Bayly Road – Detailed Site Investigation

Prepared for

Taranaki Regional Council

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Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Taranaki Regional Council, New Plymouth District Council, Southern Geophysical Limited and NZ Geomatics Limited, the excavation of test pit and drilling of boreholes, installation of monitoring wells, and the testing of soil, water and ground gases for a variety of analytes. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information. The site conditions as described in this report have been interpreted from, and are subject to, this information and its limitations and accordingly PDP does not represent that its interpretation accurately represents the full site conditions.

The information contained within this report applies to sampling undertaken on the date stated in this report. With time, the site conditions and environmental standards could change so that the reported assessment and conclusions are no longer valid. Accordingly, the report should not be used to refer to site conditions and environmental standards applying at a later date without first confirming the validity of the report's information at that time.

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Executive Summary

Taranaki Regional Council (TRC) engaged Pattle Delamore Partners (PDP) to undertake a detailed site investigation (DSI) of the property adjacent to Bayly Road and Ocean View Parade in New Plymouth. Ngāti Te Whiti intend to develop a marae at the site, with the future possibility of small commercial and residential areas. The culturally significant Waitapu Urupā is also located on the site, containing both marked and un-marked graves.

The site has a history of oil drilling activities, and the demolition of a large number of historical baches and other buildings has occurred. Three decommissioned oil wells are located on the site, the exact location of one of which is unknown. As a result of these past activities, there is the potential for soil and groundwater contamination, and the investigation has been undertaken to provide an appraisal of the sites contaminative status and to assess its suitability for the proposed development.

Site investigations were carried out in two phases in June and July, and September 2015 following an initial design and information-gathering phase. A geophysical survey investigated the urupā extent and aimed to identify the buried oil wells locations and areas of demolition material across the site. The excavation of test pits and hand augering around former oil wells and bach locations was undertaken to investigate potential contamination and collect soil samples for analytical testing. In addition, eight groundwater monitoring wells were installed to assess groundwater beneath the site.

An assessment of ground gas was carried out in the vicinity of the proposed marae and future commercial area and water samples were collected from a spring and wetland area to additionally assess surface water quality.

For locations where applicable human health criteria were available, all soil sampling results for heavy metals and hydrocarbons complied with the criteria, indicating the soils present an acceptable risk to human health under the proposed land use scenario. For the southern boundary of the urupā and the vicinity of Egmont 5 oil well, application human health criteria are not available, but based on the low likelihood or frequency of soil contact, the identified impacts in these areas are considered to present a minimal risk to human health. However, asbestos-containing material detected in shallow locations adjacent to Ocean View Parade and in the vicinity of the proposed marae, indicate a possible risk from asbestos-containing dusts during soil disturbance activities as part of the redevelopment.

An assessment of the soil against landfill acceptance criteria shows soil in the vicinity of the urupā soil mound and the proposed marae are acceptable for disposal at a Class A landfill. However, given the presence of asbestos, the soil in the vicinity of the proposed marae would be considered as special waste.

The analytical results of the soil samples obtained from the vicinity of the former baches parallel to Ocean View Parade indicate that this material would not be acceptable at a Class A landfill without additional assessment being undertaken at the time of development. Some samples from this location also contain asbestos.

Elevated concentrations of organic vapours were identified from locations within the building footprint of the proposed marae and future commercial area, indicating a possible inhalation risk may exist to people within the future buildings at the site. Results of subsequent indoor air modelling for the proposed marae found that predicted indoor air concentrations comply with target air concentrations and, therefore the ground vapours do not pose a risk to human health. Further assessment at the time of redevelopment is recommended to quantify the risk within the future commercial area.

All of the groundwater and surface water samples collected from the site were found to comply with applicable health criteria utilised for the investigation. It is therefore considered that both the risk to the aquatic environments of the wetland within the site or the nearby ocean is acceptable.

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1.0 Introduction

Pattle Delamore Partners Limited (PDP) has been engaged by the Taranaki Regional Council (TRC) to undertake a detailed site investigation (DSI) of a property adjacent to Bayly Road and Ocean View Parade, New Plymouth (the site). The site is owned by Ngāti Te Whiti (Bayly Road Trust), having been recently returned to the hapū.

Ngāti Te Whiti intend to develop a marae within the site's central area, however, a history of oil drilling activities, nearby natural oil and gas seeps on Ngāmotu Beach, and the demolition of historical baches and buildings has resulted in the potential for soil and groundwater contamination at the site. The detailed site investigation has been undertaken to provide an assessment of the sites contaminative status and to assess the human health risks for the proposed development.

A phased approach has been adopted for the investigation, with an initial preliminary investigation of assembling background information in order to develop a conceptual site model and investigation strategy (PDP, June 2015). The DSI was subsequently carried out in two stages, with the main stage during June and July 2015, and a follow-up stage during September 2015.

This report details the results of the complete investigation. The report provides general information and information common to various parts of the investigation in sections 1 to 5, with sections 6 to 11 devoted to the detail and results for specific site areas and for the ground and surface water investigations. Conclusions are provided in Section 12.

1.1 Objectives

The objectives of the DSI were to:

- Define the extent of the Waitapu Urupā using non-intrusive methods;
- Identify the location of the former oil wells on the site;
- Undertake a ground investigation to determine whether the identified historical activities undertaken on the site have caused soil contamination; and
- Assess the human health risk arising from identified site contaminants in the context of the proposed development and future site users.

1.2 Scope

The scope of the DSI included:

- A geophysical survey across four areas of the site that included the eastern and western parts of the Waitapu Urupā, the northwestern and

central areas, around Moturoa 2 oil well and in the approximate locations of Moturoa 2 and Egmont 5 oil wells;

- The excavation and sampling of test pits around former oil well locations and suspected drilling mud locations to investigate the potential for contamination around these features;
- The installation of eight groundwater monitoring wells in up and downgradient positions of the former oil wells, the Waitapu Urupā, and the proposed lagoon area;
- The collection of groundwater samples from the monitoring wells, and surface water samples from selected site features (e.g. springs, drains) for analytical testing;
- Hand augering and test pitting in the areas of the former baches and buildings within the vicinity of the proposed marae and the proposed commercial zone to assess soil contamination arising from the historical demolition of the baches and other buildings; and
- The installation and monitoring of seven ground gas monitoring points within the proposed marae location and the commercial development area.

The majority of the work was carried out in the first stage of investigation, but access was not available for intrusive investigations in the vicinity of Egmont 5 and where drilling mud was suspected within the urupā. Test pitting for these areas was carried out during the follow-up stage. In addition, further gas monitoring, groundwater monitoring and surface water sampling was carried out in the follow-up stage.

2.0 Site History

Site history information was collected as part of the initial design stage (PDP, June 2015). Information was obtained from a variety of sources including New Plymouth District Council property files, historical reports, copies of historical titles, historical aerial photographs, a preliminary site investigation (PSI) carried out by BTW Company Limited (BTW, 2013) and anecdotal information from members of Ngāti Te Whiti. The history of the different investigation areas is summarised in the sections below.

2.1 Urupā (Waitapu Urupā)

The Waitapu Urupā is situated at the southwestern portion of the site and is culturally significant to both Ngāti Te Whiti and the local public (Photograph 1).

The urupā has been in use for burials from at least the mid-1800s to the present and contains both Māori and European graves, however, only a limited number

of the graves at the urupā are currently marked by headstones. Anecdotal evidence is that there may be a significant number of unmarked burials as a result of an influenza epidemic during the early 20th Century.

A review of historical aerial photos and council files suggests that filling and alteration of ground levels may have occurred within the southwestern quadrant of the urupā, possibly as a result of adjacent historical oil exploration activities.

The same sources indicate that the mound of soil present within the eastern area of the urupā (Photographs 2 and 3) was likely formed from the levelling of the land to the east of the urupā so as to facilitate the development of former baches and buildings within this area. An alternative suggestion (BTW, 2013) is that the mound dates back to the construction of the adjacent railway in the early 1900s, although this seems less likely with soil having to have been moved some distance by horse and cart or manually. The mound is understood to have human remains around the base of the northern side of the mound, having been relocated from the construction of the Puke Ariki Museum (Shaun Keenan, pers. comm.).

Suspected drilling mud was discovered buried in the wetland that exists within the southeastern part of the urupā (BTW, 2013). This discovery was made during the installation of a sub-soil drain. The origin of the mud is not known, but possibly relates to the original drilling of either the Egmont 5 or Moturoa 2 oil wells.

2.2 Bach and Marae Investigation Areas

Certificates of title (dated 1926 and 1995) identify the bach and marae investigation areas (Photographs 4 and 5) as former railway reserve, suggesting that the land may have been used as a camp for railway workers at one time.

A number of historical photographs were obtained from New Plymouth District Council (NPDC), Taranaki Regional Council (TRC) and the Alexander Turnbull Library (PDP, June 2015). The photos show approximately 45 buildings were previously located on the site, from as early as the 1920s, with the majority constructed in the 1940s and 1950s.

The historical photograph dated 1949 (Historical Photograph 1, appended) shows that about 25 baches were present between Ocean View Parade and the current access road to the site off Bayly Road, with a small number of structures present to the south of the access road, which includes the three buildings (two houses and a boat shed) currently on the site. At the eastern end of the access road there were 10 or more buildings between the road and the railway embankment on the southern boundary, with several more buildings located on the higher ground further east. Most of the structures within this area appear to have been baches, although more substantial houses also existed, and there was evidence of possible limited commercial activities.

Due to the age and nature of the structures, it is suspected that many of the baches and other buildings that historically occupied the site would have had asbestos-cement roofs or cladding as this was a common building material in New Zealand for several decades up until about 1985.

New Plymouth District Council building files contain a number of building consents for the demolition of the baches during 1996-97. This information indicates a number of dwellings were removed or relocated from the site, the remnants of which may remain in the ground. The files indicate that features such as garages and chimneys associated with the properties were demolished but do not specify whether these materials were removed from the site. There is no information on the files as to what happened to the demolition material or whether the surface soil was stripped.

A photograph sourced from the NPDC (Historical Photograph 2) shows the majority of the site to have been cleared of the buildings by what is thought to be the late 1990s (specific date of photograph unknown). As far as can be seen given the small scale of the photograph, the building clearance seems to have been reasonably thorough. Of note in the photograph, is what appears to be disturbed ground, presumably a trench, close to and parallel to the railway. At its eastern end this presumed trench turns northward at close to a right angle, presumably linking up with one of the manholes that now exist on the site.

2.3 Historical Oil Wells

The Moturoa oilfield was the subject of extensive oil drilling activities in several phases dating from the mid-1860s, with approximately 65 wells drilled over a 130-year period[1]. Three oil wells existed on the site, Moturoa 2 and 3 and Egmont 5. Moturoa 2 is still present on the site, but no visible evidence exists of the other two wells.

A fourth well, Moturoa 4, was originally thought to be on the site but examination of historical photographs (PDP, 2015) showed the well to be on the beach (now a car park) opposite the northern end of Bayly Road.

2.3.1 Moturoa 2

Moturoa 2 well was drilled in 1931 and was in production until 1973 (Transfield Worley, 2003). This well, which still exists in a fenced compound, is located in the centre of the site (Figure 1). A photograph of the well taken in 1953 (Historical Photograph 3, Turnbull Library Ref. WA-33268-F) suggests that the original level of the wellhead was some metres below the current wellhead level, being at a similar level to the row of baches that existed further to the west at

[1] Taranaki Stories - *Moturoa black gold – 'the good oil'* by Sorrell Hoskin. Puke Arike Museum, New Plymouth http://pukeariki.com/Learning-Research/Taranaki-Research-Centre/Taranaki-Stories, accessed August 2015.

the time. The eastern end of what appears to be the original drill site is in the vicinity of the eastern part of the proposed marae development site (Figure 1).

The well was re-entered in 2003 by Greymouth Petroleum (Transfield Worley, 2003), however, it was reported that drilling muds, fluids and cuttings associated with the re-entry were contained and removed from site (Re-Source Exploration, 2001). The current oil well is shown in Photograph 6.

2.3.2 Moturoa 3

The Transfield Worley (2003) report identifies the Moturoa 3 well to have been drilled and abandoned in 1933, the well casing subsequently being recovered to approximately 195 m below ground level and the remainder of the well filled with sand and cement.

The well is shown in Historical Photograph 4, reported to have been taken around 1937 (Turnbull Library Ref. WA-55980-G), but more likely earlier given the well was abandoned in 1933. The photograph, of poor resolution, shows the well seemingly located on a bench or widened part of a track along the dune face which now overlooks Ocean View Parade towards the eastern end of the site (Figure 1).

2.3.3 Egmont 5

Historical Photograph 5 (Turnbull Library Ref. WA-47172-F) shows a drilling rig or derrick over the Egmont 5 well in 1958, four years after it was drilled (Transfield Worley, 2003).

A study of aerial photos prior to and following the drilling of the Egmont 5 well suggests the current ground level is higher than the level at the time of drilling the well. This may be associated with what appears to be the piping of the stream that existed at the time and partial filling of a gully which is apparent in the earlier 1949 photograph and the 1958 photograph.

The well was located in 2002/2003 by TRC as part of a limited intrusive investigation of this feature.

3.0 Environmental Setting

3.1 Site Description

The site is a long, truncated wedge-shaped site, approximately 650 m long and about 118 m wide at the Bayly Road (western) end and 25 m wide at its eastern end (Figure 1). The site covers approximately 4.3 hectares and comprises the legal descriptions of Lot 1 DP 18771 (3.59 ha), Section 198 Fitzroy District (0.75 ha, the Waitapu Urupā) and Section 227 Fitzroy District (0.016 ha).

The site is bounded by a railway line to the port on higher ground to the south and Ocean View Parade to the north. A sealed road provides access at the western end of the site, near the end of Bayly Road. Currently, the site is largely unoccupied and used for recreational purposes, although along the access road there are two houses near Bayly Road and what appears to be a boat shed further east.

An avenue of protected pohutukawa trees extends into the site from the western boundary along the access road. To the north of the trees, a level grassed area extends towards Ocean View Parade, where the baches once were. Land to the south of the eastern end of the access road is overgrown and boggy, and contains areas of flax and bamboo. The wetland extends to near the southwestern corner of the site, below where the railway crosses Bayly Road. The soil mound described in Section 2.1 is located towards the eastern end of the wetland (Figure 2).

The central part of the site rises from west to east and is predominantly mown grass. Moturoa 2 oil well is in the centre of the grassed area. The land slopes steeply down to Ocean View Parade from this area, with the slope heavily vegetated with flax.

The eastern-most northern site boundary and far eastern site extremity is also densely vegetated where the land slopes steeply down to Ocean View Parade (Photograph 7), but the eastern part of the site is otherwise a relatively flat, irregularly-shaped grassed terrace adjacent to the railway (Figure 1).

An overgrown track traverses west to east for about 250 m along the face of the steep slope above Ocean View Parade.

3.2 Geology, Hydrogeology

The Geological Map of the Taranaki Area (N.Z. Geological Survey Map, 1:250,000 scale) shows the site is underlain by beach deposits of marine terrace cover beds including conglomerate, sand, peat and clay.

Groundwater is estimated to flow in a general north to northwest direction, towards the port and the Tasman Sea.

Groundwater bore information was requested from TRC for groundwater bores and water-take resource consents within a 500 m radius of the site. The TRC records show 20 bores are present within an approximate 500 m radius of the site, all of which were related to oil well drilling activities and none identified to be used as potable supply.

Two resource consents for water takes were identified. The water takes are located in hydraulically upgradient positions and relate to taking groundwater from dewatering excavations and for bottled water production. The latter was located 850 m to the southeast of the site (Consent 5413-2). There is therefore

no known use of the shallow groundwater in the vicinity of the site. It should be noted, however, that small water takes (<20,000 L/day) do not require consent and may exist without TRC having a record.

A spring exits from the base of the railway embankment directly south of the soil mound. This spring was historically used for bathing when the baches existed (Shaun Keenan, pers. comm.), but is now overgrown and disused. It is intended the spring be the source of water for a lagoon proposed as part of the marae development (see Section 4.1).

3.3 Hydrology

A wetland area exists within the southern part of the land legally defined as the urupā. The wetland is fed from the spring and probably a number of other seeps along the base of the railway embankment. An ill-defined drainage channel orientated southwest to northeast (formerly the Waitapu Stream, now thought to be mainly piped) forms the northwestern extent of the wetland. The wetland drains northeast and north, partly within a sub-soil drain installed by Ngāti Te Whiti (which partially controls the wetland level), into a manhole on the edge of the access road. The manhole is connected to the stormwater system owned by Port Taranaki draining Ocean View Parade, and ultimately drains to Ngāmotu Beach, 35 m to the north of the site.

3.4 Sensitivity of the Underlying Aquifer

An assessment of the groundwater sensitivity beneath the investigation area has been carried out in accordance with Section 5.2.3 of the Ministry for the Environment's *Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand* (MfE, 2011a):

- The shallow aquifer beneath the site is not artesian;
- The depth to the first water bearing unit is less than 10 m below the potential contaminant source (considered to be the former oil wells and the urupā) and,
- The shallow aquifer in the vicinity of the site does not appear to be used for water supply purposes, based on the groundwater bore information available, and the fact that the area is serviced by the reticulated municipal water supply.

Therefore, based on the criteria above, the underlying shallow aquifer is not classified as sensitive with regard to groundwater use.

According to Section 5.2.3 of MfE (2011a), a surface water body greater than 100 m from a contaminant source is unlikely to be affected, given that natural attenuation processes generally limit the extent of dissolved phase hydrocarbon plumes to less than 100 m. Given that the spring and the wetland area are

present on the site and the sea is located approximately 35 m to the north of the site, the shallow aquifer may be considered sensitive with respect to the migration of impacted groundwater within or from the site.

4.0 Proposed Development

4.1 Marae and Lagoon

Ngāti Te Whiti intend developing Ngāmotu Marae in the central part of the site. This is to have a wharenui (communal house) and wharekai (dining hall), with an administration building and car parking at a higher level behind the wharekai and the possibility of a communal garden area. No residential use is currently proposed, although people are likely to sleep overnight in the wharenui.

A layout plan[2] of the proposed redevelopment is presented in Appendix J and the outline of the buildings, access way and parking is shown on Figure 1.

The area surrounding the marae is to be landscaped which is to include a wetland and lagoon. The lagoon is to be located at a lower level to the west of the buildings, immediately to the north of the soil mound and is to be fed by the spring draining from the base of the railway embankment. It is understood the lagoon will be lined to isolate it from the existing wetland and underlying groundwater.

There will need to be earthworks associated with preparing the building platforms, the parking areas and the access road. This will involve a combination of cutting and filling. There is likely to be a surplus of soil requiring disposal.

4.2 Future Commercial and Residential Areas

There is the possibility of a future commercial development in the northwest corner of the site, on the corner of Ocean View Parade and Bayly Road. At the time of writing, specific development proposals for this area had not been developed and are likely to be some years away. Such a development is likely to require at least stripping of the surface soil for disposal and may require small excavations for building foundations.

Additionally, there is the future possibility of residential development at the far eastern end of the site, such as pole houses along the bank overlooking Ocean View Parade and conventional smaller houses on the flat land above.

The possibility of residential development has not been considered as part of this investigation.

[2] Based on BTW Company Ltd drawing Pavement Layout, Drawing No. 14504-01-01 Marae_Driveway Option 1, Drawing No. A1.05

5.0 Investigation and Risk Assessment Process

5.1 Conceptual Site Model

The potential effects on the marae project and future commercial development from site contamination are outlined in a preliminary site conceptual model set out below. The following is an analysis of potential contaminants, receptors and pathways (linkages) between the two.

5.1.1 Hazardous substances and potential contaminants of concern

Hazardous substances potentially exist on the site as a result of past activities or natural occurrences. Different parts of the site have different likelihoods of various substances:

- Natural hydrocarbons in soil or groundwater anywhere on the site (historically, oil and gas seeps occurred along the beach front);
- Hydrocarbons in soil and drilling waste from oil drilling activities at three well sites. Drilling waste is thought to exist in the low-lying ground near the soil mound, as discussed in the PSI (BTW, 2013);
- Hydrocarbons in groundwater from drilling activities from leaking drill sites and disposal of drilling waste below the watertable;
- Volatile hydrocarbons (including methane/natural gas and monoaromatic compounds) in soil gas and ambient air from natural sources or well sites;
- Heavy metals (principally lead from lead-based paint and lead flashings) and asbestos (from asbestos-cement cladding) in soil in the vicinity of historically demolished buildings;
- Heavy metals in drilling waste from cuttings or mud additives; and
- Nitrate and other contaminants in groundwater from the urupā (Note: No intrusive investigation is to be carried out where burials have occurred, therefore contaminants in soil within this area have not been considered).

5.1.2 Potential receptors

Potential receptors will vary depending on location within the site:

- Marae staff and marae users/visitors;
- Users of a possible communal garden;
- Staff and users of the future commercial zone;
- Excavation and construction workers during redevelopment;

- Maintenance workers involved in excavation, including off-site in Ocean View Parade;
- Recreational users of the site;
- Possible future residents at the eastern end of the site;
- Ecological receptors within the proposed lagoon and the existing wetland area; and
- Ecological receptors within the coastal marine area.

As noted above, there is no known groundwater use in the vicinity.

5.1.3 Exposure pathways

A human health or environmental risk can occur only where there is complete pathway between contaminant sources and a receptor. It is expected that the majority of the site will not have exposed soil, although there will be landscaped areas that may have exposed soil. Building floors, paved areas and grass will largely or completely prevent contact with soil and therefore direct exposure pathways are or will be incomplete for such areas. There is no known use of the shallow groundwater and apart from the spring being used to fill the lagoon, future use is not expected, therefore this pathway is not considered to be complete.

Potentially complete pathways are:

- Direct contact with soil by communal garden users;
- Consumption of produce grown in communal gardens;
- Consumption of hangi cooked food;
- Direct contact with soil or groundwater during construction, maintenance of landscaped areas or subsurface maintenance works;
- Inhalation of hydrocarbon vapours;
- Possible future contact with soil in a potential future residential area at the eastern end of the site;
- Discharge of groundwater to the lagoon and wetland; and
- Discharge of groundwater to the coastal marine.

With respect to human receptors, recreational users of the site are unlikely to have significant exposure because contact with contaminated media will be slight or non-existent and exposure durations short. Similarly, most visitors/users of the commercial zone or marae will have insufficient exposure to contaminated media for a risk to arise.

A different hazard may arise from ground gases, which may be explosive (between 5 and 15 % by volume in air for methane) if sufficient build-up occurs within buildings. While not a conventional hazard for contaminated land, it is appropriate to consider this given the proximity to well sites.

5.2 Investigation Rationale

The overall rationale for the DSI was to determine whether any of the historical activities on the site have caused soil contamination that would affect the proposed marae development and future use. The rationale for the individual investigation areas is set out below.

5.2.1 Waitapu Urupā

As part of the DSI, TRC requested the extent of the urupā be defined as best as possible using geophysical techniques, the intent being to ensure intrusive soil sampling works were not carried out where human remains may exist.

The general location of the Waitapu Urupā is known within its larger legal boundaries, being generally north of the wetland in its eastern half and, within its western half, approximately northeast of a line running between the urupā entrance off Bayly Road down the slight depression in the ground to where the depression meets the wetland. However, it was considered possible that burials have extended beyond this approximate area. The intent was therefore to define the boundary, whether as generally disturbed ground or individual graves.

As the soil mound within the boundary of the urupā may require removal as part of the site redevelopment, the soil samples from here were scheduled for analysis of seven heavy metals; arsenic, cadmium, chromium, copper, lead, nickel and zinc.

As discussed in Section 2.1, suspected drilling mud was encountered in this area during drainage works (BTW, 2013). The investigation in this area aimed at re-finding the locations reported in BTW (2013) so as to take samples and also to excavate a limited number of further test pits to determine whether the suspected mud was more widespread. Soil samples were analysed for heavy metals, with selected samples analysed for total petroleum hydrocarbons (TPH).

5.2.2 Former bach and marae investigation

While residential use is not normally considered to be a contaminating activity, there is a potential for shallow soil contamination from the demolition of the historical baches and buildings, if that demolition was not carried out carefully. This is because the baches and buildings within this area may have had asbestos cladding and the use of lead-based paint and lead flashings on roofs and windows was common when the baches were constructed and through much of their life. It is assumed that the demolition of the baches and buildings previously on the

site may have left remnant materials and foundations buried at shallow depth under the current grass, the contaminants of concern being asbestos and heavy metals, predominantly lead.

Any remnant contaminated demolition material would be expected to be primarily a development and/or construction issue (asbestos-containing dusts and soil disposal) rather than a potential long-term health risk post-development. Post development, there will be little if any exposed soil (landscaped areas would normally be within imported soil if contamination was excessive) and therefore human health risks should be low from any demolition material contamination.

Soil samples from this area were analysed for a suite of heavy metals, with selected samples also analysed for TPH and asbestos (presence/absence).

While historically there were a small number of houses further to the east of the site (Historical Photograph 1), any contamination in this area was expected to be isolated and will not present a risk for the current proposal (including recreational use). House locations further east were therefore not investigated.

5.2.3 Oil well investigation

Contamination may have occurred as a result of historical oil drilling activities and contamination may also have occurred as a result of natural oil and gas seeps. There was also a concern that capping of abandoned wells was not always carried out properly (some old wells had been discovered to have been plugged with logs), with consequent possibility of leakage of gas or hydrocarbons.

Excavation in the vicinity of Egmont 5 by TRC in 2002/2003 found evidence of hydrocarbons a few metres below the surface. Also, as noted above, what was thought to be drilling mud was encountered during recent drainage works near the proposed marae site (BTW, 2013).

It was therefore considered desirable to identify the exact location of the wells, and to determine whether any contamination exists, the nature and extent of that contamination and, if possible with respect to Egmont 5 and Moturoa 3, locate the wellheads and determine whether they had been properly capped.

5.2.4 Ground gas

The past oil exploration activities suggest the potential for ground gases, whether toxic (volatile hydrocarbons) or explosive (methane), in the vicinity of the marae and future commercial zone. As such, it was considered that an assessment of ground gas in the vicinity of these two areas should be undertaken to assess the possible health risks.

5.2.5 Groundwater and surface water investigation

There is a potential for ground and surface water contamination at the site from hydrocarbons as a result of both on and off-site oil exploration activities, and also from various contaminants and nutrients from the urupā. Groundwater discharges to the coastal marine area as seeps or via the site drainage system, and has the potential to impact the coastal ecology.

Groundwater samples collected from monitoring wells were therefore analysed for TPH and BTEX compounds, on the assumption of possible contamination from historic oil well drilling activities, with samples from up and downgradient of the urupā also being subject to analysis for nitrate, ammoniacal nitrogen and formaldehyde. Selected samples were also analysed for zinc following discovery of elevated zinc in surface water samples (see below).

The intention to develop a lagoon and wetland as part of the marae development raised the possibility of surface water contamination if the groundwater is contaminated (although it was subsequently discovered that the intention is to line the lagoon). Surface water samples from within the wetland were therefore analysed for a suite of dissolved metals including arsenic, cadmium, chromium, copper, lead, nickel and zinc, with surface water samples also being scheduled for TPH analysis.

5.3 Investigation Methods

5.3.1 Geophysical survey

Southern Geophysical Ltd (SGL) undertook a geophysical investigation of selected site areas between 30 June 2015 and 2 July 2015 using non-intrusive ground penetrating radar (GPR) and magnetometry techniques.

Ground penetrating radar is an electromagnetic method of imaging objects buried in the ground. Pulses of radio energy penetrate the ground and are reflected back depending on the properties of the ground. The technique is capable of "seeing" to depths up to 10 m depending on the ground conditions and radio frequencies used.

The GPR data was collected by SGL using a GSSI SIR-20 GPR system. The GPR system was moved along a series of parallel transects across each of the four areas surveyed. The survey was designed to provide data that could identify disturbed ground, buried linear features or filled-in excavations, such as remnant building foundations, demolition materials, burial sites or drilling mud pits. A total of 143 GPR transects were completed across the site.

Magnetometers are used to measure the magnetic fields of buried metallic objects in the ground. The magnetometer survey was undertaken in the expected vicinity of the buried wellheads of the former Egmont 5 and Moturoa 3

oil wells using a field calibrated standard proton magnetometer (Geometrics G-856AX).

The location of each magnetometer reading was accurately surveyed using a GPS system. The magnetometer surveys were designed to provide data that could identify a buried wellhead to a depth of approximately 4 m. The readings were stored by the instrument in the field and subsequently processed by SGL

The geophysical report provided by SGL is appended (Appendix F).

Four areas of the site were surveyed:

- The eastern and western parts of the Waitapu Urupā.
- The area of former baches/buildings.
- The vicinity of Egmont 5 oil well.
- The vicinity of the Moturoa 3 oil well.

5.3.2 Groundwater monitoring well installation

Groundwater was investigated by installing eight monitoring wells and sampling of groundwater and also the water from the spring.

Prior to the commencement of any drilling activities, a review of all utility services on, and in the vicinity of the site was carried out. Detect Services Limited was engaged to identify the locations of on-site underground services.

The drilling and installation of the groundwater monitoring wells was undertaken by DCN Drilling Ltd using a track-mounted EP26 sonic drill rig. The monitoring wells were located in the expected up and downgradient positions from the known and assumed locations of the three on-site oil wells, and the proposed lagoon area. The wells up and downgradient of Egmont 5 are also up and downgradient of the western end of the Waitapu Urupā. Some of the monitoring wells were moved from the originally intended locations because of topographical constraints and access difficulties, or the presence of services.

Soil sampling was carried out during the drilling of the boreholes for the monitoring wells. In general, the samples were not analysed, as soil at depth is not of concern for the project unless the contamination is volatile, but samples were to be analysed if signs of contamination such as hydrocarbons were found.

The groundwater monitoring wells were installed as follows:

- Monitoring wells comprised 50mm diameter uPVC casing and 0.5 mm machine-slotted well screens. The screened section of each well was targeted to intersect the watertable with approximately 2 m of the screen extending below the watertable to allow for groundwater fluctuation.

- The screened section was backfilled with Industrial Mineral's "K1" sand (max size 1mm) to slightly above the screen, as a filter pack, followed by blinding sand and bentonite clay (at least 0.5 m thick) near the surface to prevent water ingress.
- The wells were completed with a flush-mounted toby box cemented in at ground level (Photograph 8). The exception was MW5 which was finished with a raised security cap due to its location in the wetland area.

Individual installation details for each monitoring well are recorded on the appended geological logs (MW1 to MW8 in Appendix E).

5.3.3 Test pitting and hand augering

Following the geophysical survey at the site, an intrusive investigation was carried out from 6 to 10 July 2015, and on 17 July 2015, with further intrusive works undertaken on 28 September 2015.

Investigation locations were generally set out on an approximate 20 m sampling grid as it was assumed that remnant demolition material was spread around during the demolition process and subsequent re-grading of the site to its current level prior to establishing grass. Prior to excavation, a review of all available utility plans was undertaken and all test pit locations were cleared for underground services by Detect Services Limited. Shallow test pitting, hand augering, or a combination of both, were carried out in seven areas of the site:

- The area of the former baches adjacent to ocean view parade;
- The area of the proposed marae development;
- In the vicinity of the Moturoa 2 oil well;
- In the suspected vicinity of the Moturoa 3 oil well;
- In the vicinity of the Egmont 5 oil well;
- In the southern part of the soil mound within the Waitapu Urupā; and
- Along the southern boundary of the Waitapu Urupā.

Test pits were excavated using a hydraulic excavator provided by City Care Limited. Soil samples were collected from the near-surface soils and from areas with any obvious contamination. Auger holes and test pits were backfilled and compacted upon completion of sampling.

Soil samples were collected either from soil piles placed by the excavator, or directly from the hand auger. Samples were collected into individual glass jars and containers supplied by the laboratory (RJ Hill Laboratories Limited) under PDP chain of custody procedures. The samples were sent to the laboratory

either on the day of sampling, or the following day (with samples chilled over-night). Samples were received by the laboratory the day following dispatch.

In areas considered to have possible hydrocarbon contamination, duplicate soil samples were collected for the purpose of field screening using a photo-ionisation detector (PID[3]). These samples were collected into re-sealable plastic bags, which were half filled and sealed. The samples were allowed to stand for several minutes prior to the plastic being pierced with the PID nozzle and measuring the headspace vapour.

All hand sampling equipment used during the investigation was decontaminated between sampling collection using Decon 90 solution and a water rinse. A fresh pair of nitrile gloves was used to remove each soil sample directly from sampling equipment prior to transfer to a sample jar.

5.3.4 Ground gas investigation

The ground gas assessment was carried out by two means; the installation of shallow vapour monitoring points and subsequent monitoring, and an instantaneous surface monitoring (ISM) survey using a highly sensitive portable methane meter. Seven monitoring points were installed at selected locations within the proposed marae footprint and the future commercial area, both locations where vapour intrusion into buildings could be a potential human health issue.

The typical installation of the vapour monitoring points comprised:

- Hand augering a 50mm diameter hole to approximately 1.5 m bgl;
- Backfilling of the hole to approximately 1 m bgl with fine gravel to act as a collection zone (K1 industrial minerals – 1 mm gravel);
- Inserting a 20 mm diameter uPVC pipe into the hole with slots in the lower 0.5 m section of piping;
- Backfilling the annulus of the hole with auger cuttings to approximately 0.2 m below the surface, the remainder being sealed with bentonite clay; and
- Installing a cap with valve and polyethylene tubing (folded over and secured using a cable tie) on the uPVC pipe.

A photograph displaying the ground gas monitoring point installation is provided in Appendix D (Photograph 9).

The initial intent was not to find the exact composition of gases which might be present, which would require taking air samples for laboratory analysis. Instead,

[3] A PID measures most volatile photo-ionisable compounds, including petroleum hydrocarbons, providing they have an ionisation potential below 10.6 eV.

portable instruments were used to detect the possible presence of methane (with a landfill gas meter) and general volatile organic compounds (with a highly sensitive PID). If volatile compounds were detected, by assuming whatever was detected was all benzene, which is generally considered the most toxic of the naturally occurring hydrocarbons, a conservative assessment could be made whether there was a concern for human health. The decision could then be made whether additional assessment was warranted.

Monitoring was undertaken using a calibrated ppbRAE 3000 (ppbRAE) and a GA2000+ landfill gas analyser. The ppbRAE is a highly sensitive PID which measures volatile organic compounds (VOCs) in air at concentrations down to a few parts per billion (ppb). It is a thousand times more sensitive than the standard PID commonly used for contaminated land work.

The GA2000+ is a portable landfill gas analyser which is capable of measuring methane, carbon dioxide, carbon monoxide, hydrogen sulphide and oxygen at an accuracy that allows risks to human health to be determined (explosive risk, toxicity risk, or depressed oxygen/asphyxiation risk, as the case may be). In this case the target gases were methane and oxygen. The GA2000+ is also capable of measuring atmospheric pressure.

The gas monitoring points were initially monitored a week after installation on 17 July 2015 and again on 29 September 2015. At each point the ppbRAE was initially connected to the monitoring point's tubing, forming a seal, before removing the cable tie to allow air to be drawn into the ppbRAE for two minutes. The GA2000+ analyser was then connected to the monitoring point and the concentrations of methane and oxygen recorded each minute over a five-minute period. Barometric pressure was recorded at the same time with the GA2000+ at each monitoring location.

In addition, on 17 July 2015 an ISM survey was performed across the former bach and marae investigation areas using a RKI Eagle 72 infrared detector (IRD) calibrated for low-level detection of methane. Eagle 72 IRDs are extremely sensitive instruments with the ability for real time monitoring of the selected gases at low parts per million (ppm) concentrations.

The ISM survey was conducted by:

- Walking a grid of approximately 10 - 15 m spacing over the investigation areas; and
- Targeting locations where services exit from the ground and where there were any observable cracks in the ground.

During the ISM survey the sample probe, with an inverted funnel on the end, was held as close to the ground as possible (<50 mm).

5.4 Applicable Criteria

5.4.1 Soil criteria

The results of the soil analysis from the investigation area have been compared to applicable guideline values in order to undertake a human health assessment.

Soil contaminant standards (SCS) contained in the MfE's *Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health* (MfE, 2011b) were utilised for this investigation. In the case where no SCS values exist for a particular contaminant, the appropriate values were selected in accordance with MfE *Contaminated Land Management Guidelines No. 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values* (MfE, 2011c). This document prefers standards from New Zealand where they exist but, in the case where no New Zealand standards have been developed, a risk-based overseas standard may be used as a substitute.

There are SCS contained in MfE (2011b) for all the heavy metals analysed in the investigation with the exception of nickel and zinc. For nickel and zinc, the results have been compared to the *Australian National Environmental Protection (Assessment of Site Contamination) Amendment Measure* 2013 (NEPC, 2013) criteria.

With respect to petroleum hydrocarbons, the appropriate guidance is contained in the *Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand* (MfE, 2011a) (typically referred to as the *Petroleum Guidelines*) using the 'clay', 'silty clay' and 'sand' soil types, as appropriate to the encountered soil type at the particular location, and depths of <1 m bgl and 1 – 4 m bgl. These soil types and depths are considered to best represent the soils encountered during the investigation.

The SCS and other criteria have values for different generic site uses, reflecting the different risks appropriate to each site use. However, MfE (2011b) and NEPC (2013) do not provide SCS specific to the proposed use of the site. For the heavy metals, the commercial/industrial unpaved criteria from MfE (2011b) and NEPC (2013) have been used as a conservative comparison for the marae development and bach investigation areas. It should be noted that these areas will generally be paved when in use and therefore the criteria over-estimate the potential human health risk. Such a comparison is appropriate for an initial assessment, but a less conservative site-specific assessment would be needed if the initial assessment suggested a risk was possible.

For petroleum hydrocarbons, criteria are available in MfE (2011a) for the long-term industrial commercial scenario and the shorter-term excavation/maintenance scenario. As risks from hydrocarbon are predominantly from vapours, assessment for both indoor (paved) and outdoor scenarios is appropriate.

Given the possibility of future residential use at the eastern end of the site, the SCS for a residential scenario have been used to assess soil results from the vicinity of Moturoa 3 oil well.

Soil contaminant standards do not exist for the existing (and ongoing) land uses in the vicinity of Egmont 5 and the urupā (open space/cemetery). Recreational criteria are not appropriate for these areas as such criteria are for active recreation when a person might get dirty, rather than the expected passive use of these areas. Simply as a means of comparison, results have been compared with expected background (natural) concentrations. In the absence of any background soil contaminant values for the Taranaki Region, heavy metal concentrations in soil have been compared against background soil concentrations for the Wellington Region (URS, 2003). Copper is known to be naturally elevated in some Taranaki soils and the Wellington values may underestimate the upper bound for background concentrations for copper for the site.

Soil disposal may be required as part of the site redevelopment to achieve design levels. The nearest landfill is the Colson Road Landfill (a Class A landfill). Soil sample results from all investigated areas have therefore been compared to appropriate screening criteria from MfE's *Hazardous Waste Guidelines Module 2: Landfill Waste Acceptance Criteria and Landfill Classification* (MfE, 2004).

The analysis of asbestos was intended to provide a preliminary determination of the presence or absence of asbestos within the soil. The results have therefore not been assessed against any specific criteria.

5.4.2 Groundwater and surface water criteria

Ground and surface water criteria have been taken from two documents. For petroleum hydrocarbons, the groundwater and surface water sampling results have been compared with the MfE (2011a) route-specific groundwater acceptance criteria via the inhalation pathway for commercial/industrial land use.

For all other contaminants, water samples have been assessed against guideline values in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000). The ANZECC guidelines use a precautionary approach for the freshwater assessment with the values for 'highly disturbed ecosystems', for which the site best represents, being the same as for 'slightly–moderately disturbed systems'. In this case, the guidelines allow for less stringent aquatic protection levels, provided this is acceptable to stakeholders. Although the site is considered to be a represent a '*highly disturbed ecosystem*' the values for 'slightly–moderately disturbed systems' have initially been utilised (95% species protection), as directed by the guidelines.

5.4.3 Ground gas criteria

The target gases for this investigation were methane and volatile organic compounds. As a preliminary screen, methane has been assessed against a precautionary fraction of its lower explosive limit (LEL), being 5% by volume in air. A fifth of the LEL, or 1% by volume, has been taken as the precautionary value.

The ppbRAE PID is not specific as to which volatile organic compounds are detected, however, a conservative approach has been adopted in the first instance. As noted earlier, it has been assumed that all of the gas detected by the ppbRAE will be benzene, the most toxic of the compounds likely to be present. Benzene being the sole vapour is actually highly unlikely; normally there would be a mixture of hydrocarbons within detected vapours.

If the concentration measured by the ppbRAE is below the MfE (2011a) commercial/industrial target indoor air concentration for benzene (13 µg/m^3 or 4.1 ppb), then the risk to human health from the vapours will be deemed acceptable. However, if the measured concentration is in excess of the MfE target air concentration, then further assessment will be required.

In the case of the ISM survey, the locations of ambient methane concentrations in excess of 50 ppm would warrant further investigation as this would indicate that methane is gassing from the ground.

6.0 Waitapu Urupā Investigation

6.1 Investigation Strategy

Prior to the geophysical survey by SGL, the legal boundaries of the urupā were marked out by NZ Geomatics Ltd to assist the laying out of the geophysical survey lines by SGL. The eastern (called Cemetery East by SGL) and western (called Cemetery West) areas of the Waitapu Urupā were surveyed using GPR.

The areas surveyed are shown in the geophysical report included as Appendix F (SGL Report, Figure 1) and a more detailed description of the geophysical techniques employed is provided in that report.

As the soil mound within the boundary of the urupā may require excavation and/or removal as part of the site redevelopment works, a small number of soil samples were collected for laboratory analysis.

6.2 Site Investigation Activities

Investigations within the Waitapu Urupā have been carried out as follows:

- During 30 June and 1 July 2015, a GPR survey of the eastern and western parts of the urupā was undertaken by SGL.
- On 17 July 2015, hand augering and soil sampling was carried out on the southern half of the soil mound.
- On 28 September 2015, eleven test pits were excavated within the legal extent of the Waitapu Urupā, but to the south of the expected extent of burials, to identify possible oil well drilling impacts (drilling mud, mud pits and other possible drilling remnants from activities associated with the nearby Egmont 5 well) and the suspected drilling mud identified in the BTW (2013) report.

6.2.1 Geophysical survey

The 'Cemetery West" area was positioned from near the western site boundary to the marked graves within the urupā and comprised an area of approximately 60 m by 30 m (SGL Report, Figure 5). The survey of the Cemetery West area was extended to cover the location of the Egmont 5 oil well to the south. The 'Cemetery East' area was positioned on what was considered to be the eastern boundary of the urupā and measured approximately 30 m by 25 m (SGL Report, Figure 6). A total of 31 and 28 transects, spaced at 1 m intervals, were surveyed in a northwesterly to southeasterly orientation across the two respective areas.

6.2.2 Soil sampling

Five hand auger holes (SS40 – SS44) were advanced on the southern portion of the soil mound to between 0.7 and 1.5 m. Auger holes were positioned to provide good coverage across the southern-most half of the soil mound. The northern portion of the mound was not investigated due to the probable presence of human remains.

A total of 16 soil samples were collected from the mound. Samples were obtained from the surficial soil and at 0.5 m intervals through the soil profile. Four samples, including both shallow and deeper samples (SS41 0.1, SS41 1.0, SS43 0.7, SS44 0.5), were sent for analysis of heavy metals.

The hand auger sample locations are shown on Figure 2 and a representative geological log of the mound (SS40 to SS44) is appended (Appendix E).

Eleven test pits (TP16 - TP26) were excavated on the southern boundary of the urupā to assess the presence of drilling mud. Test pits TP16 – TP19 were targeted to drilling wastes within the urupā associated with the Egmont 5 well, with test pits TP20 – TP26 targeted to locations of suspected drilling mud as

identified in the BTW (2013) PSI report. Soil samples were collected where field observations and field screening suggested the presence of material associated with drilling activities. Three samples were sent for laboratory analysis (TP16 2.0, TP18 2.7 and TP21 0.2). Samples were variously analysed for TPH and/or heavy metals based on PID and visual observations.

The test pit locations are shown on Figure 2 and three representative geological logs (TP16-18, TP20-21, and TP25) are appended (Appendix E)

6.3 Results

6.3.1 Observations

Heterogeneous soil conditions were encountered within the mound, likely reflecting the reworked nature of this material. A surficial dark brown soil was initially encountered, below which sandy clay, sandy silt or fine sand with varying amounts of clay, was present. No human remains were found. Field screening of the samples using a PID identified soil vapour concentrations to be insignificant at less than 0.6 ppm.

The soils encountered in test pits TP16 – TP19 comprised clay topsoil to approximately 0.1 m bgl, underlain by sands and silts with peat being identified in TP17 at a depth of 2.3 m bgl. The soils encountered in test pits TP20 – TP25 comprised fine silty sands underlain by sandy clay.

The PID measurements from soils collected from the test pits ranged from 0.5 to 89.8 ppm (at 2 m bgl in TP16). Groundwater was observed to seep into the test pits at depths ranging between 1.8 m bgl (TP21) and 3.5 m bgl (TP18).

6.3.2 Geophysical survey

The GPR survey within the western area of the urupā identified:

- A linear feature in the northwestern area about 1.5 m bgl, orientated approximately east/west and extending for about 10 m;
- A possible buried pipe/drain at the southern end of the survey area;
- A complex subsurface in the central survey area, interpreted as heavily reworked fill material;
- Some evidence of non-European burials (vertical/shallow/multi-person) were identified in the northeastern corner; and
- No specific evidence of burials in the northwest corner.

The GPR survey within the eastern part of the urupā identified:

- Possible burial features below a fill layer in the north-western portion;
- An in-filled gully in the south unlikely to contain burial locations;

- A sequence of fill between 0.5 – 2 m thick across the entire area;
- A filled-in slope to the north, and rock material approximately 1.5 m below the surface in the central-western portion of the area; and
- A relatively undisturbed area to the southeast.

6.3.3 Soil sampling results and comparison with applicable criteria

The results of the laboratory analysis from the soil mound and test pits are presented in appended tables 1 and 2, respectively.

All soil samples from the mound returned heavy metal concentrations above laboratory detection limits for all metals tested, with the exception of cadmium in two samples. In comparison to expected natural background concentrations, copper was identified as elevated in all of the samples from the mound, however, the remaining results appear similar to expected natural concentrations.

The metal concentrations of all samples obtained from the soil mound were below MfE (2004) Class A landfill screening criteria.

Soil sample TP18 2.7 recorded cadmium, chromium and copper concentrations above the expected background soil concentrations. Sample TP21 0.2 recorded a possibly slightly elevated copper concentration. All other heavy metal concentrations were within the expected natural range.

Soil sample TP16 2.0 recorded a concentration of 28 and 550 mg/kg for the C_{10}-C_{14} and C_{15}-C_{36} hydrocarbon ranges, respectively. All other hydrocarbon concentrations were below the laboratory level of detection.

6.4 Assessment

All soil samples from the urupā soil mound reported copper concentrations above the possible background concentration but this is of no particular significance particularly as Taranaki soils commonly have naturally elevated copper. Otherwise the soil appears to be at natural concentrations. Based on the results, the soil could be disposed of as ordinary soil, but as the site is listed as a HAIL site the soil should be disposed of to landfill. The soil is acceptable at a Class A landfill. If obvious signs of contamination are observed during excavation this assessment should be revisited by consulting a suitably qualified and experienced contaminated land practitioner.

Soil samples collected along the southern boundary of the urupā returned some heavy metal concentrations above expected background concentrations and some elevated hydrocarbon concentrations. Given the depth of these identified impacts it is considered that these marginal impacts present minimal risk to human health.

7.0 Bach Investigation

7.1 Investigation Strategy

The bach investigation assessed the potential for shallow soil contamination arising from the historical demolition of baches that formerly occupied the northeast portion of the site (Photograph 4). The investigation area in relation to the site is shown in Figure 1, located between the current access to the site from Bayly Road and Ocean View Parade. The investigation area is shown in Figure 3, which overlays the 1949 aerial photograph on the present-day layout. Figure 3 also shows the location of the possible future commercial zone in the northeastern corner of the site.

7.2 Site Investigation Activities

Site activities within the bach investigation area were carried out as follows:

- On 30 June and 1 July 2015, SGL undertook GPR surveying of the investigation area to confirm the existence of remnant demolition material within the investigation area;
- On 6 and 7 July, and on 17 July 2015, hand augering and soil sampling was carried out by PDP in the investigation area in order to assess ground conditions and soil contamination;
- On 10 July 2015 three test pits were excavated in order to confirm the soil conditions within the investigation area;
- On 10 July 2015 two vapour monitoring points were installed at the locations shown on Figure 3 (VP6 and VP7);
- On 17 July 2015, monitoring of the two vapour monitoring points was undertaken and an ISM survey was carried out over the area proposed for future commercial development; and
- Additional monitoring of the two vapour monitoring points on 29 September 2015.

7.2.1 Geophysical survey

The GPR survey of the bach investigation was undertaken by means of a series of north/south and east/west transects, spaced between approximately 5 m and 15 m (SGL Report, Figure 2). A total of 23 transects were surveyed within the bach investigation area.

7.2.2 Soil sampling

As noted earlier, the bach area was sampled on a 20 m grid. Given the dimensions of the investigation area, the 20 m grid resulted in a single row of auger locations. To improve the coverage, a number of auger locations were also

placed at intermediate positions to supplement the planned grid locations and to target the building footprints of former baches.

A total of 14 hand auger holes (SS01 – SS09, SS35 – SS39) were advanced to between 0.5 and 1.5 m bgl as part of the sampling grid. The three test pits (SS45 – SS47) were excavated in the central and northern part of the investigation area to a maximum depth of 1.5 m bgl.

Thirty-four soil samples were collected from the surficial soil, at intervals throughout the hole where a change in soil type was encountered and from any areas of obvious contamination. Thirteen soil samples were selected for heavy metals analysis (SS01 – SS09, and SS39). The depths of soil samples analysed ranged between 0.1 m bgl and 0.6 m bgl. Three of these samples (SS04 0.3, SS07 0.6 and SS39 0.3) were submitted for asbestos analysis due to the presence of suspected asbestos containing material (ACM). The hand auger and test pit sampling locations are shown on Figure 3 and logs representative of the geology encountered are appended (Logs SS03, SS07 and SS09 – Appendix E).

7.2.3 Ground gas monitoring points

The two vapour monitoring points (VP6 and VP7) were located in the area in which future commercial development is proposed. The locations of the monitoring points are displayed on Figure 3.

7.3 Results

7.3.1 Observations

The soils encountered in auger holes and test pits generally comprised a surficial brown clay, underlain by a brown, silty clay, interpreted as fill material. The thickness of the silty clay fill ranged from 0.2 to 0.7 m and contained minor demolition materials in places, including brick, metal and occasional suspected cement-asbestos fragments (Photograph 10). Beneath this fill layer, black very fine sand was encountered, considered to represent undisturbed natural ground.

The PID measurements from soil collected from the area was within the detection limit of the PID (<0.3 ppm). No visual or olfactory hydrocarbon impacts were observed at any sampling location. Groundwater was not encountered in any auger or test pit location.

7.3.2 Geophysical survey

The GPR survey (appendix F) across the bach investigation area indicated areas of subsurface disturbance, including:

- A filled-in channel area at the eastern end, possibly relating to subsurface excavation or remnant demolition waste material; and

- A deep, 'chaotic' fill area at the western end.

7.3.3 Laboratory results and comparison to applicable criteria

The results of the laboratory analysis are presented in Table 3.

All soil samples analysed from the bach investigation returned heavy metal concentrations above the laboratory detection limit, with the exception of arsenic in samples SS08 0.3 and SS09 0.3, and cadmium in SS07 0.6. None of the analytical results for metals exceeded the utilised SCS.

Asbestos fibres, including Amosite and Chrysotile, were detected in all three samples submitted for analysis. The asbestos was described by the laboratory as both ACM debris and as loose fibres.

Eight samples exceeded MfE Class A landfill screening criteria for metals that included copper, lead and zinc. Two of these samples were from sample locations (SS01 and SS39) within the area proposed for future commercial development.

7.3.4 Ground gas

The ground gas results from the vapour monitoring points VP6 and VP7 are presented in appended Table 4.

The peak PID vapour concentrations recorded for monitoring points V6 and V7 on 17 July 2015 were 1048 ppb and 318 ppb, respectively, measured in the initial 10 seconds of monitoring. However, the peak concentrations are not considered representative, and the concentrations settled down to 316 ppb and 226 ppb, respectively. During repeat monitoring on 29 September 2015, the peak PID vapour concentrations for monitoring points V6 and V7 were 846 ppb and 616 ppb, settling down to 81 ppb and 153 ppb, respectively.

The peak methane concentrations recorded were 0.1% (VP6 and VP7 on 17 July 2015). The minimum oxygen concentration recorded was 16.3% (VP6 on 29 September 2015).

All methane concentrations measured during the ISM survey of the investigation area were ≤25 ppm.

7.4 Risk Assessment

All soil samples from the bach investigation area complied with the applicable health criteria for heavy metals, indicating that heavy metal contamination in the soil at the sampled locations presents an acceptable risk to human health under the proposed land use scenario.

The presence of loose asbestos fibres in all of the samples analysed for asbestos indicates that a possible health risk could arise from asbestos-containing dust

being mobilised during soil disturbance as part of the redevelopment. This should be addressed at the time.

The analysis results for soil from many locations within the bach area exceed the screening criteria for a Class A landfill. This does not mean the soil would not be acceptable as acceptance is by means of compliance with toxicity characteristic leaching procedure (TCLP) criteria. Such testing has not been carried out, but based on PDP's experience of such tests, most if not all of the soil should be acceptable. However, as the soil contains asbestos, it will be classified as special waste by the landfill regardless of leaching test results.

Although the majority of ground gases were present in concentrations below the various trigger values, concentrations of organic vapour measured by the ppbRAE in monitoring points VP6 and VP7 exceeded the target indoor air concentration for benzene during both monitoring events. Given the location of the monitoring points within the area of proposed commercial development, and assuming that all VOCs are benzene, a possible vapour intrusion risk may exist to occupants of any future buildings constructed as part of the site redevelopment. Further assessment at the time of any future development is recommended to evaluate the health risk from possible vapour intrusion into future buildings. Similar evaluation for the marae buildings found the risk was acceptable (see below).

Given that the ISM survey results fell below the preliminary trigger value, further assessment of ambient methane concentrations is not required.

8.0 Investigation in Vicinity of Proposed Marae

8.1 Investigation Strategy

In common with the bach investigation, the investigation in the vicinity of the marae was based on possible shallow soil contamination from the demolition of baches and buildings, and the possibility of hydrocarbon vapours emanating from the ground. The investigated area is shown on Figure 1.

The investigated area was based on the location of the historical baches and buildings in 1949, overlain in Figure 4. Figure 4 also shows the sampling locations and the footprint of the proposed marae development.

8.2 Site Investigation Activities

The marae investigation site activities were carried out as follows:

- Between 30 June and 2 July 2015, SGL undertook the GPR survey to confirm the existence of possible remnant demolition material;
- Between 7 and 9 July, and on 17 July 2015, test pitting and soil sampling;
- On 10 July 2015, five ground vapour monitoring points were installed (VP1 - VP5) within the proposed footprint of the marae buildings;

- On 17 July 2015 the vapour monitoring points were monitored and an ISM survey completed with further monitoring of the vapour points being undertaken on 29 September 2015;
- Toxicity characteristic leaching procedure testing of selected samples for waste disposal; and
- Ground gas modelling assessment.

8.2.1 Geophysical Survey

The GPR survey in the vicinity of the proposed marae consisted of approximately north/south and east/west transects in areas that could be accessed, spaced approximately between 5 and 15 m (SGL Report, Figure 2). The GPR survey included 22 transects within the investigation area.

8.2.2 Soil sampling

Soil samples were taken on a grid aligned to best correspond to the former location of the baches and buildings. The locations also targeted the footprint of the proposed marae. The grid spacing was approximately 20 m east-west and 10 m north-south. Sampling locations included three hand auger holes (SS10, SS14 and SS15) advanced up to 0.6 m bgl and 22 test pits (SS011 - SS13, SS16 SS20, SS20A, SS21 – SS31, SS33 and SS34) excavated to a maximum depth of 4 m bgl.

Seventy soil samples were collected from the sampling locations. Twenty-eight soil samples were selected for a heavy metal analysis from sampling locations SS10 – SS17, SS19, SS20, SS20A, SS21, SS22, SS23, SS28, SS29, SS30 and SS34. The depths of soil samples analysed ranged between 0.1 m and 3.0 m bgl, the majority being obtained from near-surface soils. No TPH analyses were carried out given the absence of observed hydrocarbons (see next section).

The deeper samples (SS21 1.5, SS21 3.0 and SS34 1.5) were analysed as a result of the presence of demolition material (brick fragments, pipe, plastic) in these locations.

Five samples (SS10 0.1, SS15 0.3, SS19 0.3, SS20A 0.3 and SS23 0.3) were analysed for asbestos as a result of suspected ACM material being observed at these locations.

Logs representative of the geology encountered in the investigation area are appended (Logs SS10, SS13, SS15, SS17, SS20a, SS21, SS22 and SS23 – Appendix E).

8.2.3 Ground gas monitoring points

The five vapour monitoring points (VP1 – VP5) were located in the central part of the investigation area, within the proposed marae footprint. Two of the

monitoring points (VP 1 and VP2) were positioned so as to intercept possible ground gas from the Moturoa 2 oil well vicinity, northeast of the investigation area.

The locations of the monitoring points are displayed on Figure 4.

8.3 Results

8.3.1 Observations

The soils encountered in the vicinity of the marae generally consisted of a surficial brown clay underlain by brown, silty clay, interpreted as fill. The silty clay ranged in thickness across the investigated area, being absent in northwest and southeastern parts of the area, and up to 1.7 m thick in the central area. The silty clay commonly contained waste materials including glass, plastic, metal, brick, wire, concrete and terracotta (Photographs 11 and 12). Waste material was particularly common in the vicinity of the Moturoa 2 oil well (Photograph 13). Suspected ACM was found at locations SS10 and SS15.

The silty clay was underlain by black, fine sand considered to be natural dune material. This was encountered both at the surface (in the northwest and southeast), and, where overlain by clay, at a depth of 2 m bgl. In places the sand had been disturbed/reworked and these areas contained demolition-type materials.

The PID measurements from soil collected from the area ranged from the instrument's detection limit up to an insignificant 3.7 ppm. No hydrocarbon odour or visible hydrocarbon impacts were observed at any sampling location.

Groundwater was observed in four locations (SS12, SS13, SS21 and SS26) in the western part of the investigation area, ranging from 1.0 to 4 m bgl.

8.3.2 Geophysical survey

The GPR survey across the marae investigation area identified a large filled-in channel-like area in the central and northern portion, possibly relating to subsurface excavation or remnant demolition waste material.

8.3.3 Soil sample results and comparison to applicable criteria

The results of the laboratory analysis are presented in tables 5 and 6.

All analysed soil samples collected in the vicinity of the proposed marae returned heavy metal concentrations above the laboratory detection limit, with the exception of arsenic and cadmium in a number of samples. Lead and copper were noted to be significantly elevated (up to 1,710 mg/kg and 1,230 mg/kg respectively) in a number of samples, however none of the concentrations exceeded the applicable health criteria utilised for the site.

Chrysotile asbestos fibres were detected in three of the samples submitted for analysis (SS10 0.1, SS15 0.3 and SS20A 0.3). The asbestos was identified as ACM debris (SS15 0.3 and SS20A 0.3) and as loose fibres (all samples).

The majority of samples collected (20 out of 34) exceeded Class A landfill screening criteria for copper, lead and zinc. Given the screening criteria exceedances, five samples with the highest concentrations (SS11 0.3, SS15 0.1, SS20 0.2, SS29 0.1, and SS33 0.4) underwent additional TCLP analysis. All samples complied with the Class A landfill leachate criteria.

8.3.4 Ground gas

The ground gas results from vapour monitoring points V1 – V5 located in the vicinity of the proposed marae are appended (Table 4).

Peak PID vapour concentrations for the July monitoring ranged from 236 ppb (VP5) to 976 ppb (VP2), with concentrations settling to a more representative range of between 130 ppb (VP5) and 330 ppb (VP1).

Peak vapour concentrations for the September monitoring ranged from 276 ppb (VP3) to 843 ppb (VP4), with concentrations settling to between 65 ppb (VP1) and 241 ppb (VP4).

The peak methane concentration for all monitoring points (VP1 – VP5) was 0.1%. All methane concentrations measured during the ISM survey were ≤15 ppm.

8.4 Assessment

8.4.1 Soil risk assessment

All soil samples collected in the vicinity of the proposed marae development complied with the applicable heavy metal human health SCSs, indicating the heavy metal contamination in the soil at the sampled locations presents an acceptable risk to human health under the proposed land use scenario.

The detection of loose asbestos fibres in three samples from the marae investigation area indicates a possible health risk could arise from asbestos-containing dusts during any soil disturbance. Precautions against mobilising air-borne asbestos fibres are likely to be required during the development works.

The possibility of being exposed to contaminants through hangi-cooked food is not considered in the assumptions used to derive the SCSs. Such exposure is most likely through the presence of volatile hydrocarbons, rather than non-volatile contaminants, and may be no more than tainting of the food if hydrocarbons were to exist. Given the apparent absence of hydrocarbons in the marae vicinity, the risk may be low. However, once the location of the hangi is chosen, it is recommended the vicinity be sampled.

Leaching tests for heavy metals demonstrated that surplus soil can be disposed of at a Class A landfill, however, the presence of asbestos means that the soil will be regarded as special waste.

8.4.2 Vapour risk assessment

The ISM survey results fell below the preliminary trigger value and further assessment of ambient methane concentrations is not required.

In the first instance, ground gas concentrations were compared with target air concentrations. As noted earlier, this is conservative.

The concentrations of methane within all monitoring points were below the chosen trigger value of 1%. However, in all cases, the volatile organic vapour concentrations were orders of magnitude above the screening target air criteria of 4.1 ppb. This indicated a need to carry out a less conservative analysis to allow for attenuation between the ground and indoor airspaces.

Vapours can migrate through cracks in a concrete floor into a building. This is known as vapour intrusion, and is driven by air pressure differences between the ground and the indoor space. However the concentration of vapour that builds up indoors will be less than the concentrations in the ground because of resistance to vapour flow and dilution in the building. It is possible to estimate the concentration of vapours that would exist in the internal spaces of the proposed marae. The vapour intrusion calculations have been carried out using industry standard modelling software, RISC5[4], assuming all the vapours were benzene (an unlikely and therefore conservative situation).

The model assumed a floor thickness of 100 mm), a density of cracks of 0.01 and a ventilation rate of two air exchanges per hour, the latter two values being defaults from MfE (2011a).

It is also necessary to choose particular spaces to model. Small spaces generally have greater build-up of vapours than large spaces. The modelling was undertaken for four spaces, including the wharekai, a staff room, an ablutions and storage room, and the wharenui for two different vapour concentrations representing two different monitoring points. The dimensions of these spaces are shown in Table 7.

While the sub-slab vapour concentrations varied throughout the monitoring period, it is assumed for the purposes of the vapour intrusion modelling, that the highest concentrations measured for each vapour point will occur under each proposed room. The modelling software assumes that no biodegradation will occur as vapours migrate to the surface, although it is likely that this will occur.

[4] See http://www.bprisc.com/

Results of the calculations are summarised in Table 7. Predicted indoor air vapour concentrations ranged from 0.0006 to 0.013 mg/m^3, which are all within . the MfE (2011a) target guideline concentration for benzene for commercial/industrial land use. Consequently, the risk from vapour intrusion is acceptable for the measured concentrations.

9.0 Oil Well Investigation

9.1 Investigation Strategy

The investigation of the Moturoa 2, Moturoa 3 and Egmont 5 oil wells aimed to determine the location of the wells, where not otherwise known, and investigate any historical or natural contamination associated with oil exploration activities in the vicinity of the wells.

The exact location of Moturoa 2 and the approximate location of Egmont 5 were known prior to the investigation, however, due to the early date of drilling and the lack of available information, only the approximate position of Moturoa 3 was known.

The Moturoa 2 and Moturoa 3 investigation areas and soil sampling locations are shown in Figure 5 and the location of the Egmont 5 well is shown in Figure 2.

9.2 Site Investigation Activities

The oil well site investigation activities were carried out as follows:

- On 30 July 2015, vegetation was cleared by City Care on the bench thought to be the possible location of Moturoa 3;
- Between 30 June and 2 of July 2015, SGL undertook geophysical surveying at and around the locations of Moturoa 2, Moturoa 3 and Egmont 5, in an attempt to identify features such as former flare pits, drilling waste, and potential fill material;
- On 8 July 2015, test pitting and soil sampling was carried out on the cleared bench area;
- On 9 and 10 July 2015, test pitting and soil sampling was carried out in the vicinity of Moturoa 2; and
- On 28 September 2015, test pitting and soil sampling was carried out in the vicinity of Egmont 5.

9.2.1 Geophysical survey

The GPR survey in the vicinity of the Moturoa 2 oil well was included as part of the bach and marae investigations. A total of 16 transects in a north-south and

east-west orientation were completed, spaced between approximately 5 m and 20 m apart (SGL Report, Figure 2).

Two GPR transects were completed across the northern part of the cleared Moturoa 3 bench area, in an approximate northeast-southwest orientation and spaced approximately 3 m apart (SGL Report, Figure 3). A magnetometer survey, consisting of more than 50 data points was also undertaken across the cleared area.

As describe in Section 6.2, the GPR survey of the urupā (SGL Report, Figure 4) was extended to include the area of the Egmont 5 oil well. A magnetometer survey was also conducted, consisting of over 100 data points using an evenly distributed grid pattern. Data points were spaced between 1 and 3 m apart.

9.2.2 Soil Sampling

9.2.2.1 Moturoa 2

Seven test pits (TP1 – TP7) were excavated around the Moturoa 2 oil well. Test pits extended laterally out from the oil well compound between 7 and 10 m and were excavated to between 1.1 and 3.5 m bgl.

Fourteen soil samples were collected from the test pits from areas of obvious contamination such as suspected oil well features including drilling mud and/or cuttings. Soil sample depths ranged from 0.5 to 2.1 m bgl. Nine samples (TP1 0.7, TP2 0.6, TP3 0.6, TP5 0.7, TP5 1.2, TP6 0.5, TP6 2.0, TP7 0.4 and TP7 2.1) were analysed variously for heavy metals and TPH. Sample TP6 2.0 was submitted for asbestos analysis as suspected ACM was identified.

Test pit and sampling locations are shown on Figure 5 and a representative log of the encountered geology IS appended (TP1 – 7 in Appendix E).

9.2.2.2 Moturoa 3

Five test pits (TP8 – TP12) were excavated along the bench area in the approximate Moturoa 3 oil well location (Photograph 14). Test pits were spaced approximately 5 m apart to give general coverage of the bench to target anomalies identified in the geophysical survey.

Test pits were excavated to between approximately 3.0 and 4.0 m bgl. Eleven samples were collected from the test pits, from depths of between 0.1 m to 4 m bgl. Two samples (TP8 0.1 and TP9 0.1) were analysed for heavy metals and one sample (TP8 0.5) was analysed for TPH, although no obvious signs of contamination were observed (see Section 9.3.1).

The test pit and sampling locations are shown on Figure 5 and representative geological logs (TP8 and TP10) are contained in Appendix E.

9.2.2.3 Egmont 5

Four test pits (TP13 – TP15) were excavated around the Egmont 5 oil well. Test pits were excavated to depths between 4 and 5 m bgl.

Four soil samples were collected from the test pits from areas of obvious contamination and were analysed for TPH and heavy metals.

Test pit and sampling locations are shown on Figure 2 and a representative log of the encountered geology (TP13 – TP15) is presented in Appendix E.

9.3 Results

9.3.1 Observations

9.3.1.1 Moturoa 2

In general, a brown silty clay was encountered in the Moturoa 2 test pits which was interpreted as fill. It contained demolition and refuse-type materials to a depth of up to 2.1 m bgl (Photograph 15). The fill was underlain by black, fine sand considered to be undisturbed dune sand.

The fill material typically consisted of general refuse such as metal, wood, concrete, ceramic pipe, plastic and electrical insulators (Photograph 16). Suspected ACM was found in test pit TP6 between 1.5 and 2.0 m bgl.

A 0.1 m thick lens of suspected drill cuttings was identified at 0.4 m bgl in two test pits (TP2 and TP4) to the east of the oil well compound. The material comprised compacted clay containing crystalline sulphur and other minerals.

Other evidence of the former oil well (e.g. flare pits, mud pits, etc.) was not identified in any of the other test pits.

The PID measurements from test pits ranged from the instrument's detection limit to 6.3 ppm. No groundwater was encountered in any of the test pits.

9.3.1.2 Moturoa 3

The test pits in the assumed vicinity of Moturoa 3 generally encountered a fine black sand up to 1 m thick underlain by brown silty clay between 2.0 – 2.7 m thick, beneath which a greyish-brown fine to medium sand was found (Photograph 17). Test pit TP8, at the northeast end of the bench, was the exception. Black/brown fine sand extended to the full depth of this pit.

No evidence of former oil well activities was identified in any of the test pits. The PID measurements ranged from the instrument detection limit to 18.0 ppm.

9.3.1.3 Egmont 5

The material encountered in the Egmont 5 test pits generally consisted of clay topsoil underlain by fine sands and silty clays. A large concrete footing, likely associated with the former pumpjack (beam pump or "nodding donkey"), was observed in TP14 at a depth of 0.5 m bgl (Photograph 18).

The PID measurements ranged from the instrument detection limit to 390 ppm (TP13A 2.5). Groundwater was observed at depths ranging between 2.5 (TP14) and 4 m bgl (TP13a). Groundwater was not observed in TP15.

9.3.2 Geophysical survey

The results of the geophysical surveys to investigate oil wells included:

- Moturoa 2: Extensive anomalous areas to the east and southeast of the oil well, orientated east/west and described as deep 'chaotic' fill. Anomalies are suggested to relate to excavation or remnant waste material.
- Moturoa 3: An anomalous zone was detected in the eastern part of the bench, interpreted as 'disturbed'. No magnetic anomalies were identified.
- Egmont 5: A large magnetic anomaly identified in the investigation area indicative of the buried wellhead. The co-ordinates of the anomaly were measured as 1690132E, 5675837N (NZTM).

9.3.3 Laboratory results and comparison to applicable criteria

The results of the laboratory analysis from the Moturoa 2, Moturoa 3 and Egmont 5 investigations are presented in tables 8 to 13.

All soil samples analysed from the Moturoa 2 and Moturoa 3 investigations returned heavy metal concentrations above the laboratory detection limit, with the exception of cadmium and arsenic in some samples. None of the analytical results for metals exceeded the utilised SCS for the Moturoa 2 and Moturoa 3 investigation areas, with all Moturoa 3 results appearing similar to expected background concentrations. Three samples from the vicinity of the Moturoa 2 oil well were found to exceed the MfE Class A landfill screening criteria, although it is expected the samples would comply with TCLP leaching criteria if tested.

Four samples analysed for TPH (TP2 0.6, TP5 0.7, TP5 1.2 and TP7 2.1) from the vicinity of Moturoa 2 oil well returned low concentrations of C_{15}-C_{36} hydrocarbons. The two remaining samples (TP3 0.6 and TP7 0.4) returned hydrocarbon concentrations below the laboratory detection limit. All samples from the Moturoa 2 oil well location complied with MfE (2011a) Tier 1 acceptance criteria.

Chrysotile asbestos fibres were detected in the soil sample submitted from the vicinity of Moturoa 2. The asbestos was identified as asbestos-cement and as loose fibres.

Heavy metal concentrations for Egmont 5 soil samples appear typical of background concentrations. However, all four samples analysed for TPH from the vicinity of Egmont 5 recorded elevated hydrocarbon concentrations with TPH concentrations ranging from 330 (TP13 3.0) to 8,100 mg/kg (TP13A 2.5).

9.4 Risk Assessment

All soil samples collected in the vicinity of Moturoa 2 and from the bench area in the assumed approximate location of Moturoa 3, complied with the applicable heavy metal health SCSs and hydrocarbon acceptance criteria. This indicates the soil in the sampled locations presents an acceptable risk to human health under the proposed land use scenarios.

The presence of ACM in one location near Moturoa 2 does not indicate a particular risk provided soil is not disturbed in this area, however, if development works extend into the fill containing demolition-type material, then a possible health risk could arise if asbestos-containing was mobilised.

Although some of the soil results around the Moturoa 2 oil well do not meet the Class A landfill preliminary screening criteria, it is expected that the soils would meet the TCLP criteria on the basis of the TCLP testing already undertaken within the marae development area. However, the presence of asbestos means that the soil will be regarded as special waste.

No development work is planned for the vicinity of Moturoa 3, however the soil appears to be consistent with natural, uncontaminated soil.

Hydrocarbon impacts were identified in all samples obtained from the vicinity of the Egmont 5 oil well. As noted earlier, there are no appropriate human health standards or guidelines for hydrocarbons for the expected limited use of the vicinity of Egmont 5 (and the southwestern part of the site generally). Given this limited use and the depth of the identified impacts, people are unlikely to come into contact with the impacted material. It is therefore considered that the identified impacts at Egmont 5 pose a minimal risk to human health.

10.0 Groundwater Investigation

10.1 Investigation Activities

The groundwater investigation activities were carried out as follows:

- Between 2 and 9 July 2015, DCN Drilling completed borehole drilling and installation of eight groundwater monitoring wells;

- On 16 July 2015, groundwater monitoring and collection of groundwater samples for laboratory analysis;
- On 21 July 2015, the survey of monitoring well levels and locations; and
- On 29 September 2015, follow-up monitoring and collection of groundwater samples from selected wells.

10.1.1 Groundwater Monitoring Well installation

As noted earlier, groundwater investigation was carried out through the installation of groundwater monitoring wells along four transects across the site. The installation of monitoring wells was carried out following the geophysical survey by SGL, with the objective of more accurately locating the groundwater monitoring wells up and downgradient of the former oil wells. The lack of success finding evidence of Moturoa 3 means the monitoring wells for this well are no more than approximate. The locations of the eight monitoring wells are shown on Figure 6.

Prior to the drilling activities, each well location was checked for underground services and the well locations hand-cleared to depths of between 1.0 and 1.5 m bgl. The wells were installed to depths of between 3 and 12 m bgl. Individual installation details for each monitoring well are recorded on the appended geological logs (labelled MW1 to MW8 in Appendix E).

Following installation, the well levels (relative to mean sea level - Taranaki Datum 1970) and locations were surveyed by NZ Geomatics Ltd.

10.1.2 Soil sampling

Soil samples were typically collected at 0.5 m intervals down to 1.5 m bgl, below which deeper samples were collected at 0.5 m intervals above and below the expected groundwater level in each borehole.

Field screening of soil was undertaken using a PID during drilling. Soil samples were to be analysed where higher PID readings were recorded, however, as all PID readings were low (maximum of 3.1 ppm), no samples were analysed.

10.1.3 Groundwater Monitoring and Sampling

Groundwater sampling was undertaken in two phases, on 16 July and 29 September 2015.

During each phase of groundwater monitoring hydrocarbon vapours in the well headspace were first measured using a PID, following which the presence of light non-aqueous phase liquid (LNAPL) at the watertable was checked and the depth to water measured using an intrinsically safe interface probe (capable of detecting both water and separate phase hydrocarbons). Product finding paste placed on the tip of the probe was used to further check the presence of LNAPL.

Groundwater level measurements were taken relative to the top of the PVC well casings.

The groundwater levels were calculated for each monitoring well in terms of metres above mean sea level (m amsl). A summary of the well and water level data is presented in Table 14. Groundwater contours and water levels are shown on Figure 6.

Prior to taking groundwater samples from each well, the wells were purged of at least three times the well volume or until the well was dry, and until key groundwater parameters (pH and electrical conductivity) had stabilised. Once purged, groundwater samples were collected from the wells using disposable plastic bailers. Samples were collected directly into laboratory-supplied bottles. Quality control/quality assurance samples were also collected during the July monitoring event.

All samples were stored in chilled containers and sent via courier to RJ Hill Laboratories Limited on the day of sampling, and received by the laboratory the day after the samples were dispatched from New Plymouth.

For the September monitoring event, groundwater samples were only collected from the three wells upgradient of the wetland area (MW4, MW5 and MW6), these being analysed for zinc. The follow-up zinc analysis was to ascertain whether zinc was naturally elevated in the groundwater, following elevated zinc being identified in the spring water in the earlier phase of sampling.

The sample chain of custody sheets and the groundwater monitoring sheets, with details of the purging process and field observations are appended (Appendix G and H respectively).

Purged water from the monitoring was placed into drums on-site and then disposed of by InterGroup Limited (waste manifest documentation is presented in Appendix I).

10.2 Results

10.2.1 Observations

10.2.1.1 Geology

The natural black sand geology encountered in the eight monitoring wells was consistent with the expected geology (i.e. beach deposits – Photograph 19). Surface fill material was encountered in all boreholes ranging from 0.1 to 2.2 m deep, with the most significant filled areas located in the central (MW3 and MW4) and southwestern (MW6) areas. In addition, what is thought to be approximately 1 m of reclamation fill associated with Port Taranaki's development of Ocean View Parade was encountered in MW8, which was located in the northeastern corner of the site on Ocean View Parade.

10.2.1.2 Well monitoring

Photoionisation detector headspace readings in the wells ranged from 0.2 ppm (MW5) to 1.8 ppm (MW6) during July and insignificantly low readings during the September monitoring event (Table 14). No measurable LNAPL was observed in any of the monitoring wells during either groundwater monitoring events. However, minor hydrocarbon sheen was observed on water purged from wells MW1, MW2 and MW6 in July event but no sheen was observed in September.

Groundwater was measured at depths between 2.34 m amsl (MW1, near Ocean View Parade) and 8.71 m amsl (MW5 on higher ground below the railway) on 16 July 2015 and depths of 2.25 m amsl (MW1) and 8.75 m amsl (MW5) on 29 September 2015.

Groundwater flow direction was confirmed to be in a northerly direction (Figure 6), with expected anomalies around the wetland area.

10.2.2 Groundwater sampling results compared with applicable criteria

The results of the groundwater analysis are presented in Table 15 and copies of the laboratory reports are appended.

All groundwater samples returned concentrations of hydrocarbons below the laboratory limit of detection.

The well downgradient of the urupā (MW1) returned concentrations of ammoniacal nitrogen, nitrite and nitrate of 0.29 mg/L, 0.009 mg/L and 0.23 mg/L, respectively, with concentrations of formaldehyde below the laboratory level of detection. The concentrations of these analytes in the upgradient well (MW6) were below the laboratory detection limit with the exception of nitrate, which returned a concentration of 3.1 mg/L.

Zinc concentrations ranged from 0.0038 to 0.0123 mg/L, in the upgradient wells monitored in September.

All of the samples analysed reported petroleum hydrocarbon concentrations below the applicable MfE Tier 1 groundwater acceptance criteria via indoor/outdoor air inhalation pathway in the context of a commercial/industrial land use. Nitrate in MW6 was noted to exceed the preliminary trigger value with ammoniacal nitrogen falling below the utilised criterion. Zinc concentrations in MW5 exceeded the ANZECC freshwater (95% protection) trigger value.

10.3 Risk Assessment

All of the samples collected from groundwater beneath the site complied with applicable groundwater acceptance criteria with the exception of the result for zinc in MW5 and nitrate in MW6, both of which exceeded the freshwater trigger value (95% level of species protection) but met the 80% species protection value which is considered more appropriate for the site. The zinc concentration in the

groundwater appears to be naturally slightly elevated (zinc was also elevated in the spring and wetland – see below).

It is also considered that the off-site risk to the marine environment is acceptable due to the large available dilution potential meaning that the slight exceedance of the marine trigger value for nitrate is not considered significant.

It is therefore considered, in the context of the proposed development, that the risk to human health (volatilisation from the watertable) and other environmental receptors is acceptable.

11.0 Surface Water Investigation

11.1 Site Investigation Activities

To investigate the possibility of surface water contamination in the proposed lagoon, an assessment of surface water at the site was carried out. Focus was placed on the spring and wetland area, as water from the spring will be used to fill the lagoon.

On 17 July 2015, the wetland area was inspected and water samples were collected from pooled water along the western boundary of the wetland area (SW01) and from pooled water from the spring (SW02). On 29 September 2015, follow-up water samples were collected from SW02 and from within a manhole (SW03) that receives water from the complete wetland area (Photograph 20).

The samples were collected into laboratory-supplied containers, chilled and sent to RJ Hill Laboratories Limited on the day of sampling, with the samples received the following day. Sample chain of custody documentation is appended.

11.2 Results

11.2.1 Observations

During the July sampling event, locations SW01 and SW02 possessed a metallic sheen on the water surface (Photograph 21). There was no observable flow at these locations. A metallic sheen was not observed at locations SW02 and SW03 during the September monitoring event. Orange iron precipitates were noted on the vegetation surrounding sampling locations SW01 and SW03. Water was observed to be flowing into the manhole at an estimated 0.25 L/s.

11.2.2 Sampling results and comparison with applicable criteria

The results of the surface water analysis are presented in Table 16 and copies of the laboratory reports are appended.

The surface water samples returned concentrations of dissolved metals above the laboratory level of detection for copper, lead and zinc. Zinc returned the

highest concentrations, ranging from 0.0016 mg/L (SW01) to 0.0173 mg/L (SW02).

Concentrations of hydrocarbon residues were below the laboratory detection limit in the sample collected from the spring (SW02) and the manhole (SW03).

All surface water samples complied with heavy metal water quality criteria for protection of the aquatic environment with the exception of zinc in both samples obtained from SW02 and the sample obtained from SW03, with concentrations exceeding the ANZECC (2000) freshwater quality guideline (95% protection). However, the samples obtained during September were noted to meet the 90% level of protection, the sample obtained from SW02 in July marginally exceeding this but meeting the 80% level of protection.

Zinc concentrations for the sample obtained from SW02 in July also marginally exceeded the utilised marine water trigger value (95% protection) but met the 90% species protection level.

11.3 Assessment

Given that the groundwater appears to be slightly elevated in zinc, there is no particular reason to suspect the spring water or wetland is contaminated with zinc, and the slightly elevated results appear to be natural. As a result, comparison with aquatic protection guideline values is not appropriate. In addition, it is noted that the ultimate receiving environment, the sea, provides very large dilution and these marginally elevated concentrations are not significant.

12.0 Conclusions

12.1 Waitapu Urupā

The geophysical survey to define the extent of the Waitapu Urupā was inconclusive. While disturbed ground was identified, categorical evidence of burials was not identified in the western area of the urupā and a southern boundary could not be identified. Anomalies indicative of possible burials were identified in the eastern portion of the urupā, however, since the anomalies all occur beneath a layer of fill the survey was unable to definitively confirm this.

Sampling of the soil in the urupā soil mound found it to be heterogeneous. All heavy metal concentrations in the samples were typical of expected background concentrations with the possible exception of copper, but the elevated copper may be natural. As the soil does not appear to be contaminated it does not present a health risk.

If required, the mound soil would be acceptable for disposal at a Class A landfill.

Investigation for drilling wastes along the southern boundary of the urupā found the soil to be comprised of clays, sands and peat, with no obvious wastes despite BTW (2013) finding suspected drilling mud. Sampling identified limited heavy metal and hydrocarbon impacts along the southern boundary of the urupā. The depth of these impacts and the use of the land as public open space mean that people are unlikely to come into contact with these contaminants and the risk to human health is considered to be limited.

12.2 Bach Investigation

Investigation of the former bach area parallel to Ocean View parade found minor demolition materials (e.g. brick, metal) and limited surface fill. All analytical soil results for heavy metals met the applicable human health criteria indicating that the concentrations of metals within the soil in the sampled locations presents an acceptable risk to human health under the proposed commercial/industrial land use scenario. However, asbestos fibres (ACM debris and associated loose fibres) were detected in shallow samples from three locations. This could result in a possible health risk if fibres are mobilised during site redevelopment activities and should be managed at the time of any future excavation.

Some samples exceeded the Class A landfill screening criteria for metals indicating a need for leaching (TCLP) testing if this material requires off-site disposal. However, given the minor exceedance of the screening criteria, the material is expected to comply with the leaching criteria and be acceptable at a Class A landfill. Regardless of leaching test results, given the identification of ACM and associated loose fibres within the soil, asbestos-impacted soil would be classified as a special waste.

The ground gas investigations did not identify significant concentrations of methane, however, volatile organic vapours above the utilised screening value were present in the monitoring points located within the proposed commercial zone. Further assessment at the time of any future development is recommended to evaluate the health risk from possible vapour intrusion into future buildings. Similar evaluation for the marae buildings found the risk was acceptable (see below).

12.3 Investigation of Proposed Marae Vicinity

The geophysical investigation in the vicinity of the marae identified an area of deep fill in the central and northern portion of this area. Tests pits confirmed this to be up to 1.7 m thick, and containing various demolition waste materials at shallow depth, particularly adjacent to the Moturoa 2 oil well.

A number of soil samples returned elevated heavy metal concentrations, however, all results complied with the human health criteria, indicating the soil in the investigated locations presents an acceptable risk to human health under the proposed land use. Asbestos fibres, including ACM debris and loose fibres,

were detected in shallow soil at three locations. Appropriate management of asbestos-impacted soil will be required during future site redevelopment activities.

The majority of the samples from the marae area exceeded the Class A landfill screening criteria for some heavy metals and subsequently five samples underwent TCLP analysis. The TCLP analysis results complied with the Class A landfill leachate criteria and consequently material can be disposed of at the Colson Road Landfill. However, given the identification of ACM and asbestos fibres within the soil, this material may be classified as special waste.

The ground gas investigation did not identify significant concentrations of methane, however, all monitoring points possessed elevated volatile organic vapours.

Indoor air modelling was undertaken to predict possible migration of sub-slab vapour into five rooms of the proposed marae. The results of the modelling show that predicted indoor benzene concentrations comply with MfE (2011a) target air concentrations for commercial/industrial land use, indicating an acceptable health risk from ground vapours.

12.4 Oil Well Investigation

The geophysical surveying and test pitting did not identify conclusive evidence of historical drilling activities in the presumed location of the Moturoa 3 oil well. The soils in the vicinity appeared natural.

The geophysical survey identified deep fill to the east and northeast of Moturoa 2 well, which, which was subsequently confirmed to contain demolition material in the immediate vicinity of the oil well. Limited evidence of contamination associated with oil exploration activities was identified.

All soil samples collected in the vicinity of Moturoa 2 complied with applicable health criteria for heavy metals and hydrocarbons, indicating acceptable risk to human health in the context of the proposed land use. Asbestos containing material and loose fibres were detected in one deep sample in the vicinity of Moturoa 2, and may present a risk if any deep excavation were to occur around the well.

Three samples from the vicinity of Moturoa 2 exceeded the Class A landfill screening criteria for some heavy metals. Further TCLP analysis will be required if any of this material is required to be disposed of at the Colson Road Landfill, however, other TCLP analysis carried out on similar soil complied with Class A leaching criteria. The soil may be classified as special waste given the identification of asbestos in one sample.

The geophysical survey accurately identified the position of the Egmont 5 oil well. Test pitting in the vicinity found a concrete structure thought to be a pump

foundation. Soil at depth was impacted with hydrocarbons. However, due to the depth of the impacts and the use of the land as public open space, the risk to human health is minimal.

12.5 Groundwater and Surface Water Investigation

The groundwater investigation confirmed the groundwater flow beneath the site to be generally towards the north.

Groundwater samples collected and analysed from the monitoring wells returned concentrations of hydrocarbons below the laboratory limit of detection, indicating that groundwater in the sampled locations has not been significantly impacted by off-site or on-site sources of hydrocarbons.

All of the samples collected from groundwater beneath the site complied with applicable groundwater acceptance criteria with the exception of the results for zinc and nitrate.

Surface water samples were collected from the on-site spring, the wetland area and from a manhole, to investigate the possibility of surface water contamination in the proposed lagoon and wetland area.

Zinc concentrations in the spring and the wetland appear to be slightly elevated, however, all other results complied with the applicable health and environmental criteria indicating an acceptable risk to human health and the environment.

Given the groundwater appears to be naturally slightly elevated in zinc, there is no particular reason to suspect the spring water or wetland is contaminated with zinc, with the elevated results thought to be natural. As a result, comparison with the aquatic protection guideline value is not appropriate.

It is also considered that the off-site risk to the marine environment is acceptable. The large available dilution means the slight exceedance of the marine trigger values for nitrate and zinc are not significant after mixing.

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Appendix A: Figures

SITE LOCATION

PROPOSED COMMERCIAL DEVELOPMENT

BACH INVESTIGATION (SEE FIGURE 3)

MOTUROA 2 INVESTIGATION (SEE FIGURE 5 - INSET 1)

MOTUROA 3 INVESTIGATION (SEE FIGURE 5 - INSET 2)

APPROXIMATE LOCATION OF FORMER MOTUROA 3 OIL WELL

Section 227
Fitzroy District

WAITAPU URUPA
Section 198
Fitzroy District

EGMONT 5

MOTUROA 2

Lot 1
DP 18771

OCEAN VIEW PARADE

BAYLY ROAD

NEW PLYMOUTH LINE

EGMONT 5 INVESTIGATION (SEE FIGURE 2 - INSET 1)

WAITAPU URUPA INVESTIGATION (SEE FIGURE 2)

PROPOSED POND LOCATION [2]

MARAE DEVELOPMENT [1] INVESTIGATION (SEE FIGURE 4)

GROUNDWATER AND SURFACE WATER INVESTIGATION (SEE FIGURE 6)

KEY

MOTUROA 2 — FORMER OIL WELL LOCATION

INVESTIGATION AREA

PROPERTY BOUNDARY

NOTES :
1. PROPOSED MARAE BUILDING FOOTPRINT AND DRIVEWAY OUTLINE DERIVED FROM DRAWING 14505-01-01, REV 1, SUPPLIED BY BT COMPANY LTD.
2. PROPOSED POND OUTLINE DERIVED FROM DRAWING 14380-01, REV 1, SUPPLIED BY BT COMPANY LTD.

0 20 40 60 80 100m

SCALE 1:2,000 (A3)

SOURCE: AERIAL IMAGERY SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/layer/1869-taranaki-04m-rural-aerial-photos-2011-2012/ AND LICENSED BY TARANAKI REGIONAL CONSORTIUM FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 3.0 NEW ZEALAND LICENCE. CADASTRAL INFORMATION (AS AT 04/05/2015) AND INSET DERIVED FROM LINZ DATA.

FIGURE 1 : SITE PLAN AND MARAE DEVELOPMENT LAYOUT

W02050100D001.dwg Feb-16 FINAL

INSET 1 - EGMONT 5
APPROX. SCALE 1:250

KEY

TP16	TEST PIT LOCATION (SEP, 2015)
SS40	HAND AUGER LOCATION (JUL, 2015)
SS41 0.1	SOIL SAMPLE LOCATION AND DEPTH (m)
EGMONT 5	FORMER WELL LOCATION
	EGMONT 5 INVESTIGATION AREA
	WAITAPU URUPA LEGAL BOUNDARY
	PROPERTY BOUNDARY

NOTES :
1. PROPOSED POND OUTLINE DERIVED FROM DRAWING 14380-01, REV 1, SUPPLIED BY BT COMPANY LTD.

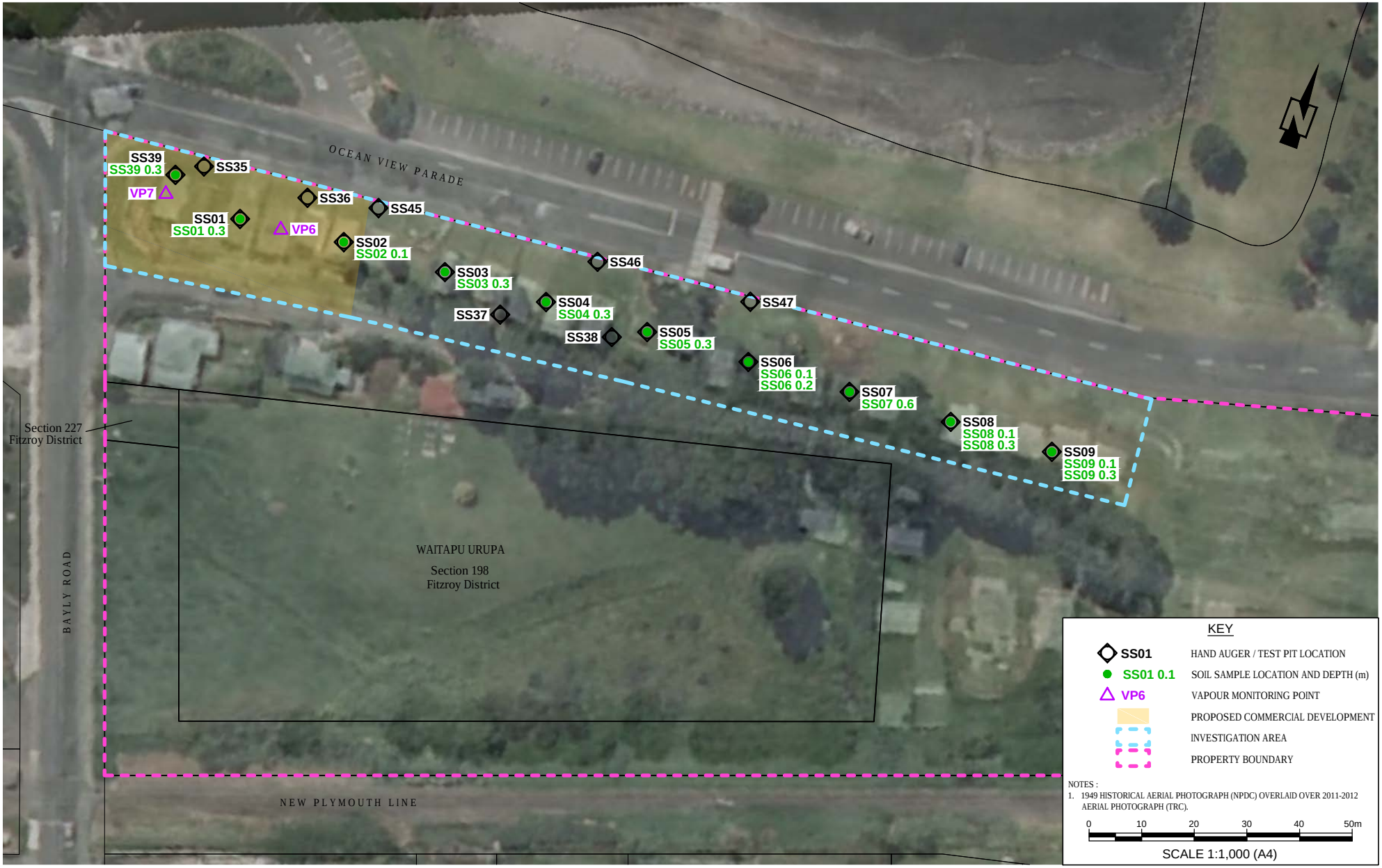
0 10 20 30 40 50m

SCALE 1:1,000 (A4)

SOURCE: AERIAL IMAGERY SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/layer/1869-taranaki-04m-rural-aerial-photos-2011-2012/ AND LICENSED BY TARANAKI REGIONAL CONSORTIUM FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 3.0 NEW ZEALAND LICENCE. CADASTRAL INFORMATION (AS AT 04/05/2015) DERIVED FROM LINZ DATA.

FIGURE 2 : WAITAPU URUPA AND EGMONT 5 - SOIL SAMPLING LOCATIONS

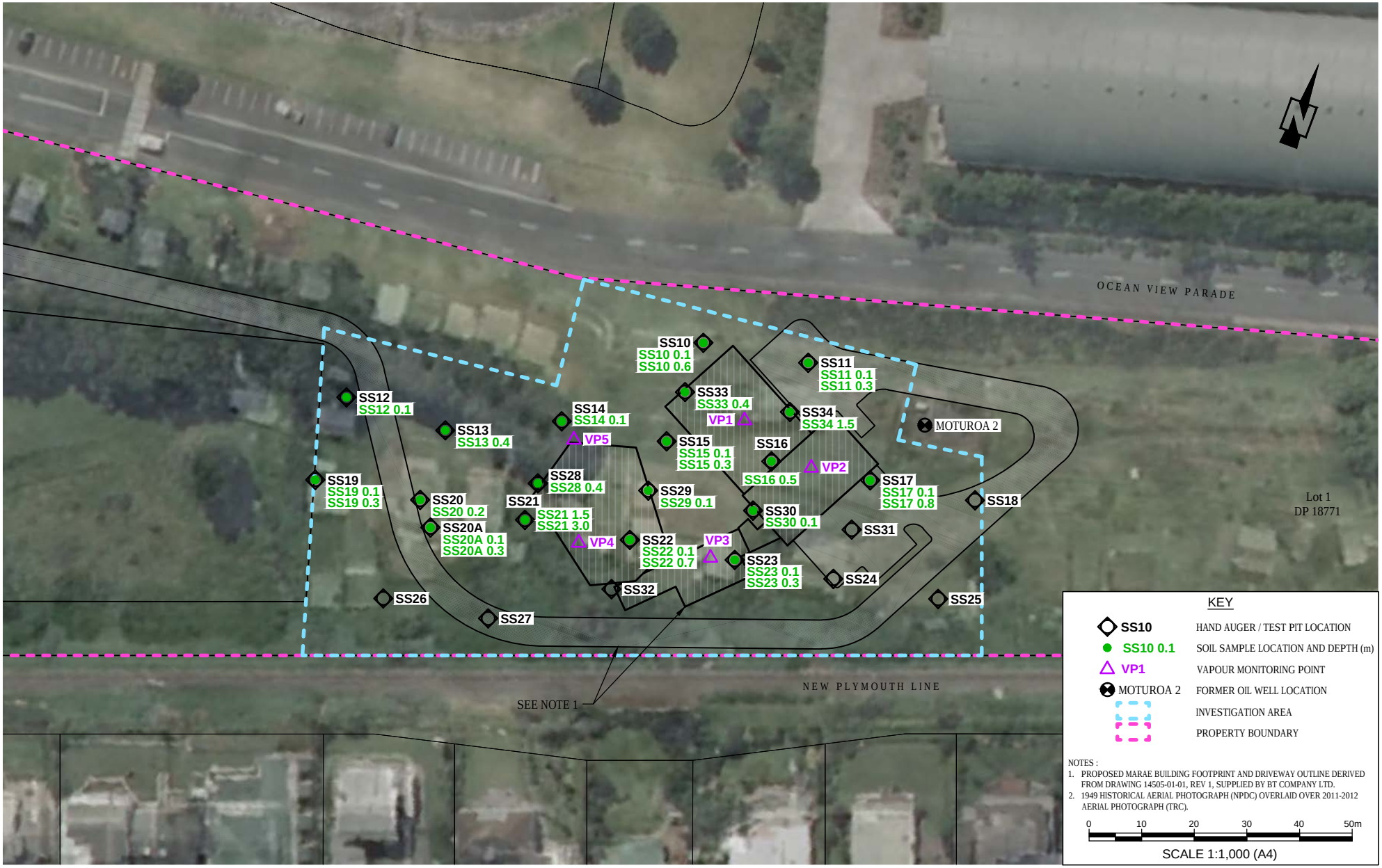
W02050100D001.dwg Feb-16 FINAL



SOURCE: AERIAL IMAGERY SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/layer/1869-taranaki-04m-rural-aerial-photos-2011-2012/ AND LICENSED BY TARANAKI REGIONAL CONSORTIUM FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 3.0 NEW ZEALAND LICENCE.
HISTORICAL AERIAL PHOTOGRAPH (DATED 1949) SUPPLIED BY NEW PLYMOUTH DISTRICT COUNCIL.
CADASTRAL INFORMATION (AS AT 04/05/2015) DERIVED FROM LINZ DATA.

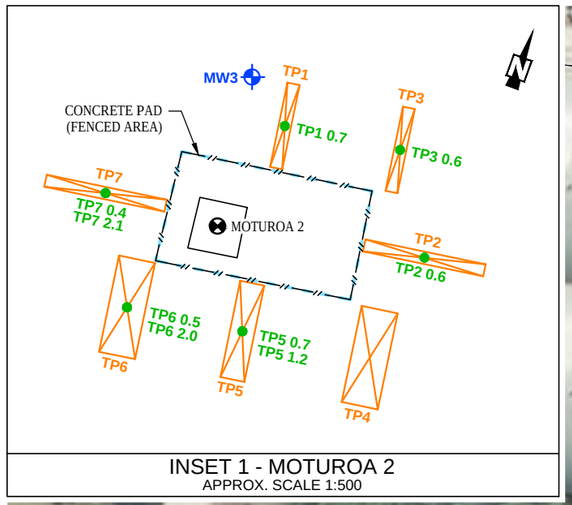
FIGURE 3 : BACH INVESTIGATION - SOIL SAMPLING LOCATIONS

W02050100D001.dwg Feb-16 FINAL



SOURCE: AERIAL IMAGERY SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/layer/1869-taranaki-04m-rural-aerial-photos-2011-2012/ AND LICENSED BY TARANAKI REGIONAL CONSORTIUM FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 3.0 NEW ZEALAND LICENCE.
HISTORICAL AERIAL PHOTOGRAPH (DATED 1949) SUPPLIED BY NEW PLYMOUTH DISTRICT COUNCIL.
CADASTRAL INFORMATION (AS AT 04/05/2015) DERIVED FROM LINZ DATA.

FIGURE 4 : MARAE INVESTIGATION - SOIL SAMPLING LOCATIONS



INSET 1 - MOTUROA 2
APPROX. SCALE 1:500

INSET 2 - MOTUROA 3
APPROX. SCALE 1:500

SOURCE: AERIAL IMAGERY SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/layer/1869-taranaki-04m-rural-aerial-photos-2011-2012/ AND LICENSED BY TARANAKI REGIONAL CONSORTIUM FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 3.0 NEW ZEALAND LICENCE. CADASTRAL INFORMATION (AS AT 04/05/2015) DERIVED FROM LINZ DATA.

FIGURE 5 : MOTUROA 2 AND MOTUROA 3 SOIL SAMPLING LOCATIONS

W02050100D001.dwg Feb-16 FINAL

SOURCE: AERIAL IMAGERY SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/layer/1869-taranaki-04m-rural-aerial-photos-2011-2012/ AND LICENSED BY TARANAKI REGIONAL CONSORTIUM FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 3.0 NEW ZEALAND LICENCE. CADASTRAL INFORMATION (AS AT 04/05/2015) DERIVED FROM LINZ DATA.

FIGURE 6 : GROUNDWATER AND SURFACE WATER INVESTIGATION (JULY 2015)

Appendix B: Tables

Table 1: Waitapu Urupā Soil Mound Investigation - Soil Sampling Results - Heavy Metals

Soil Samples Collected at a Depth of 0 - 1 m Below Ground Level [1]						
Sample Name	SS41 0.1	SS41 1.0	SS43 0.7	SS44 0.5	Typical Background Soil Concentrations for the Wellington Region (URS, 2003) [2]	Class A Landfill Screening Criteria [3]
Laboratory Reference	1452027.21	1452027.23	1452027.30	1452027.32		
Sample Location	SS41	SS41	SS43	SS44		
Soil Type - Field	Clay	Silt	Silt	Sand		
PID Reading (ppmv)	0.3	0.3	0.2	0.2		
Sample Depth (m bgl)	0.1	1.0	0.7	0.5		
Heavy Metals						
Arsenic	3	3	3	3	< 2 - 7	100
Cadmium	0.13	< 0.10	< 0.10	0.12	< 0.1 - 0.2	20
Chromium	10	12	17	9	6 - 21	100
Copper	46	68	95	48	3 - 25	100
Lead	44	12.5	16.8	6.9	4.5 - 180	100
Nickel	5	5	8	5	4 - 21	200
Zinc	87	43	71	51	24 - 201	200

Notes:
1. All results in mg/kg.
2. Concentrations from Determination of Common Pollutant Background Soil Concentrations for the Wellington Region (URS, 2003) as no background concentrations available for the Taranaki region.
3. Criteria from Landfill Waste Acceptance Criteria and Landfill Classification (MfE, 2004).

Concentration above typical background soil concentrations for the Wellington region (URS, 2003).

Table 2: Waitapu Urupā Drilling Mud Investigation - Soil Sampling Results - Total Petroleum Hydrocarbons and Heavy Metals

Soil Samples Collected at a Depth of 0 - 3 m Below Ground Level [1]

Sample Name	TP16 2.0	TP18 2.7	TP21 0.2	Typical Background Soil Concentrations for the Wellington Region (URS, 2003)[2]
Laboratory Reference	1481517.10	1481517.12	1481517.15	
Sample Location	TP16	TP18	TP21	
Soil Type - Field	Silt	Clay	Sand	
Sample Depth (m bgl)	2.0	2.7	0.2	
PID Reading (ppmv)	89.8	2.7	0.8	
C_7-C_9 hydrocarbons	< 11	-	< 9	
C_{10}-C_{14} hydrocarbons	28	-	< 20	
C_{15}-C_{36} hydrocarbons	550	-	< 40	
TPH	580	-	< 70	
Heavy Metals				
Arsenic	-	3	< 2	< 2 - 7
Cadmium	-	0.35	< 0.10	< 0.1 - 0.2
Chromium	-	27	8	6 - 21
Copper	-	123	28	3 - 25
Lead	-	12.1	2.5	4.5 - 180
Nickel	-	12	6	4 - 21
Zinc	-	121	70	24 - 201

Notes:
1. All results in mg/kg.
2. Concentrations from Determination of Common Pollutant Background Soil Concentrations for the Wellington Region (URS, 2003) as no background concentrations available for the Taranaki region.

Concentration above typical background soil concentrations for the Wellington region (URS, 2003).

Table 3: Bach Investigation - Soil Sampling Results - Heavy Metals and Asbestos

Soil Samples Collected at a Depth of <1 m Below Ground Level [1]															
Sample Name	SS01 0.3	SS02 0.1	SS03 0.3	SS04 0.3	SS05 0.3	SS06 0.1	SS06 0.2	SS07 0.6	SS08 0.1	SS08 0.3	SS09 0.1	SS09 0.3	SS39 0.3	Soil Contaminant Standards: Commercial/Industrial [2,3]	Class A Landfill Screening Criteria [4]
Laboratory Reference	1447355.14	1447355.16	1447868.2	1447868.13	1447868.15	1452027.3	1447868.17	1447868.20	1452027.5	1447868.21	1452027.6	1447868.23	1452027.16		
Sample Location	SS01	SS02	SS03	SS04	SS05	SS06	SS06	SS07	SS08	SS08	SS09	SS09	SS39		
Soil Type - Field	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Silt	Clay	Clay	Clay	Clay	Silt		
PID Reading (ppmv)	0.0	0.0	0.0	0.2	-	-	-	0.0	0.2	0.1	0.1	0.0	0.3		
Sample Depth (m bgl)	0.3	0.1	0.3	0.3	0.3	0.1	0.2	0.6	0.1	0.3	0.1	0.3	0.3		
Heavy Metals															
Arsenic	3	4	3	2	3	5	5	2	3	< 2	3	< 2	3	70	100
Cadmium	0.43	0.17	0.74	0.16	0.24	0.31	0.19	< 0.10	0.18	0.78	0.30	0.16	0.22	1,300	20
Chromium	10	16	13	22	16	18	12	21	13	12	13	11	25	6,300	100
Copper	135	69	72	91	68	68	49	85	148	23	174	50	134	NL [5]	100
Lead	186	67	38	24	220	126	49	26	710	120	560	90	210	3,300	100
Nickel	6	7	8	12	9	9	6	11	8	5	10	6	11	6,000	200
Zinc	420	173	89	190	154	280	140	85	187	175	250	220	131	400,000	200
Asbestos [6]															
Asbestos Detected (Presence / Absence)	-	-	-	Amosite and Chrysotile	-	-	-	Amosite and Chrysotile	-	-	-	-	Chrysotile		
Description of Asbestos Form	-	-	-	ACM Debris & Loose Fibres	-	-	-	ACM Debris & Loose Fibres	-	-	-	-	Loose Fibres		

Notes:
1. All results in mg/kg.
2. Arsenic, cadmium, chromium, copper and lead criteria from MfE (2011b).
3. Nickel and zinc criteria from NEPC (2013).
4. Criteria from Landfill Waste Acceptance Criteria and Landfill Classification (MfE, 2004).
5. No Limit.
6. (-) Indicates analysis was not performed.

Concentration above MfE (2004) Landfill Waste Acceptance Criteria and Landfill Classification for Class A Landfills.

Table 4: Ground Gas Investigation Results

Vapour Monitoring Point	Date	Peak PID	Peak CH_4	Min O_2
		ppb	%	%
		4.1[1]	1[2]	-
Vapour Monitoring Points[3]				
VP1	17/07/2015	899	0.1	12.2
	29/09/2015	305	0.0	14.1
VP2	17/07/2017	976	0.1	17.3
	29/09/2015	580	0.0	17.6
VP3	17/07/2017	741	0.1	19.2
	29/09/2015	276	0.0	20.1
VP4	17/07/2015	882	0.1	18.7
	29/09/2015	843	0.0	19.1
VP5	17/07/2015	236	0.1	18.8
	29/09/2015	356	0.0	18.1
VP6	17/07/2015	1048	0.1	18.0
	29/09/2015	846	0.0	16.3
VP7	17/07/2015	318	0.1	16.9
	29/09/2015	616	0.0	17.1

Notes:

1. Converted from commercial/industrial target indoor air concentration for benzene (MfE 2011a).
2. One fifth of the lower explosive limit for methane.
3. Readings taken every minute for five minutes.

Concentration above Ground Gas Trigger Values.

Table 5: Marae Investigation - Soil Sampling Results - Heavy Metals and Asbestos

Soil Samples Collected at a Depth of <1 m Below Ground Level [1]																
Sample Name	SS10 0.1	SS10 0.6	SS11 0.1	SS11 0.3	SS12 0.1	SS13 0.4	SS14 0.1	SS15 0.1	SS15 0.3	SS16 0.5	SS17 0.1	SS17 0.8	SS19 0.1	SS19 0.3	Soil Contaminant Standards: Commercial/Industrial [2,3]	Class A Landfill Screening Criteria [4]
Laboratory Reference	1452027.7	1447868.29	1452027.8	1447868.30	1449293.1	1449293.4	1452027.9	1452027.10	1447868.33	1448363.15	1452027.12	1448363.17	1449304.1	1449304.2		
Sample Location	SS10	SS10	SS11	SS11	SS12	SS13	SS14	SS15	SS15	SS16	SS17	SS17	SS19	SS19		
Soil Type - Field	Clay	Clay	Clay	Clay	Clay	Sand	Clay	Clay	Sand	Clay	Clay	Clay	Clay	Sand		
PID Reading (ppmv)	0.1	0.2	0.1	0.2	0.7	0.7	0.1	1.1	1.2	0.3	1.1	1.6	1.6	1.6		
Sample Depth (m bgl)	0.1	0.6	0.1	0.3	0.1	0.4	0.1	0.1	0.3	0.5	0.1	0.8	0.1	0.3		
Heavy Metals																
Arsenic	5	3	4	5	< 2	2	3	4	2	2	5	4	5	< 2	70	100
Cadmium	0.26	0.19	0.61	0.49	0.16	0.13	0.24	0.43	0.14	0.20	0.54	1.20	0.48	0.14	1,300	20
Chromium	11	11	12	12	10	9	11	11	11	7	13	17	11	5	6,300	100
Copper	137	84	98	173	33	26	112	290	56	23	184	630	116	17	NL [5]	100
Lead	260	87	200	400	111	61	550	1,710	147	40	690	166	200	36	3,300	100
Nickel	8	5	8	9	5	5	8	8	7	5	9	25	7	3	6,000	200
Zinc	230	116	240	280	98	111	166	430	210	117	320	740	260	123	400,000	200
Asbestos [6]																
Asbestos Detected (Presence / Absence)	Chrysotile	-	-	-	-	-	-	-	Chrysotile	-	-	-	-	Asbestos NOT detected		
Description of Asbestos Form	Loose Fibres	-	-	-	-	-	-	-	ACM Debris & Loose Fibres	-	-	-	-	-		

Soil Samples Collected at a Depth of <1 m Below Ground Level [1]													
Sample Name	SS20 0.2	SS20A 0.1	SS20A 0.3	SS22 0.1	SS22 0.7	SS23 0.1	SS23 0.3	SS28 0.4	SS29 0.1	SS30 0.1	SS33 0.4	Soil Contaminant Standards: Commercial/Industrial [2,3]	Class A Landfill Screening Criteria [4]
Laboratory Reference	1449304.4	1449304.7	1449304.8	1448363.25	1448363.27	1449302.4	1449302.5	1449302.7	1449304.10	1449304.12	1449304.15		
Sample Location	SS20	SS20A	SS20A	SS22	SS22	SS23	SS23	SS28	SS29	SS30	SS33		
Soil Type - Field	Clay	Clay	Clay	Clay	Sand	Sand	Sand	Sand	Clay	Clay	Clay		
PID Reading (ppmv)	1.3	1.3	1.4	2.9	0.9	0.5	2.4	1.3	0.8	1.5	1.9		
Sample Depth (m bgl)	0.2	0.1	0.3	0.1	0.7	0.1	0.3	0.4	0.1	0.1	0.4		
Heavy Metals [6]													
Arsenic	6	6	2	< 2	< 2	< 2	-	2	31	3	8	70	100
Cadmium	0.97	1.06	0.10	0.14	0.21	0.31	-	< 0.10	1.16	0.26	0.37	1,300	20
Chromium	13	13	9	12	12	8	-	10	37	13	13	6,300	100
Copper	390	370	52	76	22	17	-	16	1,230	199	94	NL [5]	100
Lead	420	280	240	210	31	51	-	8.6	320	230	450	3,300	100
Nickel	119	19	8	7	5	5	-	5	60	9	6	6,000	200
Zinc	580	520	111	147	320	270	-	80	620	240	260	400,000	200
Asbestos [6]													
Asbestos Detected (Presence / Absence)	-	-	Chrysotile	-	-	-	Asbestos NOT detected	-	-	-	-		
Description of Asbestos Form	-	-	ACM Debris & Loose Fibres	-	-	-	-	-	-	-	-		

Soil Samples Collected at a Depth of 1 - 3 m Below Ground Level [1]					
Sample Name	SS21 1.5	SS21 3.0	SS34 1.5	Soil Contaminant Standards: Commercial/Industrial [2,3]	Class A Landfill Screening Criteria [4]
Laboratory Reference	1448363.22	1448363.23	1449293.11		
Sample Location	SS21	SS21	SS34		
Soil Type - Field	Sand	Sand	Clay		
PID Reading (ppmv)	1.9	1.6	1.6		
Sample Depth (m bgl)	1.5	3.0	1.5		
Heavy Metals					
Arsenic	2	< 2	2	70	100
Cadmium	0.7	< 0.10	0.12	1,300	20
Chromium	9	13	10	6,300	100
Copper	64	28	35	NL [5]	100
Lead	190	17.1	67	3,300	100
Nickel	6	5	5	6,000	200
Zinc	580	117	152	400,000	200

Notes:
1. All results in mg/kg.
2. Arsenic, cadmium, chromium, copper and lead criteria from MfE (2011b).
3. Nickel and zinc criteria from NEPC (2013).
4. Criteria from Landfill Waste Acceptance Criteria and Landfill Classification (MfE, 2004).
5. No Limit
6. (-) Indicates analysis was not performed.

Concentration above MfE (2004) Landfill Waste Acceptance Criteria and Landfill Classification for Class A Landfills.

Table 6: Marae Investigation - Soil Sampling Results - TCLP Analysis

Soil Samples Collected at a Depth of <1m below ground level [1]						
Sample Name	SS11 0.3	SS15 0.1	SS20 0.2	SS29 0.1	SS33 0.4	Class A Landfill Leachate Criteria [2]
Laboratory Reference	1447868.35	1452027.40	1449304.19	1449304.20	1449304.21	
Sample Location	SS11	SS15	SS20	SS29	SS33	
Soil Type - Field	Clay	Clay	Clay	Clay	Clay	
Sample Depth (m bgl)	0.3	0.1	0.2	0.1	0.4	
Toxicity Characteristic Leaching Procedure						
Total Copper in Leachate	0.27	0.042	0.89	0.035	0.020	5
Total Lead in Leachate	0.63	1.25	0.83	1.29	0.189	5
Total Zinc in Leachate	1.72	1.72	9.6	0.47	1.32	10

Notes:
1. Results in mg/L.
2. Criteria from Landfill Waste Acceptance Criteria and Landfill Classification (MfE, 2004).

Table 7: RISC Model Results

Model Input [1,2,3,4,5]					Model Output [6]	Generic Health-Based Indoor Air Concentration for Benzene (MfE, 2011) [7] (mg/m^3)
Monitoring Point	**Room Size (L x W x H)**	**Air Exchange Rates (per hr) [8]**	**Max Field Vapour Concentration (ppb)**	**Model Input Concentration – Soil-Gas (mg/m^3) [2]**	**Calculated Indoor Air Concentration (mg/m^3)**	**Commercial / Industrial [9]**
VP1 (model ref. W02050100_VP1)	Wharekai 12.4 x 10.6 x 3.4	2	899	2.87	0.0023	0.013
VP2 (model ref. W02050100_VP2)	Wharekai (Staff) 5.8 x 4.1 x 2.4	2	976	3.11	0.0064	
VP3 (model ref. W02050100_VP3)	Ablutions (Mattress Storage Room) 13.6 x 4.2 x 2.9	0.5	741	2.36	0.013	
VP4 (model ref. W02050100_VP4)	Wharenui 18 x 15 x 4	2	882	2.81	0.0015	
VP5 (model ref. W02050100_VP5)	Wharenui 18 x 15 x 4	2	356	1.14	0.0006	

Notes:
1. All volatile compounds recorded using the PPB RAE assumed to be Benzene (78.11 g/mol). Very conservative assumption as other volatile compounds would also be present. Benzene is also very volatile and soluble so would readily degrade.
2. Concrete floor thickness of 10 cm.
3. Slab on grade, assuming sandy gravel fill material.
4. Floor crack ratio of 0.01 (cm^2 cracks/cm^2 total area) - MfE (2011a).
5. No bio-attenuation is occurring.
6. Modelling completed using RISC5.
7. Criteria from Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Revised 2011) (MfE, October 2011a).
8. Default air exchange rate of 2 per hr used - MfE (2011a). Lower rate used for mattress storage area given limited ingress points (i.e. storage area only).
9. Commercial/industrial use criteria used for all areas.

Table 8: Moturoa 2 Investigation - Soil Sampling Results - Heavy Metals and Asbestos

Soil Samples Collected at a Depth of 0 - 2 m Below Ground Level [1]

Sample Name	TP1 0.7	TP3 0.6	TP5 0.7	TP6 0.5	TP6 2.0	TP7 0.4	Soil Contaminant Standards: Commercial/Industrial [2,3]	Class A Landfill Screening Criteria [4]
Laboratory Reference	1449304.17	1449288.10	1449288.7	1449288.3	1449288.6	1449288.1		
Sample Location	N of Moturoa 2	NE Moturoa 2	S of Moturoa 2	SW of Moturoa 2	SW of Moturoa 2	W of Moturoa 2		
Soil Type - Field	Sand	Clay	Gravel	Silt	Silt	Gravel		
PID Reading (ppmv)	0.9	0.4	-	1.2	0.4	0.0		
Sample Depth (m bgl)	0.7	0.6	0.7	0.5	2.0	0.4		
Heavy Metals								
Arsenic	7	20	5	3	< 2	< 2	70	100
Cadmium	0.25	< 0.10	0.44	0.18	< 0.10	0.14	1,300	20
Chromium	13	8	12	7	8	5	6,300	100
Copper	106	26	91	33	15	59	NL [5]	100
Lead	77	12	150	172	10.3	25	3,300	100
Nickel	6	2	6	6	5	4	6,000	200
Zinc	118	43	210	168	74	66	400,000	200
Asbestos [6]								
Asbestos Detected (Presence / Absence)	-	-	-	-	Chrysotile	-		
Description of Asbestos Form	-	-	-	-	Fibre cement & loose fibres	-		

Notes:
1. All results in mg/kg.
2. Arsenic, cadmium, chromium, copper and lead criteria from MfE (2011b).
3. Nickel and zinc criteria from NEPC (2013).
4. Criteria from Landfill Waste Acceptance Criteria and Landfill Classification (MfE, 2004).
5. No Limit.
6. (-) Indicates analysis was not performed.

Concentration above MfE (2004) Landfill Waste Acceptance Criteria and Landfill Classification for Class A Landfills.

Table 9: Moturoa 2 Investigation - Soil Sample Results - Total Petroleum Hydrocarbons

Soil Samples Collected at a Depth of <1 m Below Ground Level [1]

Sample Name	TP2 0.6	TP3 0.6	TP5 0.7	TP7 0.4	Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS	Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS	Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS
Laboratory Reference	1449304.16	1449288.10	1449288.7	1449288.1			
Sample Location	E Moturoa 2	NE Moturoa 2	S of Moturoa 2	W of Moturoa 2			
Soil Fate	Remaining	Remaining	Remaining	Remaining			
Soil Type - Field	Silt	Clay	Gravel	Silt	Silty Clay	Clay	Sand
Soil Type - MfE (2011)	Silty Clay	Clay	Sand	Silty Clay			
Sample Depth (m bgl)	0.6	0.6	0.7	0.4			
PID Reading (ppmv)	0.4	0.4	-	0.0	<1 m	<1 m	<1 m
C_7-C_9 hydrocarbons	< 9	< 8	< 11	< 8	(8,800) [6,5v]	NA [4]	120 [5m]
C_{10}-C_{14} hydrocarbons	< 20	< 20	< 30	< 20	(1,900) [6,5x]	(1,900) [6,5x]	(1,500) [6,5x]
C_{15}-C_{36} hydrocarbons	210	< 40	48	< 40	NA [4]	NA [4]	NA [4]
TPH	210	< 70	< 80	< 70	-	-	-

Soil Samples Collected at a Depth of 1 - 4 m Below Ground Level [1]

Sample Name	TP5 1.2	TP7 2.1		Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS	Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS
Laboratory Reference	1449288.8	1449288.2			
Sample Location	S of Moturoa 2	W of Moturoa 2			
Soil Fate	Remaining	Remaining			
Soil Type - Field	Silt	Gravel		Silty Clay	Sand
Soil Type - MfE (2011)	Silty Clay	Sand			
Sample Depth (m bgl)	1.2	2.1			
PID Reading (ppmv)	-	6.3		1 - 4 m	1 - 4 m
C_7-C_9 hydrocarbons	< 10	< 9		(20,000) [6,5m]	120 [5m]
C_{10}-C_{14} hydrocarbons	< 20	< 20		(8,900) [6,5x]	(1,900) [6,5x]
C_{15}-C_{36} hydrocarbons	45	108		NA [4]	NA [4]
TPH	< 70	108		-	-

Notes:
1. All results in mg/kg.
2. Criteria from Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Revised 2011 (MfE 2011a).
3. Criteria assume commercial/industrial land use, 'Clay', 'Silty Clay' and 'Sand' soil types and contamination depths of <1 m and 1 - 4 m below ground level.
4. NA indicates contaminant is not limiting as health based criterion is significantly higher than may be encountered on site (i.e. 20,000 mg/kg for TPH, 10,000 mg/kg for other contaminants).
5. The following notes indicate the limiting pathway for each criterion: m - maintenance/excavation, x - PAH surrogate.
6. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons.

Table 10: Moturoa 3 Investigation - Soil Sampling Results - Heavy Metals

Soil Samples Collected at a Depth of < 1 m Below Ground Level [1]				
Sample Name	TP8 0.1	TP9 0.1	Soil Contaminant Standards: Residential (10% Produce) [2,3]	Typical Background Soil Concentrations for the Wellington Region (URS, 2003) [4]
Laboratory Reference	1452027.34	1452027.38		
Sample Location	Moturoa 3	Moturoa 3		
Soil Type - Field	Sand	Sand		
PID Reading (ppmv)	0.7	1.1		
Sample Depth (m bgl)	0.1	0.1		
Heavy Metals				
Arsenic	< 2	< 2	20	< 2 - 7
Cadmium	< 0.10	< 0.10	3	< 0.1 - 0.2
Chromium	7	10	460	6 - 21
Copper	14	18	NL [5]	3 - 25
Lead	3.7	5.3	210	4.5 - 180
Nickel	4	5	400	4 - 21
Zinc	57	74	7,400	24 - 201

Notes:
1. All results in mg/kg.
2. Arsenic, cadmium, chromium, copper and lead criteria from MfE (2011b).
3. Nickel and zinc criteria from NEPC (2013).
4. Concentrations from Determination of Common Pollutant Background Soil Concentrations for the Wellington Region (URS, 2003) as no background concentrations available for the Taranaki region.
5. No Limit.

Table 11: Moturoa 3 Investigation - Soil Sample Results - Total Petroleum Hydrocarbons

Soil Samples Collected at a Depth of <1 m Below Ground Level [1]		
Sample Name	TP8 0.5	Tier 1 Soil Acceptance Criteria[2,3]
Laboratory Reference	1452027.35	Residential Land Use
Sample Location	Moturoa 3	ALL PATHWAYS
Soil Type - Field	Sand	Sand
Soil Type - MfE (2011)	Sand	
Sample Depth (m bgl)	0.5	<1 m
PID Reading (ppmv)	2.8	
C_7-C_9 hydrocarbons	< 8	120 [5m]
C_{10}-C_{14} hydrocarbons	< 20	(470) [6,5x]
C_{15}-C_{36} hydrocarbons	< 40	NA [4]
TPH	< 70	-

Notes:
1. All results in mg/kg.
2. Criteria from Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Revised 2011 (MfE 2011a).
3. Criteria assume residential 10% produce land use, 'sand' soil type and contamination depths of <1 m below ground level.
4. NA indicates contaminant is not limiting as health based criterion is significantly higher than may be encountered on site (i.e. 20,000 mg/kg for TPH, 10,000 mg/kg for other contaminants).
5. The following notes indicate the limiting pathway for each criterion: m - maintenance/excavation, x - PAH surrogate.
6. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons.

Table 12: Egmont 5 Investigation - Soil Sampling Results - Heavy Metals

Soil Samples Collected at a Depth of 0 - 5 m Below Ground Level [1]				
Sample Name	TP13A 3.0	TP13 5.0	TP15 3.5	Typical Background Soil Concentrations for the Wellington Region (URS, 2003) [2]
Laboratory Reference	1481517.21	1481517.5	1481517.9	
Sample Location	TP13A	TP13	TP15	
Soil Type - Field	Clay	Clay	Clay	
PID Reading (ppmv)	4.5	10.6	2.5	
Sample Depth (m bgl)	3.0	5.0	3.5	
Heavy Metals				
Arsenic	2	< 2	3	< 2 - 7
Cadmium	< 0.10	< 0.10	< 0.10	< 0.1 - 0.2
Chromium	13	27	21	6 - 21
Copper	93	84	66	3 - 25
Lead	11.3	10.6	9.9	4.5 - 180
Nickel	10	9	8	4 - 21
Zinc	74	109	84	24 - 201

Notes:
1. All results in mg/kg.
2. Concentrations from Determination of Common Pollutant Background Soil Concentrations for the Wellington Region (URS, 2003) as no background concentrations available for the Taranaki region.

Concentration above typical background soil concentrations for the Wellington region (URS, 2003).

Table 13: Egmont 5 Investigation - Soil Sampling Results - Total Petroleum Hydrocarbons

Soil Samples Collected at a Depth of 1 - 4 m Below Ground Level [1,2]				
Sample Name	TP13A 2.5	TP13 3.0	TP14 3.5	TP15 2.5
Laboratory Reference	1481517.20	1481517.3	1481517.7	1481517.8
Sample Location	TP13A	TP13	TP14	TP15
Soil Type - Field	Sand	Clay	Clay	Clay
Sample Depth (m bgl)	2.5	3.0	3.5	2.5
PID Reading (ppmv)	390	223.1	40.8	160.9
C_7-C_9 hydrocarbons	26	< 12	< 12	12
C_{10}-C_{14} hydrocarbons	1,630	75	270	670
C_{15}-C_{36} hydrocarbons	6,400	250	1,030	2,200
TPH	8,100	330	1,300	2,800

Notes:
1. All results in mg/kg.
2. No appropriate criteria available for land use.

Table 14: Well Details and Water Levels

Monitoring Well Ref.		MW1	MW2	MW3	MW4	MW5	MW6	MW7	MW8
Total Depth of Well (m below ground level)		5.5	4.0	6.5	7.0	5.0	5.0	12.0	3.0
Screen Interval (m below ground level)		1	1	2	2	1.5	1	6	0.5
Diameter (mm)		50	50	50	50	50	50	50	50
TOC (m RL) [1]		4.42	4.15	8.14	8.62	9.20	10.71	16.02	3.33
Depth to Product (m below TOC) [2]	16/07/2015	-	-	-	-	-	-	-	-
	29/09/2015	-	-	-	-	-	-	-	-
Depth to Water (m below TOC) [2]	16/07/2015	2.085	1.290	3.755	3.880	0.490	2.255	10.705	0.440
	29/09/2015	2.170	1.320	3.790	3.910	0.450	2.425	10.755	0.450
Water Level (m RL) [1]	16/07/2015	2.34	2.86	4.39	4.74	8.71	8.46	5.32	2.89
	29/09/2015	2.25	2.83	4.35	4.71	8.75	8.29	5.27	2.88
Petroleum Hydrocarbons Observations	16/07/2015	Minor sheen on purge water. PID - 1.0	Minor sheen on purge water. PID - 1.1	PID - 0.8	PID - 0.7	PID - 0.2	Minor sheen on purge water. PID - 1.8	PID - 0.3	PID - 1.0
	29/09/2015	No sheen on purge water. PID - 0.0	No sheen on purge water. PID - 0.0	PID - 0.0	PID - 0.0	PID - 0.0	No sheen on purge water. PID - 0.0	PID - 0.1	PID - 0.3

Notes:
1. Reduced Level recorded relative to mean sea level (Taranaki Datum 1970).
2. Water level measurements taken from top of casing.
TOC - Top of Casing.

Table 15: Groundwater Sampling Results

Sample Location	Date	Sample Number	Sample Laboratory Reference		Total Petroleum Hydrocarbons [1,4]				Monocyclic Aromatic Hydrocarbons [1]				Total Ammoniacal-N [1]	Nitrite-N [1]	Nitrate-N [1]	Formaldehyde [1]	Dissolved Zinc [1]
					C_7-C_9	C_{10}-C_{14}	C_{15}-C_{36}	TPH	Benzene	Toluene	Ethylbenzene	Total Xylenes [6]					
MW1	16/07/2015	MW1	1451328.12		< 0.10	< 0.2	< 0.4	< 0.7	< 0.0010	< 0.0010	< 0.0010	< 0.003	0.29	0.009	0.23	< 0.02	-
MW2	16/07/2015	MW2	1451328.1		< 0.10	< 0.2	< 0.4	< 0.7	< 0.0010	< 0.0010	< 0.0010	< 0.003	-	-	-	-	-
MW3	16/07/2015	MW3	1451328.2		< 0.10	< 0.2	< 0.4	< 0.7	< 0.0010	< 0.0010	< 0.0010	< 0.003	-	-	-	-	-
MW4	16/07/2015	MW4	1451328.3		< 0.10	< 0.2	< 0.4	< 0.7	< 0.0010	< 0.0010	< 0.0010	< 0.003	-	-	-	-	-
	29/09/2015		1482124.1		-	-	-	-	-	-	-	-	-	-	-	-	0.0064
MW5	16/07/2015	MW5	1451328.4		< 0.10	< 0.2	< 0.4	< 0.7	< 0.0010	< 0.0010	< 0.0010	< 0.003	-	-	-	-	-
	29/09/2015		1482124.2		-	-	-	-	-	-	-	-	-	-	-	-	0.0123
MW6	16/07/2015	MW6A	1451328.10		< 0.10	< 0.2	< 0.4	< 0.7	< 0.0010	< 0.0010	< 0.0010	< 0.003	< 0.010	< 0.002	**3.1**	< 0.02	-
	29/09/2015	MW6	1482124.3		-	-	-	-	-	-	-	-	-	-	-	-	0.0038
MW7	16/07/2015	MW7	1451328.5		< 0.10	< 0.2	< 0.4	< 0.7	< 0.0010	< 0.0010	< 0.0010	< 0.003	-	-	-	-	-
MW8	16/07/2015	MW8	1451328.6		< 0.10	< 0.2	< 0.4	< 0.7	< 0.0010	< 0.0010	< 0.0010	< 0.003	-	-	-	-	-
Trip Blank	16/07/2015	MW9	1451328.7		< 0.3	< 0.7	< 1.4	< 3	< 0.0010	< 0.0010	< 0.0010	< 0.003	-	-	-	-	-
Field Blank	16/07/2015	MW10	1451328.8		< 0.15	< 0.4	< 0.8	< 1.4	< 0.0010	< 0.0010	< 0.0010	< 0.003	-	-	-	-	-
Duplicate of MW6A	16/07/2015	MW11	1451328.11		< 0.10	< 0.2	< 0.4	< 0.7	< 0.0010	< 0.0010	< 0.0010	< 0.003	-	-	-	-	-
Tier 1 Groundwater Acceptance Criteria [2]	Commercial/ Industrial Land Use	Indoor Air Inhalation	Sand	Depth to Groundwater - 4 m	S [3]	S [3]	S [3]	-	5.5	(480) [5]	(120) [5]	S [3]					
		Outdoor Air Inhalation			S [3]	S [3]	S [3]	-	(370) [5]	S [3]	S [3]	S [3]					
Freshwater Trigger Values (95% protection) [7]													0.9 [8]	NG [9]	0.7	NG [9]	0.008
Marine Water Trigger Values (95% protection) [7]													0.91 [8]	NG [9]	0.7	NG [9]	0.015

Notes:
1. All results in mg/L.
2. Criteria from MfE 2011a - refer to table 5.10 (Commercial/Industrial Inhalation) of the MfE Guidelines.
3. Calculated water criterion exceeds solubility limit for pure compound in water.
4. Measured TPH concentrations in groundwater are frequently dominated by the aromatic component of the TPH mixture. The aliphatic component of TPH generally exhibits very low solubility.
5. Values in brackets exceed solubility limit for compound in water when present as part of a typical gasoline mixture. Solubility is dependent upon composition of the gasoline mixture and so uncertainty arises as to the actual solubility mixture in water.
6. Total xylenes was calculated by adding the laboratory results of the individual xylene isomers with the sum rounded to the least number of significant figures of the two results. Where one of the xylene isomers was below the detection limit, a value of half the detection limit was used in the sum. Where all compounds in the sum are non-detects, the overall detection limit is the sum of the detection limits.
7. Criteria from ANZECC 2000.
8. Based on the highest pH reading of 8.0 during groundwater monitoring (16 July 2015).
9. No Guideline.

	Concentration above ANZECC (2000) freshwater trigger value.
0.0173	Concentration above ANZECC (2000) marine water trigger value.

Table 16: Surface Water Sampling Results

Sample Location	Date	Sample Number	Sample Laboratory Reference			Total Petroleum Hydrocarbons [1,6]				Dissolved Metals [1]						
						C_7-C_9	C_{10}-C_{14}	C_{15}-C_{36}	TPH	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc
SW01	16/07/2015	SW01	1452027.13			-	-	-	-	< 0.0010	< 0.00005	< 0.0005	0.0005	0.00031	< 0.0005	0.0016
SW02	16/07/2015	SW02	1452027.14			< 0.10	< 0.2	< 0.4	< 0.7	< 0.0010	< 0.00005	< 0.0005	0.0011	0.00065	< 0.0005	**0.0173**
	29/09/2015		1482124.4			-	-	-	-	-	-	-	-	-	-	0.0115
SW03	29/09/2015	SW03	1482124.5			< 0.10	< 0.2	< 0.4	< 0.7	< 0.0010	< 0.00005	< 0.0005	0.0005	0.00012	< 0.0005	0.0086
Tier 1 Groundwater Acceptance Criteria [2]	Potable Use					18 [3,4]	0.35 [4]	S [5]	-							
	Irrigation Use					S [5]	1.8 [4]	S [5]	-							
	Commercial/ Industrial Land Use	Indoor Air Inhalation	Sand	Depth to Groundwater - 4 m		S [5]	S [5]	S [5]	-							
		Outdoor Air Inhalation				S [5]	S [5]	S [5]	-							
Freshwater Trigger Values (95% protection) [7]										0.013 [8]	0.0002	0.001 [9]	0.0014	0.0034	0.011	0.008
Marine Water Trigger Values (95% protection) [7]										NG [10]	0.0055	0.0044 [9]	0.0013	0.0044	0.07	0.015

Notes:
1. All results in mg/L.
2. Criteria from MfE 2011a - refer to Table 5.10 (Commercial/Industrial Inhalation) of the MfE Guidelines.
3. Benzene fraction will be limiting.
4. Criterion exceeds solubility limit for most aliphatic hydrocarbons in this range.
5. Calculated water criterion exceeds solubility limit for pure compound in water.
6. Measured TPH concentrations in groundwater are frequently dominated by the aromatic component of the TPH mixture. The aliphatic component of TPH generally exhibits very low solubility.
7. Criteria from ANZECC 2000.
8. Value given for Arsenic (V).
9. Value given for Chromium (VI).
10. No Guideline.

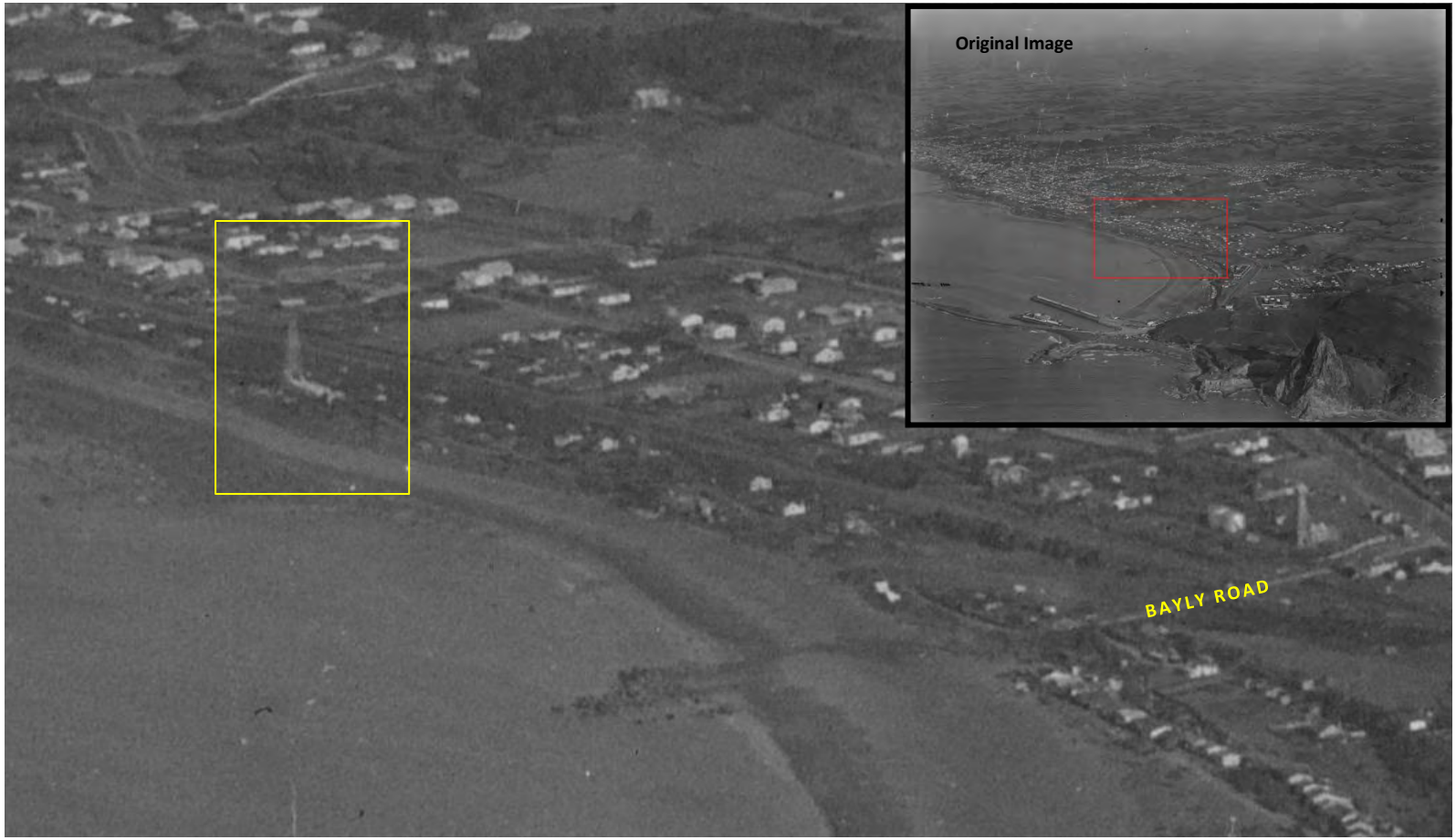
	Concentration above ANZECC (2000) freshwater trigger value.
0.0173	Concentration above ANZECC (2000) marine water trigger value.

Appendix C: Historical Photographs

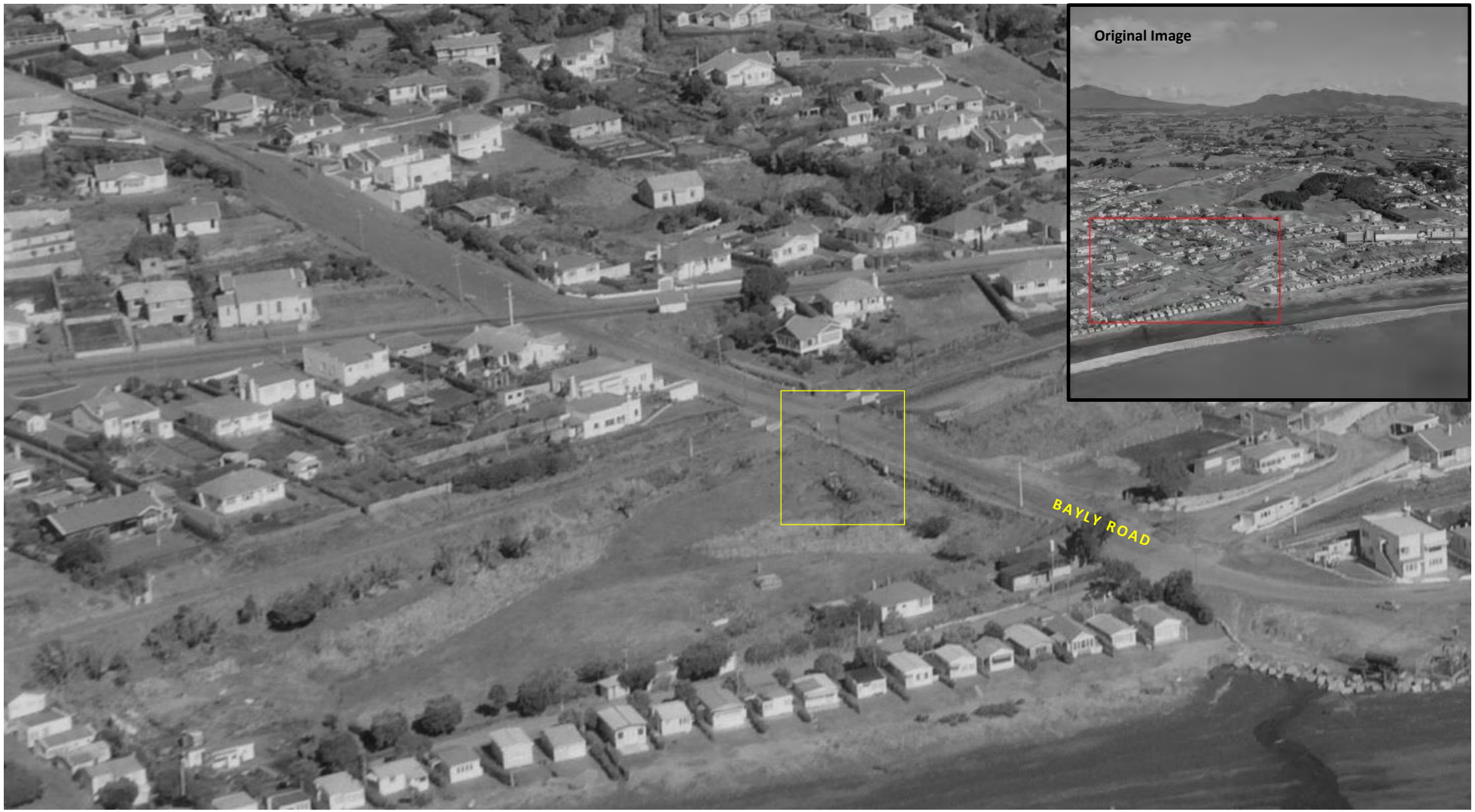
Historical Photograph 1: Bayly Road Site – 1949
Source: New Plymouth District Council

Historical Photograph 2: Bayly Road Site – late 1990s
Source: New Plymouth District Council

Historical Photograph 3: Location of Moturoa 2 - 1953
Source: Alexander Turnbull Library, Ref: WA-33268-F



Historical Photograph 4: Location of Moturoa 3 - 1937
Source: Alexander Turnbull Library, Ref: WA-55980-G



Historical Photograph 5: Location of Egmont 5 – 1958
Source: Alexander Turnbull Library, Ref: WA-47172-F

Appendix D: Site Photographs

Photograph 1: View of the Waitapu Urupā, looking west.

Photograph 2: The wetland area and soil mound in the background, in the south-western part of the site. Photograph looks east.

Photograph 3: The soil mound located in the Waitapu Urupā, looking south.

Photograph 4: Looking west across the bach investigation area in the north-western part of the site, with Ocean View Parade in the foreground.

Photograph 5: View of the Marae investigation area in the central part of the site, looking southeast.

Photograph 6: View of the Moturoa 2 oil well and the Marae investigation area, looking northwest.

Photograph 7: View of the eastern-most portion of the site, looking east.

Photograph 8: View of completed monitoring well (MW1).

Photograph 9: View of ground gas monitoring point installation.

Photograph 10: Soil encountered during the bach investigation including suspected cement-asbestos fragments.

Photograph 11: Soil and waste material encountered during the Marae investigation (SS21).

Photograph 12: Remnant building foundation encountered during the Marae investigation (SS20).

Photograph 13: View of soil and waste material encountered during the Marae Investigation (SS16).

Photograph 14: View of bench considered to be the approximate location of former oil well Moturoa 3.

Photograph 15: View of test pit during investigation of Moturoa 2 oil well.

Photograph 16: Electrical insulators encountered during investigation of Moturoa 2 oil well.

Photograph 17: Test pit excavated during the Moturoa 3 oil well investigation.

Photograph 18: Large concrete footing, likely associated with a former pumpjack, identified in test pit TP14.

Photograph 19: View of drill core at MW2.

Photograph 20: View of the manhole sampling location (SW03).

Photograph 21: View of the on-site spring sampling location (SW02).

Appendix E: Logs

PATTLE DELAMORE PARTNERS LTD

LOG OF HAND AUGER
Bayly Road Detailed Site Investigation

PIT NO. **SS03**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Bach Investigation Area	
DATE: 6/07/2015	DATE BACKFILLED: 6/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY; brown. Moist, soft; plastic. Includes rootlets/organics [TOPSOIL].		0.0	SS03 0.1	×0.0	
FILL. Silty CLAY; brown. Moist; soft; moderately plastic. Fill includes metal fragments and coarse gravel clasts [DEMOLITION WASTE].		0.2	SS03 0.3	×0.0	
		0.4	SS03 0.5	×0.3	
		0.6			
		0.8			
Fine SAND; black. Moist, loosely packed.		1.0	SS03 1.0	×0.1	
		1.2			
		1.4			
			SS03 1.5	×0.1	
END OF HAND AUGER AT 1.5m					

Notes: 1. All test results are in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Hand Auger
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B100

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF HAND AUGER

Bayly Road Detailed Site Investigation

PIT NO. **SS07**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Bach Investigation Area	
DATE: 7/07/2015	DATE BACKFILLED: 7/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY; brown. Moist, very soft, plastic. Rootlets/organics [TOPSOIL].		0.0	SS07 0.1	× 0.2	
FILL. Sandy SILT; brownish-black. Moist, soft; moderately plastic. Suspected ACM - cement fibre board fragments [DEMOLTION WASTE].			SS07 0.3	× 0.1	
0.6m - orange staining		0.5			
Fine SAND; black. Moist, loosely packed.			SS07 0.6	× 0.0	

END OF HAND AUGER AT 0.7m

Notes: 1. All test results in ppm

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- × PID Reading (ppm)

Method: Hand Auger
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B101

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF HAND AUGER
Bayly Road Detailed Site Investigation

PIT NO. **SS09**

JOB NO: W02050100

CLIENT: Taranaki Regional Council

LOCATION: Bach Investigation Area

DATE: 7/07/2015

DATE BACKFILLED: 7/07/2015

LOGGED BY: AM

SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY with fine-coarse gravel; dark brown. Moist, soft; plastic. Includes rootlets/organics [TOPSOIL].		0.0	SS09 0.1	0.1	
FILL. Silty CLAY with some sand; brown. Moist, firm, moderately plastic; sand, very fine. Fill includes metal fragments [DEMOLITION WASTE].		0.2	SS09 0.3	0.0	
Fine SAND; black. Moist, loosely packed.		0.4	SS09 0.5	0.0	
END OF HAND AUGER AT 0.6m					

Notes: 1. All test results in ppm

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Hand Auger
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B102

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF HAND AUGER
Bayly Road Detailed Site Investigation

PIT NO. **SS10**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 7/07/2015	DATE BACKFILLED: 7/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY with fine-coarse gravel; dark brown. Moist, very soft, plastic. Rootlets, organics. Includes plaster fragment [TOPSOIL].		0.0	SS10 0.1	×0.1	
FILL. Silty CLAY with some sand and trace gravel; brown. Moist, soft, moderately plastic.		0.2	SS10 0.3	×0.2	
		0.4			
		0.6	SS10 0.6	×0.2	

END OF HAND AUGER AT 0.7m

Notes: 1. All test results in ppm

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Hand Auger
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B103

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT

Bayly Road Detailed Site Investigation

PIT NO. **SS13**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 9/07/2015	DATE BACKFILLED: 9/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. Silty CLAY; brown. Moist, very soft, plastic. Organics [TOPSOIL]		0.0	SS13 0.1	× 1.8	
FILL. Fine SAND; black. Moist, loosely packed. Fill includes pieces of terracotta pipe and concrete blocks. [DEMOLITION WASTE].		0.2 0.4	SS13 0.4	× 0.7	
Fine SAND; black. Moist, loosely packed.		0.6 0.8 1.0 1.2 1.4	SS13 0.7	× 1.6	▽
END OF TEST PIT AT 1.5m					

Notes:
1. All test results in ppm.
2. Groundwater encountered at 1.4 m bgl

KEY

- ▽ Groundwater level
- Seepage inflow
- ● Grab sample
- × PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B104

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT

Bayly Road Detailed Site Investigation

PIT NO. **SS15**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 7/07/2015	DATE BACKFILLED: 7/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY; brown. Moist, very soft, plastic. Rootlets/organics. Fill includes glass and gravel [TOPSOIL].		0.0	SS15 0.1	1.7	
Fine SAND with coarse gravel; black, moist, loosely packed. Fill includes brick pieces and suspected ACM - cement fibre board fragment [DEMOLITION WASTE].		0.2	SS15 0.3	1.2	
Fine SAND; black. Moist, loosely packed.		0.4	SS15 0.5	0.2	
END OF TEST PIT AT 0.6M					

Notes: 1. All test results in ppm

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B105

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT

Bayly Road Detailed Site Investigation

PIT NO. **SS17**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 7/07/2015	DATE BACKFILLED: 7/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY with some coarse gravel; brown. Moist, very soft, plastic. Rootlets/organics [TOPSOIL].		0.0	SS17 0.1	1.1	
FILL. Silty CLAY with coarse angular gravel; Brown, moist, firm. Fill includes pieces of asphalt, metal, electrical equipment - fushackle, metal cable [DEMOLITION WASTE].		0.2	SS17 0.3	1.3	
		0.4			
		0.6			
		0.8	SS17 0.8	1.6	
Fine SAND; black. Moist, loosely packed.		1.0			

END OF TEST PIT at 1.1m

Notes: 1. All test results in ppm

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B106

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **SS20a**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 9/07/2015	DATE BACKFILLED: 9/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. Silty CLAY; brown. Moist, very soft, plastic. Rootlets/organics [TOPSOIL].		0.0	SS20a 0.1	×1.3	
FILL. Silty CLAY with some fine - coarse gravel; brown; moist; soft, plastic. Fill includes pieces of concrete blocks, metal pipe, glass fragments [DEMOLITION WASTE].		0.2	SS20a 0.3	×1.4	
Fine SAND; greyish-black. Moist; loosely packed.		0.4	SS20a 0.6	×1.3	
		0.6			
		0.8			
		1.0			

END OF TEST PIT AT 1.1m

Notes: 1. All test results in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B107

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **SS21**

JOB NO: W02050100

CLIENT: Taranaki Regional Council

LOCATION: Marae Development Investigation Area

DATE: 8/07/2015

DATE BACKFILLED: 8/07/2015

LOGGED BY: AM

SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. Sandy CLAY; dark brown. Moist; very soft, plastic. Rootlets/organics [TOPSOIL].		0.0	SS21 0.1	×2.7	
FILL. Silty CLAY with some fine - coarse gravel; dark brown; moist; soft; moderately plastic.		0.2 0.4 0.6 0.8 1.0	SS21 0.5	×2.3	
FILL. Silty SAND; brownish-black; moist; loosely packed. Fill includes brick and asphalt pieces, pipe, plastic, medium - coarse gravels [DEMOLITION MATERIAL and REWORKED NATURAL MATERIAL].		1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8	SS21 1.5	×1.9	
		3.0 3.2 3.4	SS21 3.0	×1.6	
Fine SAND; black. Moist, loosely packed.		3.6 3.8	SS21 3.8	×1.9	▽

END OF TEST PIT AT 4.0m

Notes:
1. All test results in ppm.
2. Groundwater encountered at 4.0 m bgl.

KEY

▽ Groundwater level
Seepage inflow
Grab sample
PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B108

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **SS22**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 8/07/2015	DATE BACKFILLED: 8/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY; brown. Moist, very soft,plastic. Rootlets/organics [TOPSOIL].		0.0	SS22 0.1	×2.9	
FILL. Silty CLAY with some coarse gravels and cobbles; brown. Moist, soft, moderately plastic.		0.2			
		0.4	SS22 0.4	×1.9	
Fine SAND; black. Moist, loosely packed.		0.6	SS22 0.7	×0.9	
END OF TEST PIT AT 0.8m					

Notes: 1. All test results in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B109

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **SS23**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 9/07/2015	DATE BACKFILLED: 9/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. Clayey fine SAND; greyish-brown. Moist, loosely packed. Inlcudes organics [TOPSOIL].		0.0	SS23 0.1	×0.5	
FILL. Silty fine SAND; brownish-black. Moisit, loosely packed. Includes some glass and metal wire [DEMOLITION WASTE].		0.2	SS23 0.3	×2.4	
Fine SAND; black. Moist, loosely packed.		0.4			
		0.6	SS23 0.6	×1.5	
		0.8			
		1.0			
		1.2			
		1.4			

END OF TEST PIT AT 1.5m

Notes: 1. All test results in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B110

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF HAND AUGER

Bayly Road Detailed Site Investigation

PIT NO. **SS40-44**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Waitapu Urupa Investigation Area	
DATE: 17/07/2015	DATE BACKFILLED: 17/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. Silty CLAY; dark brown. Moist, very soft, plastic. Rootlets/organics [TOPSOIL].		0.0	SS40 0.1 - SS43 0.1	0.1, 0.3, 0.2, 0.3	
		0.2	SS44 0.2	0.1	
FILL. Sandy SILT with some clay; brownish orange. Moist, soft; moderately plastic. Sand; very fine.		0.4	SS40 0.5 - SS42 0.5, SS44 0.5	0.1, 0.4, 0.3, 0.2	
		0.6	SS43 0.7	0.2	
		0.8			
		1.0	SS40 1.0 - SS42 1.0, SS44 1.0	0.1, 0.3, 0.1, 0.2	
		1.2			
		1.4	SS41 1.5, SS42 1.5	0.2, 0.2	
END OF HAND AUGER AT 1.5M					

Notes: 1. All test results in ppm

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Hand Auger

--

Filename: W02050100B113

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT

Bayly Road Detailed Site Investigation

PIT NO. **TP1-7**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Moturoa 2 Investigation	
DATE: 8/07/2015	DATE BACKFILLED: 9/07/2015	LOGGED BY: RWL	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
0.0-0.1m: FILL. Silty CLAY; dark brown. Moist - wet; soft; plastic. Unit includes organics/rootlets. [TOPSOIL]		0.0			
0.1-1.5m: FILL. [DEMOLITION WASTES] Silty CLAY with some sand and gravel; brown. Dry - moist; firm; slightly plastic. Unit contains refuse - e.g. metal, wood, concrete, ceramic pipe, plastic, elements, power pylon insulators, fushackles, ceramic bottles, fridges, etc. 0.1m: Medium gravel underlain by geotextile/filter cloth in TP2 0.5m: As above in TP5 0.7m: As above in TP7		0.2 0.4 0.6 0.8	● TP7 0.4 ● TP2 0.5, TP6 0.5 ● TP2 0.6; TP3 0.6 ● TP1 0.7; TP5 0.7	× 0.0 × 0.1, 1.2 × 0.4, 0.4 × 0.9, 0.9	
0.4m: FILL. [DRILL CUTTINGS] **TP2 and 4 only Cemented sediments; light grey speckled with brown, yellow and black. Dry; very stiff; non-plastic.		1.0	● TP6 1.0	× 2.6	
FILL. [DEMOLTION WASTES]		1.2	● TP4 1.2; TP5 1.2	× 0.6, 1.4	
0.7-2.1m: FILL. [REWORKED LOCAL MATERIAL] **not present in TP4, 6 and 7 Gravelly fine SAND; black speckled light brown. Dry - moist, tightly packed. Gravels are fine to coasre, rounded. Unit contains refuse - as above. 1.5m: Presence of asbestos containing material/Super-Six was noted in TP6. 1.9-2.1m: Novacoil sub-surface drain surrounded by coarse drainage gravel		1.4 1.6 1.8	● TP1 1.3 ● TP6 1.5	× 0.4 × 0.4	
0.9-2.1m: Gravelly fine SAND; black. Dry - moist, tightly packed. Gravels are fine to coarse, rounded.		2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4	● TP6 2.0 ● TP7 2.1	× 0.4 × 0.3	
END OF TEST PIT AT 3.5m					

Notes: 1. Log describes lithology of multiple test-pits around Moturoa 2
2. Groundwater seepage identified at approximately 3.5m bgl

KEY
- Groundwater level
- Seepage inflow
- Grab sample
- × PID Reading (ppm)

Method: 5tonne Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B009

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT

Bayly Road Detailed Site Investigation

PIT NO. **TP8**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Moturoa 3 Investigation	
DATE: 8/07/2015	DATE BACKFILLED: 9/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
Fine SAND; black. Moist, loosely packed [DUNE SANDS].		0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8	TP8 0.1 TP8 0.5	0.7 2.8	
Fine SAND; brown. Moist, loosely packed [DUNE SANDS].		2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8	TP8 4.0	2.7	
END OF TEST PIT AT 4m					

Notes: 1. All test results in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B111

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **TP10**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Moturoa 3 Investigation	
DATE: 8/07/2015	DATE BACKFILLED: 9/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
Fine SAND; black. Moist, loosely packed [DUNE SAND MATERIAL].		0.0 0.2 0.4	TP10 0.1	×0.5	
FILL. Silty CLAY, brown. Moist; firm; moderately plastic.		0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4	TP10 0.6 TP10 2.0	×1.3 ×2.7 ×2.6	
Medium SAND, grey. Moist, loosely packed [DUNE SAND]		2.6 2.8 3.0 3.2 3.4 3.6 3.8		×1.2	

END OF TEST PIT AT 4.0m

Notes: 1. All test results in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B112

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT

Bayly Road Detailed Site Investigation

PIT NO. **TP13 - TP15**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Egmont 5 Investigation	
DATE: 28/09/2015	DATE BACKFILLED: 28/09/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
0.0-0.05m: FILL [TOP SOIL]. CLAY; brown. Moist, very soft, plastic. Organics.		0.0		× 3.4	
0.0-2.0m: FILL [REWORKED LOCAL MATERIAL]. Silty fine SAND with minor clay; blackish brown - grey. Dry - moist, loosely packed. Reworked material. Includes refuse - concrete blocks, metal and wood pieces, glass bottles. 0.5m: T-shaped concrete structure, 400mm thick [possible pump jack footing] in TP14.		0.5	● TP13A 0.5	× 2.3 - 4.8	
		1.0	● TP13 1.0	× 3.5 - 5.6	
1.5m: Circular hole feature and small metal pipe in TP13A [possible drainage hole for drill cuttings disposal]. 1.5m: Minor black staining in TP14.		1.5	● TP14	× 7.5 - 20.8	
2.0-3.8m: FILL [REWORKED LOCAL MATERIAL] Silty CLAY; brown - black. Moist, soft; moderately plastic; reworked material. Moderately strong hydrocarbon odour. 2.0m: Orange brown CLAY, no hydrocarbon odour in TP14.		2.0	● TP13 2.0	× 65.8	
		2.5	● TP13A 2.5, TP15 2.5	× 2.3 - 390	▼
		3.0	● TP13 3.0, TP13A 3.0	× 4.5 - 223.1	
3.5m: Dark grey staining, minor hydrocarbon odour in TP14.		3.5	● TP14 3.5, TP15 3.5	× 2.5 - 40.8	
3.8-4.5m: FILL [REWORKED MATERIAL and DRILLING MUD]. Silty CLAY; brown with orangey red patches. Moist, soft, plastic; reworked material. Minor hydrocarbon odour - in TP13. 3.8-4.5m: CLAY and fine SAND; orangey brown; CLAY, plastic; SAND, loosely packed. No hydrocarbon odour in TP14 and TP15		4.0	● TP13 4.0	× 2.8 - 11.2	
4.5-4.8m: FILL. Sandy CLAY; brown, moist, soft, plastic.		4.5		× 4.1	
4.8-5.0m DRILLING MUD. CLAY with some fine sand; grey-brown. Soft, highly plastic. Minor hydrocarbon odour.		5.0	● TP13 5.0	× 10.6	
END OF TEST PIT AT 5.0m					

Notes: 1. End of test pit at 5.0 m bgl
2. All test results in ppm.

KEY
- Groundwater level
- Seepage inflow
- Grab sample
- × PID Reading (ppm)

Method: Hydraulic Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B114

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT

Bayly Road Detailed Site Investigation

PIT NO. **TP16 - TP18**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Waitapu Urupa Investigation Area	
DATE: 28/09/2015	DATE BACKFILLED: 28/09/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	DEPTH (m)	SAMPLE DETAILS	TESTS
0.0-0.05m: FILL [TOP SOIL]. CLAY; orangey brown. Moist, very soft, plastic. Organics.	0.0		× 0.5,1.8
0.0-2.5m: FILL [REWORKED LOCAL MATERIAL]. Clayey fine SAND and SILT; brown - black. Moist. Sand, loosely packed; Silt, non-plastic. Reworked material. 0.0-0.5m Minor refuse - concrete blocks, corrugated iron, metal pipe.		● TP17 0.3	× 0.9
	0.5		× 0.9 - 2.3
	1.0		× 1.3, 3.3
1.5-2.5m: Organic rich - rootlets, branches in TP17 and TP18.	1.5		× 1.7, 2.3
1.8-2.5m: Black staining and strong hydrocarbon odour fades with depth in TP16.	2.0	● TP16 2.0	× 2.5, 89.8
2.5-3.5m: Silty CLAY and DRILLING MUD Silty CLAY; brown. Moist - wet, soft, plastic in TP16. CLAY with minor fine sand; grey. Moist, soft, highly plastic in TP18 [DRILLING MUD].	2.5		× 4.5
		● TP18 2.7	× 2.7
2.5- 3.0m: Peat, black with timber peices, then in-situ coarse black SAND in TP17.	3.0		× 3.1
			× 2.1, 2.0
3.5-4.0m: Clayey medium SAND; greyish green. Moist, loosely packed.	3.5		
	4.0		
END OF TEST PIT AT 4.0m			

Notes:
1. End of test pit at 4.0 m bgl.
2. All test results in ppm.
3. Groundwater encountered at 3.5 m bgl.

KEY
- Groundwater level
- Seepage inflow
- Grab sample
- × PID Reading (ppm)

Method: Hydraulic Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B115

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT

Bayly Road Detailed Site Investigation

PIT NO. **TP20 - TP21**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Waitapu Urupa Investigation Area	
DATE: 28/09/2015	DATE BACKFILLED: 28/09/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
0.0-0.3m: Silty very fine - fine SAND; blackish brown. Moist, loosely packed. Surficial organics.		0.0	TP21 0.2	0.8, 2.4	
0.3-1.0m: Silty fine SAND; brown. Moist, loosely packed. 0.3-1.2m Silty CLAY; orangey brown. Wet, soft, moderately plastic in TP21.		0.5	TP21 0.6	0.9 1.9	
1.0-2.0m: Sandy CLAY; orangey brown. Moist, plastic. Sand; fine.		1.0		1.5	
		1.5	TP20 1.5	2.0, 2.6	▽
2.0-3.0m: Silty fine SAND; black. Moist-wet, loosely packed. Includes angular coarse rock clasts.		2.0	TP20 2.2	2.0, 2.8 5.2	
		2.5			
		3.0		2.9	

END OF TEST PIT AT 3.0m

Notes:
1. End of test pit at 3.0 m bgl.
2. All test results in ppm.
3. Groundwater encountered between approximately 1.8 - 2.8 m bgl.

KEY

- ▽ Groundwater level
- Seepage inflow
- ● Grab sample
- × PID Reading (ppm)

Method: Hydraulic Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B117

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT

Bayly Road Detailed Site Investigation

PIT NO. **TP25**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Waitapu Urupa Investigation Area	
DATE: 28/09/2015	DATE BACKFILLED: 28/09/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
0.0-1.5m: Silty fine SAND; black. Moist, loosely packed. Surficial organics.		0.0		× 2.1	
		0.5	● TP25 0.5	× 2.6	
		1.0			
		1.5			
1.5-2.5m: Sandy CLAY with some silt; orangey brown. Moist, soft, moderately plastic.				× 2.8	
		2.0			
2.5m: Small timber inclusions				× 2.7	▽
		2.5			
END OF TEST PIT AT 2.5m					

Notes:
1. End of test pit at 3.0 m bgl.
2. All test results in ppm.
3. Groundwater encountered at approximately 2.4 m bgl.

KEY
- ▽ Groundwater level
- Seepage inflow
- ● Grab sample
- × PID Reading (ppm)

Method: Hydraulic Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B117

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF BOREHOLE
Bayly Road Detailed Site Investigation

HOLE NO. **MW1**
JOB NO: W02050100

CLIENT: Taranaki Regional Council
LOCATION: Down-gradient of Egmont 5

START DATE: 2/07/2015
END DATE: 2/07/2015
COORDINATES: 1690101.80 5675921.77
TOTAL DEPTH: 5.5 m
LOGGED BY: RWL
SHEET 1 OF 1

GROUND LEVEL: --
TOP OF CASING: 4.42m AMSL

INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)	DEPTH (m)	RL (m)	SAMPLES	TESTS
FILL	FILL. Silty CLAY; dark brown. Moist - wet; soft; plastic. Unit includes organics/rootlets. [TOPSOIL]	0.0			
FILL	FILL. Silty fine SAND with some clay; brown. Dry; loosely packed. Gravel is fine to coarse, rounded and angular. Unit includes refuse - wood.		4	MW1 0.5	0.0
DUNE SANDS & ASH DEPOSITS	Fine SAND; black. Dry; loosely packed. 0.9m colour change to light brown 1.0m colour change to dark brown	1.0		MW1 1.0	0.0
DUNE SANDS & ASH DEPOSITS	1.2 colour change to black		3	MW1 1.5	3.0
DUNE SANDS & ASH DEPOSITS	2.0m unit is wet-saturated	2.0		MW1 2.0	2.6
DUNE SANDS & ASH DEPOSITS			2	MW1 2.5	2.5
DUNE SANDS & ASH DEPOSITS	2.9m colour change to brown/orange 2.95m colour change to grey	3.0		MW1 3.0	2.1
DUNE SANDS & ASH DEPOSITS	Sandy fine GRAVEL; light grey/orange. Saturated; tightly packed. Sand is fine.		1	MW1 3.5	1.7
DUNE SANDS & ASH DEPOSITS	Fine SAND; light grey/blue. Saturated; tightly packed.				
DUNE SANDS & ASH DEPOSITS	4.0m colour change to black	4.0		MW1 4.0	2.5
DUNE SANDS & ASH DEPOSITS			0	MW1 4.5	2.7
DUNE SANDS & ASH DEPOSITS		5.0		MW1 5.0	1.8
DUNE SANDS & ASH DEPOSITS	Silty CLAY with some sand; grey/blue. Saturated; firm; non-plastic.		-1	MW1 5.5	0.6

WATER LEVEL GAIN / LOSS: 2.335m AMSL

INSTALLATION: Concrete; Flush Toby Box; Bentonite; Casing; Sand; Industrial Minerals (White Sand K1); uPVC Strata screen

END OF BOREHOLE AT 5.5m

Notes:
1. Hand-cleared to 1.5m; 200mm diameter.
2. Tests are PID measurements in ppm
3. Coordindates are NZTM; elevation is above mean sea-level (AMSL)
4. Log scale 0.30

KEY
- Groundwater Level
- Water Gain
- Water Loss
- Grab sample
- PID Reading (ppm)

Drilled By: DCN Drilling
Diameter: 150 mm
Method: Sonic
Datum: MSL
Filename: W02050100B001

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF BOREHOLE
Bayly Road Detailed Site Investigation

HOLE NO. **MW2**

JOB NO: W02050100

CLIENT: Taranaki Regional Council

LOCATION: Down-gradient of Wetland

START DATE: 2/07/2015
END DATE: 2/07/2015

COORDINATES: 1690234.35 5675937.06

TOTAL DEPTH: 4.0 m

LOGGED BY: RWL

SHEET 1 OF 1

GROUND LEVEL:
TOP OF CASING: 4.15 AMSL

INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)	DEPTH (m)	RL (m)	SAMPLES	TESTS
FILL	FILL. Silty CLAY; dark brown. Moist - wet; soft; plastic. Unit includes organics/rootlets. [TOPSOIL]	0.0	4		
	FILL. Silty fine SAND with some gravel; orange/brown. Dry; tightly packed. Gravel is fine to coarse, rounded.			MW2 0.5	0.5
DUNE SANDS & ASH DEPOSITS	Fine SAND; black speckled grey. Dry-moist; loosely packed.	1.0	3	MW2 1.0	0.8
	1.3m colour change to black, unit is wet-saturated			MW2 1.5	0.8
		2.0	2		0.1
					0.7
		3.0	1		0.3
	Gravelly fine SAND; black. Saturated; tightly packed. Gravel is fine - coarse, rounded.			MW2 3.5	1.3
	Silty CLAY with some sand; grey/green streaked orange. Saturated; firm-stiff; non-plastic.				
	Gravelly fine SAND; black. (as above)	4.0			1.0

WATER LEVEL GAIN / LOSS: 2.86m AMSL

INSTALLATION: Concrete; Flush Toby Box; Casing; Bentonite; Sand; Industrial Minerals (White Sand K1); uPVC Strata screen

END OF BOREHOLE AT 4.0m

Notes:
1. Hand-cleared to 1.5m; 200mm diameter.
2. Tests are PID measurements in ppm
3. Coordindates are NZTM; elevation is above mean sea-level (AMSL)
4. Log scale 0.23

KEY
- Groundwater Level
- Water Gain
- Water Loss
- Grab sample
- PID Reading (ppm)

Drilled By: DCN Drilling
Diameter: 150 mm
Method: Sonic
Datum: MSL

Filename: W02050100B002

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF BOREHOLE
Bayly Road Detailed Site Investigation

HOLE NO. **MW3**
JOB NO: W02050100

CLIENT: Taranaki Regional Council
LOCATION: Down-gradient of Moturoa 2

START DATE: 6/07/2015
END DATE: 6/07/2015
COORDINATES: 1690361.75 5675955.55
TOTAL DEPTH: 6.5 m
LOGGED BY: RWL
SHEET 1 OF 1

GROUND LEVEL: --
TOP OF CASING: 8.14m AMSL

INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)	DEPTH (m)	RL (m)	SAMPLES	TESTS
FILL	FILL. Silty CLAY; dark brown. Moist - wet; soft; plastic. Unit includes organics/rootlets. [TOPSOIL]	0.0	8	MW3 0.5	0.0
	FILL. Silty CLAY with some gravel and boulder; dark brown. Dry; firm; plastic. Gravel is fine to coarse, angular. Unit includes refuse - steel pieces	1.0	7	MW3 1.0	0.0
	FILL. Gravelly fine SAND; black. Dry - moist; tightly packed. Gravel is fine - coarse, rounded. [REWORKED LOCAL MATERIAL]			MW3 1.5	0.1
	FILL. Clayey fine SAND with minor boulder and cobble; light grey/brown. Dry - moist; tightly packed.	2.0	6		0.0
DUNE SANDS & ASH DEPOSITS	Gravelly fine SAND; black. Moist; tightly packed. Gravel is fine - coarse, rounded.				0.1
	3.5m colour changes to black speckled brown, unit is wet-saturated	3.0	5	MW3 3.5	1.1
		4.0	4	MW3 4.0	1.0
				MW3 4.5	1.2
	Gravelly SAND with minor clay; black streaked orange. Saturated; tightly packed. Gravel is fine - coarse, rounded.	5.0	3		1.6
	Gravelly fine SAND; black. Saturated; tightly packed. Gravel is fine - coarse, rounded.	6.0	2		0.4
					3.1
					1.5
					1.6

WATER LEVEL GAIN / LOSS: 4.385m AMSL

INSTALLATION: Concrete; Flush Toby Box; Bentonite; Casing; Sand; Industrial Minerals (White Sand K1); uPVC Strata screen; Backfill (cuttings)

END OF BOREHOLE AT 6.5m

Notes:
1. Hand-cleared to 1.5m; 200mm diameter.
2. Tests are PID measurements in ppm
3. Coordindates are NZTM; elevation is above mean sea-level (AMSL)
4. Log scale 0.35

KEY
- Groundwater Level
- Water Gain
- Water Loss
- Grab sample
- PID Reading (ppm)

Drilled By: DCN Drilling
Diameter: 150 mm
Method: Sonic
Datum: MSL
Filename: W02050100B003

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF BOREHOLE
Bayly Road Detailed Site Investigation

HOLE NO. **MW4**

JOB NO: W02050100

CLIENT: Taranaki Regional Council

LOCATION: Up-gradient of Moturoa 2

START DATE: 3/07/2015
END DATE: 6/07/2015

COORDINATES: 1690368.99 5675922.38

TOTAL DEPTH: 7.0 m

LOGGED BY: RWL

SHEET 1 OF 1

GROUND LEVEL: --
TOP OF CASING: 8.62m AMSL

INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)
F	FILL. Silty CLAY; dark brown. Moist - wet; soft; plastic. Unit includes organics/rootlets. [TOPSOIL]
DUNE SAND DEPOSITS	Gravelly fine SAND; black. Moist; tightly packed. Gravel is fine - coarse, rounded.
	3.5m unit is wet-saturated
	END OF BOREHOLE AT 7.0m

GRAPHIC LOG

DEPTH (m): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0

RL (m): 8, 7, 6, 5, 4, 3, 2

SAMPLES: MW4 0.5; MW4 1.0; MW4 1.5; MW4 3.0; MW4 3.5; MW4 4.0

TESTS: 0.1, 0.4, 1.2, 0.6, 0.5, 0.6, 0.3, 0.9, 0.4, 0.1, 1.2, 0.7

WATER LEVEL GAIN / LOSS: 4.740m AMSL

INSTALLATION: Concrete; Flush Toby Box; Bentonite; Casing; Sand; Industrial Minerals (White Sand K1); uPVC Strata screen; Backfill (cuttings)

Notes:
1. Hand-cleared to 1.5m; 200mm diameter.
2. Tests are PID measurements in ppm
3. Coordindates are NZTM; elevation is above mean sea-level (AMSL)
4. Log scale 0.38

KEY
- Groundwater Level
- Water Gain
- Water Loss
- Grab sample
- PID Reading (ppm)

Drilled By: DCN Drilling
Diameter: 150 mm
Method: Sonic
Datum: MSL

Filename: W02050100B004

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF BOREHOLE
Bayly Road Detailed Site Investigation

HOLE NO. **MW5**
JOB NO: W02050100

CLIENT: Taranaki Regional Council
LOCATION: Up-gradient of Wetland

START DATE: 7/07/2015
END DATE: 7/07/2015
COORDINATES: 1690249.43 5675859.60
TOTAL DEPTH: 5.0 m
LOGGED BY: RWL
SHEET 1 OF 1

GROUND LEVEL: --
TOP OF CASING: 9.2m AMSL

INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)	DEPTH (m)	RL (m)	SAMPLES	TESTS
FILL	FILL. Silty CLAY; dark brown/black. Saturated; very soft; plastic. Unit includes organics/rootlets. [SWAMP MATERIAL]	0.0	9	MW5 0.5	1.0
	FILL. Silty CLAY; brown/grey. Saturated; very soft; plastic.	1.0	8	MW5 1.0	1.0
				MW5 1.5	0.0
		2.0	7	MW5 2.0	0.0
SWAMP & ASH DEPOSITS	Silty CLAY with some sand; brown. Saturated; firm; plastic.				0.1
		3.0	6		0.3
	Silty CLAY; black. Saturated; soft; plastic. Unit includes organics/rootlets and wood/peat inclusions.				0.2
	Silty CLAY with some sand; grey/brown. Saturated; soft; plastic.	4.0	5		0.6
	Silty fine SAND with some clay; light grey streaked with yellow. Saturated; tighly packed.				1.1
		5.0			0.4

WATER LEVEL GAIN / LOSS: 8.71 m AMSL

INSTALLATION: Concrete; Bentonite; Casing; Sand; Industrial Minerals (White Sand K1); uPVC Strata screen

END OF BOREHOLE AT 5.0m

Notes:
1. Hand-cleared to 1.5m; 200mm diameter.
2. Tests are PID measurements in ppm
3. Coordindates are NZTM; elevation is above mean sea-level (AMSL)
4. Log scale 0.30

KEY
- Groundwater Level
- Water Gain
- Water Loss
- Grab sample
- PID Reading (ppm)

Drilled By: DCN Drilling
Diameter: 150 mm
Method: Sonic
Datum: MSL
Filename: W02050100B005

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF BOREHOLE
Bayly Road Detailed Site Investigation

HOLE NO. **MW6**

JOB NO: W02050100

CLIENT: Taranaki Regional Council

LOCATION: Up-gradient of Egmont 5

START DATE: 7/07/2015
END DATE: 7/07/2015

COORDINATES: 1690130.63
5675829.16

TOTAL DEPTH: 5.0 m

LOGGED BY: RWL

SHEET 1 OF 1

GROUND LEVEL: --
TOP OF CASING: 10.71m AMSL

INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)	DEPTH (m)	SAMPLES	TESTS
FILL	FILL. Silty CLAY; dark brown. Moist - wet; soft; non-plastic. Unit includes organics/rootlets. [TOPSOIL]	0.0		
FILL	Fine SAND; black speckled with brown. Dry; loosely packed [REWORKED LOCAL]		MW6 0.5	0.9
		1.0	MW6 1.0	0.4
			MW6 1.5	0.1
DUNE SAND, ASH & STREAM DEPOSITS	Fine SAND; black. Moist; tightly packed.	2.0		0.0
	Silty CLAY with some sand; brown. Saturated; firm; plastic.			0.8
		3.0	MW6 3.0	0.1
			MW6 3.5	0.9
		4.0	MW6 4.0	1.0
	4.4m colour change to orange/light brown 4.7m colour change to light grey/brown			2.2
	Silty CLAY with some sand; grey/brown streaked with yellow. Saturated; firm; non-plastic.	5.0		1.3

RL (m): 10, 9, 8, 7, 6

WATER LEVEL GAIN / LOSS: 8.455m AMSL

INSTALLATION: Concrete; Flush Toby Box; Casing; Bentonite; Sand; Industrial Minerals (White Sand K1); uPVC Strata screen

END OF BOREHOLE AT 5.0m

Notes:
1. Hand-cleared to 1.5m; 200mm diameter.
2. Tests are PID measurements in ppm
3. Coordinates are NZTM; elevation is above mean sea-level (AMSL)
4. Log scale 0.34

KEY
- Groundwater Level
- Water Gain
- Water Loss
- Grab sample
- PID Reading (ppm)

Drilled By: DCN Drilling
Diameter: 150 mm
Method: Sonic
Datum: MSL

Filename: W02050100B006

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF BOREHOLE
Bayly Road Detailed Site Investigation

HOLE NO. **MW7**

JOB NO: W02050100

CLIENT: Taranaki Regional Council

LOCATION: Up-gradient of Moturoa 3

START DATE: 7/07/2015
END DATE: 8/07/2015

COORDINATES: 1690636.53 5675998.87

TOTAL DEPTH: 12.0 m

LOGGED BY: RWL

SHEET 1 OF 1

GROUND LEVEL: --
TOP OF CASING: 16.02m AMSL

INTERPRE-TATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)	GRAPHIC LOG	DEPTH (m)	RL (m)	SAMPLES	TESTS	WATER LEVEL GAIN / LOSS	INSTALLATION
F	FILL. Silty CLAY; dark brown. Moist - wet; soft; non-plastic. Unit includes organics/rootlets. [TOPSOIL]		0.0	16	MW7 0.5	0.0		Concrete; Flush Toby Box; Bentonite
DUNE SANDS & ASH DEPOSITS	Fine SAND; brown. Dry; tightly packed 0.6m colour change to black speckled brown 1.0m colour change to dark brown 2.4m colour change to black		1.0	15	MW7 1.0	0.0		
					MW7 1.5	2.2		
			2.0	14		0.2		
						0.7		
			3.0	13		0.0		Backfill (cuttings); Casing
						0.2		
			4.0	12		0.2		
						0.2		
			5.0	11		0.1		
					MW7 5.5	0.2		Bentonite
	Silty fine SAND; orange/brown mottled black. Moist - wet; tightly packed.		6.0	10	MW7 6.0	0.2		Sand
	Fine SAND; black speckled light brown and white. Dry-moist; tightly packed.				MW7 6.5	0.3		
			7.0	9	MW7 7.0	0.0		
					MW7 7.5	1.0		
			8.0	8		0.0		
						0.0		
	Silty CLAY; orange/brown. Wet; stiff; non-plastic.		9.0	7		0.3		Industrial Minerals (White Sand K1); uPVC Strata screen
	Fine SAND; black. Moist; tightly packed.					0.1		
	Silty CLAY; orange/brown. Wet; stiff; non-plastic.		10.0	6		0.0		
	Fine SAND; black. Moist; tightly packed.					0.3		
	Silty CLAY; orange/brown. Wet; stiff; non-plastic.						5.315m AMSL	
	Fine SAND; black speckled white. Saturated; tightly packed.		11.0	5		0.1		
						0.1		
			12.0			0.6		

END OF BOREHOLE AT 12.0m

Notes:
1. Hand-cleared to 1.5m; 200mm diameter.
2. Tests are PID measurements in ppm
3. Coordinates are NZTM; elevation is above mean sea-level (AMSL)
4. Log scale 0.65

KEY
- Groundwater Level
- Water Gain
- Water Loss
- Grab sample
- PID Reading (ppm)

Drilled By: DCN Drilling
Diameter: 150 mm
Method: Sonic
Datum: AMSL

Filename: W02050100B007

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF BOREHOLE
Bayly Road Detailed Site Investigation

HOLE NO. **MW8**

JOB NO: W02050100

CLIENT: Taranaki Regional Council

LOCATION: Down-gradient of Moturoa 3

START DATE: 9/07/2015
END DATE: 9/07/2015

COORDINATES: 1690661.64
5676045.80

TOTAL DEPTH: 3.0 m

LOGGED BY: RWL

SHEET 1 OF 1

GROUND LEVEL: --
TOP OF CASING: 3.33m AMSL

INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)	GRAPHIC LOG	DEPTH (m)	RL (m)	SAMPLES	TESTS	WATER LEVEL GAIN / LOSS	INSTALLATION
FILL	FILL. Silty CLAY; dark brown. Moist - wet; soft; non-plastic. Unit includes organics/rootlets. [TOPSOIL]		0.0					Concrete, Flush Toby Box, Casing, Bentonite, Sand
FILL	FILL. Silty fine SAND with some gravel; brown. Dry; tightly packed. Gravel is fine - coarse, angular [RECLAMATION FILL] 0.6m unit is wet			3	MW8 0.5	0.0	2.890m AMSL	
			1.0		MW8 1.0	0.0		
DUNE SANDS & ASH DEPOSITS	Fine SAND; black speckled light brown. Saturated; tightly packed.			2	MW8 1.5	0.4		Industrial Minerals (White Sand K1)
			2.0			0.2		uPVC Strata screen
	Silty CLAY with some sand; light grey/brown. Saturated; very stiff; non-plastic.			1		0.2		
			3.0			0.1		

END OF BOREHOLE AT 3.0m

Notes:
1. Hand-cleared to 1.5m; 200mm diameter.
2. Tests are PID measurements in ppm
3. Coordinates are NZTM; elevation is above mean sea-level (AMSL)
4. Log scale 0.20

KEY
- Groundwater Level
- Water Gain
- Water Loss
- Grab sample
- PID Reading (ppm)

Drilled By: DCN Drilling
Diameter: 150 mm
Method: Sonic
Datum: MSL

Filename: W02050100B008

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

Appendix F: Geophysical Survey Report

AUGUST 2015

Geophysical Investigation

Bayly Road Marae,

New Plymouth

Report prepared for *Pattle Delamore Partners*

REPORT

Southern Geophysical Ltd

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Table of Contents

Introduction:

Southern Geophysical Ltd (SGL) conducted geophysical investigations at a proposed marae on Bayly Road, New Plymouth, from 30 June to 2 July, 2015. SGL utilised Ground Penetrating Radar (GPR) and magnetometry to image the near surface over five areas.

The five areas were known to include a urupa (cemetery), a site that previously had baches built on it (but are now demolished) and petroleum wells (now disused). For ease of reference, we named these sites:

- Urupa - Cemetery West and Cemetery East
- Demolished building area - Bach Area
- Petroleum well sites - Egmont-5 and Moturoa-3

Objectives:

The objectives of the geophysical surveys were to:

- In the Urupa site – determine the extent of burials.
- In the demolished building area – identify areas where data indicates subsurface anomalies, in order to target areas for further (future) invasive testing.
- In the petroleum well sites – locate buried well sites.

Methodology:

GPR

GPR is a non-invasive electromagnetic method of imaging buried objects up to 10 metres below the ground surface. It uses pulses of radio energy in frequencies varying from 100 MHz to over 1600 MHz that penetrate the ground and reflect back up depending on the electrical properties of the subsurface. In general, higher frequencies produce a sharper image (higher resolution) while lower frequencies penetrate deeper. The best results occur in soils that are dry and free of clay minerals. Materials that conduct electricity such as metal, salt water, and clays reduce the penetration depth by turning the energy into dissipated heat, effectively absorbing the GPR signal.

GPR data is collected by pulling the radar antenna across the ground in a grid pattern of parallel lines. SGL used a GSSI SIR-20 GPR system connected to a 200 MHz antenna. The start and end points of each line are mapped. An odometer connected to the

antenna provides distance information along each profile. The data is transferred to a PC in the office for processing using the Reflexw software package.

Images of the subsurface, called radargrams, are usually displayed as 2-Dimensional representations of signal strength. The x-axis is usually distance and the y-axis is the time the signal takes to reach the antenna. Time is proportional to depth of penetration. Signal strength is shown as a shade of grey. Reflections occur when there is a contrast in electrical properties between materials. Smaller objects such as boulders or pipelines that cross a GPR line at an angle will produce a hyperbola shaped reflection as the GPR signal diffracts off the edge of the object. The reflection from a surface below ground will appear as a line in the GPR record. Mapping the spatial locations of points allows linear features such as utilities to be identified.

In the urupa site (Cemetery-East and Cemetery-West), the aim was to identify the extent of the burials. Depending on the age of burial, GPR has the ability to detect reflections and diffractions from structures associated with the burial such as concrete slabs, grave markers, and coffins, and sometimes from human remains. Older sites tend to have degraded signals as the contrast in electrical properties lessens.

In the demolished building site (Bach Area), the objective of the investigation was to identify areas with subsurface anomalies. GPR can detect remnant structures associated with linear concrete slab foundations, piles, excavations and possibly areas of concentrated waste materials from the demolition process.

The areas of investigation and GPR lines are shown in Figure 1. The GPR lines start and stop positions were collected using a GeoXH differential GPS system (± 15cm) and photographs were taken of key survey locations.

Magnetometer

Magnetometers measure magnetic fields. Buried ferric metals, such as well casing, alter the Earth's magnetic field and this alteration can be picked up by a magnetometer survey. Earth's magnetic poles are not at the same location as the rotational poles. The difference is known as magnetic declination. The angle at which the magnetic field lines enter the earth (inclination) also vary throughout the world. The angle is steepest at the magnetic poles and almost parallel to the surface of the earth near the equator. At New Plymouth, the magnetic declination is approximately +20.78º (toward the east) and magnetic inclination is 64.78º from horizontal. The magnetometer survey around well

sites Egmont-5 and Moturoa-3 was undertaken using a standard proton magnetometer (Geometrics G-856AX) that measures the total magnetic field.

Due to the relatively small areas undertaken, magnetic drift and diurnal change were not measured using a base station. Geomagnetic conditions were monitored using http://www.swpc.noaa.gov/products/solar-and-geophysical-event-reports. Geomagnetic storm conditions at the time were calm. Before the survey, functional testing of the magnetometers was undertaken using a Geo Instruments proton magnetometer tester PMT-2, set at 66,666 nT and 50,000 nT.

The magnetometer was run in gradiometer mode, in which two magnetic sensors are separated vertically by one metre. The operator removed all metal objects and the operators position relative to the sensors was kept as constant as possible to reduce the effects of positional changes between the magnetometer and operator.

A single set of top and bottom magnetometer readings was collected at each location. The location of each set of readings was marked and the position was accurately surveyed (±15cm) using a GeoXH differential GPS system after the magnetometer operator had moved at least six metres away. All magnetometer readings were digitally recorded in the magnetometers internal memory. The screen values were also manually checked for data quality.

The magnetic data was processed using the following processing steps:

1) The raw magnetometer readings were downloaded from the magnetometer using Magmap 2000.
2) The GPS position data for each set of gradiometer readings was recorded.
3) The magnetometer readings and positions (nT, Easting, and Northing) were gridded and contoured using the Surfer software package.

Electromagnetic surveys utilising the EM-61 was specified in the original agreement as one of the survey methods used to locate the wellheads. However, this method was deemed inadequate to locate the wellhead due to the expected depth of the top of the wellhead was approximately 3.5m (personal communication).

GPS

All survey positions were recorded using a GeoExplorer 2008 Trimble GPS system with a Zephyr antenna. The GPS positions were differentially corrected using LINZ base station data from German Hill No. 2, New Plymouth, Golden Bay, Hamilton, Mahoenui and

Wanganui. The majority of the sites had good GPS coverage. The GPS system was calibrated using a nearby order 3 LINZ geodetic marker, and was accurate to < 6 cm. The GPS points were output using the New Zealand Geodetic Datum (NZGD) 2000, in the New Zealand Transverse Mercator (NZTM) 2000 zone. Each site had significant topographic variance, and the seismic refraction and MASW 2D profiles have been plotted with their elevation in Mean Sea Level (MSL), using a defined (EGM96) geoid model.

Legend

Survey Areas

142 GPR line with direction and radargram file number

SCALE (m)

0 10 20 30 40 50

N

TITLE-	**Areas of Investigation**	NOTES-	Coordinates NZ2000 TM Grid. Aerial photo sourced from LINZ, Crown Copyright ©	Figure 1	**Southern Geophysical Ltd**
LOCATION-	**Bayly Road, New Plymouth**			A3	www.southerngeophysical.com

Results:

A total of 143 GPR lines were surveyed. The data collected was generally of high quality, with a depth of penetration averaging approximately 2-4m.

The GPR surveys were structured to provide data that could identify buried linear features with high amplitude reflections or filled-in excavations, indicative of remnant foundations, construction materials or burial sites. Several areas contained anomalous areas that are detailed below.

The magnetometer surveys were designed to provide data that could identify a buried wellhead to a depth of greater than 3m. The Egmont-5 area produced an anomalous response indicative of a wellhead as detailed below while the Moturoa-3 area did not contain any anomalies indicative of a buried well.

Bach Area

The Bach Area covers the majority of the site. Fifty-one GPR lines were surveyed in this area. The data indicates many distinct anomalies suggesting subsurface disturbance related to excavation or remnant waste material from the demolition process. Two possible filled in channels were also identified (Figure 2). Eleven test pits were dug to investigate this area and the results are shown in Figures A4 to A6. Based on the test pit results, most fill is limited to the upper metre. The exception was at test pit SS21, where fill was found to a depth of 3.5m.

Moturoa-3 Area

The Moturoa-3 Area is located at the eastern portion of the site. Two GPR lines were surveyed in this area for a total of 48 metres (Figure 3). The GPR data reveal an anomalous zone on the eastern portion of the survey area. The magnetometer survey did not indicate the presence of buried metal indicative of a well within the area. Two test pits were dug in this area (TP08, TP10) to a depth of 4 metres. See Figure A2 for interpreted radargrams.

Egmont-5 Area

The Egmont-5 Area is located at the south-western portion of the site and within the Cemetery-West Area. Thirty-one GPR lines were surveyed in this area (Figure 4) in addition to thirty lines from the southern end of the Cemetery West area. While the GPR scans provided no valuable data, the magnetometer produced a large anomalous zone indicative of a buried wellhead, which was confirmed by communication with onsite personnel.

Cemetery West

The Cemetery West Area is located on the western portion of the site between Bayly Road and the marked gravesites. Thirty-one GPR lines were surveyed in the northern portion of the area (Figure 5) for a total of 1245 metres. Another thirty-one lines were surveyed in the southern portion that also contains the Egmont-5 area. The GPR survey identified several anomalous areas. A buried linear structure near the northern portion of the site is of particular interest and may warrant further archaeological or invasive testing (See Figure A1 for GPR line NP033). A second linear structure is evident at the southern end of the site, which may be a buried pipe. A historical photo shows Egmont-5 being drilled, with an area that appears to be fill just north of it (See Fig B3). The middle portion of the area contains many point diffractions that indicate a complex subsurface and is unlikely to contain any burials.

Cemetery East

The Cemetery East Area is located on the western portion of the site east of the existing gravesites. Twenty-eight GPR lines were surveyed in this area for a total of 766 m (Figure 6). The GPR data indicate several features at this site:

- A thick (0.5-2m) sequence of fill, most likely clean topsoil, overlies the entire site.
- A filled in slope at the northern part of the site.
- Rock approximately 1.5m below the surface at the western centre of the site.
- An in-filled gully at the southern portion of the site.
- Possible burial features below the fill at the north-western portion of the site.
- A relatively undisturbed area in the south-eastern portion of the site.

Anomalies within the in-filled gully are chaotic and mostly at the base. They may represent rock or other fill materials, but are unlikely to be a burial site. The relatively undisturbed area in the south-east contains some anomalies, but the radar facies indicates a fluvial marsh sedimentary sequence. Anomalies within this area are most likely to be tree stumps and branches.

Anomalies indicative of burials were noted in the north-west part of the site. However, since the anomalies all occur beneath a layer of fill that was laid down at a later time, it is not possible to say conclusively.

Legend

- Area of deeper fill
- Fill containing a high % of demolition material. Strong chaotic GPR facies.
- 142 — GPR line with direction and radargram file number
- Approximate test pit location
- Approximate hand auger location

SCALE (m)
0 10 20 30 40 50

N

TITLE- **GPR Investigation**

LOCATION- **Bach Area**
Bayly Road, New Plymouth

NOTES-
Coordinates NZ2000 TM Grid.
Aerial photo sourced from LINZ, Crown Copyright ©
Test pit data and locations by PDP
Thin layer of fill over entire site

Figure 2
A3

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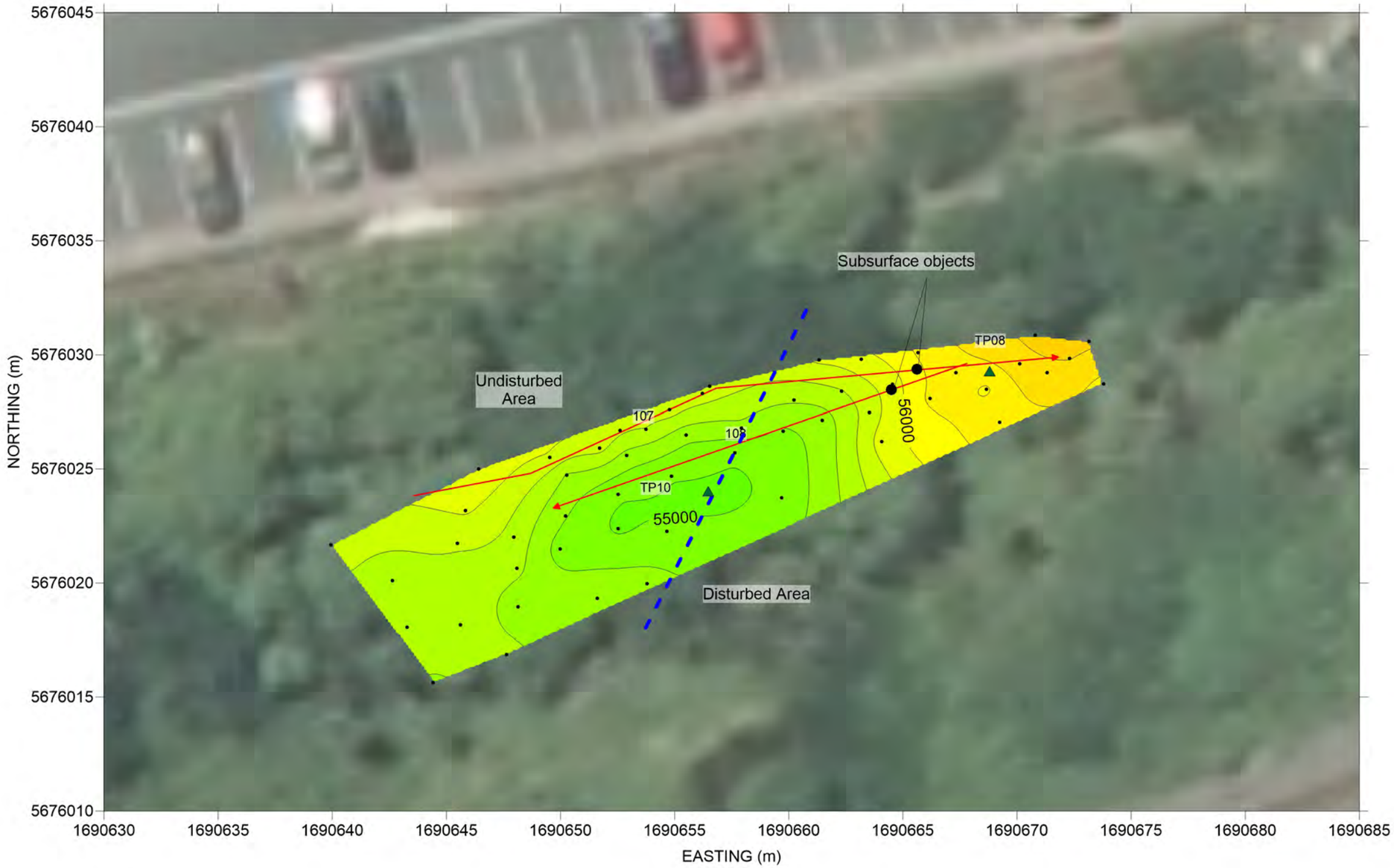


Total Magnetic Field (nT)

60000
58000
56000
54000
52000
50000

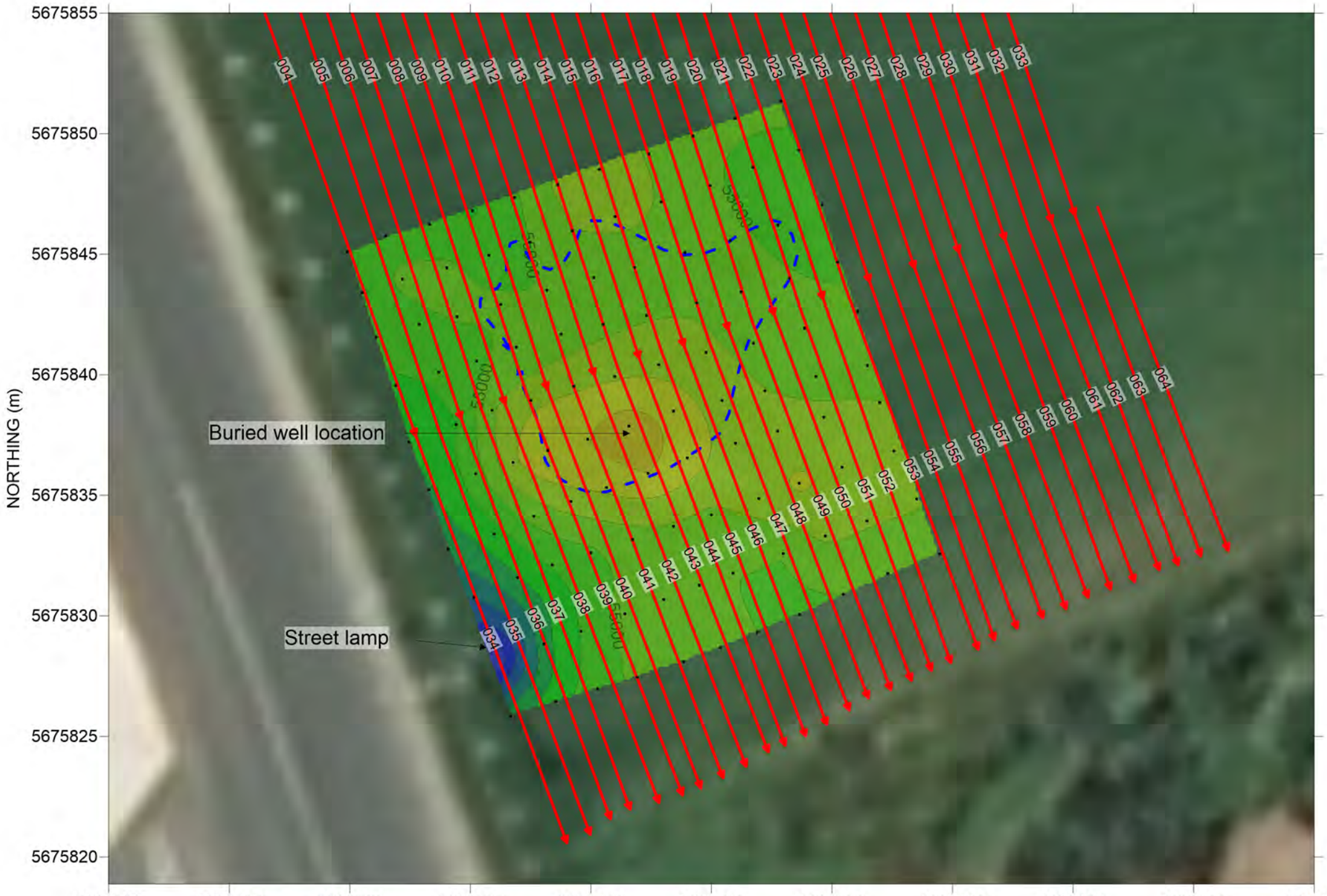
Legend

- Magnetometer data point
- 107 — GPR line with direction and radargram file number
- Magnetometer survey area
- Test pit location

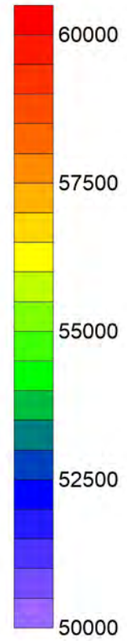
SCALE (m)
0 2 4 6 8 10

N

TITLE- **Magnetic, GPR Investigations**	NOTES- Coordinates NZ2000 TM Grid. Aerial photo sourced from LINZ, Crown Copyright ©	Figure 3	Southern Geophysical Ltd www.southerngeophysical.com
LOCATION- **Moturoa-3 Bayly Road, New Plymouth**		A3	



Total Magnetic Field (nT)



Legend

- Magnetometer data point
- Disturbed grass area
- 042 — GPR line with direction and radargram file number
- Magnetometer survey area

SCALE (m)

0 2 4 6 8 10

N

TITLE-	**Magnetic, GPR Investigations**
LOCATION-	**Egmont-5** **Bayly Road, New Plymouth**

NOTES- Coordinates NZ2000 TM Grid.

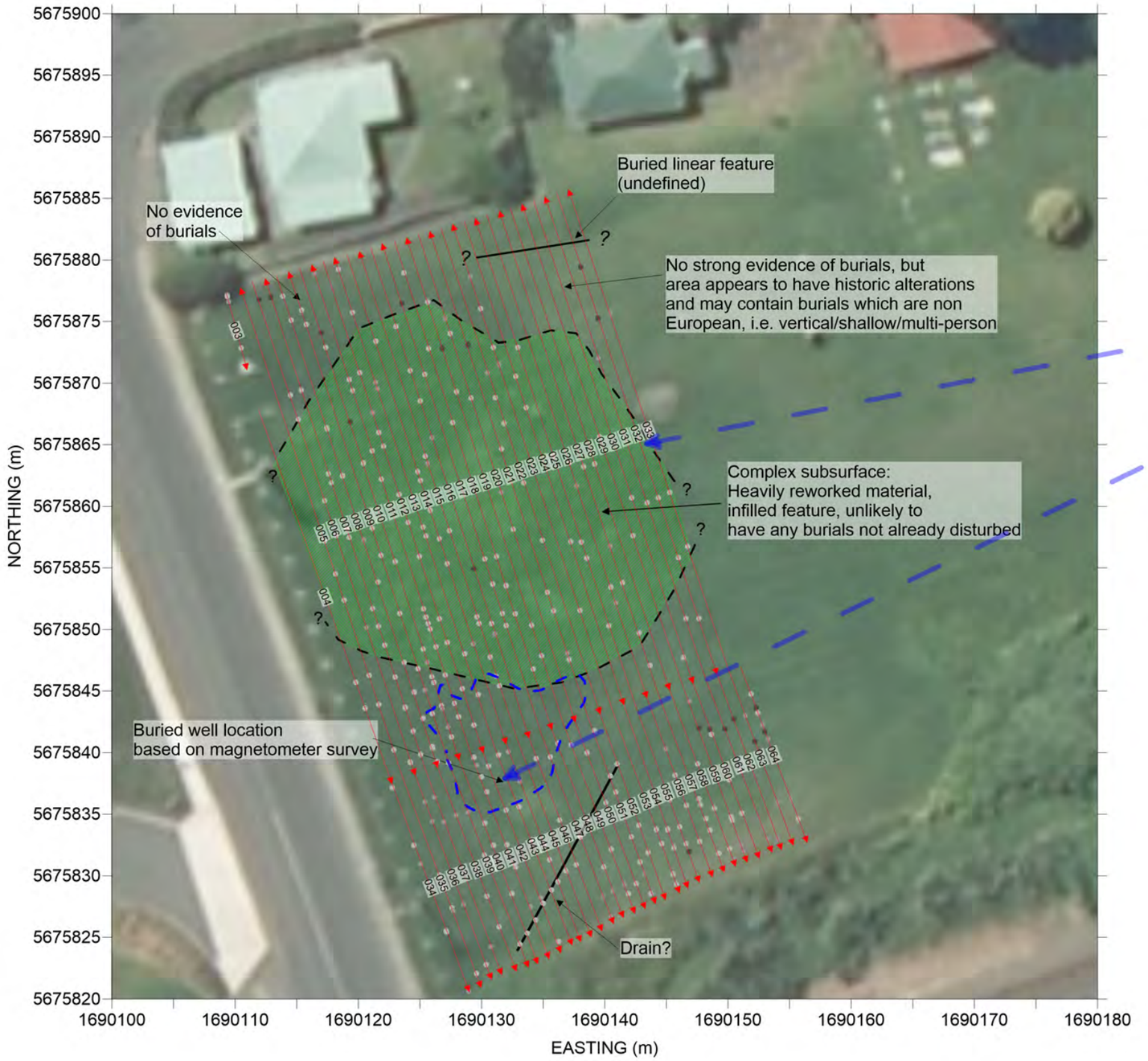
Aerial photo sourced from LINZ, Crown Copyright ©

Figure 4

A3

Southern Geophysical Ltd

www.southerngeophysical.com



Historic photo of site showing drilling of Egmont-5.
Apparent angle to south-east

SCALE (m)
0 2 4 6 8 10

N

Legend

- Point diffraction from GPR data
- Mapped well area based on ground surface
- Complex subsurface interpreted as fill
- 022 — GPR line with direction and radargram file number

TITLE- **GPR Investigation**	NOTES- Coordinates NZ2000 TM Grid. Aerial photo sourced from LINZ, Crown Copyright ©	Figure 5	Southern Geophysical Ltd
LOCATION- **Cemetery-West Bayly Road, New Plymouth**		A3	www.southerngeophysical.com

Legend

- Point diffraction from GPR data
- 122 — GPR line with direction and radargram file number
- Possible burial features below surface fill
- Rock at 1.5m below surface.
- Infilled gully

Notes:

- A thick sequence (0.5-1m) of fill, most likely clean topsoil, has been deposited over the entire site.
- Radar facies within undisturbed area indicates a fluvial marsh sedimentary sequence. Anomalies most likely to be tree stumps, etc.
- Anomalies within the infilled gully are chaotic, mainly at the base of the gully and may represent rocks or other fill material. Unlikely to contain any burials.

SCALE (m)
0 2 4 6 8 10

N

TITLE- **GPR Investigation**

LOCATION- **Cemetery-East**
Bayly Road, New Plymouth

NOTES- Coordinates NZ2000 TM Grid.

Figure 6

A3

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Limitations:

Older cemeteries have a complex history and may undergo many changes in grave orientation and placement over the time of operation of the cemetery. Along with the documented activity of the cemetery there is likely to have been unsanctioned, unrecorded or undocumented burials. Many of these are likely to have occurred at the periphery of the cemetery and may be small or shallow. Such burial locations are likely to be extremely difficult to locate and identify geophysically and may result in some remains being found almost anywhere within the cemetery boundaries during excavation. Also, only a portion of the entire site was covered by the geophysical survey. Subsurface objects are likely to exist outside the areas covered in the survey.

Disclaimer:

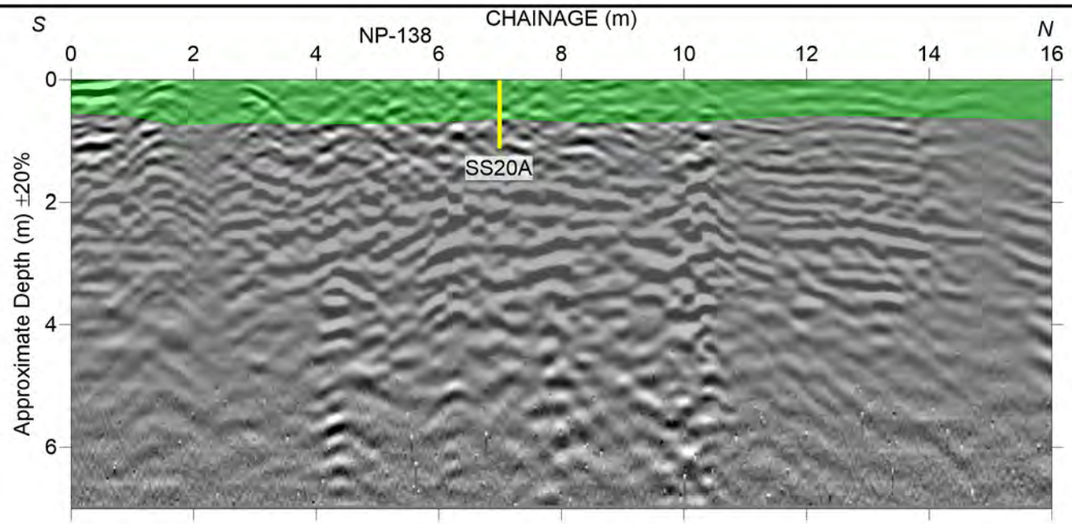
Southern Geophysical Ltd has provided this document subject to the following:

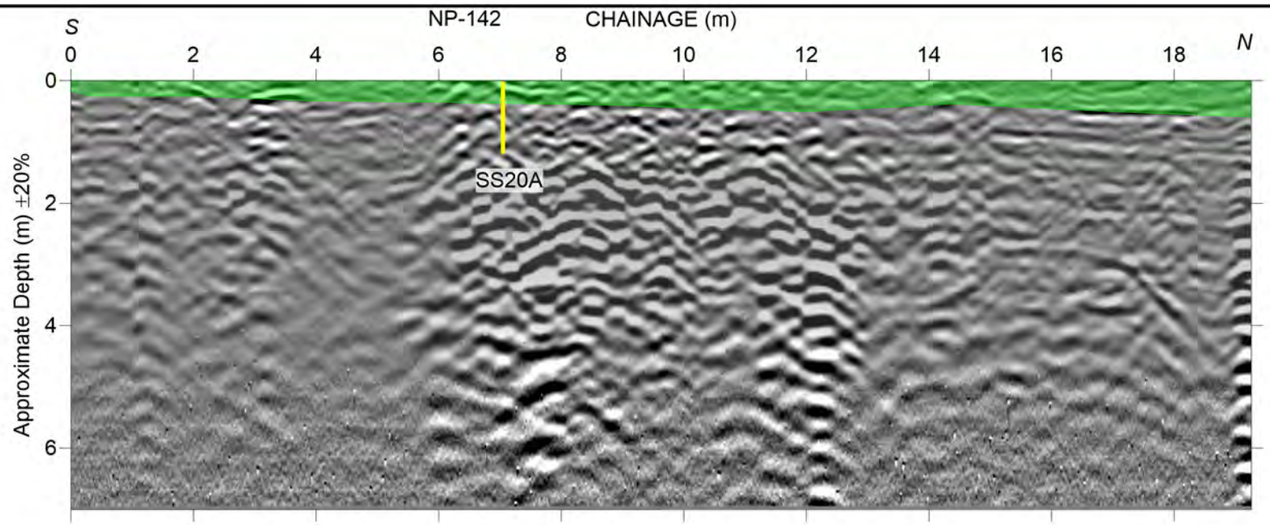
Non-invasive geophysical testing has limitations and is not a complete source of testing. Often there is a need to couple non-invasive methods with invasive testing methods such as drilling, especially in cases where the non-invasive testing indicates anomalies.

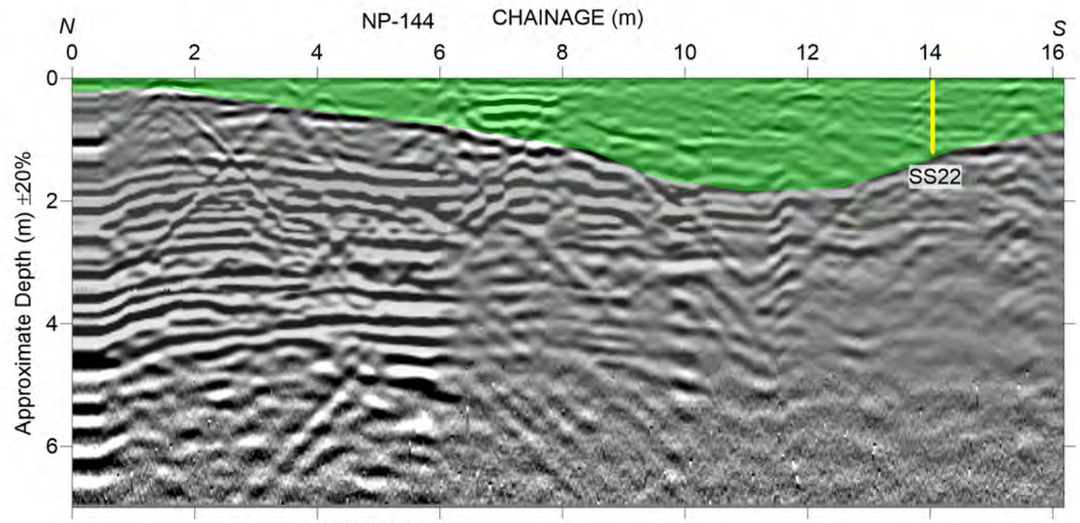
This document has been prepared for the particular purpose outlined in the project proposal and no responsibility is accepted for the use of this document, in whole or in part, in other contexts or for any other purpose. Southern Geophysical Ltd did not perform a complete assessment of all possible conditions or circumstances that may exist at the site. Conditions may exist which were undetectable given the limited nature of the enquiry Southern Geophysical Ltd was retained to undertake with respect to the site. Variations in conditions often occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account. Accordingly, additional studies and actions may be required by the client.

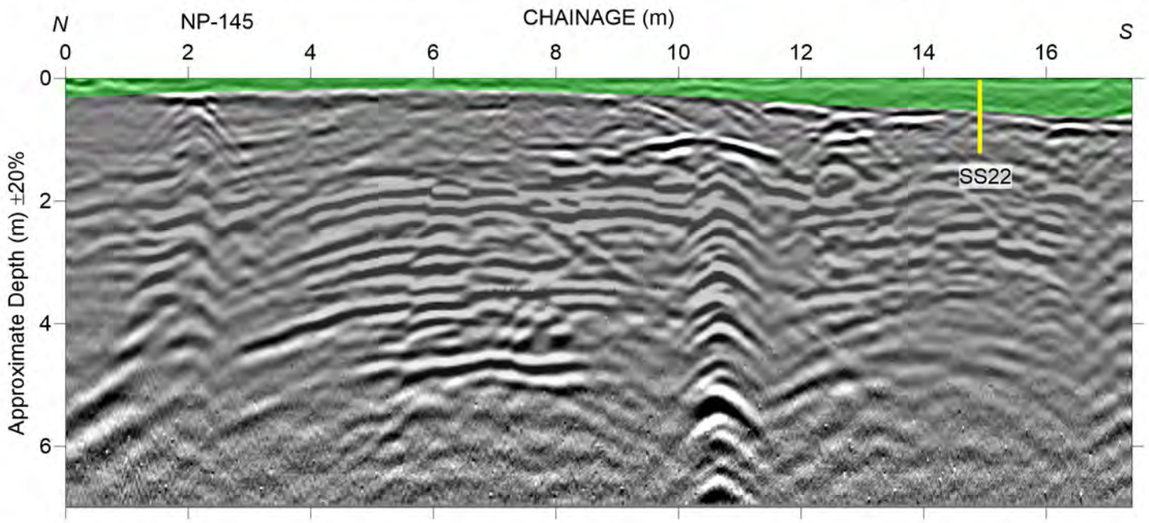
We collected our data and based our report on information which was collected at a specific point in time. The passage of time affects the information and assessment provided by Southern Geophysical Ltd. It is understood that the services provided allowed Southern Geophysical Ltd to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes for whatever reason. Where data is supplied by the client or other sources, including where previous site investigation data have been used, it has been assumed that the information is correct. Southern Geophysical Ltd accepts no responsibility for incomplete or inaccurate data supplied by others. This document is provided for sole use by the client and is confidential to that client and its professional advisers. No responsibility whatsoever for the contents of this document will be accepted to any person other than the client. Any use which a third party makes of this document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. Southern Geophysical Ltd accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this document.

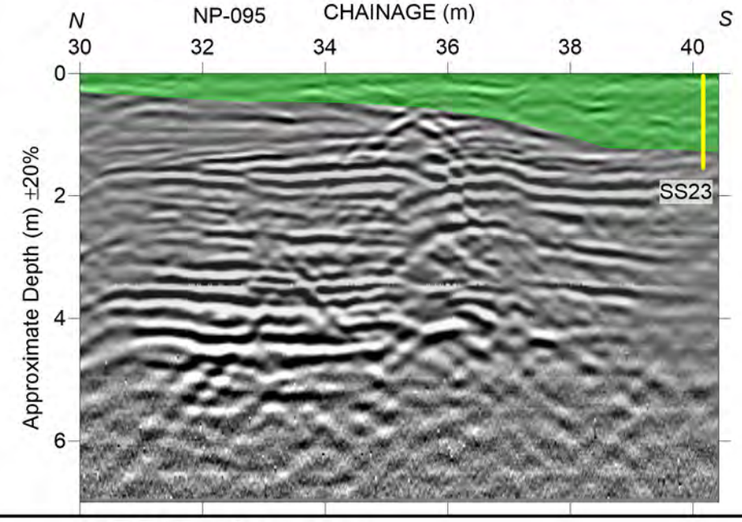
Appendix A - Selected Radargrams











Legend

Approximate test pit location and depth of investigation

Interpreted extent of Fill

PROJECT- **GPR Radargrams**

LOCATION- **Bach Area**
Bayly Road, New Plymouth

NOTES- See Figure 2 for locations.

Test pits approximately located

FIGURE
A6
A3

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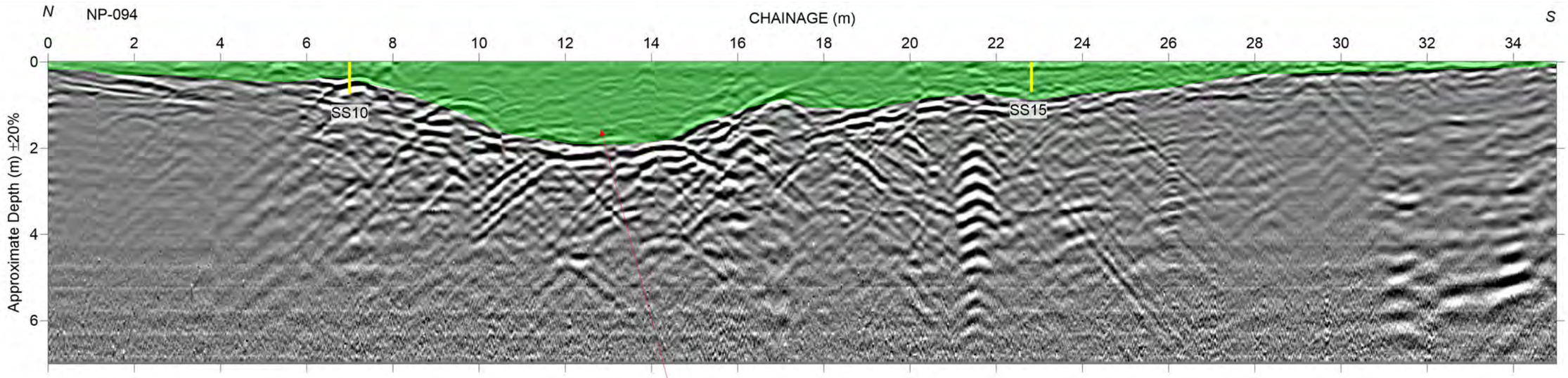
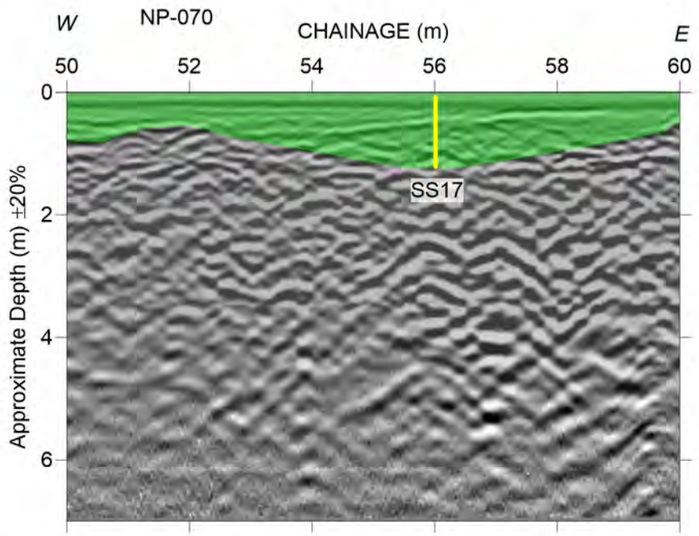
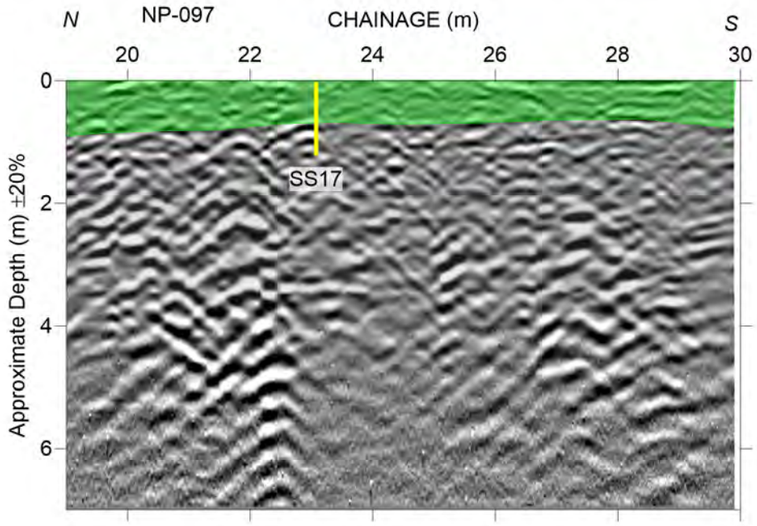
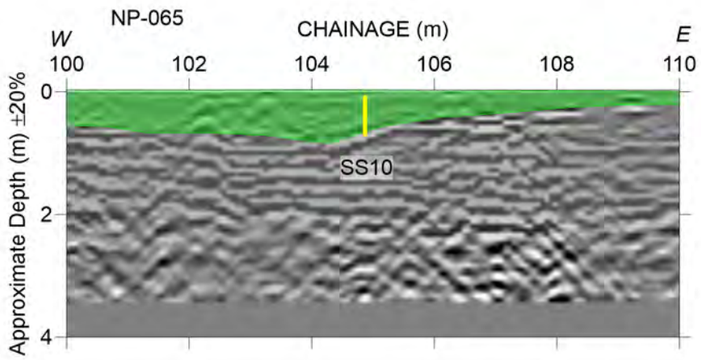






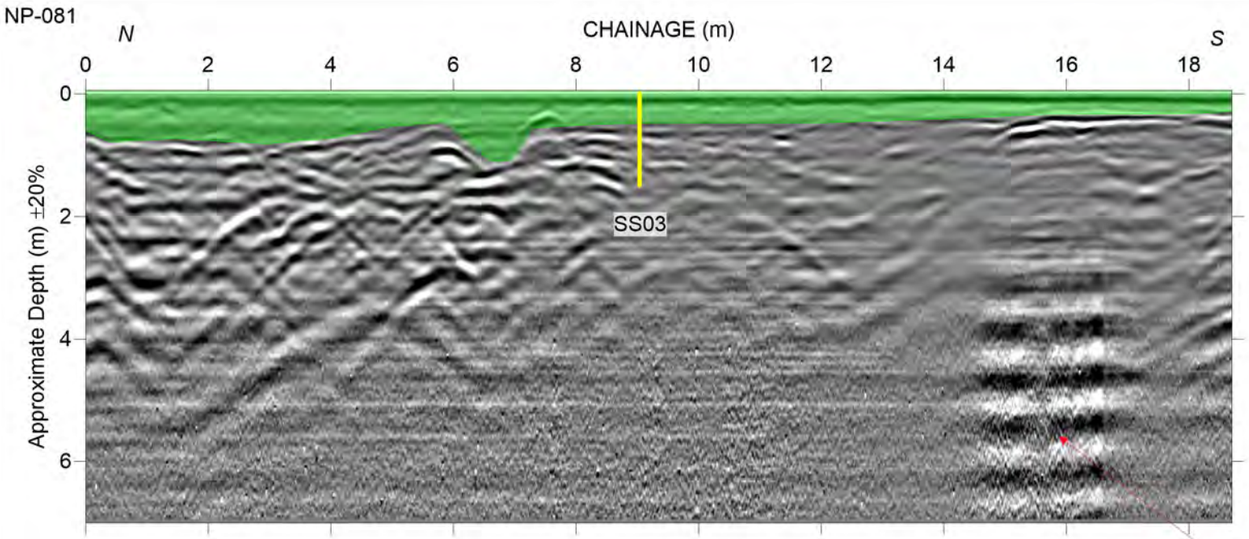


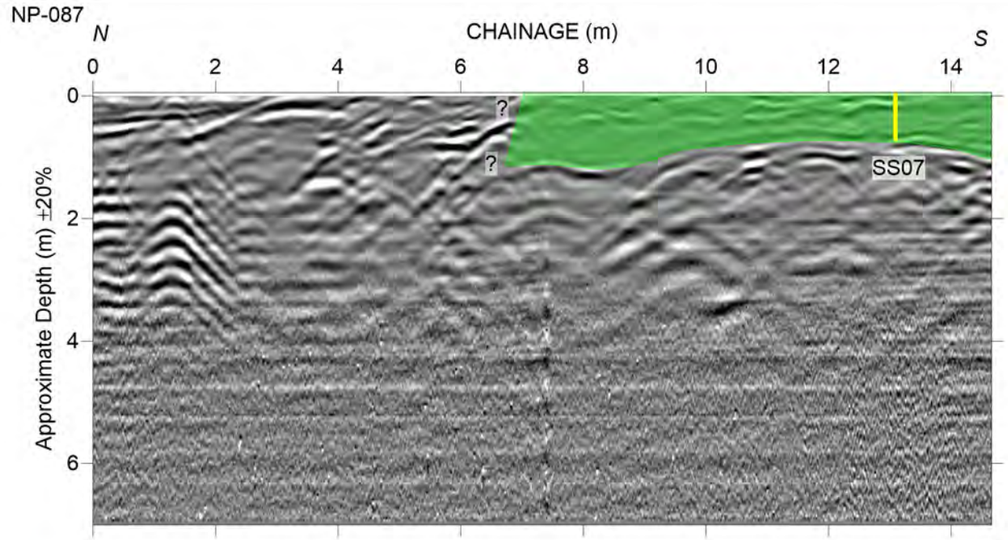
Legend

Approximate test pit location and depth of investigation

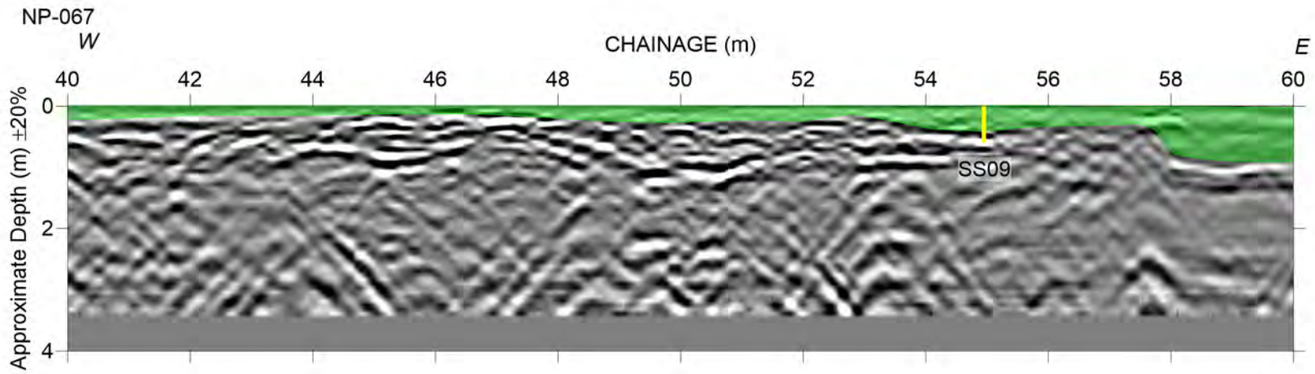
Interpreted extent of Fill

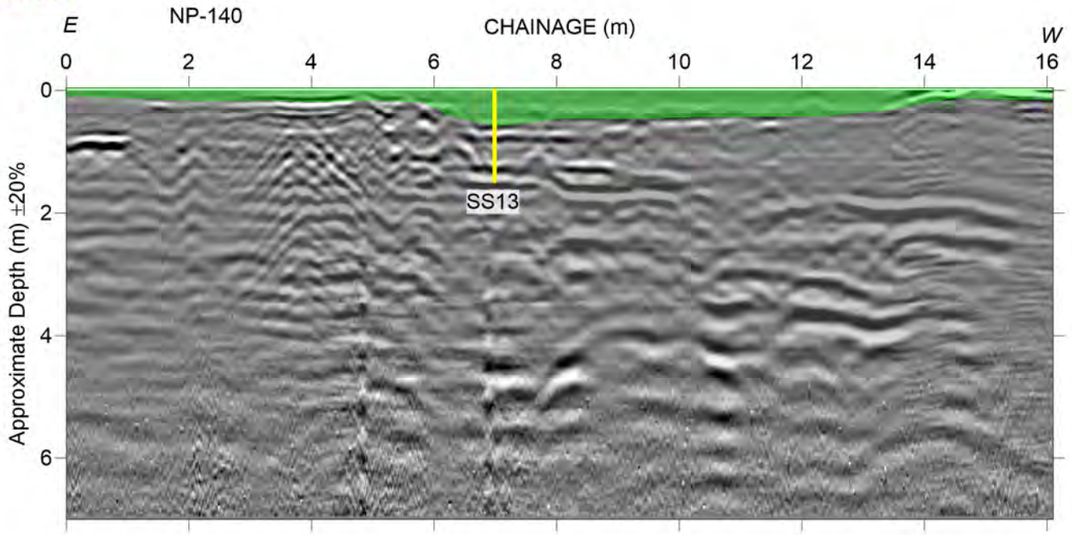
PROJECT- **GPR Radargrams**	NOTES- See Figure 2 for locations.	FIGURE A5	Southern Geophysical Ltd
LOCATION- **Bach Area Bayly Road, New Plymouth**	Test pits approximately located.	A3	www.southerngeophysical.com





noise introduced
by uneven surface



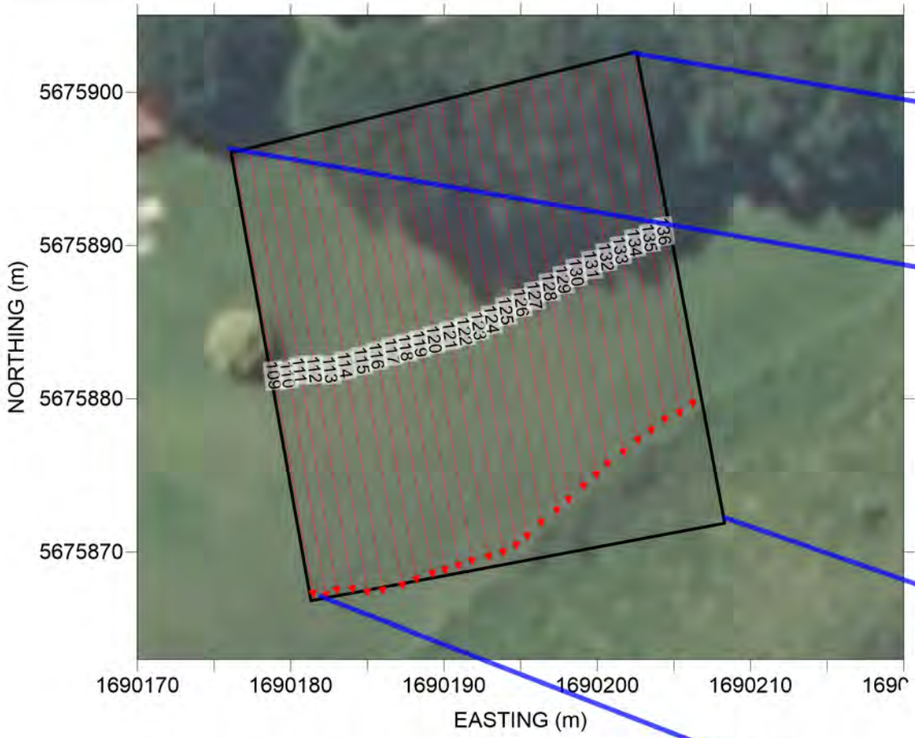


Legend

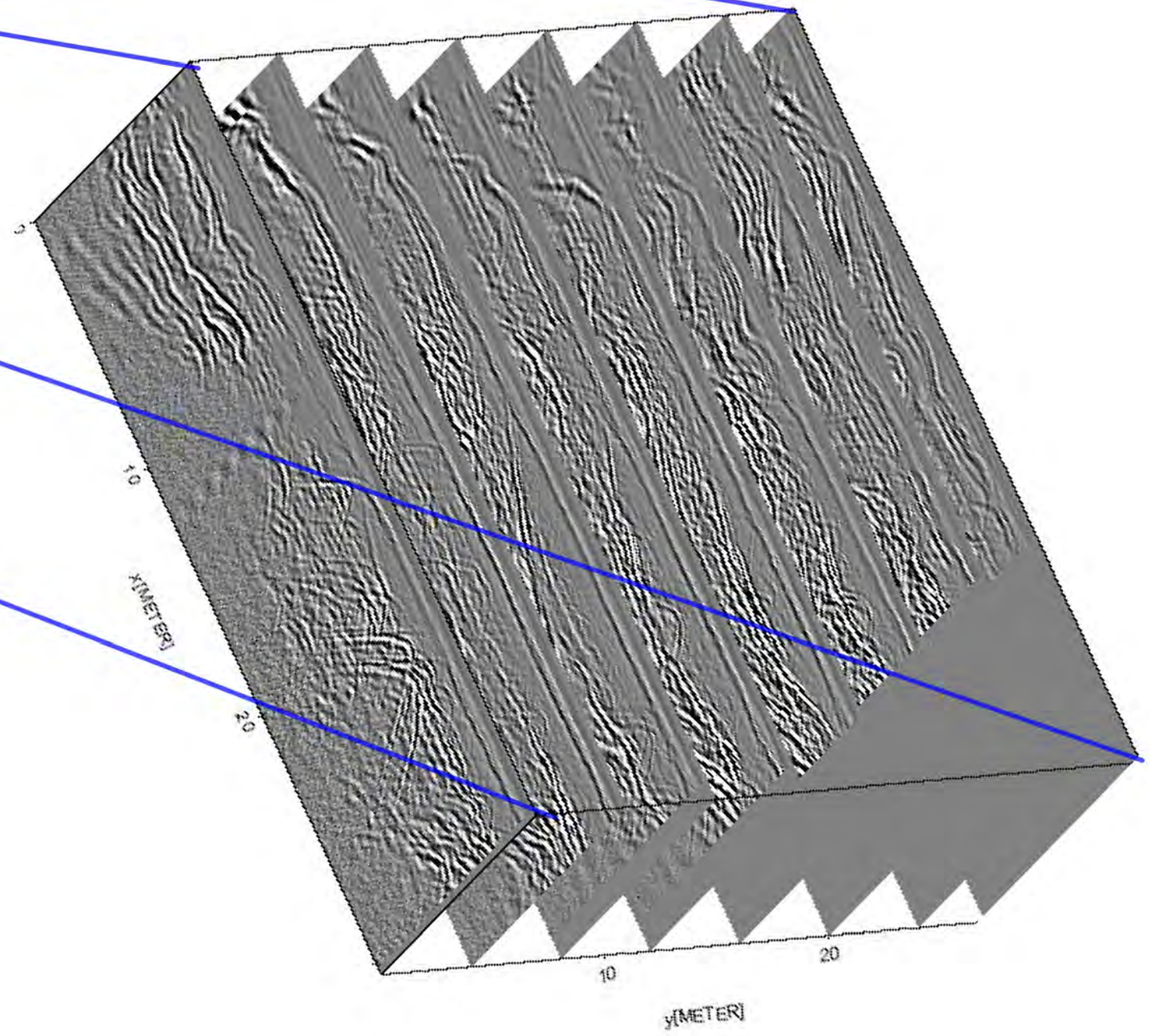
Approximate test pit location and depth of investigation

Interpreted extent of Fill

PROJECT- **GPR Radargrams**	NOTES- See Figure 2 for locations.	FIGURE	Southern Geophysical Ltd
LOCATION- **Bach Area, Bayly Road, New Plymouth**	Test pits approximately located	A4 (A3)	www.southerngeophysical.com



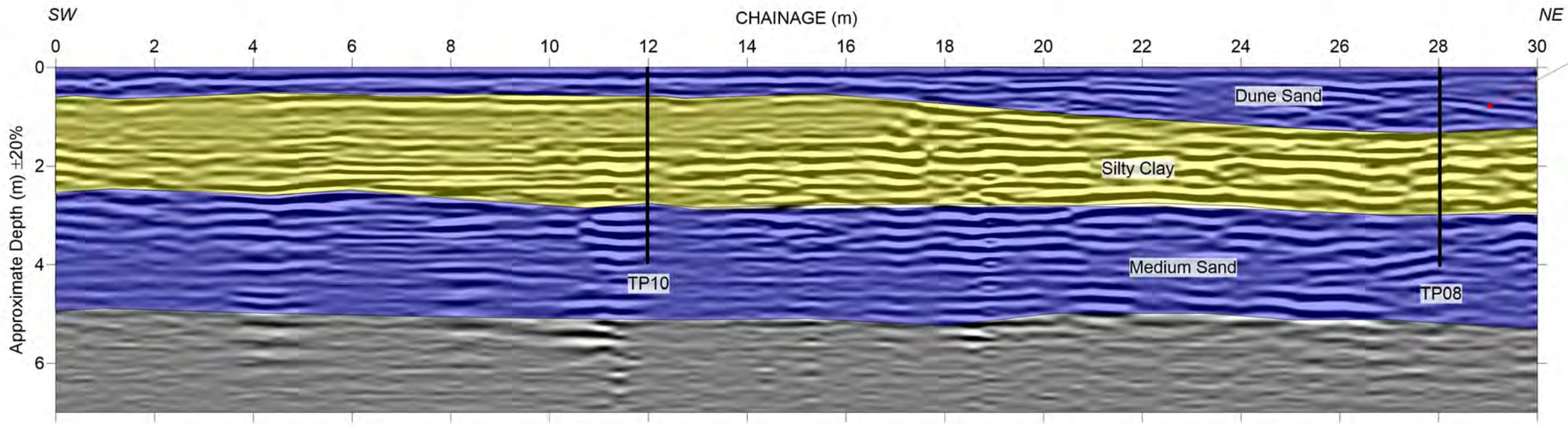
See Figure 6 for GPR interpretation



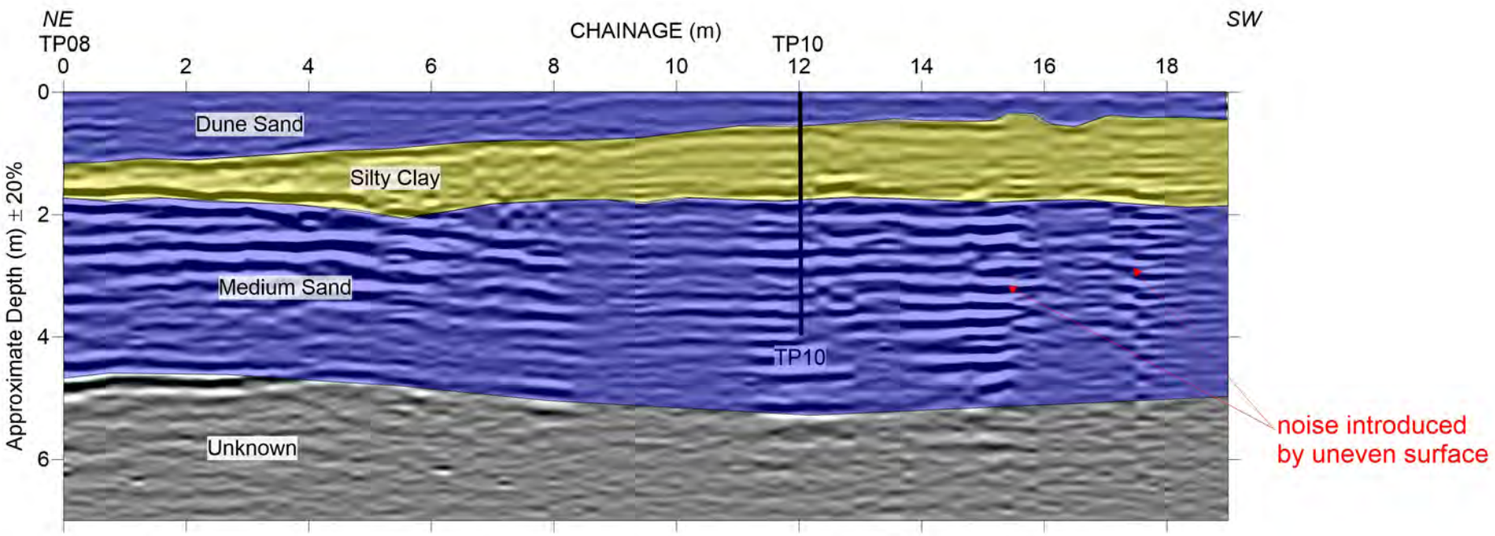
3-D slices

TITLE-	**GPR Investigation, 3-D Model**	NOTES-	Coordinates NZ2000 TM Grid. Aerial photo sourced from LINZ, Crown Copyright ©	Figure A3	**Southern Geophysical Ltd** www.southerngeophysical.com
LOCATION-	**Cemetery-East Bayly Road, New Plymouth**			A3	

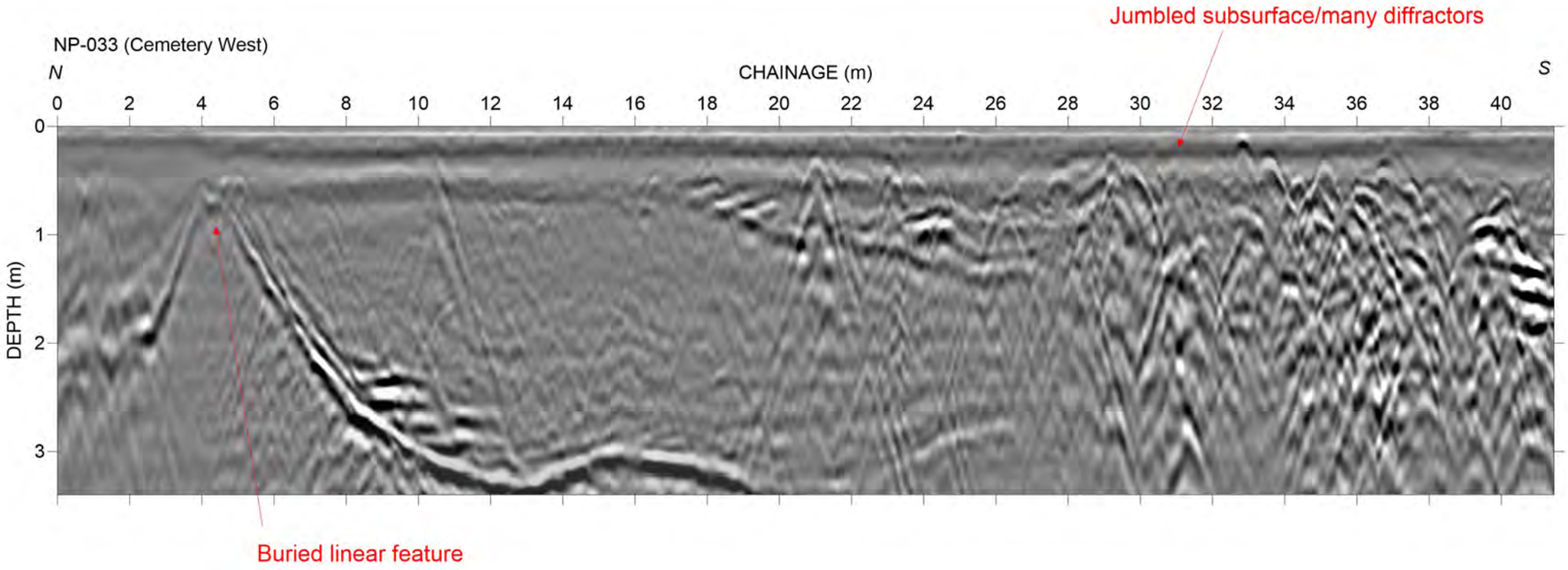
NP-107

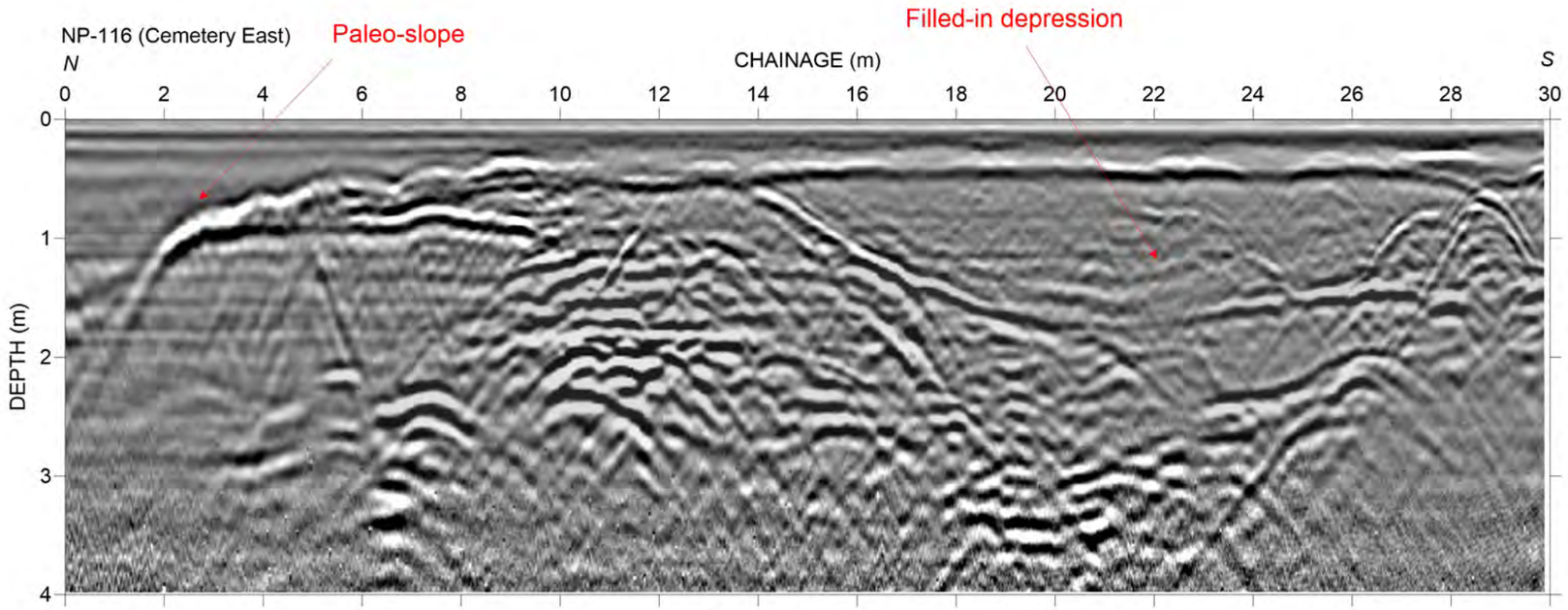


NP-108



PROJECT- **GPR Radargrams**	NOTES- See Figures 1, 5 and 6 for locations.	FIGURE A2	**Southern Geophysical Ltd**
LOCATION- **Moturoa-3 Bayly Road, New Plymouth**	TP10 approximate location projected onto GPR line NP-107	A3	www.southerngeophysical.com





PROJECT- **Selected GPR Radargrams**	NOTES- See Figures 1, 5 and 6 for locations.	FIGURE A1	**Southern Geophysical Ltd**	
LOCATION- **Bayly Road, New Plymouth**		A3	www.southerngeophysical.com	

Appendix B – Field Photographs

Figure B1 – Collection of magnetometer data at the Moturoa-3 site.

Figure B2 – Collection of GPR data at the Moturoa-3 site.

Figure B3 – Historic photo showing drilling of Egmont-5

Appendix C – Logs of Test Pits and Hand Augers

PATTLE DELAMORE PARTNERS LTD

LOG OF HAND AUGER
Bayly Road Detailed Site Investigation

PIT NO. **SS03**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Bach Investigation Area	
DATE: 6/07/2015	DATE BACKFILLED: 6/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY; brown. Moist, soft; plastic. Includes rootlets/organics [TOPSOIL].		0.0	SS03 0.1	×0.0	
FILL. Silty CLAY; brown. Moist; soft; moderately plastic. Fill includes metal fragments and coarse gravel clasts [DEMOLITION WASTE].		0.2	SS03 0.3	×0.0	
		0.4	SS03 0.5	×0.3	
		0.6			
		0.8			
Fine SAND; black. Moist, loosely packed.		1.0	SS03 1.0	×0.1	
		1.2			
		1.4			
			SS03 1.5	×0.1	
END OF HAND AUGER AT 1.5m					

Notes: 1. All test results are in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Hand Auger
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B100

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF HAND AUGER
Bayly Road Detailed Site Investigation

PIT NO. **SS07**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Bach Investigation Area	
DATE: 7/07/2015	DATE BACKFILLED: 7/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY; brown. Moist, very soft, plastic. Rootlets/organics [TOPSOIL].		0.0	SS07 0.1	×0.2	
FILL. Sandy SILT; brownish-black. Moist, soft; moderately plastic. Suspected ACM - cement fibre board fragments [DEMOLTION WASTE].		0.2	SS07 0.3	×0.1	
0.6m - orange staining		0.4			
Fine SAND; black. Moist, loosely packed..		0.6	SS07 0.6	×0.0	

END OF HAND AUGER AT 0.7m

Notes: 1. All test results in ppm

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Hand Auger
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B101

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF HAND AUGER
Bayly Road Detailed Site Investigation

PIT NO. **SS09**

JOB NO: W02050100

CLIENT: Taranaki Regional Council

LOCATION: Bach Investigation Area

DATE: 7/07/2015

DATE BACKFILLED: 7/07/2015

LOGGED BY: AM

SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY with fine-coarse gravel; dark brown. Moist, soft; plastic. Includes rootlets/organics [TOPSOIL].		0.0	SS09 0.1	0.1	
FILL. Silty CLAY with some sand; brown. Moist, firm, moderately plastic; sand, very fine. Fill includes metal fragments [DEMOLITION WASTE].		0.2	SS09 0.3	0.0	
Fine SAND; black. Moist, loosely packed.		0.4	SS09 0.5	0.0	
END OF HAND AUGER AT 0.6m					

Notes: 1. All test results in ppm

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Hand Auger
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B102

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF HAND AUGER
Bayly Road Detailed Site Investigation

PIT NO. **SS10**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 7/07/2015	DATE BACKFILLED: 7/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY with fine-coarse gravel; dark brown. Moist, very soft, plastic. Rootlets, organics. Includes plaster fragment [TOPSOIL].		0.0	SS10 0.1	×0.1	
FILL. Silty CLAY with some sand and trace gravel; brown. Moist, soft, moderately plastic.		0.2	SS10 0.3	×0.2	
		0.4			
		0.6	SS10 0.6	×0.2	

END OF HAND AUGER AT 0.7m

Notes: 1. All test results in ppm

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Hand Auger
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B103

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **SS13**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 9/07/2015	DATE BACKFILLED: 9/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. Silty CLAY; brown. Moist, very soft, plastic. Organics [TOPSOIL]		0.0	SS13 0.1	1.8	
FILL. Fine SAND; black. Moist, loosely packed. Fill includes pieces of terracotta pipe and concrete blocks. [DEMOLITION WASTE].		0.2 0.4	SS13 0.4	0.7	
Fine SAND; black. Moist, loosely packed.		0.6 0.8 1.0 1.2 1.4	SS13 0.7	1.6	▽
END OF TEST PIT AT 1.5m					

Notes: 1. All test results in ppm.
2. Groundwater encountered at 1.4 m bgl

KEY

▽ Groundwater level
Seepage inflow
Grab sample
PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B104

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **SS15**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 7/07/2015	DATE BACKFILLED: 7/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY; brown. Moist, very soft, plastic. Rootlets/organics. Fill includes glass and gravel [TOPSOIL].		0.0	SS15 0.1	×1.7	
Fine SAND with coarse gravel; black, moist, loosely packed. Fill includes brick pieces and suspected ACM - cement fibre board fragment [DEMOLITION WASTE].		0.2	SS15 0.3	×1.2	
Fine SAND; black. Moist, loosely packed.		0.4	SS15 0.5	×0.2	
END OF TEST PIT					

Notes: 1. All test results in ppm

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B105

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **SS17**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 7/07/2015	DATE BACKFILLED: 7/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY with some coarse gravel; brown. Moist, very soft, plastic. Rootlets/organics [TOPSOIL].		0.0	SS17 0.1	1.1	
FILL. Silty CLAY with coarse angular gravel. Brown, moist, firm. Fill includes pieces of asphalt, metal, electrical equipment - fushackle, metal cable [DEMOLITION WASTE].		0.2 0.4 0.6	SS17 0.3	1.3	
		0.8	SS17 0.8	1.6	
Fine SAND; black. Moist, loosely packed.		1.0			

END OF TEST PIT at 1.1m

Notes: 1. All test results in ppm

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B106

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **SS20a**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 9/07/2015	DATE BACKFILLED: 9/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. Silty CLAY; brown. Moist, very soft, plastic. Rootlets/organics [TOPSOIL].		0.0	SS20a 0.1	×1.3	
FILL. Silty CLAY with some fine - coarse gravel; brown; moist; soft, plastic. Fill includes pieces of concrete blocks, metal pipe, glass fragments [DEMOLITION WASTE].		0.2	SS20a 0.3	×1.4	
Fine SAND; greyish-black. Moist; loosely packed.		0.4	SS20a 0.6	×1.3	
		0.6			
		0.8			
		1.0			

END OF TEST PIT AT 1.1m

Notes: 1. All test results in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B107

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **SS21**

JOB NO: W02050100

CLIENT: Taranaki Regional Council

LOCATION: Marae Development Investigation Area

DATE: 8/07/2015

DATE BACKFILLED: 8/07/2015

LOGGED BY: AM

SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. Sandy CLAY; dark brown. Moist; very soft, plastic. Rootlets/organics [TOPSOIL].		0.0	SS21 0.1	×2.7	
FILL. Silty CLAY with some fine - coarse gravel; dark brown; moist; soft; moderately plastic.		0.2 0.4 0.6 0.8 1.0	SS21 0.5	×2.3	
FILL. Silty SAND; brownish-black; moist; loosely packed. Fill includes brick and asphalt pieces, pipe, plastic, medium - coarse gravels [DEMOLITION MATERIAL and REWORKED NATURAL MATERIAL].		1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8	SS21 1.5	×1.9	
		3.0 3.2 3.4	SS21 3.0	×1.6	
Fine SAND; black. Moist, loosely packed.		3.6 3.8	SS21 3.8	×1.9	▽

END OF TEST PIT AT 4.0m

Notes:
1. All test results in ppm.
2. Groundwater encountered at 4.0 m bgl.

KEY

▽ Groundwater level
Seepage inflow
Grab sample
PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B108

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **SS22**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 8/07/2015	DATE BACKFILLED: 8/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. CLAY; brown. Moist, very soft,plastic. Rootlets/organics [TOPSOIL].		0.0	SS22 0.1	×2.9	
FILL. Silty CLAY with some coarse gravels and cobbles; brown. Moist, soft, moderately plastic.		0.2			
		0.4	SS22 0.4	×1.9	
Fine SAND; black. Moist, loosely packed.		0.6	SS22 0.7	×0.9	
END OF TEST PIT AT 0.8m					

Notes: 1. All test results in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B109

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **SS23**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Marae Development Investigation Area	
DATE: 9/07/2015	DATE BACKFILLED: 9/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
FILL. Clayey fine SAND; greyish-brown. Moist, loosely packed. Inlcudes organics [TOPSOIL].		0.0	SS23 0.1	×0.5	
FILL. Silty fine SAND; brownish-black. Moisit, loosely packed. Includes some glass and metal wire [DEMOLITION WASTE].		0.2	SS23 0.3	×2.4	
Fine SAND; black. Moist, loosely packed.		0.4			
		0.6	SS23 0.6	×1.5	
		0.8			
		1.0			
		1.2			
		1.4			

END OF TEST PIT AT 1.5m

Notes: 1. All test results in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B110

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **TP8**

JOB NO: W02050100

CLIENT: Taranaki Regional Council

LOCATION: Moturoa 3 Investigation

DATE: 8/07/2015

DATE BACKFILLED: 9/07/2015

LOGGED BY: AM

SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
Fine SAND; black. Moist, loosely packed [DUNE SANDS].		0.0	TP8 0.1	×0.7	
		0.2			
		0.4	TP8 0.5	×2.8	
		0.6			
		0.8			
		1.0			
		1.2			
		1.4			
		1.6			
		1.8			
Fine SAND; brown. Moist, loosely packed [DUNE SANDS].		2.0			
		2.2			
		2.4			
		2.6			
		2.8			
		3.0			
		3.2			
		3.4			
		3.6			
		3.8			
			TP8 4.0	2.7	
END OF TEST PIT					

Notes: 1. All test results in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator

Datum:

Ground Level: --

Coordinates:

Filename: W02050100B111

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TEST PIT
Bayly Road Detailed Site Investigation

PIT NO. **TP10**

JOB NO: W02050100

CLIENT: Taranaki Regional Council		LOCATION: Moturoa 3 Investigation	
DATE: 8/07/2015	DATE BACKFILLED: 9/07/2015	LOGGED BY: AM	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
Fine SAND; black. Moist, loosely packed [DUNE SAND MATERIAL].		0.0 0.2 0.4	TP10 0.1	×0.5	
FILL. Silty CLAY, brown. Moist; firm; moderately plastic.		0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4	TP10 0.6 TP10 2.0	×1.3 ×2.7 ×2.6	
Medium SAND, grey. Moist, loosely packed [DUNE SAND]		2.6 2.8 3.0 3.2 3.4 3.6 3.8		×1.2	

END OF TEST PIT AT 4.0m

Notes: 1. All test results in ppm.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Mechanical Excavator
Datum:
Ground Level: --
Coordinates:

Filename: W02050100B112

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

Appendix G: Laboratory Reports

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Pattle Delamore Partners Limited	**Lab No:**	1447355	SPv1
Contact:	B Simkin	**Date Registered:**	07-Jul-2015	
	C/- Pattle Delamore Partners Limited	**Date Reported:**	20-Jul-2015	
	PO Box 6136	**Quote No:**		
	WELLINGTON 6141	**Order No:**		
		Client Reference:	W02050100	
		Submitted By:	Andy Mackenzie	

Sample Type: Soil

		Sample Name:	SS01 0.3 06-Jul-2015	SS02 0.1 06-Jul-2015			
		Lab Number:	1447355.14	1447355.16			
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn							
Total Recoverable Arsenic	mg/kg dry wt		3	4	-	-	-
Total Recoverable Cadmium	mg/kg dry wt		0.43	0.17	-	-	-
Total Recoverable Chromium	mg/kg dry wt		10	16	-	-	-
Total Recoverable Copper	mg/kg dry wt		135	69	-	-	-
Total Recoverable Lead	mg/kg dry wt		186	67	-	-	-
Total Recoverable Nickel	mg/kg dry wt		6	7	-	-	-
Total Recoverable Zinc	mg/kg dry wt		420	173	-	-	-

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%.	-	14, 16
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	14, 16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

PATTLE DELAMORE PARTNERS LTD

solutions for your environment

Request for Analyses

NOTE: Please acknowledge receipt of these samples by signing this form and emailing to submitter.

From: Pattle Delamore Partners Ltd

Address (Refer to base of sheet): ☐ PDP Auckland ☑ PDP Wellington ☐ PDP Christchurch

Submitted by: Andrew Mackenzie Ph No.: 021 409 906

To: Hill Labs

Quote No.: 0

PDP Job No.: WP20501.00

Chain of Custody Record

Job No: **144 7355** Date Recv: 07-Jul-15 05:31

Sent:

Name: Andrew Mackenzie

Signature: A Mackenzie

Date and time: 6-7-15

Received: ☐ Room temp. ☐ Chilled Temp. 14.0°C

Name: Amelia

Signature:

Date and time:

Notes:

Received by: Jennifer Singlewood

3114473550

Results by: ☑ Email submitter: andrew.mackenzie@pdp.co.nz ☐ Mail (address below)

☑ Email other: Bo.Simkin@pdp.co.nz ☐ Fax (number below)

Priority: ☐ Normal ☐ High ☐ Urgent

Results required by: / /

Invoice to: ☑ PDP ☐ Other:

Sample ID	Sample type	No. bottles	Analyses requested	Notes
MW4 0.5	S	1	Hot D comp	
MW4 1.0	S	1		
MW4 3.0	S	1		
MW4 3.5	S	1		
MW4 4.0	S	1		
MW3 0.5	S	1		
MW3 1.0	S	1		
MW3 1.5	S	1		
MW3 2.0	S	1		
MW3 3.5	S	1		
MW3 4.0	S	1		
MW3 4.5	S	1		
SS01 0.1	S	3		
SS01 0.3	S	3		
SS01 0.5	S	3		
SS02 0.1	S	3		
" " 0.3	S	3		
" " 0.5	S	2		
" " 1.0	S	3		
" " 1.5	S	3		

Sample type: S Soil GW Groundwater SAL Seawater/saline FW Freshwater LEACH Leachate GEO Geothermal

SED Sediment BIO Biota TW Tradewaste WW Wastewater P Potable Other:

Note: Samples may contain dangerous or hazardous substances

PDP Auckland
PDP House, 235 Broadway, Newmarket, Auckland
PO Box 9528, Newmarket, Auckland 1149
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PDP Wellington
iSOFT House, Level 1, 111 Customhouse Quay, Wellington
PO Box 6136, Wellington 6141
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PDP Christchurch
Radio NZ House, 51 Chester St West, Christchurch
PO Box 389, Christchurch 8140
Tel: +64 3 363 3100 | Fax: +64 3 363 3101
christchurch@pdp.co.nz

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web

Job Information Summary

Client:	Pattle Delamore Partners Limited	**Lab No:**	1447355
Contact:	B Simkin	**Date Registered:**	07-Jul-2015 10:04 am
	C/- Pattle Delamore Partners Limited	**Priority:**	High
	PO Box 6136	**Quote No:**	
	WELLINGTON 6141	**Order No:**	
		Client Reference:	W02050100
		Add. Client Ref:	
		Submitted By:	Andy Mackenzie
		Charge To:	Pattle Delamore Partners Limited
		Target Date:	14-Jul-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	MW4 0.5 03-Jul-2015	Soil	GSoil300	Hold Cold
2	MW4 1.0 03-Jul-2015	Soil	GSoil300	Hold Cold
3	MW4 3.0 03-Jul-2015	Soil	GSoil300	Hold Cold
4	MW4 3.5 03-Jul-2015	Soil	GSoil300	Hold Cold
5	MW4 4.0 03-Jul-2015	Soil	GSoil300	Hold Cold
6	MW3 0.5 03-Jul-2015	Soil	GSoil300	Hold Cold
7	MW3 1.0 03-Jul-2015	Soil	GSoil300	Hold Cold
8	MW3 1.5 03-Jul-2015	Soil	GSoil300	Hold Cold
9	MW3 2.0 03-Jul-2015	Soil	GSoil300	Hold Cold
10	MW3 3.5 03-Jul-2015	Soil	GSoil300	Hold Cold
11	MW3 4.0 03-Jul-2015	Soil	GSoil300	Hold Cold
12	MW3 4.5 03-Jul-2015	Soil	GSoil300	Hold Cold
13	SS01 0.1 06-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
14	SS01 0.3 06-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
15	SS01 0.5 06-Jul-2015	Soil	GSoil300, PSoil250Asb, cGSoil	Hold Cold
16	SS02 0.1 06-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
17	SS02 0.3 06-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
18	SS02 0.5 06-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
19	SS02 1.0 06-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
20	SS02 1.5 06-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold

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**
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%.	-	14, 16
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	14, 16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	14, 16

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
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:	Pattle Delamore Partners Limited	**Lab No:**	1447868	SPv2
Contact:	B Simkin	**Date Registered:**	08-Jul-2015	
	C/- Pattle Delamore Partners Limited	**Date Reported:**	02-Oct-2015	
	PO Box 6136	**Quote No:**		
	WELLINGTON 6141	**Order No:**		
		Client Reference:	W02050100	
		Submitted By:	Andrew Mackenzie	

Amended Report

This report replaces an earlier report issued on the 20 Jul 2015 at 3:07 pm
TCLP copper, lead and zinc analysis added to sample SS11 0.3, as per the clients request.

Sample Type: Soil

		Sample Name:	SS03 0.3 06-Jul-2015	SS04 0.3 07-Jul-2015	SS05 0.3 07-Jul-2015	SS06 0.2 07-Jul-2015	SS07 0.6 07-Jul-2015
		Lab Number:	1447868.2	1447868.13	1447868.15	1447868.17	1447868.20
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn							
Total Recoverable Arsenic	mg/kg dry wt		3	2	3	5	2
Total Recoverable Cadmium	mg/kg dry wt		0.74	0.16	0.24	0.19	< 0.10
Total Recoverable Chromium	mg/kg dry wt		13	22	16	12	21
Total Recoverable Copper	mg/kg dry wt		72	91	68	49	85
Total Recoverable Lead	mg/kg dry wt		38	24	220	49	26
Total Recoverable Nickel	mg/kg dry wt		8	12	9	6	11
Total Recoverable Zinc	mg/kg dry wt		89	190	154	140	85
Asbestos in Soil							
As Received Weight	g		-	228.6	-	-	227.6
Dry Weight	g		-	157.2	-	-	154.9
<2mm Subsample Weight	g ashed wt		-	61.1	-	-	60.5
Asbestos Presence / Absence			-	Amosite (Brown Asbestos) and Chrysotile (White Asbestos) detected.	-	-	Amosite (Brown Asbestos) and Chrysotile (White Asbestos) detected.
Description of Asbestos Form			-	ACM Debris & Loose Fibres	-	-	ACM Debris & Loose Fibres

		Sample Name:	SS08 0.3 07-Jul-2015	SS09 0.3 07-Jul-2015	SS10 0.6 07-Jul-2015	SS11 0.3 07-Jul-2015	SS15 0.3 07-Jul-2015
		Lab Number:	1447868.21	1447868.23	1447868.29	1447868.30	1447868.33
Individual Tests							
TCLP Weight of Sample Taken	g		-	-	-	100	-
TCLP Initial Sample pH	pH Units		-	-	-	6.6	-
TCLP Acid Adjusted Sample pH	pH Units		-	-	-	1.7	-
TCLP Extractant Type*			-	-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-
TCLP Extraction Fluid pH	pH Units		-	-	-	4.9	-
TCLP Post Extraction Sample pH	pH Units		-	-	-	5.0	-
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn							
Total Recoverable Arsenic	mg/kg dry wt		< 2	< 2	3	5	2
Total Recoverable Cadmium	mg/kg dry wt		0.78	0.16	0.19	0.49	0.14
Total Recoverable Chromium	mg/kg dry wt		12	11	11	12	11
Total Recoverable Copper	mg/kg dry wt		23	50	84	173	56
Total Recoverable Lead	mg/kg dry wt		120	90	87	400	147
Total Recoverable Nickel	mg/kg dry wt		5	6	5	9	7

Sample Type: Soil						
Sample Name:		SS08 0.3 07-Jul-2015	SS09 0.3 07-Jul-2015	SS10 0.6 07-Jul-2015	SS11 0.3 07-Jul-2015	SS15 0.3 07-Jul-2015
Lab Number:		1447868.21	1447868.23	1447868.29	1447868.30	1447868.33
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Zinc	mg/kg dry wt	175	220	116	280	210
Asbestos in Soil						
As Received Weight	g	-	-	-	-	338.1
Dry Weight	g	-	-	-	-	286.7
<2mm Subsample Weight	g ashed wt	-	-	-	-	61.7
Asbestos Presence / Absence		-	-	-	-	Chrysotile (White Asbestos) detected.
Description of Asbestos Form		-	-	-	-	ACM Debris & Loose Fibres

Sample Type: Aqueous						
Sample Name:		SS11 0.3 [TCLP Extract]				
Lab Number:		1447868.35				
Individual Tests						
Total Copper	g/m^3	0.27	-	-	-	-
Total Lead	g/m^3	0.63	-	-	-	-
Total Zinc	g/m^3	1.72	-	-	-	-

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, 13, 15, 17, 20-21, 23, 29-30, 33
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	2, 13, 15, 17, 20-21, 23, 29-30, 33
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	2, 13, 15, 17, 20-21, 23, 29-30, 33
TCLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1311	-	30
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	13, 20, 33
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	13, 20, 33
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	13, 20, 33
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.	-	13, 20, 33
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	13, 20, 33
TCLP Profile			
TCLP Weight of Sample Taken	Gravimetric. US EPA 1311.	0.1 g	30
TCLP Initial Sample pH	pH meter. US EPA 1311.	0.1 pH Units	30
TCLP Acid Adjusted Sample pH	pH meter. US EPA 1311.	0.1 pH Units	30
TCLP Extractant Type*	US EPA 1311.	-	30
TCLP Extraction Fluid pH	pH meter. US EPA 1311.	0.1 pH Units	30

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
TCLP Post Extraction Sample pH	pH meter. US EPA 1311.	0.1 pH Units	30

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	35
Total Copper	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.011 g/m^3	35
Total Lead	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0021 g/m^3	35
Total Zinc	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.021 g/m^3	35

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.

Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental Division

PATTLE DELAMORE PARTNERS LTD

solutions for your environment

Request for Analyses

NOTE: Please acknowledge receipt of these samples by signing this form and emailing to submitter.

From: Pattle Delamore Partners Ltd

Address (Refer to base of sheet): ☐ PDP Auckland ☑ PDP Wellington ☐ PDP Christchurch

Submitted by: Andrew Mackenzie Ph No.: 021 419 986

To: Hill Labs

Quote No.:

PDP Job No.: WO20501.00

Chain of Custody Record

Job No: **144 7868**

Date Recv: 08-Jul-15 05:51

Sent:

Name: Andrew Mackenzie

Signature: AMackenzie

Date and time: 7-7-15

Received: ☐ Room temp. ☐ Chilled Temp. 4.4 °C

Name: Chloe Vedder

Signature:

Date and time:

Notes: Samples Chilled

Received by: Jennifer Singlewood

31'4478688

Results by: ☑ Email submitter: andrew.mackenzie@pdp.co.nz ☐ Mail (address below)

☑ Email other: Bo.Simkin @pdp.co.nz ☐ Fax (number below)

Priority: ☑ Normal ☐ High ☐ Urgent

Results required by: ___ / ___ / ___

Invoice to: ☑ PDP ☐ Other:

Sample ID	Sample type	No. bottles	Analyses requested	Notes
SS02 0.1	S	3	HOLD COLD	
SS03 0.3	S	3		
SS03 0.5	S	2		
SS03 1.0	S	3		
SS03 1.5	S	3		
MW5 0.5	S	1		
MW5 1.0	S	1		
MW5 1.5	S	1		
MW5 2.0	S	1		
MW6 0.5	S	1		
MW6 1.0	S	1		
MW6 1.5	S	1		
SS04 0.3	S	2		
" " 0.5	S	2		
SS05 0.3	S	2		
" " 0.5	S	2		
SS06 0.2	S	2		
SS06 0.5	S	2		
SS07 0.3	S	2		
SS07 0.6	S	2		
SS08 0.3	S	2		
SS08 0.5	S	3		

Sample type: S Soil; GW Groundwater; SAL Seawater/saline; FW Freshwater; LEACH Leachate; GEO Geothermal; SED Sediment; BIO Biota; TW Tradewaste; WW Wastewater; P Potable; Other:

Note: Samples may contain dangerous or hazardous substances

PDP Auckland
PDP House, 235 Broadway, Newmarket, Auckland
PO Box 9528, Newmarket, Auckland 1149
Tel: +64 9 523 6900 | Fax: +64 9 523 6901
auckland@pdp.co.nz

PDP Wellington
iSOFT House, Level 1, 111 Customhouse Quay, Wellington
PO Box 6136, Wellington 6141
Tel: +64 4 471 4130 | Fax: +64 4 471 4131
wellington@pdp.co.nz

PDP Christchurch
Radio NZ House, 51 Chester St West, Christchurch
PO Box 389, Christchurch 8140
Tel: +64 3 363 3100 | Fax: +64 3 363 3101
christchurch@pdp.co.nz

pdp solutions for your environment

PATTLE DELAMORE PARTNERS LTD

Request for Analyses

NOTE: Please acknowledge receipt of these samples by signing this form and emailing to submitter.

From: Pattle Delamore Partners Ltd

Address (Refer to base of sheet): ☐ PDP Auckland ☑ PDP Wellington ☐ PDP Christchurch

Submitted by: Andrew Mackenzie Ph No.: 021 619 946

To: Hill Labs

Quote No.:

PDP Job No.: WO2050100

Chain of Custody Record

Sent:
Name: Andrew Mackenzie
Signature: [signature]
Date and time: 7-7-15

Received: ☐ Room temp. ☐ Chilled Temp.: °C
Name:
Signature:
Date and time:

Notes: ~~See page 1 for requirements~~ Samples in 2 chilly bins

Results by: ☑ Email submitter: andrew.mackenzie @pdp.co.nz ☐ Mail (address below)
☑ Email other: Bo. Smith @pdp.co.nz ☐ Fax (number below)

Priority: ☑ Normal ☐ High ☐ Urgent

Results required by: / /

Invoice to: ☑ PDP ☐ Other:

Sample ID	Sample type	No. bottles	Analyses requested	Notes
SS09 0.3	S	3	HOLD COLD	
SS09 0.5	S	3	↓	
MW6 3.0	S	1		
MW6 3.5	S	1		
MW6 4.0	S	1		
SS10 0.3	S	3		
SS10 0.6	S	3		
SS11 0.3	S	3		
SS14 0.3	S	3		
SS14 0.5	S	3		
SS15 0.3	S	3		
SS15 0.5	S	3	↓	

Sample type: **S** Soil **GW** Groundwater **SAL** Seawater/saline **FW** Freshwater **LEACH** Leachate **GEO** Geothermal
SED Sediment **BIO** Biota **TW** Tradewaste **WW** Wastewater **P** Potable Other:

Note: Samples may contain dangerous or hazardous substances

PDP Auckland
PDP House, 235 Broadway, Newmarket, Auckland
PO Box 9528, Newmarket, Auckland 1149
Tel: +64 9 523 6900 | Fax: +64 9 523 6901
auckland@pdp.co.nz

PDP Wellington
iSOFT House, Level 1, 111 Customhouse Quay, Wellington
PO Box 6136, Wellington 6141
Tel: +64 4 471 4130 | Fax: +64 4 471 4131
wellington@pdp.co.nz

PDP Christchurch
Radio NZ House, 51 Chester St West, Christchurch
PO Box 389, Christchurch 8140
Tel: +64 3 363 3100 | Fax: +64 3 363 3101
christchurch@pdp.co.nz

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R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz

Job Information Summary

Client:	Pattle Delamore Partners Limited	**Lab No:**	1447868
Contact:	B Simkin	**Date Registered:**	08-Jul-2015 11:07 am
	C/- Pattle Delamore Partners Limited	**Priority:**	High
	PO Box 6136	**Quote No:**	
	WELLINGTON 6141	**Order No:**	
		Client Reference:	W02050100
		Add. Client Ref:	
		Submitted By:	Andy Mackenzie
		Charge To:	Pattle Delamore Partners Limited
		Target Date:	17-Jul-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	SS03 0.1 06-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
2	SS03 0.3 06-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
3	SS03 0.5 06-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
4	SS03 1.0 06-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
5	SS03 1.5 06-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
6	MW5 0.5 07-Jul-2015	Soil	GSoil300	Hold Cold
7	MW5 1.0 07-Jul-2015	Soil	GSoil300	Hold Cold
8	MW5 1.5 07-Jul-2015	Soil	GSoil300	Hold Cold
9	MW5 2.0 07-Jul-2015	Soil	GSoil300	Hold Cold
10	MW6 0.5 07-Jul-2015	Soil	GSoil300	Hold Cold
11	MW6 1.0 07-Jul-2015	Soil	GSoil300	Hold Cold
12	MW6 1.5 07-Jul-2015	Soil	GSoil300	Hold Cold
13	SS04 0.3 07-Jul-2015	Soil	GSoil300, PSoil250Asb	Asbestos in Soil; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
14	SS04 0.5 07-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
15	SS05 0.3 07-Jul-2015	Soil	GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
16	SS05 0.5 07-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
17	SS06 0.2 07-Jul-2015	Soil	GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
18	SS06 0.5 07-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
19	SS07 0.3 07-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
20	SS07 0.6 07-Jul-2015	Soil	GSoil300, PSoil250Asb	Asbestos in Soil; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
21	SS08 0.3 07-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
22	SS08 0.5 07-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
23	SS09 0.3 07-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
24	SS09 0.5 07-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
25	MW6 3.0 07-Jul-2015	Soil	GSoil300	Hold Cold
26	MW6 3.5 07-Jul-2015	Soil	GSoil300	Hold Cold
27	MW6 4.0 07-Jul-2015	Soil	GSoil300	Hold Cold
28	SS10 0.3 07-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
29	SS10 0.6 07-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
30	SS11 0.3 07-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
31	SS14 0.3 07-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
32	SS14 0.5 07-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
33	SS15 0.3 07-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Asbestos in Soil; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
34	SS15 0.5 07-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold

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, 13, 15, 17, 20-21, 23, 29-30, 33
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	2, 13, 15, 17, 20-21, 23, 29-30, 33
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	2, 13, 15, 17, 20-21, 23, 29-30, 33
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	13, 20, 33
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	13, 20, 33
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	13, 20, 33
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.	-	13, 20, 33
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	13, 20, 33

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1 Clyde Street
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Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Pattle Delamore Partners Limited	**Lab No:**	1448363	SPv1
Contact:	B Simkin	**Date Registered:**	09-Jul-2015	
	C/- Pattle Delamore Partners Limited	**Date Reported:**	20-Jul-2015	
	PO Box 6136	**Quote No:**		
	WELLINGTON 6141	**Order No:**		
		Client Reference:	W02050100	
		Submitted By:	Andy Mackenzie	

Sample Type: Soil

	Sample Name:	SS16 0.5	SS17 0.8	SS21 1.5	SS21 3.0	SS22 0.1
	Lab Number:	1448363.15	1448363.17	1448363.22	1448363.23	1448363.25
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	2	4	2	< 2	< 2
Total Recoverable Cadmium	mg/kg dry wt	0.20	1.20	0.70	< 0.10	0.14
Total Recoverable Chromium	mg/kg dry wt	7	17	9	13	12
Total Recoverable Copper	mg/kg dry wt	23	630	64	28	76
Total Recoverable Lead	mg/kg dry wt	40	166	190	17.1	210
Total Recoverable Nickel	mg/kg dry wt	5	25	6	5	7
Total Recoverable Zinc	mg/kg dry wt	117	740	580	117	147

	Sample Name:	SS22 0.7				
	Lab Number:	1448363.27				
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	< 2	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.21	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	12	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	22	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	31	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	5	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	320	-	-	-	-

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%.	-	15, 17, 22-23, 25, 27
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	15, 17, 22-23, 25, 27
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	15, 17, 22-23, 25, 27

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 report must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

PATTLE DELAMORE PARTNERS LTD

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Request for Analyses

NOTE: Please acknowledge receipt of these samples by signing this form and emailing to submitter.

From: Pattle Delamore Partners Ltd

Address (Refer to base of sheet): ☐ PDP Auckland ☑ PDP Wellington ☐ PDP Christchurch

Submitted by: Andrew Mackenzie Ph No.: 021 419 946

To: Hill Labs

Quote No.:

PDP Job No.: WEN05010

Chain of Custody Record

Sent:

Name: Andrew Mackenzie

Signature: A Mackenzie

Date and time: 8-7-15

Received: ☐ Room temp. ☐ Chilled Temp. 5.3 °C

Name: Dow

Signature:

Date and time:

Notes:

Job No: **144 8363** Date Recv: 09-Jul-15 06:22

Received by: Jennifer Singlewood

3114483637

Results by: ☑ Email submitter: andrew.mackenzie @pdp.co.nz ☐ Mail (address below)

☑ Email other: Ba.Simkin @pdp.co.nz ☐ Fax (number below)

Priority: ☑ Normal ☐ High ☐ Urgent

Results required by: ___ / ___ / ___

Invoice to: ☑ PDP ☐ Other:

Sample ID	Sample type	No. bottles	Analyses requested	Notes
MW2 0.5	S	1	HMD CrVI	
MW7 1.0	S	1		
MW7 1.5	S	1		
TP1 4.0	S	1		
TP2 2.0	S	1		
TP3 2.0	S	2		
TP4 2.0	S	1		
MW7 5.5	S	1		
MW7 6.0	S	1		
MW7 6.5	S	1		
MW7 7.0	S	1		
MW7 7.5	S	1		
SS11 0.5	S	3		
SS16 0.3	S	3		
" " 0.5	S	1		
SS17 0.3	S			
" " 1.6	S			
SS18 0.1	S			
" " 0.3	S			
" " 0.5	S			
" " 0.7	S	↓	↓	

Sample type: S Soil GW Groundwater SAL Seawater/saline FW Freshwater LEACH Leachate GEO Geothermal

SED Sediment BIO Biota TW Tradewaste WW Wastewater P Potable Other:

Note: Samples may contain dangerous or hazardous substances

PDP Auckland
PDP House, 235 Broadway, Newmarket, Auckland
PO Box 9528, Newmarket, Auckland 1149
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auckland@pdp.co.nz

PDP Wellington
ISOFT House, Level 1, 111 Customhouse Quay, Wellington
PO Box 6136, Wellington 6141
Tel: +64 4 471 4130 | Fax: +64 4 471 4131
wellington@pdp.co.nz

PDP Christchurch
Radio NZ House, 51 Chester St West, Christchurch
PO Box 389, Christchurch 8140
Tel: +64 3 363 3100 | Fax: +64 3 363 3101
christchurch@pdp.co.nz

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Request for Analyses

NOTE: Please acknowledge receipt of these samples by signing this form and emailing to submitter.

From: Pattle Delamore Partners Ltd

Address (Refer to base of sheet): ☐ PDP Auckland ☑ PDP Wellington ☐ PDP Christchurch

Submitted by: Andrew Mackenzie Ph No.: 021 419 946

To: Hill Labs

Quote No.: _____

PDP Job No.: WE24501.00

Chain of Custody Record

Sent:

Name: Andrew Mackenzie

Signature: _____

Date and time: 6-7-12

Received: ☐ Room temp. ☐ Chilled Temp.: ____ °C

Name: _____

Signature: _____

Date and time: _____

Notes:

Samples with 1 x 2 chilly bins

Results by: ☑ Email submitter: andrew.mackenzie @pdp.co.nz ☐ Mail (address below)

☑ Email other: Bec.Simkin @pdp.co.nz ☐ Fax (number below)

Priority: ☑ Normal ☐ High ☐ Urgent

Results required by: ____ / ____ / ____

Invoice to: ☑ PDP ☐ Other:

Sample ID	Sample type	No. bottles	Analyses requested	Notes
SS210.1	S	3	Hex-D Cr7-D	
" " 0.5				
" " 1.5				
" " 3.0				
" " 3.8				
SS22 0.1				
" " 0.4				
" " 0.7				
SS24 0.1				
" " 0.3				
" " 0.8				
SS25 0.1				
" " 0.3	↓	↓	↓	

Sample type: S Soil; GW Groundwater; SAL Seawater/saline; FW Freshwater; LEACH Leachate; GEO Geothermal; SED Sediment; BIO Biota; TW Tradewaste; WW Wastewater; P Potable; Other: _____

Note: Samples may contain dangerous or hazardous substances

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wellington@pdp.co.nz

PDP Christchurch
Radio NZ House, 51 Chester St West, Christchurch
PO Box 389, Christchurch 8140
Tel: +64 3 363 3100 | Fax: +64 3 363 3101
christchurch@pdp.co.nz

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R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz

Job Information Summary

Client:	Pattle Delamore Partners Limited	**Lab No:**	1448363
Contact:	B Simkin	**Date Registered:**	09-Jul-2015 10:39 am
	C/- Pattle Delamore Partners Limited	**Priority:**	High
	PO Box 6136	**Quote No:**	
	WELLINGTON 6141	**Order No:**	
		Client Reference:	W02050100
		Add. Client Ref:	
		Submitted By:	Andy Mackenzie
		Charge To:	Pattle Delamore Partners Limited
		Target Date:	21-Jul-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	MW7 0.5	Soil	GSoil300	Hold Cold
2	MW7 1.0	Soil	GSoil300	Hold Cold
3	MW7 1.5	Soil	GSoil300	Hold Cold
4	TP11 4.0	Soil	GSoil300	Hold Cold
5	TP12 2.0	Soil	GSoil300	Hold Cold
6	TP13 2.0	Soil	GSoil300, GSoil300	Hold Cold
7	TP14 2.0	Soil	GSoil300	Hold Cold
8	MW7 5.5	Soil	GSoil300	Hold Cold
9	MW7 6.0	Soil	GSoil300	Hold Cold
10	MW7 6.5	Soil	GSoil300	Hold Cold
11	MW7 7.0	Soil	GSoil300	Hold Cold
12	MW7 7.5	Soil	GSoil300	Hold Cold
13	SS11 0.5	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
14	SS16 0.3	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
15	SS16 0.5	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
16	SS17 0.3	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
17	SS17 0.8	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
18	SS18 0.1	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
19	SS18 0.3	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
20	SS21 0.1	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
21	SS21 0.5	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
22	SS21 1.5	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
23	SS21 3.0	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
24	SS21 3.8	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
25	SS22 0.1	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
26	SS22 0.4	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
27	SS22 0.7	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
28	SS24 0.1	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
29	SS24 0.3	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
30	SS24 0.8	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
31	SS25 0.1	Soil	GSoil300, GSoil300, cPSoil250Asb	Hold Cold
32	SS25 0.3	Soil	GSoil300, GSoil300, cPSoil250Asb	Hold Cold
33	SS18 0.5	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
34	SS18 0.7	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold

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%.	-	15, 17, 22-23, 25, 27
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	15, 17, 22-23, 25, 27
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	15, 17, 22-23, 25, 27

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Pattle Delamore Partners Limited	**Lab No:**	1449288	SPv1
Contact:	B Simkin	**Date Registered:**	11-Jul-2015	
	C/- Pattle Delamore Partners Limited	**Date Reported:**	17-Jul-2015	
	PO Box 6136	**Quote No:**		
	WELLINGTON 6141	**Order No:**		
		Client Reference:	W02050100	
		Submitted By:	R Lidgard	

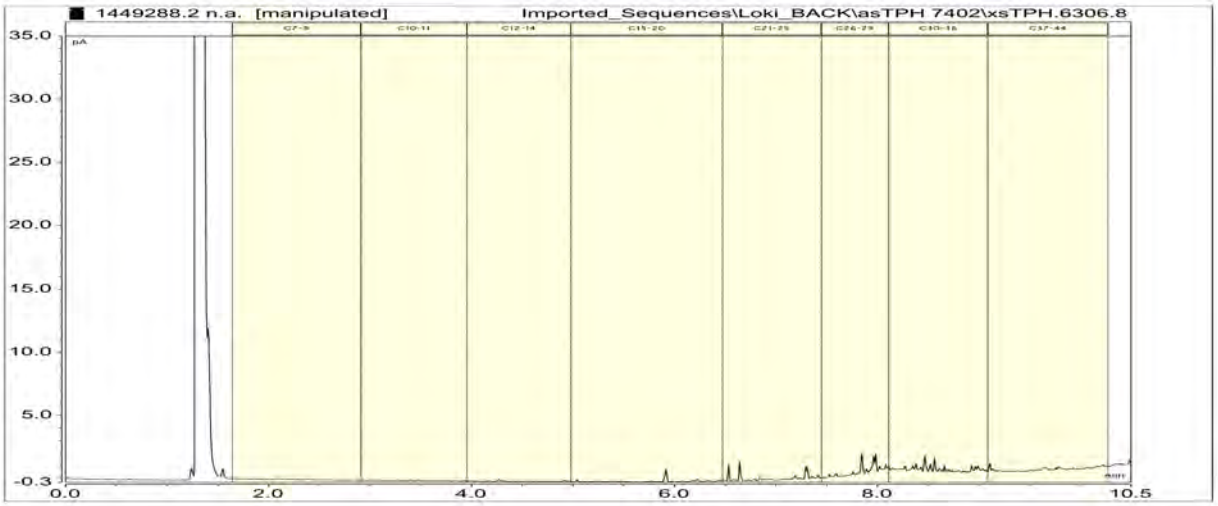
Sample Type: Soil

		Sample Name:	TP7 0.4 10-Jul-2015	TP7 2.1 10-Jul-2015	TP6 0.5 10-Jul-2015	TP6 2.0 10-Jul-2015	TP5 0.7 10-Jul-2015
		Lab Number:	1449288.1	1449288.2	1449288.3	1449288.6	1449288.7
Individual Tests							
Dry Matter	g/100g as rcvd		90	78	-	-	62
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn							
Total Recoverable Arsenic	mg/kg dry wt		< 2	-	3	< 2	5
Total Recoverable Cadmium	mg/kg dry wt		0.14	-	0.18	< 0.10	0.44
Total Recoverable Chromium	mg/kg dry wt		5	-	7	8	12
Total Recoverable Copper	mg/kg dry wt		59	-	33	15	91
Total Recoverable Lead	mg/kg dry wt		25	-	172	10.3	150
Total Recoverable Nickel	mg/kg dry wt		4	-	6	5	6
Total Recoverable Zinc	mg/kg dry wt		66	-	168	74	210
Asbestos in Soil							
As Received Weight	g		-	-	-	406.7	-
Dry Weight	g		-	-	-	370.8	-
<2mm Subsample Weight	g ashed wt		-	-	-	67.4	-
Asbestos Presence / Absence			-	-	-	Chrysotile (White Asbestos) detected.	-
Description of Asbestos Form			-	-	-	Fibre cement & loose fibres	-
Total Petroleum Hydrocarbons in Soil							
C7 - C9	mg/kg dry wt		< 8	< 9	-	-	< 11
C10 - C14	mg/kg dry wt		< 20	< 20	-	-	< 30
C15 - C36	mg/kg dry wt		< 40	108	-	-	48
Total hydrocarbons (C7 - C36)	mg/kg dry wt		< 70	108	-	-	< 80

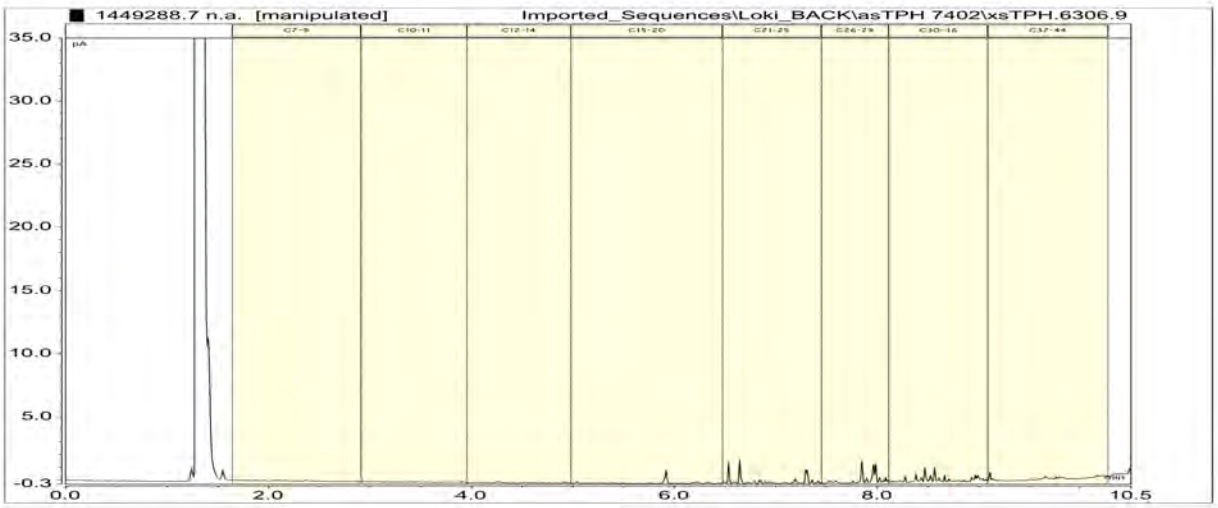
		Sample Name:	TP5 1.2 10-Jul-2015	TP3 0.6 10-Jul-2015			
		Lab Number:	1449288.8	1449288.10			
Individual Tests							
Dry Matter	g/100g as rcvd		66	84	-	-	-
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn							
Total Recoverable Arsenic	mg/kg dry wt		-	20	-	-	-
Total Recoverable Cadmium	mg/kg dry wt		-	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt		-	8	-	-	-
Total Recoverable Copper	mg/kg dry wt		-	26	-	-	-
Total Recoverable Lead	mg/kg dry wt		-	12.0	-	-	-
Total Recoverable Nickel	mg/kg dry wt		-	2	-	-	-
Total Recoverable Zinc	mg/kg dry wt		-	43	-	-	-
Total Petroleum Hydrocarbons in Soil							
C7 - C9	mg/kg dry wt		< 10	< 8	-	-	-

Sample Type: Soil						
Sample Name:		TP5 1.2 10-Jul-2015	TP3 0.6 10-Jul-2015			
Lab Number:		1449288.8	1449288.10			
Total Petroleum Hydrocarbons in Soil						
C10 - C14	mg/kg dry wt	< 20	< 20	-	-	-
C15 - C36	mg/kg dry wt	45	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	-	-	-

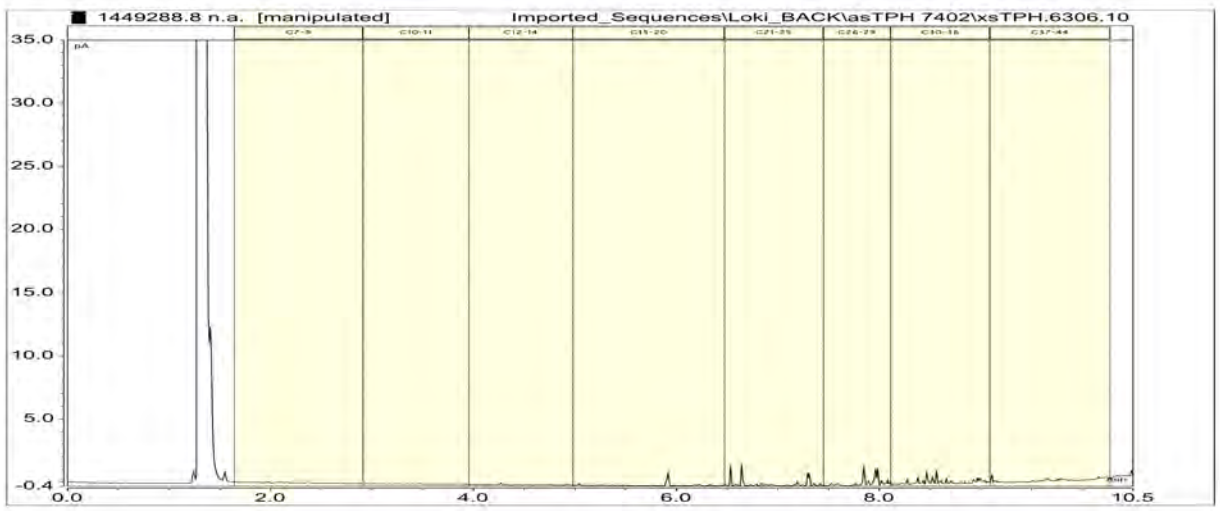
1449288.2
TP7 2.1 10-Jul-2015
Client Chromatogram for TPH by FID



1449288.7
TP5 0.7 10-Jul-2015
Client Chromatogram for TPH by FID



1449288.8
TP5 1.2 10-Jul-2015
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			
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, 6-7, 10
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1-2, 7-8, 10
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1, 3, 6-7, 10
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	1, 3, 6-7, 10
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	1-2, 7-8, 10
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	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	6
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	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.	-	6
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	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 report must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

PATTLE DELAMORE PARTNERS LTD

solutions for your environment

Request for

...se samples by signing this form and emailing to submitter.

From: Pattle Delamore Partners Ltd

Address (Refer to base of sheet): ☒ PDP Auckland ☐ PDP Wellington ☐ PDP Christchurch

Submitted by: Rod Lodge Ph No.: 021 524 963

To: Hills

Quote No.: _____

PDP Job No.: WO20501100

Chain of Custody Record

Sent:

Name: Rod

Signature: [signature]

Date and time: 10/07

Received: ☐ Room temp. ☐ Chilled Temp.: 7.2°C

Name: Daniel Watson

Signature: [signature]

Date and time: _____

Notes:

Results by: ☒ Email submitter: rod.lodge@ @pdp.co.nz ☐ Mail (address below)

☒ Email other: bo.simkin @pdp.co.nz ☐ Fax (number below)

Priority: ☐ Normal ☐ High ☐ Urgent

Results required by: ____ / ____ / ____

Invoice to: ☐ PDP ☐ Other:

Sample ID	Sample type	No. bottles	Analyses requested	Notes
TP7 0.4	S	2	HOLD UNTIL ANALYSES REQUEST	
TP7 2.1	S	2		
TP6 0.5	S	2		
TP6 1.0	S	2		
TP6 1.5	S	2		
TP6 2.0	S	2		
TP5 0.7	S	2		
TP5 1.2	S	2		
TP4 1.2	S	2		
TP3 0.6	S	2		

Sample type: S Soil GW Groundwater SAL Seawater/saline FW Freshwater LEACH Leachate GEO Geothe

SED Sediment BIO Biota TW Tradewaste WW Wastewater P Potable Other: ____

Note: Samples may contain dangerous or hazardous substances

Job No: 144928

Date Recv: 11-Jul-15 06:58

Received by: Daniel Watson

PDP Auckland
PDP House, 235 Broadway, Newmarket, Auckland
PO Box 9528, Newmarket, Auckland 1149
Tel: +64 9 523 6900 | Fax: +64 9 523 6901
auckland@pdp.co.nz

PDP Wellington
iSOFT House, Level 1, 111 Customhouse Quay, Wellington
PO Box 6136, Wellington 6141
Tel: +64 4 471 4130 | Fax: +64 4 471 4131
wellington@pdp.co.nz

PDP Christchurch
Radio NZ House, 51 Che
PO Box 389, Christchurc
Tel: +64 3 363 3100 |
christchurch@pdp.co.nz

Hill Laboratories
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R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz

Job Information Summary

Client:	Pattle Delamore Partners Limited	**Lab No:**	1449288
Contact:	B Simkin	**Date Registered:**	11-Jul-2015 10:54 am
	C/- Pattle Delamore Partners Limited	**Priority:**	High
	PO Box 6136	**Quote No:**	
	WELLINGTON 6141	**Order No:**	
		Client Reference:	W02050100
		Add. Client Ref:	
		Submitted By:	R Lidgard
		Charge To:	Pattle Delamore Partners Limited
		Target Date:	20-Jul-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	TP7 0.4 10-Jul-2015	Soil	GSoil300, GSoil30(	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Total Petroleum Hydrocarbons in Soil
2	TP7 2.1 10-Jul-2015	Soil	GSoil300, GSoil30(	Total Petroleum Hydrocarbons in Soil
3	TP6 0.5 10-Jul-2015	Soil	PSoil250Asb, GSoil300, GSoil30(	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
4	TP6 1.0 10-Jul-2015	Soil	PSoil250Asb, GSoil300, GSoil30(	Hold Cold
5	TP6 1.5 10-Jul-2015	Soil	PSoil250Asb, GSoil300, GSoil30(	Hold Cold
6	TP6 2.0 10-Jul-2015	Soil	PSoil250Asb, GSoil300, GSoil30(	Asbestos in Soil; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
7	TP5 0.7 10-Jul-2015	Soil	GSoil300, GSoil30(	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Total Petroleum Hydrocarbons in Soil
8	TP5 1.2 10-Jul-2015	Soil	GSoil300, GSoil30(	Total Petroleum Hydrocarbons in Soil
9	TP4 1.2 10-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
10	TP3 0.6 10-Jul-2015	Soil	GSoil300, GSoil30(	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Total Petroleum Hydrocarbons in Soil
11	TP2 0.5 10-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
12	TP6 1.5 [Misc] 10-Jul-2015	Miscellaneous	cpBag	Hold Cold

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%.	-	1, 3, 6-7, 10
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1-2, 7-8, 10
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1, 3, 6-7, 10
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	1, 3, 6-7, 10
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	1-2, 7-8, 10
Asbestos in Soil			

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	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	6
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	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.	-	6
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	6

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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:	Pattle Delamore Partners Limited	**Lab No:**	1449293	SPv1
Contact:	B Simkin	**Date Registered:**	11-Jul-2015	
	C/- Pattle Delamore Partners Limited	**Date Reported:**	17-Jul-2015	
	PO Box 6136	**Quote No:**		
	WELLINGTON 6141	**Order No:**		
		Client Reference:	WO2050100	
		Submitted By:	Andy Mackenzie	

Sample Type: Soil

		Sample Name:	SS12 0.1m 09-Jul-2015	SS13 0.4m 09-Jul-2015	SS34 1.5m 09-Jul-2015		
		Lab Number:	1449293.1	1449293.4	1449293.11		
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn							
Total Recoverable Arsenic	mg/kg dry wt		< 2	2	2	-	-
Total Recoverable Cadmium	mg/kg dry wt		0.16	0.13	0.12	-	-
Total Recoverable Chromium	mg/kg dry wt		10	9	10	-	-
Total Recoverable Copper	mg/kg dry wt		33	26	35	-	-
Total Recoverable Lead	mg/kg dry wt		111	61	67	-	-
Total Recoverable Nickel	mg/kg dry wt		5	5	5	-	-
Total Recoverable Zinc	mg/kg dry wt		98	111	152	-	-

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, 4, 11
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	1, 4, 11
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1, 4, 11

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

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

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

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solutions for your environment

Request for Analyses

NOTE: Please acknowledge receipt of these samples by signing this form and emailing to submitter.

From: Pattle Delamore Partners Ltd

Address (Refer to base of sheet): ☐ PDP Auckland ☑ PDP Wellington ☐ PDP Christchurch

Submitted by: Andrew Mackenzie Ph No.: 021 619 946

To: Hill Laboratories

Quote No.:

PDP Job No.: W10250.00

Chain of Custody Record

Sent:

Name: Andrew Mackenzie

Signature: A Mackenzie

Date and time: 10-7-15

Received: ☐ Room temp. ☐ Chilled Temp.: 2.5 °C

Name: Kay Pridmore

Signature:

Date and time:

Notes:

Results by: ☑ Email submitter Andrew.Mackenzie @pdp.co.nz ☑ Mail (address below)

☑ Email other: Co.Courtesy @pdp.co.nz ☐ Fax (number below)

Priority: ☐ Normal ☐ High ☐ Urgent

Results required by: ___ / ___ / ___

Invoice to: ☑ PDP ☐ Other:

Sample ID	Sample type	No. bottles	Analyses Requested	Notes
SS12 0.1	S	2	HOLD COLD	
" " 0.5	S	3		
SS13 0.1	S	3		
" " 0.4	S	3		
" " 0.7	S	2		
SS31 0.1	S	3		
SS31 0.5	S	3		
SS34 0.1	S	3		
" " 0.3	S	3		
" " 0.6	S	3		
" " 1.5	S	3		
SS33 0.6	S	3		

Sample type: S Soil GW Groundwater SAL Seawater/saline FW Freshwater LEACH Leachate GEO Geotherm

SED Sediment BIO Biota TW Tradewaste WW Wastewater P Potable Other:

Note: Samples may contain dangerous or hazardous substances

Job No: 14 9293

Date Recv: 11-Jul-15 06:58

Received by: Daniel Watson

PDP Auckland
House, 235 Broadway, Newmarket, Auckland
Box 9528, Newmarket, Auckland 1149
+64 9 523 6900 | Fax: +64 9 523 6901
kland@pdp.co.nz

PDP Wellington
CSC House, Level 1, 111 Customhouse Quay, Wellington
PO Box 6136, Wellington 6141
Tel: +64 4 471 4130 | Fax: +64 4 471 4131
wellington@pdp.co.nz

PDP Christchurch
295 Blenheim Road, Upper R
PO Box 389, Christchurch 8.
Tel: +64 3 345 7100 | Fax: +64 3 345 7101
christchurch@pdp.co.nz

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1 Clyde Street
Private Bag 3205

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web

Job Information Summary

Client:	Pattle Delamore Partners Limited	**Lab No:**	1449293
Contact:	B Simkin	**Date Registered:**	11-Jul-2015 10:45 am
	C/- Pattle Delamore Partners Limited	**Priority:**	High
	PO Box 6136	**Quote No:**	
	WELLINGTON 6141	**Order No:**	
		Client Reference:	WO2050100
		Add. Client Ref:	
		Submitted By:	Andy Mackenzie
		Charge To:	Pattle Delamore Partners Limited
		Target Date:	20-Jul-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	SS12 0.1m 09-Jul-2015	Soil	GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
2	SS12 0.5m 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
3	SS13 0.1m 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
4	SS13 0.4m 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
5	SS13 0.7m 09-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
6	SS31 0.1m 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
7	SS31 0.5m 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
8	SS34 0.1m 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
9	SS34 0.3m 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
10	SS34 0.6m 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
11	SS34 1.5m 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
12	SS33 0.6m 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold

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, 4, 11
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	1, 4, 11
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1, 4, 11

Hill Laboratories
BETTER TESTING BETTER RESULTS

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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:	Pattle Delamore Partners Limited	**Lab No:**	1449302	SPv2
Contact:	R Lidgard	**Date Registered:**	11-Jul-2015	
	C/- Pattle Delamore Partners Limited	**Date Reported:**	23-Jul-2015	
	PO Box 9528	**Quote No:**		
	Newmarket	**Order No:**		
	AUCKLAND 1149	**Client Reference:**	W02050100	
		Submitted By:	B Simkin	

Amended Report

This report replaces an earlier report issued on the 17 Jul 2015 at 3:10 pm
Asbestos analysis added to sample SS23 0.3, as per clients request.

Sample Type: Soil

		Sample Name:	SS23 0.1 09-Jul-2015	SS23 0.3 09-Jul-2015	SS28 0.4 09-Jul-2015		
		Lab Number:	1449302.4	1449302.5	1449302.7		
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn							
Total Recoverable Arsenic	mg/kg dry wt		< 2	-	2	-	-
Total Recoverable Cadmium	mg/kg dry wt		0.31	-	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt		8	-	10	-	-
Total Recoverable Copper	mg/kg dry wt		17	-	16	-	-
Total Recoverable Lead	mg/kg dry wt		51	-	8.6	-	-
Total Recoverable Nickel	mg/kg dry wt		5	-	5	-	-
Total Recoverable Zinc	mg/kg dry wt		270	-	80	-	-
Asbestos in Soil							
As Received Weight	g		-	365.5	-	-	-
Dry Weight	g		-	319.7	-	-	-
<2mm Subsample Weight	g ashed wt		-	65.4	-	-	-
Asbestos Presence / Absence			-	Asbestos NOT detected.	-	-	-
Description of Asbestos Form			-	-	-	-	-

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%.	-	4, 7
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	4, 7
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	4, 7
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	5
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	5
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	5

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.	-	5
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	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.

Peter Robinson MSc (Hons), PhD, FNZIC
Client Services Manager - Environmental Division

PATTLE DELAMORE PARTNERS LTD

solutions for your environment

Request for Analyses

NOTE of the form 144 9302 Received by: Daniel Watson

From: Pattle Delamore Partners Ltd

Address (Refer to base of sheet): ☒ PDP Auckland ☒ PDP Wellington ☐ PDP Christchurch

Submitted by: ROD LANEY Ph No.: 021 524 962

To: HILLS

3114493020

Quote No.:

PDP Job No.: WD20501001

Chain of Custody Record

Sent:

Name: ROD LANEY

Signature:

Date and time: 10/07 AM

Received: ☐ Room temp. ☐ Chilled Temp.:___°C

Name: Katie Taylor

Signature:

Date and time:

Notes:

Results by: ☒ Email submitter: rod.laney @pdp.co.nz ☐ Mail (address below)

☒ Email other: M. Simkin @pdp.co.nz ☐ Fax (number below)

Priority: ☐ Normal ☒ High ☐ Urgent

Results required by: ___/___/___

Invoice to: ☒ PDP ☐ Other:

Sample ID	Sample type	No. bottles	Analyses requested	Notes
MW2 0-5	S	1		
MW2 1-3	S	1		
MW3 1-3	S	1		
SS23 0-1	S	3		
SS23 0-3	S	3		
SS23 0-6	S	3		
SS28 0-4	S	3	HOLD UNTIL ANALYSES REQUESTED	
SS25 0-1	S	3		
SS28 0-6	S	3		
SS27 0-1	S	3		
SS27 0-5	S	3		
SS26 0-3	S	3		
SS26 0-1	S	3		
SS26 0-5	S	3		

Temperature On Arrival

3.6 °C

Temperature was measured on arbitrarily chosen samples in this batch. The Microbiology sample temperature will be recorded at Melville Lab before testing.

Sample type: S Soil GW Groundwater SAL Seawater/saline FW Freshwater LEACH Leachate GEO Geo

SED Sediment BIO Biota TW Tradewaste WW Wastewater P Potable Other:

Note: Samples may contain dangerous or hazardous substances

PDP Christchurch

144 9302 Received by: Daniel Watson

3114493020

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

Job Information Summary

Client:	Pattle Delamore Partners Limited	**Lab No:**	1449302
Contact:	R Lidgard	**Date Registered:**	11-Jul-2015 10:35 am
	C/- Pattle Delamore Partners Limited	**Priority:**	High
	PO Box 9528	**Quote No:**	
	Newmarket	**Order No:**	
	AUCKLAND 1149	**Client Reference:**	W02050100
		Add. Client Ref:	
		Submitted By:	B Simkin
		Charge To:	Pattle Delamore Partners Limited
		Target Date:	20-Jul-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	MW8 0.5 09-Jul-2015	Soil	GSoil300	Hold Cold
2	MW8 1.0 09-Jul-2015	Soil	GSoil300	Hold Cold
3	MW8 1.5 09-Jul-2015	Soil	GSoil300	Hold Cold
4	SS23 0.1 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
5	SS23 0.3 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Asbestos in Soil
6	SS23 0.6 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
7	SS28 0.4 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
8	SS28 0.1 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
9	SS28 0.6 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
10	SS27 0.1 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
11	SS27 0.5 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
12	SS26 0.8 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
13	SS26 0.1 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
14	SS26 0.5 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold

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			

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%.	-	4, 7
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	4, 7
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	4, 7
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	5
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	5
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	5
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.	-	5
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	5

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Hamilton 3240, New Zealand

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Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Pattle Delamore Partners Limited	**Lab No:**	1449304 SPv2
Contact:	B Simkin	**Date Registered:**	11-Jul-2015
	C/- Pattle Delamore Partners Limited	**Date Reported:**	30-Sep-2015
	PO Box 6136	**Quote No:**	
	WELLINGTON 6141	**Order No:**	
		Client Reference:	W02050700
		Submitted By:	Andrew Mackenzie

Amended Report

This report replaces an earlier report issued on the 20 Jul 2015 at 4:27 pm
TCLP copper, lead and zinc analysis added to samples SS20 0.2, SS29 0.1 and SS33 0.4, as per clients request.

Sample Type: Soil

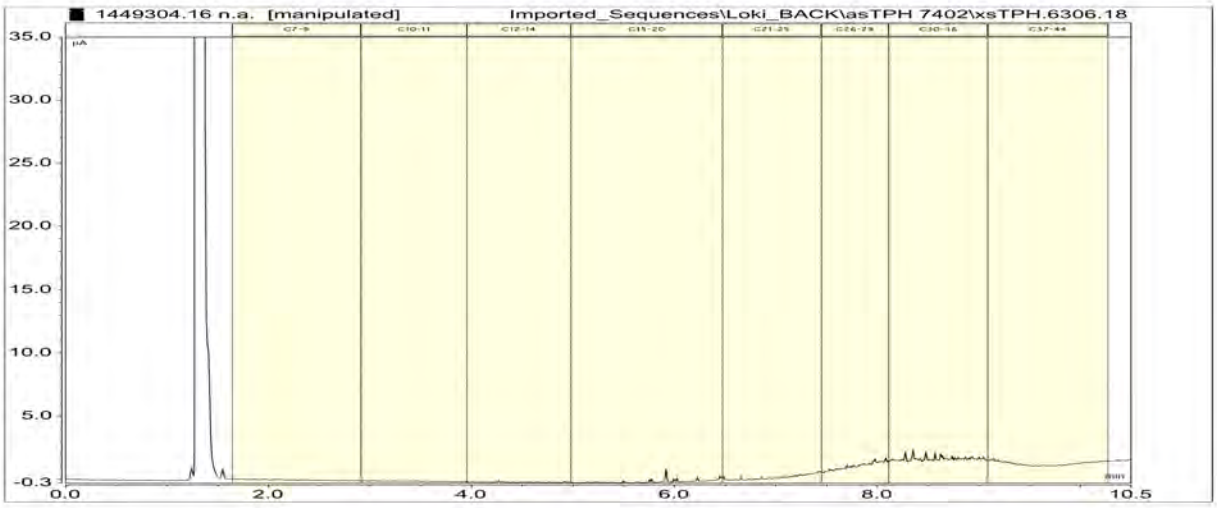
Sample Name:		SS19 0.1 09-Jul-2015	SS19 0.3 09-Jul-2015	SS20 0.2 09-Jul-2015	SS20A 0.1 09-Jul-2015	SS20A 0.3 09-Jul-2015
Lab Number:		1449304.1	1449304.2	1449304.4	1449304.7	1449304.8
Individual Tests						
TCLP Weight of Sample Taken	g	-	-	100	-	-
TCLP Initial Sample pH	pH Units	-	-	6.8	-	-
TCLP Acid Adjusted Sample pH	pH Units	-	-	1.6	-	-
TCLP Extractant Type*		-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-
TCLP Extraction Fluid pH	pH Units	-	-	5.0	-	-
TCLP Post Extraction Sample pH	pH Units	-	-	5.0	-	-
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	5	< 2	6	6	2
Total Recoverable Cadmium	mg/kg dry wt	0.48	0.14	0.97	1.06	0.10
Total Recoverable Chromium	mg/kg dry wt	11	5	13	13	9
Total Recoverable Copper	mg/kg dry wt	116	17	390	370	52
Total Recoverable Lead	mg/kg dry wt	200	36	420	280	240
Total Recoverable Nickel	mg/kg dry wt	7	3	119	19	8
Total Recoverable Zinc	mg/kg dry wt	260	123	580	520	111
Asbestos in Soil						
As Received Weight	g	-	378.3	-	-	282.7
Dry Weight	g	-	330.3	-	-	193.2
<2mm Subsample Weight	g ashed wt	-	66.1	-	-	63.2
Asbestos Presence / Absence		-	Asbestos NOT detected.	-	-	Chrysotile (White Asbestos) detected.
Description of Asbestos Form		-	-	-	-	ACM Debris & Loose Fibres

Sample Name:		SS29 0.1 09-Jul-2015	SS30 0.1 09-Jul-2015	SS33 0.4 09-Jul-2015	TP2 0.6 09-Jul-2015	TP1 0.7 09-Jul-2015
Lab Number:		1449304.10	1449304.12	1449304.15	1449304.16	1449304.17
Individual Tests						
Dry Matter	g/100g as rcvd	-	-	-	76	-
TCLP Weight of Sample Taken	g	100	-	100	-	-
TCLP Initial Sample pH	pH Units	6.7	-	6.5	-	-
TCLP Acid Adjusted Sample pH	pH Units	1.6	-	1.7	-	-
TCLP Extractant Type*		NaOH/Acetic acid at pH 4.93 +/- 0.05	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-
TCLP Extraction Fluid pH	pH Units	5.0	-	5.0	-	-
TCLP Post Extraction Sample pH	pH Units	5.0	-	5.0	-	-

Sample Type: Soil						
Sample Name:		SS29 0.1 09-Jul-2015	SS30 0.1 09-Jul-2015	SS33 0.4 09-Jul-2015	TP2 0.6 09-Jul-2015	TP1 0.7 09-Jul-2015
Lab Number:		1449304.10	1449304.12	1449304.15	1449304.16	1449304.17
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	31	3	8	-	7
Total Recoverable Cadmium	mg/kg dry wt	1.16	0.26	0.37	-	0.25
Total Recoverable Chromium	mg/kg dry wt	37	13	13	-	13
Total Recoverable Copper	mg/kg dry wt	1,230	199	94	-	106
Total Recoverable Lead	mg/kg dry wt	320	230	450	-	77
Total Recoverable Nickel	mg/kg dry wt	60	9	6	-	6
Total Recoverable Zinc	mg/kg dry wt	620	240	260	-	118
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	-	-	-	210	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	-	210	-

Sample Type: Aqueous						
Sample Name:		SS20 0.2 [TCLP Extract]	SS29 0.1 [TCLP Extract]	SS33 0.4 [TCLP Extract]		
Lab Number:		1449304.19	1449304.20	1449304.21		
Individual Tests						
Total Copper	g/m^3	0.89	0.035	0.020	-	-
Total Lead	g/m^3	0.83	1.29	0.189	-	-
Total Zinc	g/m^3	9.6	0.47	1.32	-	-

1449304.16
TP2 0.6 09-Jul-2015
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			
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, 4, 7-8, 10, 12, 15, 17
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-2, 4, 7-8, 10, 12, 15, 17

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	1-2, 4, 7-8, 10, 12, 15, 17
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	16
TCLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1311	-	4, 10, 15
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2, 8
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, 8
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	2, 8
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, 8
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	2, 8
TCLP Profile			
TCLP Weight of Sample Taken	Gravimetric. US EPA 1311.	0.1 g	4, 10, 15
TCLP Initial Sample pH	pH meter. US EPA 1311.	0.1 pH Units	4, 10, 15
TCLP Acid Adjusted Sample pH	pH meter. US EPA 1311.	0.1 pH Units	4, 10, 15
TCLP Extractant Type*	US EPA 1311.	-	4, 10, 15
TCLP Extraction Fluid pH	pH meter. US EPA 1311.	0.1 pH Units	4, 10, 15
TCLP Post Extraction Sample pH	pH meter. US EPA 1311.	0.1 pH Units	4, 10, 15

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	19-21
Total Copper	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.011 g/m^3	19-21
Total Lead	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0021 g/m^3	19-21
Total Zinc	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.021 g/m^3	19-21

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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

PATTLE DELAMORE PARTNERS LTD

solutions for your environment

Request for Analyses

NOTE: Please acknowledge receipt of these samples by signing this form and emailing to submitter.

From: Pattle Delamore Partners Ltd

Address (Refer to base of sheet): ☐ PDP Auckland ☑ PDP Wellington ☐ PDP Christchurch

Submitted by: Andrew Mackenzie Ph No.: 021419946

To: Hill Labs

Quote No.:

PDP Job No.: WOW30700

Chain of Custody Record

Sent:

Name: Andrew Mackenzie

Signature: AMackenzie

Date and time: 10-7-15

Received: ☐ Room temp. ☐ Chilled Temp.: 2 °C

Name: Viloo Vaddar

Signature:

Date and time:

Notes: Samples within 2 chilly bins

Results by: ☑ Email submitter: andrew.mackenzie@pdp.co.nz ☑ Mail (address below)

☑ Email other: Bo.Simkin@pdp.co.nz ☐ Fax (number below)

Priority: ☑ Normal ☐ High ☐ Urgent

Results required by: ____ / ____ / ____

Invoice to: ☑ PDP ☐ Other:

Sample ID	Sample type	No. bottles	Analyses requested	Notes
SS19 0.1	S	3	HOLD COLD	
SS19 0.3	S	3		
SS19 0.6	S	3		
SS20 0.2	S	3		
SS20 1.0	S	3		
SS20 1.3	S	3		
SS20A 0.1	S	3		
SS20A 0.5	S	3		
SS20A 0.6	S	3		
SS29 0.1	S	3		
SS29 0.5	S	3		
SS30 0.1	S	3		
SS30 0.5	S	3		
SS33 0.1	S	3		
SS33 0.4	S	3		
TP2 0.6	S	1		
TP1 0.5	S	2		
TP1 1.3	S	2		

Sample type: S Soil; GW Groundwater; SAL Seawater/saline; FW Freshwater; LEACH Leachate; GEO Geoth; SED Sediment; BIO Biota; TW Tradewaste; WW Wastewater; P Potable; Other:

Note: Samples may contain dangerous or hazardous substances

Job No: 144304

Date Recv: 11-Jul-15 08:58

Received by: Daniel Watson

PDP Auckland
House, 235 Broadway, Newmarket, Auckland
9528, Newmarket, Auckland 1149
9 523 6900 | Fax: +64 9 523 6901
@pdp.co.nz

PDP Wellington
iSOFT House, Level 1, 111 Customhouse Quay, Wellington
PO Box 6136, Wellington 6141
Tel: +64 4 471 4130 | Fax: +64 4 471 4131
wellington@pdp.co.nz

PDP Christchurch
Radio NZ House, 51 Che
PO Box 389, Christchurch
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christchurch@pdp.co.nz

Hill Laboratories
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1 Clyde Street
Private Bag 3205

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Fax +64 7 858 2001
Email mail@hill-labs.co.nz

Job Information Summary

Client:	Pattle Delamore Partners Limited	**Lab No:**	1449304
Contact:	B Simkin	**Date Registered:**	11-Jul-2015 10:32 am
	C/- Pattle Delamore Partners Limited	**Priority:**	High
	PO Box 6136	**Quote No:**	
	WELLINGTON 6141	**Order No:**	
		Client Reference:	W02050700
		Add. Client Ref:	
		Submitted By:	Andy Mackenzie
		Charge To:	Pattle Delamore Partners Limited
		Target Date:	20-Jul-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	SS19 0.1 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
2	SS19 0.3 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Asbestos in Soil; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
3	SS19 0.6 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
4	SS20 0.2 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
5	SS20 1.0 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
6	SS20 1.8 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
7	SS20A 0.1 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
8	SS20A 0.3 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Asbestos in Soil; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
9	SS20A 0.6 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
10	SS29 0.1 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
11	SS29 0.5 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
12	SS30 0.1 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
13	SS30 0.5 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
14	SS33 0.1 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Hold Cold
15	SS33 0.4 09-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
16	TP2 0.6 09-Jul-2015	Soil	GSoil300	Total Petroleum Hydrocarbons in Soil
17	TP1 0.7 09-Jul-2015	Soil	GSoil300, GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
18	TP1 1.3 09-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold

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%.	-	1-2, 4, 7-8, 10, 12, 15, 17
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-2, 4, 7-8, 10, 12, 15, 17
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	1-2, 4, 7-8, 10, 12, 15, 17
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	16
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	2, 8
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, 8
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	2, 8
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, 8
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	2, 8

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Hamilton 3240, New Zealand

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Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Pattle Delamore Partners Limited	**Lab No:**	1451328	SPv1
Contact:	B Simkin	**Date Registered:**	17-Jul-2015	
	C/- Pattle Delamore Partners Limited	**Date Reported:**	22-Jul-2015	
	PO Box 6136	**Quote No:**	70150	
	WELLINGTON 6141	**Order No:**	W02050100	
		Client Reference:	W02050100	
		Submitted By:	Andy Mackenzie	

Sample Type: Aqueous

Sample Name:		MW2	MW3	MW4	MW5	MW7
Lab Number:		1451328.1	1451328.2	1451328.3	1451328.4	1451328.5
BTEX in Water by Headspace GC-MS						
Benzene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m³	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m³	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36	g/m³	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

Sample Name:		MW8	MW9	MW10	MW6A	MW11
Lab Number:		1451328.6	1451328.7	1451328.8	1451328.10	1451328.11
Individual Tests						
Total Ammoniacal-N	g/m³	-	-	-	< 0.010	-
Nitrite-N	g/m³	-	-	-	< 0.002	-
Nitrate-N	g/m³	-	-	-	3.1	-
Nitrate-N + Nitrite-N	g/m³	-	-	-	3.1	-
BTEX in Water by Headspace GC-MS						
Benzene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m³	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Formaldehyde in Water by DNPH & LCMSMS						
Formaldehyde	g/m³	-	-	-	< 0.02	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.10	< 0.3	< 0.15	< 0.10	< 0.10
C10 - C14	g/m³	< 0.2	< 0.7	< 0.4	< 0.2	< 0.2
C15 - C36	g/m³	< 0.4	< 1.4	< 0.8	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 3	< 1.4	< 0.7	< 0.7

Sample Name:		MW1				
Lab Number:		1451328.12				
Individual Tests						
Total Ammoniacal-N	g/m³	0.29	-	-	-	-
Nitrite-N	g/m³	0.009	-	-	-	-
Nitrate-N	g/m³	0.23	-	-	-	-

Sample Type: Aqueous						
Sample Name:		MW1				
Lab Number:		1451328.12				
Individual Tests						
Nitrate-N + Nitrite-N	g/m³	0.23	-	-	-	-
BTEX in Water by Headspace GC-MS						
Benzene	g/m³	< 0.0010	-	-	-	-
Toluene	g/m³	< 0.0010	-	-	-	-
Ethylbenzene	g/m³	< 0.0010	-	-	-	-
m&p-Xylene	g/m³	< 0.002	-	-	-	-
o-Xylene	g/m³	< 0.0010	-	-	-	-
Formaldehyde in Water by DNPH & LCMSMS						
Formaldehyde	g/m³	< 0.02	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.10	-	-	-	-
C10 - C14	g/m³	< 0.2	-	-	-	-
C15 - C36	g/m³	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	-	-	-	-

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**
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m³	1-8, 10-12
Formaldehyde in Water by DNPH & LCMSMS	DNPH derivatisation, extraction, LCMSMS	0.02 g/m³	10, 12
Total Petroleum Hydrocarbons in Water	Hexane extraction, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734]	0.10 - 0.7 g/m³	1-8, 10-12
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	10, 12
Total Ammoniacal-N	Filtered sample. Phenol/hypochlorite colorimetry. Discrete Analyser. (NH_4-N = NH_4+-N + NH_3-N). APHA 4500-NH_3 F (modified from manual analysis) 22nd ed. 2012.	0.010 g/m³	10, 12
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I 22nd ed. 2012 (modified).	0.002 g/m³	10, 12
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	10, 12
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I 22nd ed. 2012 (modified).	0.002 g/m³	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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

Request for Analyses

pdp — PATTLE DELAMORE PARTNERS LTD

NOTE: Please acknowledge receipt of these samples by signing this form and emailing to submitter.

From: Pattle Delamore Partners Ltd — **To:**

Address (Refer to base of sheet): ☐ PDP Auckland ☐ PDP Wellington ☐ PDP Christchurch — Quote No.:

Submitted by: — PI No.: — PDP Job No.:

Chain of Custody Record

Sent:	Received: ☐ Room temp ☐ Chilled Temp.: °C	Notes:
Name:	Name:	
Signature:	Signature:	
Date and time:	Date and time:	

Results by: ☐ Email submitter: @pdp.co.nz ☐ Mail (address below)
☐ Email other: @pdp.co.nz ☐ Fax (number below)

Priority: ☐ Normal ☐ High ☐ Urgent
Results required by: / /

Invoice to: ☐ PDP ☐ Other:

Sample ID	Sample type	No. bottles	Analyses Requested	Notes
MW2	GW	3	TPH BTEX	
MW 5				
MW4				
MW 6				
MW 7				
MW 8				
MW 9				
MW 10		4		
MW-6		6	Metals (As)	
MW 6A				
MW 11	SW			
MW 12				

Sample type: A Air SAL Seawater/saline FW Freshwater LEACH Leachate GEO Geothermal
TW Tradewaste WW Wastewater P Potable Other:

Received by Jennifer Singlewood

Samples may contain dangerous or hazardous substances

PDP Auckland
PDP House, 2
PO Box 9528,
Tel: +64 9 523 6900 | Fax: +64 9 523 6901
auckland@pdp.co.nz

PDP Wellington
IC House, Level 1, 111 Customhouse Quay, Wellington
) Box 6136, Wellington 6141
Tel: +64 4 471 4130 | Fax: +64 4 471 4131
wellington@pdp.co.nz

PDP Christchurch
295 Blenheim Road, Upper Riccarton, Christchurch 8
PO Box 389, Christchurch 8140
Tel: +64 3 345 7100 | Fax: +64 3 345 7101
christchurch@pdp.co.nz

145 1328

Date Rev 17-Jul-15 05-28

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CHAIN OF CUSTODY / SAMPLE SUBMISSION

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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

Client
Name: Pattle Delamore Partners Limited 20755
Address: PO Box 6136, WELLINGTON 6141

Phone: 04 471 4130 Fax: 04 471 4131
Client Reference:
Quote No: 70150 Order No:

Primary Contact Andy Mackenzie 198611
Submitted By Andy Mackenzie 198611
Charge To Pattle Delamore Partners Limited 20755

Results To ☐ Mail Primary Contact ☐ Mail Submitter
☐ Fax Results
☐ Email Results

Office use Job No:

Sent to Hill Laboratories
☐ Please tick if you require COC to be emailed back
Date & Time:
Name:
Signature:

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen
Temp:

☐ Sample & Analysis details checked
Signature:

Priority ☐ Low ☐ Normal ☑ High
☐ **Urgent** (ASAP, extra charge applies, please contact lab first)
NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

Quoted Sample Types
Requested Reporting Date:

Ground Water (GW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

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1 Clyde Street
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Job Information Summary

Client:	Pattle Delamore Partners Limited	**Lab No:**	1451328
Contact:	B Simkin	**Date Registered:**	17-Jul-2015 10:54 am
	C/- Pattle Delamore Partners Limited	**Priority:**	High
	PO Box 6136	**Quote No:**	70150
	WELLINGTON 6141	**Order No:**	W02050100
		Client Reference:	W02050100
		Add. Client Ref:	
		Submitted By:	Andy Mackenzie
		Charge To:	Pattle Delamore Partners Limited
		Target Date:	24-Jul-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	MW2	Ground Water	TPH250, VOC40, VOC40	TPH + BTEX profile, Water
2	MW3	Ground Water	cTPH250, VOC40, VOC40	TPH + BTEX profile, Water
3	MW4	Ground Water	TPH250, VOC40, VOC40	TPH + BTEX profile, Water
4	MW5	Ground Water	TPH250, VOC40, VOC40	TPH + BTEX profile, Water
5	MW7	Ground Water	TPH250, VOC40, VOC40	TPH + BTEX profile, Water
6	MW8	Ground Water	TPH250, VOC40, VOC40	TPH + BTEX profile, Water
7	MW9	Ground Water	TPH250, VOC40, VOC40	TPH + BTEX profile, Water
8	MW10	Ground Water	TPH250, VOC40, VOC40	TPH + BTEX profile, Water
9	MW6	Ground Water	Org500, TPH250, UP250, FN100, VOC40, VOC40	Hold Cold
10	MW6A	Ground Water	Org500, TPH250, UP250, FN100, VOC40	Nitrate-N; Total Ammoniacal-N; Formaldehyde in Water by DNPH & LCMSMS; TPH + BTEX profile, Water
11	MW11	Ground Water	Org500, cTPH250, UP250, FN100, VOC40	TPH + BTEX profile, Water
12	MW1	Ground Water	Org500, TPH250, UP250, FN100, VOC40, VOC40	Nitrate-N; Total Ammoniacal-N; Formaldehyde in Water by DNPH & LCMSMS; TPH + BTEX profile, Water

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
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m^3	1-8, 10-12
Formaldehyde in Water by DNPH & LCMSMS	DNPH derivatisation, extraction, LCMSMS	0.02 g/m^3	10, 12
Total Petroleum Hydrocarbons in Water	Hexane extraction, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734]	0.10 - 0.7 g/m^3	1-8, 10-12
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	10, 12
Total Ammoniacal-N	Filtered sample. Phenol/hypochlorite colorimetry. Discrete Analyser. (NH_4-N = NH_4+-N + NH_3-N). APHA 4500-NH_3 F (modified from manual analysis) 22nd ed. 2012.	0.010 g/m^3	10, 12

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I 22nd ed. 2012 (modified).	0.002 g/m³	10, 12
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	10, 12
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I 22nd ed. 2012 (modified).	0.002 g/m³	10, 12

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ANALYSIS REPORT

Client:	Pattle Delamore Partners Limited	**Lab No:**	1451861	A2Pv1
Contact:	B Simkin	**Date Registered:**	17-Jul-2015	
	C/- Pattle Delamore Partners Limited	**Date Reported:**	20-Jul-2015	
	PO Box 6136	**Quote No:**	60811	
	WELLINGTON 6141	**Order No:**		
		Client Reference:	W02050100	
		Submitted By:	R Lidgard	

Sample Type: Building Material

Sample Name	Lab Number	Sample Category	Sample size (weight or dimensions)	Asbestos Presence / Absence
TP6 1.5	1451861.1	Fibre Cement #1	256.98	Chrysotile (White Asbestos) detected.

Analyst's Comments

#1 Sample bag contained 2 x fibre cement fragments and 1 x roofing slate/tile (non-asbestos).

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: Building Material

Test	Method Description	Default Detection Limit	Sample No
Asbestos in Bulk Material			
Sample Category	Assessment of sample type.	-	1
Sample size (weight or dimensions)	Sample size. Weight or size as appropriate.	-	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

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.

Rhodri Williams BSc (Hons)
Asbestos Section Manager

Job No: Date Recv: 17-Jul-15 14:48

145 1861

Received by: Melody Walker

Request ...

...e samples by signing this form and emailing to submitter.

...s Ltd

☒ PDP Auckland ☐ PDP Wellington ☐ PDP Christchurch

To: HAILS

Quote No.:

Submitted by: ROD LIDGARD Ph No.: 021 524 968

PDP Job No.: LW02050100

Chain of Custody Record

Sent:	Received: ☐ Room temp. ☐ Chilled Temp.: 7.4°C	Notes:
Name: ROD	Name: Daniel Watson	
Signature:	Signature:	
Date and time: 10/07	Date and time:	

Results by: ☒ Email submitter: rod.lidgard @pdp.co.nz ☐ Mail (address below)

☒ Email other: ka simkin @pdp.co.nz ☐ Fax (number below)

Priority: ☐ Normal ☐ High ☐ Urgent

Results required by: ____ / ____ / ____

Invoice to: ☐ PDP ☐ Other:

Sample ID	Sample type	No. bottles	Analyses requested	Notes
TP7 0.4	S	2	HOLD UNTIL ANALYSES REQUEST	
TP7 2.1	S	2		
TP6 0.5	S	2		
TP6 1.0	S	2		
TP6 1.5	S	2		
TP6 2.0	S	2		
TP5 0.7	S	2		
TP5 1.2	S	2		
TP4 1.2	S	2		
TP3 0.6	S	2		

Sample type: S Soil GW Groundwater SAL Seawater/saline FW Freshwater LEACH Leachate GEO Geothe

SED Sediment BIO Biota TW Tradewaste WW Wastewater P Potable Other:

Note: Samples may contain dangerous or hazardous substances

PDP Auckland
PDP House, 235 Broadway, Newmarket, Auckland
PO Box 9528, Newmarket, Auckland 1149
Tel: +64 9 523 6900 | Fax: +64 9 523 6901
auckland@pdp.co.nz

PDP Wellington
iSOFT House, Level 1, 111 Customhouse Quay, Wellington
PO Box 6136, Wellington 6141
Tel: +64 4 471 4130 | Fax: +64 4 471 4131
wellington@pdp.co.nz

PDP Christchurch
Radio NZ House, 51 Che
PO Box 389, Christchurc
Tel: +64 3 363 3100 |
christchurch@pdp.co.nz

Job No: 144 9288 Date Recv: 11-Jul-15 06:58

Received by: Daniel Watson

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Job Information Summary

Client:	Pattle Delamore Partners Limited	**Lab No:**	1451861
Contact:	B Simkin	**Date Registered:**	17-Jul-2015 2:51 pm
	C/- Pattle Delamore Partners Limited	**Priority:**	High
	PO Box 6136	**Quote No:**	
	WELLINGTON 6141	**Order No:**	
		Client Reference:	W02050100
		Add. Client Ref:	
		Submitted By:	R Lidgard
		Charge To:	Pattle Delamore Partners Limited
		Target Date:	21-Jul-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	TP6 1.5 10-Jul-2015	Building Material	ClientsAS	Hold

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ANALYSIS REPORT

Client:	Pattle Delamore Partners Limited	**Lab No:**	1452027	SPv3
Contact:	B Simkin	**Date Registered:**	18-Jul-2015	
	C/- Pattle Delamore Partners Limited	**Date Reported:**	02-Oct-2015	
	PO Box 6136	**Quote No:**		
	WELLINGTON 6141	**Order No:**		
		Client Reference:	W02050100	
		Submitted By:	Andrew Mackenzie	

Amended Report

This report replaces an earlier report issued on the 31 Jul 2015 at 1:31 pm
TCLP copper, lead and zinc analysis added to sample SS15 0.1, as per the clients request.

Sample Type: Soil

		Sample Name:	SS06 0.1 17-Jul-2015	SS08 0.1 17-Jul-2015	SS09 0.1 17-Jul-2015	SS10 0.1 17-Jul-2015	SS11 0.1 17-Jul-2015
		Lab Number:	1452027.3	1452027.5	1452027.6	1452027.7	1452027.8
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn							
Total Recoverable Arsenic	mg/kg dry wt		5	3	3	5	4
Total Recoverable Cadmium	mg/kg dry wt		0.31	0.18	0.30	0.26	0.61
Total Recoverable Chromium	mg/kg dry wt		18	13	13	11	12
Total Recoverable Copper	mg/kg dry wt		68	148	174	137	98
Total Recoverable Lead	mg/kg dry wt		126	710	560	260	200
Total Recoverable Nickel	mg/kg dry wt		9	8	10	8	8
Total Recoverable Zinc	mg/kg dry wt		280	187	250	230	240
Asbestos in Soil							
As Received Weight	g		-	-	-	226.6	-
Dry Weight	g		-	-	-	136.4	-
<2mm Subsample Weight	g ashed wt		-	-	-	Entire Fraction	-
Asbestos Presence / Absence			-	-	-	Chrysotile (White Asbestos) detected.	-
Description of Asbestos Form			-	-	-	Loose Fibres	-

		Sample Name:	SS14 0.1 17-Jul-2015	SS15 0.1 17-Jul-2015	SS17 0.1 17-Jul-2015	SS39 0.3 17-Jul-2015	SS41 0.1 17-Jul-2015
		Lab Number:	1452027.9	1452027.10	1452027.12	1452027.16	1452027.21
Individual Tests							
TCLP Weight of Sample Taken	g		-	100	-	-	-
TCLP Initial Sample pH	pH Units		-	6.3	-	-	-
TCLP Acid Adjusted Sample pH	pH Units		-	1.7	-	-	-
TCLP Extractant Type*			-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-	-
TCLP Extraction Fluid pH	pH Units		-	4.9	-	-	-
TCLP Post Extraction Sample pH	pH Units		-	5.0	-	-	-
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn							
Total Recoverable Arsenic	mg/kg dry wt		3	4	5	3	3
Total Recoverable Cadmium	mg/kg dry wt		0.24	0.43	0.54	0.22	0.13
Total Recoverable Chromium	mg/kg dry wt		11	11	13	25	10
Total Recoverable Copper	mg/kg dry wt		112	290	184	134	46
Total Recoverable Lead	mg/kg dry wt		550	1,710	690	210	44
Total Recoverable Nickel	mg/kg dry wt		8	8	9	11	5
Total Recoverable Zinc	mg/kg dry wt		166	430	320	131	87
Asbestos in Soil							

Sample Type: Soil						
Sample Name:		SS14 0.1 17-Jul-2015	SS15 0.1 17-Jul-2015	SS17 0.1 17-Jul-2015	SS39 0.3 17-Jul-2015	SS41 0.1 17-Jul-2015
Lab Number:		1452027.9	1452027.10	1452027.12	1452027.16	1452027.21
Asbestos in Soil						
As Received Weight	g	-	-	-	216.8	-
Dry Weight	g	-	-	-	144.1	-
<2mm Subsample Weight	g ashed wt	-	-	-	69.0	-
Asbestos Presence / Absence		-	-	-	Chrysotile (White Asbestos) detected.	-
Description of Asbestos Form		-	-	-	Loose Fibres	-

Sample Name:		SS41 1.0 17-Jul-2015	SS43 0.7 17-Jul-2015	SS44 0.5 17-Jul-2015	TP 8 0.1 17-Jul-2015	TP 8 0.5 17-Jul-2015
Lab Number:		1452027.23	1452027.30	1452027.32	1452027.34	1452027.35
Individual Tests						
Dry Matter	g/100g as rcvd	-	-	-	-	93
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	< 2	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	0.12	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	12	17	9	7	-
Total Recoverable Copper	mg/kg dry wt	68	95	48	14	-
Total Recoverable Lead	mg/kg dry wt	12.5	16.8	6.9	3.7	-
Total Recoverable Nickel	mg/kg dry wt	5	8	5	4	-
Total Recoverable Zinc	mg/kg dry wt	43	71	51	57	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	-	-	-	< 8
C10 - C14	mg/kg dry wt	-	-	-	-	< 20
C15 - C36	mg/kg dry wt	-	-	-	-	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	-	-	< 70

Sample Name:		TP 9 0.1 17-Jul-2015				
Lab Number:		1452027.38				
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	< 2	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	10	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	18	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	5.3	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	5	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	74	-	-	-	-

Sample Type: Aqueous						
Sample Name:		SW01 17-Jul-2015	SW02 17-Jul-2015	SS15 0.1 [TCLP Extract]		
Lab Number:		1452027.13	1452027.14	1452027.40		
Individual Tests						
Total Copper	g/m^3	-	-	0.042	-	-
Total Lead	g/m^3	-	-	1.25	-	-
Total Zinc	g/m^3	-	-	1.72	-	-
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m^3	< 0.0010	< 0.0010	-	-	-
Dissolved Cadmium	g/m^3	< 0.00005	< 0.00005	-	-	-
Dissolved Chromium	g/m^3	< 0.0005	< 0.0005	-	-	-
Dissolved Copper	g/m^3	0.0005	0.0011	-	-	-
Dissolved Lead	g/m^3	0.00031	0.00065	-	-	-
Dissolved Nickel	g/m^3	< 0.0005	< 0.0005	-	-	-
Dissolved Zinc	g/m^3	0.0016	0.0173	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m^3	-	< 0.10	-	-	-
C10 - C14	g/m^3	-	< 0.2	-	-	-

Sample Type: Aqueous						
Sample Name:		SW01 17-Jul-2015	SW02 17-Jul-2015	SS15 0.1 [TCLP Extract]		
Lab Number:		1452027.13	1452027.14	1452027.40		
Total Petroleum Hydrocarbons in Water						
C15 - C36	g/m³	-	< 0.4	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	-	< 0.7	-	-	-

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%.	-	3, 5-10, 12, 16, 21, 23, 30, 32, 34, 38
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	35
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	3, 5-10, 12, 16, 21, 23, 30, 32, 34, 38
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	3, 5-10, 12, 16, 21, 23, 30, 32, 34, 38
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	35
TCLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1311	-	10
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	7, 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	7, 16
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	7, 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.	-	7, 16
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	7, 16
TCLP Profile			
TCLP Weight of Sample Taken	Gravimetric. US EPA 1311.	0.1 g	10
TCLP Initial Sample pH	pH meter. US EPA 1311.	0.1 pH Units	10
TCLP Acid Adjusted Sample pH	pH meter. US EPA 1311.	0.1 pH Units	10
TCLP Extractant Type*	US EPA 1311.	-	10
TCLP Extraction Fluid pH	pH meter. US EPA 1311.	0.1 pH Units	10
TCLP Post Extraction Sample pH	pH meter. US EPA 1311.	0.1 pH Units	10

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	40
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	14
Total Copper	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.011 g/m³	40

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Lead	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0021 g/m^3	40
Total Zinc	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.021 g/m^3	40
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.00005 - 0.0010 g/m^3	13-14
Total Petroleum Hydrocarbons in Water	Hexane extraction, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734]	0.10 - 0.7 g/m^3	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.

Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental Division

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Job Information Summary

Client:	Pattle Delamore Partners Limited	**Lab No:**	1452027
Contact:	B Simkin	**Date Registered:**	18-Jul-2015 11:03 am
	C/- Pattle Delamore Partners Limited	**Priority:**	High
	PO Box 6136	**Quote No:**	
	WELLINGTON 6141	**Order No:**	
		Client Reference:	W02050100
		Add. Client Ref:	
		Submitted By:	Andy Mackenzie
		Charge To:	Pattle Delamore Partners Limited
		Target Date:	22-Jul-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	SS04 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
2	SS05 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
3	SS06 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	~~Hold Cold~~ Metals
4	SS07 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
5	SS08 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	~~Hold Cold~~ Metals
6	SS09 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	~~Hold Cold~~ Metals
7	SS10 0.1 17-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	~~Hold Cold~~ Metals, Asbestos presence
8	SS11 0.1 17-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	~~Hold Cold~~ Metals
9	SS14 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	~~Hold Cold~~ Metals
10	SS15 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	~~Hold Cold~~ Metals
11	SS16 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
12	SS17 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	~~Hold Cold~~ Metals
13	SW01 17-Jul-2015	Surface Water	Org500, cTPH250, UP250, FN100, VOC40, VOC40	~~Hold Cold~~ Dissolved Trace Metals
14	SW02 17-Jul-2015	Surface Water	Org500, TPH250, UP250, VOC40, VOC40	Hold Cold Dissolved Trace metals TPH
15	SS39 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
16	SS39 0.3 17-Jul-2015	Soil	GSoil300, PSoil250Asb	~~Hold Cold~~ Metals, Asbestos presence
17	SS39 0.6 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
18	SS40 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
19	SS40 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
20	SS40 1.0 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
21	SS41 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	~~Hold Cold~~ Metals
22	SS41 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
23	SS41 1.0 17-Jul-2015	Soil	GSoil300, GSoil30(	~~Hold Cold~~ Metals
24	SS41 1.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
25	SS42 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
26	SS42 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	~~Hold Cold~~ Hold Cold
27	SS42 1.0 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
28	SS42 1.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
29	SS43 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
30	SS43 0.7 17-Jul-2015	Soil	GSoil300, GSoil30(	~~Hold Cold~~ Metals
31	SS44 0.2 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
32	SS44 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	~~Hold Cold~~ Metals
33	SS44 1.0 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
34	TP11 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	~~Hold Cold~~ Metals
35	TP11 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	~~Hold Cold~~ TPH
36	TP12 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
37	TP12 0.6 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
38	TP15 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	~~Hold Cold~~ Metals
39	TP15 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold

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Web www.hill-labs.co.nz

Job Information Summary

Client:	Pattle Delamore Partners Limited	**Lab No:**	1452027
Contact:	B Simkin	**Date Registered:**	18-Jul-2015 11:03 am
	C/- Pattle Delamore Partners Limited	**Priority:**	High
	PO Box 6136	**Quote No:**	
	WELLINGTON 6141	**Order No:**	
		Client Reference:	W02050100
		Add. Client Ref:	
		Submitted By:	Andy Mackenzie
		Charge To:	Pattle Delamore Partners Limited
		Target Date:	28-Jul-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	SS04 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
2	SS05 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
3	SS06 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
4	SS07 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
5	SS08 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
6	SS09 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
7	SS10 0.1 17-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Asbestos in Soil; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
8	SS11 0.1 17-Jul-2015	Soil	GSoil300, GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
9	SS14 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
10	SS15 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
11	SS16 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
12	SS17 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
13	SW01 17-Jul-2015	Surface Water	Org500, cTPH250, UP250, FN100, VOC40, VOC40	Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn
14	SW02 17-Jul-2015	Surface Water	Org500, TPH250, UP250, VOC40, VOC40	Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn; Total Petroleum Hydrocarbons in Water
15	SS39 0.1 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
16	SS39 0.3 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Asbestos in Soil; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
17	SS39 0.6 17-Jul-2015	Soil	GSoil300, PSoil250Asb	Hold Cold
18	SS40 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
19	SS40 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
20	SS40 1.0 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
21	SS41 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
22	SS41 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
23	SS41 1.0 17-Jul-2015	Soil	GSoil300, GSoil30(	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
24	SS41 1.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
25	SS42 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
26	SS42 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
27	SS42 1.0 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
28	SS42 1.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
29	SS43 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
30	SS43 0.7 17-Jul-2015	Soil	GSoil300, GSoil30(	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
31	SS44 0.2 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
32	SS44 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
33	SS44 1.0 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
34	TP11 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
35	TP11 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Total Petroleum Hydrocarbons in Soil
36	TP12 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
37	TP12 0.6 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold
38	TP15 0.1 17-Jul-2015	Soil	GSoil300, GSoil30(	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
39	TP15 0.5 17-Jul-2015	Soil	GSoil300, GSoil30(	Hold Cold

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%.	-	3, 5-10, 12, 16, 21, 23, 30, 32, 34, 38
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	35
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	3, 5-10, 12, 16, 21, 23, 30, 32, 34, 38
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	3, 5-10, 12, 16, 21, 23, 30, 32, 34, 38
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	35
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	7, 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	7, 16
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	7, 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.	-	7, 16
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	7, 16

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012.	-	14
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.00005 - 0.0010 g/m^3	13-14
Total Petroleum Hydrocarbons in Water	Hexane extraction, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734]	0.10 - 0.7 g/m^3	14

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ANALYSIS REPORT

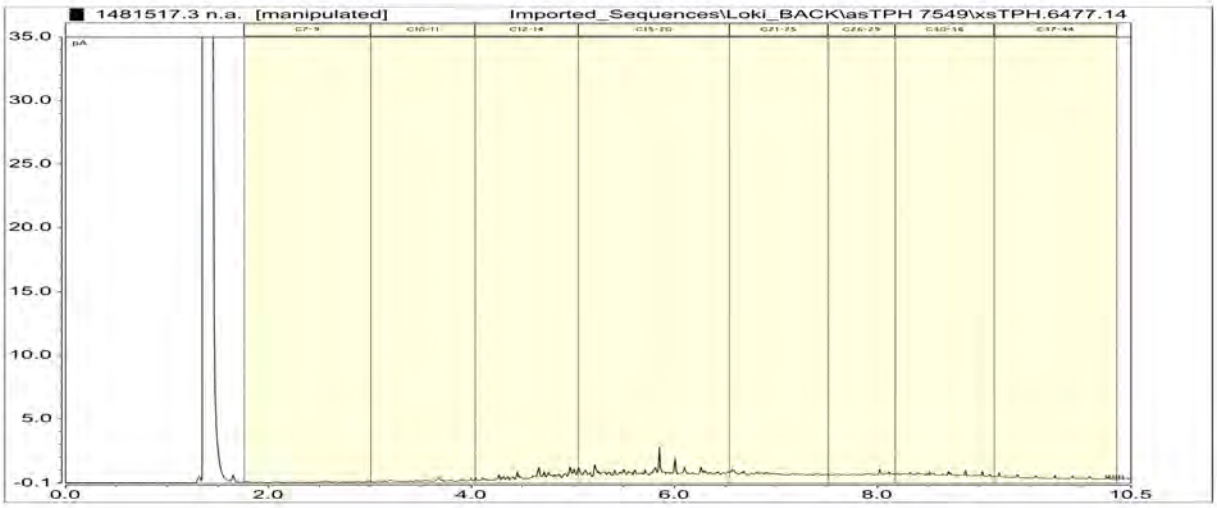
Client:	Pattle Delamore Partners Limited	**Lab No:**	1481517 SPv1
Contact:	B Simkin	**Date Registered:**	29-Sep-2015
	C/- Pattle Delamore Partners Limited	**Date Reported:**	07-Oct-2015
	PO Box 6136	**Quote No:**	
	WELLINGTON 6141	**Order No:**	
		Client Reference:	WO2050100
		Submitted By:	Andrew Mackenzie

Sample Type: Soil

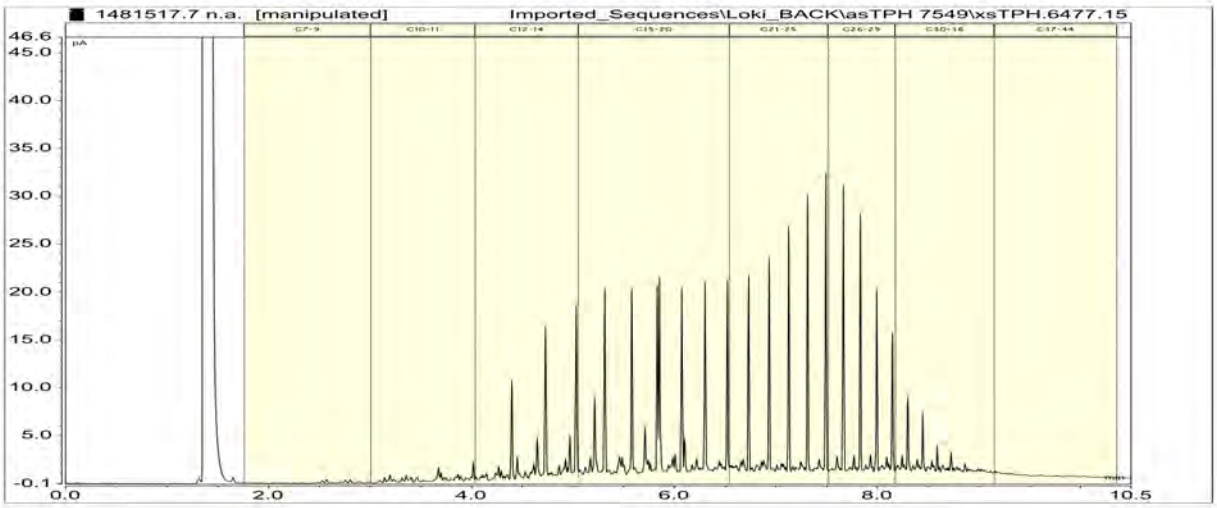
Sample Name:		TP13 3.0 28-Sep-2015	TP13 5.0 28-Sep-2015	TP14 3.5 28-Sep-2015	TP15 2.5 28-Sep-2015	TP15 3.5 28-Sep-2015
Lab Number:		1481517.3	1481517.5	1481517.7	1481517.8	1481517.9
Individual Tests						
Dry Matter	g/100g as rcvd	57	-	54	55	-
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	-	< 2	-	-	3
Total Recoverable Cadmium	mg/kg dry wt	-	< 0.10	-	-	< 0.10
Total Recoverable Chromium	mg/kg dry wt	-	27	-	-	21
Total Recoverable Copper	mg/kg dry wt	-	84	-	-	66
Total Recoverable Lead	mg/kg dry wt	-	10.6	-	-	9.9
Total Recoverable Nickel	mg/kg dry wt	-	9	-	-	8
Total Recoverable Zinc	mg/kg dry wt	-	109	-	-	84
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 12	-	< 12	12	-
C10 - C14	mg/kg dry wt	75	-	270	670	-
C15 - C36	mg/kg dry wt	250	-	1,030	2,200	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	330	-	1,300	2,800	-

Sample Name:		TP16 2.0 28-Sep-2015	TP18 2.7 28-Sep-2015	TP21 0.2 28-Sep-2015	TP13A 2.5 28-Sep-2015	TP13A 3.0 28-Sep-2015
Lab Number:		1481517.10	1481517.12	1481517.15	1481517.20	1481517.21
Individual Tests						
Dry Matter	g/100g as rcvd	59	-	76	65	-
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	-	3	< 2	-	2
Total Recoverable Cadmium	mg/kg dry wt	-	0.35	< 0.10	-	< 0.10
Total Recoverable Chromium	mg/kg dry wt	-	27	8	-	13
Total Recoverable Copper	mg/kg dry wt	-	123	28	-	93
Total Recoverable Lead	mg/kg dry wt	-	12.1	2.5	-	11.3
Total Recoverable Nickel	mg/kg dry wt	-	12	6	-	10
Total Recoverable Zinc	mg/kg dry wt	-	121	70	-	74
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 11	-	< 9	26	-
C10 - C14	mg/kg dry wt	28	-	< 20	1,630	-
C15 - C36	mg/kg dry wt	550	-	< 40	6,400	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	580	-	< 70	8,100	-

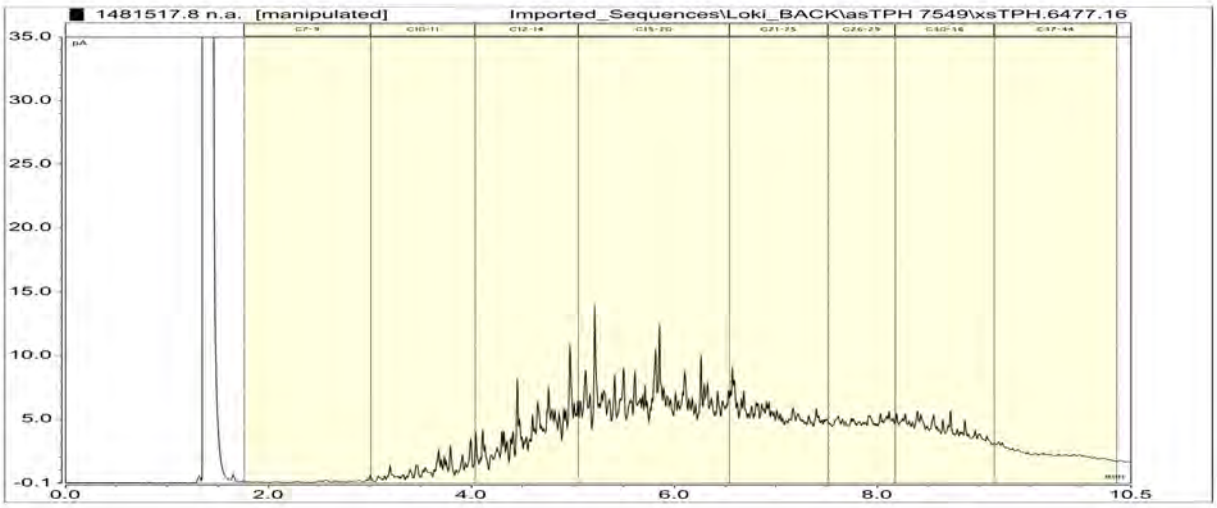
1481517.3
TP13 3.0 28-Sep-2015
Client Chromatogram for TPH by FID



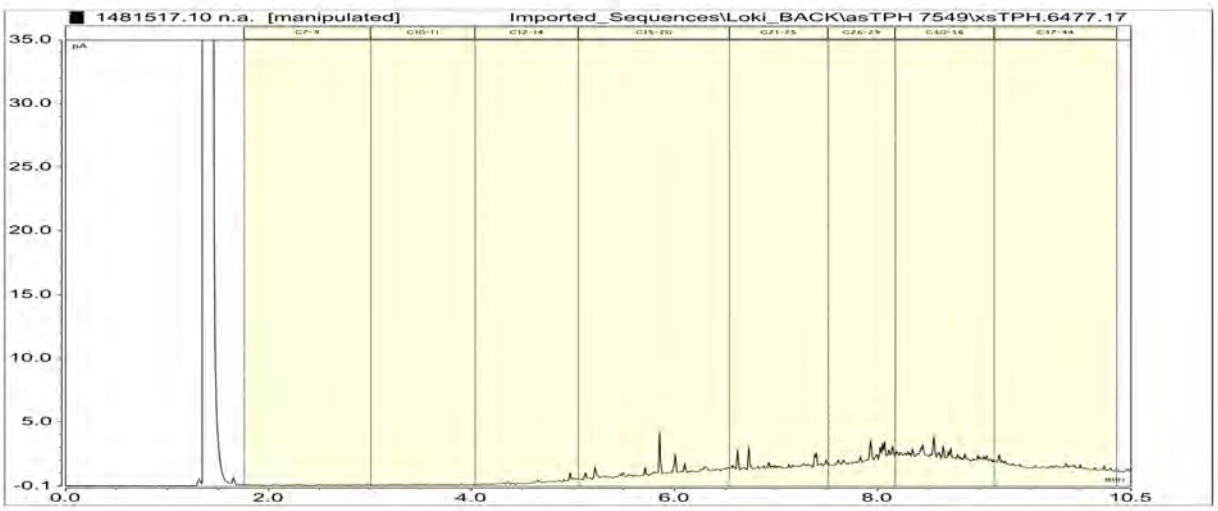
1481517.7
TP14 3.5 28-Sep-2015
Client Chromatogram for TPH by FID



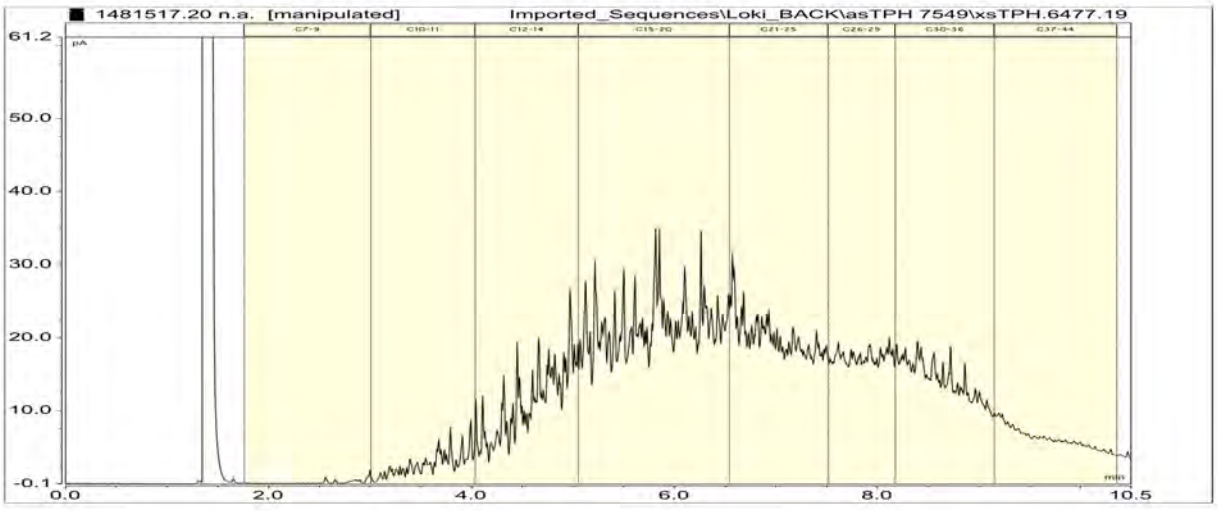
1481517.8
TP15 2.5 28-Sep-2015
Client Chromatogram for TPH by FID



1481517.10
TP16 2.0 28-Sep-2015
Client Chromatogram for TPH by FID



1481517.20
TP13A 2.5 28-Sep-2015
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
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	5, 9, 12, 15, 21
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	5, 9, 12, 15, 21
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, 7-8, 10, 15, 20
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	3, 7-8, 10, 15, 20
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	5, 9, 12, 15, 21

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 report must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

Appendix H: Well Purging and Sampling Forms

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd. DSI
Job Number: W02050 100
Weather: Fine, occ shower
Purging method: Bailer
Sampling Equipment: Bailer/bottle/jar

Well ID: MW1, 10.0 cm
Date(s): 16-7-15
Sampler Name(s): Andy M

WELL DETAILS:

PID reading in neck of well: 1.0 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: ~~5.055~~ 5.220 (m)
Distance of PVC casing above/below ground level: — (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 2.085 (m)
After Sampling: 2.160 (m)
Depth to Product: None (m)
Product Thickness: — (m)
Product measured by: (interface probe) / bailer / (product bailer)
Volume of Product Removed: — L

*** Water Level Measurement**

Reference Point: (Top of PVC Casing) / Top of Well (circle as appropriate)
Toby Key Type: ~~triangular? / allen key? / padlock?~~ Hex key
Well Cap Type: H-cap? / (screw cap?) / push-fit?
Minimum Purge Volume (L): (3 well vol.) 18.8 L

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before	~~Time~~	10.00	0	17.4	6.96	451	—	—		Clear with SS, black sand.
During		10.08	7	~~17.4~~ 17.4	6.97	479	—	—		"
During			12	17.5	7.03	469	—	—	FU	TU, minor sheen
During			18	17.5	7.04	462	—	—		TU, minor sheen
During		10.34	28	17.4	6.99	445	—	—	—	TU, "
~~During~~	After	10.45	—	—					2.160	
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d² / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Comments

Minor sheen on purge water, very tainted with fine black sand in bucket/water

Field Filtered (metals only)?: (Y) / N
Analyses Required: TPH, BTEX, N, amm. N, Formaldehyde, diss. Metals
Sample Bottles Collected: 6
Lab Quote No. —

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd
Job Number: WO20507.00
Weather: Fine, occ showers
Purging method: Bailer
Sampling Equipment: " "

Well ID: MW2 11.20
Date(s): 16-7-15
Sampler Name(s): Andy M

WELL DETAILS:

PID reading in neck of well: 1.1 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: 3.990 (m)
Distance of PVC casing above/below ground level: — (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 1.290 (m)
After Sampling: 1.295 (m)
Depth to Product: — (m)
Product Thickness: — N/A (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

*** Water Level Measurement**

Reference Point: Top of PVC Casing / Top of Well (circle as appropriate)
Toby Key Type: ~~triangular? / allen key? / padlock?~~ 1 for key
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (3 well vol.) 16.2 L ✓

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before	0	11.27	0	14.7	7.96	250	—	—	1.290	CO, sme, SS (SA) fine
During		11.33	5	14.8	7.45	250	—	—		TU, SA, oil sheen
During		11.38	12	14.8	6.90	198	—	—		TU, SA " "
During		11.43	20	14.7	6.94	192	—	—		TU, no sheen.
During		11.49	24	14.7	6.93	194	—	—		TU, " "
~~During~~	After								1.295	
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d² / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Comments

Minor oil sheen initially, more at end of purge
Blackish/grey colour to purge water

Field Filtered (metals only)?: ~~Y / N~~
Analyses Required: TPH, BTEX.
Sample Bottles Collected: 3
Lab Quote No. —

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd DS1
Job Number: WO2030100
Weather: Fine, occ shower
Purging method: Bailer
Sampling Equipment: " "

Well ID: MW3 @ 100 ppm
Date(s): 16-7-15
Sampler Name(s): Andy M

WELL DETAILS:

PID reading in neck of well: 0.8 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: 5.92 (m)
Distance of PVC casing above/below ground level: — (m)*

DEPTH TO WATER*:
Before Purging ("static water level"): 3.755 (m) — MW3 (To left) 3.76m BTOC
After Sampling: 3.760 (m)
Depth to Product: — N/A (m)
Product Thickness: — (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

*** Water Level Measurement**

Reference Point: Top of PVC Casing / Top of Well (circle as appropriate)
Toby Key Type: ~~triangular? / allen key? / padlock?~~ Hex key
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (3 well vol.) ~13 L

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before	0	1.13	1	17.1	7.35	756	—	—	3.755	Cl ~ fine, sand
During		1.16	5	17.1	~~7.20~~ 7.20	774	—	—	—	TU, brown
During		~~1.20~~	12	16.7	~~7.19~~	~~780~~	—	—	—	TU brown
During		1.27	26	17.2	7.15	768	—	—	—	TU, brown,
~~During~~	After								3.760	white bubbles on
During										top of purge
During										water
During										
During										
During										
During										
During										
After										

55

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

Comments

1 Well Volume (L) =

Turbid some 2nd bailer, brown, murky. No sheen

Field Filtered (metals only)? ~~Y~~ N
Analyses Required: TPH, BTEX
Sample Bottles Collected: 3
Lab Quote No. —

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd DSI
Job Number: WO20587700
Weather: Fine
Purging method: Bailer
Sampling Equipment: "

Well ID: MW4 @ 12.10
Date(s): 16-7-15
Sampler Name(s): Andy M

WELL DETAILS:

PID reading in neck of well: 0.7 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: 6.01 (m)
Distance of PVC casing above/below ground level: — (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 3.880 (m)
After Sampling: 3.880 (m)
Depth to Product: N/A (m)
Product Thickness: — (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

*** Water Level Measurement**

Reference Point: (Top of PVC Casing) / Top of Well (circle as appropriate)
Toby Key Type: hex / ~~triangular?~~ / ~~allen key?~~ / ~~padlock?~~
Well Cap Type: H-cap? / (screw cap?) / push-fit?
Minimum Purge Volume (L): (3 well vol.) ~13.0 L

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before	0	12.23	1	16.7	7.48	193.5	—	—	3.880	CL ⇒ Pink SA.
During		12.25	5	16.7	6.54	190	—	—	—	TU.
During		12.30	12	16.8	6.53	189.1	—	—	—	TU.
During		12.35	20	16.8	6.49	188.5	—	—	—	TU
During		12.38	24	16.8	6.46	189.7	—	—	—	TU
~~During~~	After	12.42							3.880	
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Comments

Very Turbid, brown colour.
No oil sheen.

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Field Filtered (metals only)?: ~~Y / N~~
Analyses Required: TPH, BTEX
Sample Bottles Collected: 3
Lab Quote No. —

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayley Rd DS1
Job Number: WO2030700
Weather: Fine, occ shower
Purging method: Bailer
Sampling Equipment:

WELL DETAILS:
PID reading in neck of well: 0.2 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: ~~5.5~~ 5.55 (m)
Distance of PVC casing above/below ground level: — (m)*

DEPTH TO WATER*:
Before Purging ("static water level"): 0.49 (b. TOC) (m)
After Sampling: 2.52 (m)
Depth to Product: — (m)
Product Thickness: — (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

Well ID: MW5 @ 2.10
Date(s): 16-7-15
Sampler Name(s): Brody M,

*** Water Level Measurement**
Reference Point: Top of PVC Casing / ~~Top~~ of Well (circle as appropriate)
Toby Key Type: triangular? / allen key? / padlock?
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (3 well vol.) 30L

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before		2:23	1	16.4	7.57	264	—	—	—	CL, minor SS, Fe SA
During			4	16.4	7.61	263	—	—	—	CO
During			15	16.5	6.83	265	—	—	—	TU
During		2.34	21	16.6	6.71	268	—	—	—	TU
During			23	16.6	6.72	269	—	—	—	well dry
~~During~~	Bfor	2.42							2.52	
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Comments

- 0.435 stick up of PVC casing.
- Well purged dry. Purged water turbid, brown (at end) → Then turned clear at last 2 bailers after recharging.

Field Filtered (~~metals only~~)?: ~~Y~~ / ~~N~~
Analyses Required: TPH, BTEX
Sample Bottles Collected: # 3
Lab Quote No. —

* = needs to be recorded each time you take a set of parameters

-0274786
+ 329

(50)

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd
Job Number: WO20507 00
Weather: Fine, wet previous day
Purging method: Bailer
Sampling Equipment: Bailer

WELL DETAILS:

PID reading in neck of well: 1-8 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: 4.990 (m)
Distance of PVC casing above/below ground level: Flush (m)*

DEPTH TO WATER*: ~~DTB: 4.990~~
Before Purging ("static water level"): 2.255 (m)
After Sampling: 2.320 (m)
Depth to Product: — N/A (m) no colour change
Product Thickness: N/A (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

Well ID: MW6
Date(s): 16-7-15
Sampler Name(s): Andy

*** Water Level Measurement**

Reference Point: (Top of PVC Casing) / Top of Well (circle as appropriate)
Toby Key Type: ~~triangular? / allen key? / padlock?~~ Hex
Well Cap Type: H-cap? / (screw cap?) / push-fit?
Minimum Purge Volume (L): (3 well vol.) 16.4 L

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before	0		0	17.0	6.16	263	—	—	2.255	V Turbid/min.
During			9	17.2	6.11	255				TU murky/ Sheen
During			17	17.2	6.10	250				TU " " & "
~~During~~ After	~15 mins		26	17.2	6.07	252			2.320	TU (very), No sheen.
During										
During										
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

Comments

1 Well Volume (L) =

V Turbid, since 1st bailer volume → last.
Minor sheen/slick, none at end of purge.

Duplicate sample collected (MW11).

Field Filtered (metals only)?: (Y) / N
Analyses Required: TPH, BTEX, metals, nitrogen, amm. N, Formeldehyde
Sample Bottles Collected: 6
Lab Quote No. —

* = needs to be recorded each time you take a set of parameters

QA/QC Samples

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd OS1
Job Number: WO20500700
Weather: Fine
Purging method: Bailer
Sampling Equipment: " "

WELL DETAILS:

PID reading in neck of well: 0.8 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: See MW6 (m)
Distance of PVC casing above/below ground level: — (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 2.270 (m)
After Sampling: — (m)
Depth to Product: — (m)
Product Thickness: — (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

Well ID: MW6A (MW6), MW11 (duplicate)
Date(s): 16-7-15
Sampler Name(s): Andy M.

*** Water Level Measurement**

Reference Point: (Top of PVC Casing) / Top of Well (circle as appropriate)
Toby Key Type: ~~triangular? / allen key? / padlock?~~ Hach
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (3 well vol.)

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Comments

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

- Re-sampled due to collection of duplicate samples BM
- Duplicate sample MW11, and MW6A collected

Field Filtered (metals only)? (Y) / N
Analyses Required: TPH, BTEX, N, amm. N, diss metals, formaldehyde
Sample Bottles Collected: 6 (x2)
Lab Quote No. —

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd 087
Job Number: WO2030100
Weather: Fine
Purging method: Bailer
Sampling Equipment: " "

WELL DETAILS:

PID reading in neck of well: 0.3 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: 12.32 (m)
Distance of PVC casing above/below ground level: — (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 10.705 (m)
After Sampling: 10.72 (m)
Depth to Product: — (m)
Product Thickness: — (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

Well ID: MW7
Date(s): 16-7-15
Sampler Name(s): Brady M.

*** Water Level Measurement**

Reference Point: Top of PVC Casing / Top of Well (circle as appropriate)
Toby Key Type: ~~triangular? / allen key? / padlock?~~ Hex
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (**3** well vol.) 9.7 L

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before		3.12	2	16	6.65	168	—	—	10.705	TU, brown
During										" "
During		3.25	10	15.9	6.22	163	—	—	—	" "
During		3.29	12	15.9	6.61	163	—	—	—	TU, brown
~~During~~	After								10.72	
During										
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d² / 4000
Where d = internal well casing (PVC) diameter in **mm**

Comments

1 Well Volume (L) =

Purge water ok. brown, no sheen

Field Filtered (metals only)?: Y (N)
Analyses Required: TPH, BTEX.
Sample Bottles Collected: 3
Lab Quote No. —

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

(2) 3.2 6pm

Site: Bayly Rd DSI
Job Number: W00030100
Weather: Fine
Purging method: Bailer
Sampling Equipment: " "

Well ID: MW8
Date(s): 16-7-15
Sampler Name(s): Brady M.

WELL DETAILS:

PID reading in neck of well: 1.0 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: (m)
Distance of PVC casing above/below ground level: 2.994 (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 0.440 (m)
After Sampling: 0.470 (m)
Depth to Product: — (m)
Product Thickness: — (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

*** Water Level Measurement**

Reference Point: Top of PVC Casing / Top of Well (circle as appropriate)
Toby Key Type: ~~triangular? / allen key? / padlock?~~ Hex key
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (3 well vol.) 15.3 L

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before		3.50	1	15.3	6.88	412	—	—	—	CL
During		3.57	10	11.4	6.88	411	—	—	—	TU
During		4.0								
During	After								0.470	
During										
During										
During										
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Well Volume Calculation
1 well volume (L) = (total depth[m] - depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

Comments

1 Well Volume (L) =

Field Filtered (metals only)?: Y / (N)
Analyses Required: TPH, BTEX
Sample Bottles Collected: 3
Lab Quote No. —

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd
Job Number:
Weather: Fine
Purging method: Bailer
Sampling Equipment: " "

Well ID: MW 1
Date(s): 29-9-15
Sampler Name(s): Andy M.

WELL DETAILS:

PID reading in neck of well: 0.0 (ppm)
Well casing diameter: 50mm (mm)
Total Depth of Well: 4.51 (m)
Distance of PVC casing above/below ground level: (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 2.170 (m)
After Sampling: — (m)
Depth to Product: — (m)
Product Thickness: None (m)
Product measured by: (interface probe) / bailer / product bailer
Volume of Product Removed: L

*** Water Level Measurement**

Reference Point: Top of PVC Casing / Top of Well (circle as appropriate)
Toby Key Type: triangular? / allen key? / padlock?
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (**3** well vol.)

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Comments: No H/C Sheen.

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Field Filtered (metals only)?: Y / N
Analyses Required: N/A
Sample Bottles Collected:
Lab Quote No.

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd
Job Number:
Weather: Fine
Purging method: Bailer
Sampling Equipment: " "

WELL DETAILS:

PID reading in neck of well: 0.0 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: 3.520 (m)
Distance of PVC casing above/below ground level: (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 1.320 (m)
After Sampling: — (m)
Depth to Product: None (m)
Product Thickness: — (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

Well ID: MW2
Date(s): 29-9-15
Sampler Name(s):

*** Water Level Measurement**

Reference Point: Top of PVC Casing / Top of Well (circle as appropriate)
Toby Key Type: triangular? / allen key? / padlock?
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (**3** well vol.)

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Comments: No H/C sheen

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Field Filtered (metals only)?: Y / N N/A
Analyses Required:
Sample Bottles Collected:
Lab Quote No.

* = needs to be recorded each time you take a set of parameters

western

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd

Job Number:

Weather: Fine

Purging method: –

Sampling Equipment: –

WELL DETAILS:

PID reading in neck of well: 0.0 (0.0) ~~KAH~~ (ppm)

Well casing diameter: 50 (mm)

Total Depth of Well: 5.78 (5.85) (m)

Distance of PVC casing above/below ground level (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 3.790 (3.790) (m)

After Sampling: – (m)

Depth to Product: None (m)

Product Thickness: – (m)

Product measured by: interface probe / bailer / product bailer

Volume of Product Removed: – L

Well ID: MW3 (Right) (Left in brackets)

Date(s): 29-9-15

Sampler Name(s): AM

*** Water Level Measurement**

Reference Point: Top of PVC Casing / Top of Well (circle as appropriate)

Toby Key Type: triangular? / allen key? / padlock?

Well Cap Type: H-cap? / screw cap? / push-fit?

Minimum Purge Volume (L): (**3** well vol.)

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Comments

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Field Filtered (metals only)?: Y / N

Analyses Required:

Sample Bottles Collected:

Lab Quote No.

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayley Rd
Job Number:
Weather: Fine
Purging method: Bailer
Sampling Equipment: " "

WELL DETAILS:

PID reading in neck of well: 0.0 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: 5.80 (m)
Distance of PVC casing above/below ground level (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 3.910 (m)
After Sampling: (m)
Depth to Product: None (m)
Product Thickness: — (m)
Product measured by: ~~interface probe~~ / bailer / product bailer
Volume of Product Removed: — L

Well ID: MW4
Date(s): 29-9-15
Sampler Name(s): A.M.

*** Water Level Measurement**

Reference Point: (Top of PVC Casing) / Top of Well (circle as appropriate)
Toby Key Type: triangular? / allen key? / padlock?
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (**3** well vol.) 12L

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	~~Time~~ Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before	10.53	0	1	16.2	6.06	331.4				clear + CO
During	10.56		3	16.1	6.09	286				TU
During	10.58		6	16.0	6.09	272				TU
During	11.00		9	16.1	6.09	262				TU
During	11.02		13	16.1	6.10	275				TU
During										
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Comments: NO H/C sheen. suspended red in purge water

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Field Filtered (metals only)?: Y / N
Analyses Required: diss Zn.
Sample Bottles Collected:
Lab Quote No.

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd
Job Number:
Weather: Fine
Purging method: Bailer
Sampling Equipment: " "

WELL DETAILS:

PID reading in neck of well: 0.0 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: 5.565 (m)
Distance of PVC casing above/below ground level: above. (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 0.450 (m)
After Sampling: 2.16 (m)
Depth to Product: None (m)
Product Thickness: N/A (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

Well ID: MW5
Date(s): 28-9-15
Sampler Name(s): Bm.

*** Water Level Measurement**

Reference Point: Top of PVC Casing / Top of Well (circle as appropriate)
Toby Key Type: triangular? / allen key? / padlock?
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (**3** well vol.) 30

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before	0	0	2	16.4	6.31	265.5				T
During		4	5	16.3	6.21	260				CO
During		8	10	16.4	6.47	264				CO
During		13	15	16.3	6.46	267				TU
During			20	16.3	6.47	267				TU
During			30	16.3	6.47	265				TU
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Comments: No H/C Sheen.

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Field Filtered (metals only)?: (Y) / N
Analyses Required: diss. Zn
Sample Bottles Collected:
Lab Quote No.

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd
Job Number:
Weather: Fine
Purging method: Bailer
Sampling Equipment: a n

Well ID: MW6
Date(s): 29-9-15
Sampler Name(s): Andy mn

WELL DETAILS:

PID reading in neck of well: 0.0 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: 4.99 (m)
Distance of PVC casing above/below ground level: (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 2.425 (m)
After Sampling: 2.470 (m)
Depth to Product: none (m)
Product Thickness: — (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

*** Water Level Measurement**

Reference Point: Top of PVC Casing / Top of Well (circle as appropriate)
Toby Key Type: triangular? / allen key? / padlock?
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (**3** well vol.) 16L

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before	0		2	16.8	6.28	275				†
During			3	16-8	6.28	270				TU
During			6	16.4	6.23	271				TU
During			10	16-8	6.24	273				TU
During			13	16-8	6.24	273				TU
During		1.40	16	16-8	6.24	271				TU
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Comments: No H/C sheen.

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Field Filtered (metals only)?: (Y) / N
Analyses Required: BTEX Zn
Sample Bottles Collected:
Lab Quote No.

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bayly Rd
Job Number: -
Weather: Fine
Purging method: -
Sampling Equipment: -

WELL DETAILS:

PID reading in neck of well: 0.7 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: 12.05 (m)
Distance of PVC casing above/below ground level: - (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 10.755 (m)
After Sampling: - (m)
Depth to Product: None (m)
Product Thickness: - (m)
Product measured by: ~~interface probe / baller / product baller~~
Volume of Product Removed: L

Well ID: MW7
Date(s): 29-9-15
Sampler Name(s): AM

*** Water Level Measurement**

Reference Point: Top of PVC Casing / Top of Well (circle as appropriate)
Toby Key Type: triangular? / allen key? / padlock?
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (**3** well vol.)

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Comments

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Field Filtered (metals only)?: Y / N
Analyses Required: N/A
Sample Bottles Collected:
Lab Quote No.

* = needs to be recorded each time you take a set of parameters

PATTLE DELAMORE PARTNERS LTD

PDP WELL PURGING AND SAMPLING FORM

Site: Bagley Rd
Job Number: WCC050100
Weather: Fine
Purging method: N/A
Sampling Equipment: N/A

WELL DETAILS:

PID reading in neck of well: 0.3 (ppm)
Well casing diameter: 50 (mm)
Total Depth of Well: 2.99 (m)
Distance of PVC casing above/below ground level: — (m)*

DEPTH TO WATER*:

Before Purging ("static water level"): 0.45 (m)
After Sampling: — (m)
Depth to Product: N/A (m)
Product Thickness: — (m)
Product measured by: interface probe / bailer / product bailer
Volume of Product Removed: — L

Well ID: MW8
Date(s): 29-9-15
Sampler Name(s): Andy M.

*** Water Level Measurement**

Reference Point: Top of PVC Casing / Top of Well (circle as appropriate)
Toby Key Type: triangular? / allen key? / padlock?
Well Cap Type: H-cap? / screw cap? / push-fit?
Minimum Purge Volume (L): (**3** well vol.)

for 50mm dia. well= (total depth[m] - depth to water[m]) x 6
for non-50mm diameter wells see formula below.

NOTE: purge at least 3 well volumes **AND** until well has stabilized using field parameters below (or well is dry).

Key Stabilisation Criteria: pH ± 0.1, EC ± 3%, T ± 0.2 degree
Additional Stabilisation Criteria: DO ± 0.3 mg/L
Minimum volume between readings: 1/2 well volume

	Time Elapse	Time	Volume Removed (L)	Water Temp. (°C)	pH	EC ((µS/cm)	ORP (mV)	Dissolved Oxygen (mg/L)	Water Level (m)*	Water Appearance†
Before										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
During										
After										

† CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

Comments

Well Volume Calculation
1 well volume (L) = (total depth[m] – depth to water[m] x3.141 x d^2 / 4000
Where d = internal well casing (PVC) diameter in **mm**

1 Well Volume (L) =

Field Filtered (metals only)?: Y / N
Analyses Required: N/A
Sample Bottles Collected:
Lab Quote No.

* = needs to be recorded each time you take a set of parameters

Appendix I: Purge Water Manifest Forms

INTERGROUP

P O Box 7076 New Plymouth
Ph: 06 755 9150
Fax: 06 755 1611

DESTRUCTION CERTIFICATE 2015-0493

This is to certify that Intergroup Ltd has rendered the following products unidentifiable and disposed of it in accordance with TRC and other local authority requirements.

CLIENT : Prattle Delamore Partners - Inv 699226/JD63035658

PRODUCT: Contaminated Ground Water (Hydrocarbons)

QUANTITY: 300 Litres

TREATMENT / DESTRUCTION DATE: 23/07/2015

TREATMENT / DESTRUCTION METHOD:

Physical and chemical degradation in Intergroup treatment processes.

FINAL DEPOSITORY:

Solids to New Plymouth District Council landfill. Liquids to trade waste interceptor operated by Intergroup Ltd at 28 Hudson Road, Bell Block.

SIGNED: Ross Maindonald

WITNESSED: Megan Buckley

SECTION 1: TO BE COMPLETED BY THE ENVIRONMENTAL CONSULTANT/MAIN CONTRACTOR

Consultant/Main Contractor Site Supervisor: Pattle Delamore Partners (PDP)

SID Project Number: Ref # WO2030100

Site Name: Bayly Rd

Site Address: 51 Ocean View Parade, New Plymouth

Consultant/Main Contractor: Andrew Mackenzie / Bo Simkin

Description of Contaminant

☐ Petrol ☐ Diesel ☑ Other

Comments: Potentially contaminated GW (hydrocarbons)

Waste Type (Please Tick): ☑ Hazardous ☐ Non-Hazardous ☐ Solid ☑ Liquid

Declaration By Environmental Consultant/Main Contractor

I declare that the above waste is accurately described and is in a proper condition for transport in accordance with the applicable national and local regulations.

Name: Andrew Mackenzie **Signature:** AMackenzie

Title: Env Geologist **Date:** 17/07/15

Estimated Quantity of Waste:

SECTION 2: TO BE COMPLETED BY THE TRANSPORTER

I acknowledge the receipt of the waste consignment describes the above;

Name: Murray Sutton **Signature:**

Title: Yardman **Date:** 23/7/15

Estimated Quantity of Waste:

SECTION 3: TO BE COMPLETED BY THE DISPOSER/STORER

I acknowledge that the waste consignment described has been received

Name of Facility: Intergrap Ltd

Address of Facility: 28 Hudson Road Bell Block

Name: Murray Sutton **Signature:**

Title: Yardman **Date:** 23/7/15

Quantity: 100 L

Method of Disposal ☐ Landfill ☐ Managed Fill ☑ Treatment ☐ Storage

This form has to be completed in conjunction with the accompanying dangerous goods form and returned to the above address and should accompany waste invoices.

PDP Job Number: WO2030100

PDP Contact: Andrew M 021 419 946

Return the completed form to: (Delete if not applicable)

Pattle Delamore Partners Ltd
PO Box 9528, Newmarket, Auckland

Pattle Delamore Partners Ltd
PO Box 6136, Wellington 6030

Pattle Delamore Partners Ltd
PO Box 389, Christchurch 8015

SECTION 1: TO BE COMPLETED BY THE ENVIRONMENTAL CONSULTANT/MAIN CONTRACTOR

Consultant/Main Contractor Site Supervisor: Pattle Delamore Partners (PDP)

SID Project Number: Ref # WO20501 00

Site Name: Bayly Road

Site Address: 51 Ocean View Parade, New Plymouth

Consultant/Main Contractor: Andrew Mackenzie / Bo Simkin

Description of Contaminant

☐ Petrol ☐ Diesel ☑ Other

Comments: Potentially contaminated groundwater (hydrocarbons)

Waste Type (Please Tick): ☑ Hazardous ☐ Non-Hazardous

☐ Solid ☑ Liquid

Declaration By Environmental Consultant/Main Contractor

I declare that the above waste is accurately described and is in a proper condition for transport in accordance with the applicable national and local regulations.

Name: Andrew Mackenzie **Signature:** amackenzie

Title: Environmental Geol **Date:** 17/07/15

Estimated Quantity of Waste: ~200L

SECTION 2: TO BE COMPLETED BY THE TRANSPORTER

I acknowledge the receipt of the waste consignment describes the above;

Name: Murray Sutton **Signature:**

Title: Yardman **Date:** 23/7/15

Estimated Quantity of Waste:

SECTION 3: TO BE COMPLETED BY THE DISPOSER/STORER

I acknowledge that the waste consignment described has been received

Name of Facility: Intergroup Ltd

Address of Facility: 28 Hudson Road Bell Block

Name: Murray Sutton **Signature:**

Title: Yardman **Date:** 23/7/15

Quantity: 200L

Method of Disposal ☐ Landfill ☐ Managed Fill ☑ Treatment ☐ Storage

This form has to be completed in conjunction with the accompanying dangerous goods form and returned to the above address and should accompany waste invoices.

PDP Job Number: WO20501 00

PDP Contact: Andrew M. 021 419 946

Return the completed form to: (Delete if not applicable)

Pattle Delamore Partners Ltd
PO Box 9528, Newmarket, Auckland

Pattle Delamore Partners Ltd
PO Box 6136, Wellington 6030

INTERGROUP

P O Box 7076 New Plymouth
Ph: 06 755 9150
Fax: 06 755 1611

DESTRUCTION CERTIFICATE 2015-0620

This is to certify that Intergroup Ltd has rendered the following products unidentifiable and disposed of it in accordance with TRC and other local authority requirements.

CLIENT : Pattle Delamore Partners

PRODUCT: Ground Water

QUANTITY: 40 Ltrs + 2 x 20 Ltrs Containers

TREATMENT / DESTRUCTION DATE: 29/09/2015

TREATMENT / DESTRUCTION METHOD:

Physical and chemical degradation in Intergroup treatment processes.

FINAL DEPOSITORY:

Solids to New Plymouth District Council landfill. Liquids to trade waste interceptor operated by Intergroup Ltd at 28 Hudson Road, Bell Block.

SIGNED: Stephen Bowles

WITNESSED: Megan Buckley Megan Buckley

SECTION 1: TO BE COMPLETED BY THE ENVIRONMENTAL CONSULTANT/MAIN CONTRACTOR

Consultant/Main Contractor Site Supervisor: Pattle Delamore Partners (PDP)

SID Project Number: WOW50100

Site Name: Bayly Rd, New Plymouth

Site Address: Corner Bayly Rd & Ocean View Parade

Consultant/Main Contractor: PDP

Description of Contaminant

☐ Petrol ☐ Diesel ☑ Other Groundwater

Comments:

Waste Type (Please Tick): ☐ Hazardous ☑ Non-Hazardous ☐ Solid ☑ Liquid

Declaration By Environmental Consultant/Main Contractor

I declare that the above waste is accurately described and is in a proper condition for transport in accordance with the applicable national and local regulations.

Name: Andrew Mackenzie **Signature:** amackenzie

Title: Environmental Geologist **Date:**

Estimated Quantity of Waste:

SECTION 2: TO BE COMPLETED BY THE TRANSPORTER

I acknowledge the receipt of the waste consignment describes the above;

Name: **Signature:**

Title: **Date:**

Estimated Quantity of Waste:

SECTION 3: TO BE COMPLETED BY THE DISPOSER/STORER

I acknowledge that the waste consignment described has been received

Name of Facility: INTERGROUP LTD

Address of Facility: 28 HUDSON ROAD, BELL BLOCK

Name: Stephen Boules **Signature:**

Title: Manager **Date:** 01-10-15

Quantity: 20 Ltrs

Method of Disposal ☐ Landfill ☐ Managed Fill ☐ Treatment ☐ Storage

This form has to be completed in conjunction with the accompanying dangerous goods form and returned to the above address and should accompany waste invoices.

PDP Job Number: WO2050100

PDP Contact: Andrew Mackenzie -021 419 946

Return the completed form to: (Delete if not applicable)

Pattle Delamore Partners Ltd
PO Box 9528, Newmarket, Auckland

Pattle Delamore Partners Ltd
PO Box 6136, Wellington 6030

Pattle Delamore Partners Ltd
PO Box 389, Christchurch 8015

SECTION 1: TO BE COMPLETED BY THE ENVIRONMENTAL CONSULTANT/MAIN CONTRACTOR

Consultant/Main Contractor Site Supervisor: Pattle Delamore Partners (PDP)

SID Project Number: WOW50100

Site Name: Bayly Rd, New Plymouth

Site Address: Corner Bayly Rd & Ocean View Parade

Consultant/Main Contractor: PDP

Description of Contaminant

☐ Petrol ☐ Diesel ☑ Other Groundwater

Comments:

Waste Type (Please Tick): ☐ Hazardous ☑ Non-Hazardous ☐ Solid ☑ Liquid

Declaration By Environmental Consultant/Main Contractor

I declare that the above waste is accurately described and is in a proper condition for transport in accordance with the applicable national and local regulations.

Name: Andrew Mackenzie **Signature:** amackenzie

Title: Environmental Geologist **Date:**

Estimated Quantity of Waste:

SECTION 2: TO BE COMPLETED BY THE TRANSPORTER

I acknowledge the receipt of the waste consignment describes the above;

Name: **Signature:**

Title: **Date:**

Estimated Quantity of Waste:

SECTION 3: TO BE COMPLETED BY THE DISPOSER/STORER

I acknowledge that the waste consignment described has been received

Name of Facility: INTERGROUP LTD

Address of Facility: 28 HUDSON ROAD BELL BLOCK

Name: Stephen Bowles **Signature:**

Title: Manager **Date:** 01-10-15

Quantity: 20 Ltrs.

Method of Disposal ☐ Landfill ☐ Managed Fill ☐ Treatment ☐ Storage

This form has to be completed in conjunction with the accompanying dangerous goods form and returned to the above address and should accompany waste invoices.

PDP Job Number: WO2050100

PDP Contact: Andrew Mackenzie - 021 419 946

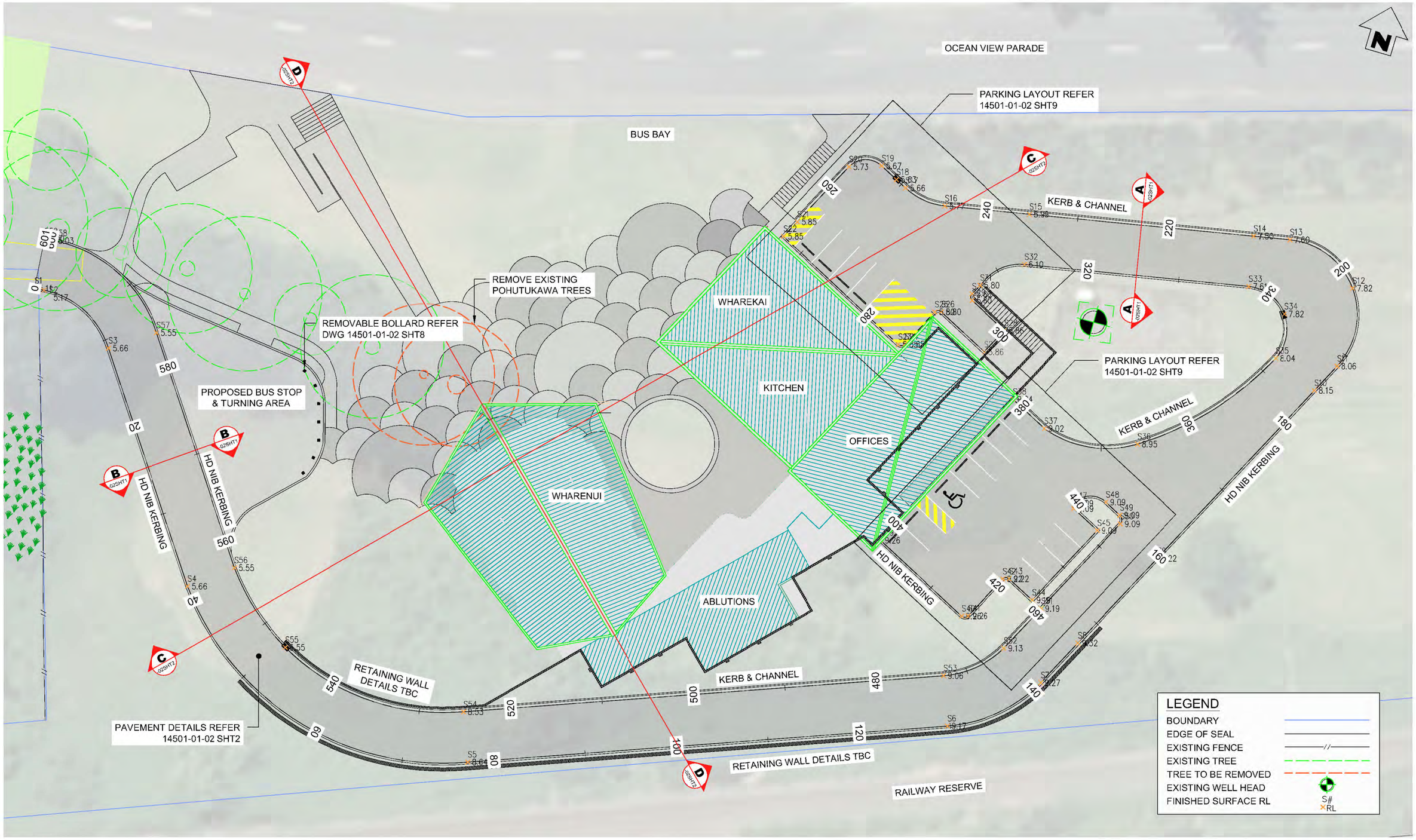
Return the completed form to: (Delete if not applicable)

Pattle Delamore Partners Ltd
PO Box 9528, Newmarket, Auckland

Pattle Delamore Partners Ltd
PO Box 6136, Wellington 6030

Pattle Delamore Partners Ltd
PO Box 389, Christchurch 8015

Appendix J: Proposed Marae Development Architect Drawings



Disclaimer:
Areas and dimensions may be subject to scale error.
Scaling from this drawing is at the users risk.

BUILDING CONSENT

btw company
. surveyors
. planners
. engineers
. land & g-i-s services

BTW Company Ltd
Cnr. Courtenay & Eliot Sts.
P.O Box 551, NEW PLYMOUTH 4340
Ph (06) 759 5040
Ph 0800 289787 Fax (06) 759 5049
E-mail survey@btwcompany.co.nz
Web www.btwcompany.co.nz

GENERAL NOTES
1. Coordinates in terms of : Geodetic Datum (Taranaki 2000)
2. Elevations in terms of : Mean Sea Level (Taranaki Datum 1970)
3. Contour interval is : 0.5m

4 0 4 8 12 16 20m
SCALE 1 : 400

NO	DATE	BY	CHKD	APPR	OPER	DESCRIPTION
1	06.07.15	LB	IS	.	.	BUILDING CONSENT

REVISIONS

NUMBER	TITLE

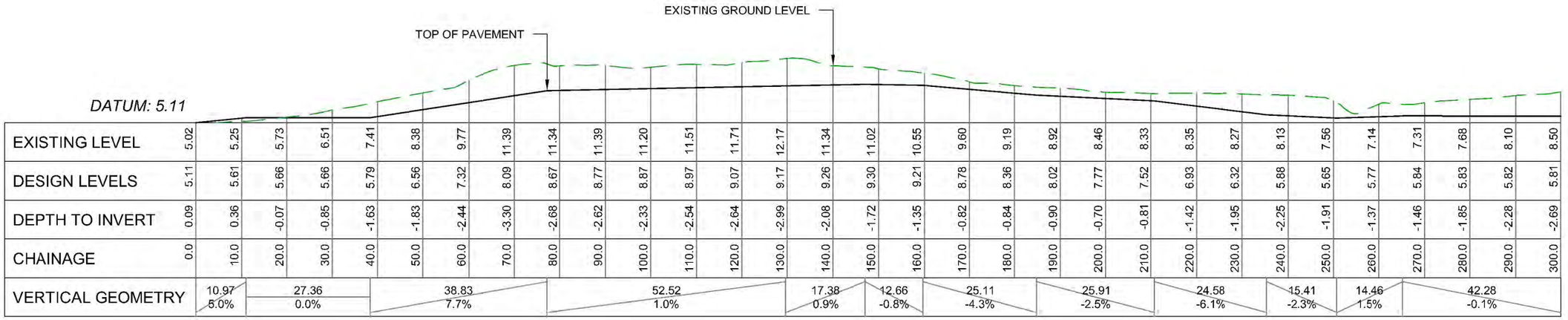
REFERENCE DRAWINGS

LOCATION	BAYLY ROAD		
PROJECT No.	14501		
SCALE	1:400 @ A3		
SURVEYED	PA & NC	08/07/14	
DRAWN	L BUNN	06.07.15	
CHECKED	I STEELE	06.07.15	
DES. CHK.	.		
PROJ. ENG.	.		
APPROVED	.		
–	ORIGINAL SIZE A3		

TITLE
NGAMOTU MARAE PROJECT
BAYLY ROAD, NEW PLYMOUTH
PAVEMENT LAYOUT

DRAWING No	SHEET	REVISION
14501-01-01	1	1

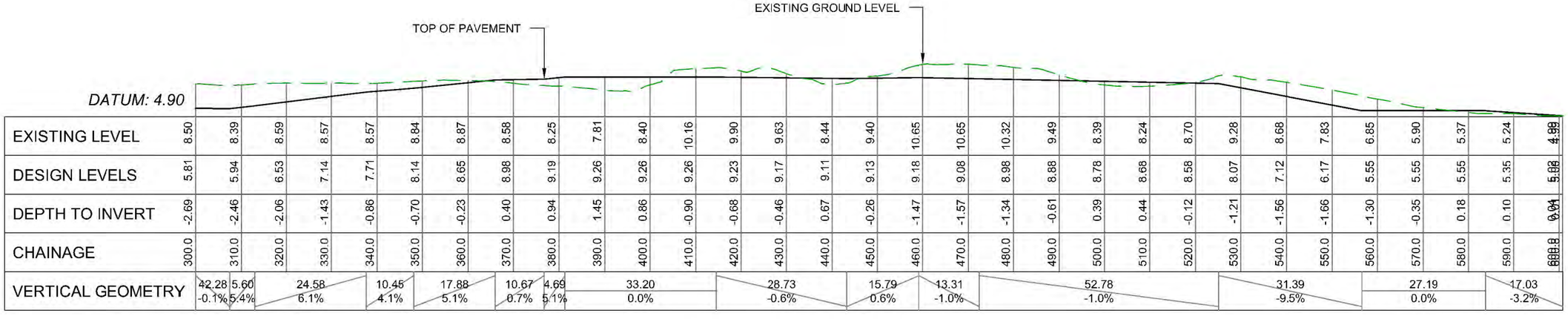
File Name: J:\14501\114501.01\114501-01-REV 3.dwg - -01 SHT 1 Plot Date: 07/07/2015 Plot Time: 17:17



EXISTING LEVEL	5.02	5.25	5.73	6.51	7.41	8.38	9.77	11.39	11.34	11.39	11.20	11.51	11.71	12.17	11.34	11.02	10.55	9.60	9.19	8.92	8.46	8.33	8.35	8.27	8.13	7.56	7.14	7.31	7.68	8.10	8.50
DESIGN LEVELS	5.11	5.61	5.66	5.66	5.79	6.56	7.32	8.09	8.67	8.77	8.87	8.97	9.07	9.17	9.26	9.30	9.21	8.78	8.36	8.02	7.77	7.52	6.93	6.32	5.88	5.65	5.77	5.84	5.83	5.82	5.81
DEPTH TO INVERT	0.09	0.36	-0.07	-0.85	-1.63	-1.83	-2.44	-3.30	-2.68	-2.62	-2.33	-2.54	-2.64	-2.99	-2.08	-1.72	-1.35	-0.82	-0.84	-0.90	-0.70	-0.81	-1.42	-1.95	-2.25	-1.91	-1.37	-1.46	-1.85	-2.28	-2.69
CHAINAGE	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0	170.0	180.0	190.0	200.0	210.0	220.0	230.0	240.0	250.0	260.0	270.0	280.0	290.0	300.0
VERTICAL GEOMETRY		10.97 5.0%	27.36 0.0%		38.83 7.7%			52.52 1.0%						17.38 0.9%	12.66 -0.8%	25.11 -4.3%		25.91 -2.5%		24.58 -6.1%		15.41 -2.3%	14.46 1.5%	42.28 -0.1%							

KERB LONGSECTION CH0 - CH300

SCALE V 1:500, H 1:1000



EXISTING LEVEL	8.50	8.39	8.59	8.57	8.57	8.84	8.87	8.58	8.25	7.81	8.40	10.16	9.90	9.63	8.44	9.40	10.65	10.65	10.32	9.49	8.39	8.24	8.70	9.28	8.68	7.83	6.85	5.90	5.37	5.24	4.99
DESIGN LEVELS	5.81	5.94	6.53	7.14	7.71	8.14	8.65	8.98	9.19	9.26	9.26	9.26	9.23	9.17	9.11	9.13	9.18	9.08	8.98	8.88	8.78	8.68	8.58	8.07	7.12	6.17	5.55	5.55	5.55	5.35	5.08
DEPTH TO INVERT	-2.69	-2.46	-2.06	-1.43	-0.86	-0.70	-0.23	0.40	0.94	1.45	0.86	-0.90	-0.68	-0.46	0.67	-0.26	-1.47	-1.57	-1.34	-0.61	0.39	0.44	-0.12	-1.21	-1.56	-1.66	-1.30	-0.35	0.18	0.10	0.09
CHAINAGE	300.0	310.0	320.0	330.0	340.0	350.0	360.0	370.0	380.0	390.0	400.0	410.0	420.0	430.0	440.0	450.0	460.0	470.0	480.0	490.0	500.0	510.0	520.0	530.0	540.0	550.0	560.0	570.0	580.0	590.0	600.8
VERTICAL GEOMETRY		42.28 -0.1%	5.60 5.4%	24.58 6.1%		10.45 4.1%	17.88 5.1%	10.67 0.7%	4.69 5.1%	33.20 0.0%			28.73 -0.6%			15.79 0.6%	13.31 -1.0%	52.78 -1.0%			31.39 -9.5%			27.19 0.0%			17.03 -3.2%				

KERB LONGSECTION CH300 - CH593.7

SCALE V 1:500, H 1:1000

Disclaimer:
Areas and dimensions may be subject to scale error.
Scaling from this drawing is at the users risk.

BUILDING CONSENT

File Name: J:\14501\14501.01\14501-01-REV 3.dwg - -01 SHT 2 Plot Date: 07/07/2015 Plot Time: 17:17

btw company
. surveyors
. planners
. engineers
. land & g-i-s services

BTW Company Ltd
Cnr. Courtenay & Eliot Sts.
P.O Box 551, NEW PLYMOUTH 4340
Ph (06) 759 5040
Ph 0800 289787 Fax (06) 759 5049
E-mail survey@btwcompany.co.nz
Web www.btwcompany.co.nz

GENERAL NOTES
1. Coordinates in terms of : Geodetic Datum (Taranaki 2000)
2. Elevations in terms of : Mean Sea Level (Taranaki Datum 1970)
3. Contour interval is : -

NO	DATE	BY	CHKD	APPR	OPER	DESCRIPTION
1	06.07.15	LB	IS			BUILDING CONSENT

REVISIONS

NUMBER	TITLE

REFERENCE DRAWINGS

LOCATION: BAYLY ROAD
PROJECT No.: 14501
SCALE: AS SHOWN

SURVEYED	PA & NC	08/07/14
DRAWN	L BUNN	06.07.15
CHECKED	I STEELE	06.07.15
DES. CHK.	-	
PROJ. ENG.		
APPROVED	-	

ORIGINAL SIZE: A3

TITLE: NGAMOTU MARAE PROJECT
BAYLY ROAD, NEW PLYMOUTH
KERBING LONGSECTION

DRAWING No: 14501-01-01
SHEET: 2
REVISION: 1

SETOUT INFORMATION			
STATION	NORTHING	EASTING	LEVEL
S1	808240.00	384019.74	5.11
S2	808240.10	384020.77	5.17
S3	808236.00	384029.30	5.66
S4	808213.50	384044.87	5.66
S5	808203.73	384079.67	8.64
S6	808222.26	384128.81	9.17
S7	808229.65	384137.24	9.27
S8	808234.94	384139.91	9.32
S9	808246.24	384145.62	9.22
S10	808268.65	384156.94	8.15
S11	808271.89	384158.58	8.06
S12	808280.53	384157.84	7.82
S13	808283.67	384149.76	7.6
S14	808282.92	384145.82	7.5
S15	808278.33	384121.67	5.99
S16	808276.61	384112.59	5.77
S17	808277.27	384107.90	5.66
S18	808277.87	384106.70	5.63
S19	808278.86	384104.74	5.67
S20	808277.74	384101.31	5.73
S21	808270.39	384097.55	5.85
S22	808268.45	384096.56	5.85
S23	808260.68	384111.94	5.85
S24	808260.90	384112.62	5.85
S25	808265.20	384114.79	5.8
S26	808265.42	384115.46	5.8
S27	808262.53	384121.17	5.86
S28	808265.39	384122.61	5.86
S29	808267.56	384118.32	5.8
S30	808268.23	384118.10	5.8

SETOUT INFORMATION			
STATION	NORTHING	EASTING	LEVEL
S31	808269.38	384118.68	5.80
S32	808272.93	384122.69	6.10
S33	808277.51	384146.85	7.61
S34	808275.73	384151.44	7.82
S35	808270.82	384151.87	8.04
S36	808257.59	384140.05	8.95
S37	808256.36	384129.81	9.02
S38	808258.48	384125.63	9.24
S39	808239.64	384116.11	9.26
S40	808234.19	384126.92	9.26
S41	808234.41	384127.59	9.26
S42	808239.35	384130.08	9.22
S43	808239.57	384130.75	9.22
S44	808238.04	384133.79	9.19
S45	808247.32	384138.48	9.09
S46	808248.89	384135.37	9.09
S47	808249.45	384135.18	9.09
S48	808250.55	384138.54	9.09
S49	808249.62	384140.39	9.09
S50	808248.72	384140.71	9.09
S51	808237.42	384135.00	9.19
S52	808232.13	384132.33	9.13
S53	808227.40	384126.87	9.06
S54	808208.86	384077.69	8.53
S55	808210.12	384057.01	6.55
S56	808216.88	384049.22	5.55
S57	808239.09	384033.85	5.55
S58	808245.57	384020.28	5.03
S59	808245.48	384019.25	5.00
S60	808245.48	384019.25	5.00

BUILDING CONSENT

File Name: J:\14501\114501.01\114501-01-REV 3.dwg - -01 SHT 3 Plot Date: 07/07/2015 Plot Time: 17:17

btw company
. surveyors
. planners
. engineers
. land & g-i-s services

BTW Company Ltd
Cnr. Courtenay & Eliot Sts.
P.O Box 551, NEW PLYMOUTH 4340
Ph (06) 759 5040
Ph 0800 289787 Fax (06) 759 5049
E-mail survey@btwcompany.co.nz
Web www.btwcompany.co.nz

GENERAL NOTES
1. Coordinates in terms of : Geodetic Datum (Taranaki 2000)
2. Elevations in terms of : Mean Sea Level (Taranaki Datum 1970)
3. Contour interval is : -

NO	DATE	BY	CHKD	APPR	OPER	DESCRIPTION
1	06.07.15	LB	IS	-	-	BUILDING CONSENT

REVISIONS

NUMBER | TITLE

REFERENCE DRAWINGS

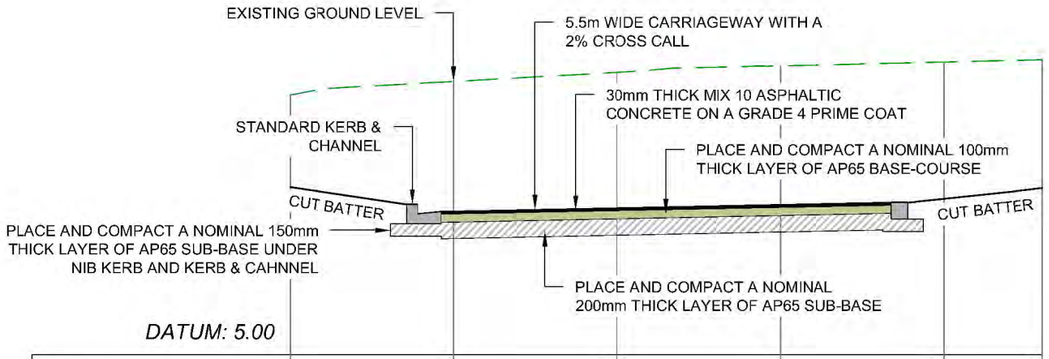
LOCATION: BAYLY ROAD
PROJECT No.: 14501
SCALE: -

SURVEYED	PA & NC	08/07/14
DRAWN	L BUNN	06.07.15
CHECKED	I STEELE	06.07.15
DES. CHK.	-	
PROJ. ENG.		
APPROVED	-	

ORIGINAL SIZE: A3

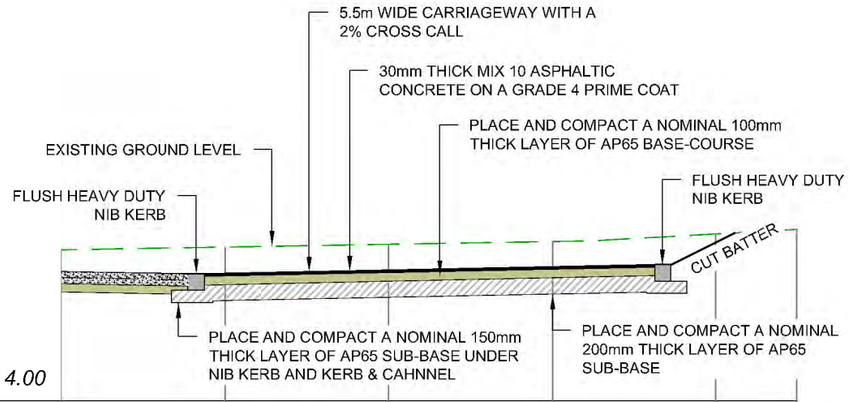
TITLE: NGAMOTU MARAE PROJECT
BAYLY ROAD, NEW PLYMOUTH
KERBING SETOUT DATA

DRAWING No: 14501-01-01
SHEET: 3
REVISION: 1



EXISTING LEVEL	8.17	8.34	8.45	8.53	8.57	8.60
DESIGN LEVELS	7.05	6.75	6.79	6.83	6.90	7.04
DEPTH TO INVERT	-1.12	-1.59	-1.66	-1.70	-1.67	-1.56
CHAINAGE	0.0	2.0	4.0	6.0	8.0	9.2

CROSS SECTION AA
SCALE 1:75



EXISTING LEVEL	5.85	5.88	5.91	5.95	6.04	6.09
DESIGN LEVELS	5.57	5.56	5.60	5.63	5.93	
DEPTH TO INVERT	-0.27	-0.32	-0.32	-0.31	-0.10	
CHAINAGE	0.0	2.0	4.0	6.0	8.0	9.0

CROSS SECTION BB
SCALE 1:75

BUILDING CONSENT

btw company
. surveyors
. planners
. engineers
. land & g-i-s services

BTW Company Ltd
Cnr. Courtenay & Eliot Sts.
P.O Box 551, NEW PLYMOUTH 4340
Ph (06) 759 5040
Ph 0800 289787 Fax (06) 759 5049
E-mail survey@btwcompany.co.nz
Web www.btwcompany.co.nz

GENERAL NOTES
1. Coordinates in terms of : NA
2. Elevations in terms of : NA
3. Contour interval is : NA

0.5 0 0.5 1 1.5 2 2.5 3 3.5m
SCALE 1 : 75

NO	DATE	BY	CHKD	APPR	OPER	DESCRIPTION
1	06.07.15	LB	IS	-	-	BUILDING CONSENT

REVISIONS

NUMBER | TITLE
REFERENCE DRAWINGS

LOCATION: BAYLY ROAD
PROJECT No.: 14501
SCALE: 1:75 @ A3

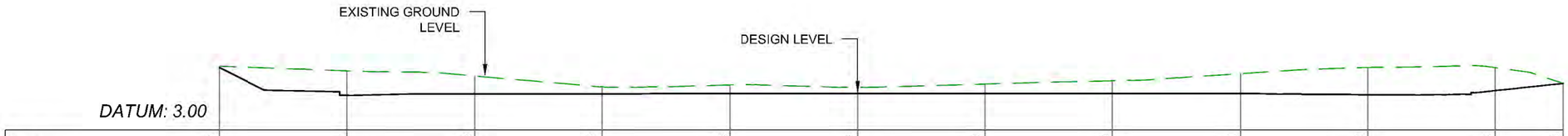
SURVEYED	PA & NC	08/07/14
DRAWN	L BUNN	06.07.15
CHECKED	I STEELE	06.07.15
DES. CHK.	-	
PROJ. ENG.		
APPROVED	-	

ORIGINAL SIZE: A3

TITLE
NGAMOTU MARAE PROJECT
BAYLY ROAD, NEW PLYMOUTH
PAVEMENT CROSS SECTIONS

DRAWING No: 14501-01-02
SHEET: 1
REVISION: 1

File Name: J:\14501\14501.01\14501-01-REV 3.dwg - -02 SHT 1 Plot Date: 08/07/2015 Plot Time: 08:36



EXISTING LEVEL	7.99	7.64	7.23	6.37	6.53	6.33	6.60	6.85	7.41	7.89	7.88	6.65
DESIGN LEVELS	7.88	5.71	5.83	5.83	5.85	5.85	5.85	5.85	5.85	5.76	6.09	6.65
DEPTH TO INVERT	-0.11	-1.93	-1.41	-0.54	-0.68	-0.48	-0.75	-1.00	-1.56	-2.13	-1.79	0.00
CHAINAGE	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	105.3

CROSS SECTION CC
SCALE 1:400

EXISTING LEVEL	4.14	4.75	5.18	5.69	6.11	6.75	7.51	7.95	9.77	11.88
DESIGN LEVELS	4.16	5.45	5.62	5.75	5.82	5.85	5.85	5.85	8.81	11.90
DEPTH TO INVERT	0.02	0.71	0.44	0.06	-0.29	-0.90	-1.66	-2.10	-0.96	0.02
CHAINAGE	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	83.8

CROSS SECTION DD
SCALE 1:400

BUILDING CONSENT

File Name: J:\14501\14501.01\14501-01-REV 3.dwg - -02 SHT 2 Plot Date: 08/07/2015 Plot Time: 08:36

btw company
. surveyors
. planners
. engineers
. land & g-i-s services

BTW Company Ltd
Cnr. Courtenay & Eliot Sts.
P.O Box 551, NEW PLYMOUTH 4340
Ph (06) 759 5040
Ph 0800 289787 Fax (06) 759 5049
E-mail survey@btwcompany.co.nz
Web www.btwcompany.co.nz

GENERAL NOTES
1. Coordinates in terms of : NA
2. Elevations in terms of : NA
3. Contour interval is : NA

4 0 4 8 12 16 20m
SCALE 1 : 400

NO	DATE	BY	CHKD	APPR	OPER	DESCRIPTION	NUMBER	TITLE
1	06.07.15	LB	IS			BUILDING CONSENT		

REVISIONS | REFERENCE DRAWINGS

LOCATION: BAYLY ROAD
PROJECT No.: 14501
SCALE: 1:400 @ A3

SURVEYED	PA & NC	08/07/14
DRAWN	L BUNN	06.07.15
CHECKED	I STEELE	06.07.15
DES. CHK.	-	
PROJ. ENG.		
APPROVED	-	

ORIGINAL SIZE: A3

TITLE: NGAMOTU MARAE PROJECT
BAYLY ROAD, NEW PLYMOUTH
SITE CROSS SECTIONS

DRAWING No: 14501-01-02
SHEET: 2
REVISION: 1

Disclaimer:
Boundary Information and Photographic imagery has been imported from external sources.
Areas and dimensions may be subject to scale error.
Scaling from this drawing is at the users risk.

4 0 4 8 12 16 20m

SCALE 1 : 400

GENERAL NOTES
1. Coordinates in terms of : Geodetic Datum (Taranaki 2000)
2. Elevations in terms of : Mean Sea Level (Taranaki Datum 1970)
3. Contour interval is : 0.5M

NGAMOTU MARAE EXISTING CONTOURS