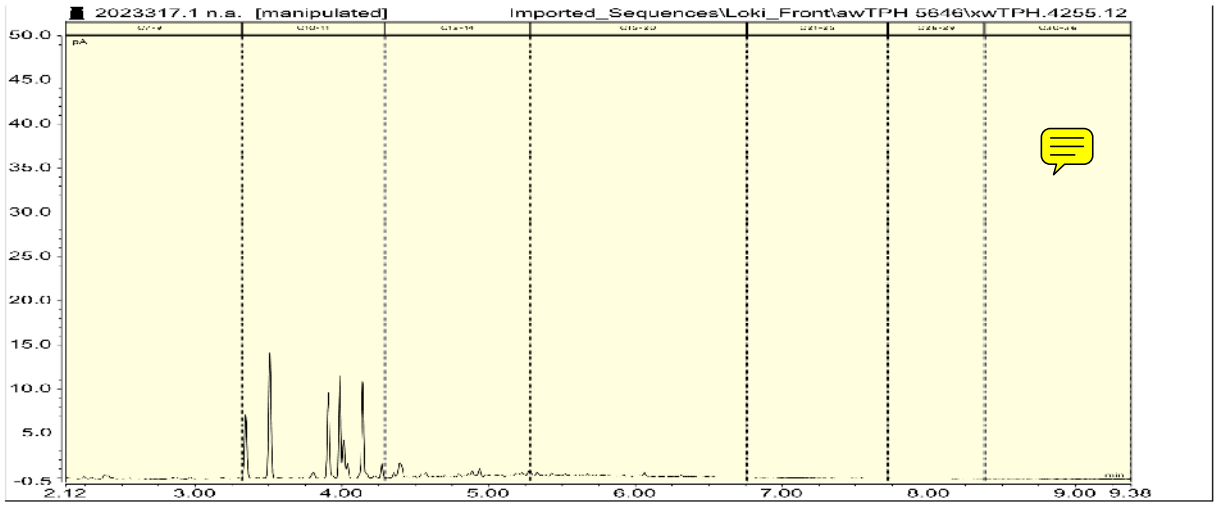
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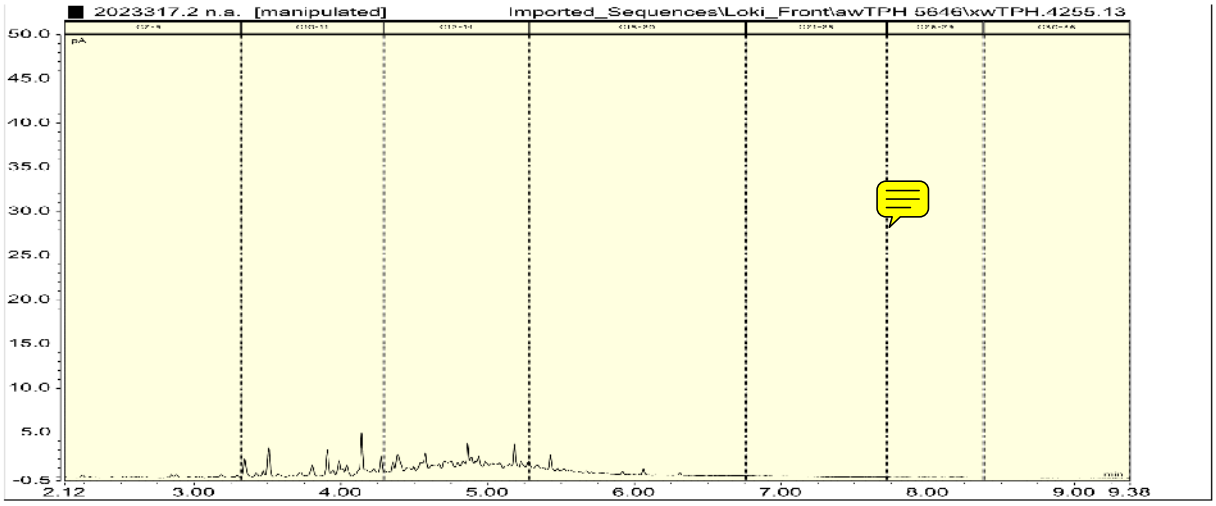
Sample Type: Aqueous						
Sample Name:		CBH205 30-Jul-2018	CBH208 30-Jul-2018			
Lab Number:		2023317.1	2023317.2			
BTEX in VOC Water by Headspace GC-MS						
Benzene	g/m³	< 0.003	< 0.003	-	-	-
Ethylbenzene	g/m³	< 0.005	< 0.005	-	-	-
Toluene	g/m³	< 0.003	< 0.003	-	-	-
m&p-Xylene	g/m³	< 0.005	< 0.005	-	-	-
o-Xylene	g/m³	< 0.003	< 0.003	-	-	-
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
Bromomethane (Methyl Bromide)	g/m³	< 0.003	< 0.003	-	-	-
Carbon tetrachloride	g/m³	< 0.003	< 0.003	-	-	-
Chloroethane	g/m³	< 0.003	< 0.003	-	-	-
Chloromethane	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003	< 0.003	-	-	-
Dibromomethane	g/m³	< 0.003	< 0.003	-	-	-
Dichlorodifluoromethane	g/m³	< 0.003	< 0.003	-	-	-
1,1-Dichloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dichloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,1-Dichloroethene	g/m³	< 0.003	< 0.003	-	-	-
cis-1,2-Dichloroethene	g/m³	< 0.003	< 0.003	-	-	-
trans-1,2-Dichloroethene	g/m³	< 0.003	< 0.003	-	-	-
Dichloromethane (methylene chloride)	g/m³	< 0.10	< 0.10	-	-	-
1,2-Dichloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,3-Dichloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,1-Dichloropropene	g/m³	< 0.003	< 0.003	-	-	-
cis-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	-	-	-
trans-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	-	-	-
Hexachlorobutadiene	g/m³	< 0.003	< 0.003	-	-	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	-	-	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003	< 0.003	-	-	-
1,1,1-Trichloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,1,2-Trichloroethane	g/m³	< 0.003	< 0.003	-	-	-
Trichloroethene (trichloroethylene)	g/m³	< 0.003	< 0.003	-	-	-
Trichlorofluoromethane	g/m³	< 0.003	< 0.003	-	-	-
1,2,3-Trichloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003	< 0.003	-	-	-
Vinyl chloride	g/m³	< 0.003	< 0.003	-	-	-
Haloaromatics in VOC Water by Headspace GC-MS						
Bromobenzene	g/m³	< 0.003	< 0.003	-	-	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003	< 0.003	-	-	-
2-Chlorotoluene	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,3-Dichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,4-Dichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
4-Chlorotoluene	g/m³	< 0.003	< 0.003	-	-	-
1,2,3-Trichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,3,5-Trichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
n-Butylbenzene	g/m³	0.021	< 0.005	-	-	-
tert-Butylbenzene	g/m³	< 0.003	< 0.003	-	-	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005	< 0.005	-	-	-
Isopropylbenzene (Cumene)	g/m³	0.007	0.009	-	-	-
n-Propylbenzene	g/m³	< 0.005	< 0.005	-	-	-
sec-Butylbenzene	g/m³	< 0.003	0.006	-	-	-

Sample Type: Aqueous						
Sample Name:		CBH205 30-Jul-2018	CBH208 30-Jul-2018			
Lab Number:		2023317.1	2023317.2			
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
Styrene	g/m³	< 0.005	< 0.005	-	-	-
1,2,4-Trimethylbenzene	g/m³	< 0.003	< 0.003	-	-	-
1,3,5-Trimethylbenzene	g/m³	< 0.003	< 0.003	-	-	-
Ketones in VOC Water by Headspace GC-MS						
Acetone	g/m³	< 0.5	< 0.5	-	-	-
2-Butanone (MEK)	g/m³	< 0.5	< 0.5	-	-	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003	< 0.003	-	-	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10	< 0.10	-	-	-
Trihalomethanes in VOC Water by Headspace GC-MS						
Bromodichloromethane	g/m³	< 0.003	< 0.003	-	-	-
Bromoform (tribromomethane)	g/m³	< 0.003	< 0.003	-	-	-
Chloroform (Trichloromethane)	g/m³	< 0.003	< 0.003	-	-	-
Dibromochloromethane	g/m³	< 0.003	< 0.003	-	-	-
Other VOC in Water by Headspace GC-MS						
Carbon disulphide	g/m³	< 0.005	< 0.005	-	-	-
Naphthalene	g/m³	< 0.005	< 0.005	-	-	-

2023317.1
CBH205 30-Jul-2018
Client Chromatogram for TPH by FID



2023317.2
CBH208 30-Jul-2018
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00005 - 0.0010 g/m³	1-2
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.00010 - 0.0005 g/m³	1-2
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m³	1-2
Volatile Organic Compounds Screening in Water by Headspace GC-MS	Headspace, GC-MS SIM analysis [KBIs:37857,37921]	0.003 - 0.5 g/m³	1-2
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2
pH	pH meter. APHA 4500-H+ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	1-2
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	10 g/m³	1-2
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	1-2
Dissolved Mercury	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m³	1-2
Total Cyanide Trace	On-line distillation, colorimetry, trace level. ISO 14403:2012(E) (modified).	0.002 g/m³	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m³	1-2
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m³	1-2
C7 - C9	Head Space, GCMS analysis.	0.06 g/m³	1-2

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

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TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2023996 SPv1
Contact:	Lucy Hine	**Date Received:**	31-Jul-2018
	C/- Tonkin & Taylor	**Date Reported:**	10-Aug-2018
	PO Box 13055	**Quote No:**	93718
	Christchurch 8141	**Order No:**	30881.2000
		Client Reference:	30881.2000
		Add. Client Ref:	Sampled on: 31.7.18
		Submitted By:	Cherise Martin

Sample Type: Air Sampling Canister 1.4 Litre

Sample Name:		VP6 [10:?-10:06 222 2020730.5] 31-Jul-2018	VP5 [10:38-10:50 1333 2020730.6] 31-Jul-2018	VP4 [11:07-11:18 514 2020730.3] 31-Jul-2018	VP3 [11:33-11:44 507 2020730.2] 31-Jul-2018	VP2 [12:?-12:? 1337 2020730.4] 31-Jul-2018
Lab Number:		2023996.1	2023996.2	2023996.3	2023996.4	2023996.6
Whole Air Sampling Volatile Compounds						
Canister Sample Volume*	L	1.274	1.146	1.308	1.207	1.299
1,1,1-Trichloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,1,2,2-Tetrachloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,1,2-Trichloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,1-Dichloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,1-Dichloroethene	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,2,4-Trichlorobenzene	ppbv	< 110	< 1.1	< 12	< 3	< 3
1,2,4-Trimethylbenzene	ppbv	< 110	< 1.1	< 12	< 3	< 3
1,2-Dibromoethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,2-Dichlorobenzene	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,2-Dichloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,2-Dichloropropane	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,3,5-Trimethylbenzene	ppbv	< 110	< 1.1	< 12	< 3	< 3
1,3-Dichlorobenzene	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,4-Dichlorobenzene	ppbv	< 3	< 1.1	< 12	< 3	< 3
1,4-Dioxane	ppbv	< 5	< 3	< 30	< 5	< 5
2,2,4-Trimethylpentane	ppbv	15,900	125	510,000	8,300	5,400
2-Butanone	ppbv	< 4	< 1.5	< 17	< 4	< 4
2-Chlorotoluene	ppbv	< 3	< 1.1	< 12	< 3	< 3
2-Hexanone	ppbv	< 3	< 1.1	< 12	< 3	< 3
4-Ethyltoluene	ppbv	< 3	< 1.1	< 12	< 3	< 3
4-Methyl-2-pentanone	ppbv	< 3	< 1.1	< 12	< 3	< 3
Acetone	ppbv	< 9	< 5	< 50	< 10	< 10
Acrolein	ppbv	< 3	< 1.1	< 12	< 3	< 3
Allyl chloride	ppbv	< 3	< 1.1	< 12	< 3	< 3
Benzene	ppbv	3	< 1.1	< 12	< 3	< 3
Benzyl chloride	ppbv	< 3	< 1.1	< 12	< 3	< 3
Bromodichloromethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Bromoethene	ppbv	< 3	< 1.1	< 12	< 3	< 3
Bromoform	ppbv	< 3	< 1.1	< 12	< 3	< 3
Bromomethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Carbon disulfide	ppbv	16	< 3	< 30	< 5	< 5
Carbon tetrachloride	ppbv	< 3	< 1.1	< 12	< 3	< 3
Chlorobenzene	ppbv	< 3	< 1.1	< 12	< 3	< 3
Chloroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Chloroform	ppbv	< 3	< 1.1	< 12	< 3	< 3

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

Sample Type: Air Sampling Canister 1.4 Litre						
Sample Name:		VP6 [10:?-10:06 222 2020730.5] 31-Jul-2018	VP5 [10:38-10:50 1333 2020730.6] 31-Jul-2018	VP4 [11:07-11:18 514 2020730.3] 31-Jul-2018	VP3 [11:33-11:44 507 2020730.2] 31-Jul-2018	VP2 [12:?-12:? 1337 2020730.4] 31-Jul-2018
Lab Number:		2023996.1	2023996.2	2023996.3	2023996.4	2023996.6
Whole Air Sampling Volatile Compounds						
Chloromethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
cis-1,2-Dichloroethene	ppbv	< 3	< 1.1	26	< 3	< 3
cis-1,3-Dichloropropene	ppbv	< 3	< 1.1	< 12	< 3	< 3
Cyclohexane	ppbv	1,140	17.9	< 12	350	640
Dichlorodifluoromethane	ppbv	< 5	< 5	< 12	< 5	< 5
Dichlorotetrafluoroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Ethyl acetate	ppbv	< 3	< 1.1	< 12	< 3	< 3
Ethylbenzene	ppbv	< 3	< 1.1	< 12	< 3	< 3
Heptane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Hexachlorobutadiene	ppbv	< 110	< 1.1	< 12	< 3	< 3
Hexane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Cumene (Isopropylbenzene)	ppbv	< 110	3.2	97	6	4
Methyl methacrylate	ppbv	< 9	< 5	< 50	< 10	< 10
Methyl tert-butyl ether	ppbv	< 3	< 1.1	< 12	< 3	< 3
Methylene chloride	ppbv	< 14	< 7	< 70	< 15	< 14
Naphthalene	ppbv	< 110	< 1.1	< 12	< 3	< 3
n-Propylbenzene	ppbv	< 110	7.7	88	7	5
o-Xylene	ppbv	< 110	< 1.1	< 12	< 3	< 3
m,p-Xylene	ppbv	< 130	< 1.3	< 14	< 3	< 3
Propene	ppbv	310	2.3	< 12	< 3	< 3
Styrene	ppbv	< 3	4.6	< 12	< 3	3
tert-Butyl alcohol	ppbv	< 3	< 1.1	< 12	< 3	< 3
Tetrachloroethene	ppbv	< 3	1.6	440	77	11
Tetrahydrofuran	ppbv	< 3	< 1.1	< 12	< 3	< 3
Toluene	ppbv	55	64	< 12	25	29
trans-1,2-Dichloroethene	ppbv	< 3	< 1.1	< 12	< 3	< 3
trans-1,3-Dichloropropene	ppbv	< 3	< 1.1	< 12	< 3	< 3
Trichloroethene	ppbv	< 3	< 1.1	59	4	< 3
Trichlorofluoromethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Trichlorotrifluoroethane	ppbv	< 3	< 1.1	< 12	< 3	< 3
Vinyl acetate	ppbv	< 3	< 1.1	< 12	< 3	< 3
Vinyl chloride*	ppbv	< 3	< 1.3	< 14	< 3	< 3
Whole Air Sampling Volatile Compounds TPH						
C5 TPH referenced to *n*-heptane	ppbv	26,000	1,240	42,000	6,600	4,900
C6 TPH referenced to *n*-heptane	ppbv	50,000	1,800	1,200,000	27,000	14,500
C7 TPH referenced to *n*-heptane	ppbv	68,000	2,100	700,000	41,000	16,700
C8 TPH referenced to *n*-heptane	ppbv	104,000	2,000	79,000	16,700	8,600
C9 TPH referenced to *n*-heptane	ppbv	98,000	2,900	66,000	21,000	13,200
C10 TPH referenced to *n*-heptane	ppbv	15,200	1,670	20,000	8,600	8,100
C11 TPH referenced to *n*-heptane	ppbv	1,550	710	1,600	1,600	1,850
C12-C14 TPH referenced to *n*-heptane	ppbv	300	400	< 1,200	370	430
C7-C9 TPH referenced to *n*-heptane	ppbv	270,000	7,000	850,000	79,000	39,000
C10-C14 TPH referenced to *n*-heptane	ppbv	17,100	2,800	22,000	10,600	10,300
Whole Air Sampling Volatile Compounds TPH ug/m³						
C5 TPH referenced to *n*-heptane	µg/m³	76,000	3,700	124,000	19,600	14,300
C6 TPH referenced to *n*-heptane	µg/m³	175,000	6,300	4,200,000	95,000	51,000
C7 TPH referenced to *n*-heptane	µg/m³	280,000	8,600	2,900,000	168,000	68,000
C8 TPH referenced to *n*-heptane	µg/m³	490,000	9,500	370,000	78,000	40,000
C9 TPH referenced to *n*-heptane	µg/m³	510,000	15,300	340,000	110,000	69,000
C10 TPH referenced to *n*-heptane	µg/m³	89,000	9,700	119,000	50,000	47,000
C11 TPH referenced to *n*-heptane	µg/m³	9,900	4,600	10,200	10,200	11,800
C12-C14 TPH referenced to *n*-heptane	µg/m³	2,300	3,000	< 9,000	2,800	3,200
C7-C9 TPH referenced to *n*-heptane	µg/m³	1,280,000	33,000	3,600,000	360,000	178,000
C10-C14 TPH referenced to *n*-heptane	µg/m³	101,000	17,300	129,000	63,000	62,000

Sample Type: Air Sampling Canister 1.4 Litre						
Sample Name:		VP6 [10:?-10:06 222 2020730.5] 31-Jul-2018	VP5 [10:38-10:50 1333 2020730.6] 31-Jul-2018	VP4 [11:07-11:18 514 2020730.3] 31-Jul-2018	VP3 [11:33-11:44 507 2020730.2] 31-Jul-2018	VP2 [12:?-12:? 1337 2020730.4] 31-Jul-2018
Lab Number:		2023996.1	2023996.2	2023996.3	2023996.4	2023996.6
Whole Air Sampling Volatile Compounds ug/m3						
1,1,1-Trichloroethane	µg/m³	< 13	< 6	< 70	< 13	< 13
1,1,2,2-Tetrachloroethane	µg/m³	< 16	< 8	< 80	< 17	< 16
1,1,2-Trichloroethane	µg/m³	< 13	< 6	< 70	< 13	< 13
1,1-Dichloroethane	µg/m³	< 10	< 5	< 50	< 10	< 10
1,1-Dichloroethene	µg/m³	< 9	< 5	< 50	< 10	< 10
1,2,4-Trichlorobenzene	µg/m³	< 800	< 8	< 90	< 18	< 18
1,2,4-Trimethylbenzene	µg/m³	< 500	< 6	< 60	< 12	< 12
1,2-Dibromoethane	µg/m³	< 18	< 9	< 90	< 18	< 18
1,2-Dichlorobenzene	µg/m³	< 14	< 7	< 70	< 15	< 14
1,2-Dichloroethane	µg/m³	< 10	< 5	< 50	< 10	< 10
1,2-Dichloropropane	µg/m³	< 11	< 5	< 60	< 11	< 11
1,3,5-Trimethylbenzene	µg/m³	< 500	< 6	< 60	< 12	< 12
1,3-Dichlorobenzene	µg/m³	< 14	< 7	< 70	< 15	< 14
1,4-Dichlorobenzene	µg/m³	< 14	< 7	< 70	< 15	< 14
1,4-Dioxane	µg/m³	< 17	< 8	< 90	< 17	< 17
2,2,4-Trimethylpentane	µg/m³	74,000	580	2,400,000	39,000	25,000
2-Butanone	µg/m³	< 10	< 5	< 50	< 10	< 10
2-Chlorotoluene	µg/m³	< 12	< 6	< 60	< 13	< 13
2-Hexanone	µg/m³	< 10	< 5	< 50	< 10	< 10
4-Ethyltoluene	µg/m³	< 11	< 6	< 60	< 12	< 12
4-Methyl-2-pentanone	µg/m³	< 10	< 5	< 50	< 10	< 10
Acetone	µg/m³	< 30	< 11	< 110	< 30	< 30
Acrolein	µg/m³	< 6	< 3	< 30	< 6	< 6
Allyl chloride	µg/m³	< 7	< 4	< 40	< 8	< 8
Benzene	µg/m³	8	< 4	< 40	< 8	< 8
Benzyl chloride	µg/m³	< 12	< 6	< 60	< 13	< 13
Bromodichloromethane	µg/m³	< 15	< 8	< 80	< 16	< 16
Bromoethene	µg/m³	< 10	< 5	< 60	< 11	< 11
Bromoform	µg/m³	< 30	< 11	< 120	< 30	< 30
Bromomethane	µg/m³	< 9	< 5	< 50	< 10	< 10
Carbon disulfide	µg/m³	51	< 7	< 80	< 15	< 15
Carbon tetrachloride	µg/m³	< 15	< 7	< 80	< 15	< 15
Chlorobenzene	µg/m³	< 11	< 5	< 60	< 11	< 11
Chloroethane	µg/m³	< 6	< 3	< 40	< 7	< 7
Chloroform	µg/m³	< 11	< 6	< 60	< 12	< 12
Chloromethane	µg/m³	< 5	< 3	< 30	< 5	< 5
cis-1,2-Dichloroethene	µg/m³	< 9	< 5	103	< 10	< 10
cis-1,3-Dichloropropene	µg/m³	< 11	< 5	< 60	< 11	< 11
Cyclohexane	µg/m³	3,900	62	< 40	1,200	2,200
Dichlorodifluoromethane	µg/m³	< 30	< 30	< 60	< 30	< 30
Dichlorotetrafluoroethane	µg/m³	< 16	< 8	< 90	< 17	< 17
Ethyl acetate	µg/m³	< 9	< 4	< 50	< 9	< 9
Ethylbenzene	µg/m³	< 10	< 5	< 50	< 11	< 11
Heptane	µg/m³	< 10	< 5	< 50	< 10	< 10
Hexachlorobutadiene	µg/m³	< 1,100	< 12	< 130	< 30	< 30
Hexane	µg/m³	< 8	< 4	< 50	< 9	< 9
Cumene (Isopropylbenzene)	µg/m³	< 500	16	480	30	21
Methyl methacrylate	µg/m³	< 40	< 18	< 190	< 40	< 40
Methyl tert-butyl ether	µg/m³	< 9	< 4	< 50	< 9	< 9
Methylene chloride	µg/m³	< 50	< 30	< 300	< 50	< 50
Naphthalene	µg/m³	< 600	< 6	< 70	< 13	< 13
n-Propylbenzene	µg/m³	< 500	38	430	37	27
o-Xylene	µg/m³	< 500	< 5	< 50	< 11	< 11
m,p-Xylene	µg/m³	< 1,100	< 11	< 120	< 30	< 30

Sample Type: Air Sampling Canister 1.4 Litre						
Sample Name:		VP6 [10:?-10:06 222 2020730.5] 31-Jul-2018	VP5 [10:38-10:50 1333 2020730.6] 31-Jul-2018	VP4 [11:07-11:18 514 2020730.3] 31-Jul-2018	VP3 [11:33-11:44 507 2020730.2] 31-Jul-2018	VP2 [12:?-12:? 1337 2020730.4] 31-Jul-2018
Lab Number:		2023996.1	2023996.2	2023996.3	2023996.4	2023996.6
Whole Air Sampling Volatile Compounds ug/m3						
Propene	µg/m³	530	4	< 20	< 5	< 4
Styrene	µg/m³	< 10	19	< 50	< 10	12
tert-Butyl alcohol	µg/m³	< 7	< 4	< 40	< 8	< 8
Tetrachloroethene	µg/m³	< 16	11	3,000	520	72
Tetrahydrofuran	µg/m³	< 7	< 4	< 40	< 7	< 7
Toluene	µg/m³	210	240	< 50	95	110
trans-1,2-Dichloroethene	µg/m³	< 9	< 5	< 50	< 10	< 10
trans-1,3-Dichloropropene	µg/m³	< 10	< 5	< 50	< 10	< 10
Trichloroethene	µg/m³	< 12	< 6	320	23	< 13
Trichlorofluoromethane	µg/m³	< 13	< 6	< 70	< 14	< 14
Trichlorotrifluoroethane	µg/m³	< 18	< 9	< 90	< 18	< 18
Vinyl acetate	µg/m³	< 8	< 4	< 50	< 9	< 9
Vinyl chloride*	µg/m³	< 7	< 4	< 40	< 8	< 8

Analyst's Comments

The detection limit for methyl methacrylate was increased to 2 ppbv. Dibromochloromethane and 1,3-butadiene could not be reported as they did not meet US EPA performance criteria.

Vinyl chloride met US EPA TO-15 performance criteria but did not meet in-house set calibration criteria so is reported as unaccredited.

Some detection limits reported for these samples are elevated. This is due to high levels of hydrocarbons observed in some samples that overloaded the instrument and interfered with internal standards used for quantification.

Helium results:

Laboratory air gave 0% full scale reading on the meter before and after sample analysis.
0.1% helium gave a positive reading of 19% and 25% full scale before and after sample analysis respectively.

Samples were tested after dilution with VOC free air on receipt at the laboratory.

VP6 [10:?-10:06 222 2020730.5] (2023996.1), gave a reading of 0% full scale which indicating a helium level of <0.2% helium.

VP5 [10:38-10:50 1333 2020730.6] (2023996.2), gave a negative reading of -10% full scale indicating the probable presence of CO2 in the sample.

VP4 [11:07-11:18 514 2020730.3] (2023996.3), gave a negative reading of -70% full scale indicating the probable presence of CO2 in the sample.

VP3 [11:33-11:44 507 2020730.2] (2023996.4), gave a negative reading of -60% full scale indicating the probable presence of CO2 in the sample.

VP2 [12:?-12:? 1337 2020730.4] (2023996.6), gave a negative reading of -35% full scale indicating the probable presence of CO2 in the sample.

Owing to the non-routine nature of the requested work, the method used was not validated using our standard validation process based on ISO Standard 17025 requirements. The results produced are supported by appropriate Quality Control. Details of the method used is available on request, as is all related Quality Control data. All results will be supplied on the basis that the customer assumes responsibility for approval of the fitness for purpose of the Quality Control prior to using the results for decision making purposes. Further validation work may be performed on request.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Air Sampling Canister 1.4 Litre			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Whole Air Sampling Volatile Compounds	Whole air analysed by active SPME-GC-MS. Sample diluted with zero air by a factor of 2. µ/m3 = (ppbv * Mr)/24.45. Assumes STP (25°C 1 atm pressure). US EPA TO-15.	-	1-4, 6

Sample Type: Air Sampling Canister 1.4 Litre			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Whole Air Sampling Volatile Compounds TPH	Whole air analysed by active SPME-GC-MS. Sample diluted with zero air by a factor of 2. µ/m3 = (ppbv * Mr)/24.45. Assumes STP (25°C 1 atm pressure). US EPA TO-15.	-	1-4, 6

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

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TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2024121	A2Pv1
Contact:	Lucy Hine	**Date Received:**	31-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	17-Aug-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Sediment

Sample Name:		GBH303 1.0-1.2 31-Jul-2018	GBH303 1.85-2.1 31-Jul-2018	GBH304 0.35-0.55 31-Jul-2018	GBH304 1.0-1.2 31-Jul-2018	GBH304 2.45-2.65 31-Jul-2018
Lab Number:		2024121.3	2024121.5	2024121.10	2024121.12	2024121.14
Asbestos Presence / Absence		Chrysotile (White Asbestos) detected.	-	Asbestos NOT detected.	Asbestos NOT detected.	-
Description of Asbestos Form		Loose Fibres	-	-	-	-
As Received Weight	g	403.1	-	401.8	391.0	-
Dry Weight	g	228.0	-	232.3	233.4	-
Dry Sample Fraction >10mm	g ashed wt	< 0.1	-	< 0.1	< 0.1	-
Sample Fraction <10mm to >2mm	g ashed wt	88.6	-	79.5	82.3	-
Sample Fraction <2mm	g ashed wt	135.9	-	150.6	148.0	-
<2mm Subsample Weight	g ashed wt	58.1	-	54.0	54.3	-
Weight of Asbestos in >10mm Sample Fraction	g ashed wt	< 0.00001	-	< 0.00001	< 0.00001	-
Weight of Asbestos in <10mm to > 2mm Sample Fraction	g ashed wt	< 0.00001	-	< 0.00001	< 0.00001	-
Weight of Asbestos in <2mm Sample Fraction	g ashed wt	0.00006	-	< 0.00001	< 0.00001	-
Dry Matter	g/100g as rcvd	54	60	57	62	75
Total Recoverable Arsenic	mg/kg dry wt	11	< 2	9	9	-
Total Recoverable Cadmium	mg/kg dry wt	0.13	< 0.10	< 0.10	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	23	6	16	15	-
Total Recoverable Copper	mg/kg dry wt	51	11	5	6	-
Total Recoverable Lead	mg/kg dry wt	89	5.9	6.8	6.1	-
Total Recoverable Mercury	mg/kg dry wt	2.0	< 0.10	< 0.10	< 0.10	-
Total Recoverable Nickel	mg/kg dry wt	12	< 2	7	8	-
Total Recoverable Zinc	mg/kg dry wt	133	9	33	29	-
Total Cyanide*	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	-
Total Organic Carbon*	g/100g dry wt	1.28	0.58	0.46	0.43	-
1-Methylnaphthalene	mg/kg dry wt	< 0.019	< 0.017	< 0.017	< 0.016	-
2-Methylnaphthalene	mg/kg dry wt	< 0.019	< 0.017	< 0.017	< 0.016	-
Bromobenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Benzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,3-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Bromodichloromethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
4-Chlorotoluene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
2-Butanone (MEK)	mg/kg dry wt	< 70	< 60	< 70	< 60	< 50
n-Butylbenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
tert-Butylbenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Sediment						
Sample Name:		GBH303 1.0-1.2 31-Jul-2018	GBH303 1.85-2.1 31-Jul-2018	GBH304 0.35-0.55 31-Jul-2018	GBH304 1.0-1.2 31-Jul-2018	GBH304 2.45-2.65 31-Jul-2018
Lab Number:		2024121.3	2024121.5	2024121.10	2024121.12	2024121.14
Carbon disulphide	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Carbon tetrachloride	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Chloroethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Chloromethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 14	< 12	< 13	< 12	< 9
Acetone	mg/kg dry wt	< 70	< 60	< 70	< 60	< 50
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Dibromochloromethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Dibromomethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Dibutyltin (as Sn)	mg/kg dry wt	0.036	< 0.005	< 0.005	< 0.005	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,3-Dichloropropane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,2-Dichloroethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,1-Dichloroethene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	< 3	< 3	< 3	< 3
1,2-Dichloropropane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,4-Dichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
2-Chlorotoluene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,1-Dichloropropene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Ethylbenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Hexachlorobutadiene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	< 0.007	< 0.007	< 0.007	-
Perylene	mg/kg dry wt	0.075	< 0.017	< 0.017	< 0.016	-
n-Propylbenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.42	< 0.04	< 0.05	< 0.04	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.42	< 0.05	< 0.05	< 0.04	-
sec-Butylbenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Styrene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Toluene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Tributyltin (as Sn)	mg/kg dry wt	0.070	< 0.004	< 0.004	< 0.004	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,1,1-Trichloroethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,1,2-Trichloroethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3

Sample Type: Sediment						
Sample Name:		GBH303 1.0-1.2 31-Jul-2018	GBH303 1.85-2.1 31-Jul-2018	GBH304 0.35-0.55 31-Jul-2018	GBH304 1.0-1.2 31-Jul-2018	GBH304 2.45-2.65 31-Jul-2018
Lab Number:		2024121.3	2024121.5	2024121.10	2024121.12	2024121.14
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Trichlorofluoromethane	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	< 0.003	< 0.003	< 0.003	-
Vinyl chloride	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
m&p-Xylene	mg/kg dry wt	< 0.7	< 0.6	< 0.7	< 0.6	< 0.5
o-Xylene	mg/kg dry wt	< 0.4	< 0.3	< 0.4	< 0.3	< 0.3
C7 - C9	mg/kg dry wt	< 11	< 10	< 11	< 10	< 8
C10 - C14	mg/kg dry wt	< 30	< 20	< 30	< 20	< 20
C15 - C36	mg/kg dry wt	86	< 40	< 50	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	86	< 70	< 80	< 70	< 70
Acenaphthylene	mg/kg dry wt	0.030	< 0.017	< 0.017	< 0.016	-
Acenaphthene	mg/kg dry wt	< 0.019	< 0.017	< 0.017	< 0.016	-
Anthracene	mg/kg dry wt	0.056	< 0.017	< 0.017	< 0.016	-
Benzo[a]anthracene	mg/kg dry wt	0.197	< 0.017	< 0.017	< 0.016	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.28	< 0.017	< 0.017	< 0.016	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.37	< 0.017	< 0.017	< 0.016	-
Benzo[e]pyrene	mg/kg dry wt	0.20	< 0.017	< 0.017	< 0.016	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.22	< 0.017	< 0.017	< 0.016	-
Benzo[k]fluoranthene	mg/kg dry wt	0.152	< 0.017	< 0.017	< 0.016	-
Chrysene	mg/kg dry wt	0.24	< 0.017	< 0.017	< 0.016	-
Dibenzo[a,h]anthracene	mg/kg dry wt	0.037	< 0.017	< 0.017	< 0.016	-
Fluoranthene	mg/kg dry wt	0.55	< 0.017	< 0.017	< 0.016	-
Fluorene	mg/kg dry wt	< 0.019	< 0.017	< 0.017	< 0.016	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.25	< 0.017	< 0.017	< 0.016	-
Naphthalene	mg/kg dry wt	< 0.4	< 0.09	< 0.4	< 0.3	< 0.3
Phenanthrene	mg/kg dry wt	0.21	< 0.017	< 0.017	< 0.016	-
Pyrene	mg/kg dry wt	0.57	< 0.017	< 0.017	< 0.016	-
Total of Reported PAHs in Soil*	mg/kg	3.5	< 0.4	< 0.5	< 0.4	-

Sample Name:		GBH304 4.5-4.7 31-Jul-2018				
Lab Number:		2024121.16				
Dry Matter	g/100g as rcvd	70	-	-	-	-
Bromobenzene	mg/kg dry wt	< 0.3	-	-	-	-
Benzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
Bromodichloromethane	mg/kg dry wt	< 0.3	-	-	-	-
4-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
Bromoform (tribromomethane)	mg/kg dry wt	< 0.5	-	-	-	-
Bromomethane (Methyl Bromide)	mg/kg dry wt	< 0.3	-	-	-	-
2-Butanone (MEK)	mg/kg dry wt	< 50	-	-	-	-
n-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
tert-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Carbon disulphide	mg/kg dry wt	< 0.3	-	-	-	-
Carbon tetrachloride	mg/kg dry wt	< 0.3	-	-	-	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	< 0.3	-	-	-	-
Chloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Chloroform (Trichloromethane)	mg/kg as rcvd	< 0.3	-	-	-	-
Chloromethane	mg/kg dry wt	< 0.3	-	-	-	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	< 10	-	-	-	-

Sample Type: Sediment						
Sample Name:		GBH304 4.5-4.7 31-Jul-2018				
Lab Number:		2024121.16				
Acetone	mg/kg dry wt	< 50	-	-	-	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	< 0.5	-	-	-	-
Dibromochloromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	< 0.3	-	-	-	-
Dibromomethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
Dichlorodifluoromethane	mg/kg dry wt	< 0.5	-	-	-	-
1,1-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2-Dichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,2-Dichloroethene	mg/kg dry wt	< 0.3	-	-	-	-
Dichloromethane (methylene chloride)	mg/kg dry wt	< 3	-	-	-	-
1,2-Dichloropropane	mg/kg dry wt	< 0.3	-	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
2-Chlorotoluene	mg/kg dry wt	< 0.3	-	-	-	-
1,1-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
cis-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
trans-1,3-Dichloropropene	mg/kg dry wt	< 0.3	-	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 0.3	-	-	-	-
Isopropylbenzene (Cumene)	mg/kg dry wt	< 0.3	-	-	-	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	< 0.3	-	-	-	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	< 0.3	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.3	-	-	-	-
n-Propylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
sec-Butylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Styrene	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
Toluene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trichlorobenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,1,1-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
1,1,2-Trichloroethane	mg/kg dry wt	< 0.3	-	-	-	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	< 0.3	-	-	-	-
Trichlorofluoromethane	mg/kg dry wt	< 0.3	-	-	-	-
1,2,3-Trichloropropane	mg/kg dry wt	< 0.5	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	< 0.3	-	-	-	-
1,2,4-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
1,3,5-Trimethylbenzene	mg/kg dry wt	< 0.3	-	-	-	-
Vinyl chloride	mg/kg dry wt	< 0.3	-	-	-	-
m&p-Xylene	mg/kg dry wt	< 0.5	-	-	-	-
o-Xylene	mg/kg dry wt	< 0.3	-	-	-	-
C7 - C9	mg/kg dry wt	< 9	-	-	-	-
C10 - C14	mg/kg dry wt	< 20	-	-	-	-
C15 - C36	mg/kg dry wt	< 40	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	-	-	-	-

Testing has been carried out under the assumption that the weight of asbestos in the sample is unaffected by the ashing process.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Sediment

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	3, 5, 10, 12
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	3, 5, 10, 12, 14, 16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	3, 5, 10, 12
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	3, 5, 10, 12
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN- C (modified) & Skalar Method I295-004(+P14). ISO 14403:2012(E).	0.10 mg/kg dry wt	3, 5, 10, 12
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	3, 5, 10, 12
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	3, 5, 10, 12
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	3, 5, 10, 12
Total of Reported PAHs in Soil*	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg	3, 5, 10, 12
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	-	3, 5, 10, 12
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	3, 5, 10, 12
Semi Quantitative Asbestos in Soil	Based on approximately 100g of sample provided.	-	3, 10, 12
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	3, 5, 10, 12
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	14, 16
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	3, 5, 10, 12, 14, 16
Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3, 10, 12
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3, 10, 12
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3, 10, 12
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3, 10, 12
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3, 10, 12

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	3, 10, 12
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	3, 10, 12
Weight of Asbestos in >10mm Sample Fraction	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	3, 10, 12
Weight of Asbestos in <10mm to >2mm Sample Fraction	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	3, 10, 12
Weight of Asbestos in <2mm Sample Fraction	Measurement on analytical balance. Asbestos weight in <2mm subsample, if <2mm subsample weight is not "Entire Fraction". Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	3, 10, 12

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Kim Harrison MSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2024121	SPv2
Contact:	Lucy Hine	**Date Received:**	31-Jul-2018	
	C/- Tonkin & Taylor	**Date Reported:**	31-Aug-2018	**(Amended)**
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Saline

Sample Name:		Seawater 1 [2018088.5]				
Lab Number:		2024121.20				
Individual Tests						
Total Arsenic*	g/m³	< 0.0042	-	-	-	-
Total Cadmium*	g/m³	< 0.00021	-	-	-	-
Total Chromium*	g/m³	< 0.0011	-	-	-	-
Total Copper*	g/m³	0.0031	-	-	-	-
Total Lead*	g/m³	< 0.0011	-	-	-	-
Total Mercury*	g/m³	< 0.00008	-	-	-	-
Total Nickel*	g/m³	< 0.007	-	-	-	-
Total Zinc*	g/m³	0.0047	-	-	-	-
Polycyclic Aromatic Hydrocarbons Trace in Water, By Liq/Liq						
Acenaphthene*	g/m³	< 0.000008	-	-	-	-
Acenaphthylene*	g/m³	< 0.000008	-	-	-	-
Anthracene*	g/m³	< 0.000008	-	-	-	-
Benzo[a]anthracene*	g/m³	< 0.000008	-	-	-	-
Benzo[a]pyrene (BAP)*	g/m³	< 0.000008	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene*	g/m³	< 0.000008	-	-	-	-
Benzo[g,h,i]perylene*	g/m³	< 0.000008	-	-	-	-
Benzo[k]fluoranthene*	g/m³	< 0.000008	-	-	-	-
Chrysene*	g/m³	< 0.000008	-	-	-	-
Dibenzo[a,h]anthracene*	g/m³	< 0.000008	-	-	-	-
Fluoranthene*	g/m³	< 0.000008	-	-	-	-
Fluorene*	g/m³	< 0.000008	-	-	-	-
Indeno(1,2,3-c,d)pyrene*	g/m³	< 0.000008	-	-	-	-
Naphthalene*	g/m³	< 0.00004	-	-	-	-
Phenanthrene*	g/m³	< 0.000008	-	-	-	-
Pyrene*	g/m³	< 0.000008	-	-	-	-
Tributyl Tin Trace in Water samples by GCMS						
Dibutyltin (as Sn)*	g/m³	< 0.00006	-	-	-	-
Tributyltin (as Sn)*	g/m³	< 0.00005	-	-	-	-
Triphenyltin (as Sn)*	g/m³	< 0.00004	-	-	-	-

Sample Type: Sediment

Sample Name:	GBH303 0.2-0.4 31-Jul-2018	GBH303 0.6-0.8 31-Jul-2018	GBH303 1.0-1.2 31-Jul-2018	GBH303 1.85-2.1 31-Jul-2018	GBH304 0.35-0.55 31-Jul-2018
Lab Number:	2024121.1	2024121.2	2024121.3	2024121.5	2024121.10

ilac-MRA IANZ ACCREDITED LABORATORY

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

Sample Type: Sediment						
Sample Name:		GBH303 0.2-0.4 31-Jul-2018	GBH303 0.6-0.8 31-Jul-2018	GBH303 1.0-1.2 31-Jul-2018	GBH303 1.85-2.1 31-Jul-2018	GBH304 0.35-0.55 31-Jul-2018
Lab Number:		2024121.1	2024121.2	2024121.3	2024121.5	2024121.10
Individual Tests						
Dry Matter	g/100g as rcvd	43	50	54	60	57
Total Cyanide*	mg/kg dry wt	-	-	< 0.10	< 0.10	< 0.10
Total Organic Carbon*	g/100g dry wt	-	-	1.28	0.58	0.46
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	9.3	12.2	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	1.53	0.118	-	-	-
Total Recoverable Chromium	mg/kg dry wt	28	23	-	-	-
Total Recoverable Copper	mg/kg dry wt	105	84	-	-	-
Total Recoverable Lead	mg/kg dry wt	44	76	-	-	-
Total Recoverable Mercury	mg/kg dry wt	0.49	1.53	-	-	-
Total Recoverable Nickel	mg/kg dry wt	12.0	24	-	-	-
Total Recoverable Zinc	mg/kg dry wt	155	138	-	-	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	-	-	11	< 2	9
Total Recoverable Cadmium	mg/kg dry wt	-	-	0.13	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	-	-	23	6	16
Total Recoverable Copper	mg/kg dry wt	-	-	51	11	5
Total Recoverable Lead	mg/kg dry wt	-	-	89	5.9	6.8
Total Recoverable Mercury	mg/kg dry wt	-	-	2.0	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	-	-	12	< 2	7
Total Recoverable Zinc	mg/kg dry wt	-	-	133	9	33
Semi Quantitative Asbestos in Soil						
As Received Weight	g	-	-	403.1	-	401.8
Dry Weight	g	-	-	228.0	-	232.3
Dry Sample Fraction >10mm	g ashed wt	-	-	< 0.1	-	< 0.1
Sample Fraction <10mm to >2mm	g ashed wt	-	-	88.6	-	79.5
Sample Fraction <2mm	g ashed wt	-	-	135.9	-	150.6
<2mm Subsample Weight	g ashed wt	-	-	58.1	-	54.0
Asbestos Presence / Absence		-	-	Chrysotile (White Asbestos) detected.	-	Asbestos NOT detected.
Description of Asbestos Form		-	-	Loose Fibres	-	-
Weight of Asbestos in >10mm Sample Fraction	g ashed wt	-	-	< 0.00001	-	< 0.00001
Weight of Asbestos in <10mm to > 2mm Sample Fraction	g ashed wt	-	-	< 0.00001	-	< 0.00001
Weight of Asbestos in <2mm Sample Fraction	g ashed wt	-	-	0.00006	-	< 0.00001
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	-	-	< 0.019	< 0.017	< 0.017
2-Methylnaphthalene	mg/kg dry wt	-	-	< 0.019	< 0.017	< 0.017
Perylene	mg/kg dry wt	-	-	0.075	< 0.017	< 0.017
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	-	-	0.42	< 0.04	< 0.05
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	-	-	0.42	< 0.05	< 0.05
Acenaphthylene	mg/kg dry wt	-	-	0.030	< 0.017	< 0.017
Acenaphthene	mg/kg dry wt	-	-	< 0.019	< 0.017	< 0.017
Anthracene	mg/kg dry wt	-	-	0.056	< 0.017	< 0.017
Benzo[a]anthracene	mg/kg dry wt	-	-	0.197	< 0.017	< 0.017
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	0.28	< 0.017	< 0.017
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	0.37	< 0.017	< 0.017
Benzo[e]pyrene	mg/kg dry wt	-	-	0.20	< 0.017	< 0.017
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	0.22	< 0.017	< 0.017
Benzo[k]fluoranthene	mg/kg dry wt	-	-	0.152	< 0.017	< 0.017

Sample Type: Sediment						
Sample Name:		GBH303 0.2-0.4 31-Jul-2018	GBH303 0.6-0.8 31-Jul-2018	GBH303 1.0-1.2 31-Jul-2018	GBH303 1.85-2.1 31-Jul-2018	GBH304 0.35-0.55 31-Jul-2018
Lab Number:		2024121.1	2024121.2	2024121.3	2024121.5	2024121.10
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Chrysene	mg/kg dry wt	-	-	0.24	< 0.017	< 0.017
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	0.037	< 0.017	< 0.017
Fluoranthene	mg/kg dry wt	-	-	0.55	< 0.017	< 0.017
Fluorene	mg/kg dry wt	-	-	< 0.019	< 0.017	< 0.017
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	0.25	< 0.017	< 0.017
Naphthalene	mg/kg dry wt	-	-	< 0.10	< 0.09	< 0.09
Phenanthrene	mg/kg dry wt	-	-	0.21	< 0.017	< 0.017
Pyrene	mg/kg dry wt	-	-	0.57	< 0.017	< 0.017
Total of Reported PAHs in Soil*	mg/kg	-	-	3.5	< 0.4	< 0.5
Polycyclic Aromatic Hydrocarbons Trace in Soil						
1-Methylnaphthalene	mg/kg dry wt	0.004	0.007	-	-	-
2-Methylnaphthalene	mg/kg dry wt	0.005	0.009	-	-	-
Acenaphthene	mg/kg dry wt	0.014	0.012	-	-	-
Acenaphthylene	mg/kg dry wt	0.012	0.035	-	-	-
Anthracene	mg/kg dry wt	0.027	0.052	-	-	-
Benzo[a]anthracene	mg/kg dry wt	0.100	0.26	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.157	0.41	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.190	0.49	-	-	-
Benzo[e]pyrene	mg/kg dry wt	0.104	0.24	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.131	0.31	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	0.082	0.184	-	-	-
Chrysene	mg/kg dry wt	0.116	0.29	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	0.026	0.061	-	-	-
Fluoranthene	mg/kg dry wt	0.26	0.58	-	-	-
Fluorene	mg/kg dry wt	0.012	0.015	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.154	0.37	-	-	-
Naphthalene	mg/kg dry wt	< 0.016	0.016	-	-	-
Perylene	mg/kg dry wt	0.043	0.105	-	-	-
Phenanthrene	mg/kg dry wt	0.117	0.21	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.24	0.61	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.24	0.62	-	-	-
Pyrene	mg/kg dry wt	0.26	0.59	-	-	-
Total of Reported PAHs in Soil*	mg/kg	1.8	4.2	-	-	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	0.053	0.021	0.036	< 0.005	< 0.005
Monobutyltin (as Sn)	mg/kg dry wt	0.010	< 0.007	< 0.007	< 0.007	< 0.007
Tributyltin (as Sn)	mg/kg dry wt	0.128	0.024	0.070	< 0.004	< 0.004
Triphenyltin (as Sn)	mg/kg dry wt	0.018	< 0.003	< 0.003	< 0.003	< 0.003
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	-	< 11	< 10	< 11
C10 - C14	mg/kg dry wt	-	-	< 30	< 20	< 30
C15 - C36	mg/kg dry wt	-	-	86	< 40	< 50
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	86	< 70	< 80
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Ethylbenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Toluene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
m&p-Xylene	mg/kg dry wt	-	-	< 0.7	< 0.6	< 0.7
o-Xylene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4

Sample Type: Sediment						
Sample Name:		GBH303 0.2-0.4 31-Jul-2018	GBH303 0.6-0.8 31-Jul-2018	GBH303 1.0-1.2 31-Jul-2018	GBH303 1.85-2.1 31-Jul-2018	GBH304 0.35-0.55 31-Jul-2018
Lab Number:		2024121.1	2024121.2	2024121.3	2024121.5	2024121.10
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Carbon tetrachloride	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Chloroethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Chloromethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	-	< 0.5	< 0.5	< 0.5
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Dibromomethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,3-Dichloropropane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Dichlorodifluoromethane	mg/kg dry wt	-	-	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,2-Dichloroethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,1-Dichloroethene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
cis-1,2-Dichloroethene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
trans-1,2-Dichloroethene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Dichloromethane (methylene chloride)	mg/kg dry wt	-	-	< 3	< 3	< 3
1,2-Dichloropropane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,1-Dichloropropene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
cis-1,3-Dichloropropene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
trans-1,3-Dichloropropene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Hexachlorobutadiene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,1,1-Trichloroethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,1,2-Trichloroethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Trichlorofluoromethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,2,3-Trichloropropane	mg/kg dry wt	-	-	< 0.5	< 0.5	< 0.5
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Vinyl chloride	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,3-Dichlorobenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
4-Chlorotoluene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,2-Dichlorobenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,4-Dichlorobenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
2-Chlorotoluene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,2,3-Trichlorobenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,2,4-Trichlorobenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,3,5-Trichlorobenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
tert-Butylbenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Isopropylbenzene (Cumene)	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
n-Propylbenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
sec-Butylbenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Styrene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,2,4-Trimethylbenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
1,3,5-Trimethylbenzene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4

Sample Type: Sediment						
Sample Name:		GBH303 0.2-0.4 31-Jul-2018	GBH303 0.6-0.8 31-Jul-2018	GBH303 1.0-1.2 31-Jul-2018	GBH303 1.85-2.1 31-Jul-2018	GBH304 0.35-0.55 31-Jul-2018
Lab Number:		2024121.1	2024121.2	2024121.3	2024121.5	2024121.10
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	-	-	< 70	< 60	< 70
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	-	< 14	< 12	< 13
Acetone	mg/kg dry wt	-	-	< 70	< 60	< 70
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Bromoform (tribromomethane)	mg/kg dry wt	-	-	< 0.5	< 0.5	< 0.5
Chloroform (Trichloromethane)	mg/kg as rcvd	-	-	< 0.4	< 0.3	< 0.4
Dibromochloromethane	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	-	-	< 0.3	< 0.3	< 0.3
Naphthalene	mg/kg dry wt	-	-	< 0.4	< 0.3	< 0.4

Sample Name:		GBH304 0.6-0.8 31-Jul-2018	GBH304 1.0-1.2 31-Jul-2018	GBH304 2.45-2.65 31-Jul-2018	GBH304 4.5-4.7 31-Jul-2018	
Lab Number:		2024121.11	2024121.12	2024121.14	2024121.16	
Individual Tests						
Dry Matter	g/100g as rcvd	58	62	75	70	-
Total Cyanide*	mg/kg dry wt	-	< 0.10	-	-	-
Total Organic Carbon*	g/100g dry wt	-	0.43	-	-	-
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	9.6	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.034	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	18.8	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	5.5	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	7.0	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	0.03	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	8.5	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	40	-	-	-	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	-	9	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	-	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt	-	15	-	-	-
Total Recoverable Copper	mg/kg dry wt	-	6	-	-	-
Total Recoverable Lead	mg/kg dry wt	-	6.1	-	-	-
Total Recoverable Mercury	mg/kg dry wt	-	< 0.10	-	-	-
Total Recoverable Nickel	mg/kg dry wt	-	8	-	-	-
Total Recoverable Zinc	mg/kg dry wt	-	29	-	-	-
Semi Quantitative Asbestos in Soil						
As Received Weight	g	-	391.0	-	-	-
Dry Weight	g	-	233.4	-	-	-
Dry Sample Fraction >10mm	g ashed wt	-	< 0.1	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	-	82.3	-	-	-
Sample Fraction <2mm	g ashed wt	-	148.0	-	-	-
<2mm Subsample Weight	g ashed wt	-	54.3	-	-	-
Asbestos Presence / Absence		-	Asbestos NOT detected.	-	-	-
Description of Asbestos Form		-	-	-	-	-
Weight of Asbestos in >10mm Sample Fraction	g ashed wt	-	< 0.00001	-	-	-
Weight of Asbestos in <10mm to > 2mm Sample Fraction	g ashed wt	-	< 0.00001	-	-	-
Weight of Asbestos in <2mm Sample Fraction	g ashed wt	-	< 0.00001	-	-	-

Sample Type: Sediment						
Sample Name:		GBH304 0.6-0.8 31-Jul-2018	GBH304 1.0-1.2 31-Jul-2018	GBH304 2.45-2.65 31-Jul-2018	GBH304 4.5-4.7 31-Jul-2018	
Lab Number:		2024121.11	2024121.12	2024121.14	2024121.16	
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	-	< 0.016	-	-	-
2-Methylnaphthalene	mg/kg dry wt	-	< 0.016	-	-	-
Perylene	mg/kg dry wt	-	< 0.016	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	-	< 0.04	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	-	< 0.04	-	-	-
Acenaphthylene	mg/kg dry wt	-	< 0.016	-	-	-
Acenaphthene	mg/kg dry wt	-	< 0.016	-	-	-
Anthracene	mg/kg dry wt	-	< 0.016	-	-	-
Benzo[a]anthracene	mg/kg dry wt	-	< 0.016	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	< 0.016	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	< 0.016	-	-	-
Benzo[e]pyrene	mg/kg dry wt	-	< 0.016	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	< 0.016	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	-	< 0.016	-	-	-
Chrysene	mg/kg dry wt	-	< 0.016	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.016	-	-	-
Fluoranthene	mg/kg dry wt	-	< 0.016	-	-	-
Fluorene	mg/kg dry wt	-	< 0.016	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	< 0.016	-	-	-
Naphthalene	mg/kg dry wt	-	< 0.08	-	-	-
Phenanthrene	mg/kg dry wt	-	< 0.016	-	-	-
Pyrene	mg/kg dry wt	-	< 0.016	-	-	-
Total of Reported PAHs in Soil*	mg/kg	-	< 0.4	-	-	-
Polycyclic Aromatic Hydrocarbons Trace in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.003	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.003	-	-	-	-
Acenaphthene	mg/kg dry wt	< 0.003	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.003	-	-	-	-
Anthracene	mg/kg dry wt	< 0.003	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.003	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.003	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.003	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.003	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.003	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.003	-	-	-	-
Chrysene	mg/kg dry wt	< 0.003	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.003	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.003	-	-	-	-
Fluorene	mg/kg dry wt	< 0.003	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.003	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.012	-	-	-	-
Perylene	mg/kg dry wt	0.003	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.003	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.006	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.006	-	-	-	-
Pyrene	mg/kg dry wt	< 0.003	-	-	-	-
Total of Reported PAHs in Soil*	mg/kg	< 0.3	-	-	-	-
Tributyl Tin Trace in Soil samples by GCMS						
Dibutyltin (as Sn)	mg/kg dry wt	< 0.005	< 0.005	-	-	-
Monobutyltin (as Sn)	mg/kg dry wt	< 0.007	< 0.007	-	-	-

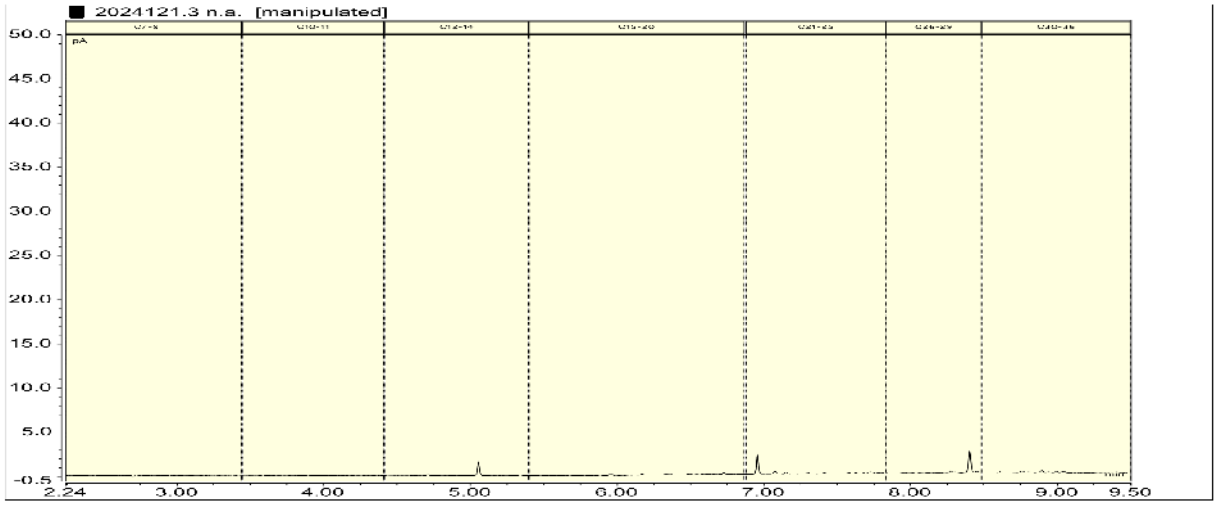
Sample Type: Sediment						
Sample Name:		GBH304 0.6-0.8 31-Jul-2018	GBH304 1.0-1.2 31-Jul-2018	GBH304 2.45-2.65 31-Jul-2018	GBH304 4.5-4.7 31-Jul-2018	
Lab Number:		2024121.11	2024121.12	2024121.14	2024121.16	
Tributyl Tin Trace in Soil samples by GCMS						
Tributyltin (as Sn)	mg/kg dry wt	< 0.004	< 0.004	-	-	-
Triphenyltin (as Sn)	mg/kg dry wt	< 0.003	< 0.003	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	< 10	< 8	< 9	-
C10 - C14	mg/kg dry wt	-	< 20	< 20	< 20	-
C15 - C36	mg/kg dry wt	-	< 40	< 40	< 40	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	< 70	< 70	< 70	-
BTEX in VOC Soils by Headspace GC-MS						
Benzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Ethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Toluene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
m&p-Xylene	mg/kg dry wt	-	< 0.6	< 0.5	< 0.5	-
o-Xylene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Halogenated Aliphatics in VOC Soils by Headspace GC-MS						
Bromomethane (Methyl Bromide)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Carbon tetrachloride	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Chloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Chloromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,2-Dibromo-3-chloropropane	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	-
1,2-Dibromoethane (ethylene dibromide, EDB)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Dibromomethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,3-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Dichlorodifluoromethane	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	-
1,1-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,2-Dichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,1-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
cis-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
trans-1,2-Dichloroethene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Dichloromethane (methylene chloride)	mg/kg dry wt	-	< 3	< 3	< 3	-
1,2-Dichloropropane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,1-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
cis-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
trans-1,3-Dichloropropene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Hexachlorobutadiene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,1,1,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,1,2,2-Tetrachloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Tetrachloroethene (tetrachloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,1,1-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,1,2-Trichloroethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Trichloroethene (trichloroethylene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Trichlorofluoromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,2,3-Trichloropropane	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Vinyl chloride	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Haloaromatics in VOC Soils by Headspace GC-MS						
Bromobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,3-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
4-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Chlorobenzene (monochlorobenzene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-

Sample Type: Sediment						
Sample Name:		GBH304 0.6-0.8 31-Jul-2018	GBH304 1.0-1.2 31-Jul-2018	GBH304 2.45-2.65 31-Jul-2018	GBH304 4.5-4.7 31-Jul-2018	
Lab Number:		2024121.11	2024121.12	2024121.14	2024121.16	
Haloaromatics in VOC Soils by Headspace GC-MS						
1,2-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,4-Dichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
2-Chlorotoluene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,2,3-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,2,4-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,3,5-Trichlorobenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Monoaromatic Hydrocarbons in VOC Soils by Headspace GC-MS						
n-Butylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
tert-Butylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Isopropylbenzene (Cumene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
4-Isopropyltoluene (p-Cymene)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
n-Propylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
sec-Butylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Styrene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,2,4-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
1,3,5-Trimethylbenzene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Ketones in VOC Soils by Headspace GC-MS						
2-Butanone (MEK)	mg/kg dry wt	-	< 60	< 50	< 50	-
4-Methylpentan-2-one (MIBK)	mg/kg dry wt	-	< 12	< 9	< 10	-
Acetone	mg/kg dry wt	-	< 60	< 50	< 50	-
Methyl tert-butylether (MTBE)	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Trihalomethanes in VOC Soils by Headspace GC-MS						
Bromodichloromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Bromoform (tribromomethane)	mg/kg dry wt	-	< 0.5	< 0.5	< 0.5	-
Chloroform (Trichloromethane)	mg/kg as rcvd	-	< 0.3	< 0.3	< 0.3	-
Dibromochloromethane	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Other VOC in Soils by Headspace GC-MS						
Carbon disulphide	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-
Naphthalene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.3	-

Sample Type: Aqueous						
Sample Name:		GBH303 0.2-0.4 [Elutriation Extract]	GBH303 0.6-0.8 [Elutriation Extract]	GBH304 0.6-0.8 [Elutriation Extract]		
Lab Number:		2024121.17	2024121.18	2024121.19		
Individual Tests						
Total Arsenic*	g/m³	0.0103	0.0097	0.0172	-	-
Total Cadmium*	g/m³	< 0.00021	< 0.00021	0.00027	-	-
Total Chromium*	g/m³	< 0.0011	< 0.0011	< 0.0011	-	-
Total Copper*	g/m³	< 0.0011	0.0025	0.0014	-	-
Total Lead*	g/m³	< 0.0011	< 0.0011	< 0.0011	-	-
Total Mercury	g/m³	< 0.00008	< 0.00008	< 0.00008	-	-
Total Nickel*	g/m³	< 0.007	< 0.007	< 0.007	-	-
Total Zinc*	g/m³	0.078	0.094	0.117	-	-
Polycyclic Aromatic Hydrocarbons Trace in Water, By Liq/Liq						
Acenaphthene	g/m³	< 0.000008	< 0.000008	0.000019	-	-
Acenaphthylene	g/m³	< 0.000008	< 0.000008	< 0.000008	-	-
Anthracene	g/m³	< 0.000008	< 0.000008	< 0.000008	-	-
Benzo[a]anthracene	g/m³	< 0.000008	< 0.000008	< 0.000008	-	-
Benzo[a]pyrene (BAP)	g/m³	< 0.000008	< 0.000008	< 0.000008	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	< 0.000008	< 0.000008	< 0.000008	-	-
Benzo[g,h,i]perylene	g/m³	< 0.000008	< 0.000008	< 0.000008	-	-
Benzo[k]fluoranthene	g/m³	< 0.000008	< 0.000008	< 0.000008	-	-
Chrysene	g/m³	< 0.000008	< 0.000008	< 0.000008	-	-

Sample Type: Aqueous						
Sample Name:		GBH303 0.2-0.4 [Elutriation Extract]	GBH303 0.6-0.8 [Elutriation Extract]	GBH304 0.6-0.8 [Elutriation Extract]		
Lab Number:		2024121.17	2024121.18	2024121.19		
Polycyclic Aromatic Hydrocarbons Trace in Water, By Liq/Liq						
Dibenzo[a,h]anthracene	g/m³	< 0.000008	< 0.000008	< 0.000008	-	-
Fluoranthene	g/m³	< 0.000008	< 0.000008	< 0.000008	-	-
Fluorene	g/m³	< 0.000008	< 0.000008	0.000014	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.000008	< 0.000008	< 0.000008	-	-
Naphthalene	g/m³	< 0.00004	< 0.00004	< 0.00004	-	-
Phenanthrene	g/m³	< 0.000008	< 0.000008	0.000023	-	-
Pyrene	g/m³	< 0.000008	< 0.000008	0.000010	-	-
Tributyl Tin Trace in Water samples by GCMS						
Dibutyltin (as Sn)	g/m³	< 0.00007	< 0.00007	< 0.00007	-	-
Tributyltin (as Sn)	g/m³	< 0.00006	< 0.00006	< 0.00006	-	-
Triphenyltin (as Sn)	g/m³	< 0.00005	< 0.00005	< 0.00005	-	-

2024121.3
GBH303 1.0-1.2 31-Jul-2018
Client Chromatogram for TPH by FID



Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier certificate issued on 17 Aug 2018 at 11:58 am
Reason for amendment: Elutriation testing has been added at the request of the client.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-3, 5, 10-12
Elutriation testing*	Extn with (client supplied) water, eg seawater, Sed:Water 1:4 by vol, mix 30 min, settle 1 hr, filtration or centrifugation. US EPA 503/8-91/001, "Evaluation of Dredged Material for Ocean Disposal".	-	1-2, 11
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-3, 5, 10-12, 14, 16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-3, 5, 10-12
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	3, 5, 10, 12

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN- C (modified) & Skalar Method I295-004(+P14). ISO 14403:2012(E).	0.10 mg/kg dry wt	3, 5, 10, 12
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (900°C, O2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	3, 5, 10, 12
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	3, 5, 10, 12
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	3, 5, 10, 12
Total of Reported PAHs in Soil*	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg	3, 5, 10, 12
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	-	3, 5, 10, 12
Heavy metals, trace As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, trace level.	0.010 - 0.4 mg/kg dry wt	1-2, 11
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	3, 5, 10, 12
Semi Quantitative Asbestos in Soil	Based on approximately 100g of sample provided.	-	3, 10, 12
Polycyclic Aromatic Hydrocarbons Trace in Soil*	Sonication extraction, SPE cleanup, GC-MS SIM analysis US EPA 8270C. Tested on as received sample [KBIs:5784,4273,2695]	-	1-2, 11
Tributyl Tin Trace in Soil samples by GCMS	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis. Tested on dried sample	0.003 - 0.007 mg/kg dry wt	1-3, 5, 10-12
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	14, 16
Volatile Organic Compounds Screening in Soil by Headspace GC-MS	Sonication extraction, Headspace, GC-MS SIM analysis. Tested on as received sample [KBIs:31662,37857,37921]	-	3, 5, 10, 12, 14, 16
Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3, 10, 12
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	3, 10, 12
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3, 10, 12
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3, 10, 12
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	3, 10, 12
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	3, 10, 12
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	3, 10, 12
Weight of Asbestos in >10mm Sample Fraction	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	3, 10, 12
Weight of Asbestos in <10mm to >2mm Sample Fraction	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	3, 10, 12

Sample Type: Sediment			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Weight of Asbestos in <2mm Sample Fraction	Measurement on analytical balance. Asbestos weight in <2mm subsample, if <2mm subsample weight is not "Entire Fraction". Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	3, 10, 12

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Total Digestion of Saline Samples*	Nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	17-20
Total Arsenic*	Nitric acid digestion, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0042 g/m^3	17-20
Total Cadmium*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.00021 g/m^3	17-20
Total Chromium*	Nitric acid digestion, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0011 g/m^3	17-20
Total Copper*	Nitric acid digestion, ICP-MS, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0011 g/m^3	17-20
Total Lead*	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0011 g/m^3	17-20
Total Mercury	Bromine Oxidation followed by Atomic Fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m^3	17-20
Total Nickel*	Nitric acid digestion, ICP-MS with universal cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.007 g/m^3	17-20
Total Zinc*	Nitric acid digestion, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0042 g/m^3	17-20
Polycyclic Aromatic Hydrocarbons Trace in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.000005 g/m^3	17-20
Tributyl Tin Trace in Water samples by GCMS*	Solvent extraction, ethylation, SPE cleanup, GC-MS SIM analysis	0.00003 - 0.00005 g/m^3	17-20

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

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

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2024974	SPv1
Contact:	Lucy Hine	**Date Received:**	01-Aug-2018	
	C/- Tonkin & Taylor	**Date Reported:**	14-Aug-2018	
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2000	
		Client Reference:	30881.2000	
		Submitted By:	James Smith	

Sample Type: Aqueous

Sample Name:		CBH206 01-Aug-2018	GBH106 01-Aug-2018			
Lab Number:		2024974.1	2024974.2			
Individual Tests						
pH	pH Units	6.9	7.4	-	-	-
Electrical Conductivity (EC)	mS/m	414	110.2	-	-	-
Total Dissolved Solids (TDS)	g/m³	2,900	690	-	-	-
Dissolved Mercury	g/m³	< 0.00008	< 0.00008	-	-	-
Total Cyanide	g/m³	0.154	0.004	-	-	-
Chloride	g/m³	1,000	105	-	-	-
Sulphate	g/m³	32	2.5	-	-	-
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m³	< 0.005	0.0012	-	-	-
Dissolved Cadmium	g/m³	< 0.00010	< 0.00005	-	-	-
Dissolved Chromium	g/m³	0.0012	< 0.0005	-	-	-
Dissolved Copper	g/m³	< 0.0010	< 0.0005	-	-	-
Dissolved Lead	g/m³	0.0006	0.00012	-	-	-
Dissolved Nickel	g/m³	< 0.0010	< 0.0005	-	-	-
Dissolved Zinc	g/m³	< 0.002	< 0.0010	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq						
Acenaphthene	g/m³	0.00105	0.00141	-	-	-
Acenaphthylene	g/m³	0.00024	< 0.00010	-	-	-
Anthracene	g/m³	0.00051	0.00016	-	-	-
Benzo[a]anthracene	g/m³	0.00011	< 0.00010	-	-	-
Benzo[a]pyrene (BAP)	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[g,h,i]perylene	g/m³	< 0.00010	< 0.00010	-	-	-
Benzo[k]fluoranthene	g/m³	< 0.00010	< 0.00010	-	-	-
Chrysene	g/m³	< 0.00010	< 0.00010	-	-	-
Dibenzo[a,h]anthracene	g/m³	< 0.00010	< 0.00010	-	-	-
Fluoranthene	g/m³	0.00081	0.00012	-	-	-
Fluorene	g/m³	0.0014	0.0026	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.00010	< 0.00010	-	-	-
Naphthalene	g/m³	0.097	< 0.0005	-	-	-
Phenanthrene	g/m³	0.0027	0.0013	-	-	-
Pyrene	g/m³	0.0006	< 0.0002	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	2.0	0.25	-	-	-
C10 - C14	g/m³	5.9	0.9	-	-	-
C15 - C36	g/m³	< 0.4	1.1	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	7.9	2.3	-	-	-

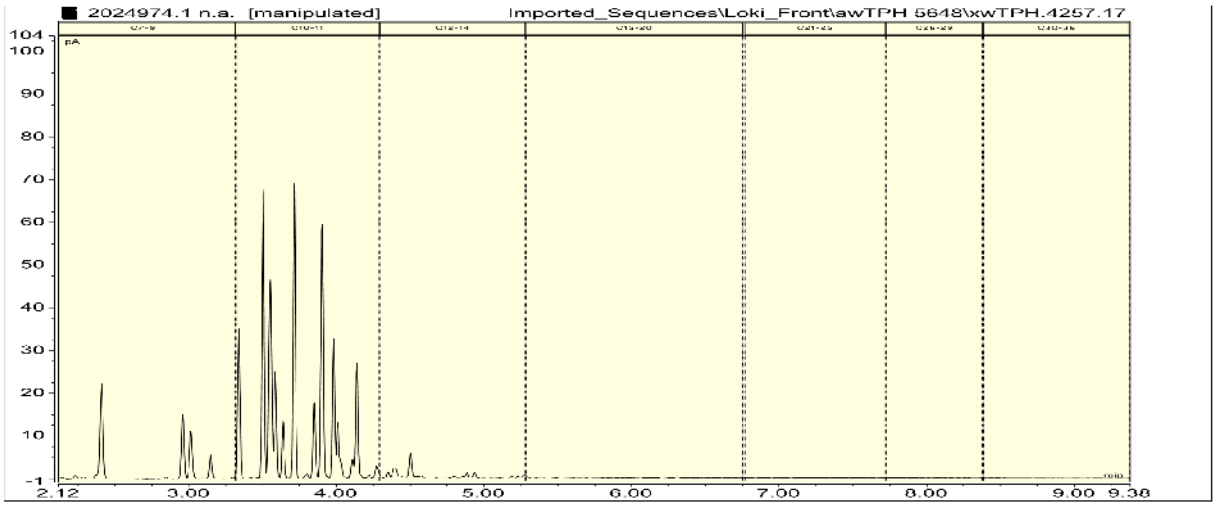
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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

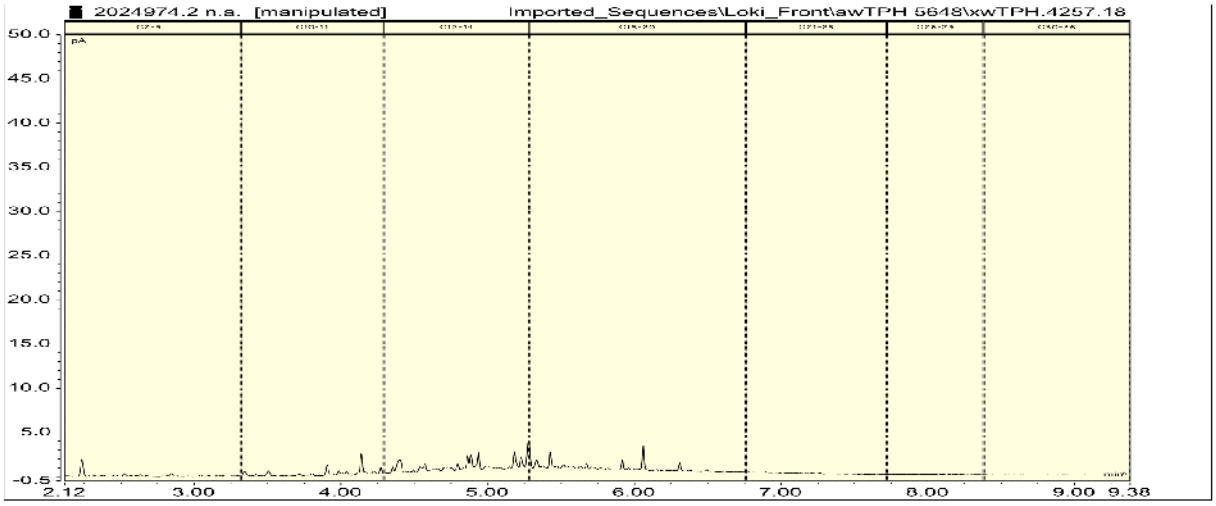
Sample Type: Aqueous						
Sample Name:		CBH206 01-Aug-2018	GBH106 01-Aug-2018			
Lab Number:		2024974.1	2024974.2			
BTEX in VOC Water by Headspace GC-MS						
Benzene	g/m³	0.87	< 0.003	-	-	-
Ethylbenzene	g/m³	0.39	< 0.005	-	-	-
Toluene	g/m³	0.76	< 0.003	-	-	-
m&p-Xylene	g/m³	0.28	< 0.005	-	-	-
o-Xylene	g/m³	0.130	< 0.003	-	-	-
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
Bromomethane (Methyl Bromide)	g/m³	< 0.003	< 0.003	-	-	-
Carbon tetrachloride	g/m³	< 0.003	< 0.003	-	-	-
Chloroethane	g/m³	< 0.003	< 0.003	-	-	-
Chloromethane	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003	< 0.003	-	-	-
Dibromomethane	g/m³	< 0.003	< 0.003	-	-	-
Dichlorodifluoromethane	g/m³	< 0.003	< 0.003	-	-	-
1,1-Dichloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dichloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,1-Dichloroethene	g/m³	0.014	< 0.003	-	-	-
cis-1,2-Dichloroethene	g/m³	11.0	< 0.003	-	-	-
trans-1,2-Dichloroethene	g/m³	0.047	< 0.003	-	-	-
Dichloromethane (methylene chloride)	g/m³	< 0.10	< 0.10	-	-	-
1,2-Dichloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,3-Dichloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,1-Dichloropropene	g/m³	< 0.003	< 0.003	-	-	-
cis-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	-	-	-
trans-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	-	-	-
Hexachlorobutadiene	g/m³	< 0.003	< 0.003	-	-	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	-	-	-
Tetrachloroethene (tetrachloroethylene)	g/m³	0.005	< 0.003	-	-	-
1,1,1-Trichloroethane	g/m³	< 0.003	< 0.003	-	-	-
1,1,2-Trichloroethane	g/m³	< 0.003	< 0.003	-	-	-
Trichloroethene (trichloroethylene)	g/m³	0.004	< 0.003	-	-	-
Trichlorofluoromethane	g/m³	< 0.003	< 0.003	-	-	-
1,2,3-Trichloropropane	g/m³	< 0.003	< 0.003	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003	< 0.003	-	-	-
Vinyl chloride	g/m³	3.7	< 0.003	-	-	-
Haloaromatics in VOC Water by Headspace GC-MS						
Bromobenzene	g/m³	< 0.003	< 0.003	-	-	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003	< 0.003	-	-	-
2-Chlorotoluene	g/m³	< 0.003	< 0.003	-	-	-
1,2-Dichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,3-Dichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,4-Dichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
4-Chlorotoluene	g/m³	< 0.003	< 0.003	-	-	-
1,2,3-Trichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
1,3,5-Trichlorobenzene	g/m³	< 0.003	< 0.003	-	-	-
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
n-Butylbenzene	g/m³	0.103	< 0.005	-	-	-
tert-Butylbenzene	g/m³	< 0.003	< 0.003	-	-	-
4-Isopropyltoluene (p-Cymene)	g/m³	0.007	< 0.005	-	-	-
Isopropylbenzene (Cumene)	g/m³	0.87	< 0.003	-	-	-
n-Propylbenzene	g/m³	1.68	< 0.005	-	-	-
sec-Butylbenzene	g/m³	0.026	< 0.003	-	-	-

Sample Type: Aqueous						
Sample Name:		CBH206 01-Aug-2018	GBH106 01-Aug-2018			
Lab Number:		2024974.1	2024974.2			
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
Styrene	g/m³	< 0.005	< 0.005	-	-	-
1,2,4-Trimethylbenzene	g/m³	1.61	< 0.003	-	-	-
1,3,5-Trimethylbenzene	g/m³	0.64	< 0.003	-	-	-
Ketones in VOC Water by Headspace GC-MS						
Acetone	g/m³	< 0.5	< 0.5	-	-	-
2-Butanone (MEK)	g/m³	< 0.5	< 0.5	-	-	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003	< 0.003	-	-	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10	< 0.10	-	-	-
Trihalomethanes in VOC Water by Headspace GC-MS						
Bromodichloromethane	g/m³	< 0.003	< 0.003	-	-	-
Bromoform (tribromomethane)	g/m³	< 0.003	< 0.003	-	-	-
Chloroform (Trichloromethane)	g/m³	< 0.003	< 0.003	-	-	-
Dibromochloromethane	g/m³	< 0.003	< 0.003	-	-	-
Other VOC in Water by Headspace GC-MS						
Carbon disulphide	g/m³	< 0.005	< 0.005	-	-	-
Naphthalene	g/m³	0.125	< 0.005	-	-	-

2024974.1
CBH206 01-Aug-2018
Client Chromatogram for TPH by FID



2024974.2
GBH106 01-Aug-2018
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00005 - 0.0010 g/m³	1-2
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.00010 - 0.0005 g/m³	1-2
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m³	1-2
Volatile Organic Compounds Screening in Water by Headspace GC-MS	Headspace, GC-MS SIM analysis [KBIs:37857,37921]	0.003 - 0.5 g/m³	1-2
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2
pH	pH meter. APHA 4500-H+ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	1-2
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	10 g/m³	1-2
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	1-2
Dissolved Mercury	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m³	1-2
Total Cyanide Trace	On-line distillation, colorimetry, trace level. ISO 14403:2012(E) (modified).	0.002 g/m³	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m³	1-2
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m³	1-2
C7 - C9	Head Space, GCMS analysis.	0.06 g/m³	1-2

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

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

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Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2026369	SPv2
Contact:	Lucy Hine	**Date Received:**	03-Aug-2018	
	C/- Tonkin & Taylor	**Date Reported:**	03-Sep-2018	**(Amended)**
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2	
		Client Reference:	30881.2	
		Submitted By:	Melody Robyns	

Sample Type: Saline

Sample Name:		GBH110 03-Aug-2018	GBH102 03-Aug-2018	GBH104 03-Aug-2018	MWB 03-Aug-2018	
Lab Number:		2026369.1	2026369.2	2026369.3	2026369.6	
Individual Tests						
pH*	pH Units	7.8	7.6	7.3	-	-
Electrical Conductivity (EC)*	mS/m	1,651	1,566	321	-	-
Total Dissolved Solids (TDS)*	g/m³	9,700	9,000	1,950	-	-
Dissolved Arsenic*	g/m³	0.005	0.006	< 0.004	< 0.004	-
Dissolved Cadmium*	g/m³	0.0002	< 0.0002	< 0.0002	< 0.0002	-
Dissolved Chromium*	g/m³	< 0.0010	0.0014	< 0.0010	< 0.0010	-
Dissolved Copper*	g/m³	0.0014	0.0030	< 0.0010	< 0.0010	-
Dissolved Lead*	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Dissolved Mercury*	g/m³	< 0.00008	< 0.00008	< 0.00008	< 0.00008	-
Dissolved Nickel*	g/m³	< 0.007	0.014	< 0.007	< 0.007	-
Dissolved Zinc*	g/m³	< 0.004	0.008	0.007	0.004	-
Total Cyanide*	g/m³	< 0.02	< 0.02	0.06	-	-
Chloride*	g/m³	5,400	5,200	680	-	-
Sulphate*	g/m³	129	96	64	-	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq						
Acenaphthene*	g/m³	< 0.00010	< 0.00010	0.00151	-	-
Acenaphthylene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Anthracene*	g/m³	< 0.00010	< 0.00010	0.00080	-	-
Benzo[a]anthracene*	g/m³	< 0.00010	< 0.00010	0.00023	-	-
Benzo[a]pyrene (BAP)*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene*	g/m³	< 0.00010	< 0.00010	0.00014	-	-
Benzo[g,h,i]perylene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[k]fluoranthene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Chrysene*	g/m³	< 0.00010	< 0.00010	0.00019	-	-
Dibenzo[a,h]anthracene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Fluoranthene*	g/m³	< 0.00010	< 0.00010	0.00159	-	-
Fluorene*	g/m³	< 0.0002	< 0.0002	0.0024	-	-
Indeno(1,2,3-c,d)pyrene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Naphthalene*	g/m³	< 0.0005	< 0.0005	< 0.0005	-	-
Phenanthrene*	g/m³	< 0.0004	< 0.0004	0.0041	-	-
Pyrene*	g/m³	< 0.0002	< 0.0002	0.0011	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.06	< 0.06	0.11	0.16	-
C10 - C14*	g/m³	< 0.2	< 0.2	1.9	2.1	-
C15 - C36*	g/m³	< 0.4	< 0.4	3.1	2.5	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 0.7	5.1	4.8	-

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

Sample Type: Saline						
Sample Name:		GBH110 03-Aug-2018	GBH102 03-Aug-2018	GBH104 03-Aug-2018	MWB 03-Aug-2018	
Lab Number:		2026369.1	2026369.2	2026369.3	2026369.6	
BTEX in VOC Water by Headspace GC-MS						
Benzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Ethylbenzene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	-
Toluene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
m&p-Xylene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	-
o-Xylene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
Bromomethane (Methyl Bromide)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Carbon tetrachloride	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Chloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Chloromethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Dibromomethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Dichlorodifluoromethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,1-Dichloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,2-Dichloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,1-Dichloroethene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
cis-1,2-Dichloroethene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
trans-1,2-Dichloroethene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Dichloromethane (methylene chloride)	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	-
1,2-Dichloropropane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,3-Dichloropropane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,1-Dichloropropene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
cis-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	-
trans-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	-
Hexachlorobutadiene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,1,1-Trichloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,1,2-Trichloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Trichloroethene (trichloroethylene)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Trichlorofluoromethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,2,3-Trichloropropane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Vinyl chloride	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Haloaromatics in VOC Water by Headspace GC-MS						
Bromobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
2-Chlorotoluene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,2-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,3-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,4-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
4-Chlorotoluene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,2,3-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,2,4-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,3,5-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
n-Butylbenzene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	-
tert-Butylbenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	-
Isopropylbenzene (Cumene)	g/m³	< 0.003	< 0.003	0.023	0.041	-
n-Propylbenzene	g/m³	< 0.005	< 0.005	0.022	0.047	-
sec-Butylbenzene	g/m³	< 0.003	< 0.003	< 0.003	0.029	-

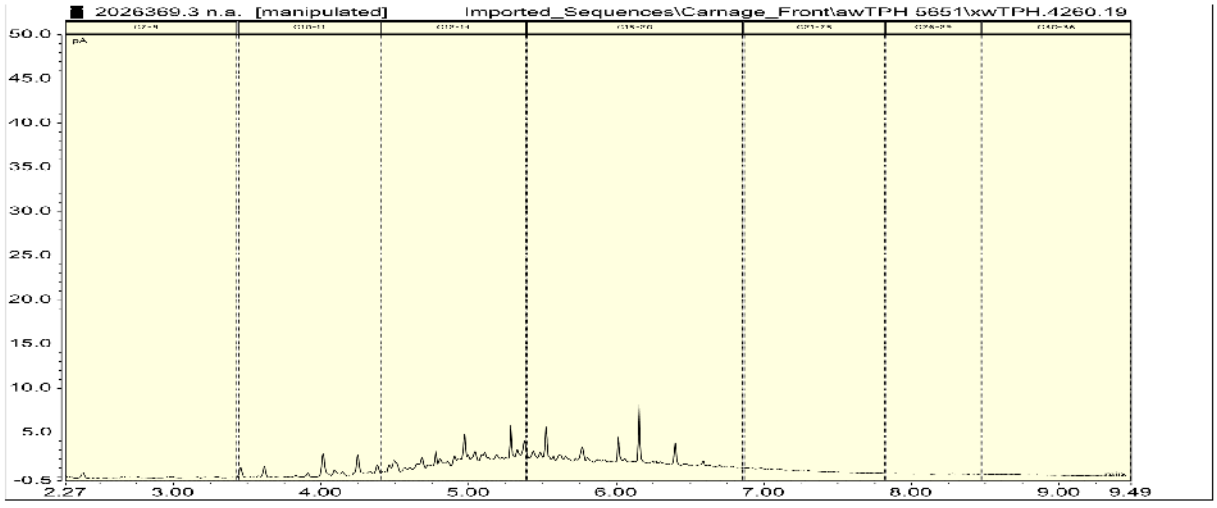
Sample Type: Saline						
Sample Name:		GBH110 03-Aug-2018	GBH102 03-Aug-2018	GBH104 03-Aug-2018	MWB 03-Aug-2018	
Lab Number:		2026369.1	2026369.2	2026369.3	2026369.6	
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
Styrene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	-
1,2,4-Trimethylbenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
1,3,5-Trimethylbenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Ketones in VOC Water by Headspace GC-MS						
Acetone	g/m³	< 0.5	< 0.5	< 0.5	< 0.5	-
2-Butanone (MEK)	g/m³	< 0.5	< 0.5	< 0.5	< 0.5	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	-
Trihalomethanes in VOC Water by Headspace GC-MS						
Bromodichloromethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Bromoform (tribromomethane)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Chloroform (Trichloromethane)	g/m³	< 0.003	0.004	< 0.003	< 0.003	-
Dibromochloromethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Other VOC in Water by Headspace GC-MS						
Carbon disulphide	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	-
Naphthalene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	-

Sample Type: Aqueous						
Sample Name:		CBH209 03-Aug-2018	GBH104 - Product 03-Aug-2018			
Lab Number:		2026369.4	2026369.7			
Individual Tests						
pH	pH Units	7.2	-	-	-	-
Electrical Conductivity (EC)	mS/m	87.1	-	-	-	-
Total Dissolved Solids (TDS)	g/m³	560	-	-	-	-
Dissolved Mercury	g/m³	< 0.00008	-	-	-	-
Total Cyanide	g/m³	0.095	-	-	-	-
Chloride	g/m³	30	-	-	-	-
Sulphate	g/m³	0.8	-	-	-	-
Free Product GC Scan by FID						
Free Product*	mL/100mL	-	100	-	-	-
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m³	< 0.0010	-	-	-	-
Dissolved Cadmium	g/m³	< 0.00005	-	-	-	-
Dissolved Chromium	g/m³	< 0.0005	-	-	-	-
Dissolved Copper	g/m³	< 0.0005	-	-	-	-
Dissolved Lead	g/m³	0.00142	-	-	-	-
Dissolved Nickel	g/m³	< 0.0005	-	-	-	-
Dissolved Zinc	g/m³	< 0.0010	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq						
Acenaphthene	g/m³	0.00070	-	-	-	-
Acenaphthylene	g/m³	< 0.00010	-	-	-	-
Anthracene	g/m³	0.00064	-	-	-	-
Benzo[a]anthracene	g/m³	0.00026	-	-	-	-
Benzo[a]pyrene (BAP)	g/m³	< 0.00010	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	0.00015	-	-	-	-
Benzo[g,h,i]perylene	g/m³	< 0.00010	-	-	-	-
Benzo[k]fluoranthene	g/m³	< 0.00010	-	-	-	-
Chrysene	g/m³	0.00021	-	-	-	-
Dibenzo[a,h]anthracene	g/m³	< 0.00010	-	-	-	-
Fluoranthene	g/m³	0.00123	-	-	-	-
Fluorene	g/m³	0.0012	-	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.00010	-	-	-	-
Naphthalene	g/m³	< 0.0005	-	-	-	-

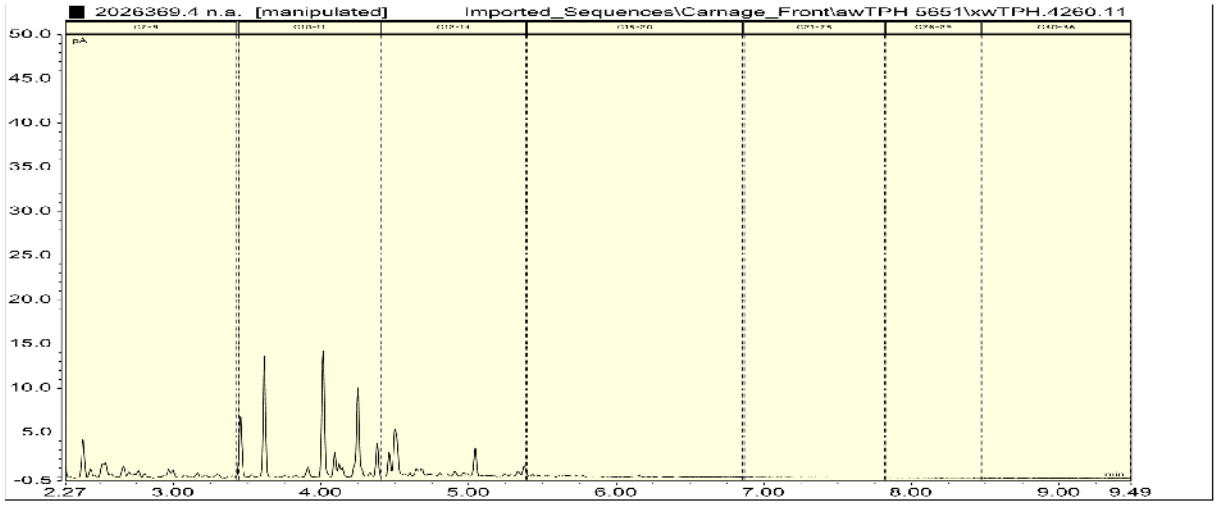
Sample Type: Aqueous							
Sample Name:		CBH209 03-Aug-2018	GBH104 - Product 03-Aug-2018				
Lab Number:		2026369.4	2026369.7				
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq							
Phenanthrene	g/m³	0.0024	-	-	-	-	
Pyrene	g/m³	0.0007	-	-	-	-	
Total Petroleum Hydrocarbons in Water							
C7 - C9	g/m³	1.40	-	-	-	-	
C10 - C14	g/m³	1.5	-	-	-	-	
C15 - C36	g/m³	< 0.4	-	-	-	-	
Total hydrocarbons (C7 - C36)	g/m³	2.9	-	-	-	-	
BTEX in VOC Water by Headspace GC-MS							
Benzene	g/m³	< 0.003	-	-	-	-	
Ethylbenzene	g/m³	< 0.005	-	-	-	-	
Toluene	g/m³	< 0.003	-	-	-	-	
m&p-Xylene	g/m³	< 0.005	-	-	-	-	
o-Xylene	g/m³	< 0.003	-	-	-	-	
Halogenated Aliphatics in VOC Water by Headspace GC-MS							
Bromomethane (Methyl Bromide)	g/m³	< 0.003	-	-	-	-	
Carbon tetrachloride	g/m³	< 0.003	-	-	-	-	
Chloroethane	g/m³	< 0.003	-	-	-	-	
Chloromethane	g/m³	< 0.003	-	-	-	-	
1,2-Dibromo-3-chloropropane	g/m³	< 0.003	-	-	-	-	
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003	-	-	-	-	
Dibromomethane	g/m³	< 0.003	-	-	-	-	
Dichlorodifluoromethane	g/m³	< 0.003	-	-	-	-	
1,1-Dichloroethane	g/m³	< 0.003	-	-	-	-	
1,2-Dichloroethane	g/m³	< 0.003	-	-	-	-	
1,1-Dichloroethene	g/m³	< 0.003	-	-	-	-	
cis-1,2-Dichloroethene	g/m³	< 0.003	-	-	-	-	
trans-1,2-Dichloroethene	g/m³	< 0.003	-	-	-	-	
Dichloromethane (methylene chloride)	g/m³	< 0.10	-	-	-	-	
1,2-Dichloropropane	g/m³	< 0.003	-	-	-	-	
1,3-Dichloropropane	g/m³	< 0.003	-	-	-	-	
1,1-Dichloropropene	g/m³	< 0.003	-	-	-	-	
cis-1,3-Dichloropropene	g/m³	< 0.005	-	-	-	-	
trans-1,3-Dichloropropene	g/m³	< 0.005	-	-	-	-	
Hexachlorobutadiene	g/m³	< 0.003	-	-	-	-	
1,1,1,2-Tetrachloroethane	g/m³	< 0.003	-	-	-	-	
1,1,2,2-Tetrachloroethane	g/m³	< 0.003	-	-	-	-	
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003	-	-	-	-	
1,1,1-Trichloroethane	g/m³	< 0.003	-	-	-	-	
1,1,2-Trichloroethane	g/m³	< 0.003	-	-	-	-	
Trichloroethene (trichloroethylene)	g/m³	< 0.003	-	-	-	-	
Trichlorofluoromethane	g/m³	< 0.003	-	-	-	-	
1,2,3-Trichloropropane	g/m³	< 0.003	-	-	-	-	
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003	-	-	-	-	
Vinyl chloride	g/m³	< 0.003	-	-	-	-	
Haloaromatics in VOC Water by Headspace GC-MS							
Bromobenzene	g/m³	< 0.003	-	-	-	-	
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003	-	-	-	-	
2-Chlorotoluene	g/m³	< 0.003	-	-	-	-	
1,2-Dichlorobenzene	g/m³	< 0.003	-	-	-	-	
1,3-Dichlorobenzene	g/m³	< 0.003	-	-	-	-	
1,4-Dichlorobenzene	g/m³	< 0.003	-	-	-	-	
4-Chlorotoluene	g/m³	< 0.003	-	-	-	-	
1,2,3-Trichlorobenzene	g/m³	< 0.003	-	-	-	-	

Sample Type: Aqueous							
Sample Name:		CBH209 03-Aug-2018	GBH104 - Product 03-Aug-2018				
Lab Number:		2026369.4	2026369.7				
Haloaromatics in VOC Water by Headspace GC-MS							
1,2,4-Trichlorobenzene	g/m³	< 0.003	-	-	-	-	
1,3,5-Trichlorobenzene	g/m³	< 0.003	-	-	-	-	
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS							
n-Butylbenzene	g/m³	0.021	-	-	-	-	
tert-Butylbenzene	g/m³	< 0.003	-	-	-	-	
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005	-	-	-	-	
Isopropylbenzene (Cumene)	g/m³	0.164	-	-	-	-	
n-Propylbenzene	g/m³	0.34	-	-	-	-	
sec-Butylbenzene	g/m³	0.020	-	-	-	-	
Styrene	g/m³	< 0.005	-	-	-	-	
1,2,4-Trimethylbenzene	g/m³	< 0.003	-	-	-	-	
1,3,5-Trimethylbenzene	g/m³	< 0.003	-	-	-	-	
Ketones in VOC Water by Headspace GC-MS							
Acetone	g/m³	< 0.5	-	-	-	-	
2-Butanone (MEK)	g/m³	< 0.5	-	-	-	-	
Methyl tert-butylether (MTBE)	g/m³	< 0.003	-	-	-	-	
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10	-	-	-	-	
Trihalomethanes in VOC Water by Headspace GC-MS							
Bromodichloromethane	g/m³	< 0.003	-	-	-	-	
Bromoform (tribromomethane)	g/m³	< 0.003	-	-	-	-	
Chloroform (Trichloromethane)	g/m³	< 0.003	-	-	-	-	
Dibromochloromethane	g/m³	< 0.003	-	-	-	-	
Other VOC in Water by Headspace GC-MS							
Carbon disulphide	g/m³	< 0.005	-	-	-	-	
Naphthalene	g/m³	< 0.005	-	-	-	-	

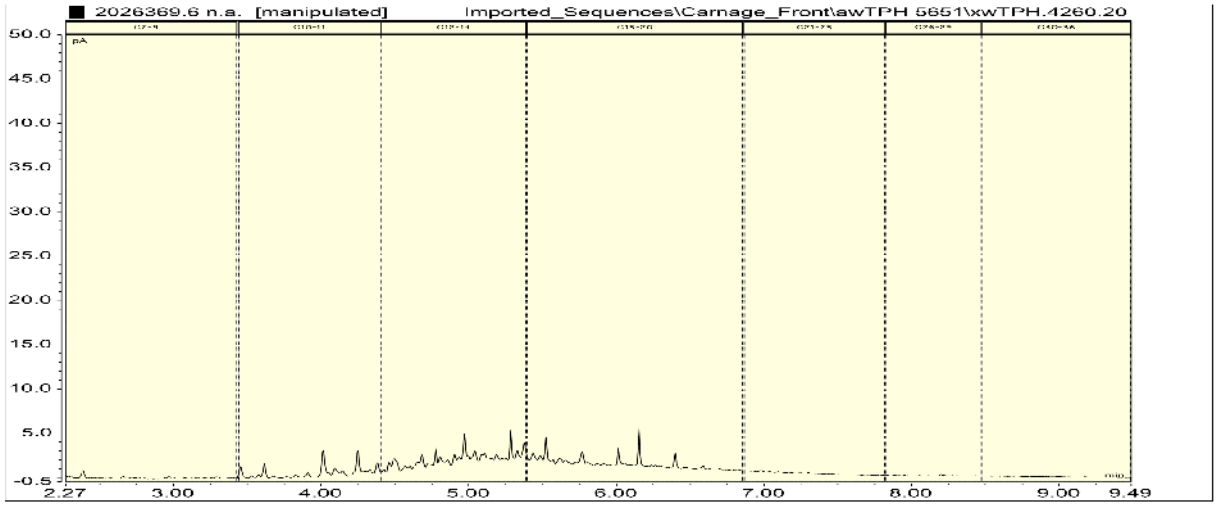
2026369.3
GBH104 03-Aug-2018
Client Chromatogram for TPH by FID



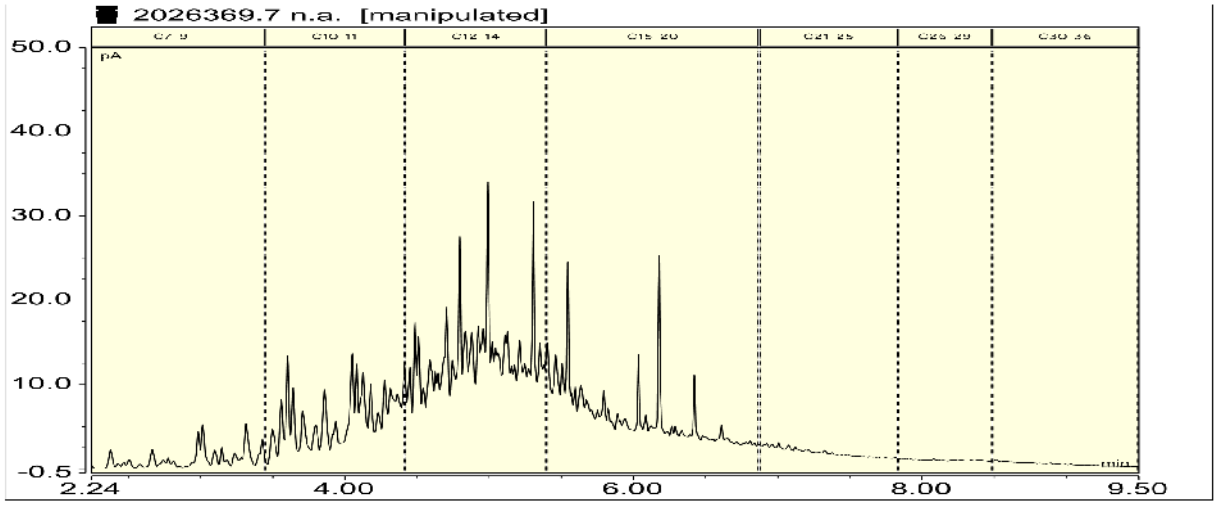
2026369.4
CBH209 03-Aug-2018
Client Chromatogram for TPH by FID



2026369.6
MWB 03-Aug-2018
Client Chromatogram for TPH by FID



2026369.7
GBH104 - Product 03-Aug-2018
Client Chromatogram for GC Scan



Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier certificate issued on 14 Aug 2018 at 5:24 pm
Reason for amendment: Sample ID amendment.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Saline

Test	Method Description	Default Detection Limit	Sample No
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq*	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.00010 - 0.0005 g/m^3	1-4
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m^3	1-4, 6
Volatile Organic Compounds Screening in Water by Headspace GC-MS	Headspace, GC-MS SIM analysis [KBIs:37857,37921]	0.003 - 0.5 g/m^3	1-4, 6
Filtration, Unpreserved*	Sample filtration through 0.45µm membrane filter.	-	1-4
pH*	Saline water, pH meter. APHA 4500-H$^+$ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Electrical Conductivity (EC)*	Saline water, Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.10 mS/m	1-3
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	50 g/m^3	1-3
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	1-4, 6
Dissolved Arsenic*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m^3	1-3, 6
Dissolved Cadmium*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0002 g/m^3	1-3, 6
Dissolved Chromium*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	1-3, 6
Dissolved Copper*	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	1-3, 6
Dissolved Lead*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	1-3, 6
Dissolved Mercury*	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m^3	1-4, 6
Dissolved Nickel*	Filtered sample, ICP-MS with universal cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.007 g/m^3	1-3, 6
Dissolved Zinc*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m^3	1-3, 6
Total Cyanide Trace*	On-line distillation, colorimetry, trace level. ISO 14403:2012(E) (modified).	0.002 g/m^3	1-4
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1-4
Sulphate*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1-4
C7 - C9	Head Space, GCMS analysis.	0.06 g/m^3	1-4, 6

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Client Chromatogram for GC Scan*	.	-	7
Free Product GC Scan by FID*	Dilution of free product in organic solvent	1.0 mL/100mL	7
Volume of Free Product present in TPH Water samples*	Volumes estimated using Measuring Cylinder.	1.0 mL/100mL	7
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00005 - 0.0010 g/m^3	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
pH	pH meter. APHA 4500-H^+ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	4
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	10 g/m^3	4

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Kim Harrison MSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2027205	SPv2
Contact:	Lucy Hine	**Date Received:**	06-Aug-2018	
	C/- Tonkin & Taylor	**Date Reported:**	03-Sep-2018	**(Amended)**
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2	
		Client Reference:	30881.2	
		Submitted By:	Sami Hutchings	

Sample Type: Saline

Sample Name:		CBH202 06-Aug-2018 10:30 am	GBH109 06-Aug-2018 3:15 pm	GBH103 06-Aug-2018 1:10 pm	GBH111 06-Aug-2018 12:30 pm	MWE 06-Aug-2018
Lab Number:		2027205.2	2027205.3	2027205.4	2027205.5	2027205.6
Individual Tests						
pH*	pH Units	7.6	7.7	7.2	8.0	-
Electrical Conductivity (EC)*	mS/m	2,120	849	167.3	629	-
Total Dissolved Solids (TDS)*	g/m³	13,500	5,200	1,060	3,600	-
Dissolved Arsenic*	g/m³	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Dissolved Cadmium*	g/m³	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0022
Dissolved Chromium*	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved Copper*	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved Lead*	g/m³	< 0.0010	< 0.0010	0.0035	< 0.0010	0.0039
Dissolved Mercury*	g/m³	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008
Dissolved Nickel*	g/m³	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
Dissolved Zinc*	g/m³	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
Total Cyanide*	g/m³	0.02	0.03	0.08	0.03	-
Chloride*	g/m³	6,600	2,700	169	1,650	-
Sulphate*	g/m³	780	126	67	58	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq						
Acenaphthene*	g/m³	0.00056	< 0.00010	0.00045	< 0.00010	-
Acenaphthylene*	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	-
Anthracene*	g/m³	0.00015	< 0.00010	< 0.00010	< 0.00010	-
Benzo[a]anthracene*	g/m³	0.00017	< 0.00010	< 0.00010	< 0.00010	-
Benzo[a]pyrene (BAP)*	g/m³	0.00014	< 0.00010	< 0.00010	< 0.00010	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene*	g/m³	0.00020	< 0.00010	< 0.00010	< 0.00010	-
Benzo[g,h,i]perylene*	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	-
Benzo[k]fluoranthene*	g/m³	0.00012	< 0.00010	< 0.00010	< 0.00010	-
Chrysene*	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	-
Dibenzo[a,h]anthracene*	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	-
Fluoranthene*	g/m³	0.00068	< 0.00010	< 0.00010	< 0.00010	-
Fluorene*	g/m³	0.0008	< 0.0002	0.0006	< 0.0002	-
Indeno(1,2,3-c,d)pyrene*	g/m³	0.00011	< 0.00010	< 0.00010	< 0.00010	-
Naphthalene*	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Phenanthrene*	g/m³	0.0007	< 0.0004	< 0.0004	< 0.0004	-
Pyrene*	g/m³	0.0007	< 0.0002	< 0.0002	< 0.0002	-
Polychlorinated Biphenyls Screening in Water, By Liq/Liq						
PCB-18	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-28	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-31	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-44	g/m³	-	< 0.00010	-	< 0.00010	-

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Saline						
Sample Name:		CBH202 06-Aug-2018 10:30 am	GBH109 06-Aug-2018 3:15 pm	GBH103 06-Aug-2018 1:10 pm	GBH111 06-Aug-2018 12:30 pm	MWE 06-Aug-2018
Lab Number:		2027205.2	2027205.3	2027205.4	2027205.5	2027205.6
Polychlorinated Biphenyls Screening in Water, By Liq/Liq						
PCB-49	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-52	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-60	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-77	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-81	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-86	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-101	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-105	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-110	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-114	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-118	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-121	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-123	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-126	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-128	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-138	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-141	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-149	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-151	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-153	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-156	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-157	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-159	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-167	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-169	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-170	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-180	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-189	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-194	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-206	g/m³	-	< 0.00010	-	< 0.00010	-
PCB-209	g/m³	-	< 0.00010	-	< 0.00010	-
Total PCB (Sum of 35 congeners)	g/m³	-	< 0.005	-	< 0.005	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	0.24	9.9	0.46	< 0.06	0.46
C10 - C14	g/m³	2.9	< 0.2	2.0	< 0.2	1.5
C15 - C36	g/m³	2.3	< 0.4	1.2	< 0.4	0.8
Total hydrocarbons (C7 - C36)	g/m³	5.4	9.9	3.6	< 0.7	2.8
BTEX in VOC Water by Headspace GC-MS						
Benzene	g/m³	< 0.003	0.008	< 0.003	< 0.003	< 0.003
Ethylbenzene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Toluene	g/m³	< 0.003	0.021	< 0.003	< 0.003	< 0.003
m&p-Xylene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
o-Xylene	g/m³	< 0.003	0.004	< 0.003	< 0.003	< 0.003
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
Bromomethane (Methyl Bromide)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Carbon tetrachloride	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Chloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Chloromethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,2-Dibromo-3-chloropropane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Dibromomethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Dichlorodifluoromethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,1-Dichloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003

Sample Type: Saline						
Sample Name:		CBH202 06-Aug-2018 10:30 am	GBH109 06-Aug-2018 3:15 pm	GBH103 06-Aug-2018 1:10 pm	GBH111 06-Aug-2018 12:30 pm	MWE 06-Aug-2018
Lab Number:		2027205.2	2027205.3	2027205.4	2027205.5	2027205.6
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
1,2-Dichloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,1-Dichloroethene	g/m³	< 0.003	0.013	< 0.003	< 0.003	< 0.003
cis-1,2-Dichloroethene	g/m³	< 0.003	18.4	< 0.003	< 0.003	< 0.003
trans-1,2-Dichloroethene	g/m³	< 0.003	0.40	< 0.003	< 0.003	< 0.003
Dichloromethane (methylene chloride)	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1,2-Dichloropropane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,3-Dichloropropane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,1-Dichloropropene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
cis-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
trans-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Hexachlorobutadiene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,1,1,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,1,2,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003	7.6	< 0.003	< 0.003	< 0.003
1,1,1-Trichloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,1,2-Trichloroethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Trichloroethene (trichloroethylene)	g/m³	< 0.003	9.2	< 0.003	< 0.003	< 0.003
Trichlorofluoromethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,2,3-Trichloropropane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Vinyl chloride	g/m³	< 0.003	5.4	< 0.003	< 0.003	< 0.003
Haloaromatics in VOC Water by Headspace GC-MS						
Bromobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
2-Chlorotoluene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,2-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,3-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,4-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
4-Chlorotoluene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,2,3-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,2,4-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,3,5-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
n-Butylbenzene	g/m³	< 0.005	< 0.005	0.019	< 0.005	0.018
tert-Butylbenzene	g/m³	< 0.003	< 0.003	0.003	< 0.003	< 0.003
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Isopropylbenzene (Cumene)	g/m³	< 0.003	0.042	0.134	< 0.003	0.126
n-Propylbenzene	g/m³	< 0.005	0.024	0.28	< 0.005	0.26
sec-Butylbenzene	g/m³	< 0.003	< 0.003	0.017	< 0.003	0.016
Styrene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
1,2,4-Trimethylbenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
1,3,5-Trimethylbenzene	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Ketones in VOC Water by Headspace GC-MS						
Acetone	g/m³	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2-Butanone (MEK)	g/m³	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Methyl tert-butylether (MTBE)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Trihalomethanes in VOC Water by Headspace GC-MS						
Bromodichloromethane	g/m³	< 0.003	0.107	< 0.003	< 0.003	< 0.003
Bromoform (tribromomethane)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Chloroform (Trichloromethane)	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Dibromochloromethane	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003

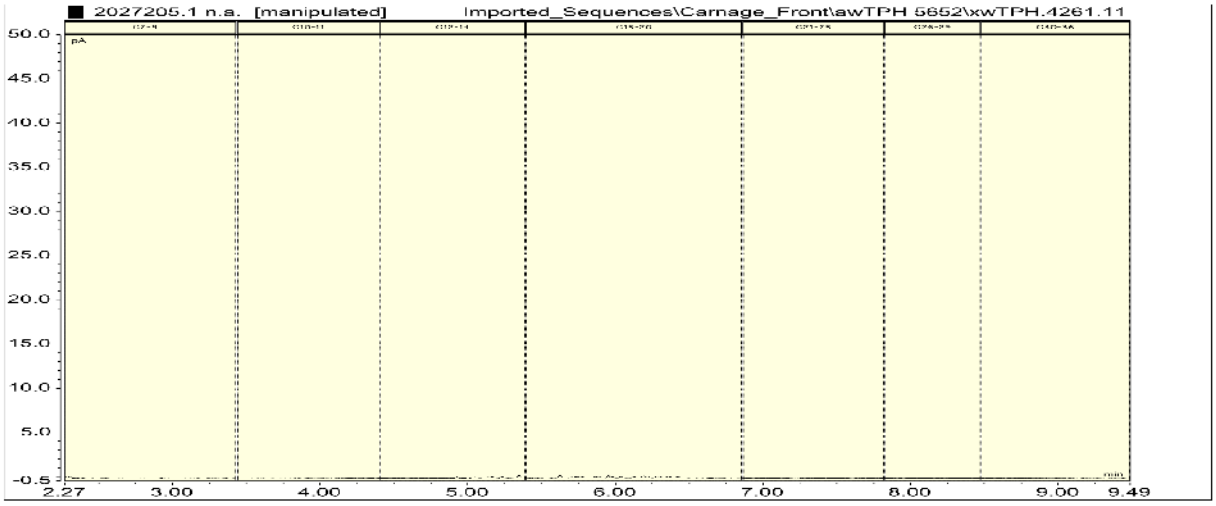
Sample Type: Saline						
Sample Name:		CBH202 06-Aug-2018 10:30 am	GBH109 06-Aug-2018 3:15 pm	GBH103 06-Aug-2018 1:10 pm	GBH111 06-Aug-2018 12:30 pm	MWE 06-Aug-2018
Lab Number:		2027205.2	2027205.3	2027205.4	2027205.5	2027205.6
Other VOC in Water by Headspace GC-MS						
Carbon disulphide	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Naphthalene	g/m³	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005

Sample Type: Aqueous						
Sample Name:		GBH107 06-Aug-2018 3:30 pm	CBH202 - Product 1 06-Aug-2018	CBH202 - Product 2 06-Aug-2018		
Lab Number:		2027205.1	2027205.7	2027205.8		
Individual Tests						
pH	pH Units	6.6	-	-	-	-
Electrical Conductivity (EC)	mS/m	115.3	-	-	-	-
Total Dissolved Solids (TDS)	g/m³	890	-	-	-	-
Dissolved Mercury	g/m³	< 0.00008	-	-	-	-
Total Cyanide	g/m³	0.023	-	-	-	-
Chloride	g/m³	55	-	-	-	-
Sulphate	g/m³	420	-	-	-	-
Free Product GC Scan by FID						
Free Product*	mL/100mL	-	100	2.3	-	-
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m³	< 0.0010	-	-	-	-
Dissolved Cadmium	g/m³	< 0.00005	-	-	-	-
Dissolved Chromium	g/m³	< 0.0005	-	-	-	-
Dissolved Copper	g/m³	< 0.0005	-	-	-	-
Dissolved Lead	g/m³	< 0.00010	-	-	-	-
Dissolved Nickel	g/m³	0.0016	-	-	-	-
Dissolved Zinc	g/m³	0.0017	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq						
Acenaphthene	g/m³	< 0.00010	-	-	-	-
Acenaphthylene	g/m³	< 0.00010	-	-	-	-
Anthracene	g/m³	< 0.00010	-	-	-	-
Benzo[a]anthracene	g/m³	< 0.00010	-	-	-	-
Benzo[a]pyrene (BAP)	g/m³	< 0.00010	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	< 0.00010	-	-	-	-
Benzo[g,h,i]perylene	g/m³	< 0.00010	-	-	-	-
Benzo[k]fluoranthene	g/m³	< 0.00010	-	-	-	-
Chrysene	g/m³	< 0.00010	-	-	-	-
Dibenzo[a,h]anthracene	g/m³	< 0.00010	-	-	-	-
Fluoranthene	g/m³	0.00018	-	-	-	-
Fluorene	g/m³	< 0.0002	-	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.00010	-	-	-	-
Naphthalene	g/m³	< 0.0010	-	-	-	-
Phenanthrene	g/m³	0.0008	-	-	-	-
Pyrene	g/m³	< 0.0002	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.06	-	-	-	-
C10 - C14	g/m³	< 0.2	-	-	-	-
C15 - C36	g/m³	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	-	-	-	-
BTEX in VOC Water by Headspace GC-MS						
Benzene	g/m³	< 0.003	-	-	-	-
Ethylbenzene	g/m³	< 0.005	-	-	-	-
Toluene	g/m³	< 0.003	-	-	-	-
m&p-Xylene	g/m³	< 0.005	-	-	-	-
o-Xylene	g/m³	< 0.003	-	-	-	-

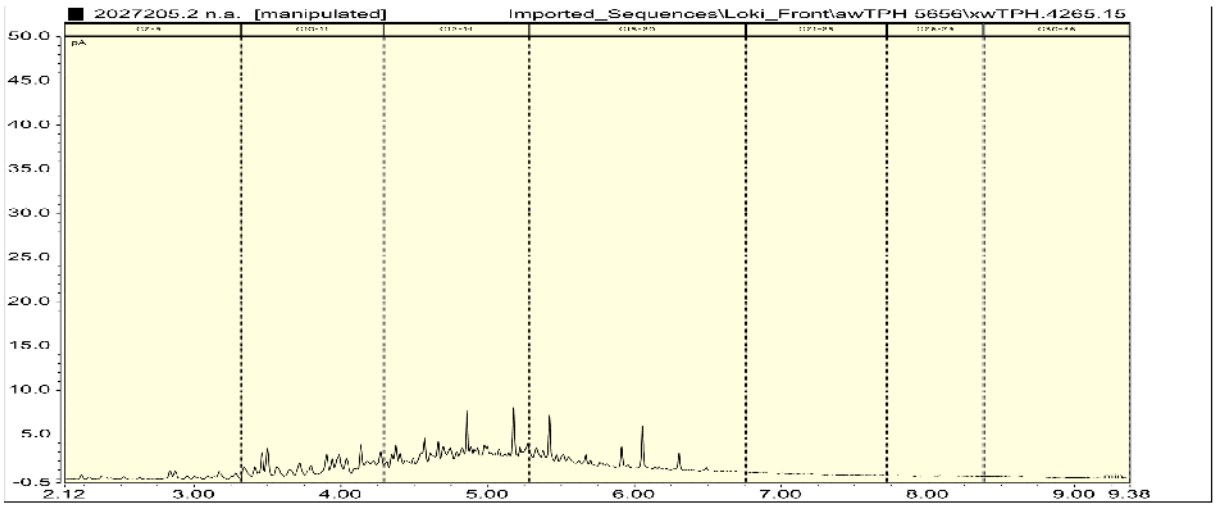
Sample Type: Aqueous						
Sample Name:		GBH107 06-Aug-2018 3:30 pm	CBH202 - Product 1 06-Aug-2018	CBH202 - Product 2 06-Aug-2018		
Lab Number:		2027205.1	2027205.7	2027205.8		
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
Bromomethane (Methyl Bromide)	g/m³	< 0.003	-	-	-	-
Carbon tetrachloride	g/m³	< 0.003	-	-	-	-
Chloroethane	g/m³	< 0.003	-	-	-	-
Chloromethane	g/m³	< 0.003	-	-	-	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003	-	-	-	-
Dibromomethane	g/m³	< 0.003	-	-	-	-
Dichlorodifluoromethane	g/m³	< 0.003	-	-	-	-
1,1-Dichloroethane	g/m³	< 0.003	-	-	-	-
1,2-Dichloroethane	g/m³	< 0.003	-	-	-	-
1,1-Dichloroethene	g/m³	< 0.003	-	-	-	-
cis-1,2-Dichloroethene	g/m³	< 0.003	-	-	-	-
trans-1,2-Dichloroethene	g/m³	< 0.003	-	-	-	-
Dichloromethane (methylene chloride)	g/m³	< 0.10	-	-	-	-
1,2-Dichloropropane	g/m³	< 0.003	-	-	-	-
1,3-Dichloropropane	g/m³	< 0.003	-	-	-	-
1,1-Dichloropropene	g/m³	< 0.003	-	-	-	-
cis-1,3-Dichloropropene	g/m³	< 0.005	-	-	-	-
trans-1,3-Dichloropropene	g/m³	< 0.005	-	-	-	-
Hexachlorobutadiene	g/m³	< 0.003	-	-	-	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003	-	-	-	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003	-	-	-	-
1,1,1-Trichloroethane	g/m³	< 0.003	-	-	-	-
1,1,2-Trichloroethane	g/m³	< 0.003	-	-	-	-
Trichloroethene (trichloroethylene)	g/m³	< 0.003	-	-	-	-
Trichlorofluoromethane	g/m³	< 0.003	-	-	-	-
1,2,3-Trichloropropane	g/m³	< 0.003	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003	-	-	-	-
Vinyl chloride	g/m³	< 0.003	-	-	-	-
Haloaromatics in VOC Water by Headspace GC-MS						
Bromobenzene	g/m³	< 0.003	-	-	-	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003	-	-	-	-
2-Chlorotoluene	g/m³	< 0.003	-	-	-	-
1,2-Dichlorobenzene	g/m³	< 0.003	-	-	-	-
1,3-Dichlorobenzene	g/m³	< 0.003	-	-	-	-
1,4-Dichlorobenzene	g/m³	< 0.003	-	-	-	-
4-Chlorotoluene	g/m³	< 0.003	-	-	-	-
1,2,3-Trichlorobenzene	g/m³	< 0.003	-	-	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003	-	-	-	-
1,3,5-Trichlorobenzene	g/m³	< 0.003	-	-	-	-
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
n-Butylbenzene	g/m³	< 0.005	-	-	-	-
tert-Butylbenzene	g/m³	< 0.003	-	-	-	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005	-	-	-	-
Isopropylbenzene (Cumene)	g/m³	< 0.003	-	-	-	-
n-Propylbenzene	g/m³	< 0.005	-	-	-	-
sec-Butylbenzene	g/m³	< 0.003	-	-	-	-
Styrene	g/m³	< 0.005	-	-	-	-
1,2,4-Trimethylbenzene	g/m³	< 0.003	-	-	-	-
1,3,5-Trimethylbenzene	g/m³	< 0.003	-	-	-	-

Sample Type: Aqueous						
Sample Name:		GBH107 06-Aug-2018 3:30 pm	CBH202 - Product 1 06-Aug-2018	CBH202 - Product 2 06-Aug-2018		
Lab Number:		2027205.1	2027205.7	2027205.8		
Ketones in VOC Water by Headspace GC-MS						
Acetone	g/m³	< 0.5	-	-	-	-
2-Butanone (MEK)	g/m³	< 0.5	-	-	-	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003	-	-	-	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10	-	-	-	-
Trihalomethanes in VOC Water by Headspace GC-MS						
Bromodichloromethane	g/m³	< 0.003	-	-	-	-
Bromoform (tribromomethane)	g/m³	< 0.003	-	-	-	-
Chloroform (Trichloromethane)	g/m³	< 0.003	-	-	-	-
Dibromochloromethane	g/m³	< 0.003	-	-	-	-
Other VOC in Water by Headspace GC-MS						
Carbon disulphide	g/m³	< 0.005	-	-	-	-
Naphthalene	g/m³	< 0.005	-	-	-	-

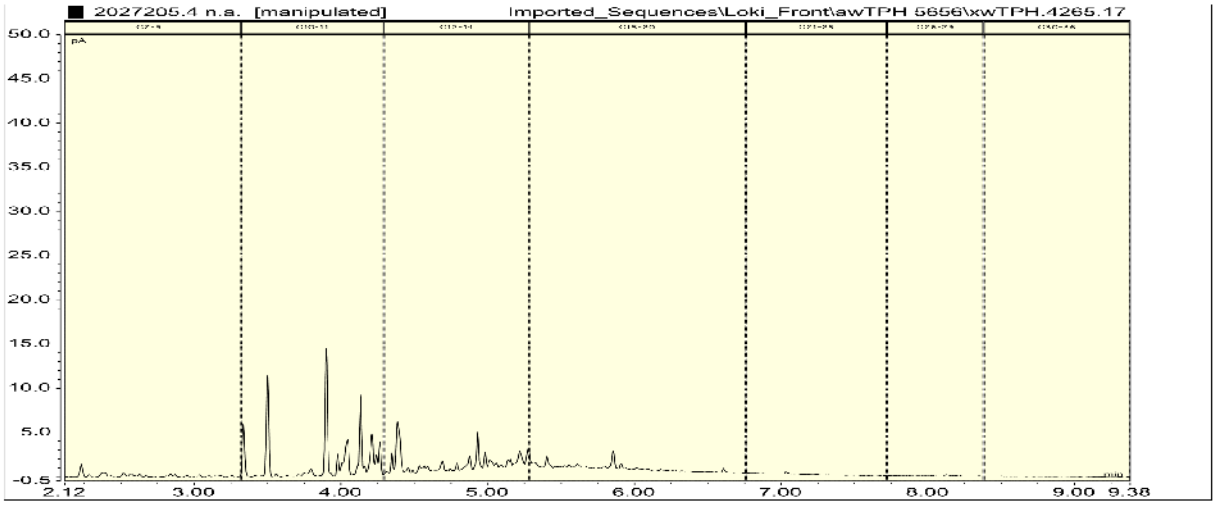
2027205.1
GBH107 06-Aug-2018 3:30 pm
Client Chromatogram for TPH by FID



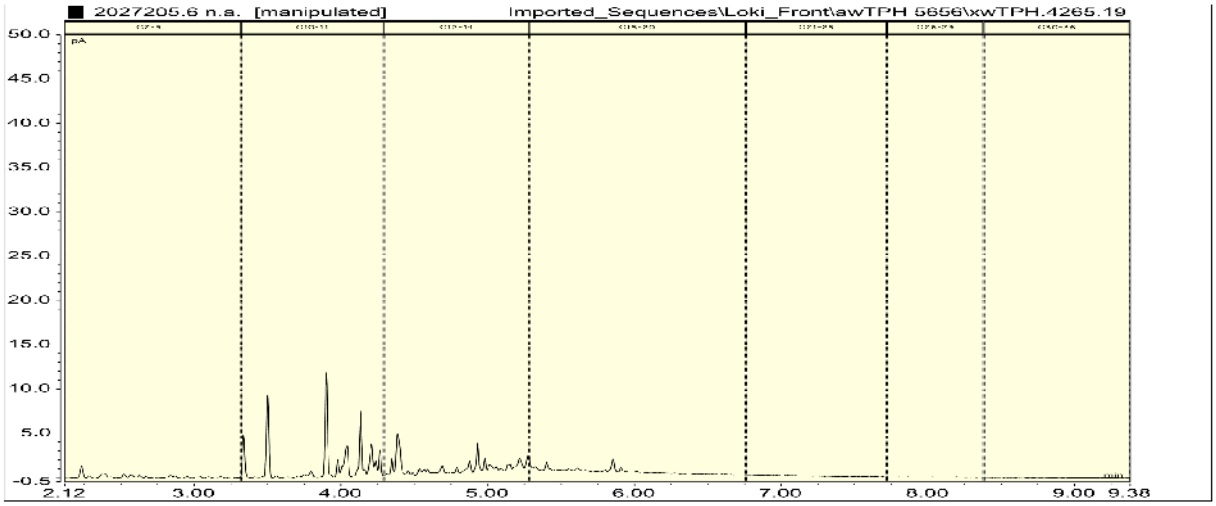
2027205.2
CBH202 06-Aug-2018 10:30 am
Client Chromatogram for TPH by FID



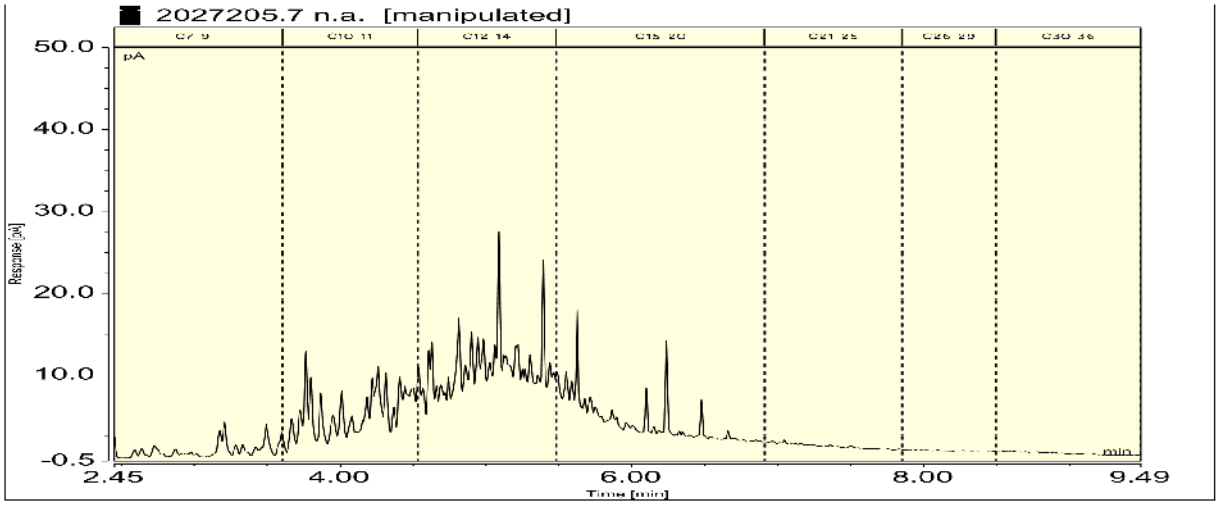
2027205.4
GBH103 06-Aug-2018 1:10 pm
Client Chromatogram for TPH by FID



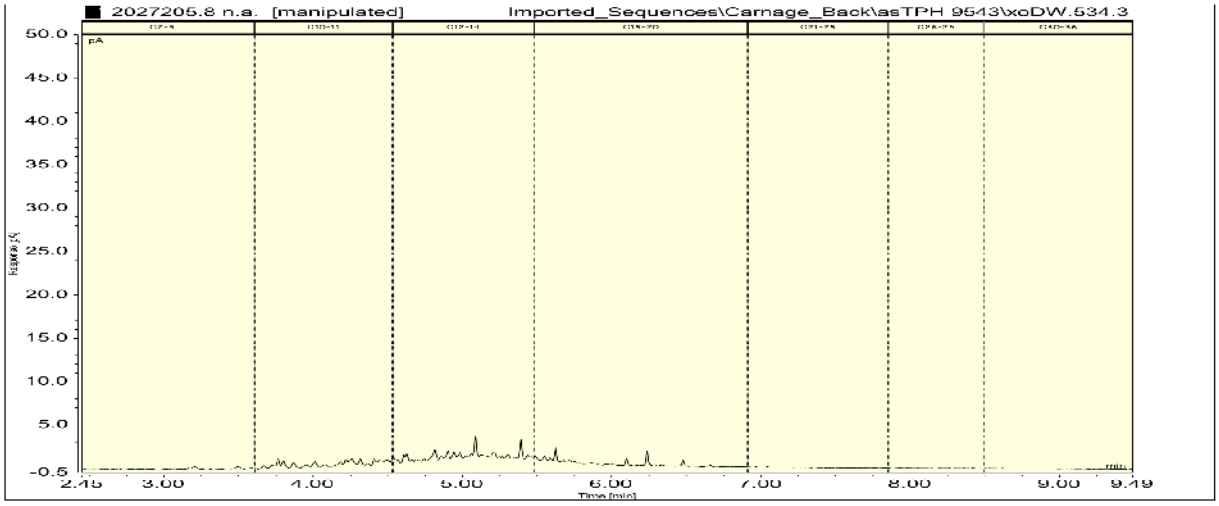
2027205.6
MWE 06-Aug-2018
Client Chromatogram for TPH by FID



2027205.7
CBH202 - Product 1 06-Aug-2018
Client Chromatogram for GC Scan



2027205.8
CBH202 - Product 2 06-Aug-2018
Client Chromatogram for GC Scan



Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier certificate issued on 20 Aug 2018 at 2:36 pm
Reason for amendment: Sample ID amendments.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Saline

Test	Method Description	Default Detection Limit	Sample No
Polychlorinated Biphenyls Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS analysis	0.00010 - 0.005 g/m^3	3, 5
pH*	Saline water, pH meter. APHA 4500-H$^+$ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	2-5
Electrical Conductivity (EC)*	Saline water, Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.10 mS/m	2-5
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	50 g/m^3	2-5
Dissolved Arsenic*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m^3	2-6
Dissolved Cadmium*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0002 g/m^3	2-6
Dissolved Chromium*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	2-6
Dissolved Copper*	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	2-6
Dissolved Lead*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	2-6
Dissolved Nickel*	Filtered sample, ICP-MS with universal cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.007 g/m^3	2-6
Dissolved Zinc*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m^3	2-6

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Client Chromatogram for GC Scan*	.	-	7-8
Free Product GC Scan by FID*	Dilution of free product in organic solvent	1.0 mL/100mL	7-8
Volume of Free Product present in TPH Water samples*	Volumes estimated using Measuring Cylinder.	1.0 mL/100mL	7-8
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00005 - 0.0010 g/m^3	1

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.00010 - 0.0005 g/m^3	1-5
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m^3	1-6
Volatile Organic Compounds Screening in Water by Headspace GC-MS	Headspace, GC-MS SIM analysis [KBIs:37857,37921]	0.003 - 0.5 g/m^3	1-6
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-5
pH	pH meter. APHA 4500-H$^+$ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	1
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	10 g/m^3	1
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	1-6
Dissolved Mercury	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m^3	1-6
Total Cyanide Trace	On-line distillation, colorimetry, trace level. ISO 14403:2012(E) (modified).	0.002 g/m^3	1-5
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1-5
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1-5
C7 - C9	Head Space, GCMS analysis.	0.06 g/m^3	1-6

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Kim Harrison MSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2027205	SUPv2
Contact:	Lucy Hine	**Date Received:**	06-Aug-2018	
	C/- Tonkin & Taylor	**Date Reported:**	03-Sep-2018	**(Amended)**
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2	
		Client Reference:	30881.2	
		Submitted By:	Sami Hutchings	

Sample Type: Saline

Sample Name:		CBH202 06-Aug-2018 10:30 am	GBH109 06-Aug-2018 3:15 pm	GBH103 06-Aug-2018 1:10 pm	GBH111 06-Aug-2018 12:30 pm
Lab Number:		2027205.2	2027205.3	2027205.4	2027205.5
Individual Tests					
pH*	pH Units	7.6 ± 0.2	7.7 ± 0.2	7.2 ± 0.2	8.0 ± 0.2
Electrical Conductivity (EC)*	mS/m	2,120 ± 43	849 ± 17	167.3 ± 3.4	629 ± 13
Total Dissolved Solids (TDS)*	g/m³	13,500 ± 1,700	5,170 ± 630	1,060 ± 140	3,560 ± 430
Dissolved Arsenic*	g/m³	< 0.004 ± 0.0027	< 0.004 ± 0.0027	< 0.004 ± 0.0027	< 0.004 ± 0.0027
Dissolved Cadmium*	g/m³	< 0.0002 ± 0.00014	< 0.0002 ± 0.00014	< 0.0002 ± 0.00014	< 0.0002 ± 0.00014
Dissolved Chromium*	g/m³	< 0.0010 ± 0.00067	< 0.0010 ± 0.00067	< 0.0010 ± 0.00067	< 0.0010 ± 0.00067
Dissolved Copper*	g/m³	< 0.0010 ± 0.00067	< 0.0010 ± 0.00067	< 0.0010 ± 0.00067	< 0.0010 ± 0.00067
Dissolved Lead*	g/m³	< 0.0010 ± 0.00067	< 0.0010 ± 0.00067	0.0035 ± 0.0011	< 0.0010 ± 0.00067
Dissolved Mercury*	g/m³	< 0.00008 ± 0.000054	< 0.00008 ± 0.000054	< 0.00008 ± 0.000054	< 0.00008 ± 0.000054
Dissolved Nickel*	g/m³	< 0.007 ± 0.0041	< 0.007 ± 0.0041	< 0.007 ± 0.0041	< 0.007 ± 0.0041
Dissolved Zinc*	g/m³	< 0.004 ± 0.0027	< 0.004 ± 0.0027	< 0.004 ± 0.0027	< 0.004 ± 0.0027
Total Cyanide*	g/m³	0.02	0.03	0.08	0.03
Chloride*	g/m³	6,600 ± 400	2,710 ± 170	169 ± 11	1,650 ± 100
Sulphate*	g/m³	781 ± 47	126.1 ± 7.6	66.7 ± 4.1	57.7 ± 3.5
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq					
Acenaphthene*	g/m³	0.00056 ± 0.00029	< 0.00010 ± 0.000067	0.00045 ± 0.00023	< 0.00010 ± 0.000067
Acenaphthylene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Anthracene*	g/m³	0.000151 ± 0.000079	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Benzo[a]anthracene*	g/m³	0.000171 ± 0.000081	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Benzo[a]pyrene (BAP)*	g/m³	0.000139 ± 0.000082	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Benzo[b]fluoranthene + Benzo[j] fluoranthene*	g/m³	0.00020 ± 0.00011	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Benzo[g,h,i]perylene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Benzo[k]fluoranthene*	g/m³	0.000117 ± 0.000072	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Chrysene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Dibenzo[a,h]anthracene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Fluoranthene*	g/m³	0.00068 ± 0.00019	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Fluorene*	g/m³	0.00080 ± 0.00036	< 0.0002 ± 0.00011	0.00061 ± 0.00028	< 0.0002 ± 0.00011
Indeno(1,2,3-c,d)pyrene*	g/m³	0.000112 ± 0.000072	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067
Naphthalene*	g/m³	< 0.0010 ± 0.00067	< 0.0010 ± 0.00067	< 0.0010 ± 0.00067	< 0.0010 ± 0.00067
Phenanthrene*	g/m³	0.00068 ± 0.00022	< 0.0004 ± 0.00014	< 0.0004 ± 0.00014	< 0.0004 ± 0.00014
Pyrene*	g/m³	0.00067 ± 0.00028	< 0.0002 ± 0.000097	< 0.0002 ± 0.000097	< 0.0002 ± 0.000097
Polychlorinated Biphenyls Screening in Water, By Liq/Liq					
PCB-18	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-28	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-31	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-44	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-49	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Saline					
Sample Name:		CBH202 06-Aug-2018 10:30 am	GBH109 06-Aug-2018 3:15 pm	GBH103 06-Aug-2018 1:10 pm	GBH111 06-Aug-2018 12:30 pm
Lab Number:		2027205.2	2027205.3	2027205.4	2027205.5
Polychlorinated Biphenyls Screening in Water, By Liq/Liq					
PCB-52	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-60	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-77	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-81	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-86	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-101	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-105	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-110	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-114	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-118	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-121	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-123	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-126	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-128	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-138	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-141	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-149	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-151	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-153	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-156	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-157	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-159	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-167	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-169	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-170	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-180	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-189	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-194	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-206	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
PCB-209	g/m³	-	< 0.00010 ± 0.000067	-	< 0.00010 ± 0.000067
Total PCB (Sum of 35 congeners)	g/m³	-	< 0.005 ± 0.0024	-	< 0.005 ± 0.0024
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m³	0.237 ± 0.076	9.9 ± 2.8	0.46 ± 0.14	< 0.06 ± 0.041
C10 - C14	g/m³	2.87 ± 0.66	< 0.2 ± 0.095	1.99 ± 0.43	< 0.2 ± 0.095
C15 - C36	g/m³	2.32 ± 0.52	< 0.4 ± 0.12	1.20 ± 0.32	< 0.4 ± 0.13
Total hydrocarbons (C7 - C36)	g/m³	5.44 ± 0.85	9.9 ± 2.8	3.64 ± 0.56	< 0.7 ± 0.17
BTEX in VOC Water by Headspace GC-MS					
Benzene	g/m³	< 0.003 ± 0.0032	0.0078 ± 0.0037	< 0.003 ± 0.0032	< 0.003 ± 0.0032
Ethylbenzene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034
Toluene	g/m³	< 0.003 ± 0.0060	0.0211 ± 0.0089	< 0.003 ± 0.0060	< 0.003 ± 0.0060
m&p-Xylene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034
o-Xylene	g/m³	< 0.003 ± 0.0032	0.0036 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032
Halogenated Aliphatics in VOC Water by Headspace GC-MS					
Bromomethane (Methyl Bromide)	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Carbon tetrachloride	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Chloroethane	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032
Chloromethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,2-Dibromo-3-chloropropane	g/m³	< 0.003 ± 0.0028	< 0.003 ± 0.0028	< 0.003 ± 0.0028	< 0.003 ± 0.0028
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Dibromomethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Dichlorodifluoromethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,1-Dichloroethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,2-Dichloroethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,1-Dichloroethene	g/m³	< 0.003 ± 0.0032	0.0125 ± 0.0044	< 0.003 ± 0.0032	< 0.003 ± 0.0032

Sample Type: Saline					
Sample Name:		CBH202 06-Aug-2018 10:30 am	GBH109 06-Aug-2018 3:15 pm	GBH103 06-Aug-2018 1:10 pm	GBH111 06-Aug-2018 12:30 pm
Lab Number:		2027205.2	2027205.3	2027205.4	2027205.5
Halogenated Aliphatics in VOC Water by Headspace GC-MS					
cis-1,2-Dichloroethene	g/m³	< 0.003 ± 0.0031	18.4 ± 6.2	< 0.003 ± 0.0031	< 0.003 ± 0.0031
trans-1,2-Dichloroethene	g/m³	< 0.003 ± 0.0031	0.40 ± 0.15	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Dichloromethane (methylene chloride)	g/m³	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067
1,2-Dichloropropane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,3-Dichloropropane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,1-Dichloropropene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
cis-1,3-Dichloropropene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034
trans-1,3-Dichloropropene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034
Hexachlorobutadiene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,1,1,2-Tetrachloroethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,1,2,2-Tetrachloroethane	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003 ± 0.0032	7.6 ± 2.1	< 0.003 ± 0.0032	< 0.003 ± 0.0032
1,1,1-Trichloroethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,1,2-Trichloroethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Trichloroethene (trichloroethylene)	g/m³	< 0.003 ± 0.0031	9.2 ± 3.0	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Trichlorofluoromethane	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032
1,2,3-Trichloropropane	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003 ± 0.024	< 0.003 ± 0.024	< 0.003 ± 0.024	< 0.003 ± 0.024
Vinyl chloride	g/m³	< 0.003 ± 0.0031	5.4 ± 1.9	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Haloaromatics in VOC Water by Headspace GC-MS					
Bromobenzene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
2-Chlorotoluene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,2-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032
1,3-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032
1,4-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032
4-Chlorotoluene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,2,3-Trichlorobenzene	g/m³	< 0.003 ± 0.0030	< 0.003 ± 0.0030	< 0.003 ± 0.0030	< 0.003 ± 0.0030
1,2,4-Trichlorobenzene	g/m³	< 0.003 ± 0.0030	< 0.003 ± 0.0030	< 0.003 ± 0.0030	< 0.003 ± 0.0030
1,3,5-Trichlorobenzene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS					
n-Butylbenzene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	0.0194 ± 0.0066	< 0.005 ± 0.0034
tert-Butylbenzene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	0.0032 ± 0.0032	< 0.003 ± 0.0032
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034
Isopropylbenzene (Cumene)	g/m³	< 0.003 ± 0.0031	0.042 ± 0.014	0.134 ± 0.043	< 0.003 ± 0.0031
n-Propylbenzene	g/m³	< 0.005 ± 0.0034	0.0242 ± 0.0096	0.28 ± 0.11	< 0.005 ± 0.0034
sec-Butylbenzene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	0.0173 ± 0.0065	< 0.003 ± 0.0031
Styrene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034
1,2,4-Trimethylbenzene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
1,3,5-Trimethylbenzene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Ketones in VOC Water by Headspace GC-MS					
Acetone	g/m³	< 0.5 ± 0.34	< 0.5 ± 0.34	< 0.5 ± 0.34	< 0.5 ± 0.34
2-Butanone (MEK)	g/m³	< 0.5 ± 0.16	< 0.5 ± 0.16	< 0.5 ± 0.16	< 0.5 ± 0.16
Methyl tert-butylether (MTBE)	g/m³	< 0.003 ± 0.031	< 0.003 ± 0.031	< 0.003 ± 0.031	< 0.003 ± 0.031
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10 ± 0.045	< 0.10 ± 0.045	< 0.10 ± 0.045	< 0.10 ± 0.045
Trihalomethanes in VOC Water by Headspace GC-MS					
Bromodichloromethane	g/m³	< 0.003 ± 0.0031	0.107 ± 0.037	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Bromoform (tribromomethane)	g/m³	< 0.003 ± 0.0030	< 0.003 ± 0.0030	< 0.003 ± 0.0030	< 0.003 ± 0.0030
Chloroform (Trichloromethane)	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Dibromochloromethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031
Other VOC in Water by Headspace GC-MS					
Carbon disulphide	g/m³	< 0.005 ± 0.031	< 0.005 ± 0.031	< 0.005 ± 0.031	< 0.005 ± 0.031
Naphthalene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034

Sample Type: Saline					
Sample Name:		MWE 06-Aug-2018			
Lab Number:		2027205.6			
Individual Tests					
Dissolved Arsenic*	g/m³	< 0.004 ± 0.0027	-	-	-
Dissolved Cadmium*	g/m³	0.00221 ± 0.00051	-	-	-
Dissolved Chromium*	g/m³	< 0.0010 ± 0.00067	-	-	-
Dissolved Copper*	g/m³	< 0.0010 ± 0.00067	-	-	-
Dissolved Lead*	g/m³	0.0039 ± 0.0012	-	-	-
Dissolved Mercury*	g/m³	< 0.00008 ± 0.000054	-	-	-
Dissolved Nickel*	g/m³	< 0.007 ± 0.0041	-	-	-
Dissolved Zinc*	g/m³	< 0.004 ± 0.0027	-	-	-
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m³	0.46 ± 0.14	-	-	-
C10 - C14	g/m³	1.53 ± 0.34	-	-	-
C15 - C36	g/m³	0.85 ± 0.24	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	2.84 ± 0.44	-	-	-
BTEX in VOC Water by Headspace GC-MS					
Benzene	g/m³	< 0.003 ± 0.0032	-	-	-
Ethylbenzene	g/m³	< 0.005 ± 0.0034	-	-	-
Toluene	g/m³	< 0.003 ± 0.0060	-	-	-
m&p-Xylene	g/m³	< 0.005 ± 0.0034	-	-	-
o-Xylene	g/m³	< 0.003 ± 0.0032	-	-	-
Halogenated Aliphatics in VOC Water by Headspace GC-MS					
Bromomethane (Methyl Bromide)	g/m³	< 0.003 ± 0.0031	-	-	-
Carbon tetrachloride	g/m³	< 0.003 ± 0.0031	-	-	-
Chloroethane	g/m³	< 0.003 ± 0.0032	-	-	-
Chloromethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003 ± 0.0028	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003 ± 0.0031	-	-	-
Dibromomethane	g/m³	< 0.003 ± 0.0031	-	-	-
Dichlorodifluoromethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,1-Dichloroethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,2-Dichloroethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,1-Dichloroethene	g/m³	< 0.003 ± 0.0032	-	-	-
cis-1,2-Dichloroethene	g/m³	< 0.003 ± 0.0031	-	-	-
trans-1,2-Dichloroethene	g/m³	< 0.003 ± 0.0031	-	-	-
Dichloromethane (methylene chloride)	g/m³	< 0.10 ± 0.067	-	-	-
1,2-Dichloropropane	g/m³	< 0.003 ± 0.0031	-	-	-
1,3-Dichloropropane	g/m³	< 0.003 ± 0.0031	-	-	-
1,1-Dichloropropene	g/m³	< 0.003 ± 0.0031	-	-	-
cis-1,3-Dichloropropene	g/m³	< 0.005 ± 0.0034	-	-	-
trans-1,3-Dichloropropene	g/m³	< 0.005 ± 0.0034	-	-	-
Hexachlorobutadiene	g/m³	< 0.003 ± 0.0031	-	-	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003 ± 0.0032	-	-	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003 ± 0.0032	-	-	-
1,1,1-Trichloroethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,1,2-Trichloroethane	g/m³	< 0.003 ± 0.0031	-	-	-
Trichloroethene (trichloroethylene)	g/m³	< 0.003 ± 0.0031	-	-	-
Trichlorofluoromethane	g/m³	< 0.003 ± 0.0032	-	-	-
1,2,3-Trichloropropane	g/m³	< 0.003 ± 0.0032	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003 ± 0.024	-	-	-
Vinyl chloride	g/m³	< 0.003 ± 0.0031	-	-	-
Haloaromatics in VOC Water by Headspace GC-MS					
Bromobenzene	g/m³	< 0.003 ± 0.0032	-	-	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003 ± 0.0031	-	-	-
2-Chlorotoluene	g/m³	< 0.003 ± 0.0031	-	-	-

Sample Type: Saline					
Sample Name:		MWE 06-Aug-2018			
Lab Number:		2027205.6			
Haloaromatics in VOC Water by Headspace GC-MS					
1,2-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	-	-	-
1,3-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	-	-	-
1,4-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	-	-	-
4-Chlorotoluene	g/m³	< 0.003 ± 0.0031	-	-	-
1,2,3-Trichlorobenzene	g/m³	< 0.003 ± 0.0030	-	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003 ± 0.0030	-	-	-
1,3,5-Trichlorobenzene	g/m³	< 0.003 ± 0.0031	-	-	-
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS					
n-Butylbenzene	g/m³	0.0184 ± 0.0063	-	-	-
tert-Butylbenzene	g/m³	< 0.003 ± 0.0032	-	-	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005 ± 0.0034	-	-	-
Isopropylbenzene (Cumene)	g/m³	0.126 ± 0.041	-	-	-
n-Propylbenzene	g/m³	0.256 ± 0.097	-	-	-
sec-Butylbenzene	g/m³	0.0159 ± 0.0061	-	-	-
Styrene	g/m³	< 0.005 ± 0.0034	-	-	-
1,2,4-Trimethylbenzene	g/m³	< 0.003 ± 0.0031	-	-	-
1,3,5-Trimethylbenzene	g/m³	< 0.003 ± 0.0031	-	-	-
Ketones in VOC Water by Headspace GC-MS					
Acetone	g/m³	< 0.5 ± 0.34	-	-	-
2-Butanone (MEK)	g/m³	< 0.5 ± 0.16	-	-	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003 ± 0.031	-	-	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10 ± 0.045	-	-	-
Trihalomethanes in VOC Water by Headspace GC-MS					
Bromodichloromethane	g/m³	< 0.003 ± 0.0031	-	-	-
Bromoform (tribromomethane)	g/m³	< 0.003 ± 0.0030	-	-	-
Chloroform (Trichloromethane)	g/m³	< 0.003 ± 0.0031	-	-	-
Dibromochloromethane	g/m³	< 0.003 ± 0.0031	-	-	-
Other VOC in Water by Headspace GC-MS					
Carbon disulphide	g/m³	< 0.005 ± 0.031	-	-	-
Naphthalene	g/m³	< 0.005 ± 0.0034	-	-	-

Sample Type: Aqueous					
Sample Name:		GBH107 06-Aug-2018 3:30 pm	CBH202 - Product 1 06-Aug-2018	CBH202 - Product 2 06-Aug-2018	
Lab Number:		2027205.1	2027205.7	2027205.8	
Individual Tests					
pH	pH Units	6.6 ± 0.2	-	-	-
Electrical Conductivity (EC)	mS/m	115.3 ± 2.4	-	-	-
Total Dissolved Solids (TDS)	g/m³	890 ± 110	-	-	-
Dissolved Mercury	g/m³	< 0.00008 ± 0.000054	-	-	-
Total Cyanide	g/m³	0.023	-	-	-
Chloride	g/m³	55.2 ± 3.4	-	-	-
Sulphate	g/m³	425 ± 26	-	-	-
Free Product GC Scan by FID					
Free Product*	mL/100mL	-	100	2.3	-
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn					
Dissolved Arsenic	g/m³	< 0.0010 ± 0.00067	-	-	-
Dissolved Cadmium	g/m³	< 0.00005 ± 0.000034	-	-	-
Dissolved Chromium	g/m³	< 0.0005 ± 0.00034	-	-	-
Dissolved Copper	g/m³	< 0.0005 ± 0.00034	-	-	-
Dissolved Lead	g/m³	< 0.00010 ± 0.000067	-	-	-
Dissolved Nickel	g/m³	0.00165 ± 0.00034	-	-	-
Dissolved Zinc	g/m³	0.00174 ± 0.00068	-	-	-

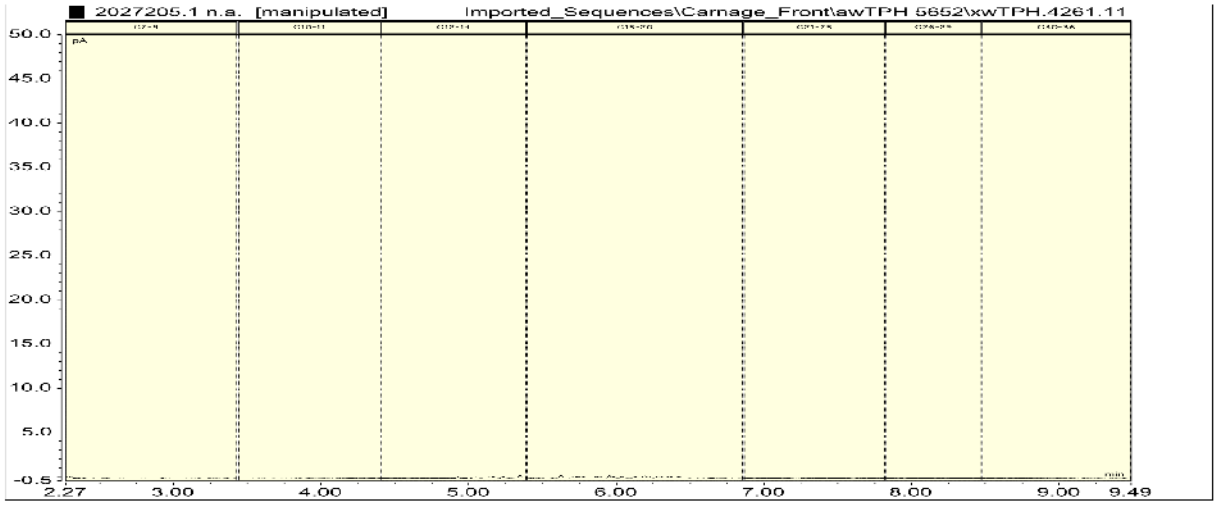
Sample Type: Aqueous					
Sample Name:		GBH107 06-Aug-2018 3:30 pm	CBH202 - Product 1 06-Aug-2018	CBH202 - Product 2 06-Aug-2018	
Lab Number:		2027205.1	2027205.7	2027205.8	
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq					
Acenaphthene	g/m³	< 0.00010 ± 0.000067	-	-	-
Acenaphthylene	g/m³	< 0.00010 ± 0.000067	-	-	-
Anthracene	g/m³	< 0.00010 ± 0.000067	-	-	-
Benzo[a]anthracene	g/m³	< 0.00010 ± 0.000067	-	-	-
Benzo[a]pyrene (BAP)	g/m³	< 0.00010 ± 0.000067	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	< 0.00010 ± 0.000067	-	-	-
Benzo[g,h,i]perylene	g/m³	< 0.00010 ± 0.000067	-	-	-
Benzo[k]fluoranthene	g/m³	< 0.00010 ± 0.000067	-	-	-
Chrysene	g/m³	< 0.00010 ± 0.000067	-	-	-
Dibenzo[a,h]anthracene	g/m³	< 0.00010 ± 0.000067	-	-	-
Fluoranthene	g/m³	0.000181 ± 0.000078	-	-	-
Fluorene	g/m³	< 0.0002 ± 0.00011	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.00010 ± 0.000067	-	-	-
Naphthalene	g/m³	< 0.0010 ± 0.00067	-	-	-
Phenanthrene	g/m³	0.00076 ± 0.00024	-	-	-
Pyrene	g/m³	< 0.0002 ± 0.000097	-	-	-
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m³	< 0.06 ± 0.041	-	-	-
C10 - C14	g/m³	< 0.2 ± 0.095	-	-	-
C15 - C36	g/m³	< 0.4 ± 0.12	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7 ± 0.16	-	-	-
BTEX in VOC Water by Headspace GC-MS					
Benzene	g/m³	< 0.003 ± 0.0032	-	-	-
Ethylbenzene	g/m³	< 0.005 ± 0.0034	-	-	-
Toluene	g/m³	< 0.003 ± 0.0060	-	-	-
m&p-Xylene	g/m³	< 0.005 ± 0.0034	-	-	-
o-Xylene	g/m³	< 0.003 ± 0.0032	-	-	-
Halogenated Aliphatics in VOC Water by Headspace GC-MS					
Bromomethane (Methyl Bromide)	g/m³	< 0.003 ± 0.0031	-	-	-
Carbon tetrachloride	g/m³	< 0.003 ± 0.0031	-	-	-
Chloroethane	g/m³	< 0.003 ± 0.0032	-	-	-
Chloromethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003 ± 0.0028	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003 ± 0.0031	-	-	-
Dibromomethane	g/m³	< 0.003 ± 0.0031	-	-	-
Dichlorodifluoromethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,1-Dichloroethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,2-Dichloroethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,1-Dichloroethene	g/m³	< 0.003 ± 0.0032	-	-	-
cis-1,2-Dichloroethene	g/m³	< 0.003 ± 0.0031	-	-	-
trans-1,2-Dichloroethene	g/m³	< 0.003 ± 0.0031	-	-	-
Dichloromethane (methylene chloride)	g/m³	< 0.10 ± 0.067	-	-	-
1,2-Dichloropropane	g/m³	< 0.003 ± 0.0031	-	-	-
1,3-Dichloropropane	g/m³	< 0.003 ± 0.0031	-	-	-
1,1-Dichloropropene	g/m³	< 0.003 ± 0.0031	-	-	-
cis-1,3-Dichloropropene	g/m³	< 0.005 ± 0.0034	-	-	-
trans-1,3-Dichloropropene	g/m³	< 0.005 ± 0.0034	-	-	-
Hexachlorobutadiene	g/m³	< 0.003 ± 0.0031	-	-	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003 ± 0.0032	-	-	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003 ± 0.0032	-	-	-
1,1,1-Trichloroethane	g/m³	< 0.003 ± 0.0031	-	-	-
1,1,2-Trichloroethane	g/m³	< 0.003 ± 0.0031	-	-	-

Sample Type: Aqueous					
Sample Name:		GBH107 06-Aug-2018 3:30 pm	CBH202 - Product 1 06-Aug-2018	CBH202 - Product 2 06-Aug-2018	
Lab Number:		2027205.1	2027205.7	2027205.8	
Halogenated Aliphatics in VOC Water by Headspace GC-MS					
Trichloroethene (trichloroethylene)	g/m³	< 0.003 ± 0.0031	-	-	-
Trichlorofluoromethane	g/m³	< 0.003 ± 0.0032	-	-	-
1,2,3-Trichloropropane	g/m³	< 0.003 ± 0.0032	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003 ± 0.024	-	-	-
Vinyl chloride	g/m³	< 0.003 ± 0.0031	-	-	-
Haloaromatics in VOC Water by Headspace GC-MS					
Bromobenzene	g/m³	< 0.003 ± 0.0032	-	-	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003 ± 0.0031	-	-	-
2-Chlorotoluene	g/m³	< 0.003 ± 0.0031	-	-	-
1,2-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	-	-	-
1,3-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	-	-	-
1,4-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	-	-	-
4-Chlorotoluene	g/m³	< 0.003 ± 0.0031	-	-	-
1,2,3-Trichlorobenzene	g/m³	< 0.003 ± 0.0030	-	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003 ± 0.0030	-	-	-
1,3,5-Trichlorobenzene	g/m³	< 0.003 ± 0.0031	-	-	-
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS					
n-Butylbenzene	g/m³	< 0.005 ± 0.0034	-	-	-
tert-Butylbenzene	g/m³	< 0.003 ± 0.0032	-	-	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005 ± 0.0034	-	-	-
Isopropylbenzene (Cumene)	g/m³	< 0.003 ± 0.0031	-	-	-
n-Propylbenzene	g/m³	< 0.005 ± 0.0034	-	-	-
sec-Butylbenzene	g/m³	< 0.003 ± 0.0031	-	-	-
Styrene	g/m³	< 0.005 ± 0.0034	-	-	-
1,2,4-Trimethylbenzene	g/m³	< 0.003 ± 0.0031	-	-	-
1,3,5-Trimethylbenzene	g/m³	< 0.003 ± 0.0031	-	-	-
Ketones in VOC Water by Headspace GC-MS					
Acetone	g/m³	< 0.5 ± 0.34	-	-	-
2-Butanone (MEK)	g/m³	< 0.5 ± 0.16	-	-	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003 ± 0.031	-	-	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10 ± 0.045	-	-	-
Trihalomethanes in VOC Water by Headspace GC-MS					
Bromodichloromethane	g/m³	< 0.003 ± 0.0031	-	-	-
Bromoform (tribromomethane)	g/m³	< 0.003 ± 0.0030	-	-	-
Chloroform (Trichloromethane)	g/m³	< 0.003 ± 0.0031	-	-	-
Dibromochloromethane	g/m³	< 0.003 ± 0.0031	-	-	-
Other VOC in Water by Headspace GC-MS					
Carbon disulphide	g/m³	< 0.005 ± 0.031	-	-	-
Naphthalene	g/m³	< 0.005 ± 0.0034	-	-	-

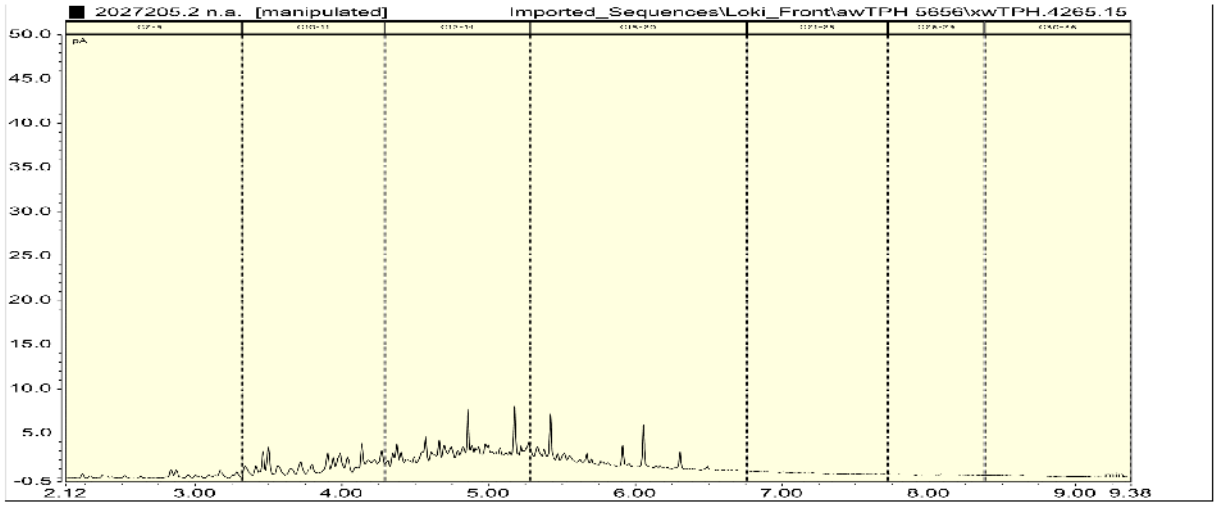
The reported uncertainty is an expanded uncertainty with a level of confidence of approximately 95 percent (i.e. two standard deviations, calculated using a coverage factor of 2). Reported uncertainties are calculated from the performance of typical matrices, and do not include variation due to sampling.

For further information on uncertainty of measurement at Hill Laboratories, refer to the technical note on our website: www.hill-laboratories.com/files/Intro_To_UOM.pdf, or contact the laboratory.

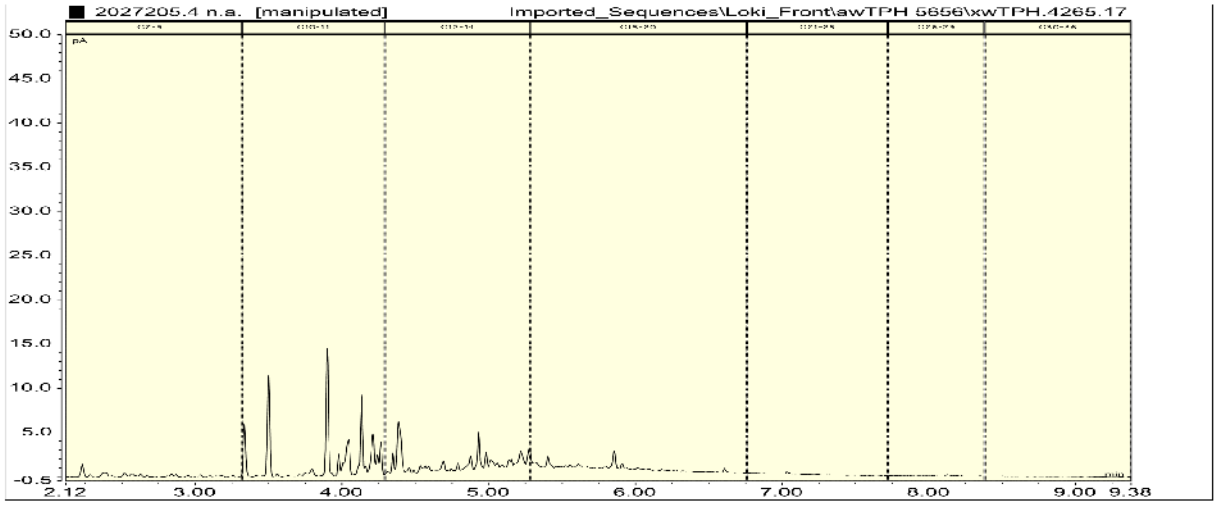
2027205.1
GBH107 06-Aug-2018 3:30 pm
Client Chromatogram for TPH by FID



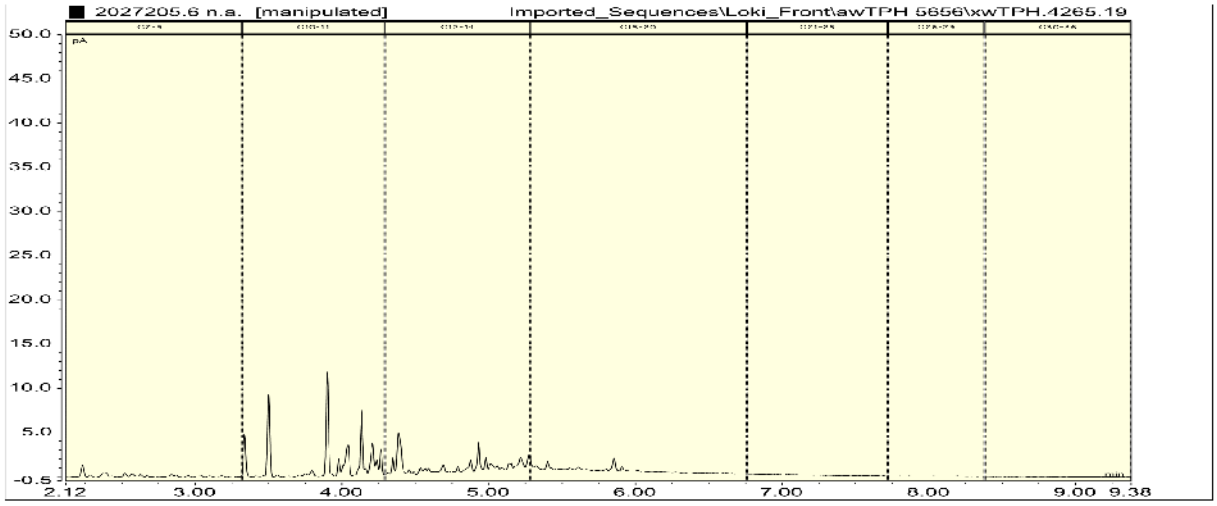
2027205.2
CBH202 06-Aug-2018 10:30 am
Client Chromatogram for TPH by FID



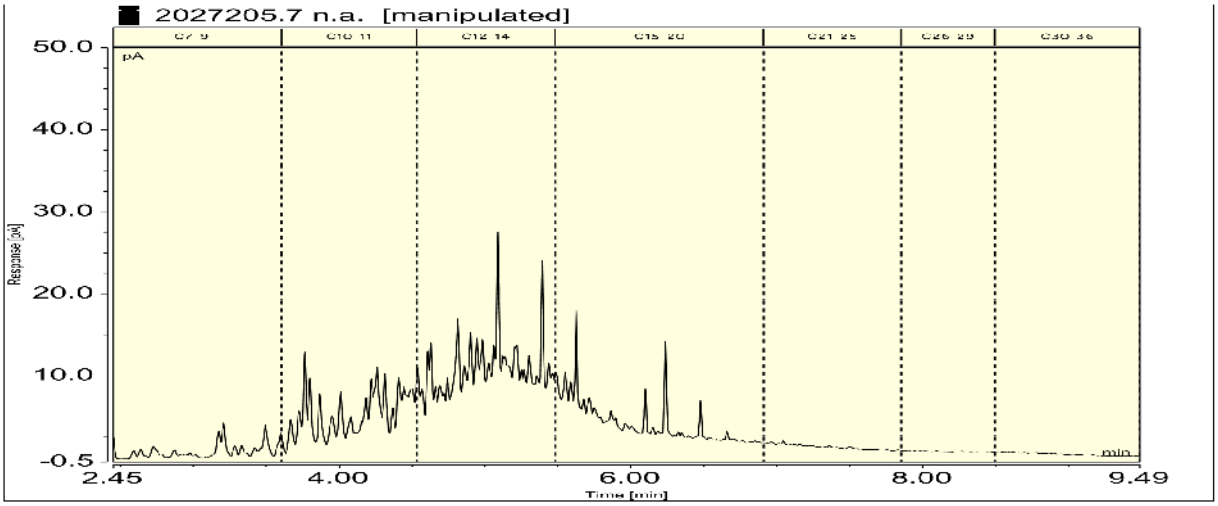
2027205.4
GBH103 06-Aug-2018 1:10 pm
Client Chromatogram for TPH by FID



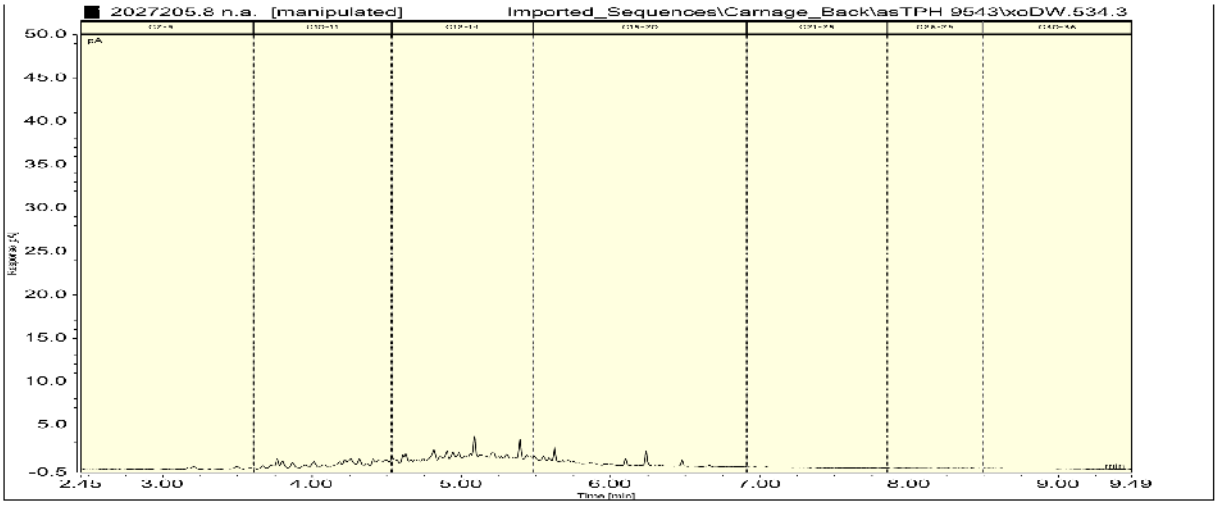
2027205.6
MWE 06-Aug-2018
Client Chromatogram for TPH by FID



2027205.7
CBH202 - Product 1 06-Aug-2018
Client Chromatogram for GC Scan



2027205.8
CBH202 - Product 2 06-Aug-2018
Client Chromatogram for GC Scan



Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier certificate issued on 20 Aug 2018 at 2:36 pm
Reason for amendment: Sample ID amendments.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Saline

Test	Method Description	Default Detection Limit	Sample No
Polychlorinated Biphenyls Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS analysis	0.00010 - 0.005 g/m^3	3, 5
pH*	Saline water, pH meter. APHA 4500-H$^+$ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	2-5
Electrical Conductivity (EC)*	Saline water, Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.10 mS/m	2-5
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	50 g/m^3	2-5
Dissolved Arsenic*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m^3	2-6
Dissolved Cadmium*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0002 g/m^3	2-6
Dissolved Chromium*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	2-6
Dissolved Copper*	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	2-6
Dissolved Lead*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	2-6
Dissolved Nickel*	Filtered sample, ICP-MS with universal cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.007 g/m^3	2-6
Dissolved Zinc*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m^3	2-6

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Client Chromatogram for GC Scan*	.	-	7-8
Free Product GC Scan by FID*	Dilution of free product in organic solvent	1.0 mL/100mL	7-8
Volume of Free Product present in TPH Water samples*	Volumes estimated using Measuring Cylinder.	1.0 mL/100mL	7-8
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00005 - 0.0010 g/m^3	1
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.00010 - 0.0005 g/m^3	1-5
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m^3	1-6
Volatile Organic Compounds Screening in Water by Headspace GC-MS	Headspace, GC-MS SIM analysis [KBIs:37857,37921]	0.003 - 0.5 g/m^3	1-6
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-5
pH	pH meter. APHA 4500-H$^+$ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	1
Total Dissolved Solids (TDS)	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	10 g/m^3	1
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	1-6
Dissolved Mercury	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m^3	1-6

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Cyanide Trace	On-line distillation, colorimetry, trace level. ISO 14403:2012(E) (modified).	0.002 g/m^3	1-5
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1-5
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	1-5
C7 - C9	Head Space, GCMS analysis.	0.06 g/m^3	1-6

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Kim Harrison MSc
Client Services Manager - Environmental

Hill Laboratories
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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2031679 SPv1
Contact:	Lucy Hine	**Date Received:**	15-Aug-2018
	C/- Tonkin & Taylor	**Date Reported:**	22-Aug-2018
	PO Box 13055	**Quote No:**	92235
	Christchurch 8141	**Order No:**	30881.2
		Client Reference:	30881.2000
		Submitted By:	Melody Robyns

Sample Type: Saline

		Sample Name:	Existing MW1 14-Aug-2018				
		Lab Number:	2031679.4				
Individual Tests							
pH*	pH Units		7.5	-	-	-	-
Electrical Conductivity (EC)*	mS/m		2,880	-	-	-	-
Total Dissolved Solids (TDS)*	g/m³		19,100	-	-	-	-
Dissolved Arsenic*	g/m³		< 0.004	-	-	-	-
Dissolved Cadmium*	g/m³		< 0.0002	-	-	-	-
Dissolved Chromium*	g/m³		< 0.0010	-	-	-	-
Dissolved Copper*	g/m³		< 0.0010	-	-	-	-
Dissolved Lead*	g/m³		< 0.0010	-	-	-	-
Dissolved Mercury*	g/m³		< 0.00008	-	-	-	-
Dissolved Nickel*	g/m³		< 0.007	-	-	-	-
Dissolved Zinc*	g/m³		< 0.004	-	-	-	-
Total Cyanide*	g/m³		< 0.02	-	-	-	-
Chloride*	g/m³		9,600	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq							
Acenaphthene*	g/m³		0.00014	-	-	-	-
Acenaphthylene*	g/m³		< 0.00010	-	-	-	-
Anthracene*	g/m³		< 0.00010	-	-	-	-
Benzo[a]anthracene*	g/m³		< 0.00010	-	-	-	-
Benzo[a]pyrene (BAP)*	g/m³		< 0.00010	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene*	g/m³		0.00018	-	-	-	-
Benzo[g,h,i]perylene*	g/m³		0.00015	-	-	-	-
Benzo[k]fluoranthene*	g/m³		< 0.00010	-	-	-	-
Chrysene*	g/m³		< 0.00010	-	-	-	-
Dibenzo[a,h]anthracene*	g/m³		< 0.00010	-	-	-	-
Fluoranthene*	g/m³		0.00021	-	-	-	-
Fluorene*	g/m³		< 0.0002	-	-	-	-
Indeno(1,2,3-c,d)pyrene*	g/m³		0.00013	-	-	-	-
Naphthalene*	g/m³		< 0.0005	-	-	-	-
Phenanthrene*	g/m³		< 0.0004	-	-	-	-
Pyrene*	g/m³		0.0002	-	-	-	-
Total Petroleum Hydrocarbons in Water							
C7 - C9	g/m³		0.24	-	-	-	-
C10 - C14*	g/m³		12.2	-	-	-	-
C15 - C36*	g/m³		11.9	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m³		24	-	-	-	-

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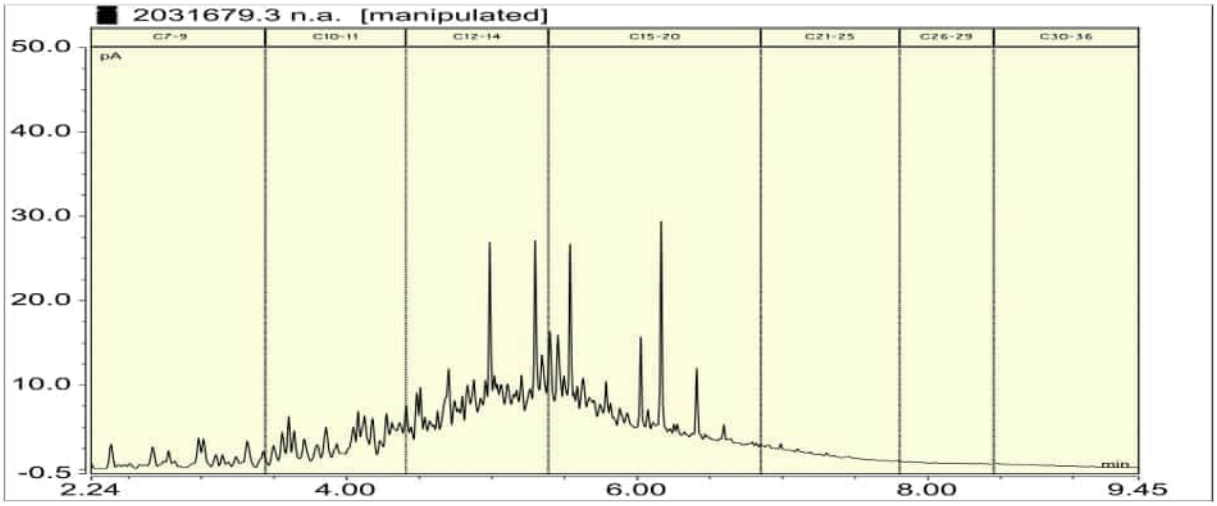
This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported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

Sample Type: Saline						
Sample Name:		Existing MW1 14-Aug-2018				
Lab Number:		2031679.4				
BTEX in VOC Water by Headspace GC-MS						
Benzene	g/m³	< 0.003	-	-	-	-
Ethylbenzene	g/m³	< 0.005	-	-	-	-
Toluene	g/m³	< 0.003	-	-	-	-
m&p-Xylene	g/m³	< 0.005	-	-	-	-
o-Xylene	g/m³	< 0.003	-	-	-	-
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
Bromomethane (Methyl Bromide)	g/m³	< 0.003	-	-	-	-
Carbon tetrachloride	g/m³	< 0.003	-	-	-	-
Chloroethane	g/m³	< 0.003	-	-	-	-
Chloromethane	g/m³	< 0.003	-	-	-	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003	-	-	-	-
Dibromomethane	g/m³	< 0.003	-	-	-	-
Dichlorodifluoromethane	g/m³	< 0.003	-	-	-	-
1,1-Dichloroethane	g/m³	< 0.003	-	-	-	-
1,2-Dichloroethane	g/m³	< 0.003	-	-	-	-
1,1-Dichloroethene	g/m³	< 0.003	-	-	-	-
cis-1,2-Dichloroethene	g/m³	< 0.003	-	-	-	-
trans-1,2-Dichloroethene	g/m³	< 0.003	-	-	-	-
Dichloromethane (methylene chloride)	g/m³	< 0.10	-	-	-	-
1,2-Dichloropropane	g/m³	< 0.003	-	-	-	-
1,3-Dichloropropane	g/m³	< 0.003	-	-	-	-
1,1-Dichloropropene	g/m³	< 0.003	-	-	-	-
cis-1,3-Dichloropropene	g/m³	< 0.005	-	-	-	-
trans-1,3-Dichloropropene	g/m³	< 0.005	-	-	-	-
Hexachlorobutadiene	g/m³	< 0.003	-	-	-	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003	-	-	-	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003	-	-	-	-
1,1,1-Trichloroethane	g/m³	< 0.003	-	-	-	-
1,1,2-Trichloroethane	g/m³	< 0.003	-	-	-	-
Trichloroethene (trichloroethylene)	g/m³	< 0.003	-	-	-	-
Trichlorofluoromethane	g/m³	< 0.003	-	-	-	-
1,2,3-Trichloropropane	g/m³	< 0.003	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003	-	-	-	-
Vinyl chloride	g/m³	< 0.003	-	-	-	-
Haloaromatics in VOC Water by Headspace GC-MS						
Bromobenzene	g/m³	< 0.003	-	-	-	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003	-	-	-	-
2-Chlorotoluene	g/m³	< 0.003	-	-	-	-
1,2-Dichlorobenzene	g/m³	< 0.003	-	-	-	-
1,3-Dichlorobenzene	g/m³	< 0.003	-	-	-	-
1,4-Dichlorobenzene	g/m³	< 0.003	-	-	-	-
4-Chlorotoluene	g/m³	< 0.003	-	-	-	-
1,2,3-Trichlorobenzene	g/m³	< 0.003	-	-	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003	-	-	-	-
1,3,5-Trichlorobenzene	g/m³	< 0.003	-	-	-	-
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
n-Butylbenzene	g/m³	< 0.005	-	-	-	-
tert-Butylbenzene	g/m³	< 0.003	-	-	-	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005	-	-	-	-
Isopropylbenzene (Cumene)	g/m³	0.058	-	-	-	-
n-Propylbenzene	g/m³	0.008	-	-	-	-
sec-Butylbenzene	g/m³	0.004	-	-	-	-

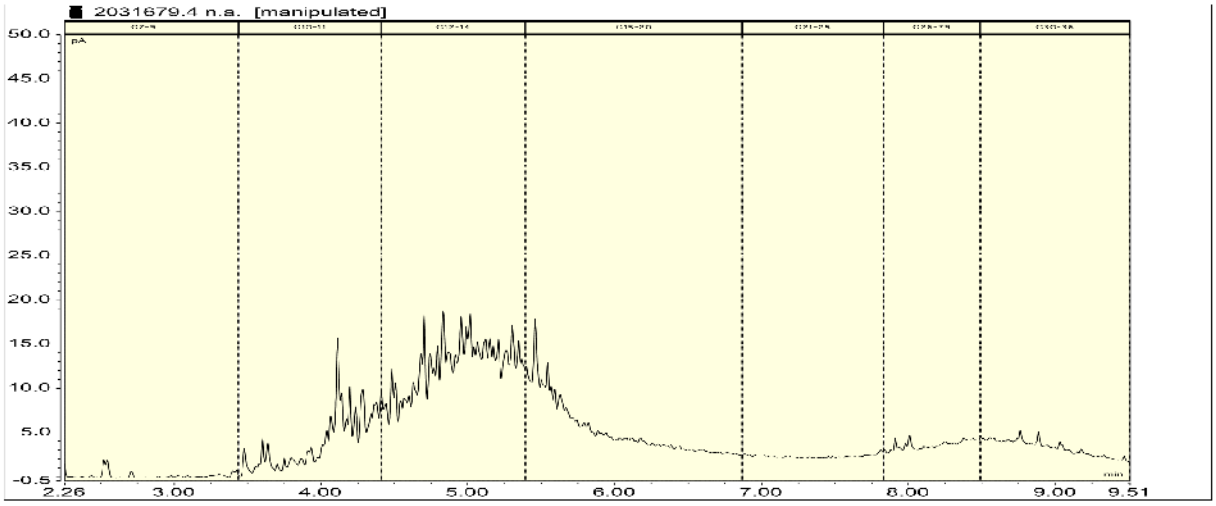
Sample Type: Saline						
Sample Name:		Existing MW1 14-Aug-2018				
Lab Number:		2031679.4				
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
Styrene	g/m³	< 0.005	-	-	-	-
1,2,4-Trimethylbenzene	g/m³	< 0.003	-	-	-	-
1,3,5-Trimethylbenzene	g/m³	< 0.003	-	-	-	-
Ketones in VOC Water by Headspace GC-MS						
Acetone	g/m³	< 0.5	-	-	-	-
2-Butanone (MEK)	g/m³	< 0.5	-	-	-	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003	-	-	-	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10	-	-	-	-
Trihalomethanes in VOC Water by Headspace GC-MS						
Bromodichloromethane	g/m³	< 0.003	-	-	-	-
Bromoform (tribromomethane)	g/m³	< 0.003	-	-	-	-
Chloroform (Trichloromethane)	g/m³	< 0.003	-	-	-	-
Dibromochloromethane	g/m³	< 0.003	-	-	-	-
Other VOC in Water by Headspace GC-MS						
Carbon disulphide	g/m³	< 0.005	-	-	-	-
Naphthalene	g/m³	< 0.005	-	-	-	-

Sample Type: Aqueous						
Sample Name:		Product 7 14-Aug-2018				
Lab Number:		2031679.3				
Free Product GC Scan by FID						
Free Product*	mL/100mL	81	-	-	-	-

2031679.3
Product 7 14-Aug-2018
Client Chromatogram for GC Scan



2031679.4
Existing MW1 14-Aug-2018
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Saline

Test	Method Description	Default Detection Limit	Sample No
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq*	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.00010 - 0.0005 g/m^3	4
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m^3	4
Volatile Organic Compounds Screening in Water by Headspace GC-MS	Headspace, GC-MS SIM analysis [KBIs:37857,37921]	0.003 - 0.5 g/m^3	4
pH*	Saline water, pH meter. APHA 4500-H$^+$ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	4
Electrical Conductivity (EC)*	Saline water, Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.10 mS/m	4
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	50 g/m^3	4
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	4
Dissolved Arsenic*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m^3	4
Dissolved Cadmium*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0002 g/m^3	4
Dissolved Chromium*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	4
Dissolved Copper*	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	4
Dissolved Lead*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	4
Dissolved Mercury*	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m^3	4
Dissolved Nickel*	Filtered sample, ICP-MS with universal cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.007 g/m^3	4
Dissolved Zinc*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m^3	4
Total Cyanide Trace*	On-line distillation, colorimetry, trace level. ISO 14403:2012(E) (modified).	0.002 g/m^3	4
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	4

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
C7 - C9	Head Space, GCMS analysis.	0.06 g/m^3	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Client Chromatogram for GC Scan*	.	-	3
Free Product GC Scan by FID*	Dilution of free product in organic solvent	1.0 mL/100mL	3
Volume of Free Product present in TPH Water samples*	Volumes estimated using Measuring Cylinder.	1.0 mL/100mL	3

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

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

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Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2031679	SPv2
Contact:	Lucy Hine	**Date Received:**	15-Aug-2018	
	C/- Tonkin & Taylor	**Date Reported:**	03-Sep-2018	**(Amended)**
	PO Box 13055	**Quote No:**	92235	
	Christchurch 8141	**Order No:**	30881.2	
		Client Reference:	30881.2000	
		Submitted By:	Melody Robyns	

Sample Type: Saline

Sample Name:		Existing MW1 14-Aug-2018				
Lab Number:		2031679.4				
Individual Tests						
pH*	pH Units	7.5	-	-	-	-
Electrical Conductivity (EC)*	mS/m	2,880	-	-	-	-
Total Dissolved Solids (TDS)*	g/m³	19,100	-	-	-	-
Dissolved Arsenic*	g/m³	< 0.004	-	-	-	-
Dissolved Cadmium*	g/m³	< 0.0002	-	-	-	-
Dissolved Chromium*	g/m³	< 0.0010	-	-	-	-
Dissolved Copper*	g/m³	< 0.0010	-	-	-	-
Dissolved Lead*	g/m³	< 0.0010	-	-	-	-
Dissolved Mercury*	g/m³	< 0.00008	-	-	-	-
Dissolved Nickel*	g/m³	< 0.007	-	-	-	-
Dissolved Zinc*	g/m³	< 0.004	-	-	-	-
Total Cyanide*	g/m³	< 0.02	-	-	-	-
Chloride*	g/m³	9,600	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq						
Acenaphthene*	g/m³	0.00014	-	-	-	-
Acenaphthylene*	g/m³	< 0.00010	-	-	-	-
Anthracene*	g/m³	< 0.00010	-	-	-	-
Benzo[a]anthracene*	g/m³	< 0.00010	-	-	-	-
Benzo[a]pyrene (BAP)*	g/m³	< 0.00010	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene*	g/m³	0.00018	-	-	-	-
Benzo[g,h,i]perylene*	g/m³	0.00015	-	-	-	-
Benzo[k]fluoranthene*	g/m³	< 0.00010	-	-	-	-
Chrysene*	g/m³	< 0.00010	-	-	-	-
Dibenzo[a,h]anthracene*	g/m³	< 0.00010	-	-	-	-
Fluoranthene*	g/m³	0.00021	-	-	-	-
Fluorene*	g/m³	< 0.0002	-	-	-	-
Indeno(1,2,3-c,d)pyrene*	g/m³	0.00013	-	-	-	-
Naphthalene*	g/m³	< 0.0005	-	-	-	-
Phenanthrene*	g/m³	< 0.0004	-	-	-	-
Pyrene*	g/m³	0.0002	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	0.24	-	-	-	-
C10 - C14*	g/m³	12.2	-	-	-	-
C15 - C36*	g/m³	11.9	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	24	-	-	-	-

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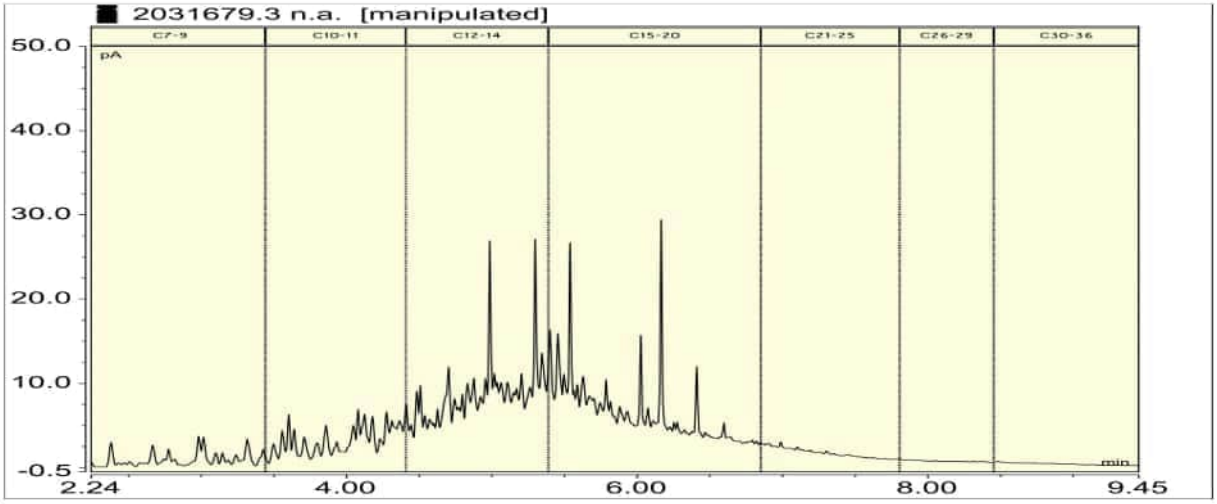
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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Saline						
Sample Name:		Existing MW1 14-Aug-2018				
Lab Number:		2031679.4				
BTEX in VOC Water by Headspace GC-MS						
Benzene	g/m³	< 0.003	-	-	-	-
Ethylbenzene	g/m³	< 0.005	-	-	-	-
Toluene	g/m³	< 0.003	-	-	-	-
m&p-Xylene	g/m³	< 0.005	-	-	-	-
o-Xylene	g/m³	< 0.003	-	-	-	-
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
Bromomethane (Methyl Bromide)	g/m³	< 0.003	-	-	-	-
Carbon tetrachloride	g/m³	< 0.003	-	-	-	-
Chloroethane	g/m³	< 0.003	-	-	-	-
Chloromethane	g/m³	< 0.003	-	-	-	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003	-	-	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003	-	-	-	-
Dibromomethane	g/m³	< 0.003	-	-	-	-
Dichlorodifluoromethane	g/m³	< 0.003	-	-	-	-
1,1-Dichloroethane	g/m³	< 0.003	-	-	-	-
1,2-Dichloroethane	g/m³	< 0.003	-	-	-	-
1,1-Dichloroethene	g/m³	< 0.003	-	-	-	-
cis-1,2-Dichloroethene	g/m³	< 0.003	-	-	-	-
trans-1,2-Dichloroethene	g/m³	< 0.003	-	-	-	-
Dichloromethane (methylene chloride)	g/m³	< 0.10	-	-	-	-
1,2-Dichloropropane	g/m³	< 0.003	-	-	-	-
1,3-Dichloropropane	g/m³	< 0.003	-	-	-	-
1,1-Dichloropropene	g/m³	< 0.003	-	-	-	-
cis-1,3-Dichloropropene	g/m³	< 0.005	-	-	-	-
trans-1,3-Dichloropropene	g/m³	< 0.005	-	-	-	-
Hexachlorobutadiene	g/m³	< 0.003	-	-	-	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003	-	-	-	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003	-	-	-	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003	-	-	-	-
1,1,1-Trichloroethane	g/m³	< 0.003	-	-	-	-
1,1,2-Trichloroethane	g/m³	< 0.003	-	-	-	-
Trichloroethene (trichloroethylene)	g/m³	< 0.003	-	-	-	-
Trichlorofluoromethane	g/m³	< 0.003	-	-	-	-
1,2,3-Trichloropropane	g/m³	< 0.003	-	-	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003	-	-	-	-
Vinyl chloride	g/m³	< 0.003	-	-	-	-
Haloaromatics in VOC Water by Headspace GC-MS						
Bromobenzene	g/m³	< 0.003	-	-	-	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003	-	-	-	-
2-Chlorotoluene	g/m³	< 0.003	-	-	-	-
1,2-Dichlorobenzene	g/m³	< 0.003	-	-	-	-
1,3-Dichlorobenzene	g/m³	< 0.003	-	-	-	-
1,4-Dichlorobenzene	g/m³	< 0.003	-	-	-	-
4-Chlorotoluene	g/m³	< 0.003	-	-	-	-
1,2,3-Trichlorobenzene	g/m³	< 0.003	-	-	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003	-	-	-	-
1,3,5-Trichlorobenzene	g/m³	< 0.003	-	-	-	-
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
n-Butylbenzene	g/m³	< 0.005	-	-	-	-
tert-Butylbenzene	g/m³	< 0.003	-	-	-	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005	-	-	-	-
Isopropylbenzene (Cumene)	g/m³	0.058	-	-	-	-
n-Propylbenzene	g/m³	0.008	-	-	-	-
sec-Butylbenzene	g/m³	0.004	-	-	-	-

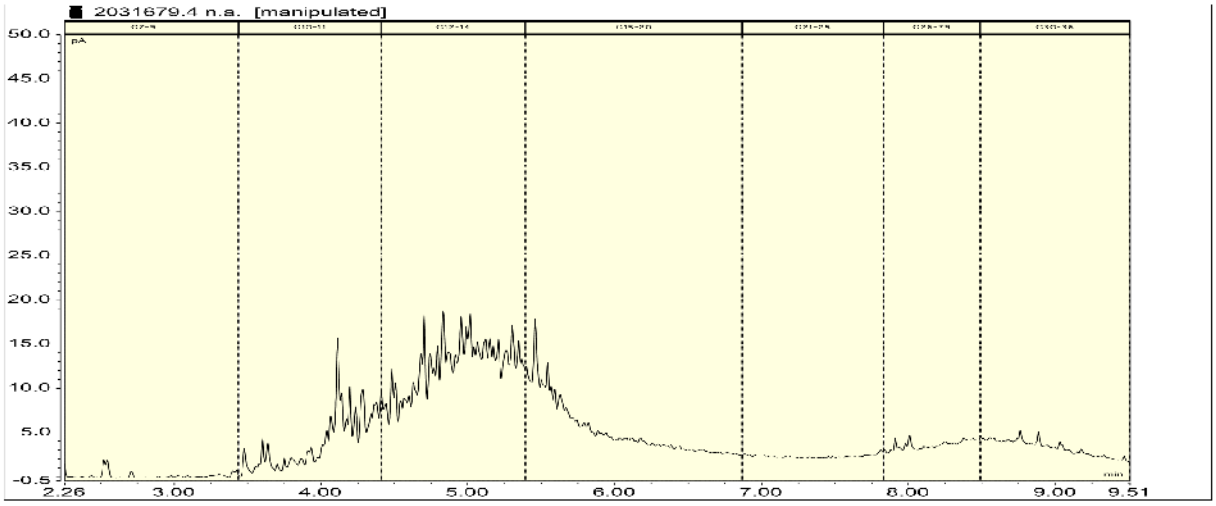
Sample Type: Saline						
Sample Name:		Existing MW1 14-Aug-2018				
Lab Number:		2031679.4				
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
Styrene	g/m³	< 0.005	-	-	-	-
1,2,4-Trimethylbenzene	g/m³	< 0.003	-	-	-	-
1,3,5-Trimethylbenzene	g/m³	< 0.003	-	-	-	-
Ketones in VOC Water by Headspace GC-MS						
Acetone	g/m³	< 0.5	-	-	-	-
2-Butanone (MEK)	g/m³	< 0.5	-	-	-	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003	-	-	-	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10	-	-	-	-
Trihalomethanes in VOC Water by Headspace GC-MS						
Bromodichloromethane	g/m³	< 0.003	-	-	-	-
Bromoform (tribromomethane)	g/m³	< 0.003	-	-	-	-
Chloroform (Trichloromethane)	g/m³	< 0.003	-	-	-	-
Dibromochloromethane	g/m³	< 0.003	-	-	-	-
Other VOC in Water by Headspace GC-MS						
Carbon disulphide	g/m³	< 0.005	-	-	-	-
Naphthalene	g/m³	< 0.005	-	-	-	-

Sample Type: Aqueous						
Sample Name:		GBH106 - Product 14-Aug-2018				
Lab Number:		2031679.3				
Free Product GC Scan by FID						
Free Product*	mL/100mL	81	-	-	-	-

2031679.3
GBH106 - Product 14-Aug-2018
Client Chromatogram for GC Scan



2031679.4
Existing MW1 14-Aug-2018
Client Chromatogram for TPH by FID



Analyst's Comments

Amended Report: This certificate of analysis replaces an earlier certificate issued on 22 Aug 2018 at 2:14 pm
Reason for amendment: Sample ID amendments.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Saline

Test	Method Description	Default Detection Limit	Sample No
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq*	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.00010 - 0.0005 g/m^3	4
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m^3	4
Volatile Organic Compounds Screening in Water by Headspace GC-MS	Headspace, GC-MS SIM analysis [KBIs:37857,37921]	0.003 - 0.5 g/m^3	4
pH*	Saline water, pH meter. APHA 4500-H$^+$ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	4
Electrical Conductivity (EC)*	Saline water, Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.10 mS/m	4
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	50 g/m^3	4
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	4
Dissolved Arsenic*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m^3	4
Dissolved Cadmium*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0002 g/m^3	4
Dissolved Chromium*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	4
Dissolved Copper*	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	4
Dissolved Lead*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0010 g/m^3	4
Dissolved Mercury*	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m^3	4
Dissolved Nickel*	Filtered sample, ICP-MS with universal cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.007 g/m^3	4
Dissolved Zinc*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m^3	4

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Cyanide Trace*	On-line distillation, colorimetry, trace level. ISO 14403:2012(E) (modified).	0.002 g/m^3	4
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m^3	4
C7 - C9	Head Space, GCMS analysis.	0.06 g/m^3	4

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Client Chromatogram for GC Scan*	.	-	3
Free Product GC Scan by FID*	Dilution of free product in organic solvent	1.0 mL/100mL	3
Volume of Free Product present in TPH Water samples*	Volumes estimated using Measuring Cylinder.	1.0 mL/100mL	3

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

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

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Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2036924	SPv1
Contact:	Lucy Hine	**Date Received:**	23-Aug-2018	
	C/- Tonkin & Taylor	**Date Reported:**	30-Aug-2018	
	PO Box 13055	**Quote No:**		
	Christchurch 8141	**Order No:**	30881.2	
		Client Reference:	30881.2	
		Submitted By:	Sami Hutchings	

Sample Type: Saline

Sample Name:		mw3 23-Aug-2018 1:20 pm	mw4 23-Aug-2018 12:00 pm	mw2 23-Aug-2018 2:30 pm		
Lab Number:		2036924.1	2036924.2	2036924.3		
Individual Tests						
pH*	pH Units	7.5	7.7	6.4	-	-
Electrical Conductivity (EC)*	mS/m	4,230	4,840	2,310	-	-
Total Dissolved Solids (TDS)*	g/m³	29,000	34,000	15,300	-	-
Dissolved Arsenic*	g/m³	< 0.004	< 0.004	< 0.004	-	-
Dissolved Cadmium*	g/m³	< 0.0002	< 0.0002	0.0008	-	-
Dissolved Chromium*	g/m³	0.0011	0.0015	< 0.0010	-	-
Dissolved Copper*	g/m³	< 0.0010	0.098	0.65	-	-
Dissolved Lead*	g/m³	< 0.0010	0.0028	< 0.0010	-	-
Dissolved Mercury*	g/m³	< 0.00008	< 0.00008	< 0.00008	-	-
Dissolved Nickel*	g/m³	< 0.007	< 0.007	0.052	-	-
Dissolved Zinc*	g/m³	< 0.004	0.141	5.4	-	-
Total Cyanide*	g/m³	< 0.02	< 0.02	< 0.02	-	-
Chloride*	g/m³	15,700	18,500	8,300	-	-
Sulphate*	g/m³	1,690	2,200	1,140	-	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq						
Acenaphthene*	g/m³	< 0.0002	< 0.0002	< 0.0002	-	-
Acenaphthylene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Anthracene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[a]anthracene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[a]pyrene (BAP)*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[g,h,i]perylene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Benzo[k]fluoranthene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Chrysene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Dibenzo[a,h]anthracene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Fluoranthene*	g/m³	< 0.00010	< 0.00010	0.00031	-	-
Fluorene*	g/m³	< 0.0002	< 0.0002	< 0.0002	-	-
Indeno(1,2,3-c,d)pyrene*	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Naphthalene*	g/m³	< 0.0005	< 0.0005	< 0.0005	-	-
Phenanthrene*	g/m³	< 0.0004	< 0.0004	< 0.0004	-	-
Pyrene*	g/m³	< 0.0002	< 0.0002	< 0.0002	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.06	< 0.06	< 0.06	-	-
C10 - C14*	g/m³	< 0.2	< 0.2	< 0.2	-	-
C15 - C36*	g/m³	< 0.4	< 0.4	< 0.4	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 0.7	< 0.7	-	-

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Sample Type: Saline						
Sample Name:		mw3 23-Aug-2018 1:20 pm	mw4 23-Aug-2018 12:00 pm	mw2 23-Aug-2018 2:30 pm		
Lab Number:		2036924.1	2036924.2	2036924.3		
BTEX in VOC Water by Headspace GC-MS						
Benzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Ethylbenzene	g/m³	< 0.005	< 0.005	< 0.005	-	-
Toluene	g/m³	< 0.003	< 0.003	< 0.003	-	-
m&p-Xylene	g/m³	< 0.005	< 0.005	< 0.005	-	-
o-Xylene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Halogenated Aliphatics in VOC Water by Headspace GC-MS						
Bromomethane (Methyl Bromide)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Carbon tetrachloride	g/m³	< 0.003	< 0.003	< 0.003	-	-
Chloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Chloromethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Dibromomethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Dichlorodifluoromethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1-Dichloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2-Dichloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1-Dichloroethene	g/m³	< 0.003	< 0.003	< 0.003	-	-
cis-1,2-Dichloroethene	g/m³	< 0.003	< 0.003	< 0.003	-	-
trans-1,2-Dichloroethene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Dichloromethane (methylene chloride)	g/m³	< 0.10	< 0.10	< 0.10	-	-
1,2-Dichloropropane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,3-Dichloropropane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1-Dichloropropene	g/m³	< 0.003	< 0.003	< 0.003	-	-
cis-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	< 0.005	-	-
trans-1,3-Dichloropropene	g/m³	< 0.005	< 0.005	< 0.005	-	-
Hexachlorobutadiene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1,1-Trichloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1,2-Trichloroethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Trichloroethene (trichloroethylene)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Trichlorofluoromethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2,3-Trichloropropane	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Vinyl chloride	g/m³	< 0.003	< 0.003	< 0.003	-	-
Haloaromatics in VOC Water by Headspace GC-MS						
Bromobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003	< 0.003	< 0.003	-	-
2-Chlorotoluene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,3-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,4-Dichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
4-Chlorotoluene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2,3-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,3,5-Trichlorobenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
n-Butylbenzene	g/m³	< 0.005	< 0.005	< 0.005	-	-
tert-Butylbenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005	< 0.005	< 0.005	-	-
Isopropylbenzene (Cumene)	g/m³	< 0.003	< 0.003	< 0.003	-	-
n-Propylbenzene	g/m³	< 0.005	< 0.005	< 0.005	-	-

Sample Type: Saline						
Sample Name:		mw3 23-Aug-2018 1:20 pm	mw4 23-Aug-2018 12:00 pm	mw2 23-Aug-2018 2:30 pm		
Lab Number:		2036924.1	2036924.2	2036924.3		
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS						
sec-Butylbenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Styrene	g/m³	< 0.005	< 0.005	< 0.005	-	-
1,2,4-Trimethylbenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1,3,5-Trimethylbenzene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Ketones in VOC Water by Headspace GC-MS						
Acetone	g/m³	< 0.5	< 0.5	< 0.5	-	-
2-Butanone (MEK)	g/m³	< 0.5	< 0.5	< 0.5	-	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003	< 0.003	< 0.003	-	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10	< 0.10	< 0.10	-	-
Trihalomethanes in VOC Water by Headspace GC-MS						
Bromodichloromethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Bromoform (tribromomethane)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Chloroform (Trichloromethane)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Dibromochloromethane	g/m³	< 0.003	< 0.003	< 0.003	-	-
Other VOC in Water by Headspace GC-MS						
Carbon disulphide	g/m³	< 0.005	< 0.005	< 0.005	-	-
Naphthalene	g/m³	< 0.005	< 0.005	< 0.005	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq*	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.00010 - 0.0005 g/m³	1-3
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m³	1-3
Volatile Organic Compounds Screening in Water by Headspace GC-MS	Headspace, GC-MS SIM analysis [KBIs:37857,37921]	0.003 - 0.5 g/m³	1-3
Filtration, Unpreserved*	Sample filtration through 0.45µm membrane filter.	-	1-3
pH*	Saline water, pH meter. APHA 4500-H⁺ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Electrical Conductivity (EC)*	Saline water, Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.10 mS/m	1-3
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	50 g/m³	1-3
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	1-3
Dissolved Arsenic*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m³	1-3
Dissolved Cadmium*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0002 g/m³	1-3
Dissolved Chromium*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m³	1-3
Dissolved Copper*	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m³	1-3
Dissolved Lead*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0010 g/m³	1-3
Dissolved Mercury*	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m³	1-3
Dissolved Nickel*	Filtered sample, ICP-MS with universal cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.007 g/m³	1-3

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dissolved Zinc*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m³	1-3
Total Cyanide Trace*	On-line distillation, colorimetry, trace level. ISO 14403:2012(E) (modified).	0.002 g/m³	1-3
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m³	1-3
Sulphate*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m³	1-3
C7 - C9	Head Space, GCMS analysis.	0.06 g/m³	1-3

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

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

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



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Client Services Manager - Environmental

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2036924	SUPv1
Contact:	Lucy Hine	**Date Received:**	23-Aug-2018	
	C/- Tonkin & Taylor	**Date Reported:**	30-Aug-2018	
	PO Box 13055	**Quote No:**		
	Christchurch 8141	**Order No:**	30881.2	
		Client Reference:	30881.2	
		Submitted By:	Sami Hutchings	

Sample Type: Saline

Sample Name:		mw3 23-Aug-2018 1:20 pm	mw4 23-Aug-2018 12:00 pm	mw2 23-Aug-2018 2:30 pm	
Lab Number:		2036924.1	2036924.2	2036924.3	
Individual Tests					
pH*	pH Units	7.5 ± 0.2	7.7 ± 0.2	6.4 ± 0.2	-
Electrical Conductivity (EC)*	mS/m	4,230 ± 85	4,840 ± 97	2,310 ± 47	-
Total Dissolved Solids (TDS)*	g/m³	28,700 ± 3,500	33,900 ± 4,100	15,300 ± 1,900	-
Dissolved Arsenic*	g/m³	< 0.004 ± 0.0027	< 0.004 ± 0.0027	< 0.004 ± 0.0027	-
Dissolved Cadmium*	g/m³	< 0.0002 ± 0.00014	< 0.0002 ± 0.00014	0.00075 ± 0.00021	-
Dissolved Chromium*	g/m³	0.00109 ± 0.00068	0.00149 ± 0.00070	< 0.0010 ± 0.00067	-
Dissolved Copper*	g/m³	< 0.0010 ± 0.00067	0.098 ± 0.024	0.65 ± 0.16	-
Dissolved Lead*	g/m³	< 0.0010 ± 0.00067	0.00275 ± 0.00091	< 0.0010 ± 0.00067	-
Dissolved Mercury*	g/m³	< 0.00008 ± 0.000054	< 0.00008 ± 0.000054	< 0.00008 ± 0.000054	-
Dissolved Nickel*	g/m³	< 0.007 ± 0.0041	< 0.007 ± 0.0041	0.0519 ± 0.0090	-
Dissolved Zinc*	g/m³	< 0.004 ± 0.0027	0.141 ± 0.023	5.37 ± 0.86	-
Total Cyanide*	g/m³	< 0.02	< 0.02	< 0.02	-
Chloride*	g/m³	15,660 ± 940	18,500 ± 1,200	8,270 ± 500	-
Sulphate*	g/m³	1,690 ± 110	2,180 ± 140	1,139 ± 69	-
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq					
Acenaphthene*	g/m³	< 0.0002 ± 0.00011	< 0.0002 ± 0.00011	< 0.0002 ± 0.00011	-
Acenaphthylene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	-
Anthracene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	-
Benzo[a]anthracene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	-
Benzo[a]pyrene (BAP)*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	-
Benzo[g,h,i]perylene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	-
Benzo[k]fluoranthene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	-
Chrysene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	-
Dibenzo[a,h]anthracene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	-
Fluoranthene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	0.00031 ± 0.00011	-
Fluorene*	g/m³	< 0.0002 ± 0.00011	< 0.0002 ± 0.00011	< 0.0002 ± 0.00011	-
Indeno(1,2,3-c,d)pyrene*	g/m³	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	< 0.00010 ± 0.000067	-
Naphthalene*	g/m³	< 0.0005 ± 0.00034	< 0.0005 ± 0.00034	< 0.0005 ± 0.00034	-
Phenanthrene*	g/m³	< 0.0004 ± 0.00014	< 0.0004 ± 0.00014	< 0.0004 ± 0.00014	-
Pyrene*	g/m³	< 0.0002 ± 0.000097	< 0.0002 ± 0.000097	< 0.0002 ± 0.000097	-
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m³	< 0.06 ± 0.041	< 0.06 ± 0.041	< 0.06 ± 0.041	-
C10 - C14*	g/m³	< 0.2 ± 0.095	< 0.2 ± 0.095	< 0.2 ± 0.095	-
C15 - C36*	g/m³	< 0.4 ± 0.12	< 0.4 ± 0.12	< 0.4 ± 0.12	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7 ± 0.16	< 0.7 ± 0.16	< 0.7 ± 0.16	-

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

Sample Type: Saline					
Sample Name:		mw3 23-Aug-2018 1:20 pm	mw4 23-Aug-2018 12:00 pm	mw2 23-Aug-2018 2:30 pm	
Lab Number:		2036924.1	2036924.2	2036924.3	
BTEX in VOC Water by Headspace GC-MS					
Benzene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
Ethylbenzene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	-
Toluene	g/m³	< 0.003 ± 0.0060	< 0.003 ± 0.0060	< 0.003 ± 0.0060	-
m&p-Xylene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	-
o-Xylene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
Halogenated Aliphatics in VOC Water by Headspace GC-MS					
Bromomethane (Methyl Bromide)	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Carbon tetrachloride	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Chloroethane	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
Chloromethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,2-Dibromo-3-chloropropane	g/m³	< 0.003 ± 0.0028	< 0.003 ± 0.0028	< 0.003 ± 0.0028	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Dibromomethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Dichlorodifluoromethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,1-Dichloroethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,2-Dichloroethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,1-Dichloroethene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
cis-1,2-Dichloroethene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
trans-1,2-Dichloroethene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Dichloromethane (methylene chloride)	g/m³	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067	-
1,2-Dichloropropane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,3-Dichloropropane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,1-Dichloropropene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
cis-1,3-Dichloropropene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	-
trans-1,3-Dichloropropene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	-
Hexachlorobutadiene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,1,1,2-Tetrachloroethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,1,2,2-Tetrachloroethane	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
Tetrachloroethene (tetrachloroethylene)	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
1,1,1-Trichloroethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,1,2-Trichloroethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Trichloroethene (trichloroethylene)	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Trichlorofluoromethane	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
1,2,3-Trichloropropane	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	< 0.003 ± 0.024	< 0.003 ± 0.024	< 0.003 ± 0.024	-
Vinyl chloride	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Haloaromatics in VOC Water by Headspace GC-MS					
Bromobenzene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
Chlorobenzene (monochlorobenzene)	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
2-Chlorotoluene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,2-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
1,3-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
1,4-Dichlorobenzene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
4-Chlorotoluene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,2,3-Trichlorobenzene	g/m³	< 0.003 ± 0.0030	< 0.003 ± 0.0030	< 0.003 ± 0.0030	-
1,2,4-Trichlorobenzene	g/m³	< 0.003 ± 0.0030	< 0.003 ± 0.0030	< 0.003 ± 0.0030	-
1,3,5-Trichlorobenzene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS					
n-Butylbenzene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	-
tert-Butylbenzene	g/m³	< 0.003 ± 0.0032	< 0.003 ± 0.0032	< 0.003 ± 0.0032	-
4-Isopropyltoluene (p-Cymene)	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	-
Isopropylbenzene (Cumene)	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
n-Propylbenzene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	-
sec-Butylbenzene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-

Sample Type: Saline					
Sample Name:		mw3 23-Aug-2018 1:20 pm	mw4 23-Aug-2018 12:00 pm	mw2 23-Aug-2018 2:30 pm	
Lab Number:		2036924.1	2036924.2	2036924.3	
Monoaromatic Hydrocarbons in VOC Water by Headspace GC-MS					
Styrene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	-
1,2,4-Trimethylbenzene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
1,3,5-Trimethylbenzene	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Ketones in VOC Water by Headspace GC-MS					
Acetone	g/m³	< 0.5 ± 0.34	< 0.5 ± 0.34	< 0.5 ± 0.34	-
2-Butanone (MEK)	g/m³	< 0.5 ± 0.16	< 0.5 ± 0.16	< 0.5 ± 0.16	-
Methyl tert-butylether (MTBE)	g/m³	< 0.003 ± 0.031	< 0.003 ± 0.031	< 0.003 ± 0.031	-
4-Methylpentan-2-one (MIBK)	g/m³	< 0.10 ± 0.045	< 0.10 ± 0.045	< 0.10 ± 0.045	-
Trihalomethanes in VOC Water by Headspace GC-MS					
Bromodichloromethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Bromoform (tribromomethane)	g/m³	< 0.003 ± 0.0030	< 0.003 ± 0.0030	< 0.003 ± 0.0030	-
Chloroform (Trichloromethane)	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Dibromochloromethane	g/m³	< 0.003 ± 0.0031	< 0.003 ± 0.0031	< 0.003 ± 0.0031	-
Other VOC in Water by Headspace GC-MS					
Carbon disulphide	g/m³	< 0.005 ± 0.031	< 0.005 ± 0.031	< 0.005 ± 0.031	-
Naphthalene	g/m³	< 0.005 ± 0.0034	< 0.005 ± 0.0034	< 0.005 ± 0.0034	-

The reported uncertainty is an expanded uncertainty with a level of confidence of approximately 95 percent (i.e. two standard deviations, calculated using a coverage factor of 2). Reported uncertainties are calculated from the performance of typical matrices, and do not include variation due to sampling.

For further information on uncertainty of measurement at Hill Laboratories, refer to the technical note on our website: www.hill-laboratories.com/files/Intro_To_UOM.pdf, or contact the laboratory.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Polycyclic Aromatic Hydrocarbons Screening in Water, By Liq/Liq*	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.00010 - 0.0005 g/m³	1-3
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m³	1-3
Volatile Organic Compounds Screening in Water by Headspace GC-MS	Headspace, GC-MS SIM analysis [KBIs:37857,37921]	0.003 - 0.5 g/m³	1-3
Filtration, Unpreserved*	Sample filtration through 0.45µm membrane filter.	-	1-3
pH*	Saline water, pH meter. APHA 4500-H⁺ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Electrical Conductivity (EC)*	Saline water, Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.10 mS/m	1-3
Total Dissolved Solids (TDS)*	Filtration through GF/C (1.2 µm), gravimetric. APHA 2540 C (modified; drying temperature of 103 - 105°C used rather than 180 ± 2°C) 22nd ed. 2012.	50 g/m³	1-3
Filtration for dissolved metals analysis*	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	1-3
Dissolved Arsenic*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m³	1-3
Dissolved Cadmium*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0002 g/m³	1-3
Dissolved Chromium*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m³	1-3
Dissolved Copper*	Filtered sample, ICP-MS, ultratrace. APHA 3125 B 22nd ed. 2012.	0.0010 g/m³	1-3

Sample Type: Saline			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dissolved Lead*	Filtered sample, ICP-MS, ultratrace level. APHA 3125 B 22nd ed. 2012.	0.0010 g/m³	1-3
Dissolved Mercury*	0.45µm filtration, bromine oxidation followed by atomic fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m³	1-3
Dissolved Nickel*	Filtered sample, ICP-MS with universal cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.007 g/m³	1-3
Dissolved Zinc*	Filtered sample, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22nd ed. 2012.	0.004 g/m³	1-3
Total Cyanide Trace*	On-line distillation, colorimetry, trace level. ISO 14403:2012(E) (modified).	0.002 g/m³	1-3
Chloride*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m³	1-3
Sulphate*	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 22nd ed. 2012.	0.5 g/m³	1-3
C7 - C9	Head Space, GCMS analysis.	0.06 g/m³	1-3

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

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

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Global Experts in Food Assurance

Certificate of Analysis

Submission Reference: 30881.2000
Final Report

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Report Issued: 20-Aug-2018 **AsureQuality Reference: 18-201030** **Sample(s) Received:** 08-Aug-2018 08:15

Results

The tests were performed on the samples as received.

Customer Sample Name: GBH103 **AsureQuality ID:** 18-201030-1

Sample Condition: Acceptable **Sampled Date**: 06-Aug-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
Perfluoroalkylsulfonic acids			
PFPrS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	0.12	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	0.21	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	1.4	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	1.6	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.98	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	3.4	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	4.4	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	6.0	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	NR	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.36	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.43	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.13	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)

AsureQuality has used reasonable skill, care, and effort to provide an accurate analysis of the sample(s) which form(s) the subject of this report. However, the accuracy of this analysis is reliant on, and subject to, the sample(s) provided by you and your responsibility as to transportation of the sample(s). AsureQuality's standard terms of business apply to the analysis set out in this report.

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Test	Result	Unit	Method Reference
Perfluorooctanesulfonamides			
PFOSA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	76	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	106	%	AsureQuality Method (LC-MS/MS)
M8PFOS	105	%	AsureQuality Method (LC-MS/MS)
M4PFBA	NR	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	57	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	89	%	AsureQuality Method (LC-MS/MS)
MPFHpA	97	%	AsureQuality Method (LC-MS/MS)
M8PFOA	102	%	AsureQuality Method (LC-MS/MS)
M9PFNA	100	%	AsureQuality Method (LC-MS/MS)
M6PFDA	103	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	106	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	105	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	102	%	AsureQuality Method (LC-MS/MS)
MPFOSA	106	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	102	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	101	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	97	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	103	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	106	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	105	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	137	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	132	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	114	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: BH111 **AsureQuality ID:** 18-201030-2

Sample Condition: Acceptable **Sampled Date**: 06-Aug-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
Perfluoroalkylsulfonic acids			
PFPrS	NR	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	0.27	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	0.31	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	0.44	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	2.4	µg/L	AsureQuality Method (LC-MS/MS)

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Test	Result	Unit	Method Reference
Total PFHxS (3)	2.8	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	1.0	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	3.5	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	4.5	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	7.3	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	NR	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.48	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.82	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.17	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.17	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	0.22	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	79	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	104	%	AsureQuality Method (LC-MS/MS)
M8PFOS	104	%	AsureQuality Method (LC-MS/MS)
M4PFBA	NR	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	58	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	96	%	AsureQuality Method (LC-MS/MS)
MPFHpA	102	%	AsureQuality Method (LC-MS/MS)
M8PFOA	103	%	AsureQuality Method (LC-MS/MS)
M9PFNA	104	%	AsureQuality Method (LC-MS/MS)
M6PFDA	108	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	105	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	103	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	97	%	AsureQuality Method (LC-MS/MS)

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Test	Result	Unit	Method Reference
MPFOSA	106	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	102	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	102	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	97	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	101	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	101	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	105	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	129	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	128	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	108	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: GBH106 **AsureQuality ID:** 18-201030-3

Sample Condition: Acceptable **Sampled Date**: 01-Aug-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
Perfluoroalkylsulfonic acids			
PFPrS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	0.13	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.88	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	1.0	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	1.5	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	4.1	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	5.6	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	6.6	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.84	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.56	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.25	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)

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Test	Result	Unit	Method Reference
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	1.3	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	98	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	108	%	AsureQuality Method (LC-MS/MS)
M8PFOS	108	%	AsureQuality Method (LC-MS/MS)
M4PFBA	63	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	87	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	107	%	AsureQuality Method (LC-MS/MS)
MPFHpA	112	%	AsureQuality Method (LC-MS/MS)
M8PFOA	108	%	AsureQuality Method (LC-MS/MS)
M9PFNA	106	%	AsureQuality Method (LC-MS/MS)
M6PFDA	108	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	106	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	105	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	102	%	AsureQuality Method (LC-MS/MS)
MPFOSA	106	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	107	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	105	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	97	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	104	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	106	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	102	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	127	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	126	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	111	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: CBH201 **AsureQuality ID:** 18-201030-4

Sample Condition: Acceptable **Sampled Date**: 25-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
Perfluoroalkylsulfonic acids			
PFPrS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	0.11	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	0.19	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	1.5	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	1.7	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.72	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	4.0	µg/L	AsureQuality Method (LC-MS/MS)

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Test	Result	Unit	Method Reference
Total PFOS (7)	4.7	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	6.4	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	NR	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	0.26	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.46	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.11	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	0.10	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	77	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	106	%	AsureQuality Method (LC-MS/MS)
M8PFOS	106	%	AsureQuality Method (LC-MS/MS)
M4PFBA	NR	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	60	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	87	%	AsureQuality Method (LC-MS/MS)
MPFHpA	103	%	AsureQuality Method (LC-MS/MS)
M8PFOA	103	%	AsureQuality Method (LC-MS/MS)
M9PFNA	105	%	AsureQuality Method (LC-MS/MS)
M6PFDA	106	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	106	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	104	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	109	%	AsureQuality Method (LC-MS/MS)
MPFOSA	107	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	103	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	102	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	95	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	95	%	AsureQuality Method (LC-MS/MS)

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Test	Result	Unit	Method Reference
DNEtFOSE	105	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	108	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	135	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	131	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	118	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: GBH107 **AsureQuality ID:** 18-201030-5

Sample Condition: Acceptable **Sampled Date**: 06-Aug-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
Perfluoroalkylsulfonic acids			
PFPrS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.16	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.16	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.16	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	NR	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)

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Test	Result	Unit	Method Reference
6:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	87	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	102	%	AsureQuality Method (LC-MS/MS)
M8PFOS	103	%	AsureQuality Method (LC-MS/MS)
M4PFBA	NR	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	68	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	98	%	AsureQuality Method (LC-MS/MS)
MPFHpA	104	%	AsureQuality Method (LC-MS/MS)
M8PFOA	103	%	AsureQuality Method (LC-MS/MS)
M9PFNA	101	%	AsureQuality Method (LC-MS/MS)
M6PFDA	103	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	106	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	101	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	77	%	AsureQuality Method (LC-MS/MS)
MPFOSA	103	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	102	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	100	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	92	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	96	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	103	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	104	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	120	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	116	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	105	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: MWE **AsureQuality ID:** 18-201030-8

Sample Condition: Acceptable **Sampled Date**: 06-Aug-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
Perfluoroalkylsulfonic acids			
PFPrS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	0.13	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	0.21	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	1.5	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	1.7	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.95	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	3.5	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	4.4	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	6.1	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	NR	µg/L	AsureQuality Method (LC-MS/MS)

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Test	Result	Unit	Method Reference
PFPeA	0.37	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	0.45	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	0.13	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	77	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	101	%	AsureQuality Method (LC-MS/MS)
M8PFOS	105	%	AsureQuality Method (LC-MS/MS)
M4PFBA	NR	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	55	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	84	%	AsureQuality Method (LC-MS/MS)
MPFHpA	100	%	AsureQuality Method (LC-MS/MS)
M8PFOA	98	%	AsureQuality Method (LC-MS/MS)
M9PFNA	105	%	AsureQuality Method (LC-MS/MS)
M6PFDA	100	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	101	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	105	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	108	%	AsureQuality Method (LC-MS/MS)
MPFOSA	106	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	105	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	104	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	99	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	98	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	108	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	106	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	131	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	129	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	109	%	AsureQuality Method (LC-MS/MS)

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QC Results

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Relates to sample(s) 18-201030-1, 18-201030-2, 18-201030-3, 18-201030-4, 18-201030-5, 18-201030-8

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
Perfluoroalkylsulfonic acids			
PFPrS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)

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Internal Standards			
M3PFBS	104	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	108	%	AsureQuality Method (LC-MS/MS)
M8PFOS	106	%	AsureQuality Method (LC-MS/MS)
M4PFBA	105	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	107	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	102	%	AsureQuality Method (LC-MS/MS)
MPFHpA	107	%	AsureQuality Method (LC-MS/MS)
M8PFOA	108	%	AsureQuality Method (LC-MS/MS)
M9PFNA	104	%	AsureQuality Method (LC-MS/MS)
M6PFDA	108	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	105	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	102	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	98	%	AsureQuality Method (LC-MS/MS)
MPFOSA	106	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	106	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	99	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	103	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	107	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	104	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	103	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	105	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	109	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	97	%	AsureQuality Method (LC-MS/MS)

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Relates to sample(s) 18-201030-1, 18-201030-2, 18-201030-3, 18-201030-4, 18-201030-5, 18-201030-8

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
Perfluoroalkylsulfonic acids			
PFPrS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.20	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)

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Test	Result	Unit	Method Reference
PFHxA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	<5.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	105	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	106	%	AsureQuality Method (LC-MS/MS)
M8PFOS	107	%	AsureQuality Method (LC-MS/MS)
M4PFBA	105	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	104	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	111	%	AsureQuality Method (LC-MS/MS)
MPFHpA	104	%	AsureQuality Method (LC-MS/MS)
M8PFOA	103	%	AsureQuality Method (LC-MS/MS)
M9PFNA	104	%	AsureQuality Method (LC-MS/MS)
M6PFDA	105	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	102	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	103	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	99	%	AsureQuality Method (LC-MS/MS)
MPFOSA	106	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	105	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	105	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	102	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	108	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	103	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	104	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	99	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	110	%	AsureQuality Method (LC-MS/MS)

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Test	Result	Unit	Method Reference
M8:2FTS	104	%	AsureQuality Method (LC-MS/MS)

Analysis Summary

Wellington Laboratory

Analysis	Method	Accreditation	Authorised by
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level			
DX-PFCS01, 05-HIGHLEVEL	AsureQuality Method (LC-MS/MS)	IANZ	Cameron Evans

di-PFHxS (1) = Concentration determined using a branched di-PFHxS isomer standard (399>80 transition)

mono-PFHxS (1) = Concentration determined using a branched mono-PFHxS isomer standard (399>80 transition)

L-PFHxS (1) = Concentration determined using the linear PFHxS isomer standard (399>80 transition)

Total PFHxS (3) = The numerical sum of di-PFHxS (1), mono-PFHxS (1), and L-PFHxS (1)

di-PFOS (5) = Concentration determined using a branched di-PFOS isomer standard (499>80 transition)

mono-PFOS (5) = Concentration determined using a branched mono-PFOS isomer standard (499>80 transition)

L-PFOS (5) = Concentration determined using the linear PFOS isomer standard (499>230 transition)

Total PFOS (7) = The numerical sum of di-PFOS (5), mono-PFOS (5), and L-PFOS (5)

Sum PFHxS+PFOS (1) = The numerical sum of Total PFHxS (3) and Total PFOS (7)

For all Totals, where a component is detected below the LOR, the value of zero is used in the calculation of the sum. The result represents the lower-bound concentration present in the sample.

Reported results are corrected for internal standard recovery

Results that are prefixed with '<' indicate the lowest level at which the analyte can be reported, and that in this case the analyte was not observed above this limit.

NR = Not Reportable



Cameron Evans

Scientist

Accreditation

Appendix

Analyte LOR Summary

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level - AsureQuality Method (LC-MS/MS)

Analyte	LOR (µg/L)
Perfluoroalkylsulfonic acids	
PFPrS	NR
PFBS	0.10
PFPeS	0.10
di-PFHxS (1)	0.10
mono-PFHxS (1)	0.10
L-PFHxS (1)	0.10
Total PFHxS (3)	0.10
PFHpS	0.10
di-PFOS (5)	0.10
mono-PFOS (5)	0.10
L-PFOS (5)	0.10
Total PFOS (7)	0.10
Sum PFHxS+PFOS (1)	0.10
PFNS	0.10
PFDS	0.10
Perfluoroalkylcarboxylic acids	
PFBA	NR
PFPeA	0.10
PFHxA	0.10
PFHpA	0.10
PFOA	0.10
PFNA	0.10
PFDA	0.10
PFUnDA	0.10
PFDoDA	0.10
PFTrDA	0.10
PFTeDA	0.10
Perfluorooctanesulfonamides	
PFOSA	0.10
NEtFOSA-M	0.10
NMeFOSA-M	0.10
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	0.10
NMeFOSAA	0.10
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	0.10
NMeFOSE-M	0.10
Telomere Sulfonic acids	
4:2 FTS	0.10
6:2 FTS	0.10
8:2 FTS	0.10

Analyte Definitions

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Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - High Level - AsureQuality Method (LC-MS/MS)

Analyte	Full Name
Perfluoroalkylsulfonic acids	
PFPrS	Perfluoro-1-propanesulfonic acid
PFBS	Perfluoro-1-butanesulfonic acid
PFPeS	Perfluoro-1-pentanesulfonic acid
di-PFHxS (1)	Total Perfluorodimethylbutane sulfonic acids
mono-PFHxS (1)	Total Perfluoromethylpentane sulfonic acids
L-PFHxS (1)	Linear Perfluorohexanesulfonic acid
PFHpS	Perfluoro-1-heptanesulfonic acid
di-PFOS (5)	Total Perfluorodimethylhexane sulfonic acids
mono-PFOS (5)	Total Perfluoromethylheptane sulfonic acids
L-PFOS (5)	Linear Perfluorooctanesulfonic acid
PFNS	Perfluoro-1-nonanesulfonic acid
PFDS	Perfluoro-1-decanesulfonic acid
Perfluoroalkylcarboxylic acids	
PFBA	Perfluoro-n-butanoic acid
PFPeA	Perfluoro-n-pentanoic acid
PFHxA	Perfluoro-n-hexanoic acid
PFHpA	Perfluoro-n-heptanoic acid
PFOA	Perfluoro-n-octanoic acid
PFNA	Perfluoro-n-nonanoic acid
PFDA	Perfluoro-n-decanoic acid
PFUnDA	Perfluoro-n-undecanoic acid
PFDoDA	Perfluoro-n-dodecanoic acid
PFTrDA	Perfluoro-n-tridecanoic acid
PFTeDA	Perfluoro-n-tetradecanoic acid
Perfluorooctanesulfonamides	
PFOSA	Perfluoro-1-octanesulfonamide
NEtFOSA-M	N-ethylperfluoro-1-octanesulfonamide
NMeFOSA-M	N-methylperfluoro-1-octanesulfonamide
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	N-ethylperfluoro-1-octanesulfonamidoacetic acid
NMeFOSAA	N-methylperfluoro-1-octanesulfonamidoacetic acid
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol
NMeFOSE-M	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
Telomere Sulfonic acids	
4:2 FTS	1H,1H,2H,2H-perfluoro-1-hexanesulfonic acid
6:2 FTS	1H,1H,2H,2H-perfluoro-1-octanesulfonic acid
8:2 FTS	1H,1H,2H,2H-perfluoro-1-decanesulfonic acid
Internal Standards	
M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid
M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid
M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid
M4PFBA	Perfluoro-n-[1,2,3,4-13C4]butanoic acid
M5PFPeA	Perfluoro-n-[1,2,3,4,5-13C5]pentanoic acid
M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid
MPFHpA	Perfluoro-n-[-1,2,3,4-13C4]heptanoic acid
M8PFOA	Perfluoro-n-[13C8]octanoic acid
M9PFNA	Perfluoro-n-[13C9]nonanoic acid
M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid
M7PFUnDA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid
MPFDoDA	Perfluoro-n-[1,2-13C2]dodecanoic acid
MPFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid

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Analyte	Full Name
MPFOSA	Perfluoro-1-[13C8]octanesulfonamide
DNEtFOSA	N-ethyl-D5-perfluoro-1-octanesulfonamide
DNMeFOSA	N-methyl-D3-perfluoro-1-octanesulfonamide
DNEtFOSAA	N-ethyl-D5-perfluoro-1-octanesulfonamidoacetic acid
DNMeFOSAA	N-methyl-D3-perfluoro-1-octanesulfonamidoacetic acid
DNEtFOSE	2-(N-ethyl-D5-perfluoro-1-octanesulfonamido)ethan-D4-ol
DNMeFOSE	2-(N-methyl-D3-perfluoro-1-octanesulfonamido)ethan-D4-ol
M4:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonic acid
M6:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonic acid
M8:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonic acid

LOR = Limit of Reporting LOD = Limit of Detection NR = Not Reportable

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Global Experts in Food Assurance

Certificate of Analysis

Submission Reference: 30881.2000
Final Report

Melody Robyns
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PO Box 5271
Auckland 1141
New Zealand

Report Issued: 24-Aug-2018 **AsureQuality Reference: 18-210504** **Sample(s) Received:** 21-Aug-2018 09:10

Results

The tests were performed on the samples as received.

Customer Sample Name: CBH204/30881.2000 **AsureQuality ID:** 18-210504-1

Sample Condition: Acceptable **Sampled Date**: 25-Jul-2018

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	0.013	µg/L	AsureQuality Method (LC-MS/MS)
L-PFHxS (1)	0.090	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.022	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.027	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.049	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.15	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.017	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)

AsureQuality has used reasonable skill, care, and effort to provide an accurate analysis of the sample(s) which form(s) the subject of this report. However, the accuracy of this analysis is reliant on, and subject to, the sample(s) provided by you and your responsibility as to transportation of the sample(s). AsureQuality's standard terms of business apply to the analysis set out in this report.

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Test	Result	Unit	Method Reference
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	100	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	104	%	AsureQuality Method (LC-MS/MS)
M8PFOS	105	%	AsureQuality Method (LC-MS/MS)
M4PFBA	65	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	92	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	107	%	AsureQuality Method (LC-MS/MS)
MPFHpA	107	%	AsureQuality Method (LC-MS/MS)
M8PFOA	111	%	AsureQuality Method (LC-MS/MS)
M9PFNA	102	%	AsureQuality Method (LC-MS/MS)
M6PFDA	105	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	105	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	105	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	102	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	100	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	96	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	109	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	101	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	109	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	110	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	120	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	107	%	AsureQuality Method (LC-MS/MS)

Customer Sample Name: Duplicate of 18-210504-1 **AsureQuality ID:** 18-210504-2

Sample Description: CBH204/30881.2000 dup

Sample Condition: Acceptable

Test	Result	Unit	Method Reference
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water			
Perfluoroalkylsulfonic acids			
PFPrS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFBS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFPeS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
di-PFHxS (1)	<0.010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFHxS (1)	0.015	µg/L	AsureQuality Method (LC-MS/MS)

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Test	Result	Unit	Method Reference
L-PFHxS (1)	0.090	µg/L	AsureQuality Method (LC-MS/MS)
Total PFHxS (3)	0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHpS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
di-PFOS (5)	<0.010	µg/L	AsureQuality Method (LC-MS/MS)
mono-PFOS (5)	0.024	µg/L	AsureQuality Method (LC-MS/MS)
L-PFOS (5)	0.030	µg/L	AsureQuality Method (LC-MS/MS)
Total PFOS (7)	0.054	µg/L	AsureQuality Method (LC-MS/MS)
Sum PFHxS+PFOS (1)	0.15	µg/L	AsureQuality Method (LC-MS/MS)
PFNS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFDS	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
Perfluoroalkylcarboxylic acids			
PFBA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFPeA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
PFHxA	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFHpA	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFOA	0.016	µg/L	AsureQuality Method (LC-MS/MS)
PFNA	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFDA	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFUnDA	<0.050	µg/L	AsureQuality Method (LC-MS/MS)
PFDoDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
PFTrDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
PFTeDA	NR	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamides			
PFOSA	<0.0010	µg/L	AsureQuality Method (LC-MS/MS)
NEtFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSA-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoacetic acids			
NEtFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSAA	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Perfluorooctanesulfonamidoethanols			
NEtFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
NMeFOSE-M	<1.0	µg/L	AsureQuality Method (LC-MS/MS)
Telomere Sulfonic acids			
4:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
6:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
8:2 FTS	<0.10	µg/L	AsureQuality Method (LC-MS/MS)
Internal Standards			
M3PFBS	95	%	AsureQuality Method (LC-MS/MS)
M3PFHxS	105	%	AsureQuality Method (LC-MS/MS)
M8PFOS	108	%	AsureQuality Method (LC-MS/MS)
M4PFBA	56	%	AsureQuality Method (LC-MS/MS)
M5PFPeA	82	%	AsureQuality Method (LC-MS/MS)
M5PFHxA	105	%	AsureQuality Method (LC-MS/MS)
MPFHpA	104	%	AsureQuality Method (LC-MS/MS)
M8PFOA	111	%	AsureQuality Method (LC-MS/MS)
M9PFNA	101	%	AsureQuality Method (LC-MS/MS)
M6PFDA	106	%	AsureQuality Method (LC-MS/MS)
M7PFUnDA	107	%	AsureQuality Method (LC-MS/MS)
MPFDoDA	NR	%	AsureQuality Method (LC-MS/MS)

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Test	Result	Unit	Method Reference
MPFTeDA	NR	%	AsureQuality Method (LC-MS/MS)
MPFOSA	103	%	AsureQuality Method (LC-MS/MS)
DNEtFOSA	106	%	AsureQuality Method (LC-MS/MS)
DNMeFOSA	102	%	AsureQuality Method (LC-MS/MS)
DNEtFOSAA	102	%	AsureQuality Method (LC-MS/MS)
DNMeFOSAA	109	%	AsureQuality Method (LC-MS/MS)
DNEtFOSE	104	%	AsureQuality Method (LC-MS/MS)
DNMeFOSE	111	%	AsureQuality Method (LC-MS/MS)
M4:2FTS	121	%	AsureQuality Method (LC-MS/MS)
M6:2FTS	119	%	AsureQuality Method (LC-MS/MS)
M8:2FTS	114	%	AsureQuality Method (LC-MS/MS)

Analysis Summary

Wellington Laboratory

Analysis	Method	Authorised by
Poly- and Perfluorinated Alkyl Substances (PFAS) in Water		
DX-PFCS01, 03-SUITE_B	AsureQuality Method (LC-MS/MS)	Cameron Evans

di-PFHxS (1) = Concentration determined using a branched di-PFHxS isomer standard (399>80 transition)

mono-PFHxS (1) = Concentration determined using a branched mono-PFHxS isomer standard (399>80 transition)

L-PFHxS (1) = Concentration determined using the linear PFHxS isomer standard (399>80 transition)

Total PFHxS (3) = The numerical sum of di-PFHxS (1), mono-PFHxS (1), and L-PFHxS (1)

di-PFOS (5) = Concentration determined using a branched di-PFOS isomer standard (499>80 transition)

mono-PFOS (5) = Concentration determined using a branched mono-PFOS isomer standard (499>80 transition)

L-PFOS (5) = Concentration determined using the linear PFOS isomer standard (499>230 transition)

Total PFOS (7) = The numerical sum of di-PFOS (5), mono-PFOS (5), and L-PFOS (5)

Sum PFHxS+PFOS (1) = The numerical sum of Total PFHxS (3) and Total PFOS (7)

For all Totals, where a component is detected below the LOR, the value of zero is used in the calculation of the sum. The result represents the lower-bound concentration present in the sample.

Reported results are corrected for internal standard recovery

Results that are prefixed with '<' indicate the lowest level at which the analyte can be reported, and that in this case the analyte was not observed above this limit.

NR = Not Reportable



Cameron Evans

Scientist

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Appendix

Analyte LOR Summary

Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	LOR (µg/L)
Perfluoroalkylsulfonic acids	
PFPrS	0.0010
PFBS	0.0010
PFPeS	0.0010
di-PFHxS (1)	0.0010
mono-PFHxS (1)	0.0010
L-PFHxS (1)	0.0010
Total PFHxS (3)	0.0010
PFHpS	0.0010
di-PFOS (5)	0.0010
mono-PFOS (5)	0.0010
L-PFOS (5)	0.0010
Total PFOS (7)	0.0010
Sum PFHxS+PFOS (1)	0.0010
PFNS	0.0010
PFDS	0.0010
Perfluoroalkylcarboxylic acids	
PFBA	0.0010
PFPeA	0.0010
PFHxA	0.0010
PFHpA	0.0010
PFOA	0.0010
PFNA	0.0010
PFDA	0.0010
PFUnDA	0.0010
PFDoDA	NR
PFTrDA	NR
PFTeDA	NR
Perfluorooctanesulfonamides	
PFOSA	0.0010
NEtFOSA-M	0.0010
NMeFOSA-M	0.0010
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	0.0010
NMeFOSAA	0.0010
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	0.0010
NMeFOSE-M	0.0010
Telomere Sulfonic acids	
4:2 FTS	0.0010
6:2 FTS	0.0010
8:2 FTS	0.0010

Analyte Definitions

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Poly- and Perfluorinated Alkyl Substances (PFAS) in Water - AsureQuality Method (LC-MS/MS)

Analyte	Full Name
Perfluoroalkylsulfonic acids	
PFPrS	Perfluoro-1-propanesulfonic acid
PFBS	Perfluoro-1-butanesulfonic acid
PFPeS	Perfluoro-1-pentanesulfonic acid
di-PFHxS (1)	Total Perfluorodimethylbutane sulfonic acids
mono-PFHxS (1)	Total Perfluoromethylpentane sulfonic acids
L-PFHxS (1)	Linear Perfluorohexanesulfonic acid
PFHpS	Perfluoro-1-heptanesulfonic acid
di-PFOS (5)	Total Perfluorodimethylhexane sulfonic acids
mono-PFOS (5)	Total Perfluoromethylheptane sulfonic acids
L-PFOS (5)	Linear Perfluorooctanesulfonic acid
PFNS	Perfluoro-1-nonanesulfonic acid
PFDS	Perfluoro-1-decanesulfonic acid
Perfluoroalkylcarboxylic acids	
PFBA	Perfluoro-n-butanoic acid
PFPeA	Perfluoro-n-pentanoic acid
PFHxA	Perfluoro-n-hexanoic acid
PFHpA	Perfluoro-n-heptanoic acid
PFOA	Perfluoro-n-octanoic acid
PFNA	Perfluoro-n-nonanoic acid
PFDA	Perfluoro-n-decanoic acid
PFUnDA	Perfluoro-n-undecanoic acid
PFDoDA	Perfluoro-n-dodecanoic acid
PFTrDA	Perfluoro-n-tridecanoic acid
PFTeDA	Perfluoro-n-tetradecanoic acid
Perfluorooctanesulfonamides	
PFOSA	Perfluoro-1-octanesulfonamide
NEtFOSA-M	N-ethylperfluoro-1-octanesulfonamide
NMeFOSA-M	N-methylperfluoro-1-octanesulfonamide
Perfluorooctanesulfonamidoacetic acids	
NEtFOSAA	N-ethylperfluoro-1-octanesulfonamidoacetic acid
NMeFOSAA	N-methylperfluoro-1-octanesulfonamidoacetic acid
Perfluorooctanesulfonamidoethanols	
NEtFOSE-M	2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol
NMeFOSE-M	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
Telomere Sulfonic acids	
4:2 FTS	1H,1H,2H,2H-perfluoro-1-hexanesulfonic acid
6:2 FTS	1H,1H,2H,2H-perfluoro-1-octanesulfonic acid
8:2 FTS	1H,1H,2H,2H-perfluoro-1-decanesulfonic acid
Internal Standards	
M3PFBS	Perfluoro-1-[2,3,4-13C3]butanesulfonic acid
M3PFHxS	Perfluoro-1-[1,2,3-13C3]hexanesulfonic acid
M8PFOS	Perfluoro-1-[13C8]octanesulfonic acid
M4PFBA	Perfluoro-n-[1,2,3,4-13C4]butanoic acid
M5PFPeA	Perfluoro-n-[1,2,3,4,5-13C5]pentanoic acid
M5PFHxA	Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid
MPFHpA	Perfluoro-n-[-1,2,3,4-13C4]heptanoic acid
M8PFOA	Perfluoro-n-[13C8]octanoic acid
M9PFNA	Perfluoro-n-[13C9]nonanoic acid
M6PFDA	Perfluoro-n-[1,2,3,4,5,6-13C6]decanoic acid
M7PFUnDA	Perfluoro-n-[1,2,3,4,5,6,7-13C7]undecanoic acid
MPFDoDA	Perfluoro-n-[1,2-13C2]dodecanoic acid
MPFTeDA	Perfluoro-n-[1,2-13C2]tetradecanoic acid

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Analyte	Full Name
MPFOSA	Perfluoro-1-[13C8]octanesulfonamide
DNEtFOSA	N-ethyl-D5-perfluoro-1-octanesulfonamide
DNMeFOSA	N-methyl-D3-perfluoro-1-octanesulfonamide
DNEtFOSAA	N-ethyl-D5-perfluoro-1-octanesulfonamidoacetic acid
DNMeFOSAA	N-methyl-D3-perfluoro-1-octanesulfonamidoacetic acid
DNEtFOSE	2-(N-ethyl-D5-perfluoro-1-octanesulfonamido)ethan-D4-ol
DNMeFOSE	2-(N-methyl-D3-perfluoro-1-octanesulfonamido)ethan-D4-ol
M4:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-hexane sulfonic acid
M6:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonic acid
M8:2FTS	1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonic acid

LOR = Limit of Reporting LOD = Limit of Detection NR = Not Reportable

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Appendix M: Groundwater and Contaminant Discharge at Coast

1 Groundwater and contaminant discharge at the coast

1.1 General

Groundwater flow into the sea from unconfined aquifers occurring via submarine groundwater discharges can be bounded by two saline circulation zones[1] (see freshwater groundwater discharge (FGD) in Diagram M1, below). The deeper saltwater wedge circulation zone is typically the focus of saltwater intrusion studies. The shallower zone is a tidally driven recirculation cell (intertidal saltwater cell (ISC)) which fills with seawater during high tides and flushes back to the ocean during tide recession. The variable-densities of fresh and salt water and the effects of the tide mean that it is difficult to quantify contaminant fluxes via these groundwater discharges.

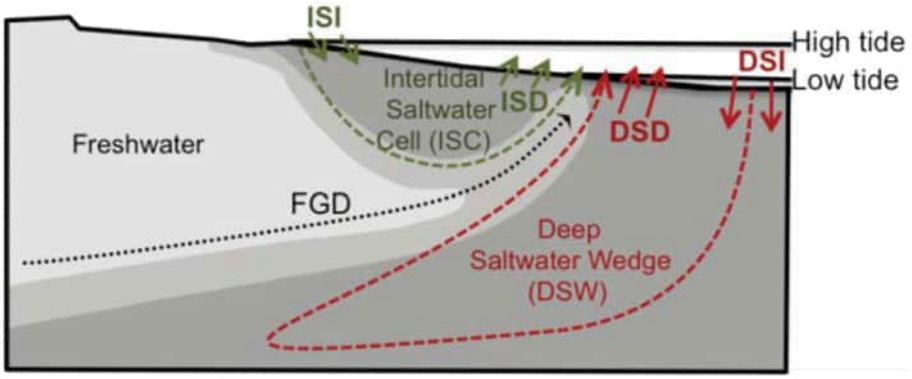


Diagram M1: Flow components in an unconfined coastal aquifer (Source: Figure 1, Abarca (2013), referenced in footnotes). Abbreviations: fresh groundwater discharges (FGD), intertidal saltwater discharge (ISD).

1.2 Tidal pumping

Tidal pumping reverses the flow direction in the aquifer adjacent to the coast over the peak of a tide cycle. When the tide drops, the flow resumes outward at a gradient higher than regional gradients, increasing the maximum outward flow velocities[2].

As discussed in Section 8.2 of the main text of this report, logger data indicates tidal pumping occurs at the subject site with influence noted 35m inland of the seawall. Flow direction changes were noted too with their extent observed further inland in the northwest corner than elsewhere.

In comparison with regional gradients, i.e. in the eastern part of the site where groundwater remains unaffected by tidal movements, a flow velocity increase of 15-fold was measured for the site near the bottom of the tidal cycle. This is based on gradients measured using loggers (discussed in Section 8.2 of the main text of this report).

Modelling of the effects of tidal pumping on coastal contaminant plumes has been carried out by Yim and Mohsen[2], indicating that contaminant discharge concentrations in aquifers affected by tidal pumping are significantly lower than discharge concentrations from aquifers without tidal pumping. The decrease in discharge concentrations is considered to be due to dilution from seawater infiltration into the aquifer. This infiltration is characterised as the intertidal saltwater cell (ISC).

[1] Abarca, E., H. Karam, H. F. Hemond, and C. F. Harvey (2013), Transient groundwater dynamics in a coastal aquifer: The effects of tides, the lunar cycle, and the beach profile, Water Resource. Res., 49, 2473–2488, doi:10.1002/wrcr.20075
[2] Yim, C.S. and M.F.N. Mohsen, 1992. Simulation of tidal effects on contaminant transport in porous media. Ground Water, 30(1), 78-86.

1.3 Other key elements of the CSM

The key elements of the conceptual site model (CSM) as they relate to groundwater discharges are shown in Figure M1 and M2, and described below.

As described in Section 10.1 of the main body of the report, chlorinated solvents are principally present in deeper sandier in situ marine sediments at depths of between 5 and 7 m below ground level, being some 3m to 5m below mean sea level. Considering the likely location of the ISC, deep groundwater affected by chlorinated contaminants is currently anticipated to be discharging at a distance of 4 m (or more) from the toe of the sea wall. Taking the shortest flow path, in order to provide a conservative assessment, suggests that the flow path for chlorinated compounds in groundwater to discharge to the marine environment is expected to be some 8 m.

As indicated in Section 2.4, a deep soil mixed (DSM) panel wall 10 m deep and 0.6 m wide will be installed on the landward side of the existing seawall/wharf. This will extend along the western boundary of the site. 7 m DSM panels will be constructed along the southern boundary of Site 18, around the southeast corner and 80m up the eastern boundary.

The layout of the proposed wall is expected to affect groundwater discharges as follows:

- Provide a low permeability barrier to contaminant discharges in shallow groundwater from Site 18. The DSM is expected to have a permeability of 10^{-9} m/s; and
- Provides a partial barrier to discharges of chlorinated solvent contamination at depth beneath Site 18 by enclosing bulk of this contamination. In contrast to contaminants in shallow groundwater, some deeper groundwater will continue flow beneath the DSM. Considering the CSM, taking the shortest flow path, in order to provide a conservative assessment, suggests that the flow path for chlorinated compounds in groundwater to discharge to the marine environment after installation of the DSM is expected to be some 16 m.

A thin zone of contamination will remain in front of the 10 m DSM wall, and possibly to the south of the 7 m DSM wall proposed along the southern boundary of Site 18. However, the mass of this contamination is minor in comparison to the materials that will be enclosed.

2 Summary of potential effects

2.1 Groundwater levels and flows

The DSM walls will cause some groundwater mounding which has been quantified as follows by the SEEP/W modelling presented in the T+T groundwater and settlement effects report[3].

Table M1: SEEP/W mounding predictions

Case	Seaward Water Level (m CD)	Landward Water Level (m CD)	Mound Height (m)
Mean Tide	2.2	3.5	1.3
Low Tide	0.3	2.7	2.4

The flow is expected to decrease flow through the property from 0.079m^3/day 0.012m^3/day, i.e. reduce flow to 1/7th of current conditions.

[3] T+T, September 2018, *142 - 188 Beaumont Street, Groundwater and settlement effects report*

2.2 Discharges associated with ISC

Shallow groundwater adjacent to the seawall, as monitored by shallow screened wells, is currently subject to seawater infiltration and tidal pumping.

The extent of seawater infiltration at the subject site is difficult to determine from salinity measurements collected from groundwater monitoring wells. Moderate salinity has been measured throughout the site, attributed to the fact that aquifer comprises insitu or reclaimed sea bed materials, so groundwater remains saline. However, shallow screened wells close to the seawall (CBH203P, MW1, MW3 and MW4) show a marked higher salinity level; approaching seawater concentrations at 20,000 mg/L to 25,000 mg/L (see Table 9.7 in main body of report). The exception is CBH204P; the reasons for which are not clear.

Contaminant concentrations measured in shallow screened wells directly adjacent to the seawall (CBH203P, CBH204P, MW1, MW3 and MW4) are similar to and/or lower than levels in shallow wells throughout the rest of the site. It is therefore possible that groundwater contaminants in these wells are diluted by seawater infiltration given the elevated salinity.

However, at Site 18 one or more of cyanide, ethylbenzene or cumene exceed the marine water quality protection criteria in each of the shallow screened wells directly adjacent to the seawall. Installation of the DSM wall will reduce these discharges at Site 18 by providing a low permeability barrier to groundwater flow. The ISC and tidal pumping is expected to then be restricted the seaward side of the DSM wall. Given that contaminant levels are not significantly elevated above marine protection criteria, levels discharging to the harbour post wall installation are expected to be well below protection criteria. In the same manner, while it is already expected to have low mobility, any residual SPH is expected to be trapped behind the 10 m DSM wall.

Zinc and copper exceedances were noted for the Orams current site. Copper has the highest ratio of measured levels to protection criteria of the contaminants at 12 times (MW4 at 0.098 mg/L compared with 0.080 mg/L). No DSM wall is proposed here, however, given the tidal pumping in the aquifer, its low permeability and hence slow groundwater movement and dilution effect of the tidal movements in the harbour, exceedances of criteria in surface water are not expected.

2.3 Discharges between ISC and saltwater wedge

Given their position with regard to the geometry of the existing seawall and tidal range, wells screened between 6m and 8m depth, i.e. GBH109 and GBH111, are likely to intercept at least some of the freshwater groundwater discharge (see Figure M1). These wells are unlikely to be affected by the ISC. This is evidenced by both GBH109P and GBH111P having salinity levels which are similar to wells away from the seawall at the site.

Marine water quality protection criteria are exceeded by numerous chlorinated compounds, cyanide and cumene in GBH109. Only cyanide exceeds marine water quality protection criteria at GBH111. PCE has the highest ratio of measured levels to protection criteria of the contaminants at 100 times (7.6 mg/L compared with criteria of 0.07 mg/L).

Estimates of the levels of contaminants discharging from groundwater to the harbour via this pathway, with and without the DSM wall, are presented below.

3 Modelling of discharges before and after DSM wall installation

3.1 General

Based on the above understanding of the likely mechanism by which contaminants are likely to discharge to the harbour, the following sets out fate and transport modelling to estimate the groundwater discharge levels. As noted in Section 1.3, a conservative approach has been taken to

this assessment, including considering factors such as the shortest flow paths, lowest biotransformation rates and so on. Further detail is provided below.

3.2 Model selection

Fate and transport modelling was conducted using Biochlor a screening model that simulates natural attenuation of dissolved solvents in groundwater. Biochlor is based on the Domenico analytical solute transport model, has the ability to simulate 1-D advection, 3-D dispersion, linear adsorption, and biotransformation via reductive dechlorination.

While a complex CSM is described in the preceding sections it is considered appropriate to assess fate and transport using a 1-D model as the critical factors affecting the attenuation of chlorinated compounds relate to the length of the flow path. In this case, the flow path is relatively short for the discharges before and after DSM wall installation so uncertainty relating to contaminant velocity and attenuation during transport does not have the impact on the results it might have for longer flow paths. Furthermore, input values for the critical factors affecting the modelling have been selected from the conservative ends of the feasible ranges to manage the uncertainty introduced by selecting a 1-D model.

3.3 Adopted receptor protection criteria

Marine water quality guidelines for 80% protection level have been adopted as the receptor protection criteria as per the controlled activity rules in the AUP.

3.4 Model inputs

Modelling inputs are presented below with the source of the inputs and notes on conservatism.

Table M2: Values adopted for fate and transport modelling

Parameter	Value adopted	Source and comments
Source concentrations	PCE 7.6 mg/L TCE 9.2 mg/L DCE 18.8 mg/L VC 5.4 mg/L	GBH109. Assumed infinite source
Marine environment protection values	PCE 0.070 mg/L TCE 0.33 mg/L DCE 0.7 mg/L VC 0.1 mg/L	Marine water quality guidelines for 80% protection level
Hydraulic gradient – pre-DSM wall	0.018 m/m	Site specific data – low tide maximum gradient at GBH109
Hydraulic gradient – post-DSM wall	0.00.066 m/m	Average water level upgradient of DSM wall (3.1m RL) – average tide level (2.05m) divided by anticipated flow path length (16m)

Parameter	Value adopted	Source and comments
Hydraulic Conductivity - pre DSM wall	10^{-7} m/s	As described in Section 3.4 of the main body of the report, the hydraulic conductivity of marine sediments and hydraulic fill is known to be highly variable, reflecting the heterogeneous nature of these materials. However, under the current condition discharges pass through predominantly fine grained sediments accumulated on the seabed. On this basis an average hydraulic conductivity of 10^{-7} m/s has been applied
Hydraulic Conductivity - post DSM wall	5 x 10^{-8} m/s	Estimate accounting increased vertical flow through underlying Tauranga Group sediments comprising silts with variable clay content (vertical conductivities are typically 10 – 100 times less than horizontal)
Fraction organic carbon	0.0064	Average value from site data (refer to Section 9.5 in main body of report). Value selected considered to be conservative as Tauranga Group sediments in the harbour have higher carbon content
Organic carbon coefficient (Koc)	Various	Biochlor referenced values
Distance to receptor	8m	Distance from GBH109P to low tide point (see Figure M1)
	16m	Distance from GBH109P to sea bed below low tide point around new 10m deep DSM wall (see Figure M2)
Plume width	40m	Width estimated based on site data
Biotransformation rates	PCE->TCE 0.8 yr^{-1} TCE->DCE 0.3 yr^{-1} DCE->VC 1 yr^{-1} VC->ETH 0.4 yr^{-1}	Lowest rates from Biochlor references. Site data indicates biotransformation is occurring and conducive conditions present but no site data for biotransformation rates are currently available.
Modelling duration	1000 years	Long duration selected to achieve pseudo steady-state which is conservative for an infinite source

3.5 Results and discussion

Full modelling inputs and outputs are presented at the end of this Appendix. The groundwater concentrations estimated to discharge to harbour are presented in Table M3 below.

Table M3 – Concentrations of chlorinated compounds estimated in groundwater discharging to the harbour

Compound	Source concentration	Estimate of current concentrations being discharged	Estimate of concentrations being discharged after DSM installed	Marine environment protection values
PCE	7.6	0.014	<0.001	0.070
TCE	9.2	0.94	<0.001	0.33

Compound	Source concentration	Estimate of current concentrations being discharged	Estimate of concentrations being discharged after DSM installed	Marine environment protection values
DCE	18.8	10.5	0.148	0.7
VC	5.4	2.1	0.032	0.1

Notes:

All data presented in mg/L

The modelling predicts significantly reduced concentrations (about 2 orders of magnitude) after the DSM wall has been installed. Predicted discharge concentrations would exceed marine environment protection values before the DSM wall but not after the wall has been completed. Given that there would be dilution and dispersion as the discharge enters the harbour which is not accounted for in the modelling, surface water concentrations would therefore be expected to be further attenuated.

3.6 Model calibration and sensitivity

Given the paucity of data, model calibration is not feasible. However, there is some harbour survey information that indicates current discharges may not be having an impact on the marine environment as follows.

Harbour sediment samples were collected for examination of benthic ecology conditions from adjacent to the seawall including within about 10m of the GBH109 (sample location SW1)[4]. Although results indicated disturbed conditions for benthic ecology, the sample did not indicate substantially different results from others collected along the seawall.

Input values were generally selected from the conservative end of the range, especially for variables in which no site data is available. However, it is considered that the modelling results are sensitive to hydraulic conductivity, fraction organic carbon and biotransformation rates. Should it become evident that these values are significantly different to the input values, modelling should be checked for the impacts on results. If necessary discharges could be mitigated by deepening the section of DSM where chlorinated compounds are discharging from the site. This would have the effect of directing contaminants to flow through the underlying, typically lower permeability Tauranga Group sediments, (refer to Figures M1 and M2) increasing the flow path length and reducing flow rates, with an associated increase in the attenuation of contaminants. It is expected that relatively small increases in depth (~2 m) of a limited number of panels (~10) will result in significant increases in attenuation.

3.7 Addressing uncertainty

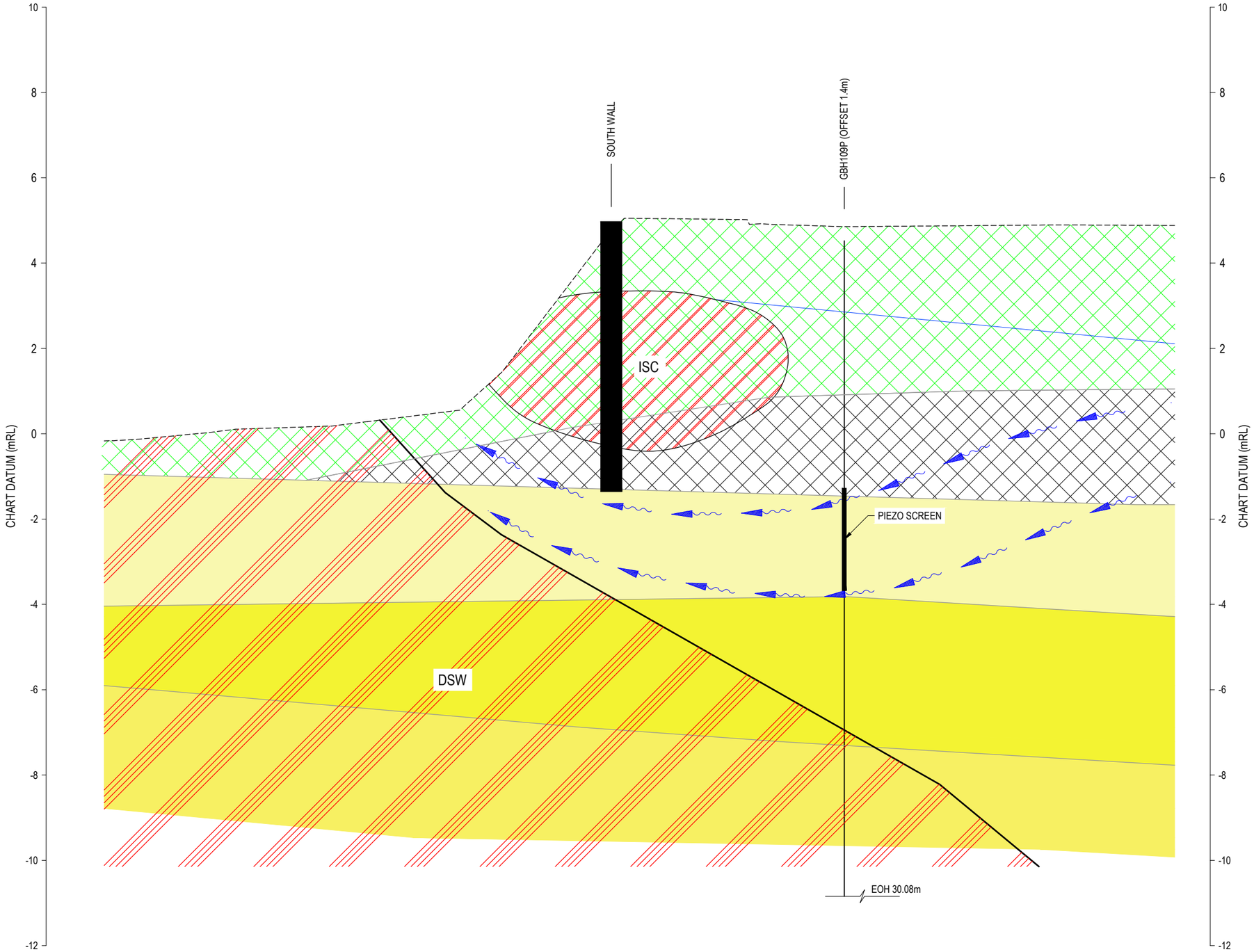
As a risk mitigation measure it is proposed to locally deepen selected DSM panels in the south-western corner of the site to address any potential uncertainty in the modelling results.

The depth and number of panels to be deepened will be confirmed during detailed design. However provisionally it is anticipated that the selected infill panels shown in Figure M3 will be deepened by 2 m to 12 m depth.

[4] Coastal Ecology Assessment Report: 142 - 188 Beaumont Street, Wynyard Quarter. Prepared for Orams Marine Ltd by Tonkin & Taylor Ltd, September 2018x

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C:\12dSynergy\1\Orams Expansion Facility_18\CAD\FIG\30881-CONT-FM1.dwg 2018-Sep-28 1:53:06 PM Plotted By: JONALD CASTRO



LEGEND

- EXISTING GROUND PROFILE
- INFERRED GEOLOGICAL BOUNDARY
- PIEZOMETRIC LEVEL HIGH TIDE
- GROUNDWATER DISCHARGE FLOW
- FILL MATERIAL (GENERAL)
- FILL (HYDRAULIC)
- RECENT MARINE SEDIMENTS
- UPPER TAURANGA GROUP
- LOWER TAURANGA GROUP
- INTERTIDAL SALTWATER CELL (ISC)
- DEEP SALTWATER WEDGE (DSW)

A3 SCALE 1:100

0 1 2 3 4 5 (m)

ORIGINAL IN COLOUR

NOTES:

1. ALL DIMENSION ARE IN METRES UNLESS NOTED OTHERWISE.
2. LEVEL DATUM: CHART DATUM.

Tonkin+Taylor

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PROJECT No.	30881.2000		
DESIGNED	LKH	Aug. 18	
DRAWN	JC	Aug. 18	
CHECKED			
PRELIMINARY DRAFT			
APPROVED		DATE	

CLIENT **ORAMS MARINE**

PROJECT **142-188 BEAUMONT STREET**

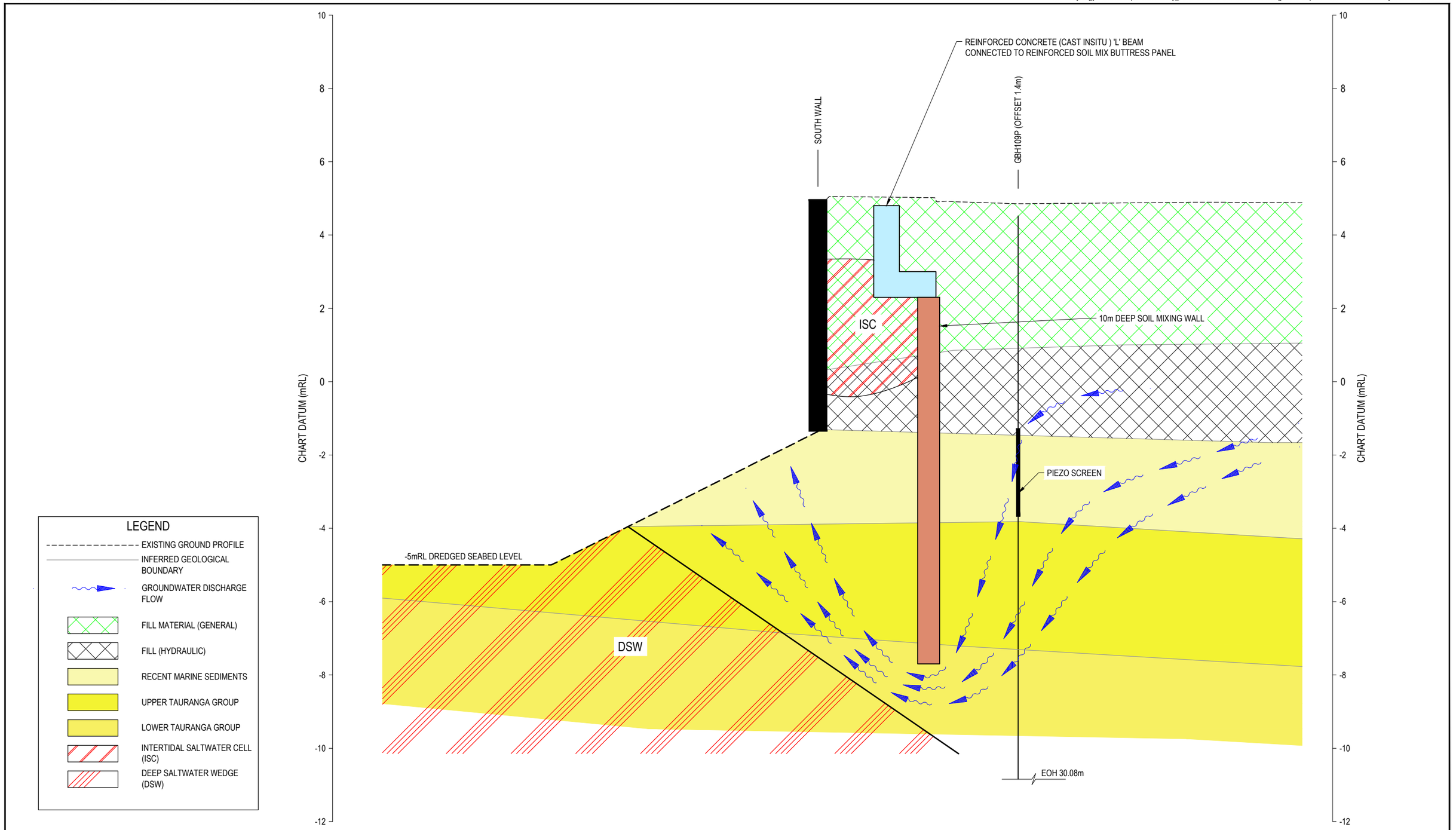
TITLE GROUND CONTAMINATION SITE INVESTIGATION
CURRENT GROUNDWATER DISCHARGE MECHANISM

SCALE (A3) 1:100 FIG No. CONT - FIGURE M1 REV 1

UNDER REVISION

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C:\12dSynergy\1\Orams Expansion Facility_18\CAD\FIG\30881-CONT-FM1.dwg 2018-Sep-28 1:53:06 PM Plotted By: JONALD CASTRO



NOTES:

1. ALL DIMENSION ARE IN METRES UNLESS NOTED OTHERWISE.
2. LEVEL DATUM: CHART DATUM.

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PROJECT No.	30881.2000		
DESIGNED	LKH	Aug. 18	
DRAWN	JC	Aug. 18	
CHECKED			
PRELIMINARY DRAFT			
APPROVED		DATE	

CLIENT	**ORAMS MARINE**
PROJECT	**142-188 BEAUMONT STREET**
TITLE	GROUND CONTAMINATION SITE INVESTIGATION GROUNDWATER DISCHARGE WITH 10m DSM WALL
SCALE (A3)	1:100
FIG No.	CONT - FIGURE M2
REV	1

PRELIMINARY NOT FOR CONSTRUCTION

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C:\12dSynergy\data\ALBTCAD\Orams Expansion Facility_166\CAD\FIG\30881-CONT-F2.dwg 2018-Nov-02 3:30:12 PM Plotted By: MARK ENNION

NOTES
1. ALL LEVELS ARE IN CHART DATUM UNLESS NOTED OTHERWISE.

EXISTING TO BE REMOVED

5H:1V SLOPE

DREDGE 600T TRAVEL LIFT POCKET TO RL-6.0m C.D. MINIMUM DEPTH

TOP OF DREDGING

5H:1V SLOPE

RL -6m

RL -5m

3H:1V SLOPE

65m

58m

55m

28m

25m

NEW 85T MARINE TRAVEL LIFT

NEW 620T MARINE TRAVEL LIFT

EXISTING SOUTHERN SEAWALL WITH NEW WALL CONSTRUCTED BEHIND EXISTING.

EXISTING TO BE REMOVED

EXISTING TO BE REMOVED

EXISTING BERM (APPROX)

REMOVE EXISTING NORTHERN WALL BELOW RL0.4m (CHART DATUM)

INFERRED SECTION OVER WHICH DSM PANELS ARE PROPOSED TO BE DEEPENED (TO BE CONFIRMED DURING DETAILED DESIGN).

CONSTRUCT NEW WALL (LIKELY CANTILEVER TIMBER OR CONCRETE WALL) TO RETAIN SOIL OUTSIDE BOUNDARY AND TO MAINTAIN ACCESS TO THE PONTOON OUTSIDE SITE.

10m DEEP STABILISED PANELS FOR CONTAMINATION CUT OFF

18m REINFORCED SOIL MIX BUTTRESS PANELS (IN YELLOW)

EXTENT OF NEW PAVEMENT / STABILISED SUBGRADE (REFER DRAWING SK-80)

NEW STABILISED SUBGRADE (NO CONCRETE PAVEMENT)

TIE-RODS AT 3.15m CRS

NEW DEADMAN

BUILDING (ORAMS) TO BE DEMOLISHED

7m DEEP CUT OFF WALL

ORAM'S OPERATION YARD

EXCAVATE BEHIND EXISTING WALL TO FORM NEW SLOPE BATTER PROFILE AT 3H:1V

NEW 10m DEEP SOIL MIX PANELS (CONTAMINATION CUT OFF WALL)

NEW 85T SHED

EXISTING

EXISTING

NEW BUILDING 1A

NEW BUILDING 1B

NEW BUILDING 2

FUTURE BUILDING (INDICATIVE LOCATION)

JELLICOE STREET

7m DEEP CUT OFF WALL

NEW STABILISED SUBGRADE UNDER NEW BUILDING 1A REFER DRAWING SK-80. (NOTE: SLAB TO BE CONFIRMED) ALTERNATELY BUILDING TO BE SUPPORTED ON PILES WITH VAPOUR BARRIER

BEAUMONT STREET

NEW STABILISED SUBGRADE UNDER NEW BUILDINGS B1B & B2 REFER DRAWING SK-80. (NOTE: SLAB TO BE CONFIRMED) ALTERNATELY BUILDING TO BE SUPPORTED ON PILES WITH VAPOUR BARRIER

A3 SCALE 1:1000

0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

Tonkin+Taylor

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PROJECT No.	30881.2000		
DESIGNED	LKH	Sep. 18	
DRAWN	WTHU	Sep. 18	
CHECKED	AMM	Nov.18	
	WMW	Nov.18	
	APPROVED	DATE	

CLIENT **ORAMS MARINE**

PROJECT **142-188 BEAUMONT STREET**

TITLE GROUND CONTAMINATION SITE INVESTIGATION
LOCAL DEEPENING OF DSM INFILL PANELS

SCALE (A3) 1:1000 FIG No. CONT - FIGURE M3 REV

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Site 18
Pre DSM panel wall
Run Name

Data Input Instructions:
115 → 1. Enter value directly....or
↑ or
0.02 → 2. Calculate by filling in gray cells. Press Enter, then C
(To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation Screening Protocol

TYPE OF CHLORINATED SOLVENT: ◉ Ethenes ○ Ethanes

1. ADVECTION

Seepage Velocity*	Vs	0.7	(ft/yr)
or			
Hydraulic Conductivity	K	1.0E-06	(cm/sec)
Hydraulic Gradient	i	0.066	(ft/ft)
Effective Porosity	n	0.1	(-)

2. DISPERSION

Alpha x*	2.4	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	1.E-99	(-)

Calc. Alpha x

3. ADSORPTION

Retardation Factor* → R

or

					R
Soil Bulk Density, rho	1.6	(kg/L)			
FractionOrganicCarbon, foc	6.4E-3	(-)			
Partition Coefficient	Koc				
PCE	426	(L/kg)			44.62 (-)
TCE	130	(L/kg)			14.31 (-)
DCE	125	(L/kg)			13.80 (-)
VC	30	(L/kg)			4.03 (-)
ETH	302	(L/kg)			31.92 (-)

Common R (used in model)* = 14.31

4. BIOTRANSFORMATION

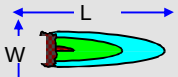
-1st Order Decay Coefficient*

		l (1/yr)	half-life (yrs)	Yield
Zone 1				
PCE	TCE	0.800		0.79
TCE	DCE	0.300		0.74
DCE	VC	0.100		0.64
VC	ETH	0.400		0.45
Zone 2		l (1/yr)	half-life (yrs)	
PCE	TCE	0.000		
TCE	DCE	0.000		
DCE	VC	0.000		
VC	ETH	0.000		

l HELP

5. GENERAL

Simulation Time*	10000	(yr)
Modeled Area Width*	300	(ft)
Modeled Area Length*	120	(ft)
Zone 1 Length*	120	(ft)
Zone 2 Length*	0	(ft)



Zone 2=

6. SOURCE DATA

TYPE: Decaying
Single Planar

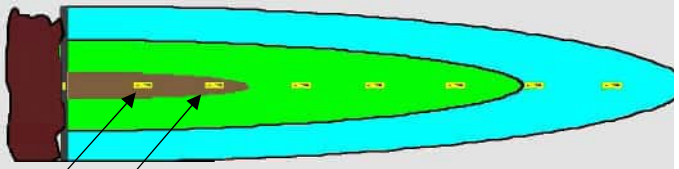
Source Options

Source Thickness in Sat. Zone* 20 (ft)

Width* (ft) Y1: 120

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE	7.6	
TCE	9.2	
DCE	18.8	
VC	5.4	
ETH	0.013	

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	7.6										
TCE Conc. (mg/L)	9.2										
DCE Conc. (mg/L)	18.8										
VC Conc. (mg/L)	5.4										
ETH Conc. (mg/L)	0.013										
Distance from Source (ft)	0	66									
Date Data Collected	2000										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | **RUN ARRAY** | ***Help*** | Restore | RESET | ***SEE OUTPUT*** | Paste

Start Here → ○ PCE ○ TCE ◉ DCE ○ VC ○ ETH

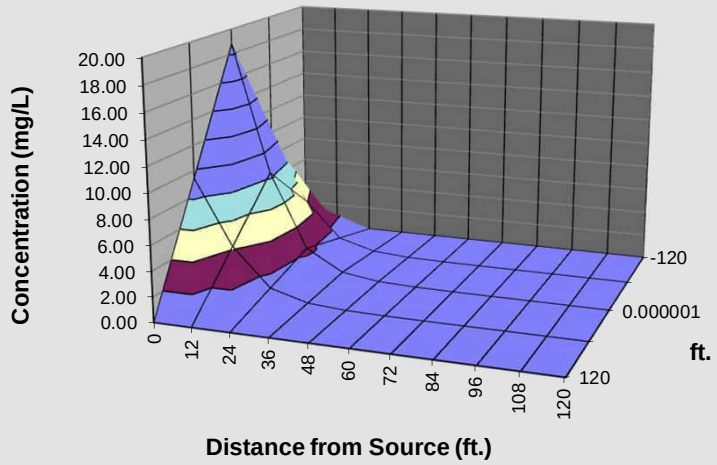
DISSOLVED SOLVENT CONCENTRATIONS IN PLUME

Transverse Distance (ft) ↓	*Distance from Source (ft)* 0	12	24	36	48	60	72	84	96	108	120
120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	9.400	4.198	1.147	0.293	0.074	0.019	0.005	0.001	0.000	0.000	0.000
0	18.800	8.397	2.294	0.586	0.148	0.037	0.009	0.002	0.001	0.000	0.000
-60	9.400	4.198	1.147	0.293	0.074	0.019	0.005	0.001	0.000	0.000	0.000
-120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MASS RATE (mg/day)	2.4E+2	1.1E+2	2.9E+1	7.4E+0	1.9E+0	4.7E-1	1.2E-1	3.0E-2	7.6E-3	1.9E-3	4.8E-4

Show No Degradation

Show Biotransformation

Time: 10000 yr Target Level: **0.070** mg/L Displayed Model: **Biotransformation** Displayed Compound: **DCE**



Plume Mass (Order-of-Magnitude Accuracy)

See Gallons

Plume Mass If No Degradation: 230.3 (Kg)

- Plume Mass If Biotransformation/Production: 24.3 (Kg)

Mass Removed: 205.9 (Kg)

If "Can't Calc.", make model area longer

% Biotransformed = +89.4%

% Change in Mass Rate = 100.0 % (source to edge)

See acre-ft

Current Volume of Ground Water in Plume: 0.20 MGal

Flow Rate of Water Through Source Area: 0.000 MGD

Compare to Pump and Treat

Pumping Rate: (gpm)

Pore Volumes Removed Per Yr.: 0.00

Pore Volumes to Clean-Up:

Clean-Up Time: (yr)

Plot All Data | Plot Data > Target

Mass HELP | To Centerline | Return to Input

Start Here → ◉ PCE ○ TCE ○ DCE ○ VC ○ ETH

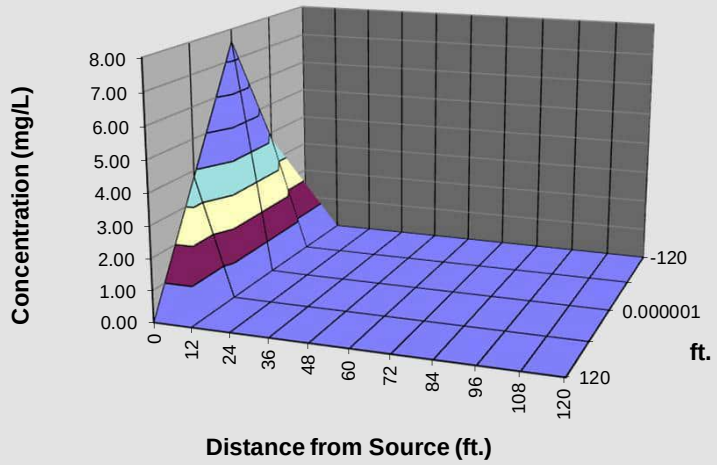
DISSOLVED SOLVENT CONCENTRATIONS IN PLUME

Transverse Distance (ft) ↓ / Distance from Source (ft)	0	12	24	36	48	60	72	84	96	108	120
120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	3.800	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	7.600	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-60	3.800	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MASS RATE (mg/day)	9.7E+1	1.9E-1	3.6E-4	7.0E-7	1.3E-9	2.6E-12	5.0E-15	9.7E-18	1.9E-20	3.6E-23	7.0E-26

Show No Degradation

Show Biotransformation

Time: 10000 yr Target Level: **0.005** mg/L Displayed Model: **Biotransformation** Displayed Compound: **PCE**



Plume Mass (Order-of-Magnitude Accuracy)

See Gallons

Plume Mass If No Degradation	93.1	*(Kg)*
- Plume Mass If Biotransformation/Production	4.4	*(Kg)*
Mass Removed	88.6	*(Kg)*

If "Can't Calc.", make model area longer

% Biotransformed = **+95.2%**

% Change in Mass Rate = **100.0 %** (source to edge)

See acre-ft

Current Volume of Ground Water in Plume	0.06	*MGal*
Flow Rate of Water Through Source Area	0.000	*MGD*

Compare to Pump and Treat

Pumping Rate		*(gpm)*
# Pore Volumes Removed Per Yr.	0.00	
# Pore Volumes to Clean-Up		
Clean-Up Time		*(yr)*

Plot All Data Plot Data > Target

Mass HELP **To Centerline** **Return to Input**

Start Here → ○ PCE ◉ TCE ○ DCE ○ VC ○ ETH

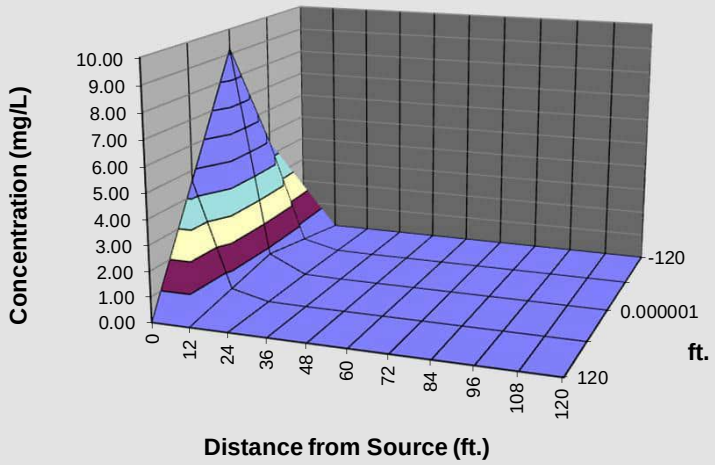
DISSOLVED SOLVENT CONCENTRATIONS IN PLUME

Transverse Distance (ft) ↓ / Distance from Source (ft)	0	12	24	36	48	60	72	84	96	108	120
120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	4.600	0.371	0.015	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	9.200	0.742	0.031	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-60	4.600	0.371	0.015	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MASS RATE (mg/day)	1.2E+2	9.4E+0	3.9E-1	1.6E-2	6.3E-4	2.6E-5	1.0E-6	4.2E-8	1.7E-9	6.8E-11	2.7E-12

Show No Degradation

Show Biotransformation

Time: 10000 yr Target Level: **0.005** mg/L Displayed Model: **Biotransformation** Displayed Compound: **TCE**



Plume Mass (Order-of-Magnitude Accuracy)

See Gallons

Plume Mass If No Degradation	112.7	(Kg)
- Plume Mass If Biotransformation/Production	6.3	(Kg)
Mass Removed	106.4	(Kg)

If "Can't Calc.", make model area longer

% Biotransformed = +94.4%

% Change in Mass Rate = 100.0 % (source to edge)

See acre-ft

Current Volume of Ground Water in Plume	0.10	MGal
Flow Rate of Water Through Source Area	0.000	MGD

Compare to Pump and Treat

Pumping Rate		(gpm)
# Pore Volumes Removed Per Yr.	0.00	
# Pore Volumes to Clean-Up		
Clean-Up Time		(yr)

Plot All Data | Plot Data > Target

Mass HELP | To Centerline | Return to Input

Start Here → ○ PCE ○ TCE ○ DCE ◉ VC ○ ETH

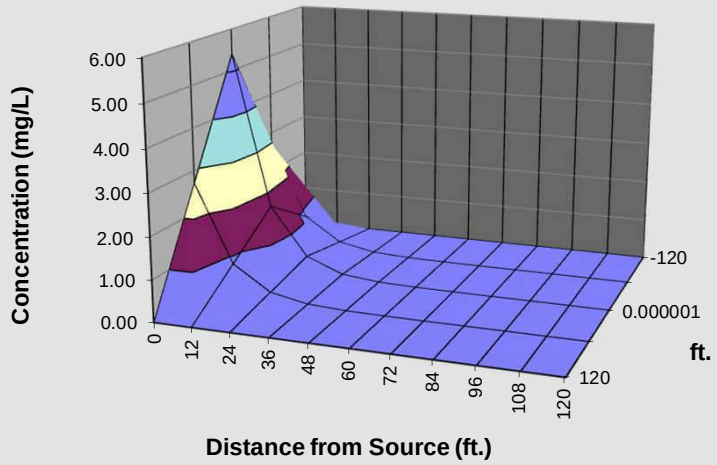
DISSOLVED SOLVENT CONCENTRATIONS IN PLUME

Transverse Distance (ft) ↓ / Distance from Source (ft)	0	12	24	36	48	60	72	84	96	108	120
120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	2.700	0.833	0.242	0.063	0.016	0.004	0.001	0.000	0.000	0.000	0.000
0	5.400	1.666	0.483	0.125	0.032	0.008	0.002	0.001	0.000	0.000	0.000
-60	2.700	0.833	0.242	0.063	0.016	0.004	0.001	0.000	0.000	0.000	0.000
-120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MASS RATE (mg/day)	6.9E+1	2.1E+1	6.1E+0	1.6E+0	4.0E-1	1.0E-1	2.6E-2	6.5E-3	1.6E-3	4.1E-4	1.0E-4

Show No Degradation

Show Biotransformation

Time: 10000 yr Target Level: **0.002** mg/L Displayed Model: **Biotransformation** Displayed Compound: **VC**



Plume Mass (Order-of-Magnitude Accuracy)

See Gallons

Plume Mass If No Degradation	66.1	*(Kg)*
- Plume Mass If Biotransformation/Production	5.9	*(Kg)*
Mass Removed	60.3	*(Kg)*

If "Can't Calc.", make model area longer

% Biotransformed = **+91.2%**

% Change in Mass Rate = **100.0 %** (source to edge)

See acre-ft

Current Volume of Ground Water in Plume	0.17	*MGal*
Flow Rate of Water Through Source Area	0.000	*MGD*

Compare to Pump and Treat

Pumping Rate		*(gpm)*
# Pore Volumes Removed Per Yr.	0.00	
# Pore Volumes to Clean-Up		
Clean-Up Time		*(yr)*

Plot All Data | Plot Data > Target

Mass HELP | To Centerline | Return to Input

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Site 18
Pre DSM panel wall
Run Name

Data Input Instructions:
115 → 1. Enter value directly....or
↑ or
0.02 → 2. Calculate by filling in gray cells. Press Enter, then C
(To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation Screening Protocol

TYPE OF CHLORINATED SOLVENT: ◉ Ethenes ○ Ethanes

1. ADVECTION

Seepage Velocity*	Vs	1.9	(ft/yr)
or			
Hydraulic Conductivity	K	1.0E-05	(cm/sec)
Hydraulic Gradient	i	0.018	(ft/ft)
Effective Porosity	n	0.1	(-)

2. DISPERSION

Alpha x*	2.4	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	1.E-99	(-)

Calc. Alpha x

3. ADSORPTION

Retardation Factor* → R

or

					R
Soil Bulk Density, rho	1.6	(kg/L)			
FractionOrganicCarbon, foc	6.4E-3	(-)			
Partition Coefficient	Koc				
PCE	426	(L/kg)			44.62 (-)
TCE	130	(L/kg)			14.31 (-)
DCE	125	(L/kg)			13.80 (-)
VC	30	(L/kg)			4.03 (-)
ETH	302	(L/kg)			31.92 (-)

Common R (used in model)* = 14.31

4. BIOTRANSFORMATION

-1st Order Decay Coefficient*

		l (1/yr)	half-life (yrs)	Yield
Zone 1				
PCE	TCE	0.800		0.79
TCE	DCE	0.300		0.74
DCE	VC	0.100		0.64
VC	ETH	0.400		0.45
Zone 2		l (1/yr)	half-life (yrs)	
PCE	TCE	0.000		
TCE	DCE	0.000		
DCE	VC	0.000		
VC	ETH	0.000		

l HELP

5. GENERAL

Simulation Time*	10000	(yr)
Modeled Area Width*	300	(ft)
Modeled Area Length*	120	(ft)
Zone 1 Length*	120	(ft)
Zone 2 Length*	0	(ft)

L, W

Zone 2=

6. SOURCE DATA

TYPE: Decaying
Single Planar

Source Options

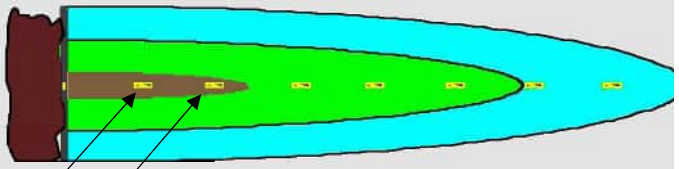
Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

Source Thickness in Sat. Zone* 20 (ft)

Width* (ft) Y1 = 120

k_s* (1/yr)

Conc. (mg/L)*	C1
PCE	7.6
TCE	9.2
DCE	18.8
VC	5.4
ETH	0.013



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	7.6										
TCE Conc. (mg/L)	9.2										
DCE Conc. (mg/L)	18.8										
VC Conc. (mg/L)	5.4										
ETH Conc. (mg/L)	0.013										
Distance from Source (ft)	0	66									
Date Data Collected	2000										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | **RUN ARRAY** | ***Help*** | Restore | RESET | ***SEE OUTPUT*** | Paste

Start Here → ○ PCE ○ TCE ○ DCE ◉ VC ○ ETH

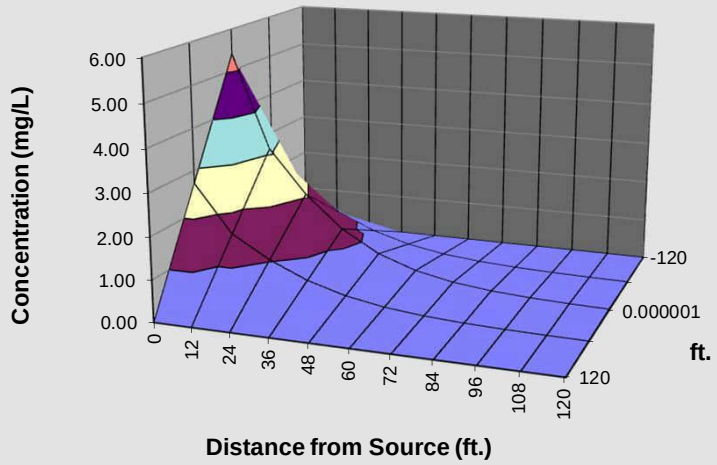
DISSOLVED SOLVENT CONCENTRATIONS IN PLUME

Transverse Distance (ft) ↓ / Distance from Source (ft)	0	12	24	36	48	60	72	84	96	108	120
120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	2.700	1.562	1.032	0.639	0.376	0.216	0.122	0.069	0.039	0.022	0.012
0	5.400	3.123	2.064	1.279	0.753	0.431	0.244	0.138	0.077	0.043	0.024
-60	2.700	1.562	1.032	0.639	0.376	0.216	0.122	0.069	0.039	0.022	0.012
-120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MASS RATE (mg/day)	1.9E+2	1.1E+2	7.2E+1	4.4E+1	2.6E+1	1.5E+1	8.5E+0	4.8E+0	2.7E+0	1.5E+0	8.5E-1

Show No Degradation

Show Biotransformation

Time: 10000 yr Target Level: **0.002** mg/L Displayed Model: **Biotransformation** Displayed Compound: **VC**



Plume Mass (Order-of-Magnitude Accuracy)

See Gallons

Plume Mass If No Degradation	66.1	*(Kg)*
- Plume Mass If Biotransformation/Production	12.7	*(Kg)*
Mass Removed	53.5	*(Kg)*
% Biotransformed =	**+80.8%**	
% Change in Mass Rate =	**99.5 %**	(source to edge)

If "Can't Calc.", make model area longer

See acre-ft

Current Volume of Ground Water in Plume	Can't Calc.	*MGal*
Flow Rate of Water Through Source Area	0.000	*MGD*

Compare to Pump and Treat

Pumping Rate		*(gpm)*
# Pore Volumes Removed Per Yr.		
# Pore Volumes to Clean-Up		
Clean-Up Time		*(yr)*

Plot All Data Plot Data > Target

Mass HELP **To Centerline** **Return to Input**

Start Here → ○ PCE ○ TCE ◉ DCE ○ VC ○ ETH

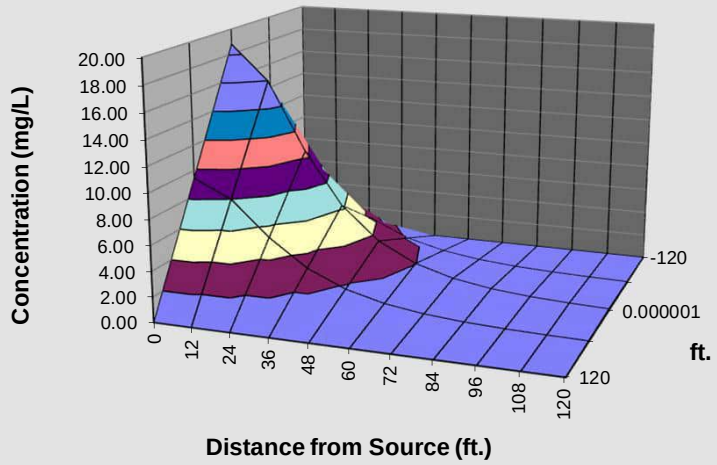
DISSOLVED SOLVENT CONCENTRATIONS IN PLUME

Transverse Distance (ft) ↓ / Distance from Source (ft)	0	12	24	36	48	60	72	84	96	108	120
120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	9.400	7.986	5.239	3.117	1.789	1.013	0.571	0.321	0.180	0.101	0.057
0	18.800	15.973	10.477	6.234	3.579	2.027	1.141	0.642	0.360	0.202	0.114
-60	9.400	7.986	5.239	3.117	1.789	1.013	0.571	0.321	0.180	0.101	0.057
-120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MASS RATE (mg/day)	6.5E+2	5.5E+2	3.6E+2	2.2E+2	1.2E+2	7.0E+1	4.0E+1	2.2E+1	1.2E+1	7.0E+0	3.9E+0

Show No Degradation

Show Biotransformation

Time: 10000 yr Target Level: **0.070** mg/L Displayed Model: **Biotransformation** Displayed Compound: **DCE**



Plume Mass (Order-of-Magnitude Accuracy)

See Gallons

Plume Mass If No Degradation: 230.3 (Kg)

- Plume Mass If Biotransformation/Production: 58.5 (Kg)

Mass Removed: 171.8 (Kg)

If "Can't Calc.", make model area longer

% Biotransformed = +74.6%

% Change in Mass Rate = 99.4 % (source to edge)

See acre-ft

Current Volume of Ground Water in Plume: Can't Calc. MGal

Flow Rate of Water Through Source Area: 0.000 MGD

Compare to Pump and Treat

Pumping Rate: (gpm)

Pore Volumes Removed Per Yr.:

Pore Volumes to Clean-Up:

Clean-Up Time: (yr)

Plot All Data | Plot Data > Target

Mass HELP | To Centerline | Return to Input

Start Here → ○ PCE

DISSOLVED SOLVENT CONCENTRATIONS IN PLUME

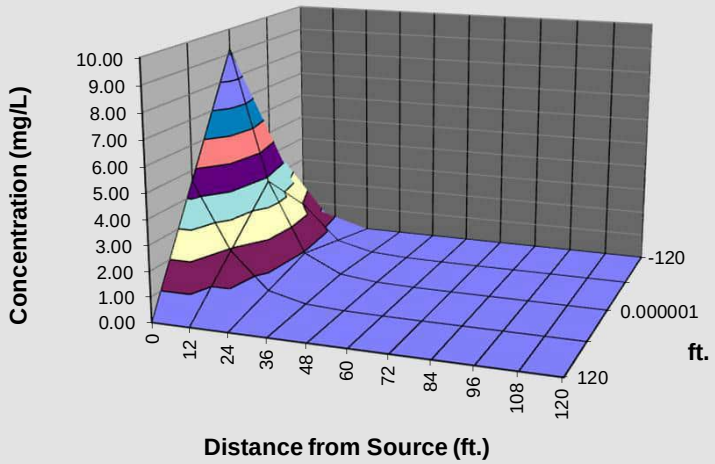
◉ TCE ○ DCE ○ VC ○ ETH

Transverse Distance (ft) ↓	Distance from Source (ft) 0	12	24	36	48	60	72	84	96	108	120
120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	4.600	1.922	0.471	0.108	0.024	0.006	0.001	0.000	0.000	0.000	0.000
0	9.200	3.844	0.942	0.216	0.049	0.011	0.002	0.001	0.000	0.000	0.000
-60	4.600	1.922	0.471	0.108	0.024	0.006	0.001	0.000	0.000	0.000	0.000
-120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MASS RATE (mg/day)	3.2E+2	1.3E+2	3.3E+1	7.5E+0	1.7E+0	3.8E-1	8.6E-2	1.9E-2	4.4E-3	9.9E-4	2.2E-4

Show No Degradation

Show Biotransformation

Time: 10000 yr Target Level: **0.005** mg/L Displayed Model: **Biotransformation** Displayed Compound: **TCE**



Plume Mass (Order-of-Magnitude Accuracy)

See Gallons

Plume Mass If No Degradation	112.7	*(Kg)*
- Plume Mass If Biotransformation/Production	11.3	*(Kg)*
Mass Removed	101.4	*(Kg)*

If "Can't Calc.", make model area longer

% Biotransformed = **+90.0%**

% Change in Mass Rate = **100.0 %** (source to edge)

See acre-ft

Current Volume of Ground Water in Plume	0.19	*MGal*
Flow Rate of Water Through Source Area	0.000	*MGD*

Compare to Pump and Treat

Pumping Rate		*(gpm)*
# Pore Volumes Removed Per Yr.	0.00	
# Pore Volumes to Clean-Up		
Clean-Up Time		*(yr)*

Plot All Data Plot Data > Target

Mass HELP **To Centerline** **Return to Input**

Start Here → ◉ PCE ○ TCE ○ DCE ○ VC ○ ETH

DISSOLVED SOLVENT CONCENTRATIONS IN PLUME

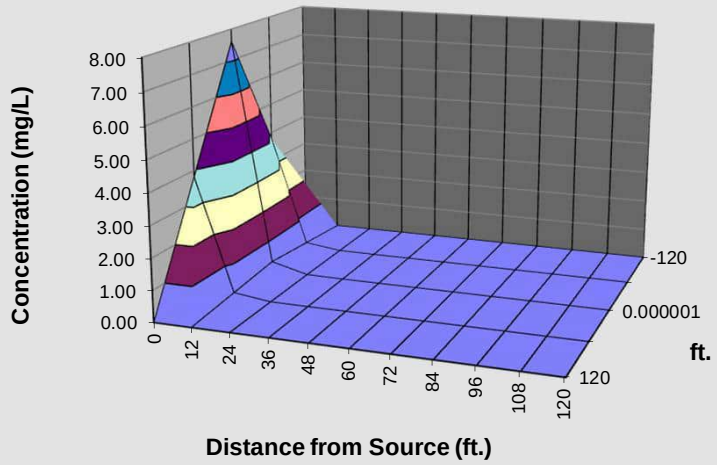
Transverse Distance (ft) ↓ / Distance from Source (ft)	0	12	24	36	48	60	72	84	96	108	120
120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	3.800	0.161	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	7.600	0.323	0.014	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-60	3.800	0.161	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MASS RATE (mg/day)	2.6E+2	1.1E+1	4.8E-1	2.0E-2	8.6E-4	3.6E-5	1.5E-6	6.6E-8	2.8E-9	1.2E-10	5.0E-12

Show No Degradation

Show Biotransformation

Displayed Compound

Time: 10000 yr Target Level: 0.005 mg/L Displayed Model: Biotransformation PCE



Plume Mass (Order-of-Magnitude Accuracy)

See Gallons

Plume Mass If No Degradation 93.1 (Kg)

- Plume Mass If Biotransformation/Production 4.8 (Kg)

Mass Removed 88.3 (Kg)

If "Can't Calc.", make model area longer

% Biotransformed = +94.8%

% Change in Mass Rate = 100.0 % (source to edge)

See acre-ft

Current Volume of Ground Water in Plume 0.10 MGal

Flow Rate of Water Through Source Area 0.000 MGD

Compare to Pump and Treat

Pumping Rate (gpm)

Pore Volumes Removed Per Yr. 0.00

Pore Volumes to Clean-Up

Clean-Up Time (yr)

Plot All Data | Plot Data > Target

Mass HELP | To Centerline | Return to Input

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