Tonkin+Taylor

Job No: 1007466
16 January 2019

Ministry of Education
48 Hereford Street
West End
Christchurch 8013

Attention: Deb Taylor

Dear Deb

TKKM o Horouta Wananga - 17 Ranfurly Street, Gisborne
Ground contamination investigation and assessment report

1 Introduction

This letter report presents the results of a ground contamination investigation completed by Tonkin & Taylor Ltd (T+T) for the property at 17 Ranfurly Street in Gisborne (the Site). The work described in this document was commissioned by the Ministry of Education (MoE) and has been completed in accordance with our letter of engagement dated 17 July 2018.

2 Background and Objectives

The Site is a former Mobil Oil New Zealand (Mobil) terminal that was decommissioned during the late 1980s/early 1990s. Since that time the Site has remained unused and covered with grass. The MoE is considering the purchase of the Site for the relocation of TKKM o Horouta Wananga.

T+T has completed a review[1] of previous site contamination investigations for the Site provide by MoE. This review was undertaken to identify what additional ground contamination investigations were required to assist the MoE in understanding ground contamination-related development implications at the Site. The T+T review identified that:

- It is likely that sub-surface soils, particularly within the range of groundwater surface fluctuation, may contain pockets of elevated hydrocarbon contamination and/or LNAPL[2] and this will need to be considered in terms of soil disposal, soil reuse, the specification of potable supply pipework and dewatering.
- Elevated concentrations of lead have also been detected in soils and in some cases are above published standards for residential land use. The presence of elevated lead will also need to be considered in terms of soil disposal, soil reuse, and dewatering.
- Previous investigations have not considered the presence of asbestos within soils associated with former buildings and structures. The presence of asbestos contamination in soil can significantly constrain its reuse, require additional health and safety controls during

[1] 17 Ranfurly Street, Gisborne. Review of previous investigation data. Tonkin & Taylor Ltd. 11 July 2018. 1007446.
[2] LNAPL-Light, Non-Aqueous Phase Liquid.

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earthworks, limit the options for soil disposal, significantly increase soil disposal costs and considerable extend earthworks timeframes, if unexpectedly encountered.

Based on the findings of the review, the MoE engaged T+T to undertake a ground contamination investigation at the Site in order to:

- Assess for the presence of asbestos in soils associated with the former terminal structures.
- Assess for the presence and magnitude of contamination within shallow groundwater beneath the Site.
- Provide updated recommendations associated with the assessed ground contamination in the context of the proposed educational development for the Site.

3 Investigation Scope and Approach

3.1 Rationale

The principal objective of the investigation completed by T+T was to assess for the presence of asbestos associated with the former Mobil terminal structures. The investigation included targeted soil sampling of fill in the approximate location of former terminal buildings and facilities, based on plans included in the Pattle Delamore Partners (PDP) 2009 investigation report[3].

In addition, the investigation sought to assess current groundwater contamination conditions in order to inform consideration of potential treatment for dewatering discharges, on the assumption that the preference would be to discharge to Gisborne District Council (GDC) stormwater or trade waste networks. The collection of groundwater samples from test pits was considered to be representative of groundwater conditions that would likely be encountered during construction works.

3.2 Scope

The ground contamination investigation completed by T+T for the purposes of this report comprised:

- Pre-excavation service clearance, completed on behalf of T+T by Land Development & Exploration Ltd (LDE).
- The mechanical excavation of 13 test pits (TP01-TP13) to a maximum depth of 3.0 metres below ground level (m bgl) on 14 and 15 August 2018. All test pits were excavated by Pete Burgess Contracting Ltd under the supervision of a T+T ground contamination specialist. Test pit locations are shown on Figure 1 (refer Appendix A).
- The collection of soil samples for laboratory analysis for a range of contaminants including asbestos, metals, total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylene (BTEX) and polycyclic aromatic hydrocarbons (PAHs).
- The collection of groundwater samples from three test pits to analyse for suspended solids, metals, TPH and PAHs.
- The comparison of detected contaminant concentrations against accepted assessment criteria for the protection of human health, disposal of soil to landfill, and discharge of groundwater to the GDC stormwater network.
- The preparation of this report.

[3] Phase 2 Environmental Site Investigation, Former Mobil Gisborne Terminal (Site No 410-280). Prepared for Mobil Oil New Zealand Ltd. Pattle Delamore Partners, 16 November 2009.

3.3 Soil sampling methodology

A total to 30 soil samples were collected from the 13 test pit locations and submitted for laboratory analysis. Soil sampling was undertaken by a T+T contaminated land specialist according to the following procedures:

- Sampling for chemical contaminants was conducted in general accordance with the MfE's *"Contaminated Land Management Guidelines No. 5, Site Investigation and Analysis of Soils (Revised 2011)"* with samples collected with freshly gloved hands, directly from the recovered material, and placed into laboratory supplied containers.
- All soil samples selected for chemical analysis were couriered chilled, under chain of custody documentation, to IANZ-accredited Analytica Laboratories for testing.
- All soil samples were screened on-site for volatile contaminants using a photo-ionisation detector (PID).
- Samples for asbestos analysis were collected in general accordance with the *"New Zealand Guidelines for Assessing and Managing Asbestos in Soil"* (Asbestos in Soil Guidelines), as follows:
    - The recovered soils were visually inspected for the presence of asbestos containing material (ACM).
    - 500 ml samples were collected and submitted to IANZ-accredited Precise Consulting and Laboratories, under chain of custody documentation, for semi-quantitative analysis of asbestos content.
    - A total of 15 soil samples were submitted for semi-quantitative asbestos analysis. As indicated above the sampling typically targeted the location of former terminal buildings and facilities. A few samples were also distributed across the site to screen for any wider impacts.
- Materials encountered were logged in general accordance with the NZ Geotechnical Society "*Guidelines for the classification and field description of soils and rocks for engineering purposes*".
- All non-dedicated sampling equipment was decontaminated between sample locations using Decon-90 (a phosphate-free detergent) and fresh water rinses.

3.4 Groundwater sampling methodology

Groundwater samples were collected from three test pits (TP02, TP05 and TP07) using dedicated plastic bailers before being transferred into laboratory-supplied containers. Water was allowed to stabilise for 30 minutes within each test pit prior to sample collection.

All water samples were couriered in a chilled container, under chain of custody documentation, to IANZ-accredited Analytica Laboratories for testing.

4 Investigation Findings

4.1 Field observations

4.1.1 Ground conditions

The materials encountered during the ground contamination investigation were generally consistent with those encountered during the geotechnical investigation[4] undertaken by T+T in parallel with this investigation, and that by PDP in 2009, and can be summarised as follows:

- Fill containing varying proportions of demolition material (brick fragments, concrete, wood, wire etc.) was encountered to a maximum depth of 1.7 m bgl within 11 of the 13 test pits, with the greatest thickness observed in the locations of the former office (TP11), former wagon filling stand (TP10), former tank farm (TP03) and former drum storage area (TP07).
- Demolition material was not observed within TP05, located in the eastern third of the site, or TP06, near the former tank farm.
- In some cases, the thickness of demolition material-containing fill was greater than encountered in nearby soil bores completed by PDP in 2009, including TP03, TP04, TP06, TP10, and TP11.
- Demolition material-containing fill was underlain by what appeared to be naturally occurring silty clay or clay. In many test pits a distinct colour change was noted from brown to blue. As this change was consistent with the depth of wet soil, this change is thought to be due to saturated soils rather than defining the boundary between fill/natural soil.
- The thickness of fill encountered in TP08 and TP12 is considerably less than in nearby PDP (2009) soil bores. It is possible that PDP has identified reworked natural materials (potentially resulting from historic soil remediation) as fill materials – however T+T observed no evidence in these locations upon which to identify silty clay and clay materials underlying demolition fill, as fill.

Photographs showing examples of materials encountered within the test pits are included in Appendix B. Test Pit logs are included in Appendix C.

4.1.2 Groundwater

Groundwater inflow was observed in all test pits with the exception of TP01 and TP06. Moist to wet soils were generally observed from approximately 1.0 m bgl, with visible water seepage occurring at between 0.8 to 1.8 m bgl in TP07 (refer Photograph 2), TP08, TP09 and TP13.

4.1.3 Indications of contamination

With the exception of fill containing building demolition material and associated anthropogenic elements (brick, concrete, wire etc.), indications of contamination (odours and/or staining) were noted within soils samples collected from TP06, TP07, TP10, TP11, and TP13. A peak PID screening reading of 121 parts per million (ppm) was recorded within samples that included soils containing a strong hydrocarbon odour within TP07 and TP11. Generally the strongest odours and highest PID readings in these test pits were within wet soil, close to the groundwater surface.

Fragments of suspected ACM were encountered in two test pits (TP3 and TP13). Samples of fragments from both pits were collected and submitted for laboratory asbestos identification.

[4] TKKM o Horouta Wananga – 17 Ranfurly Street, Gisborne. Geotechnical investigation and assessment report. Tonkin & Taylor Ltd. 1007466. 21 September 2018.

No evidence of LNAPL was observed on water that collected in the base of the test pits.

4.2 Soil analytical results

4.2.1 Assessment criteria

The soil analytical results have been evaluated against the following criteria:

- Re-use of soil/need for soil remediation to allow operation of the Wananga:
  - NES Soil[5] Contaminant Standard (SCS) for metals for residential land use (10% produce consumption) as a conservative assessment of the suitability of contaminated soils in a school setting.
  - New Zealand Asbestos in Soil Guidelines 'Residential scenario' soil guideline values for ACM, asbestos fines (AF) and fibrous asbestos (FA).
  - Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 Soil Acceptance Criteria for residential land use.
- Soil disposal:
  - Class A Landfill Screening Criteria as set out in the Ministry for the Environment Hazardous Waste Guidelines, Module 2: Landfill acceptance Criteria and Landfill Classification, 2004.
- Worker health and safety:
  - NES Soil SCS for commercial land use with respect to protection of construction workers during any soil disturbance works associated with the development or future subsurface maintenance works.
  - Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 Soil Acceptance Criteria for commercial/industrial land use.
  - New Zealand Asbestos in Soil guidelines commercial and industrial soil guideline values for ACM, AF and FA.

4.2.2 Quality Assurance/Quality Control

A quality assurance and quality control (QA/QC) program was implemented during soil sampling to confirm data was fit for purpose. This included:

- Fresh gloves were worn for collection and placement of each sample into laboratory supplied containers or bags.
- Preservation of samples for chemical analysis with ice during transport from the field to the laboratory.
- Transportation of samples with accompanying chain of custody documentation.
- Compliance with sample holding times.
- Laboratory testing by an accredited laboratory.
- Duplicate analysis of two soil samples and calculation of relative percentage difference (RPD) between paired analytical results.

The quality control measures implemented at the laboratory include testing of blanks with all batches of samples and frequent replicates and spikes, along with peer review of worksheets.

[5] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations, 2011.

Standard laboratory QA/QC reports were not examined as part of this project, but are available from the laboratory on request.

4.2.3 Analytical results

Soil analytical results are summarised in Table 1 (refer Appendix D). Soil analysis certificates are also included in Appendix D.

The soil analytical results for soil samples collected by T+T during this investigation can be summarised as follows:

- Trace levels (<0.001 % weight/weight) of AF and/or FA were detected within two of the 15 soil samples analysed. The level of AF/FA detected is below the NZ Asbestos in Soils Guidelines value for residential and commercial land use. In both samples the asbestos was present as free fibres of chrysotile asbestos.
- Both fragments of suspected ACM that were submitted for asbestos identification were confirmed as containing asbestos. Both comprised asbestos cements sheet containing amosite and/or chrysotile.
- Metals were not detected above NES SCS for residential or commercial land use. Zinc was detected above the screening criteria for Class A landfill disposal in one of the samples analysed.
- Low TPH concentrations were detected within the majority of the 9 samples analysed with a peak concentration of 1,137 mg/kg detected within a sample collected from test pit TP06. Generally, hydrocarbons were detected within the C_{10}-C_{14} carbon band and not in the more volatile C_7-C_9 band. This is consistent with the absence of detectable BTEX (benzene, toluene, ethylbenzene and xylene which are volatile hydrocarbons) within the soil samples analysed.

4.3 Groundwater analytical results

4.3.1 Assessment criteria

Groundwater at the site is known to be shallow, periodically being at ground level. It is possible that dewatering will be required during construction, with dewatering fluid likely to be discharged to the GDC stormwater system. Discharge of dewatering fluid is likely to be considered a permitted activity (i.e. can be undertaken without the need for resource consent) under the Gisborne Regional Freshwater Plan providing the discharge does not exceed the trigger values for 95% species protection for substances that are toxic to aquatic ecosystems[6]. Concentrations of contaminants detected within the groundwater samples collected from test pits TP02, TP05 and TP07 have been compared against these trigger values to assess the need for the treatment of discharge water.

4.3.2 Quality Assurance/Quality Control

A quality assurance and quality control (QA/QC) program was implemented during the collection of groundwater samples to confirm data was fit for purpose. This included:

- Fresh gloves were worn for collection and placement of each groundwater sample into laboratory supplied containers or bags.
- Preservation of samples for chemical analysis with ice during transport from the field to the laboratory.
- Transportation of samples with accompanying chain of custody documentation.
- Compliance with sample holding times.

[6] ANZECC Guidelines for Fresh and Marine Water Quality, 2000.

- Laboratory testing by an accredited laboratory.
- Duplicate analysis of two groundwater samples (primary and duplicate) collected from test pit TP07 and calculation of relative percentage difference (RPD) between paired analytical results.
- The analysis of a groundwater trip blank for TPH, PAHs and BTEX.

Table 2 in Appendix D summarises the RPD calculations for the duplicate groundwater samples collected from TP07. Note that only contaminants which recorded concentrations above the laboratory level of detection have been reported.

It is typically considered acceptable (refer to MfE CLM Guideline No. 5) if an RPD range of less than 50% is achieved for duplicate soil samples. As shown in Table 2, the contaminant concentrations in duplicate samples typically reported RPDs within this range indicating that variability in sample collection, handling and analysis is acceptable.

BTEX and TPH were not detected within the trip blank indicating that cross contamination of groundwater samples by volatile compounds during transit is unlikely to have occurred. A low concentration of fluorene, close to the laboratory limit of reporting was detected within the trip blank. Fluorene has a relatively low volatility, and as the trip blank was sealed at the laboratory before being shipped into the field, it is considered likely that the low concentration of fluorene has occurred due to cross contamination within the laboratory, rather than during transit of the groundwater samples from the Site to the laboratory.

4.3.3 Analytical results

Groundwater analytical results are summarised in Table 3 (refer Appendix D). Groundwater analysis certificates are also included in Appendix D.

The groundwater analytical results for groundwater samples collected by T+T during this investigation can be summarised as follows:

- TPH and BTEX were not detected within groundwater samples collected from test pits TP02 and TP05. Low concentrations of PAHs (below the applicable assessment criteria) were detected in samples collected from TP05 and TP07. Low concentrations of TPH were detected in the sample collected from TP07.
- Copper was detected above the assessment criteria in the groundwater samples collected from all three test pits. In addition, chromium and zinc were detected above the assessment criteria in the groundwater samples collected from test pits TP05 and TP07.
- The highest contaminant concentrations were detected in the groundwater sample collected from TP07. This sample also contained the highest concentration of suspended solids, and it is considered likely that groundwater contaminant concentrations are related to the suspended sediment content within the sample.

5 Discussion

5.1 Nature and distribution of contamination

5.1.1 Asbestos in fill

Trace levels of asbestos fibres were detected within a small proportion of the samples (two of 15) analysed by T+T during this investigation. Fragments of ACM were observed within a further two test pits. It is possible that higher levels of asbestos are present elsewhere on the Site but there is no clear evidence to indicate that asbestos contamination is extensive at the Site or that it is likely to consistently be present above the levels detected to date.

Although both samples that contained asbestos fibres were collected from fill that contained demolition materials (brick, concrete, metal etc.), asbestos was not detected in other samples collected from similar fill in other test pits. This is consistent with our experience of asbestos-contaminated fill, in which the distribution of asbestos in demolition materials can be effectively random.

Unless the presence of asbestos is associated with a specific, visually distinguishable fill type, the delineation of asbestos contaminated fill cannot be undertaken with any confidence. The presence of asbestos in fill at the Site does not appear to be associated with a particular fill type and so it would be necessary to assume that all fill that contains demolition material has the potential (albeit low) to contain asbestos (albeit at relatively low levels).

Based on the data obtained by PDP (in 2009) and T+T during this investigation, demolition material-containing fill is most likely to occur, and be present to a greater depth, on the western two thirds of the Site, which corresponds to where the former terminal was located, rather than the eastern third of the Site that was historically used for empty tank storage.

5.1.2 Other contaminants in fill

Concentrations of metals and petroleum hydrocarbons (TPH, PAHs and BTEX) detected in soil samples collected by T+T during this investigation are generally consistent with those reported by PDP (2009). With limited exceptions, concentrations of metals have been detected below assessment criteria for the protection of human health. Moderate concentrations of moderate to low volatility hydrocarbons have also been detected, but also below assessment criteria. Volatile contaminants typically associated with fuel handling facilities (BTEX) were not detected in the soil samples analysed by T+T, and at low concentrations and in a small proportion of the samples analysed by PDP in 2009. Whilst odorous soils were encountered during both the PDP (2009) and T+T investigations, the analytical data indicates that residual hydrocarbon concentrations are unlikely to present a significant health-related vapour/inhalation threat (but could present an aesthetic issue if exposed/left at the surface).

Elevated hydrocarbon concentrations were generally not observed in fill materials shallower than approximately 0.5 m bgl, and were most frequently noted in saturated fill or saturated natural soil that was generally deeper than 1.0 m bgl. The Site is understood to have undergone soil remediation in the 1990s that comprised excavation, land-framing and reinstatement. Soil remediation is likely to have focussed on the most highly contaminated soils in and beneath the principal fuel transfer and storage areas in the former terminal including the tank farm, wagon filling stand and drum storage areas. This is likely to account for the relative absence/low concentrations of hydrocarbons in shallow fill compared to the presence of hydrocarbons within the vertical extent of groundwater fluctuation. Although the analytical data suggests that hydrocarbon concentrations are likely to be below human health assessment criteria, globules of LNAPL were encountered by PDP in 2009, and it is possible that isolated pockets of LNAPL may remain at the Site.

The potential for hydrocarbon contaminated soils to be present in the eastern third of the Site (i.e. outside of the former terminal) is considered to be low based on our understanding of historical site activities together with our test pit observations, assessment of analytical data and inferred relatively low permeability of natural materials (which would limit lateral movement of hydrocarbons from the former terminal).

5.1.3 Groundwater contamination

Low concentrations of petroleum hydrocarbons were detected in one of three groundwater samples collected from the test pits, by T+T. The concentrations detected within the sample collected by T+T from test pit TP07 were generally higher than those detected within any of the six on-site wells

sampled by PDP in 2009. The concentrations of zinc, chromium and copper detected in the groundwater samples collected by T+T exceed trigger values for the assessment of aquatic ecosystems. However, it is likely that the contaminant concentrations detected are associated with suspended sediment within the samples, and treatment to remove suspended sediment would reduce contaminant concentrations in the groundwater (for example, pre-discharge settlement of dewatering fluid prior to release to the stormwater network).

5.2 Implications for development

5.2.1 Soil remediation/soil reuse

With limited exceptions, contaminant concentrations in soils have not been detected above assessment criteria for residential land use. Adoption of residential land use assessment criteria is conservative in the context of the future use of the Site as a Wananga. Therefore the limited occurrence of soil contamination above these criteria would not normally be expected to trigger remediation or management actions to allow the use of the Site for a Wananga. Similarly, excavated materials would generally be expected to be suitable for reuse on the Site. However, material excavated from within the zone of groundwater fluctuation may contain strong hydrocarbon odours and therefore be aesthetically unsuitable for reuse on or near areas of exposed ground surface.

The amount of asbestos present as free fibre is below the guideline value for residential land use in New Zealand. In other words, the soil containing this material could be reused on the Site, and in fact this is common practice for the redevelopment of brownfield sites. Good practice is to manage potential exposure to asbestos wherever possible, and this could be achieved at this Site through relatively straightforward procedures, for example placing such material under buildings and/or sealed pavement areas.

However, we are aware that for other sites, the MoE has elected to remove (rather than retain) asbestos-containing soils, including in cases where asbestos levels are below applicable land use criteria. If the ministry were to adopt the same approach for this Site then all fill that potentially contains demolition material would need to be removed. The potential implications that this approach could have for soil disposal are discussed below.

5.2.2 Soil disposal

Any materials that cannot be retained on site and which contain asbestos or petroleum hydrocarbons will require disposal to a licensed landfill. The contaminant concentrations detected within samples from the Site indicate that pre-treatment of soils (such as cement stabilisation) would not be required to allow disposal to a licensed landfill.

If the MoE was to require that all asbestos-containing material be removed from the Site then the volume of material that would likely require removal could be significant. The nearest licensed landfill to the Site is the Waiapu Area Landfill located more than 100 km to the north. This landfill has a relatively small capacity, having been designed primarily to provide a disposal location for domestic refuse in the Gisborne Region. Therefore, this landfill may be unable or unwilling to accept a significant volume of contaminated soil from the Site. The disposal rate for asbestos-contaminated soil at the Waiapu Area Landfill is likely to be above $300 per tonne. Alternatively, the Wairoa Landfill is located approximately 100 km south of the Site, within the Hawkes Bay Region. The published rate[7] for the disposal of asbestos waste that originates from outside of the Hawkes Bay Region is $450 per tonne.

It is possible that the volume of fill requiring disposal as asbestos-contaminated material could be reduced through further sampling. However, there is a high likelihood that the cost savings

[7] https://www.wairoadc.govt.nz/services/rubbish-and-recycling/.

associated with trying to reduce this volume could be outweighed by the cost of sampling, segregating and double handling materials during this process.

The retention of contaminated materials on the Site, subject to various controls, and limiting the amount of contaminated material taken away from the Site, is likely to limit the ground-contamination related development costs.

5.2.3 Worker health and safety

Any works that could result in worker exposure to asbestos-contaminated material (including construction earthworks and post-development maintenance works) trigger the requirements of the Asbestos Regulations[8]. Worksafe New Zealand has prepared an ACoP[9] which, along with the Regulations, require that works involving asbestos contaminated soils must be undertaken with appropriate asbestos controls in place and that contaminated soil removed from a site must be taken to an approved disposal facility. Details relating to the standards and controls that apply to asbestos-in-soils, are subject to further guidance within the NZ Asbestos in Soils Guidelines which are incorporated by reference into the Worksafe ACOP.

The controls and procedures specified in the NZ Asbestos in Soils Guidelines are based on the percentage by weight (%w/w) of asbestos fines and fibrous asbestos (AF/FA) in soil. Based on the levels of asbestos detected in the samples collected from the Site to date, there appears to be a relatively low occurrence of asbestos in sampled fill and therefore a low potential for fibre release to air. Therefore T+T considers that works within asbestos-contaminated fill at the Site can be undertaken as '*Unlicensed Asbestos Works*[10]'. *Unlicensed Asbestos Works* require relatively limited protocols over and above standard earthworks controls, and include:

- The segregation of *Unlicensed Asbestos Works* from other on site works using fencing and signage.
- Personnel decontamination facilities (minimum of bootwash) at the entry/exit to the *Unlicensed Asbestos Works* area.
- Decontamination of equipment and inspection by a *Competent Person* prior to leaving the *Unlicensed Asbestos Works* area.
- Strict adherence to dust control, stockpiling and erosion and sediment control procedures.

Monitoring for airborne asbestos fibres is not required for *Unlicensed Asbestos Works,* although it is recommended that limited monitoring is undertaken to confirm assumptions regarding the low potential for fibre release.

The implementation of specific controls for *Unlicensed Asbestos Works* will present a contamination-related development cost that will depend on the duration of the works.

As other ground contaminants (metals, hydrocarbons) have not been detected above assessment criteria for outdoor workers, no specific PPE or other health and safety controls are likely to be required to control human exposure to these contaminants (observing personal hygiene requirements is likely to afford adequate protection).

A site management plan (SMP) for ground contamination will need to be prepared to support development-related resource consent applications and this document will provide details of the contamination-related health and safety controls required for the development. The SMP will also

[8] Health and Safety at Work (Asbestos) Regulations, 2016.
[9] Worksafe New Zealand (2016). Approved Code of Practice (ACoP): Management and Removal of Asbestos. November 2016.
[10] Italicised words have specific meaning under the Regulations/ACOP.

include contingency actions in case unexpectedly high levels of contamination (or unexpected contaminants) are encountered during earthworks.

5.2.4 Treatment of dewatering discharge

Our initial groundwater sampling and analysis indicates that contaminants are present in groundwater above levels that would allow dewatering water to be discharged to the GDC stormwater network without consent.

It is likely that the contaminant concentrations detected are associated with suspended solids within groundwater. Mechanical (settlement) and/or chemical (flocculent) treatment of dewatering fluid to reduce the suspended sediment load (which itself would likely be required, irrespective of the presence of contaminants) would likely result in contaminant concentrations being reduced to below permitted activity levels. In addition, given the potential, albeit low, for the presence of LNAPL, it is likely that discharge via an oil/water separator would be required by GDC. Further investigation would be required in order to determine the necessary performance specifications of a dewatering treatment system.

Reduced (or no) treatment of dewatering fluid may be possible for discharge to trade waste, if a suitable discharge point is located on or immediately adjacent to the site.

5.2.5 Consent requirements

Although a development concept has not yet been prepared, given the historic use of the Site and known presence of contaminants, it is highly likely that resource consent will be required from GDC under the NES Soil. Based on the contaminant concentrations detected to date, it is likely that a consent will be required for soil disturbance and change of landuse, as a controlled activity. A SMP will be required to support the NES Soil consent application.

Aside from the NES Soil, the historical use of the site for HAIL[11] activities and the presence of contaminants in soil will have implications on resource consents required during the works under Regional and District Plans. The resource consents that will be required will depend on the specific project and should be assessed once further details are available, as part of a holistic planning review for any proposed development.

5.2.6 Ongoing management

If contaminated materials are retained or reused on the Site, a long term management plan (LTMP) will be required to provide controls and procedures to protect workers from exposure to contaminated materials, and provide guidance regarding the reuse and/or disposal of contaminated materials. If any asbestos remains on site it will trigger the need for an Asbestos Management Plan (AMP) under the Asbestos Regulations. The AMP may be able to be incorporated into the LTMP.

6 Conclusions

T+T was engaged by the MoE to undertake a ground contamination investigation at 17 Ranfurly Street in Gisborne to supplement existing investigation data. The T+T investigation focussed on the assessment of asbestos in soil and the presence of contamination in groundwater. The findings of the investigation can be summarised as follows:

- Low levels of asbestos fibres and fragments were detected in a small number of samples collected from fill that contained demolition material. As asbestos contamination can be randomly distributed within demolition material, all such material at the Site should be

[11] Hazardous Activities and Industries List.

assumed to contain asbestos. Based on the historic site activities, this material is most likely to be confined to the western two thirds of the Site, associated with the former Mobil terminal.

- Although it is possible that higher levels of asbestos are present elsewhere on the Site, there is no clear evidence to indicate that asbestos contamination above the levels detected to date is widespread.
- The level of asbestos encountered is below the guideline for residential land use in New Zealand. In other words, this material could be reused on the Site, and in fact this is common practice for brownfields redevelopments in New Zealand. Good practice is to manage potential exposure to asbestos wherever possible, and this could be achieved for the likely MoE development through relatively straightforward procedures, for example placing such material under buildings and/or sealed areas.
- The distribution and concentrations of other contaminants of concern (petroleum hydrocarbons and metals) detected during the T+T investigation are generally consistent with those previously detected by PDP in 2009. With limited exceptions, the contaminant concentrations do not exceed residential land use standards and from this perspective soils would generally be suitable for reuse on the Site. A small number of soil samples analysed by PDP (2009) contained lead concentrations that exceed residential land use standards, but it is likely that such moderately contaminated soils can be retained on the Site and managed as per asbestos-contaminated soils.
- Soils with strong hydrocarbon odours are present within the zone of groundwater fluctuation, in the western two thirds of the site. Hydrocarbon concentrations detected to date are not at a level that would suggest that vapour management should be considered during building design. However, being odorous, these soils may be aesthetically unsuitable for reuse on or near the ground surface.
- If asbestos or hydrocarbon contaminated soils cannot be retained on the Site, they will need to be removed to a licensed landfill. The nearest licensed landfills are located more than 100 km from the Site. Disposal fees above $300 per tonne are likely, plus additional transport costs, which are likely to be significant given the return distance.
- As contaminant concentrations generally meet residential land use standards, the retention of contaminated materials on the Site, subject to various controls, and limiting the amount of contaminated material taken away from the Site, should be considered as this is likely to limit the ground-contamination related development costs.
- Due to the presence of asbestos, relatively low-level health and safety controls will be required for construction and maintenance workers to limit potential hazards due to airborne asbestos fibres. Such controls would include boot washing, earthworks dust control and limited air quality monitoring. These controls will present a contamination-related development cost that will depend on the duration of earthworks.
- If construction dewatering is required, treatment of dewatering fluid will be required before it can be discharged. As a minimum this is likely to comprise settlement to reduce suspended solid loads, but may also require treatment through an oil/water separator. Additional investigation will be required to develop a suitable performance specification for a treatment system (for example to determine potential flow rate, required treatment duration, potential chemical dose rates, etc.).
- Resource consent is likely to be required under the NES Soil, and potentially due to other rules within the regional and/or district plans. An SMP will need to be prepared to support consent applications, which will have development cost implications.

- A LTMP will also be required if contaminated material is retained on the site, which may incur some design and operational costs over and above that associated with a “clean” site

7 Applicability

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

Recommendations and opinions in this report are based on visual inspections and a limited number of sample points. The nature and continuity of the subsoil away from the sample locations is inferred and it must be appreciated that the actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

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.....	.....
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Appendix A: Figures

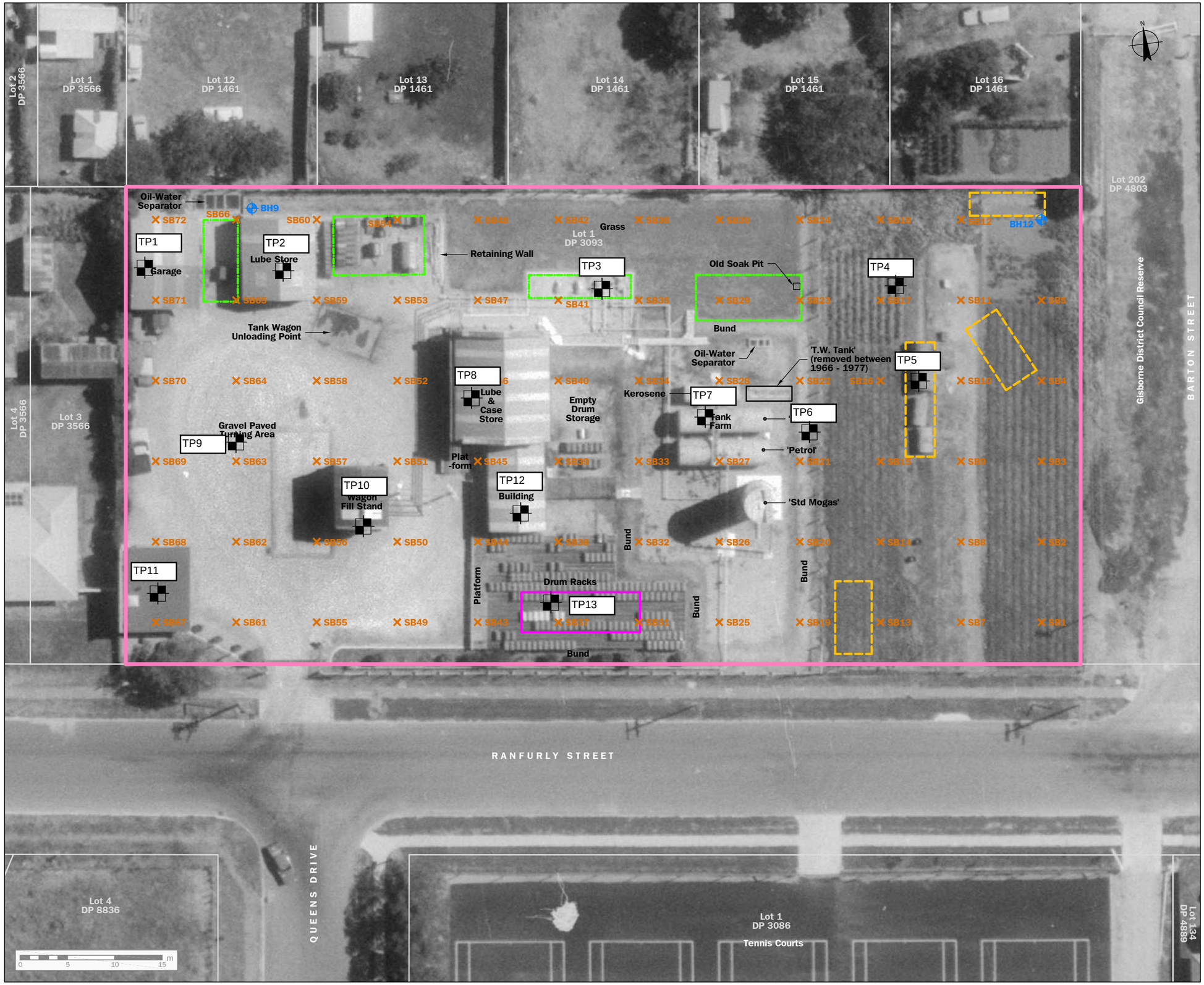


Figure 2 : HISTORICAL SITE LAYOUT (1986) & SAMPLE LOCATION PLAN

Legend

- SB1 — Soil bore (7-16 July 2009)
- BH9 — Monitoring well (installed July 2009)
- Empty AST storage, historical
- Former location of original AST c.1942
- Historical drum storage
- Site boundary
- T+T test pit (August 2018)

Figure 1. TKKM o Horouta Wananga, 17 Ranfurly Street, Gisborne

Site Investigation Plan

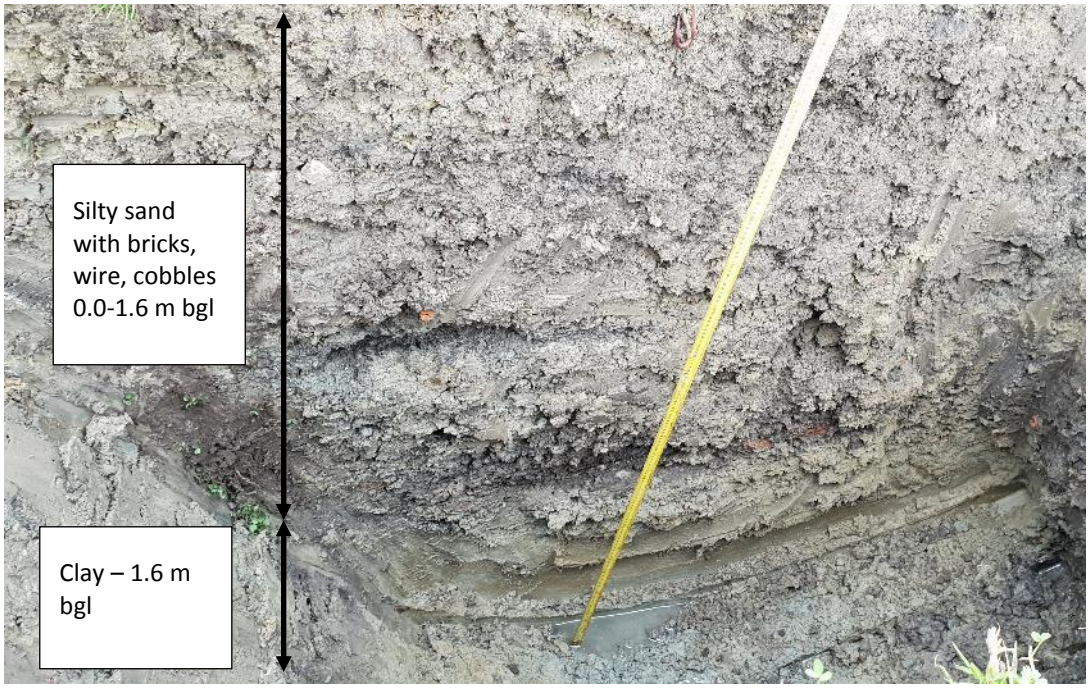
T+T Ref:1007466
PEW 11/01/2019

Base drawing from Pattle Delamore Partners (2009)

Notes:
1) Aerial photography supplied by NZ Aerial Mapping Ltd. (may not be spatially accurate).
Date of photography 28 Jan 1986.
2) Cadastral information derived from LINZ data.

Scale 1:400 (A3)

Appendix B: Photographs



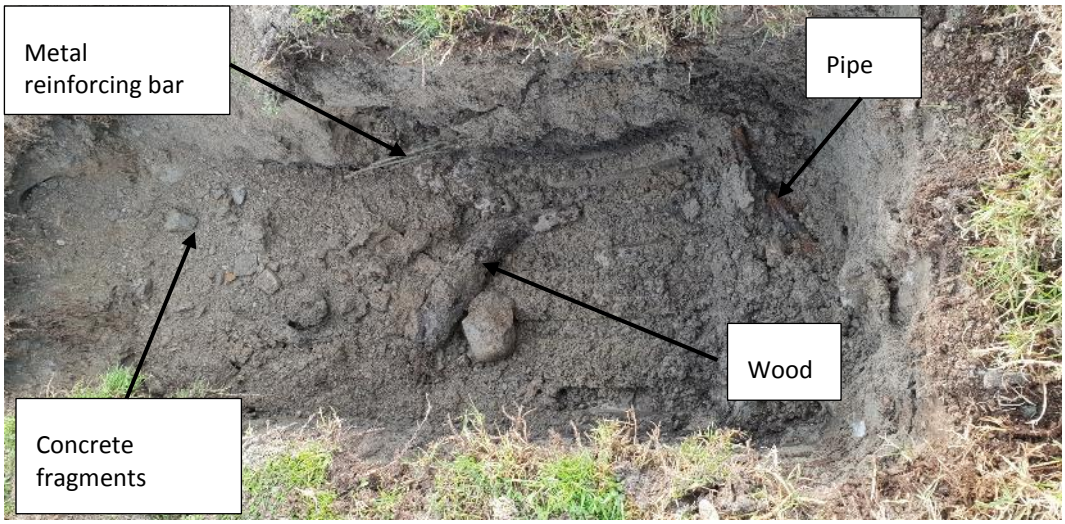
Photograph 1: TP03 soil profile.

Photograph 2: TP05 – water seepage and accumulation at 1.9m bgl.

Photograph 3: TP06 showing odorous silty clay layer.

Photograph 4: TP07 showing fill material, and moist to wet soil at 1.2 m (contained strong hydrocarbon odour).

Photograph 5: TP07, water accumulation at 3.0 m bgl.



Photograph 6: TP10 showing metal, concrete, pipe, boulders in fill.

Appendix C: Test Pit Logs

EXCAVATION LOG

Excavation Id.: **TP01**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000

CO-ORDINATES: (NZTM2000)	5707330.40 mN 2038106.20 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	14/08/2018
		EQUIPMENT:	9.5T Digger	EXCAV. FINISHED:	14/08/2018
R.L.:	12.10m	OPERATOR:	Pete	LOGGED BY:	SAHU
DATUM:	ELLIPSOID	DIMENSIONS:		CHECKED BY:	PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION (-1 -2 -3)	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) (10 25 50 100 200)	DEFECTS, STRUCTURE, COMMENTS	UNIT
			Sample TP1-0.1 @ 0.1m PID= 0.0		12	0.0	TS	Topsoil.					
			Sample TP1-0.3 @ 0.3m PID= 0.0			0.5		Silty SAND; light brown, grey. Dry; sand, fine to medium, rare brick (fragments and whole), rare shells, rusted steel pipe approx 0.35 m long.					Fill
					11	1.0		Silty CLAY; medium brown. Dry to moist; silt, brick fragements in top 0.2m.					
			Sample TP1-1.2 @ 1.2m PID= 0.0					Silty CLAY; medium brown with orange mottling. Dry to moist.					
			Sample TP1-1.5 @ 1.5m PID= 0.3			1.5							
			Sample TP1-1.8 @ 1.8m PID= 0.4			2.0							
					10							*2.0m:* No water or odorous material encountered.	
						2.5							

SKETCH / PHOTO:

Log report

COMMENTS:

Hole Depth 2m

Scale 1:25

Rev.: A

Tonkin+Taylor

EXCAVATION LOG

Excavation Id.: **TP02**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000

CO-ORDINATES: (NZTM2000)	5707320.11 mN 2038127.29 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	14/08/2018
		EQUIPMENT:	9.5T Digger	EXCAV. FINISHED:	14/08/2018
R.L.:	12.20m	OPERATOR:	Pete	LOGGED BY:	SAHU
DATUM:	ELLIPSOID	DIMENSIONS:		CHECKED BY:	PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION (-1 -2 -3)	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) (10 25 50 100 200)	DEFECTS, STRUCTURE, COMMENTS	UNIT
			Sample TP2-0.1 @ 0.1m PID= 1.0		12	0.0		Dry; Topsoil.	D				
			Sample TP2-0.4 @ 0.4m PID= 0.8			0.5		Sandy SILT; medium brown. Dry, sand, fine to medium, with some claystone cobbles (Fill), common brick fragments, rare timber pieces, rare concrete with rebar.					Fill
			Sample TP2-0.8 @ 0.8m PID= 0.3			1.0		Silty CLAY; dark brown. Dry to moist; silt, with some claystone cobbles (Fill).					
					11			CLAY; medium brown. Dry to moist.					
						1.5		CLAY; light to medium brown. Moist to wet; clay, with ash.					
								CLAY; medium brown. Moist to wet.					
						2.0						*2.0m:* No odorous material encountered.	
					10								
						2.5							

COMMENTS:

Hole Depth 2m

Scale 1:25

Rev.: A

Tonkin+Taylor

EXCAVATION LOG

Excavation Id.: **TP03**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000

CO-ORDINATES: (NZTM2000)	5707313.69 mN 2038161.00 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	14/08/2018
		EQUIPMENT:	9.5T Digger	EXCAV. FINISHED:	14/08/2018
R.L.:	12.70m	OPERATOR:	Pete	LOGGED BY:	SAHU
DATUM:	ELLIPSOID	DIMENSIONS:		CHECKED BY:	PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION (-1 -2 -3)	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) (10 25 50 100 200)	DEFECTS, STRUCTURE, COMMENTS	UNIT
			Sample TP3-0.4 @ 0.4m PID= 0.2		12	0.5		Silty SAND; brownish. Dry to moist; sand, common bricks (whole and fragments), rare wire, come siltstone cobbles.					Fill
			Sample TP3-1.1 @ 1.1m PID= 0.3			1.0						*1.1m:* Honeycomb ACM in Fill material.	
		▼	Sample TP3-1.6 @ 1.6m PID= 0.4		11	1.5		CLAY; medium brow, minor orange mottling. Moist to wet.					
						2.0						*2.0m:* No odorous material encountered.	
					10	2.5							

COMMENTS:

Hole Depth 2.1m

Scale 1:25

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP04**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000

CO-ORDINATES: (NZTM2000)	5707309.70 mN 2038190.82 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	14/08/2018
		EQUIPMENT:	9.5T Digger	EXCAV. FINISHED:	14/08/2018
R.L.:	12.60m	OPERATOR:	Pete	LOGGED BY:	SAHU
DATUM:	ELLIPSOID	DIMENSIONS:		CHECKED BY:	PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION (-1 -2 -3)	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) (10 25 50 100 200)	DEFECTS, STRUCTURE, COMMENTS	UNIT
						0.0	TS						
			Sample TP4-0.5 @ 0.5m PID= 0.6		12	0.5		Sandy SILT; medium brown. Dry; sand, fine to medium, with common siltstone cobbles (Fill), some bricks, some wood pieces.					Fill
			Sample TP4-0.7 @ 0.7m PID= 0.7			1.0		Silty CLAY; dark brown. Dry; silt, with some siltstone cobbles (Fill).					
			Sample TP4-1.1 @ 1.1m PID= 0.7		11	1.5		CLAY; medium brown. Moist to wet.				*1.45m:* Ash layer in Clay approximately 0.1 m thick.	
					10	2.0						*1.9m:* No odorous material encountered.	
						2.5							

COMMENTS:

Hole Depth 1.9m

Scale 1:25

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP05**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000
CO-ORDINATES: (NZTM2000) 5707299.41 mN 2038193.74 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 14/08/2018
	EQUIPMENT: 9.5T Digger	EXCAV. FINISHED: 14/08/2018
R.L.: 12.60m	OPERATOR: Pete	LOGGED BY: SAHU
DATUM: ELLIPSOID	DIMENSIONS:	CHECKED BY: PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION (-1 -2 -3)	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) (10 25 50 100 200)	DEFECTS, STRUCTURE, COMMENTS	UNIT
			Sample TP5-0.1 @ 0.1m PID= 0.6			0.5		Sandy SILT; medium brown. Dry, sand, fine to medium, with some claystone cobbles.					Fill
			Sample TP5-0.6 @ 0.6m PID= 0.1		12			CLAY; light grey. Wet; ashy.					
			Sample TP5-0.8 @ 0.8m PID= 0.0			1.0		CLAY; medium brown with orange mottling. Wet.					
					11	1.5							
						2.0						*1.9m:* No odorous material encountered.	
					10	2.5							

COMMENTS:

Hole Depth 1.9m

Scale 1:25

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP06**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000
CO-ORDINATES: (NZTM2000) 5707296.38 mN 2038177.86 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 15/08/2018
	EQUIPMENT: 9.5T Digger	EXCAV. FINISHED: 15/08/2018
R.L.: 12.70m	OPERATOR: Pete	LOGGED BY: SAHU
DATUM: ELLIPSOID	DIMENSIONS:	CHECKED BY: PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION (-1 -2 -3)	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) (10 25 50 100 200)	DEFECTS, STRUCTURE, COMMENTS	UNIT
			Sample TP6-0.3 @ 0.3m PID= 0.1			0.0	TS	Topsoil.				*0.0m:* No water seeping into the test pit.	
						0.5		Sandy GRAVEL; grey. Dry; gravel, fine to coarse, subangular to rounded; sand, fine to coarse.				*0.3m:* Steel pipe encountered at 0.3m. Moved pit 1m to the west.	Fill
			Sample TP6-0.6 @ 0.6m PID= 6.2		12			SAND; yellow grey. Dry; sand, fine to coarse.					
			Sample TP6-0.9 @ 0.9m PID= 10.1			1.0		Silty CLAY; dark grey, black. Dry to moist; Strong hydrocarbon odour.					
			Sample TP6-1.1 @ 1.1m PID= 30.2					CLAY; blue grey. Dry to moist; Strong hydrocarbon odour.					
					11	1.5							
						2.0							
						2.5							
					10								

COMMENTS:

Hole Depth 2m

Scale 1:25

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP07**

SHEET: 1 OF 2

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000
CO-ORDINATES: 5707297.93 mN (NZTM2000) 2038163.89 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 14/08/2018
	EQUIPMENT: 9.5T Digger	EXCAV. FINISHED: 14/08/2018
R.L.: 12.90m	OPERATOR: Pete	LOGGED BY: SAHU
DATUM: ELLIPSOID	DIMENSIONS:	CHECKED BY: PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3			Sample TP7-0.3 @ 0.3m PID= 0.1			0.0	TS	Topsoil.					
			Sample TP7-0.5 @ 0.5m PID= 0.2		12	0.5		Sandy SILT; medium brown. Dry to moist; sand, fine to medium, with rare brick fragments, rare concrete pieces.					Fill
			Sample TP7-1.2 @ 1.2m PID= 6.2			1.0		CLAY; brown grey and blue grey. Moist to wet; Slight hydrocarbon odour.				*1.2m:* Water seeping into testpit at 1.2m.	
			Sample TP7-1.8 @ 1.8m PID= 121		11	1.5		CLAY; blue grey. Wet; Strong hydrocarbon odour.					
			Sample TP7-2.8 @ 2.8m PID= 40.9		10	2.0							
						2.5							
						3.0						*3.0m:* Test pit left open for 30 minutes for water to pool. Water sample collected at 16:00.	

COMMENTS:

Hole Depth 3m

Scale 1:27

Rev.: A

Tonkin+Taylor

EXCAVATION LOG

Excavation Id.: **TP07**

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000

CO-ORDINATES: (NZTM2000)	5707297.93 mN 2038163.89 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	14/08/2018
		EQUIPMENT:	9.5T Digger	EXCAV. FINISHED:	14/08/2018
R.L.:	12.90m	OPERATOR:	Pete	LOGGED BY:	SAHU
DATUM:	ELLIPSOID	DIMENSIONS:		CHECKED BY:	PEW

EXCAVATION TESTS					ENGINEERING DESCRIPTION						GEOLOGICAL	
PENETRATION (-1, -2, -3)	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) (10, 25, 50, 100, 200)	DEFECTS, STRUCTURE, COMMENTS	UNIT

COMMENTS:

Hole Depth
3m

Scale 1:27

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP08**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000

CO-ORDINATES: (NZTM2000)	5707303.18 mN 2038145.49 mE	EXPOSURE METHOD:	TP	EXCAV. STARTED:	14/08/2018
		EQUIPMENT:	9.5T Digger	EXCAV. FINISHED:	14/08/2018
R.L.:	13.10m	OPERATOR:	Pete	LOGGED BY:	SAHU
DATUM:	ELLIPSOID	DIMENSIONS:		CHECKED BY:	PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION (-1 -2 -3)	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) (10 25 50 100 200)	DEFECTS, STRUCTURE, COMMENTS	UNIT
			Sample TP8-0.2 @ 0.2m PID= 1.8		13	0.0		Topsoil.					Fill
								Sandy SILT; medium brown. Dry to moist; sand, fine to medium, with common bricks, rare rusted steel pieces.					
			Sample TP8-0.5 @ 0.5m PID= 1.7			0.5		Silty CLAY; dark brown. Moist to wet.					
			Sample TP8-0.7 @ 0.7m PID= 4.2					CLAY; medium grey brown.					
					12	1.0							
						1.5						*1.8m:* Water flowing steadily into the test pit from 1.8m.	
						2.0							
					11							*2.0m:* No odorous material encountered.	
						2.5							

COMMENTS:

Hole Depth 2m

Scale 1:25

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP09**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St | LOCATION: 17 Ranfurly St | JOB No.: 1007466.0000

CO-ORDINATES: (NZTM2000) 5707306.59 mN, 2038122.01 mE
R.L.: 13.20m
DATUM: ELLIPSOID

EXPOSURE METHOD: TP
EQUIPMENT: 9.5T Digger
OPERATOR: Pete
DIMENSIONS:

EXCAV. STARTED: 14/08/2018
EXCAV. FINISHED: 14/08/2018
LOGGED BY: SAHU
CHECKED BY: PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3			Sample TP9-0.2 @ 0.2m PID= 1.0		13	0.5		SILT; medium brown. Dry to moist; silt, with common siltstone boulders.			10 25 50 100 200		Fill
			Sample TP9-0.6 @ 0.6m PID= 1.3					CLAY; light grey. Moist to wet; clay, ashy.					
			Sample TP9-0.9 @ 0.9m PID= 2.9		12	1.0		CLAY; medium grey, brown, with orange mottling. Wet.				*0.8m:* Water entering the test pit from 0.8.	
					11	1.5 2.0 2.5						*1.95m:* No odorous material encountered.	

COMMENTS:

Hole Depth 1.95m

Scale 1:25

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP10**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000
CO-ORDINATES: 5707294.78 mN (NZTM2000) 2038132.10 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 15/08/2018
	EQUIPMENT: 9.5T Digger	EXCAV. FINISHED: 15/08/2018
R.L.: 13.10m	OPERATOR: Pete	LOGGED BY: SAHU
DATUM: ELLIPSOID	DIMENSIONS:	CHECKED BY: PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
-1 -2 -3					13	0	TS	Topsoil.					
			Sample TP10-0.2 @ 0.2m PID= 0.8			0.5		Gravelly SAND; grey. Dry; sand, fine to coarse; gravel, fine to coarse, rounded to subangular, with rare brick fragments.				*0.5m:* PVC pipe encountered	Fill
			Sample TP10-0.7 @ 0.7m PID= 8.2					Sandy SILT; dark brown. Moist; sand, fine to medium.				*0.7m:* Old piece of timber *0.8m:* Old copper pipe	
			Sample TP10-1.0 @ 1.0m PID= 10.1		12	1.0		CLAY; medium brown. Moist to wet.					
			Sample TP10-1.5 @ 1.5m PID= 62.1			1.5		CLAY; blue grey. Moist to wet; Strong hydrocarbon odour. .					
					11	2.0							
						2.5							

COMMENTS:

Hole Depth 2m

Scale 1:25

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP11**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000
CO-ORDINATES: (NZTM2000) 5707287.95 mN 2038110.50 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 15/08/2018
	EQUIPMENT: 9.5T Digger	EXCAV. FINISHED: 15/08/2018
R.L.: 12.70m	OPERATOR: Pete	LOGGED BY: SAHU
DATUM: ELLIPSOID	DIMENSIONS:	CHECKED BY: PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION (-1 -2 -3)	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) (10 25 50 100 200)	DEFECTS, STRUCTURE, COMMENTS	UNIT
			Sample TP11-0.25 @ 0.3m PID= 1.8					Topsoil. Sandy SILT; medium brown. Dry to moist; sand, fine to medium, with common brick fragments.				*0.4m:* Rusted metal pipe.	Fill
			Sample TP11-0.5 @ 0.5m PID= 1.6		12	0.5							
			Sample TP11-1.1 @ 1.1m PID= 5.6			1.0							
			Sample TP11-1.4 @ 1.4m PID= 36.9			1.5		CLAY; brown grey with some orange mottling. Moist to wet.					
					11			CLAY; blue grey. Moist to wet; Strong hydrocarbon odour.					
			Sample TP11-1.8 @ 1.9m PID= 121			2.0							
						2.5						*2.5m:* Water seeping into base of test pit during excavation.	
					10								

COMMENTS:

Hole Depth 2.5m

Scale 1:25

Rev.: A

EXCAVATION LOG

Excavation Id.: **TP12**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000
CO-ORDINATES: (NZTM2000) 5707292.62 mN 2038145.08 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 15/08/2018
	EQUIPMENT: 9.5T Digger	EXCAV. FINISHED: 15/08/2018
R.L.: 12.90m	OPERATOR: Pete	LOGGED BY: SAHU
DATUM: ELLIPSOID	DIMENSIONS:	CHECKED BY: PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION \ WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	DEFECTS, STRUCTURE, COMMENTS	UNIT
			Sample TP12-0.2 @ 0.2m PID= 0.9			0.0		Silty gravelly SAND; dark brown. Dry; sand, fine to medium, with some brick fragments, glass and wood.					Fill
			Sample TP12-0.4 @ 0.4m PID= 0.8			0.5		SILT; medium to dark brown with orange mottling. Dry to moist.					
			Sample TP12-0.7 @ 0.7m PID= 1.2		12			Silty CLAY; dark brown with orange mottling. Moist.					
			Sample TP12-1.0 @ 1.0m PID= 1.2			1.0		SILT; light to medium brown. Moist.					
			Sample TP12-1.4 @ 1.4m PID= 4.1			1.5		CLAY; medium brown. Moist.					
					11								
						2.0						*2.0m:* No odorous material or water encountered.	
						2.5							
					10								

COMMENTS:

Hole Depth 2m

Scale 1:25

Rev.: A

Tonkin+Taylor

EXCAVATION LOG

Excavation Id.: **TP13**

SHEET: 1 OF 1

PROJECT: MoE 17 Ranfurly St	LOCATION: 17 Ranfurly St	JOB No.: 1007466.0000
CO-ORDINATES: (NZTM2000) 5707282.24 mN 2038153.50 mE	EXPOSURE METHOD: TP	EXCAV. STARTED: 14/08/2018
	EQUIPMENT: 9.5T Digger	EXCAV. FINISHED: 14/08/2018
R.L.: 12.80m	OPERATOR: Pete	LOGGED BY: SAHU
DATUM: ELLIPSOID	DIMENSIONS:	CHECKED BY: PEW

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION (-1 -2 -3)	SUPPORT	WATER	SAMPLES, TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) (10 25 50 100 200)	DEFECTS, STRUCTURE, COMMENTS	UNIT
			Sample TP13-0.3 @ 0.3m PID= 1.3		12	0.5		Topsoil. Sandy SILT; medium brown, grey. Dry to moist; silt, common claystone cobbles.				*0.3m:* ACM fragment identified.	Fill
			Sample TP13-0.85 @ 0.9m PID= 16.2			1.0		Clayey SILT; dark brown. Moist to wet.				*1.1m:* Water seeping into the test pit.	
			Sample TP13-1.6 @ 1.6m PID= 80.9		11	1.5		CLAY; blue grey. Wet; Strong hydrocarbon odour.					
						2.0							
					10	2.5							

COMMENTS:

Hole Depth 2m

Scale 1:25

Rev.: A

Appendix D: Analytical Results

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Certificate of Analysis

Tonkin and Taylor Ltd
PO Box 271 Wellesley St, Auckland
Auckland
Attention: Sami Hutchings
Phone: 027 6409 639
Email: shutchings@tonkintaylor.co.nz

Lab Reference: 18-26915
Submitted by: Sami Hutchings
Date Received: 16/08/2018
Date Completed: 23/08/2018
Order Number:
Reference: 1007466

Sampling Site:

Report Comments

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

Water Aggregate Properties and Nutrients

Client Sample ID			TP7	TP5	TP2
Date Sampled			14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-41	18-26915-42	18-26915-43
Total Suspended Solids	g/m^3	*3*	364	109	74

Heavy Metals in Soil

Client Sample ID			TP8-0.2 0.2	TP8-0.5 0.5	TP13-0.2 0.2	TP13-0.85 0.85	TP13-1.6 1.6
Date Sampled			14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-1	18-26915-2	18-26915-4	18-26915-5	18-26915-6
Arsenic	mg/kg dry wt	*0.125*	4.39	4.09	3.78	5.38	5.38
Cadmium	mg/kg dry wt	*0.005*	0.086	0.071	0.073	0.11	0.11
Chromium	mg/kg dry wt	*0.125*	12.4	11.0	11.8	13.0	13.9
Copper	mg/kg dry wt	*0.075*	9.62	12.8	9.16	15.0	12.5
Lead	mg/kg dry wt	*0.05*	15.8	11.2	16.6	11.3	40.3
Mercury	mg/kg dry wt	*0.025*	0.044	0.046	0.041	0.046	0.055
Nickel	mg/kg dry wt	*0.05*	15.6	13.1	14.3	16.5	14.0
Zinc	mg/kg dry wt	*0.05*	62.7	46.3	54.7	56.5	92.3

IANZ ACCREDITED LABORATORY

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

Heavy Metals in Soil

Client Sample ID			TP4-0.5 0.5	TP4-0.7 0.7	TP3-1.1 1.1	TP2-0.4 0.4	TP2-0.8 0.8
Date Sampled			14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-7	18-26915-8	18-26915-11	18-26915-14	18-26915-15
Arsenic	mg/kg dry wt	*0.125*	3.89	3.48	5.56	4.93	4.18
Cadmium	mg/kg dry wt	*0.005*	0.043	0.29	0.14	0.14	0.14
Chromium	mg/kg dry wt	*0.125*	13.4	10.7	10.2	11.9	11.5
Copper	mg/kg dry wt	*0.075*	8.81	11.1	11.1	12.9	14.1
Lead	mg/kg dry wt	*0.05*	14.6	30.7	41.7	45.2	27.1
Mercury	mg/kg dry wt	*0.025*	0.054	0.039	0.040	0.052	0.053
Nickel	mg/kg dry wt	*0.05*	15.2	11.6	12.5	12.7	12.8
Zinc	mg/kg dry wt	*0.05*	54.0	668	75.0	90.7	82.0

Heavy Metals in Soil

Client Sample ID			TP9-0.2 0.2	TP5-0.1 0.1	TP5-0.6 0.6	TP1-0.3 0.3	TP11-0.5 0.5
Date Sampled			14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-17	18-26915-20	18-26915-21	18-26915-25	18-26915-29
Arsenic	mg/kg dry wt	*0.125*	5.14	5.29	1.42	3.41	5.31
Cadmium	mg/kg dry wt	*0.005*	0.45	0.055	0.040	0.035	0.13
Chromium	mg/kg dry wt	*0.125*	13.3	10.6	4.24	3.22	14.9
Copper	mg/kg dry wt	*0.075*	24.1	8.86	1.54	3.09	13.3
Lead	mg/kg dry wt	*0.05*	47.3	20.2	7.78	14.1	50.3
Mercury	mg/kg dry wt	*0.025*	0.048	0.033	0.025	0.045	0.046
Nickel	mg/kg dry wt	*0.05*	13.3	10.7	3.19	3.78	15.3
Zinc	mg/kg dry wt	*0.05*	106	45.1	20.5	24.4	99.2

Heavy Metals in Soil

Client Sample ID			TP11-1.1 1.1	TP7-0.5 0.5	TP7-1.2 1.2	TP12-0.2	TP10-0.2 0.2
Date Sampled			14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-30	18-26915-34	18-26915-35	18-26915-38	18-26915-48
Arsenic	mg/kg dry wt	*0.125*	4.94	4.23	2.75	6.63	4.72
Cadmium	mg/kg dry wt	*0.005*	0.20	0.13	0.089	2.42	0.16
Chromium	mg/kg dry wt	*0.125*	15.7	11.2	11.2	12.9	8.54
Copper	mg/kg dry wt	*0.075*	12.2	13.5	7.96	28.1	8.82
Lead	mg/kg dry wt	*0.05*	87.9	64.0	21.9	83.6	44.7
Mercury	mg/kg dry wt	*0.025*	0.049	0.054	0.044	0.063	0.033
Nickel	mg/kg dry wt	*0.05*	14.2	12.6	11.3	12.3	10.5
Zinc	mg/kg dry wt	*0.05*	145	105	70.6	198	114

Heavy Metals in Soil

Client Sample ID			TP10-0.7 0.7	TP10-1.5 1.5	TP6-0.3 0.3	TP6-0.6
Date Sampled			14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-50	18-26915-51	18-26915-52	18-26915-55
Arsenic	mg/kg dry wt	*0.125*	3.61	4.11	3.58	1.98
Cadmium	mg/kg dry wt	*0.005*	0.077	0.11	0.063	0.007
Chromium	mg/kg dry wt	*0.125*	11.3	19.6	5.75	2.00
Copper	mg/kg dry wt	*0.075*	13.4	11.9	6.44	1.44
Lead	mg/kg dry wt	*0.05*	10.3	9.82	22.4	1.58
Mercury	mg/kg dry wt	*0.025*	0.035	0.059	0.039	<0.025

Heavy Metals in Soil

			Client Sample ID	TP10-0.7 0.7	TP10-1.5 1.5	TP6-0.3 0.3	TP6-0.6
			Date Sampled	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Nickel	mg/kg dry wt	*0.05*		13.5	28.7	9.08	2.59
Zinc	mg/kg dry wt	*0.05*		51.2	61.3	63.0	45.3

Total Heavy Metals in Water

		Client Sample ID	TP7	TP5	TP2	Dup
		Date Sampled	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-41	18-26915-42	18-26915-43	18-26915-44
Arsenic	g/m^3	*0.0005*	0.0240	0.0038	0.0064	0.0257
Beryllium	g/m^3	*0.00001*	0.00025	0.00010	0.00005	0.00029
Boron	g/m^3	*0.005*	0.125	0.066	0.144	0.126
Cadmium	g/m^3	*0.00001*	0.00020	0.00005	0.00006	0.00021
Chromium	g/m^3	*0.0002*	0.0077	0.0035	0.0018	0.011
Copper	g/m^3	*0.0002*	0.0097	0.0035	0.0028	0.0120
Lead	g/m^3	*0.00005*	0.04262	0.00222	0.00154	0.04575
Mercury	g/m^3	*0.0001*	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	g/m^3	*0.0002*	0.0093	0.0059	0.0049	0.0115
Zinc	g/m^3	*0.001*	0.094	0.010	0.007	0.103

Total Petroleum Hydrocarbons - Soil

			Client Sample ID	TP8-0.5 0.5	TP13-1.6 1.6	TP2-0.8 0.8	TP11-1.8 1.8	TP7-1.2 1.2
			Date Sampled	14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*		18-26915-2	18-26915-6	18-26915-15	18-26915-32	18-26915-35
C7-C9	mg/kg dry wt	*10*		<10	<10	<10	<10	<10
C10-C14	mg/kg dry wt	*15*		<15	18	<15	118	<15
C15-C36	mg/kg dry wt	*25*		<25	83	46	292	193
C7-C36 (Total)	mg/kg dry wt	*50*		<50	101	<50	410	193

Total Petroleum Hydrocarbons - Soil

			Client Sample ID	TP7-1.8 1.8	TP7-2.8 2.8	TP10-1.5 1.5	TP6-1.1 1.1
			Date Sampled	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*		18-26915-36	18-26915-37	18-26915-51	18-26915-54
C7-C9	mg/kg dry wt	*10*		<10	<10	<10	411
C10-C14	mg/kg dry wt	*15*		134	53	52	464
C15-C36	mg/kg dry wt	*25*		434	187	<25	262
C7-C36 (Total)	mg/kg dry wt	*50*		568	240	52	1,137

BTEX in Soil

			Client Sample ID	TP8-0.5 0.5	TP13-1.6 1.6	TP2-0.8 0.8	TP11-1.8 1.8	TP7-1.2 1.2
			Date Sampled	14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*		18-26915-2	18-26915-6	18-26915-15	18-26915-32	18-26915-35
Benzene	mg/kg dry wt	*0.05*		<0.05	<0.05	<0.05	<0.05	<0.05
Ethylbenzene	mg/kg dry wt	*0.05*		<0.05	<0.05	<0.05	<0.05	<0.05
Toluene	mg/kg dry wt	*0.05*		<0.05	<0.05	<0.05	<0.05	<0.05
m,p-xylene	mg/kg dry wt	*0.05*		<0.05	<0.05	<0.05	<0.05	<0.05
o-xylene	mg/kg dry wt	*0.05*		<0.05	<0.05	<0.05	<0.05	<0.05

BTEX in Soil

		Client Sample ID	TP8-0.5 0.5	TP13-1.6 1.6	TP2-0.8 0.8	TP11-1.8 1.8	TP7-1.2 1.2
		Date Sampled	14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Benzene-d6 (Surrogate)	%	*1*	101.0	95.1	95.4	96.0	93.7

BTEX in Soil

	Client Sample ID	TP7-1.8 1.8	TP7-2.8 2.8	TP10-1.5 1.5	TP6-1.1 1.1
	Date Sampled	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte Unit	*Reporting Limit*	18-26915-36	18-26915-37	18-26915-51	18-26915-54
Benzene mg/kg dry wt	*0.05*	<0.05	<0.05	<0.05	<0.35
Ethylbenzene mg/kg dry wt	*0.05*	<0.05	<0.05	<0.05	<0.35
Toluene mg/kg dry wt	*0.05*	<0.05	<0.05	<0.05	<0.35
m,p-xylene mg/kg dry wt	*0.05*	<0.05	<0.05	<0.05	<0.35
o-xylene mg/kg dry wt	*0.05*	<0.05	<0.05	<0.05	<0.35
Benzene-d6 (Surrogate) %	*1*	103.4	98.9	98.6	88.0

Polycyclic Aromatic Hydrocarbons - Soil

	Client Sample ID	TP5-0.6 0.6
	Date Sampled	14/08/2018
Analyte Unit	*Reporting Limit*	18-26915-21
1-Methylnaphthalene mg/kg dry wt	*0.01*	<0.01
2-Methylnaphthalene mg/kg dry wt	*0.01*	<0.01
Acenaphthene mg/kg dry wt	*0.01*	<0.01
Acenaphthylene mg/kg dry wt	*0.01*	<0.01
Anthracene mg/kg dry wt	*0.01*	<0.01
Benz[a]anthracene mg/kg dry wt	*0.02*	<0.02
Benzo[a]pyrene mg/kg dry wt	*0.01*	<0.01
Benzo[b]&[j] fluoranthene mg/kg dry wt	*0.02*	<0.02
Benzo[g,h,i]perylene mg/kg dry wt	*0.02*	<0.02
Benzo[k]fluoranthene mg/kg dry wt	*0.01*	<0.01
Chrysene mg/kg dry wt	*0.01*	<0.01
Dibenz(a,h)anthracene mg/kg dry wt	*0.01*	<0.01
Fluoranthene mg/kg dry wt	*0.02*	<0.02
Fluorene mg/kg dry wt	*0.01*	<0.01
Indeno(1,2,3-cd)pyrene mg/kg dry wt	*0.01*	<0.01
Naphthalene mg/kg dry wt	*0.01*	<0.01
Phenanthrene mg/kg dry wt	*0.01*	<0.01
Pyrene mg/kg dry wt	*0.02*	<0.02
Benzo[a]pyrene TEQ (LOR) mg/kg dry wt	*0.01*	0.03
Benzo[a]pyrene TEQ (Zero) mg/kg dry wt	*0.01*	<0.01
Anthracene-d10 (Surrogate) %	*1*	92.8

Moisture Content

	Client Sample ID		TP8-0.5 0.5	TP13-1.6 1.6	TP2-0.8 0.8	TP5-0.6 0.6	TP11-1.8 1.8
	Date Sampled		14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-2	18-26915-6	18-26915-15	18-26915-21	18-26915-32
Moisture Content	%	*1*	29	26	32	26	25

Moisture Content

	Client Sample ID		TP7-1.2 1.2	TP7-1.8 1.8	TP7-2.8 2.8	TP10-1.5 1.5	TP6-1.1 1.1
	Date Sampled		14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-35	18-26915-36	18-26915-37	18-26915-51	18-26915-54
Moisture Content	%	*1*	23	24	26	25	27

Polycyclic Aromatic Hydrocarbons - Water

	Client Sample ID		TP7	TP5	TP2	Dup	Trip
	Date Sampled		14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-41	18-26915-42	18-26915-43	18-26915-44	18-26915-45
1-Methylnaphthalene	g/m^3	*0.00006*	0.00100	<0.00006	<0.00006	0.00082	<0.00006
2-Methylnaphthalene	g/m^3	*0.00006*	0.00074	<0.00006	<0.00006	0.00066	<0.00006
Acenaphthene	g/m^3	*0.00002*	0.00064	<0.00002	<0.00002	0.00077	<0.00002
Acenaphthylene	g/m^3	*0.00002*	0.00020	<0.00002	<0.00002	0.00024	<0.00002
Anthracene	g/m^3	*0.00002*	0.00006	<0.00002	<0.00002	0.00027	<0.00002
Benz[a]anthracene	g/m^3	*0.00003*	<0.00003	<0.00003	<0.00003	<0.00003	<0.00003
Benzo[a]pyrene	g/m^3	*0.00002*	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Benzo[b]&[j] fluoranthene	g/m^3	*0.00002*	<0.00002	<0.00002	<0.00002	0.00003	<0.00002
Benzo[g,h,i]perylene	g/m^3	*0.00002*	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Benzo[k]fluoranthene	g/m^3	*0.00002*	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Chrysene	g/m^3	*0.00002*	<0.00002	<0.00002	<0.00002	0.00002	<0.00002
Dibenz[a,h]anthracene	g/m^3	*0.00002*	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Fluoranthene	g/m^3	*0.00002*	0.00011	<0.00002	<0.00002	0.00010	<0.00002
Fluorene	g/m^3	*0.00002*	0.00209	0.00003	<0.00002	0.00218	0.00004
Indeno[1,2,3-cd]pyrene	g/m^3	*0.00003*	<0.00003	<0.00003	<0.00003	<0.00003	<0.00003
Naphthalene	g/m^3	*0.00006*	<0.00006	<0.00006	<0.00006	<0.00006	<0.00006
Phenanthrene	g/m^3	*0.00003*	<0.00003	<0.00003	<0.00003	<0.00003	<0.00003
Pyrene	g/m^3	*0.00002*	0.00004	<0.00002	<0.00002	0.00005	<0.00002
Benzo[a]pyrene TEQ (LOR)	g/m^3	*0.00002*	0.00005	0.00005	0.00005	0.00005	0.00005
Benzo[a]pyrene TEQ (Zero)	g/m^3	*0.00002*	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Anthracene-d10 (Surrogate)	%	*1*	97.5	95.1	92.0	96.4	96.2

Total Petroleum Hydrocarbons - Water

	Client Sample ID		TP7	TP5	TP2	Dup	Trip
	Date Sampled		14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-41	18-26915-42	18-26915-43	18-26915-44	18-26915-45
C7-C9	g/m^3	*0.2*	<0.2	<0.2	<0.2	<0.2	<0.2
C10-C14	g/m^3	*0.2*	0.6	<0.2	<0.2	1.0	<0.2
C15-C36	g/m^3	*0.3*	3.5	<0.3	<0.3	5.7	<0.3
C7-C36 (Total)	g/m^3	*0.5*	4.1	<0.5	<0.5	6.7	<0.5

BTEX in Water

	Client Sample ID		TP7	TP5	TP2	Dup	Trip
	Date Sampled		14/08/2018	14/08/2018	14/08/2018	14/08/2018	14/08/2018
Analyte	Unit	*Reporting Limit*	18-26915-41	18-26915-42	18-26915-43	18-26915-44	18-26915-45
Benzene	g/m^3	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	g/m^3	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene	g/m^3	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001
m,p-xylene	g/m^3	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001
o-xylene	g/m^3	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001
Benzene-d6 (Surrogate)	%	*1*	97.7	97.4	103.2	97.8	98.0

Method Summary

Total Suspended Solids Samples filtered, TSS determined by gravimetric analysis. APHA 2540 D. (22nd edition) - Modified.

Elements in Soil Acid digestion followed by ICP-MS analysis. US EPA method 200.8.

Recoverable Trace Elements Samples were analysed as received by the laboratory using ICP-MS following an acid digestion. US EPA method 200.8.

TPH in Soil Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36)

BTEX in Soil Solvent extraction, followed by Headspace GC-MS analysis. US EPA method 5021A.

PAH in Soil Solvent extraction, silica cleanup, followed by GC-MS analysis.
Benzo[a]pyrene TEQ (LOR): The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH.
Benzo[a]pyrene TEQ (Zero): The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation.
Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Enivronment. 2011.

Moisture Moisture content is determined gravimetrically by drying at 103 °C.

PAH in Water Liquid-liquid extraction with hexane, florisil cleanup with analysis by GC-MS.
Benzo[a]pyrene TEQ (LOR): The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH.
Benzo[a]pyrene TEQ (Zero): The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation.
Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Enivronment. 2011.

TPH in Water Solvent extraction, silica cleanup, followed by GC-FID analysis (C7-C36). MFE Petroleum Industry Guidelines.

BTEX in Water Solvent extraction, followed by Headspace GC-MS analysis. US EPA method 5021A.

Elizabeth Fitzgerald, B.Sc.
Inorganics Team Leader

Karam Wadi, B.E. (Hons)
Technologist

Sharelle Frank, B.Sc. (Tech)
Technologist

Tom Featonby, M.Sc.
Technologist

Report Date: 22 Aug 2018

Certificate Number: B1808211430

PRECISE
CONSULTING & LABORATORY

Tonkin and Taylor Ltd, Auckland
105 Carlton Gore Rd, Newmarket, Auckland 1023

Client Reference: 1007466

Dear Sami Hutchings,

Re: Asbestos Identification Analysis – 1007466

2 sample(s) received on 21 Aug 2018 by Karleen Glen.

The results of fibre analysis were performed by Alice Knowles of Precise Consulting and Laboratory Ltd on 22 Aug 2018.

The sample(s) were stated to be from 1007466.

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

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

Should you require further information please contact Alice Knowles.

Yours sincerely

Alice Knowles
PRECISE LABORATORY IDENTIFIER

Sample Analysis Results

Certificate Number: B1808211430
Report Date: 22 Aug 2018
Site Location: 1007466

PRECISE
CONSULTING & LABORATORY

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

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

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

Identified by:

Approved Identifier: Alice Knowles

Reviewed by:

Key Technical Person: Alice Knowles

Sample ID	Client Sample ID	Sample Location/Description/Dimensions	Analysis Results
S001	TP13 - Frag	ID Asbestos Fragment Fibre cement sheeting L1 - Surface Debris L2 - Fibre Cement Sheet 100 x 55 x 8 mm	Chrysotile (white asbestos) Fibres Organic Fibres
S002	Frag - 1.1	ID Asbestos Fragment Fibre cement sheeting L1 - Surface Debris L2 - Fibre Cement Sheet 140 x 76 x 19 mm	Chrysotile (white asbestos) Fibres Organic Fibres Amosite (brown asbestos) Fibres

Precise Consulting & Laboratory Limited
Level 2, 10 Hutt Road, Petone, Lower Hutt Wellington 5012

P: 04 974 8356 W: www.preciseconsulting.co.nz

Report Date: 24 Aug 2018

Certificate Number: S1808220814

Tonkin & Taylor
105 Carlton Gore Road, New Market, Auckland

Client Reference: 1007466

Dear Sami Hutchings,

Re: Asbestos Soil Identification Analysis – Gisborne

15 sample(s) received on 21 Aug 2018 by Georgina Jackson.

The results of fibre analysis were performed by Georgina Jackson of Precise Consulting and Laboratory Ltd on 24 Aug 2018.

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

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

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

Should you require further information please contact Georgina Jackson.

Yours sincerely

Georgina Jackson
PRECISE LABORATORY IDENTIFIER

Sample Analysis Results

Certificate Number: S1808220814
Report Date: 24 Aug 2018
Site Location: Gisborne

PRECISE
CONSULTING & LABORATORY

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

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

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

Identified by: Georgina Jackson

Reviewed by: Georgina Jackson

Approved Identifier: Georgina Jackson

Key Technical Person: Georgina Jackson

Sample ID	Client Sample ID	Sample Location/Description/Dimensions	Analysis Results
TP01-0.3	TP01-0.3	- Non-Homogeneous Soil 1324.0g	No Asbestos Detected Organic Fibres Synthetic Mineral Fibres
TP02-0.4	TP02-0.4	- Non-Homogeneous Soil 702.0g	Chrysotile (white asbestos) Fibres Organic Fibres Synthetic Mineral Fibres
TP03-0.4	TP03-0.4	- Non-Homogeneous Soil 737.5g	No Asbestos Detected Organic Fibres
TP03-1.1	TP03-1.1	- Non-Homogeneous Soil 632.0g	No Asbestos Detected Organic Fibres
TP04-0.5	TP04-0.5	- Non-Homogeneous Soil 631g	No Asbestos Detected Organic Fibres
TP06-0.3	TP06-0.3	- Non-Homogeneous Soil 1038.5g	No Asbestos Detected Organic Fibres
TP06-0.6	TP06-0.6	- Non-Homogeneous Soil 1159.5g	No Asbestos Detected Organic Fibres
TP07-0.5	TP07-0.5	- Non-Homogeneous Soil 642.0g	No Asbestos Detected Organic Fibres Synthetic Mineral Fibres
TP08-0.2	TP08-0.2	- Non-Homogeneous Soil 851.5g	No Asbestos Detected Organic Fibres

Precise Consulting & Laboratory Limited
Unit 1, 30 Greenpark Road, Penrose, Auckland 8023

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

Sample Analysis Results

Certificate Number: S1808220814
Report Date: 24 Aug 2018
Site Location: Gisborne

PRECISE
CONSULTING & LABORATORY

Sample ID	Client Sample ID	Sample Location/Description/Dimensions	Analysis Results
TP10-0.2	TP10-0.2	- Non-Homogeneous Soil 1038.5g	No Asbestos Detected Organic Fibres
TP10-0.7	TP10-0.7	- Non-Homogeneous Soil 25.0g	No Asbestos Detected Organic Fibres Synthetic Mineral Fibres
TP11-0.5	TP11-0.5	- Non-Homogeneous Soil 664.5g	No Asbestos Detected Organic Fibres
TP11-1.1	TP11-1.1	- Non-Homogeneous Soil 692.5g	Chrysotile (white asbestos) Fibres Organic Fibres Synthetic Mineral Fibres
TP12-0.2	TP12-0.2	- Non-Homogeneous Soil 721.0g	No Asbestos Detected Organic Fibres Synthetic Mineral Fibres
TP13-0.3	TP13-0.3	- Non-Homogeneous Soil 671.5g	No Asbestos Detected Organic Fibres Synthetic Mineral Fibres

Precise Consulting & Laboratory Limited
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Appendix 1: Soil Analysis Raw Data

Certificate Number: S1808220814
Report Date: 24 Aug 2018
Site Location: Gisborne

PRECISE
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Quantitative Results (non IANZ)																			
Sample ID	Client Sample ID	Total 10L (Kg)	Total 500mL Sub-Sample (g)	ACM (>10mm)*				AF / FA (2-10mm) (100% ACM)*				AF / FA (<2mm) (100% ACM)*				<2mm Excess (g)	Trace Asbestos Detected **	W/W% Asbestos as ACM	W/W% Asbestos as AF / FA
				>10mm Weight (g)	>10mm ACM (g)	ACM Form	Form %***	2-10mm Weight (g)	2-10mm AF/FA (g)	ACM Form	Form %***	<2mm Weight (g)	<2mm AF/FA (g)	ACM Form	Form %***				
TP01-0.3	TP01-0.3		1324.0	82.0	0	N/A	0	107.5	0	N/A	0	101.0	0	N/A	0	1033.5	No	<0.001	<0.001
TP02-0.4	TP02-0.4	-	702.0	149.5	0	N/A	0	354.5	0	N/A	0	101.5	0.0032	Fibre Cement Sheet	15	96.5	Yes	<0.001	<0.001
TP03-0.4	TP03-0.4	-	737.5	254.5	0	N/A	0	284	0	N/A	0	102	0	N/A	0	97	No	<0.001	<0.001
TP03-1.1	TP03-1.1	-	632.0	189.5	0	N/A	0	284.0	0	N/A	0	99.5	0	N/A	0	59.0	No	<0.001	<0.001
TP04-0.5	TP04-0.5	-	631	126.5	0	N/A	0	264.0	0	N/A	0	98.0	0	N/A	0	142.5	No	<0.001	<0.001
TP06-0.3	TP06-0.3	-	1038.5	129.5	0	N/A	0	288.0	0	N/A	0	99.0	0	N/A	0	522.0	No	<0.001	<0.001
TP06-0.6	TP06-0.6	-	1159.5	0	0	N/A	0	24.0	0	N/A	0	99.0	0	N/A	0	1159.5	No	<0.001	<0.001
TP07-0.5	TP07-0.5	-	642.0	70.5	0	N/A	0	274.0	0	N/A	0	102.00	0	N/A	0	195.5	No	<0.001	<0.001
TP08-0.2	TP08-0.2	-	851.5	247.0	0	N/A	0	353.5	0	N/A	0	99.5	0	N/A	0	151.5	No	<0.001	<0.001
TP10-0.2	TP10-0.2	-	1038.5	196.0	0	N/A	0	296.0	0	N/A	0	100.0	0	N/A	0	446.5	No	<0.001	<0.001
TP10-0.7	TP10-0.7	-	25.0	25.0	0	N/A	0	351.0	0	N/A	0	101.0	0	N/A	0	272.0	No	<0.001	<0.001
TP11-0.5	TP11-0.5	-	664.5	125.0	0	N/A	0	312.0	0	N/A	0	101.5	0	N/A	0	126.0	No	<0.001	<0.001
TP11-1.1	TP11-1.1	-	692.5	179.5	0.0002	Free Fibres	100	344.0	0.0016	Free Fibres	100	100.5	0	N/A	0	68.5	Yes	<0.001	<0.001
TP12-0.2	TP12-0.2	-	721.0	200.5	0	N/A	0	190.0	0	N/A	0	98.0	0	N/A	0	232.5	No	<0.001	<0.001

Precise Consulting & Laboratory Ltd Limited
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Appendix 1: Soil Analysis Raw Data

Certificate Number: S1808220814
Report Date: 24 Aug 2018
Site Location: Gisborne

PRECISE
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Quantitative Results (non IANZ)																			
Sample ID	Client Sample ID	Total 10L (Kg)	Total 500mL Sub-Sample (g)	ACM (>10mm)*				AF / FA (2-10mm) (100% ACM)*				AF / FA (<2mm) (100% ACM)*				<2mm Excess (g)	Trace Asbestos Detected **	W/W% Asbestos as ACM	W/W% Asbestos as AF / FA
				>10mm Weight (g)	>10mm ACM (g)	ACM Form	Form %***	2-10mm Weight (g)	2-10mm AF/FA (g)	ACM Form	Form %***	<2mm Weight (g)	<2mm AF/FA (g)	ACM Form	Form %***				
TP13-0.3	TP13-0.3	-	671.5	49.0	0	N/A	0	399.5	0	N/A	0	100.0	0	N/A	0	123.0	No	<0.001	<0.001

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

Precise Consulting & Laboratory Limited
Unit 1, 30 Greenpark Road, Penrose, Auckland 8023

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Table 1: soil results summary

Sample name		TP1 0.3	TP2 0.4	TP2 0.8	TP3 0.4	TP3 1.1	TP4 0.5	TP4 0.7	TP5 0.1	TP5 0.6	TP6 0.3	Assessment criteria		
Depth (m)		0.3	0.4	0.8	0.4	1.1	0.5	0.7	0.1	0.6	0.3			
Soil type	Units	Silty SAND	Sandy SILT	Silty CLAY	Silty SAND	Silty SAND	Sandy SILT	Sandy SILT	Sandy SILT	CLAY	Sandy GRAVEL	Residential [2]	Outdoor worker [5]	Class A landfill screen [8]
Metals														
Arsenic	mg/kg	3.41	4.93	4.18	-	5.56	3.89	3.48	5.29	1.42	3.58	20	70	100
Cadmium	mg/kg	0.035	0.14	0.14	-	0.14	0.043	0.29	0.055	0.04	0.063	3	1,300	20
Chromium	mg/kg	3.22	11.9	11.5	-	10.2	13.4	10.7	10.6	4.24	5.75	460	6,300	100
Copper	mg/kg	3.09	12.9	14.1	-	11.1	8.81	11.1	8.86	1.54	6.44	>10,000	>10,000	100
Lead	mg/kg	14.1	45.2	27.1	-	41.7	14.6	30.7	20.2	7.78	22.4	210	3,300	100
Mercury	mg/kg	0.045	0.052	0.053	-	0.04	0.054	0.039	0.033	0.025	0.039	310	4,200	4
Nickel	mg/kg	3.78	12.7	12.8	-	12.5	15.2	11.6	10.7	3.19	9.08	400 [3]	6,000 [3]	200
Zinc	mg/kg	24.4	90.7	82	-	75	54	668	45.1	20.5	63	7,400 [3]	400,000 [3]	200
Total Petroleum Hydrocarbons														
C7-C9	mg/kg	-	-	<10	-	-	-	-	-	-	-	Surface: 120/ 500/ 15,000; 1m-4m: 120/ 500/ NA [4]	Surface: 120/ 500/ NA; 1m-4m: 120/ 500/ NA [6]	NGV
C10-C14	mg/kg	-	-	<15	-	-	-	-	-	-	-	Surface: 470/ 510/ 570; 1m-4m: 560/ 670/ 2,900 [4]	Surface: 1,500/1,700/1,900; 1m-4m: 1,900/ 2,200/ 9,700 [6]	NGV
C15-C36	mg/kg	-	-	46	-	-	-	-	-	-	-	NA [4]	NA [6]	NGV
C7-C36 (Total)	mg/kg	-	-	<50	-	-	-	-	-	-	-	NGV	NGV	NGV
BTEX														
Benzene	mg/kg	-	-	<0.05	-	-	-	-	-	-	-	Surface: 1.1/ 1.1/ 1.7; 1m-4m: 1.9/ 1.9/ 8.8 [4]	Surface: 3/ 3.6/ 11; 1m-4m: 3/ 7.2/ 41 [6]	10
Ethylbenzene	mg/kg	-	-	<0.05	-	-	-	-	-	-	-	Surface: 53/ 59/ 160; 1m-4m: 92/ 92/ NA [4]	Surface: 180/ 200/ 540; 1m-4m: 300/ 300/ NA [6]	1000
Toluene	mg/kg	-	-	<0.05	-	-	-	-	-	-	-	Surface: 68/ 82/ 320; 1m-4m: 94/ 170/ 2,400 [4]	Surface: 94/ 270/ 1,000; 1m-4m: 94/ 480/ 7,900 [6]	2000
m,p-xylene	mg/kg	-	-	<0.05	-	-	-	-	-	-	-	Surface: 48/ 59/ 250; 1m-4m: 130/ 130/	Surface: 150/ 200/ 810; 1m-4m: 150/ 420/ 6,000	
o-xylene	mg/kg	-	-	<0.05	-	-	-	-	-	-	-			2000
Polycyclic Aromatic Hydrocarbons														
Benzo[a]pyrene TEQ (LOR) [1]	mg/kg	-	-	-	-	-	-	-	-	0.03	-	10	35	NGV
Asbestos														
Qualitative (form)	-	NAD	*Chrysotile (fibre cement sheet)*	-	NAD	NAD	NAD	-	-	-	NAD	n/a	n/a	NGV
Semi-quantitative as ACM	w/w%		NAD	-				-	-	-		0.01 [9]	0.05 [7]	NGV
Semi-quantitative as AF/FA	w/w%		<0.001	-				-	-	-		0.001 [9]	0.001 [7]	NGV

Notes:
Bold indicates that Class A landfill screening criteria are exceeded (TCLP test needed).
- Denotes not analysed.
NGV- No Guideline Value.
NAD- No Asbestos Detected.
NA- Indicates criterion non limiting as estimated health based criterion is significantly higher than likley to be encountered on site (i.e. 20,000 mg/kg for TPH, 10,000 mg/kg for other contaminants).
n/a- Not Applicable
Chromium (VI) SCS values used for soil.
1- Benzo[a]pyrene potency equivalence as calculated using the Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health, 2011.
2- MfE 2011, NES Users' Guide, Soil Contaminant Standards, Residential (10% produce consumption).
3-ASC NEPM Toolbox - Update Febrary 2014 - www.nepc.gov.au/nepms/assessment-site-contamination/toolbox.
4-MfE 2011, Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 soil acceptance criteria for TPH and BTEX, Residential land use, ALL Pathways, Surface and 1m-4m depth contamination guidelines for SAND/SANDY SILT/CLAY soils respectively.
5- MfE 2011, NES Users' Guide, Outdoor Worker protection.
6- MfE 2011, Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 soil acceptance criteria for TPH and BTEX, Commercial land use, ALL Pathways, Surface and 1m-4m depth contamination guidelines for SAND/SANDY SILT/CLAY soils respectively.
7- BRANZ 2017, New Zealand Guidelines for Assessing and Managing Asbestos in Soil; ACM - asbestos containing material, AF- asbestos fines, FA- fibrous asbestos.
8- MfE 2004, Module 2: Hazardous Waste Guidelines, Landfill Waste Acceptance Criteria and Landfill Classification. Class A landfill screening criteria (20 X TCLP criteria; where contaminant concentration

Table 1 soil results summary (cont)

Sample name	Units	TP6 0.6	TP6 1.1	TP7 0.5	TP7 1.2	TP7 1.8	TP7 2.8	TP8 0.2	TP8 0.5	TP9 0.2	TP10 0.2	Assessment criteria		
Depth (m)		0.6	1.1	0.5	1.2	1.8	2.8	0.2	0.5	0.2	0.2	Residential [2]	Outdoor worker [5]	Class A landfill screen [8]
Soil type		SAND	CLAY	Sandy SILT	Sandy SILT	CLAY	CLAY	Sandy SILT	Sandy SILT	SILT	Gravelly SAND			
Metals														
Arsenic	mg/kg	1.98	-	4.23	2.75	-	-	4.39	4.09	5.14	4.72	20	70	100
Cadmium	mg/kg	0.007	-	0.13	0.089	-	-	0.086	0.071	0.45	0.16	3	1,300	20
Chromium	mg/kg	2	-	11.2	11.2	-	-	12.4	11	13.3	8.54	460	6,300	100
Copper	mg/kg	1.44	-	13.5	7.96	-	-	9.62	12.8	24.1	8.82	>10,000	>10,000	100
Lead	mg/kg	1.58	-	64	21.9	-	-	15.8	11.2	47.3	44.7	210	3,300	100
Mercury	mg/kg	<0.025	-	0.054	0.044	-	-	0.044	0.046	0.048	0.033	310	4,200	4
Nickel	mg/kg	2.59	-	12.6	11.3	-	-	15.6	13.1	13.3	10.5	400 [3]	6,000 [3]	200
Zinc	mg/kg	45.3	-	105	70.6	-	-	62.7	46.3	106	114	7,400 [3]	400,000 [3]	200
Total Petroleum Hydrocarbons														
C7-C9	mg/kg	-	411	-	<10	<10	<10	-	<10	-	-	Surface: 120/ 500/ 15,000; 1m-4m: 120/ 500/ NA [4]	Surface: 120/ 500/ NA; 1m-4m: 120/ 500/ NA [6]	NGV
C10-C14	mg/kg	-	464	-	<15	134	53	-	<15	-	-	Surface: 470/ 510/ 570; 1m-4m: 560/ 670/ 2,900 [4]	Surface: 1,500/1,700/1,900; 1m-4m: 1,900/ 2,200/ 9,700 [6]	NGV
C15-C36	mg/kg	-	262	-	193	434	187	-	<25	-	-	NA [4]	NA [6]	NGV
C7-C36 (Total)	mg/kg	-	1137	-	193	568	240	-	<50	-	-	NGV	NGV	NGV
BTEX														
Benzene	mg/kg	-	<0.35	-	<0.05	<0.05	<0.05	-	<0.05	-	-	Surface: 1.1/ 1.1/ 1.7; 1m-4m: 1.9/ 1.9/ 8.8 [4]	Surface: 3/ 3.6/ 11; 1m-4m: 3/ 7.2/ 41 [6]	10
Ethylbenzene	mg/kg	-	<0.35	-	<0.05	<0.05	<0.05	-	<0.05	-	-	Surface: 53/ 59/ 160; 1m-4m: 92/ 92/ NA [4]	Surface: 180/ 200/ 540; 1m-4m: 300/ 300/ NA [6]	1000
Toluene	mg/kg	-	<0.35	-	<0.05	<0.05	<0.05	-	<0.05	-	-	Surface: 68/ 82/ 320; 1m-4m: 94/ 170/ 2,400 [4]	Surface: 94/ 270/ 1,000; 1m-4m: 94/ 480/ 7,900 [6]	2000
m,p-xylene	mg/kg	-	<0.35	-	<0.05	<0.05	<0.05	-	<0.05	-	-	Surface: 48/ 59/ 250; 1m-4m: 130/ 130/ 1,800 [4]	Surface: 150/ 200/ 810; 1m-4m: 150/ 420/ 6,000 [6]	2000
o-xylene	mg/kg	-	<0.35	-	<0.05	<0.05	<0.05	-	<0.05	-	-			
Asbestos														
Qualitative (form)	-	NAD	-	NAD	-	-	-	NAD	-	-	NAD	n/a	n/a	NGV
Semi-quantitative as ACM	w/w%		-		-	-	-		-	-		0.01 [9]	0.05 [7]	NGV
Semi-quantitative as AF/FA	w/w%		-		-	-	-		-	-		0.001 [9]	0.001 [7]	NGV

Notes:
Bold indicates that Class A landfill screening criteria are exceeded (TCLP test needed).
- Denotes not analysed.
NGV- No Guideline Value.
NAD- No Asbestos Detected.
NA- Indicates criterion non limiting as estimated health based criterion is significantly higher than likley to be encountered on site (i.e. 20,000 mg/kg for TPH, 10,000 mg/kg for other contaminants).
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Chromium (VI) SCS values used for soil.
1- Benzo[a]pyrene potency equivalence as calculated using the Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health, 2011.
2- MfE 2011, NES Users' Guide, Soil Contaminant Standards, Residential (10% produce consumption).
3-ASC NEPM Toolbox - Update Febrary 2014 - www.nepc.gov.au/nepms/assessment-site-contamination/toolbox.
4-MfE 2011, Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 soil acceptance criteria for TPH and BTEX, Residential land use, ALL Pathways, Surface and 1m-4m depth contamination guidelines for SAND/SANDY SILT/CLAY soils respectively.
5- MfE 2011, NES Users' Guide, Outdoor Worker protection.
6- MfE 2011, Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 soil acceptance criteria for TPH and BTEX, Commercial land use, ALL Pathways, Surface and 1m-4m depth contamination guidelines for SAND/SANDY SILT/CLAY soils respectively.
7- BRANZ 2017, New Zealand Guidelines for Assessing and Managing Asbestos in Soil; ACM - asbestos containing material, AF- asbestos fines, FA- fibrous asbestos.
8- MfE 2004, Module 2: Hazardous Waste Guidelines, Landfill Waste Acceptance Criteria and Landfill Classification. Class A landfill screening criteria (20 X TCLP criteria; where contaminant concentration

Table 1 soil results summary (cont)

Sample name	Units	TP10 0.7	TP10 1.5	TP11 0.5	TP11 1.1	TP 11 1.8	TP12 0.2	TP13 0.2	TP13 0.3	TP13 0.85	TP13 1.6	Assessment criteria		
Depth (m)		0.7	1.5	0.5	1.1	1.8	0.2	0.2	0.3	0.85	1.6	Residential [2]	Outdoor worker [5]	Class A landfill screen [8]
Soil type		Sandy SILT	CLAY	Sandy SILT	Sandy SILT	CLAY	ty/Gravelly SAI	Sandy SILT	Sandy SILT	Clayey SILT	CLAY			
Metals														
Arsenic	mg/kg	3.61	4.11	5.31	4.94	-	6.63	3.78	-	5.38	5.38	20	70	100
Cadmium	mg/kg	0.077	0.11	0.13	0.2	-	2.42	0.073	-	0.11	0.11	3	1,300	20
Chromium	mg/kg	11.3	19.6	14.9	15.7	-	12.9	11.8	-	13	13.9	460	6,300	100
Copper	mg/kg	13.4	11.9	13.3	12.2	-	28.1	9.16	-	15	12.5	>10,000	>10,000	100
Lead	mg/kg	10.3	9.82	50.3	87.9	-	83.6	16.6	-	11.3	40.3	210	3,300	100
Mercury	mg/kg	0.035	0.059	0.046	0.049	-	0.063	0.041	-	0.046	0.055	310	4,200	4
Nickel	mg/kg	13.5	28.7	15.3	14.2	-	12.3	14.3	-	16.5	14	400 [3]	6,000 [3]	200
Zinc	mg/kg	51.2	61.3	99.2	145	-	198	54.7	-	56.5	92.3	7,400 [3]	400,000 [3]	200
Total Petroleum Hydrocarbons														
C7-C9	mg/kg	-	<10	-	-	<10	-	-	-	-	<10	Surface: 120/ 500/ 15,000; 1m-4m: 120/ 500/ NA [4]	Surface: 120/ 500/ NA; 1m-4m: 120/ 500/ NA [6]	NGV
C10-C14	mg/kg	-	52	-	-	118	-	-	-	-	18	Surface: 470/ 510/ 570; 1m-4m: 560/ 670/ 2,900 [4]	Surface: 1,500/1,700/1,900; 1m-4m: 1,900/ 2,200/ 9,700 [6]	NGV
C15-C36	mg/kg	-	<25	-	-	292	-	-	-	-	83	NA [4]	NA [6]	NGV
C7-C36 (Total)	mg/kg	-	52	-	-	410	-	-	-	-	101	NGV	NGV	NGV
BTEX														
Benzene	mg/kg	-	<0.05	-	-	<0.05	-	-	-	-	<0.05	Surface: 1.1/ 1.1/ 1.7; 1m-4m: 1.9/ 1.9/ 8.8 [4]	Surface: 3/ 3.6/ 11; 1m-4m: 3/ 7.2/ 41 [6]	10
Ethylbenzene	mg/kg	-	<0.05	-	-	<0.05	-	-	-	-	<0.05	Surface: 53/ 59/ 160; 1m-4m: 92/ 92/ NA [4]	Surface: 180/ 200/ 540; 1m-4m: 300/ 300/ NA [6]	1000
Toluene	mg/kg	-	<0.05	-	-	<0.05	-	-	-	-	<0.05	Surface: 68/ 82/ 320; 1m-4m: 94/ 170/ 2,400 [4]	Surface: 94/ 270/ 1,000; 1m-4m: 94/ 480/ 7,900 [6]	2000
m,p-xylene	mg/kg	-	<0.05	-	-	<0.05	-	-	-	-	<0.05	Surface: 48/ 59/ 250; 1m-4m: 130/ 130/ 1,800 [4]	Surface: 150/ 200/ 810; 1m-4m: 150/ 420/ 6,000 [6]	2000
o-xylene	mg/kg	-	<0.05	-	-	<0.05	-	-	-	-	<0.05			
Asbestos														
Qualitative (form)	-	NAD	-	NAD	*Chrysotile (free fibres)*	-	NAD	-	NAD	-	-	n/a	n/a	NGV
Semi-quantitative as ACM	w/w%		-		<0.001	-		-		-	-	0.01 [9]	0.05 [7]	NGV
Semi-quantitative as AF/FA	w/w%		-		<0.001	-		-		-	-	0.001 [9]	0.001 [7]	NGV

Notes:
Bold indicates that Class A landfill screening criteria are exceeded (TCLP test needed).
- Denotes not analysed.
NGV- No Guideline Value.
NAD- No Asbestos Detected.
NA- Indicates criterion non limiting as estimated health based criterion is significantly higher than likley to be encountered on site (i.e. 20,000 mg/kg for TPH, 10,000 mg/kg for other contaminants).
n/a- Not Applicable
Chromium (VI) SCS values used for soil.
1- Benzo[a]pyrene potency equivalence as calculated using the Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health, 2011.
2- MfE 2011, NES Users' Guide, Soil Contaminant Standards, Residential (10% produce consumption).
3-ASC NEPM Toolbox - Update Febrary 2014 - www.nepc.gov.au/nepms/assessment-site-contamination/toolbox.
4-MfE 2011, Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 soil acceptance criteria for TPH and BTEX, Residential land use, ALL Pathways, Surface and 1m-4m depth contamination guidelines for SAND/SANDY SILT/CLAY soils respectively.
5- MfE 2011, NES Users' Guide, Outdoor Worker protection.
6- MfE 2011, Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 soil acceptance criteria for TPH and BTEX, Commercial land use, ALL Pathways, Surface and 1m-4m depth contamination guidelines for SAND/SANDY SILT/CLAY soils respectively.
7- BRANZ 2017, New Zealand Guidelines for Assessing and Managing Asbestos in Soil; ACM - asbestos containing material, AF- asbestos fines, FA- fibrous asbestos.
8- MfE 2004, Module 2: Hazardous Waste Guidelines, Landfill Waste Acceptance Criteria and Landfill Classification. Class A landfill screening criteria (20 X TCLP criteria; where contaminant concentration

Table 2: Relative Percentage Difference in groundwater duplicate samples

Sample name	TP7	Dup	RPD (%)
Metals			
Arsenic	0.024	0.0257	7
Boron	0.125	0.126	1
Cadmium	0.0002	0.00021	5
Chromium	0.0077	0.011	35
Copper	0.0097	0.012	21
Lead	0.04262	0.04575	7
Nickel	0.0093	0.0115	21
Zinc	0.094	0.103	9
Polycyclic Aromatic Hydrocarbons			
1-Methylnaphthalene	0.001	0.00082	20
2-Methylnaphthalene	0.00074	0.00066	11
Acenaphthene	0.00064	0.00077	18
Acenaphthylene	0.0002	0.00024	18
Anthracene	0.00006	0.00027	127
Fluoranthene	0.00011	0.0001	10
Fluorene	0.00209	0.00218	4
Pyrene	0.00004	0.00005	22
Benzo[a]pyrene TEQ (LOR) [1]	0.00005	0.00005	0
Total Petroleum Hydrocarbons			
C10-C14	0.6	1	50
C15-C36	3.5	5.7	48
C7-C36 (Total)	4.1	6.7	48

Table 3: Groundwater results summary

Sample name	TP2	TP5	TP7	ANZECC 95% species protection [2]
Total Suspended Solids	74	109	364	
Metals				
Arsenic	0.0064	0.0038	0.024	0.024 [3]
Boron	0.144	0.066	0.125	0.37
Cadmium	0.00006	0.00005	0.0002	0.0002
Chromium	0.0018	0.0035	0.0077	0.0033 [4, 5]
Copper	0.0028	0.0035	0.0097	0.0014
Lead	0.00154	0.00222	0.04262	0.0034
Mercury	<0.0001	<0.0001	<0.0001	0.0006
Nickel	0.0049	0.0059	0.0093	0.011
Zinc	0.007	0.01	0.094	0.008
Polycyclic Aromatic Hydrocarbons				
1-Methylnaphthalene	<0.00006	<0.00006	0.001	NGV
2-Methylnaphthalene	<0.00006	<0.00006	0.00074	NGV
Acenaphthene	<0.00002	<0.00002	0.00064	NGV
Acenaphthylene	<0.00002	<0.00002	0.0002	NGV
Anthracene	<0.00002	<0.00002	0.00006	0.0001 [5]
Benz[a]anthracene	<0.00003	<0.00003	<0.00003	NGV
Benzo[a]pyrene	<0.00002	<0.00002	<0.00002	0.0001 [5]
Benzo[b]&[j] fluoranthene	<0.00002	<0.00002	<0.00002	NGV
Benzo[g,h,i]perylene	<0.00002	<0.00002	<0.00002	NGV
Benzo[k]fluoranthene	<0.00002	<0.00002	<0.00002	NGV
Chrysene	<0.00002	<0.00002	<0.00002	NGV
Dibenz[a,h]anthracene	<0.00002	<0.00002	<0.00002	NGV
Fluoranthene	<0.00002	<0.00002	0.00011	0.001 [5]
Fluorene	<0.00002	0.00003	0.00209	NGV
Indeno[1,2,3-cd]pyrene	<0.00003	<0.00003	<0.00003	NGV
Naphthalene	<0.00006	<0.00006	<0.00006	0.016
Phenanthrene	<0.00003	<0.00003	<0.00003	0.0006 [5]
Pyrene	<0.00002	<0.00002	0.00004	NGV
Benzo[a]pyrene TEQ (LOR) [1]	0.00005	0.00005	0.00005	0.0001
Total Petroleum Hydrocarbons				
C7-C9	<0.2	<0.2	<0.2	NGV
C10-C14	<0.2	<0.2	0.6	NGV
C15-C36	<0.3	<0.3	3.5	NGV
C7-C36 (Total)	<0.5	<0.5	4.1	NGV
BTEX				
Benzene	<0.001	<0.001	<0.001	0.95
Ethylbenzene	<0.001	<0.001	<0.001	0.08 [5]
Toluene	<0.001	<0.001	<0.001	0.18 [5]
m,p-xylene	<0.001	<0.001	<0.001	ID
o-xylene	<0.001	<0.001	<0.001	0.35

Notes:
All units mg/kg.
Bold indicates that ANZECC Guidelines have been exceeded.
NGV- No applicable ANZECC Guideline Value.
ID- Insufficient data to derive a reliable trigger value.
1- Benzo[a]pyrene potency equivalence as calculated using the Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health, 2011.

2- Gisborne Regional Freshwater Plan- Decision Version August 2017. Rule 5.1.3/ 5.1.4;
The discharge of stormwater from land to a public stormwater network. The discharge shall not contain hazrdous substances, agricultural chemicals, or cause exceedance of trigger values for 95% species protection for substances that are toxic to aquatic ecosystems (identified in the ANZECC Guidelines 2000).
3- Arsenic (III) guideline used.
4-Chromium (III) guideline used.
5-Unkown level of species protection.