66 BURNETT STREET, NORTH HOBART

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PLANNING & URBAN DESIGN

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66 BURNETT STREET, NORTH HOBART

Submission to the Hobart City Council

Planning Application for Demolition and early works

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1. INTRODUCTION

Ireneinc Planning have been engaged to prepare an application for demolition and early works at 66 Burnett Street, North Hobart. This report provides an assessment of the proposal against the provisions of the *Hobart Interim Planning Scheme 2015*.

The site location is described in the following figure:

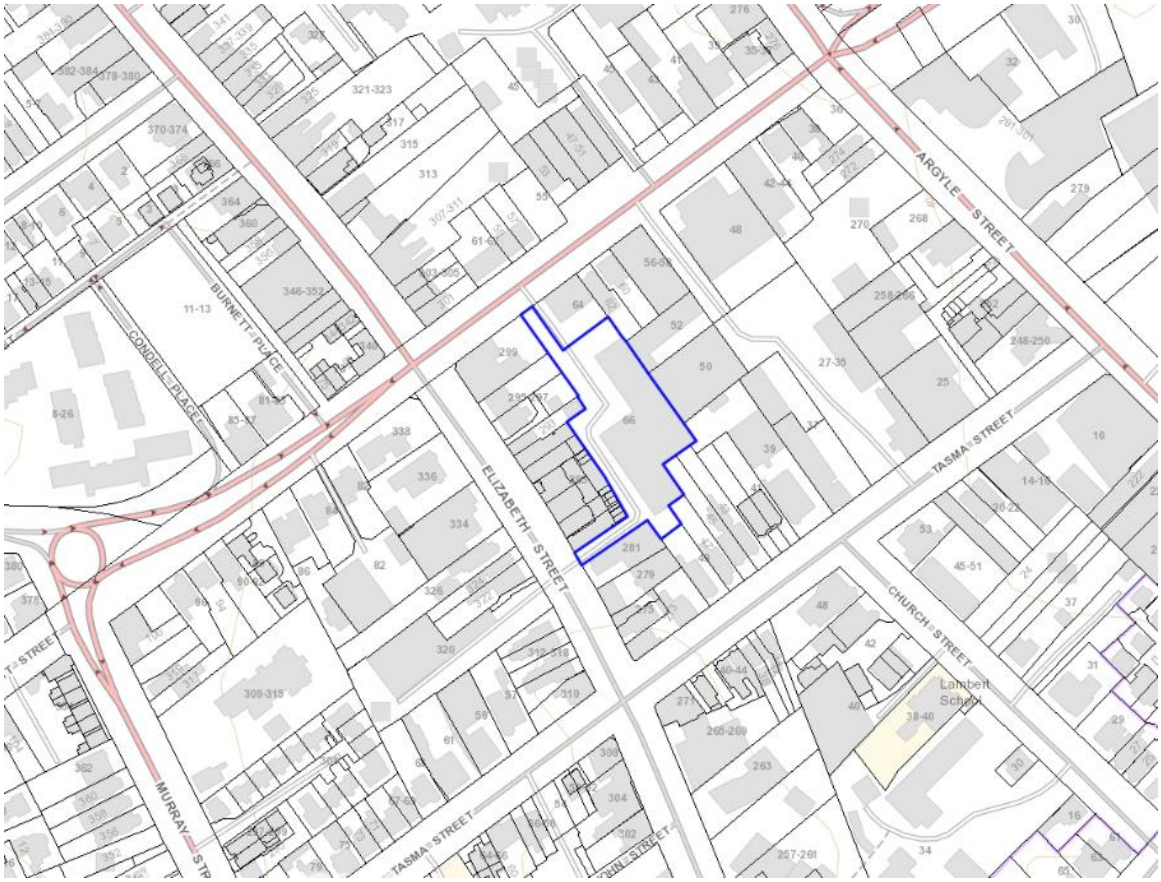

Figure 1:Location (Source: LISTMap)

1.1 BACKGROUND

There is currently an application with Council for redevelopment on the site for a residential and visitor apartment use and development (PLN-17-1066), the current application seeks approval for the demolition and early works in the hope that these can proceed more quickly.

1.2 SITE, EXISTING AND PROPOSED DEVELOPMENT

The land comprising the site is as follows:

66 Burnett Street, is a 3014m^2 internal lot (Title ref: 26099/4) which contains large existing buildings previously operating as Donald Gorringe Reconditioning and Spare Parts Pty Ltd, an automotive repair centre and machining workshop.

The site has frontages to both Burnett Street and Elizabeth Street. The existing buildings proposed to be demolished are located along the eastern boundaries as highlighted in red in the figure below.

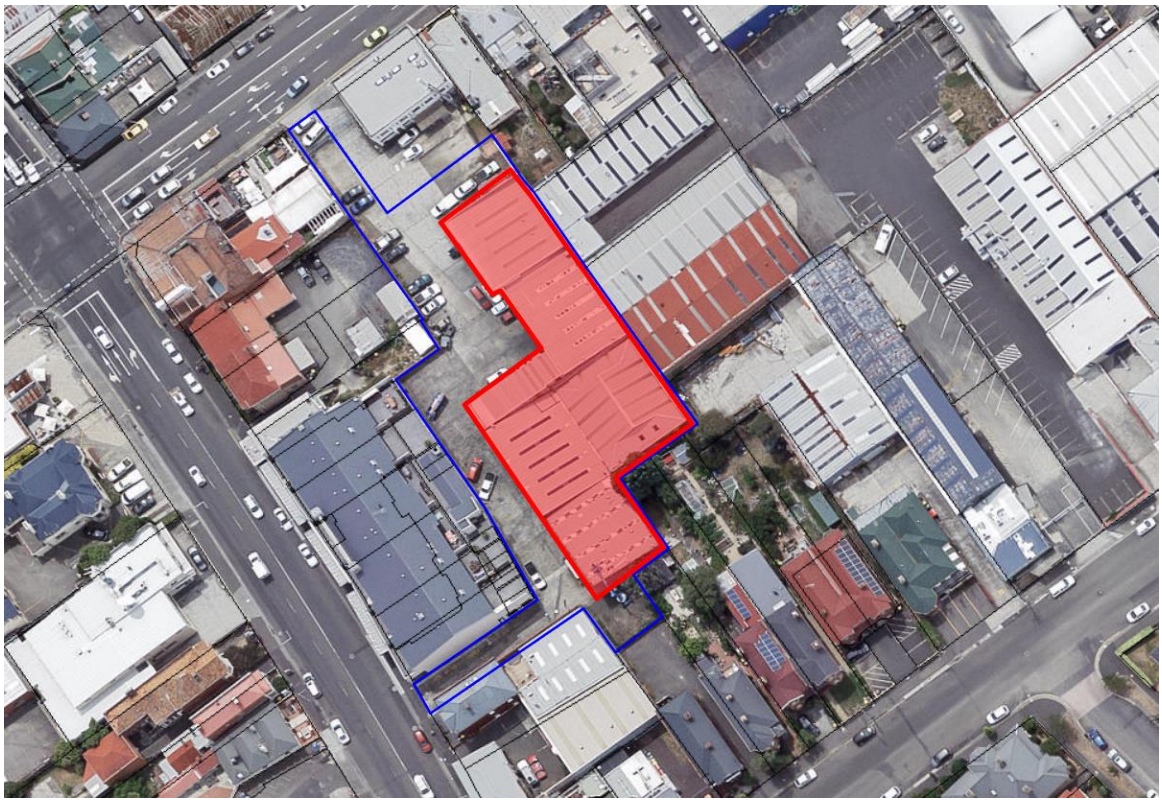

Figure 2: Aerial Image, site is blue and development area in red (Source: LISTMap)

This application proposes demolition of the buildings to ground level along with the site decontamination and archaeology works detailed in the accompanying reports.

2. PLANNING SCHEME PROVISIONS

The following provisions of the *Hobart Interim Planning Scheme 2015* are relevant to consideration of the proposal.

2.1 ZONING AND OVERLAYS

The figure below describes the subject site primarily within the Commercial (medium slate blue), with the Elizabeth Street access way being in the Urban Mixed Use Zone (silver). Surrounding zones include the General Business (royal blue) and Light Industry (fushia) on the northern side of Burnett Street.

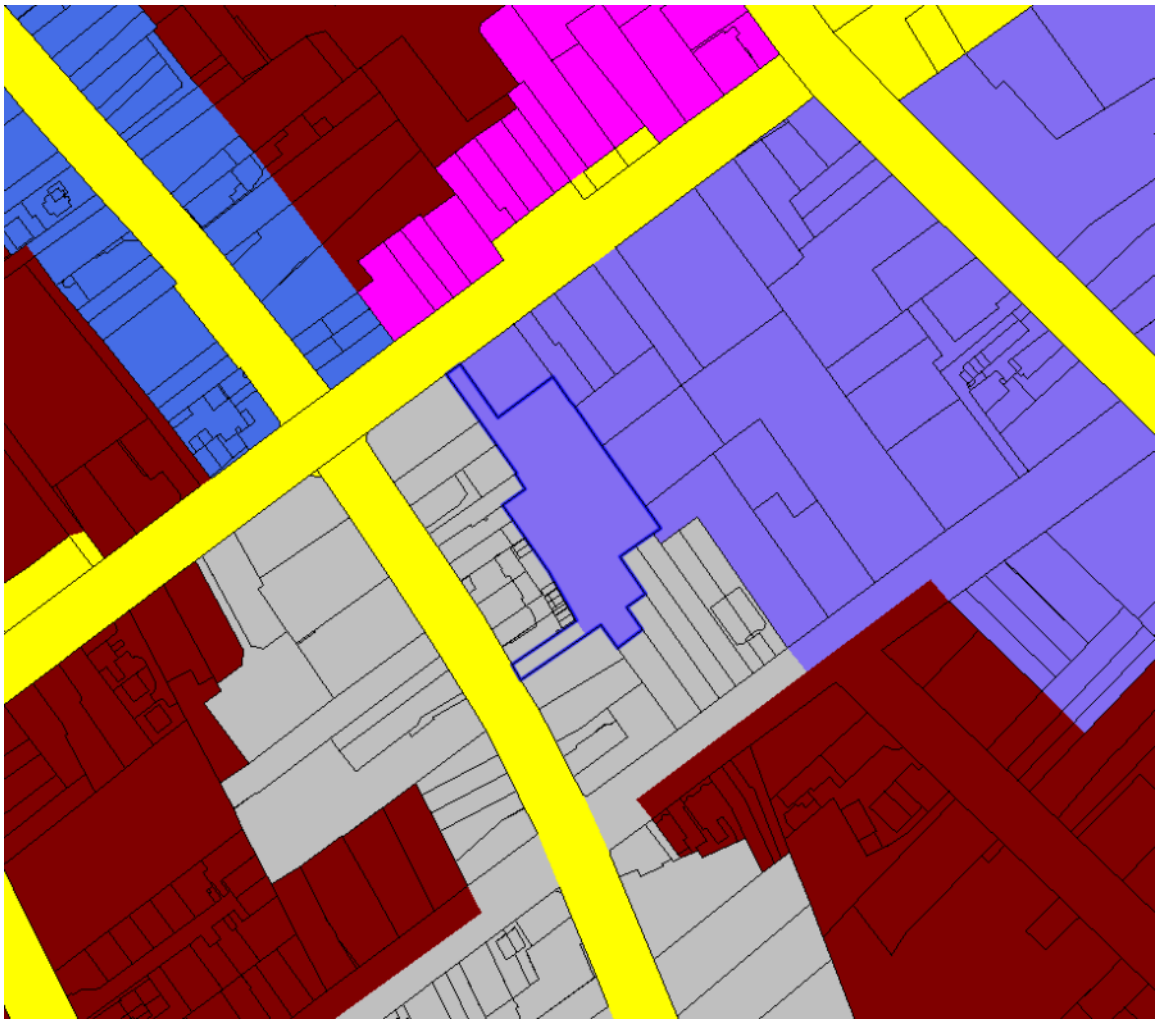

Figure 7: Zoning Plan (Source LISTMap)

All demolition works proposed as part of this application are within contained within the Commercial zoned area of the site, while a small part of the archaeology will also be within the Urban Mixed Use Zone.

The only mapped overlay which affects the site is the NH6 Heritage Precinct which applies to the Urban Mixed Use zoned part of the land, as follows:

Figure 3: Overlay Plan (Source LISTMap)

2.2 SPECIAL PROVISIONS

Part C of the Scheme includes the following in relation to demolition:

> *9.4.1 Unless approved as part of another development or prohibited by another provision, an application for demolition may be approved at the discretion of the planning authority having regard to:*
>
> *(a) the purpose of the applicable zone;*
>
> *(b) any relevant local area objective or desired future character statement of the applicable zone;*
>
> *(c) the purpose of any applicable code; …*

The application will not conflict with the Purpose of either the applicable Zone or Codes further detailed in the following sections.

2.3 COMMERCIAL ZONE

The Zone Purpose is as follows:

23.1.1.1 To provide for large floor area retailing and service industries.

23.1.1.2 To provide for development that requires high levels of vehicle access and car parking for customers.

23.1.1.3 To provide for a diversity of generally non-residential uses reflecting the transition between the Central Business Zone and inner residential areas.

23.1.1.4 To allow for uses such as car yards, warehouse and showrooms in the areas of high traffic volume and high passing visibility.

23.1.1.5 To allow good quality building stock to be used for less land extensive central service uses such as offices and specialist wholesaling uses.

23.1.1.6 To allow for service industry uses such as motor repairs which provide a valuable service to users of the central area.

23.1.1.7 To provide for residential use primarily above ground floor level.

The demolition and early works proposed will provide for the redevelopment if the site, consistent with the above Purpose statements, subject to separate application.

There are no Local Area Objectives or Desired Future Character Statements for the Zone, and none of the Use or Development Standards of the Zone are relevant to the proposed application.

2.4 URBAN MIXED USE ZONE

The Zone Purpose is as follows:

15.1.1.1 To provide for integration of residential, retail, community services and commercial activities in urban locations.

15.1.1.2 To encourage use and development at street level that generates activity and pedestrian movement through the area.

15.1.1.3 To provide for design that maximises the amenity at street level including considerations of microclimate, lighting, safety, and pedestrian connectivity.

15.1.1.4 To ensure that commercial use are consistent with the activity centre hierarchy.

15.1.1.5 To ensure development is accessible by public transport, walking and cycling.

15.1.1.6 To provide for a diversity of uses at densities responsive to the character of streetscapes, historic areas and buildings and which do not compromise the amenity of surrounding residential areas.

15.1.1.7 To encourage the retention of existing residential uses and the greater use of underutilised sites as well as the reuse and adaptation of existing buildings for uses with a scale appropriate to the site and area.

15.1.1.8 To ensure that the proportions, materials, openings and decoration of building facades contribute positively to the streetscape and reinforce the built environment of the area in which the site is situated.

15.1.1.9 To maintain an appropriate level of amenity for residential uses without unreasonable restriction or constraint on the nature and hours of commercial activities.

15.1.1.10 To ensure that retail shopping strips do not develop along major arterial roads within the zone.

The demolition and early works proposed will provide for the redevelopment if the site, consistent with the above Purpose statements, subject to separate application.

There are no Local Area Objectives or Desired Future Character Statements for the Zone, and none of the Use or Development Standards of the Zone are relevant to the proposed application.

2.5 POTENTIALLY CONTAMINATED LAND CODE

The Zone Purpose is as follows:

E2.1.1 The purpose of this provision is to:

(a) ensure that use or development of potentially contaminated land does not adversely impact on human health or the environment.

2.5.1 DEVELOPMENT STANDARDS

E2.6.2 Excavation	
Objective: *To ensure that works involving excavation of potentially contaminated land does not adversely impact on human health or the environment.*	
SCHEME PROVISION	**APPLICATION RESPONSE**
P1 *Excavation does not adversely impact on health and the environment, having regard to:* *(a) an environmental site assessment that demonstrates there is no evidence the land is contaminated; or* *(b) a plan to manage contamination and associated risk to human health and the environment that includes:* *(i) an environmental site assessment;* *(ii) any specific remediation and protection measures required to be implemented before excavation commences; and* *(iii) a statement that the excavation does not adversely impact on human health or the environment.*	The *Environmental Site Assessment 66 Burnett Street, North Hobart*, Geo-Environmental Solutions, December 2017 and *Contamination Management Plan, 66 Burnett Street, North Hobart*, Geo-Environmental Solutions, December 2017 (amended 29 March 2018) detail how P1 will be met.

2.6 HISTORIC HERITAGE CODE

The Code includes the following purpose:

E13.1.1 To recognise and protect the historic cultural heritage significance of places, precincts, landscapes and areas of archaeological potential by regulating development that may impact on their values, features and characteristics.

As detailed previously the Elizabeth Street (existing access) area of the site is within the NH6 – Elizabeth Street Heritage Precinct, this application does not propose any demolition within the precinct. The rest of the site (ie excepting the Elizabeth Street access) is within the Archaeological Potential area.

2.6.1 DEVELOPMENT STANDARDS FOR HERITAGE PRECINCTS

E13.8.1 Demolition	
Objective: *To ensure that demolition in whole or in part of buildings or works within a heritage precinct does not result in the loss of historic cultural heritage values unless there are exceptional circumstances.*	
SCHEME PROVISION	**APPLICATION RESPONSE**
P1 *Demolition must not result in the loss of any of the following:* *(a) buildings or works that contribute to the historic cultural heritage significance of the precinct;* *(b) fabric or landscape elements, including plants, trees, fences, paths, outbuildings and other items, that contribute to the historic cultural heritage significance of the precinct;* *unless all of the following apply;* *(i) there are, environmental, social, economic or safety reasons of greater value to the community than the historic cultural heritage values of the place;* *(ii) there are no prudent or feasible alternatives;* *(iii) opportunity is created for a replacement building that will be more complementary to the heritage values of the precinct.*	The area of the land within the precinct is a driveway and there is therefore no building demolition proposed within the precinct, however some archaeology work is proposed in this area. The application therefore is in accordance with P1 in that it will not result in the loss of buildings, works or landscape elements which contribute to the cultural heritage significance of the precinct.

2.6.2 DEVELOPMENT STANDARDS FOR PLACES OF ARCHAEOLOGICAL POTENTIAL

The body of the lot (site excluding the Elizabeth Street accessway) is mapped within the area of archaeological potential. Separate accompanying reports provide a detailed history of the site and the proposed archaeological investigation.

E13.10.1 Building, Works and Demolition	
Objective: *To ensure that building, works and demolition at a place of archaeological potential is planned and implemented in a manner that seeks to understand, retain, protect, preserve and otherwise appropriately manage significant archaeological evidence.*	
SCHEME PROVISION	**APPLICATION RESPONSE**
P1 *Buildings, works and demolition must not unnecessarily impact on archaeological*	The *Statement of Archaeological Potential & Archaeological Method Statement, 66 Burnett*

resources at places of archaeological potential, having regard to: *(a) the nature of the archaeological evidence, either known or predicted;* *(b) measures proposed to investigate the archaeological evidence to confirm predictive statements of potential;* *(c) strategies to avoid, minimise and/or control impacts arising from building, works and demolition;* *(d) where it is demonstrated there is no prudent and feasible alternative to impacts arising from building, works and demolition, measures proposed to realise both the research potential in the archaeological evidence and a meaningful public benefit from any archaeological investigation;* *(e) measures proposed to preserve significant archaeological evidence 'in situ'.*	*Street North Hobart*, Tasarc, 5 June 2018, details how P1 is met.

3. CONCLUSION

The application relates to land at 66 Burnett Street, North Hobart. It is proposed to demolish the existing buildings, and to undertake site decontamination and archaeology as a preliminary stage of works related to later redevelopment of the site, which is subject to separate application to Council.

The application meets the requirements of the Scheme including the relevant Standards.

GES

GEO-ENVIRONMENTAL

SOLUTIONS

ENVIRONMENTAL SITE ASSESSMENT
66 BURNETT STREET
DECEMBER 2017

1 EXECUTIVE SUMMARY

This report builds on the findings from the *Preliminary Environmental Site Assessment* and presents the findings from the current invasive soil and soil vapour investigation. Geo-Environmental Solutions Pty. Ltd. (GES) was commissioned to conduct this work by Hobart Properties & Securities Pty Ltd, for the site located at 66 Burnett Street, North Hobart - hereby referred to as 'The Site' and formally referred to as 281a Elizabeth Street.

The purpose of this Environmental Site Assessment is to meet planning requirements for redevelopment of the site from a commercial garage and workshop to residential apartments. The *Preliminary Environmental Site Assessment* was written with the assumption that the land use was remaining unchanged, all results from the *Preliminary Environmental Site Assessment* will be assessed against appropriate guidelines for the redevelopment.

The objective of this environmental site assessment was to satisfy the planning requirement for the proposed site redevelopment, which involves the construction of a 7-level residential unit development that includes 2 levels of carparking with 96 parking spaces, 13 serviced apartments, 68 smaller apartments, 8 penthouse apartments and a proposed café shop front on Elizabeth Street. GES was required to determine the suitability of the site for the intended use and considered the following;

- Is the site suitable for residential apartments;
- Are there any contaminants of Potential Concern present;
- Is there a human health risk to current or future site users or trench workers;
- Is there an ecological health risk to offsite receptors;
- Identify any environmental site assessment data gaps;
- Provide recommendations on what measures may need to be put in place to address any potential data gaps and to further assess contamination remediation and/or management (if required).
- Provide a separate document, a Contamination Management Plan which outlines contamination management during the redevelopment phase of works.

The scope of works of this environmental site assessment was to:

- Conduct an invasive investigation in areas where site development is proposed;
- Review soil sample information (21 sample from 11 boreholes) from the previous investigation to compared against revised development works;
- Drill an additional ten (10) soil bores and collect 17 primary samples at the site in areas where data gaps were determined to further identify potential human health and ecosystem risk to onsite receptors from potentially contamination soil;
- Installation of 4 passive soil vapour samplers (plus a duplicate), Waterloo Membrane Samplers to confirm if there is a vapour risk present at the site.
- Soil samples were sent with quality assurance/ quality control samples for analysis to a National Association of Testing Authorities accredited laboratory;
- Compare soil analytical results against the NEPM 2013 guidelines and CRC CARE Technical Report 10 guidelines;
- Determine the absence or presence and if present the level of site contamination;
- Report in an environmental site assessment:
    - document the findings of the *Preliminary Environmental Site Assessment* and current site investigation;
    - present recommendations for remediation and protection measures during development and for future land users and
    - update the conceptual site model from *Preliminary Environmental Site Assessment* and contamination management recommendations.
- If contamination impact is identified at the site, advise on the preparation of a Contamination Management Plan which outlines contamination management during the redevelopment phase of works.

The following conclusions can be made from the invasive soil assessment.

- Site contamination findings are summarised:
    - Shallow soil impact has been identified in fill throughout the site within the top 0.3 to 0.4 m of the soil profile. Most of the identified impact is proposed to be excavated with a smaller amount to remain which is predominantly within guideline limits:
        - ESL exceedances have been identified based on a residential setting comprising benzo(a)pyrene and heavy oil compounds. Eight (8) exceedances are in the proposed excavation areas and three (3) which are to remain at the site beneath the new slab. Provided management measures are put in place, there is a LOW risk that the soil will present an environmental hazard;
        - EIL exceedances have been identified based on a residential setting comprising copper, nickel, zinc and lead. Ten (10) exceedances are in the proposed excavation areas and seven (7) which are to remain at the site beneath the new slab. Soil which is to remain at the site exceeds guidelines for copper and zinc. Provided management measures are put in place, there is a LOW risk that the soil will present an environmental hazard;
        - HIL B guidelines for assessing soil ingestion and dust inhalation risk are exceeded in six (6) samples at the site for assessing risk to future site users, of which all samples are proposed to be excavated except for BH4 0.5 m near the interceptor trap which exceeds HIL D. If the areas around the interceptor trap are excavated, there is an exposure risk to commercial workers, however based on available information, a risk to ongoing site users will be mitigated;
        - HSL D guidelines for assessing dermal contact risk to commercial workers have been identified in BH4 0.5 m near the interceptor trap (the same HIL D exceedance). Provided this impacted soil is removed, risk to future trench workers can be mitigated.
    - **Investigation Area A** – Other than the identified site fill, no impact has been identified in the truck service area nor around underground storage tanks T3 and T4;
    - **Investigation Area B** - Other than the identified site fill, and impact around the interceptor trap, no impact has been identified. There remain data gaps in this Area B. Areas around former underground storage tanks T1 and T2 as well as the nearby former bowser area have not been investigated given the presence of the building obstructions;
    - **Investigation Area C** - has not been investigated given the presence of the building and infrastructure obstructions; and
    - **Investigation Area D** – no soil impact has been identified in this area.
    - Areas where data gaps have been identified will need to be addressed in a site contamination management plan;

It has been identified that the bulk of the proposed excavated material averages out to Level 2 based on IB105 due to barium, lead, zinc and benzo(a)pyrene in the proposed excavation material. Barium is likely to be an artefact of background soils in the area and not a contaminant of concern at the site which may deem it as being classified Level 2. The bulk of the impact occurs in shallow fill material at the site, and care should be taken to scraping the top 0.3 m from the site and stockpiling is separately from the remaining deep excavations. This is likely to bring the bulk excavations below 0.3 m BGS to Level 1.

GES are not aware of any tank decommissioning and it needs to be assumed that all tanks (identified or not identified) remain at the site.

When redevelopment work commences for the site, GES recommends that the following actions should be undertaken:

- A Contamination Management Plan will be required
- Further Environmental Site Assessment which should include but not be limited to;
    - All four underground storage tanks should be formally decommissioned and tank pits should be validated.
    - The interceptor trap should be removed, and remaining soil should be validated; and
    - Further investigations will be required under the footprint of the buildings, at a minimum in Area C for contamination.
- All excavated soil at the site should be stockpiled and assessed against IB105 guidelines

- GES recommends separating stockpiles; and keeping the shallow material 0.0-0.4 m bgs separate. All remaining material is likely to be classified as Level 1 clean fill (with proof of analytical results).

In summary, if recommendations herein are implemented, based on the adopted land used class, there is a low risk that soil at the site will present a risk to human health or the environment

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2 ABREVIATIONS

AEC	Areas of Environmental Concern
AHD	Australian Height Datum
ALS	Analytical Laboratory Services
ANZECC	Australia and New Zealand Environment and Conservation Council
BGS	Below Ground Surface
BH	Borehole
BTEX	Benzene Toluene Ethylbenzene Xylene
COA	Certificate of Analysis
COC	Chain of Custody
COPC	Chemical of Potential Concern
CRC CARE	Corporative Research Centre for Contamination Assessment and Remediation of the Environment
CSM	Conceptual Site Model
DA	Development Application
DQO	Data Quality Objectives
DWS	Depth Water Struck
EPA	Environmental Protection Authority
ESA	Environmental Site Assessment
GES	Geo-Environmental Solutions Pty. Ltd.
HIL	Health Investigation Levels
HSL	Health Screening Levels
IL	Investigation Levels
LOR	Limits of Reporting
NATA	National Association of Testing Authorities
NEPM	National Environmental Protection Measure
NHMRC	National Health and Medical Research Council
NRMMC	Natural Resource Management Ministerial Council
NL	Non Limiting
NRMMC	Natural Resource Management Ministerial Council
PESA	Preliminary Environmental Site Assessment
PAH	Poly-Aromatic Hydrocarbons
PCP	Physico-Chemical Parameters
PEV	Protected Environmental Values
PHC	Petroleum Hydrocarbons
PPA	Preferential (PVI) Pathways Assessment
PVI	Petroleum Vapour Intrusion
SCA	Site Contamination Assessment
SCM	Site Contamination Model
SGS	Specialist Laboratory Services
TPH	Total Petroleum Hydrocarbons

TRH	Total Recoverable Hydrocarbons
USCS	Unified Soil Classification System
WMS	Waterloo Membrane Samplers

3 INTRODUCTION

3.1 General

This report builds on the findings from the *Preliminary Environmental Site Assessment* (PESA; GES, July 2017) and presents the findings from the current invasive soil and soil vapour investigation. Geo-Environmental Solutions Pty. Ltd. (GES) was commissioned to conduct this work by Hobart Properties & Securities Pty Ltd, for the site located at 66 Burnett Street, North Hobart - hereby referred to as 'The Site' and formally referred to as 281a Elizabeth Street (GES 2017). The site location is presented in **Figure** 1 and **Figure** 2.

The purpose of this Environmental Site Assessment (ESA) is to meet planning requirements for redevelopment of the site from a commercial garage and workshop to residential apartments. The *PESA* was written with the assumption that the land use was remaining unchanged, all results from the PESA will be assessed against appropriate guidelines for the redevelopment.

The ESA has been prepared by a suitably qualified and experience practitioner in accordance with procedures and practices detailed in National Environmental Protection Measure (NEPM, 2013) guidelines and key regulations and policies identified in the References section of this document. Personnel engaged in preparing this ESA are listed in Appendix 1 along with their relevant qualifications and years of experience.

Figure 1 Site Location, 20m scale, image sourced from the LIST. Site outlined in red

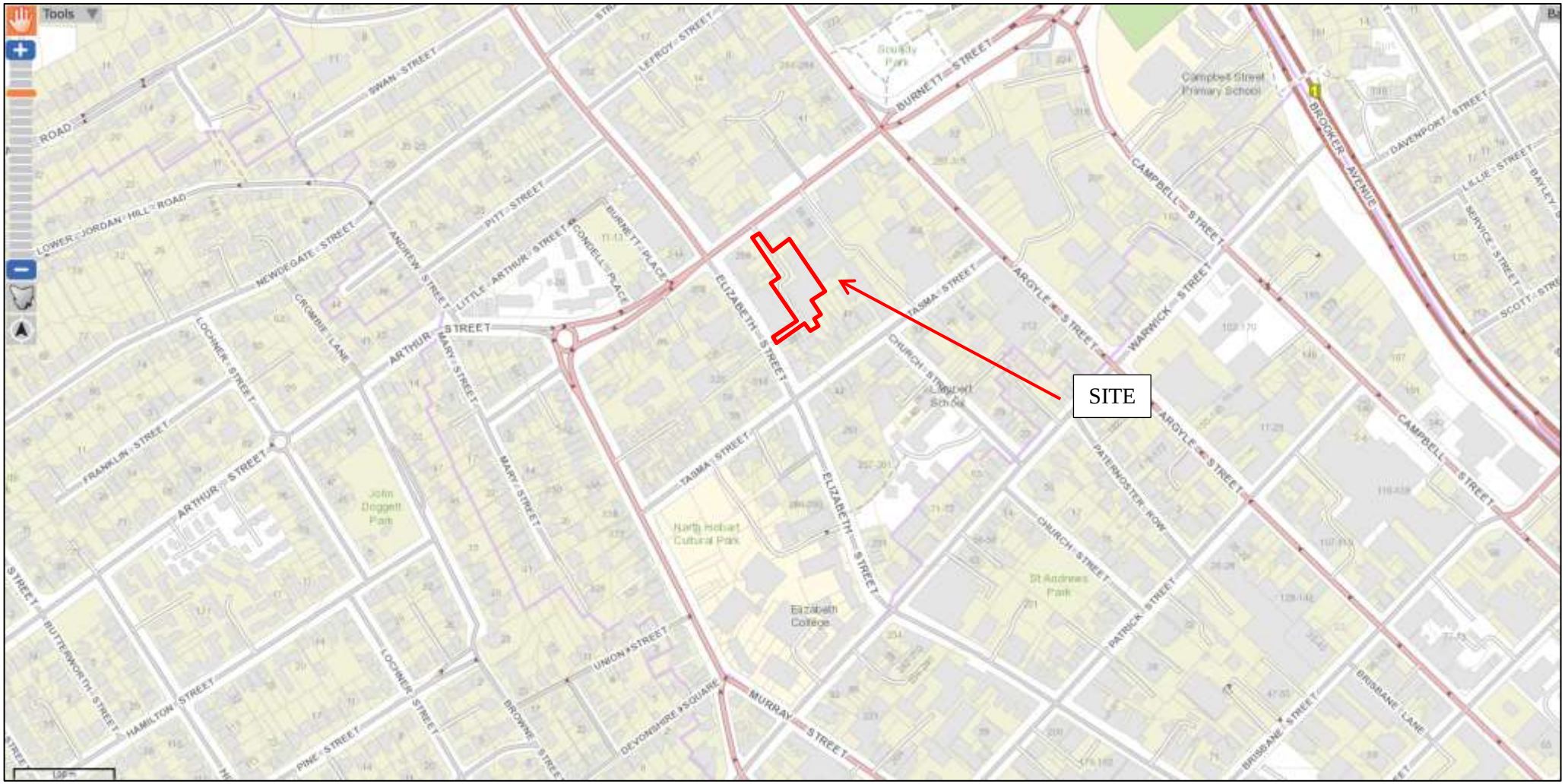

Figure 2 Site Location, 100m scale, image sourced from the LIST

3.2 Site Details

Site details are presented in Table 1 and Plate 1 shows the office and one of the workshops on site.

Table 1 Site Details

SITE LOCATION: 66 Burnett Street, North Hobart. Identified as 281a Elizabeth Street, North Hobart in the PESA (GES 2017)
INVESTIGATION AREA 281a Elizabeth Street which has a second entrance at 66 Burnett Street. Limits approximately defined by borehole extent
SITE ELEVATION & GRADIENT 41.7 to 46.2 m Australian Height Datum (AHD) over 110m with a 2.5º or 4.5% increase to the northern end of the site.
SITE SURFACING The surface of the site is 95 % concrete and 5% gravel fill.
TITLE REFERENCES The investigation area includes the following title reference for 66 Burnett Street, North Hobart: CT 26099/4
SITE OWNER Hobart Properties & Securities Pty Ltd
PREVIOUS LANDUSE Residential Properties
SITE SURROUNDING LAND ZONING Tasmanian Interim Planning Scheme 2015 The majority of the site is zone '23.0 Commercial' Drive way from Elizabeth Street is Zoned '15.0 Urban Mixed Use'
SITE LAND USE Commercial Land Use for the maintenance and repairs of a range of cars and trucks
PROPOSED LAND USE Unknown
SURROUNDING LAND USE: NE: Commercial Properties; SE to NW: Mixed Urban use – Café's and Restaurants; N Light Industrial premises.

Plate 1 The Site, 66 Burnett Street; Street View looking in a Southeasterly direction.

3.3 Investigation Objectives

The objective of this ESA was to satisfy the planning requirement for the proposed site redevelopment, which involves the construction of a 7-level residential unit development that includes 2 levels of carparking with 96 parking spaces, 13 serviced apartments, 68 smaller apartments, 8 penthouse apartments and a proposed café shop front on Elizabeth Street. GES was required to determine the suitability of the site for the intended use and considered the following;

- Is the site suitable for residential apartments;
- Are there any contaminants of Potential Concern (COPC's) present;
- Is there a human health risk to current or future site users or trench workers;
- Is there an ecological health risk to offsite receptors;
- Identify any data gaps;
- Provide recommendations on what measures may need to be put in place to address any potential data gaps and to further assess contamination remediation and/or management (if required).
- Provide a separate document, a Contamination Management Plan which outlines contamination management during the redevelopment phase of works.

3.4 Scope of Works

The scope of works of this ESA was to:

- Conduct an invasive investigation in areas where site development is proposed;
- Review soil sample information (21 sample from 11 boreholes) from the previous investigation to compared against revised development works;
- Drill an additional ten (10) soil bores and collect 17 primary samples at the site in areas where data gaps were determined to further identify potential human health and ecosystem risk to onsite receptors from potentially contamination soil;
- Installation of 4 passive soil vapour samplers (plus a duplicate), Waterloo Membrane Samplers (WMS) to confirm if there is a vapour risk present at the site.
- Soil samples were sent with quality assurance/ quality control (QA/QC) samples for analysis of total recoverable hydrocarbons (TRH) Benzene Toluene Ethylbenzene Xylene (BTEX), Polynuclear Aromatic Hydrocarbons (PAH) and Heavy Metals to a National Association of Testing Authorities (NATA) accredited laboratory;
- Compare soil analytical results against the NEPM 2013 guidelines and CRC CARE Technical Report 10 guidelines (Friebel & Nadebaum 2011);
- Determine the absence or presence and if present the level of site contamination;
- Report in an ESA:
    - document the findings of the PESA and current site investigation;
    - present recommendations for remediation and protection measures during development and for future land users and
    - update the conceptual site model (CSM) from PESA (GES 2017) and contamination management recommendations.
- If contamination impact is identified at the site, advise on the preparation of a Contamination Management Plan which outlines contamination management during the redevelopment phase of works.

4 PLANNING

4.1 Site Zoning

The site is currently zoned Commercial under the Tasmanian Interim Planning Scheme 2015 (Figure 3), except for the driveway on Elizabeth Street which is zoned Urban Mixed Use. It is expected that if the proposed residential unit development proceeds a change of use will be required.

The land use surrounding the site is consistent with the zoning; the land east of the site is largely Commercial, the properties along Elizabeth Street are zoned Urban Mixed use, northwest of the intersection of Elizabeth Street and Burnett Street Elizabeth Street is General Business and there is a small strip along Burnett Street that is zone Light Industrial. More broadly the site is surrounded by Inner Residential and the major roads in the area are zoned Utilities.

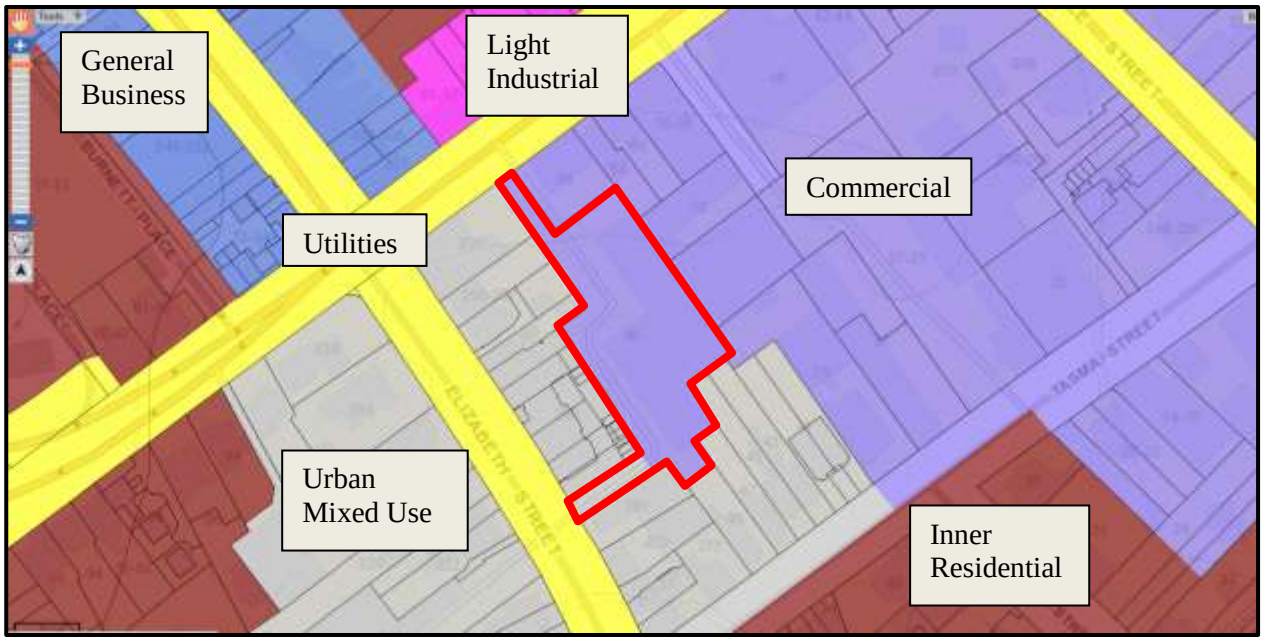

Figure 3 Tasmanian Interim Planning Scheme Zoning (2015), site outlined in red

4.2 Existing Site Layout

A schematic of the existing site layout is presented in Figure 4. A driveway runs the length of the site from 66 Burnett Street exiting at 281a Elizabeth Street. There are five workshop buildings and one office building.

4.3 Proposed Site Development Works

At the time the PESA (GES 2017) was written GES was unaware of any changes to use of the site. However, since the PESA was written, GES has been provided with Development Application (DA) plans that include a multistory residential unit development, designed by Andrew and Mckellar design, Noosaville, Queensland (August 2017). See Appendix 2 for the proposed design. The following is proposed for the site:

- Level 1 – Carparking, gym and storage and a separate café with kitchen and washroom facilities;
- Level 2 – Carparking, storage and 11 serviced apartments; 2 apartments will be located on the current ground floor level in the northern edge of the building and 2 apartments will be built above the café;
- Level 3 – 19 apartments, including 2 above the café (final level on café building);
- Level 4 – 17 apartments;
- Level 5 – 17 apartments;
- Level 6 – 17 apartments;
- Level 7 – 8 penthouse apartments.

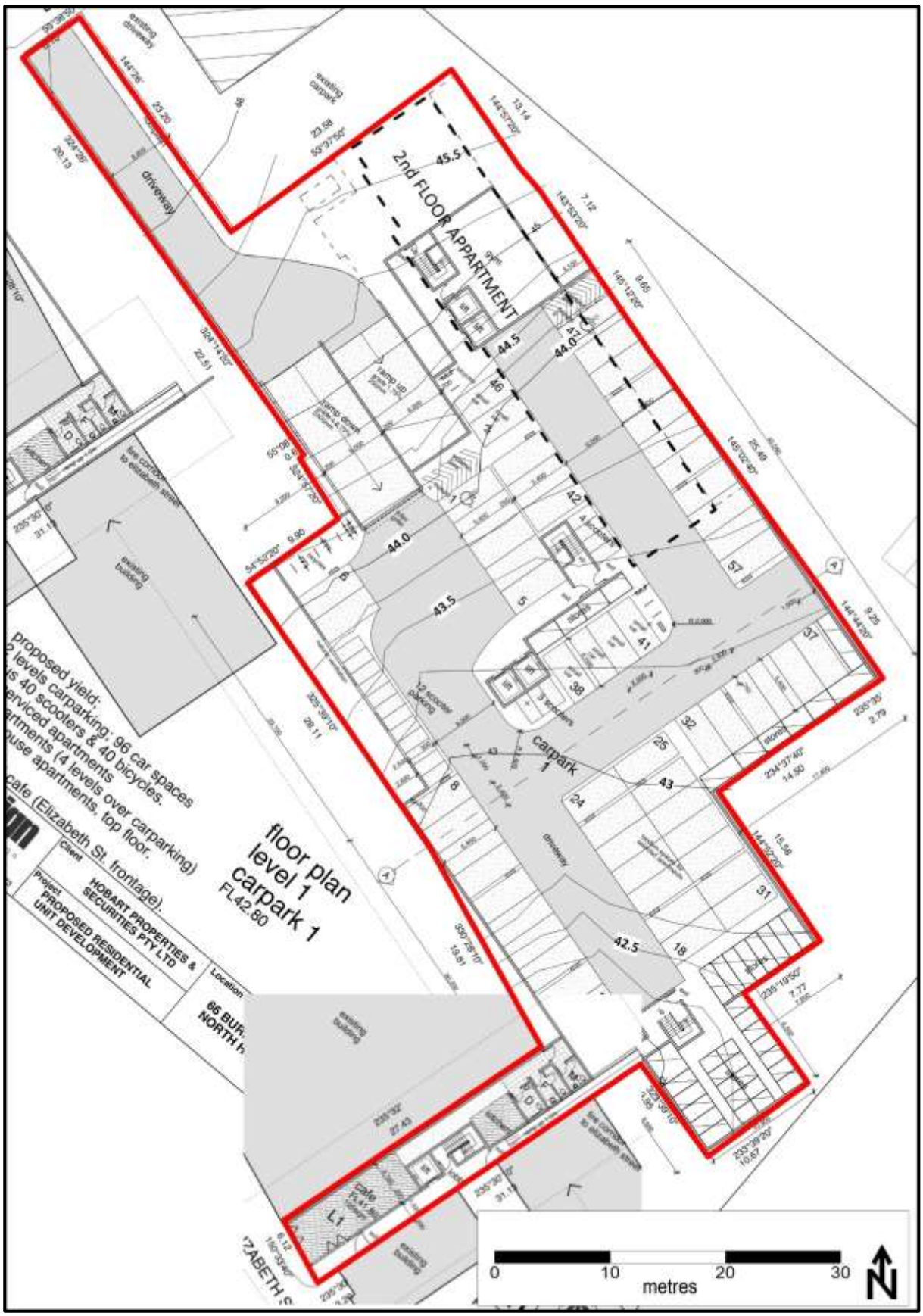

Figure 4 Proposed Site Layout

The risk assessment herein depends on likely soil and/ or vapour exposure pathways based on:

- Present site conditions;
- Proposed development site layout and building construction; and
- Site earthworks

4.4 Assessment Trigger

The need for this assessment has been triggered by the following:

- The ESA is a requirement for the proposed Sale of Land.
- The site falls within the Hobart City Council contaminated site overlay and need to be assessed in accordance with the following interim planning scheme code:
    - *E2.5 Use Standards*
    - *E2.6.2 Excavation.*
- Given that there is proposed ***excavation works*** at the site, there are no acceptable solutions to proposed works, and therefore E2.6.2 P1 performance criteria are to be addressed
- Given that there is a proposed ***change of use*** at the site *The Director, or a person approved by the Director for the purpose of this Code:*
    a) certifies that the land is suitable for the intended use; or
    b) approves a plan to manage contamination and associated risk to human health or the environment that will ensure the land is suitable for the intended use.

4.5 Performance Criteria

Excavation does not adversely impact on health and the environment, having regard to:

(a) an environmental site assessment that demonstrates there is no evidence the land is contaminated; or
(b) a plan to manage contamination and associated risk to human health and the environment that includes:
    i. an environmental site assessment;
    ii. any specific remediation and protection measures required to be implemented before excavation commences; and
    iii. a statement that the excavation does not adversely impact on human health or the environment.

Land is suitable for the intended use, having regard to:

(a) an environmental site assessment that demonstrates there is no evidence the land is contaminated; or
(b) an environmental site assessment that demonstrates that the level of contamination does not present a risk to human health or the environment; or
(c) a plan to manage contamination and associated risk to human health or the environment that includes:
    i. an environmental site assessment;
    ii. (any specific remediation and protection measures required to be implemented before any use commences; and
    iii. a statement that the land is suitable for the intended use.

5 DESKTOP STUDY

Please see the desk top study from the PESA (GES, 2017) for details on the following:

- Site walkover conducted on the 17 June
- MRT Geology Mapping
- Site Topography, Drainage & Hydrogeology
- Historical Aerial Photography Interpretation
- Dangerous Goods Records (Work Standards Tasmania)
- Environmental Protection Authority (EPA) Property Information Request

5.1 Conceptual Site Model – From PESA

5.1.1 Areas of Potential Concern

The following areas of potential concern (AOPC) have been identified and illustrated in Figure 5.

Area A: contains two underground storage tanks (USTs), T2 and T3, historical bowser location and associated fuel lines, a truck service pit in a workshop and a large area in front of the office building where the ground appears stained in the historical aerial photographs.

Area B: contains UST - T1, historical bowser location and associated fuel lines and the interceptor trap plus probably associated pipework. Potential contamination from neighboring historical service station site is also possible in this area.

Area C: appeared to have dark staining on the ground in the 1965 historical aerial photograph.

Area D: appeared to have dark staining on the ground in the 1965 historical aerial photograph and the surface is soil and gravel. This location has had a lot of vehicles parked on it overtime and during the site walkover it was identified as an area where potentially hazardous material is stored.

General potential contamination across the site includes the following:

- Historical vehicle wash-down bay
- Oil/ fuel and hazardous chemical dump points, piping to the interceptor trap
- Battery and oil storage areas
- Corrosion of metal from cars and buildings

There may be other areas on the site where potentially contaminating activities have occurred, but historical links have not been identified.

Contaminants of potential concern (COPC) include the following:

- Total Petroleum/Recoverable Hydrocarbons (TPH/TRH);
- Mono Aromatic hydrocarbons: Benzene, Toluene, Ethylbenzene, Xylene (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAH);
- Lead from unleaded fuel and battery acid and
- Heavy Metals in possible site fill.

5.1.2 Confirmed Areas of Contamination

The following contamination has been confirmed:

- There is localised surface contamination around T3 and T4
- There is localised surface contamination around the interceptor trap, and
- Elevated levels of Lead contamination across the site.

5.1.3 Receptors

After conducting the PESA the following conclusions were made about the potential receptors and the complete contamination exposure pathways:

- Ecosystems – ecosystem impact was ruled as there are not ecosystems within 100m.
- Offsite receptors – exposure may result from
- Trenchworks – during the development and future trench workers
- Indoor inhabitants – on site, current and future.

5.1.4 Data Gaps from PESA

Areas that require further investigations regarding contamination include the following;

- UST T1 and T2 plus Area C – unknown levels of contamination
- Interceptor trap and Tank pit – once this infrastructure and associated pipework has been removed, the remaining soil around the excavated sites will need to be sampled, analysised and validation to confirm that remaining material on site is within guidelines limits for human health and ecosystem protection.
- Vapour risk to ground floor users – the proposed location of the café on Elizabeth Street.

- Changes of land use – all analytical results from the PESA were compared against the HSL/HIL D guideline for Commercial Land use. Given that some of the proposed apartments will be on ground floor level the results need to be compared against HSLB.

Tank	Product	Volume (gln)	Commissioned	Decomissioned	Comments
T1	Distillate	1000	approx 1957	unknown	Covered by new building in 1977
T2	Petrol	2000	10/05/1965	unknown	Covered by new building in 1977
T3	Petrol	3000	24/01/1966	unknown	
T4	Distillate	2000	24/01/1966	unknown	

Figure 5 Locations of underground storage tanks and Areas of Potential Concern

6 FIELD INVESTIGATION PROCEDURES

6.1 Works Summary

Site investigation work was conducted on the 17 June 2017 and the 11 December 2017, details of the investigation are included in Table 2. All soil bore and soil vapour sampling locations are presented in Figure 6.

Table 2 Summary of Site Investigations

Hole ID	SB Drilled & Samples	Soil Vapour sampled
BH1 – BH11	17 June 2017	-
BH12 – BH21	11 December 2017	-
VP1-VP4 (BH13, BH16, BH20 & BH21)	11 December 2017	11-14 December 2017

The following boreholes BH1, BH2, BH15 and BH21 were drilled in area D to assess for potential contaminates from storage of materials and parking of vehicles. Bore hole BH3 and BH20 were drilled in the driveway to assess any potential contamination from the former upgradient BP service station and/ or the site, and BH4 was drilled adjacent to the interceptor trap. Bore holes BH6 to BH9 were drilling surrounding the two UST's on site. BH10 and BH17 were drilled in the open unpaved parking area and BH11 was drilled in the base of the service pit. BH12, BH13 and BH14 were drilled under the existing building to identify any soil contamination under the existing buildings.

6.2 Soil Investigation

6.2.1 Borehole Drilling

At each of the soil bore locations, the following precautions were put in place to avoid disrupting underground service assets:

- Dial Before You Dig plans were obtained;
- Archers Underground Service were engaged; and
- Where practical, the first meter of the bore was cleared with a hand auger.

Concrete coring was undertaken through bitumen or concrete at each drilling location as required.

A total of ten (10) 65 mm diameter soil bores were drilled for assessing site geology and sampling for contamination impact. The bores were drilled by GES using a hand auger and or the industry recognized Geoprobe direct push drilling system. The selected drilling method involved using a Geoprobe dual tube to retain wall integrity and eliminates risk of profile collapse whilst allowing extraction of 1.0 m length sample cores.

Figure 6 Borehole (BH1 to BH21) Investigation Areas

6.2.2 Soil Sampling

Soil bore soil sampling was conducted per the National Environmental Protection Measure (NEPM 2013) and AS4482 sampling guidelines. Table 3 presents a summary of the soil assessment methodology adopted at the site.

Table 3 Summary of Soil Sampling Methods

Activity	Details / Comments
Drilling Method	Soil bores were drilled: • Hand auger over the first meter to clear for services, and grab sampling; • Hollow stem auger until refusal depth and split spoon sampling; • Percussion drilling in rock and grab samples were collected from air blasted cuttings
Soil Logging	Logging the soil was conducted in accordance with the unified soil classification system (USCS) as detailed in AS1726 (1993).
Decontamination of Sampling Equipment	Quantum Clean Laboratory Detergent (R213) was used to decontaminate reusable sampling equipment.
Laboratory Soil Sample Collection	In accordance with AS4482.2. All samples were collected using disposable nitrile gloves. Samples were selected for laboratory analysis: • at least every metre; • select samples were collected from representative horizons and submitted for analysis. A minimum number of samples were carefully selected which would provide sufficient information to delineate hydrocarbon contamination in soils.
Sample preservation	Samples were placed into a jar for laboratory analysis. Soil jars were placed in a pre-chilled cool box with ice bricks.
Sample holding times	Sample holding times were within acceptable range (based on NEPM B3-2013) from collection to extraction.

6.2.3 Soil Analysis

Primary and QC samples were submitted to Analytical Laboratory Services (ALS) Springvale Avenue in Melbourne for analysis. Of the 17 primary samples collected, 17 were selected for analysis. Chain of Custody (COC) documentation was completed and is provided in Appendix 5. Table 4 presents a summary of the laboratory analyses undertaken.

Table 4 Overview of Soil Analysis and Quality Control

Analytes	Primary Soil Samples	Duplicates[a]	Rinse Blank[b]	Trip Blank[c]
TPH/TRH	17	1	1	-
BTEX	17	1	1	-
PAH*	17	1	1	-

Sampling Quality Control Standards (AS4482):
a – One (1) in twenty (20) duplicate samples
b - Single rinse sample per piece of equipment per day

Given that a full 15 metal suite was analysed, there was requirement to assess the following soil physical properties to determine soil threshold investigation levels:

- Soil grain class (sand/silt or clay)
- % Clay content;
- Cation exchange capacity; and
- Soil pH

The soil physical properties were assessed through site assessment and chemical properties were based on knowledge of similar soil types encountered around Hobart.

6.3 Soil Vapor Investigation

The objective of the soil vapour assessment was to confirm if there is a risk to future site users. Waterloo Membrane Samplers(WMS) were used to semi quantitatively assess vapour intrusion risk.

A total of four (4) 65 mm diameter soil bores were drilled and adopted for the installation of the WMS to assessing soil vapour conditions. Vapour sampling probes were installed in each hole VP1-VP4, plus a

duplicate in adjacent to VP4 hole. The passive sampler ID numbers and deployment locations are also summarised in Table 5 and presented in Figure 6.

Table 5 Summary of Passive VOC Sampler ID Numbers, Deployment Locations

Soil Bores for WMS	Corresponding Borehole	Installation depth (m)	Details
VP1	BH20	1.1	Southwestern laneway that enters Elizabeth Street, which will be the location of the proposed Café.
VP2	BH21	1.1	Southern corner of the apartment complex, located in the *'stores'* areas of the ground floor.
VP3	BH13	0.55	Eastern corner of the apartment complex, located in the driveway of the ground floor carpark between parking spaces 41, 35 and 57.
VP4	BH16	3.4	Northern end of the Apartment complex, site for the ground floor Gym, soil vapour duplicate placed here

WMS were installed as per the deployment methods outlined in the Waterloo Membrane Sampler – Installation Methodology (SGS, 2017) guide. Standard procedures for passive sampler deployment, collection and dispatch are detailed in Table 6.

Table 6 Summary of Ambient Passive VOC Sampling Procedures using the Waterloo Membrane Sampler

Activity	Procedure Details
Ambient Probe Deployment	For each sampling location, the following sampling method for deployment was as follows: • Each hole was hand augered and/ or drilled to the required depth, maximum 1.2m bgs. • WMS in a wire casing was lowered into hole with a fishing line • The foam plug inside the ridged plastic sleeve was installed in the borehole with the assistance of a PVC pipe. • PVC pipe was then removed • The borehole was covered with a aluminum foil to protect from precipitation entering the how.
Sampling Duration	To achieve to achieve the desired LOR's and the full sampling requirement for F2 (C^9 to C^{16}) the samples were in situ for three days, 11th to 14th December 2017. The following was undertaken in collecting the samples after the appropriate sample exposure time as lapsed: • A note is taken of the date and time of the end of exposure. • The reverse to the installation was conducted, the cartridge was removed from the borehole and placed into the glass tube that it was deployed from.
Field Observations	Passive vapour sampling field observations included the following information: • Location, Time & Date, Relative humidity and Ambient temperature.
Field Quality Control Sampling	Sample QC are based on AS5667.1 and AS5667.11 QC procedures. The following quality control measures are put in place: • A single duplicate sample was collected simultaneously with the primary sample.
Sample preservation	The primary and QC samplers were removed from their deployment locations, sealed in their original glass tube and delivered to the Nata Accredited laboratory for analysis.
Sample holding times	The sample holding times for the WMS is 14 days and 14 days following extraction.
WMS Analysis	The Primary and duplicate samples were submitted to NATA certified laboratory, Specialist Laboratory Services (SGS) for analysis.
Calculations	Standard procedures are available for converting passive sample adsorbed concentrations expressed in ug into ug/m3. Input parameters include average barometric pressure, temperature, sampler sampling rates, laboratory extraction efficiency, minutes sampling duration and analyte molecular weight.

7 QUALITY CONTROL

All Field and laboratory Quality Assurance and Quality Control (QA/QC) details are presented in Appendix 6.

7.1 Field

It is standard to expect up to 10% error in field duplication and up to 10% laboratory error. Therefore, in theory up to 20% error can be assumed on duplicate analysis. Some variation may exist in soil and groundwater because even though all efforts are made to split samples homogeneously, fragments of materials may bias samples in certain elements.

Relative Percentage Differences (RPDs) for the duplicate and triplicate samples where applicable are calculated using the method outlined below.

The acceptance criteria used for the RPDs depend on the levels of contaminants detected and the laboratory's Method Detection Limits. The closer the levels detected are to the MDL the greater the acceptable RPD. RPDs are calculated as follows:

- RPD <50% for low level results (<20 * MDL)
- RPD <30% for medium level results (20-100 * MDL)
- RPD <15% for high level results (>100 * MDL)
- No limit applies at <2 * MDL (Method Detection Limit)

Field QA/QC procedures and compliance are summarised in Table 7

7.1.1 Soil

Table 7 Soil Field QA/QC procedures and Compliance

QA/QC Requirement	Completed	Comments
Appropriate sampling strategy used and representative samples collected	Yes	Sampling program was undertaken in accordance with AS4482.1-2005
Appropriate and well documented sample collection, handling, logging and transportation procedures.	Yes	Appropriate and well documented
Decontamination	Yes	Appropriate decontamination such as cleaning tools before sampling and between sample locations was undertaken
Chain-of-custody documentation completed	Yes	COC were completed in accordance with NEPM Schedule B2, Section 5.4.5 and transported under strict COC procedures. The signed COC documents are included in this report, which includes the condition report on arrival of samples to the Laboratory, cross checking of sample identification and paperwork and preservation method.
Required number of duplicate samples collected (1:20)	Yes	A single duplicate from 10 primary samples
QA/QC samples reported method detection limits within indicated guidelines.	No	Noncompliance for Co, Ni, Pb, PAH – Phenanthrene and the sum of PAHs
Required numbers of field and rinse blank samples collected	No	One rinse blank was collected. As one rinsate is required per day of sampling.
Samples delivered to the laboratory within sample holding times and with correct preservative	Yes	All samples were sent to the laboratory within holding times and correct preservative.

7.1.2 Soil Vapour

Soil vapour field QA/QC procedures and compliance are included in Table 8.

Table 8 Soil Vapour Field QA/QC procedures and Compliance

QA/QC Requirement	Completed	Comments
Appropriate sampling strategy used and representative samples collected	Yes	SGS was consulted in detail on best installation, sampling and WMS collection practices. Standard sampling practices such as wearing nitrile gloves and changing between sampling locations was undertaken.
Appropriate and well documented sample collection, handling, logging and transportation procedures.	Yes	Appropriate and well documented
Chain-of-custody documentation completed	Yes	All samples were transported under strict COC procedures and signed COC documents are included in this report.
Required number of duplicate samples collected (1:20)	Yes	4 Primary samples and 1 duplicate
Acceptable duplicated comparison results	Yes	Both the duplicate and the primary sample were reported below detection limits, and therefore a reasonable comparison could not be made between the duplicate pair.
Samples delivered to the laboratory within sample holding times and with correct preservative	Yes	All samples were sent to the laboratory within holding times and correct preservative.

7.2 Laboratory

7.2.1 Soil

Soil laboratory QA/QC procedures and compliance are summarised in Table 9.

Table 9 Soil Laboratory QA/QC Procedures and Compliance

QA/QC Requirement	Compliance	Comments
All analyses NATA accredited	Yes	ALS Laboratories is NATA Accredited.
Appropriate analytical methods used, in accordance with Schedule B(3) of the NEPM	Yes	
Acceptable laboratory limits of reporting (LORs) adopted.	Yes	
Method Blanks: zero to <Practical Quantitation Limit (PQL)	Yes	There were no method blank value outliners.
Duplicate Samples:<30% to 50% RPD.	Yes	There were no Duplicate outliners.
Control Samples: 70% to 130% recovery for soil; or 80% to 120% recovery for waters;	Yes	There were no Laboratory Control outliners.
Matrix spikes: 70% to 130% recovery for organics or 80%-120% recovery for inorganics	Yes	There were no matrix spike outliners.
	No	Duplicate: Mn
Surrogates: 70% to 130% recovery	Yes	There were no surrogate recovery outliners.
Analysis holding time outliers	Yes	No hold-time outliners exist.
Quality Control Sample Frequency Outliers	No	Water rinsate – laboratory duplicates TRH did not meet QC NEPM 2013 B3 or ALS Standard. Water rinsate – Matrix spikes for TRH did not meet QC NEPM 2013 B3 or ALS Standard.
	No	Soil matrix spikes for soils did not meet QC NEPM 2013 B3 or ALS Standard.

7.2.2 Soil Vapour

Soil vapour laboratory QA/QC procedures and compliance are summarised in Table 10.

Table 10 Soil Vapour Laboratory QA/QC Procedures and Compliance

QA/QC Requirement	Completed	Comments
Appropriately selected NATA Accredited Laboratory	Yes	Parent Company SGS Australia Pty Ltd, has a quality system certified to ISO:9001 and all Laboratories maintain ISO/IEC 17025:2005 accreditation. SGS is an independent testing service.
Appropriate analytical methods used, in accordance with Schedule B(3) of the NEPM	Yes	MA- 5.WL.04 Volatile Organics MA- 5.WL.03 Volatile Organics MA- 30.AIR.04 Total Recoverable Hydrocarbons
Acceptable laboratory limits of reporting (LORs) adopted.	Yes	
Chain of custody – Mandatory	Yes	
Timeframes	Yes	All samples were given sufficient duration in the ground in accordance with CRC CARE Technical Report 23
Method Blanks: zero to <Practical Quantitation Limit (PQL)	Yes	No detect (nd) within the PQL limits
Sufficient sample to preform analysis	Yes	
Analysis holding time	Yes	OK

8 FIELD INVESTIGATION FINDINGS

8.1 Soil Bores

8.1.1 Geological Interpretation

The geology of the site is summarised in Table 11 and soil bore logs are presented in Appendix 7, the PESA and current logs have been included. The majority of the site is paved with approximately 100-200 mm of concrete. Below the concrete is a clayey SAND to silty CLAY that ranges in colours from orange, light brown to brown and sometimes stained grey, it is firm to stiff and generally has high plasticity. Bedrock was not encountered.

Table 11 Stratigraphy at the Site (depths indicate base of horizon)

Investigation Holes	Fill Composition	Fill Base (m)	Natural Soil Composition	Natural Soil Base Top of Rock (m)	Rock Composition	Hole Depth (m)
BH1	Sandy GRAVEL	0.6	Sandy CLAY	1	-	1.0
BH2	Sandy GRAVEL; Clayey SAND & Sandy CLAY	0.6	Sandy CLAY	1	-	1.0
BH3	CONCRETE over Clayey GRAVEL	0.6	Silty CLAY Silty GRAVEL	2.3 2.9	-	2.9
BH4	CONCRETE over Clayey GRAVEL	0.9	Silty CLAY	2.0	-	2.0
BH5	Sandy GRAVEL, Gravelly CLAY	0.6	Silty CLAY Silty Sandy CLAY	2.9	-	2.9
BH6	CONCRETE Clayey SAND Silty Sandy CLAY	0.6	Silty CLAY	1.5	-	3.0
BH7	CONCRETE Clayey SAND Silty Sandy CLAY	0.6	Silty CLAY	3.0	-	3.0
BH8	CONCRETE TO 0.2 SAND some clay	1.7	Silty CLAY	3.0	-	3.0
BH9	CONCRETE TO 0.2 Clayey SAND	0.5	Silty CLAY Silty Sandy CLAY Silty CLAY FILL – SAND some clay Silty CLAY	2.9	-	2.9
BH10	GRAVEL	0.2	Sandy Silty CLAY	1.0	-	1.0
BH11	CONCRETE	0.1	Silty CLAY	0.15	-	0.15
BH12	CONCRETE Clayey GRAVEL	0.3	Sandy SILTY CLAY Silty CLAY	-	-	1.2
BH13	CONCRETE	0.25	-	0.25	Extremely weathered SILTSTONE	0.55
BH14	CONCRETE GRAVEL Sandy CLAY	0.6	Sandy SILTY CLAY Silty CLAY	-	-	1.4
BH15	CONCRETE SAND Clayey GRAVEL	-	Refusal at 0.6m bgs	-	-	0.6
BH16	CONCRETE GRAVEL Gravelly CLAY Silty CLAY	0.9	Silty clayey GRAVEL Silty gravelly CLAY Gravelly silty CLAY	-	-	3.4
BH17	Sandy GRAVEL Gravelly clayey SAND	0.5	Silty CLAY	1.1	Extremely weathered SANDSTONE / SILTSTONE	2.6
BH18	CONCRETE	0.2	Silty CLAY Sandy Silty CLAY Silty gravelly CLAY Silty CLAY	-	-	1.9
BH19	CONCRETE GRAVEL	0.3	Silty CLAY	-	-	1.9
BH20	CONCRETE Clayey GRAVEL	0.6	Silty CLAY	-	-	1.1
BH21	Sandy GRAVEL GRAVEL	0.6	Mixed clayey SAND & Sandy CLAY	-	-	1.1

8.1.2 Soil Grain Class Interpretation

Grain size classifications are applied to all soils at the site to determine threshold screening level concentrations for hydrocarbons (and chromium) to assess soil ecological and human health risks.

Grain class threshold values are determined based on either the:

- sample grain size (in the case of ecological screening levels or chromium limits); or
- average grain class overlying the sample point (when assessing petroleum vapour screening levels).

When assessing petroleum vapour intrusion health screening levels (HSL's), where soil is proposed to be excavated from the site, the excavated material is excluded from the grain class averaging. The corresponding depth class from which the sample is collected is also shallowed based on the renewed basement depth.

Table 12 provides a summary of the grain class averages for material overlying the sample (excluding the excavated materials). Where the fields are left blank, a class is not assigned given the sample was collected from within the proposed excavation. Pavement is assigned a clay class by default.

Table 12 Summary of Soil Grain Class Averaging Based on USCS Classification

Sample	Excavation (m)	Soil Grain Class Averaging Above Soil Sample															Rock (R)	Pavement (P)	New SLAB	Petroleum Vapour Intrusion HSL Grain Class*	SAMPLE USCS
		GW	GP	GM	GC	SW	SP	SM	SC	ML	CL	OL	MH	CH	OH	CI					
BH1 0.10m	0.0																		0.1	CLAY	GW
BH1 0.9m	0.0	0.3									0.5								0.1	CLAY	CL
BH2 0.1m	0.0																		0.1	CLAY	GW
BH2 0.9m	0.0	0.3									0.5								0.1	CLAY	CL
BH3 0.5m	0.0				0.2													0.2	0.1	CLAY	GC
BH3 2.3m	0.0				0.4									1.6				0.2	0.1	CLAY	CH
BH4 0.5m	0.0				0.3													0.2	0.1	CLAY	GC
BH4 1.0m	0.0				0.8													0.2	0.1	SAND	CH
BH5 0.1m	0.1																		0.1	CLAY	GW
BH5 3.0m	0.1	0.1									0.8			1.9					0.1	CLAY	CL
BH6 0.2m	1.5																		0.1	CLAY	SC
BH6 2.0m	1.5													0.4					0.1	CLAY	CH
BH6 3.0m	1.5													1.4					0.1	CLAY	CH
BH7 0.2m	1.6																		0.1	CLAY	SC
BH7 1.0m	1.6																		0.1	CLAY	CH
BH7 3.0m	1.6													1.3					0.1	CLAY	CH
BH8 1.0m	1.8																		0.1	CLAY	SC
BH8 0.5m	1.8																		0.1	CLAY	SC
BH9 0.2m	1.8																		0.1	CLAY	P
BH9 3.0m	1.8								0.3		0.3			0.5					0.1	CLAY	CH
BH10 0.1m	2.7																		0.1	CLAY	GW
BH10 1.0m	2.7																		0.1	CLAY	CL
BH11 0.1m	1.1																		0.1	CLAY	P
DUP	0.0								0.2		0.3			2.3				0.2	0.1	CLAY	CH
BH12 0.5m	0.9																		0.1	CLAY	CI
BH12 1.0m	0.9																		0.1	CLAY	CH
BH13 0.4-0.5m	0.5																		0.1	CLAY	ML
BH14 0.3-0.4m	0.4																		0.1	CLAY	CI
BH14 1.0-1.1m	0.4													0.1		0.5			0.1	CLAY	CH
BH15 0.5-0.6m	0.0				0.3	0.1												0.2	0.1	CLAY	GC
BH16 1.0-1.1m	2.2																		0.1	CLAY	GC
BH16 2.0-2.1m	2.2																		0.1	CLAY	CL
BH16 2.9-3.0m	2.2				1.0						0.2								0.1	SAND	CL
BH17 0.5-0.6m	2.7																		0.1	CLAY	CH
BH17 1.9-2.0m	2.7																		0.1	CLAY	R
BH18 0.2-0.3m	1.0																		0.1	CLAY	CH
BH18 0.9-1.0m	1.0																		0.1	CLAY	CH
BH19 0.2-0.3m	1.3																		0.1	CLAY	GW
BH19 0.9-1.0m	1.3																		0.1	CLAY	CH
BH20 0.5m	0.0				0.2													0.2	0.1	CLAY	GC
BH21 0.5m	0.0	0.3									0.1								0.1	SAND	CL
BH10 0.1m	0.0																		0.1	CLAY	GW
BH10 1.0m	0.0	0.2									0.7								0.1	CLAY	CL
BH16 1.0-1.1m	0.0	0.2			0.1									0.8		0.4		0.4	0.1	CLAY	GC
BH16 2.0-2.1m	0.0	0.2			0.7						0.4			0.8		0.4		0.4	0.1	CLAY	CL
BH16 2.9-3.0m	0.0	0.2			1.9						0.7			0.8		0.4		0.4	0.1	CLAY	CL
BH17 0.5-0.6m	0.0	0.4							0.6										0.1	SAND	CH
BH17 1.9-2.0m	0.0	0.4							0.6					0.6			0.8		0.1	CLAY	R

* Grain class may be modified if overlying slab is present. Concrete is interpreted to have similar vapour intrusion properties to clay and is therefore designated as CLAY within the averaging assessment.

8.2 Passive Soil Vapour Assessment

8.2.1 Soil Grain Class Interpretation

When assessing petroleum vapour intrusion health screening levels (HSL's), where soil is proposed to be excavated from the site, the excavated material is excluded from the grain class averaging. The corresponding depth class from which the sample is collected is also shallowed based on the renewed basement depth.

Table 13 provides a summary of the grain class averages for material overlying the sample (excluding the excavated materials). Where the fields are left blank, a class is not assigned given the sample was collected from within the proposed excavation. Pavement is assigned a clay class by default.

Table 13 Summary of Soil Grain Class Averaging Based on USCS Classification

Sample	Excavation (m)	Soil Grain Class Averaging Above Vapour Point																	Petroleum Vapour Intrusion HSL Grain Class*
		GW	GP	GM	GC	SW	SP	SM	SC	ML	CL	OL	MH	CH	OH	CI	Rock (R)	Pavement (P)	New SLAB	
VP1	0.0				0.4									0.4				0.2	0.1	CLAY
VP2	0.0	0.3									0.3					0.4			0.1	CLAY
VP3	0.4									0.1									0.1	CLAY
VP4	2.3				0.8						0.7								0.1	SAND
VP4	0.0	0.2			1.9						1.2			0.8		0.4		0.4	0.1	CLAY
Dup	2.3				0.8						0.7								0.1	SAND

* Grain class may be modified if overlying slab is present. Concrete is interpreted to have similar vapour intrusion properties to clay and is therefore designated as CLAY within the averaging assessment.

9 SOIL ECOLOGICAL IMPACT ASSESSMENT

9.1 Protected Environmental Values

The requirement for protecting soil from contaminated activities in Tasmania is managed under the Environmental Management and Pollution Control Act 1994 (EMPCA) which states in Part 5A:

(2) An area of land is a contaminated site if –

(a) there is in, on or under that area of land a pollutant in a concentration that –

(i) is above the background concentration; and

(ii) is causing or is likely to be causing serious or material environmental harm or environmental nuisance, or is likely to cause serious or material environmental harm or environmental nuisance in the future if not appropriately managed;

Potential soil impact at the site is assessed through application of the following environmental investigation guidelines.

9.2 NEPM (2013) Guidelines

The following ecological investigation guidelines are to be addressed in order to assess acceptable levels of risk to terrestrial ecosystems:

- NEPM (2013) Ecological Investigation Levels (EIL's) – have been developed for selected metal and organic substances. EIL's depend on specific soil and physicochemical properties and land use scenarios and generally apply to the top two (2) metres of the soil profile (NEPM 2013);
- NEPM (2013) Ecological Screening Levels (ESL's) – have been developed for selected petroleum hydrocarbon compounds and total petroleum hydrocarbon fractions. ESL's broadly apply to coarse

and fine grained soils and various land use scenarios within the top two (2) metres of the soil profile (NEPM 2013).

Soil analytical results are compared against Ecological Screening Levels (ESL's) and Ecological Investigation Levels (EIL's) limits presented in Table 14.

Table 14 Summary of Soil Investigation Limits Considered at the Site based in NEPM (2013) ASC

Investigation Levels (IL)	Analytes Investigated						
	Hydrocarbons				Metals		DDT
	BTEX	TRH (F1 to F4)	Benzo(a) pyrene (PAH)	Naphthalene (PAH)	Zn, Cu, Cr(III), Ni & As	Lead	
ESL's	Analysed	Analysed	Analysed				
EIL's				Analysed	Analysed	Analysed	Not Analysed

9.3 Guidelines

9.3.1 Ecological Screening Levels

The following compounds were compared against NEPM (2013) Ecological Screening Levels (ESL's):

- BTEX;
- F1 to F4 TRH; and
- Benzo(a)pyrene

Selection of ESL threshold investigation limits are set out in the NEPM (2013) guidelines and require classification of the soil according to:

- Land use sensitivity:
    - Areas of ecological significance
    - Urban residential and public open space; and
    - Commercial and industrial.
- Dominant particle size passing through a 2 mm sieve into:
    - Coarse – sand sizes and greater; and
    - Fine – clay and silt sizes.

Adopted NEPM (2013) soil and land use classifications are presented below.

9.3.2 Ecological Investigation Levels

There was a requirement to classify the soil according to physicochemical properties given that the above listed compounds. Adopted physicochemical parameters are presented in the results tables.

Selection of EIL threshold investigation limits are set out in the NEPM (2013) guidelines and require classification of the soil per specific soil and physicochemical properties which are presented in the results tables. The adopted land use scenarios presented in Table 15.

Table 15 Adopted Land Use Scenario For the Various Soil Bores

Land Use Scenario	Applicable Soil Bores
Areas of Ecological Significance	
Urban Residential & Public Open Space	All soil bores
Commercial & Industrial	

9.4 Findings

9.4.1 Ecological Screening Levels

Laboratory analytical results are presented in Appendix 5. Table 16compares soil analytical results for residual samples (non-excavated soil which is to remain at the site) against relevant NEPM ESL's. Concentrations which exceeded laboratory levels of reporting (LOR) are highlighted in bold, ESL exceedances are highlighted with a colored cell, and samples within the proposed excavation zone are marked with an X.

Of the 40 samples analysised, 12 had detections above the laboratory LOR and of these, 11 samples had exceedences above the ESL B guidelines for Urban residential and public opens space for Benzo(a)pyrene (B(a)p), TRH $C^6 – C^{10}$, $C^{10} – C^{16}$, and/ or $C^{16} – C^{34}$. All samples with exceedances were collected from shallow locations ranging from 0.1-0.2 m bgs, 0.3-0.4m bgs and 0.4-0.5m bgs.

8 out of the 11 exceedances are within the proposed excavation zone.

9.4.2 Ecological Investigation Levels

Laboratory analytical results are presented in Appendix 5. Table 17 compares soil analytical results for residual samples (non-excavated soil which is to remain at the site) against relevant ecological investigation limits (EIL's). Concentrations which exceeded laboratory LOR are highlighted indicated in bold, EIL exceedances are highlighted with a colored cell, and samples within the proposed excavation zone are marked with an X.

Of the 40 samples analysised, 15 samples had exceedances above the NEPM (2013) EIL threshold investigation limits for copper, nickel, zinc and lead for Urban residential and public opens space. All samples with exceedances were collected from shallow locations ranging from 0.1-0.2 m bgs, 0.3-0.4m bgs, 0.4-0.5m bgs and 1.0-1.1m bgs.

10 out of the 17 exceedances are within the proposed excavation zone.

Table 16 Summary of Soil Analytical Results Compared with ESL's

NEPM Ecological Screening Levels for Soil				BTEX				PAH	TRH			
Bold - Indicates LOR Exceedances X - Indicates Sample Within Proposed Excavation Zone Colour Shading - Indicates ESL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x				Benzene	Toluene	Ethylbenzene	Xylenes	Benzo(a)pyrene	F1 (C6 - C10)	F2 (>C10 - C16)	F3 (>C16 - C34)	F4 (>C34 - C40)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Sample ID	Sample Date	Soil Texture Class	Land Use	LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 0.5	LOR 10	LOR 50	LOR 100	LOR 100
BH1 0.10m	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	**0.8**	<10	<50	**250**	<100
BH1 0.9m	17/6/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH2 0.1m	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**100**	<100
BH2 0.9m	17/6/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH3 0.5m	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH3 2.3m	17/6/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH4 0.5m	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	**2.2***	**256**	**1780****	**6380*****	**2200**
BH4 1.0m	17/6/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH5 0.1m X	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	**3.6****	<10	**50**	**640***	**240**
BH5 3.0m	17/6/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH6 0.2m X	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	**3.5***	<10	<50	**460**	<100
BH6 2.0m	17/6/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH6 3.0m	17/6/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH7 0.2m X	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	**3.8****	<10	<50	**280**	<100
BH7 1.0m X	17/6/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH7 3.0m	17/6/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH8 1.0m X	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH8 0.5m X	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH9 0.2m X	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	**2.3***	<10	<50	**140**	<100
BH9 3.0m	17/6/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH10 0.1m X	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	**1**	<10	<50	<100	<100
BH10 1.0m X	17/6/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH11 0.1m X	17/6/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**360**	<100
BH12 0.5m X	12/12/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH12 1.0m	12/12/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH13 0.4-0.5m X	12/12/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH14 0.3-0.4m X	12/12/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	**5.2****	<10	<50	**370**	**110**
BH14 1.0-1.1m	12/12/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH15 0.5-0.6m	12/12/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH16 1.0-1.1m X	12/12/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH16 2.0-2.1m X	12/12/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH16 2.9-3.0m	12/12/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH17 0.5-0.6m X	12/12/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH17 1.9-2.0m X	12/12/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH18 0.2-0.3m X	12/12/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH18 0.9-1.0m X	12/12/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH19 0.2-0.3m X	12/12/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	**3.6****	<10	<50	**530**	**160**
BH19 0.9-1.0m X	12/12/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH20 0.5m	12/12/17	COARSE	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH21 0.5m	12/12/17	FINE	URBAN	<0.2	<0.5	<0.5	<0.5	**2.8***	<10	<50	**140**	<100

Table 17 Soil Analytical Results Compared Against Ecological Investigation Levels

NEPM Ecological Investigation Levels for Soil													
Bold - Indicates LOR Exceedances X - Indicates Sample Within Proposed Excavation Zone													
Colour Shading - Indicates ESL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x													
Sample ID	Sample Date	EIL Land Use Sensitivity Class	Soil CEC (cmolc/kg)	Soil pH	Soil Grain Class	Copper (CEC) mg/kg	Copper (pH) mg/kg	Nickel mg/kg	Zinc mg/kg	Chromium III mg/kg	Lead mg/kg	Arsenic mg/kg	Naphthalene mg/kg
BH1 0.10m	17/06/2017	URBAN	10	4.5 (3)	COARSE	172	172	28	390	30	362	<5	<1
BH1 0.9m	17/06/2017	URBAN	35	4.5 (3)	FINE	16	16	6	17	7	26	<5	<1
BH2 0.1m	17/06/2017	URBAN	10	4.5 (3)	COARSE	53	53	22	329	23	364	<5	<1
BH2 0.9m	17/06/2017	URBAN	35	4.5 (3)	FINE	20	20	6	26	5	359	<5	<1
BH3 0.5m	17/06/2017	URBAN	20	4.5 (3)	COARSE	83	83	9	36	4	9	<5	<1
BH3 2.3m	17/06/2017	URBAN	45	4.5 (3)	FINE	16	16	20	65	8	11	<5	<1
BH4 0.5m	17/06/2017	URBAN	20	4.5 (3)	COARSE	116	116	16	473	10	4570	17	7
BH4 1.0m	17/06/2017	URBAN	45	4.5 (3)	FINE	17	17	8	25	13	16	<5	<1
BH5 0.1m X	17/06/2017	URBAN	10	4.5 (3)	COARSE	69	69	18	184	16	208	<5	<1
BH5 3.0m	17/06/2017	URBAN	35	4.5 (3)	FINE	8	8	6	24	23	13	18	<1
BH6 0.2m X	17/06/2017	URBAN	20	4.5 (3)	COARSE	122	122	20	941	20	1430	8	<1
BH6 2.0m	17/06/2017	URBAN	45	4.5 (3)	FINE	8	8	11	23	13	11	6	<1
BH6 3.0m	17/06/2017	URBAN	45	4.5 (3)	FINE	8	8	4	33	10	12	16	<1
BH7 0.2m X	17/06/2017	URBAN	20	4.5 (3)	COARSE	101	101	18	614	16	1140	8	<1
BH7 1.0m X	17/06/2017	URBAN	45	4.5 (3)	FINE	28	28	50	47	15	16	<5	<1
BH7 3.0m	17/06/2017	URBAN	45	4.5 (3)	FINE	<5	<5	3	13	6	5	<5	<1
BH8 1.0m X	17/06/2017	URBAN	20	4.5 (3)	COARSE	<5	<5	7	18	14	<5	<5	<1
BH8 0.5m X	17/06/2017	URBAN	20	4.5 (3)	COARSE	<5	<5	3	28	13	<5	<5	<1
BH9 0.2m X	17/06/2017	URBAN	0	4.5 (3)	COARSE	76	76	16	588	17	852	10	<1
BH9 3.0m	17/06/2017	URBAN	45	4.5 (3)	FINE	5	5	3	13	8	<5	<5	<1
BH10 0.1m X	17/06/2017	URBAN	10	4.5 (3)	COARSE	90	90	11	99	5	60	<5	<1
BH10 1.0m X	17/06/2017	URBAN	35	4.5 (3)	FINE	19	19	28	23	11	9	6	<1
BH11 0.1m X	17/06/2017	URBAN	0	4.5 (3)	COARSE	27	27	30	79	11	17	7	<1
BH12 0.5m X	12/12/2017	URBAN	35	6 (3)	FINE	32	32	14	28	18	10	5	<1
BH12 1.0m	12/12/2017	URBAN	45	4.5 (3)	FINE	39	39	72	45	16	11	8	<1
BH13 0.4-0.5m X	12/12/2017	URBAN	20	4.5 (3)	COARSE	16	16	13	53	7	<5	<5	<1
BH14 0.3-0.4m X	12/12/2017	URBAN	35	6 (3)	FINE	80	80	22	728	20	314	35	<1
BH14 1.0-1.1m	12/12/2017	URBAN	45	4.5 (3)	FINE	17	17	13	14	14	11	<5	<1
BH15 0.5-0.6m	12/12/2017	URBAN	20	4.5 (3)	COARSE	57	57	15	34	11	<5	<5	<1
BH16 1.0-1.1m X	12/12/2017	URBAN	20	4.5 (3)	COARSE	67	67	100	13	<4	<5	<5	<1
BH16 2.0-2.1m X	12/12/2017	URBAN	35	4.5 (3)	FINE	46	46	18	48	4	8	9	<1
BH16 2.9-3.0m	12/12/2017	URBAN	35	4.5 (3)	FINE	<5	<5	3	13	6	<5	<5	<1
BH17 0.5-0.6m X	12/12/2017	URBAN	45	4.5 (3)	FINE	24	24	16	32	17	12	<5	<1
BH17 1.9-2.0m X	12/12/2017	URBAN	10	4.5 (3)	COARSE	32	32	38	75	16	6	<5	<1
BH18 0.2-0.3m X	12/12/2017	URBAN	45	4.5 (3)	FINE	72	72	14	104	10	144	<5	<1
BH18 0.9-1.0m X	12/12/2017	URBAN	45	4.5 (3)	FINE	15	15	29	30	13	<5	<5	<1
BH19 0.2-0.3m X	12/12/2017	URBAN	10	4.5 (3)	COARSE	44	44	12	227	21	341	<5	<1
BH19 0.9-1.0m X	12/12/2017	URBAN	45	4.5 (3)	FINE	13	13	19	17	11	14	<5	<1
BH20 0.5m	12/12/2017	URBAN	20	4.5 (3)	COARSE	10	10	4	12	12	9	<5	<1
BH21 0.5m	12/12/2017	URBAN	35	4.5 (3)	FINE	49	49	15	157	12	238	6	<1
BH10 0.1m	17/06/2017	URBAN	10	4.5 (3)	COARSE	90	90	11	99	5	60	<5	<1
BH10 1.0m	17/06/2017	URBAN	35	4.5 (3)	FINE	19	19	28	23	11	9	6	<1
BH16 1.0-1.1m	12/12/2017	URBAN	20	4.5 (3)	COARSE	67	67	100	13	<4	<5	<5	<1
BH16 2.0-2.1m	12/12/2017	URBAN	35	4.5 (3)	FINE	46	46	18	48	4	8	9	<1
BH16 2.9-3.0m	12/12/2017	URBAN	35	4.5 (3)	FINE	<5	<5	3	13	6	<5	<5	<1
BH17 0.5-0.6m	12/12/2017	URBAN	45	4.5 (3)	FINE	24	24	16	32	17	12	<5	<1
BH17 1.9-2.0m	12/12/2017	URBAN	10	4.5 (3)	COARSE	32	32	38	75	16	6	<5	<1

10 SOIL HUMAN HEALTH DIRECT CONTACT ASSESSMENT

10.1 Guidelines

Guidelines presented herein are based on potential exposure of human receptors to soil impact which may include:

- Trench workers repairing or building services, typically to 1 m below ground surface (BGS). This classification is not dependent on the land use class.
- Onsite inhabitants which may be exposed to potential shallow soil impact in non-paved areas of the site; and
- Onsite excavation works which may include potential swimming pools (up to 3 m BGS); basement carparks; and deep foundations.

10.1.1 Land Use Classification

The NEPM (2013) guidelines have been referenced to ensure that the correct land use and density category has been adopted for the site and the surrounding properties (where applicable). As per NEPM 2013 guidelines, the adopted land use class is dependent on the building density and the opportunity for soil access by site occupants (exposure to potentially impacted soil). Aspects needing to be considered include:

- Whether the site is of sensitive land use such as a childcare center, preschool, primary school or aged care facility in which case land use Class A is applicable;
- The percentage of paved area to determine direct contact exposure risk and therefore classification as low or high density; and
- Classification based on residential, recreational or commercial/industrial setting.

10.1.2 Adopted Land Use Classification

The adopted land use class is presented in Table 18. Land use class is based on the opportunity for soil access as per NEPM 2013 guidelines.

A land use class D has been applied to all soil samples which is consistent with site commercial worker exposure to impacted soil and future trenching works after the development has been established.

Although soil exposure is unlikely a conservative approach has been applied to results where ground floor apartments are proposed: land use class B has been applied to the entire site.

Table 18 Summary of Land Use Setting and Density for Determining Exposure Risk

Location	Land Use Class	Land Use Density	Paved Area	Sensitive Land Use
Al soil bores	D	high	Presumed 100%	No
All soil bores	B	high	Presumed 100%	No

Table 19 summarises the areas of the site in which the soil analytical results are expected to be relevant as well as the applicable land use class for defining the threshold limits.

Table 19 Summary of Land Use Class Adopted for Defining Soil Analysis Threshold Limits

Soil Bores	Relevant Scenario	Adopted Land Use Class
All soil bores	Site development works and future trenching works	D
All soil bores	Future site users	B

10.1.3 Health Investigation & Screening Levels

The main exposure pathways and methods for assessing short term heath risk from contaminated soils are presented in Table 20. Vapour inhalation risk is addressed in Section 12 of this report.

Table 20 Summary of Exposure Pathways and Preliminary (Tier 1) Methods for Assessing Human Exposure Risk

Exposure Scenario	Contaminant Type	Tier 1 Assessment Method	Reference
Vapour Inhalation – Indoor (PVI)	Petroleum Hydrocarbons	HSLs (addressed in PVI sections)	NEPM (2013)
Vapour Inhalation – Trench (PVI)			CRC CARE (Friebel & Nadebaum, 2011)
Dermal Contact		HSLs	
Dust Inhalation	Metals PAHs Organochlorides Phenols Herbicides Other Pesticides	Health Investigation Levels (HILs)	NEPM (2013)
Soil Ingestion			

PVI – Petroleum Vapour Intrusion

10.2 Findings

10.2.1 Dermal Contact - Petroleum Hydrocarbons

Laboratory analytical results are presented in Appendix 5. Table 21 presents soil hydrocarbon analytical results compared against CRC CARE (Friebel & Nadebaum, 2011) HSL guidelines for assessing dermal contact risk. Concentrations which exceeded laboratory LOR are highlighted in bold, and HSL exceedances are highlighted with a colored cell indicating the highest HSL land used class which is exceeded.

Of the 40 samples analysed 11 had detections above the laboratory LOR and was one exceedance of HSL B guidelines for High Density Residential in BH4 0.5 of TPH $C^{16} – C^{34}$. BH4 is located near the historical interceptor trap.

Table 21 Soil Analytical Results Compared Against CRC CARE (Friebel & Nadebaum, 2011) Guidelines for Dermal Contact

CRC CARE Health Screening Level Dermal Contact Hazard from Soil Hydrocarbons'		EP080: BTEXN					EP080/071: TRH			
		Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		0.2	0.5	0.5	0.5	1	10	50	100	100
HSL A Low Density Residential		100	14000	4500	12000	1400	4400	3300	4500	6300
HSL B High Density Residential		140	21000	5900	17000	2200	5600	4200	5800	8100
HSL C Recreational		120	18000	5300	15000	1900	5100	3800	5300	7400
HSL D Commercial/Industrial		430	99000	27000	81000	11000	26000	20000	27000	38000
Intrusive Maintenance Worker		1100	120000	85000	130000	29000	82000	62000	85000	120000
Date	Sample									
17/06/2017	BH1 0.10m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**250**	<100
17/06/2017	BH1 0.9m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH2 0.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**100**	<100
17/06/2017	BH2 0.9m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH3 0.5m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH3 2.3m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH4 0.5m	<0.2	<0.5	<0.5	<0.5	**7**	**256**	**1790**	**6380**	**2200**
17/06/2017	BH4 1.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH5 0.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	**50**	**640**	**240**
17/06/2017	BH5 3.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH6 0.2m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**460**	<100
17/06/2017	BH6 2.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH6 3.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH7 0.2m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**280**	<100
17/06/2017	BH7 1.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH7 3.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH8 1.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH8 0.5m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH9 0.2m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**140**	<100
17/06/2017	BH9 3.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH10 0.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH10 1.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/06/2017	BH11 0.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**360**	<100
12/12/2017	BH12 0.5m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH12 1.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH13 0.4-0.5m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH14 0.3-0.4m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**370**	**110**
12/12/2017	BH14 1.0-1.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH15 0.5-0.6m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH16 1.0-1.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH16 2.0-2.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH16 2.9-3.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH17 0.5-0.6m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH17 1.9-2.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH18 0.2-0.3m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH18 0.9-1.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH19 0.2-0.3m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**530**	**160**
12/12/2017	BH19 0.9-1.0m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH20 0.5m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
12/12/2017	BH21 0.5m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**140**	<100

10.2.2 Dust Inhalation & Soil Ingestion

Combined dust inhalation and soil ingestion risk is assessed through the application of NEPM (2013) HIL's for exposure to soil contaminants. Laboratory analytical results are presented in Appendix 5. Soil analytical results are compared against the HIL's presented in Table 22. PAH concentrations which exceeded laboratory LOR are highlighted in bold, and for all results the HIL exceedances are highlighted with a colored cell indicating the highest HIL land used class which is exceeded, and samples within the proposed excavation zone are marked with an X.

All samples exceeding HIL B guideline limits are within the proposed excavation areas with the exception for the following:

- There was a single HIL D exceedance of Lead based on guidelines for *commercial land use*. At BH4 this sample was collected from 0.5m bgs. This sample is located next to the interceptor trap area.

Table 22 Soil Analytical Results Compared Against NEPM (2013) Health Investigation Limit Guidelines

Bold - Indicates LOR Exceedance in Non Metalic Compounds		EA055: Moisture Content	EG005T: Total Metals by ICP-AES													T: Total Recov	EP075(SIM)B: Polynuclear Aromatic Hydrocarbons																	
NEPM Health Investigation Levels (HIL's) **Dust Inhalation and Soil Ingestion Assessment** X - Indicates Sample Within Proposed Excavation Zone		Moisture Content (dried @ 103°C)	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Mercury	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	PAHs	Benzo(a)pyrene TEQ (WHO)
Units		%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		1	5	10	1	50	1	2	2	5	5	5	2	5	5	5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
HIL A Low Density Residential			100		60	4500	20		100	6000	300	3800	400	200		7400	40																	300	3
HIL B High Density Residential			500		90	40000	150		600	30000	1200	14000	1200	1400		60000	120																	400	4
HIL C Recreational			300		90	20000	90		300	17000	600	19000	1200	700		30000	80																	300	3
HIL D Comercial/Industrial			3000		500	3E+05	900		4000	2E+05	1500	60000	6000	10000		4E+05	730																	4000	40
Sample date:	Sample ID																																		
17/06/2017	BH1 0.10m	12.2	<5	80	<1	<50	18	30	13	172	362	275	28	<5	41	390	0.6	<0.5	<0.5	<0.5	<0.5	**0.6**	<0.5	**1.4**	**1.4**	**0.8**	**0.7**	**0.9**	<0.5	**0.8**	<0.5	<0.5	**0.5**	**7.1**	**1**
17/06/2017	BH1 0.9m	25	<5	50	<1	<50	<1	7	4	16	26	148	6	<5	33	17	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH2 0.1m	15.1	<5	140	<1	<50	<1	23	6	53	364	176	22	<5	29	329	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH2 0.9m	23.4	<5	80	<1	<50	<1	5	6	20	359	256	6	<5	23	26	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH3 0.5m	14.2	<5	40	<1	<50	<1	4	21	83	9	262	9	<5	67	36	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH3 2.3m	16.5	<5	170	1	<50	<1	8	19	16	11	125	20	<5	29	65	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH4 0.5m	33.7	17	400	1	<50	<1	10	13	116	4570	512	16	<5	28	473	1	**4.9**	<0.5	<0.5	<0.5	**1.1**	<0.5	**2.2**	**2.6**	**1.7**	**1.5**	**2.3**	**0.9**	**2.2**	**1.3**	<0.5	**1.6**	**22.3**	**2.8**
17/06/2017	BH4 1.0m	26.6	<5	120	1	<50	<1	13	6	17	16	80	8	<5	51	25	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH5 0.1m X x	13.1	<5	80	<1	<50	1	16	8	69	208	217	18	<5	30	184	0.5	<0.5	<0.5	<0.5	<0.5	**5.2**	**1.3**	**9.2**	**8.7**	**3.3**	**2.9**	**3.8**	**1.4**	**3.6**	**2.1**	<0.5	**2.7**	**44.2**	**4.7**
17/06/2017	BH5 3.0m	19.3	18	10	<1	<50	<1	23	4	8	13	554	6	<5	54	24	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH6 0.2m X x	34.6	8	900	<1	<50	2	20	11	122	1430	248	20	<5	28	941	1.5	<0.5	**0.7**	<0.5	<0.5	**1.7**	**0.7**	**5.2**	**5.5**	**3.2**	**3.0**	**4.0**	**1.4**	**3.5**	**2.0**	<0.5	**2.4**	**33.3**	**4.6**
17/06/2017	BH6 2.0m	21.8	6	30	<1	<50	<1	13	8	8	11	1680	11	<5	31	23	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH6 3.0m	21.8	16	<10	<1	<50	<1	10	<2	8	12	70	4	<5	48	33	0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH7 0.2m X x	31.4	8	820	<1	<50	1	16	10	101	1140	213	18	<5	31	614	2.1	<0.5	**0.7**	<0.5	<0.5	**2.4**	**0.9**	**6.0**	**6.3**	**3.7**	**3.4**	**4.1**	**1.6**	**3.8**	**2.0**	**0.5**	**2.4**	**37.8**	**5.5**
17/06/2017	BH7 1.0m X x	26.7	<5	1090	5	<50	<1	15	67	28	16	198	50	<5	40	47	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH7 3.0m	22.8	<5	10	<1	<50	<1	6	3	<5	5	121	3	<5	24	13	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH8 1.0m X x	17.9	<5	20	<1	<50	<1	14	3	<5	<5	37	7	<5	50	18	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH8 0.5m X x	12.8	<5	10	<1	<50	<1	13	2	<5	<5	51	3	<5	42	28	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH9 0.2m X x	24.2	10	500	1	<50	<1	17	17	76	852	366	16	<5	43	588	1.6	<0.5	<0.5	<0.5	<0.5	**1.8**	**0.7**	**4.1**	**4.2**	**2.3**	**2.1**	**2.5**	**1.1**	**2.3**	**1.2**	<0.5	**1.4**	**23.7**	**3**
17/06/2017	BH9 3.0m	26.4	<5	30	<1	<50	<1	8	4	5	<5	55	3	<5	14	13	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH10 0.1m X x	5.5	<5	30	<1	<50	<1	5	15	90	60	279	11	<5	58	99	0.1	<0.5	<0.5	<0.5	<0.5	**0.5**	<0.5	**1.9**	**2.0**	**0.8**	**0.6**	**1.0**	<0.5	**1.0**	**0.7**	<0.5	**1.0**	**9.5**	**1.3**
17/06/2017	BH10 1.0m X x	20.6	6	110	1	<50	<1	11	32	19	9	1490	28	<5	41	23	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/06/2017	BH11 0.1m X x	25.3	7	50	1	<50	<1	11	32	27	17	2260	30	<5	46	79	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH12 0.5m X x	22	5	220	1	<50	<1	18	13	32	10	116	14	<5	85	28	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH12 1.0m	19.5	8	660	4	<50	<1	16	368	39	11	1690	72	<5	65	45	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH13 0.4-0.5m X x	14.3	<5	20	1	<50	<1	7	6	16	<5	268	13	<5	23	53	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH14 0.3-0.4m X x	28.9	35	180	<1	<50	<10	20	12	80	314	825	22	<5	61	728	0.8	<0.5	**0.6**	<0.5	<0.5	**2.5**	**0.8**	**5.1**	**5.9**	**3.3**	**3.1**	**5.4**	**1.8**	**5.2**	**3.1**	**0.9**	**4.4**	**42.1**	**7.5**
12/12/2017	BH14 1.0-1.1m	23.2	<5	480	1	<50	<1	14	14	17	11	54	13	<5	59	14	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH15 0.5-0.6m	6	<5	10	<1	<50	<1	11	13	57	<5	350	15	<5	39	34	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH16 1.0-1.1m X x	18.5	<5	230	<4	<50	<2	<4	33	67	<5	1050	100	<5	69	13	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH16 2.0-2.1m X x	27	9	90	1	<50	<1	4	13	46	8	760	18	<5	66	48	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH16 2.9-3.0m	16.7	<5	<10	<1	<50	<1	6	<2	<5	<5	10	3	<5	10	13	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH17 0.5-0.6m X x	23.2	<5	50	1	<50	<1	17	16	24	12	115	16	<5	70	32	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH17 1.9-2.0m X x	18.1	<5	220	<1	<50	<1	16	45	32	6	2410	38	<5	61	75	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH18 0.2-0.3m X x	22.1	<5	130	1	<50	<1	10	14	72	144	167	14	<5	53	104	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH18 0.9-1.0m X x	17.3	<5	180	<5	<50	<3	13	17	15	<5	1100	29	<5	43	30	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH19 0.2-0.3m X x	19	<5	220	<1	<50	<1	21	9	44	341	208	12	<5	29	227	1.5	<0.5	**0.5**	<0.5	<0.5	**1.7**	**1.0**	**6.1**	**6.6**	**2.9**	**2.7**	**4.1**	**1.4**	**3.6**	**1.9**	<0.5	**2.6**	**35.1**	**4.7**
12/12/2017	BH19 0.9-1.0m X x	19.6	<5	2770	3	<50	<1	11	37	13	14	255	19	<5	43	17	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH20 0.5m	22.1	<5	40	<1	<50	<1	12	3	10	9	59	4	<5	48	12	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH21 0.5m	20.1	6	170	<1	<50	<1	12	11	49	238	301	15	<5	29	157	0.8	<0.5	<0.5	<0.5	<0.5	**1.5**	<0.5	**3.5**	**3.7**	**2.6**	**2.1**	**3.4**	**1.1**	**2.8**	**1.5**	<0.5	**1.8**	**24.0**	**3.7**
17/06/2017	BH10 0.1m	5.5	<5	30	<1	<50	<1	5	15	90	60	279	11	<5	58	99	0.1	<0.5	<0.5	<0.5	<0.5	**0.5**	<0.5	**1.9**	**2.0**	**0.8**	**0.6**	**1.0**	<0.5	**1.0**	**0.7**	<0.5	**1.0**	**9.5**	**1.3**
17/06/2017	BH10 1.0m	20.6	6	110	1	<50	<1	11	32	19	9	1490	28	<5	41	23	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH16 1.0-1.1m	18.5	<5	230	<4	<50	<2	<4	33	67	<5	1050	100	<5	69	13	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH16 2.0-2.1m	27	9	90	1	<50	<1	4	13	46	8	760	18	<5	66	48	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH16 2.9-3.0m	16.7	<5	<10	<1	<50	<1	6	<2	<5	<5	10	3	<5	10	13	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH17 0.5-0.6m	23.2	<5	50	1	<50	<1	17	16	24	12	115	16	<5	70	32	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
12/12/2017	BH17 1.9-2.0m	18.1	<5	220	<1	<50	<1	16	45	32	6	2410	38	<5	61	75	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

11 INDOOR INHABITANT PVI ASSESSMENT – HSL's

This PVI assessment has been conducted in accordance with relevant CRC CARE Technical Documentation and NEPM 2013 guidelines presented in references section of this report. The HSL assessment approach is generally the first (Tier 1) investigation phase adopted for assessing PVI risk at petroleum hydrocarbon (PHC) impacted sites. HSL guidelines have been applied for samples collected from the site to account for risks that may be associated with volatile hydrocarbon vapour intrusion into confined spaces where there may be an inhalation risk through longer term exposure. This does not constitute a full vapour risk assessment but provides additional information from which to further quantify any risk.

A detailed investigation (Tier 2 to 3) is recommended over an HSL assessment where an acute risk has been identified at the site (CRC CARE 2013) because of:

- Migrating product on surface soils beneath buildings;
- Strong PHC odors;
- Flammable risk in confined spaces; and/or
- Health complaints from occupants.

Based on the site visits, none of the above conditions have been identified at the site. If the outcome of this Tier 1 assessment reveals HSL exceedances for hydrocarbon vapour intrusion, a more detailed (Tier 2) assessment will be required to further evaluate the human health risk.

PVI risk is initially interpreted through the development of HSL threshold limits from the following classifications:

- The geology and or hydrogeology of the investigation point; and
- Land use sensitivity:

The resulting HSL threshold limits are compared with laboratory analytical results.

11.1 Selected Media for Assessing PVI Risk

Table 23 presents a summary of the preferred HSL approach to assessing PVI risk.

Table 23 Preferred Methods for Determining Site PVI Risk

Media Analysed	Method	Limitations	Order of Preference
Soil Gas	Concentrations of a soil gas through a soil vapor probe	This approach provides the most reliable data in interpreting PVI risk, although direct modelling should be applied if concentrations exceed HSL threshold limits.	Primary
Groundwater	Concentrations of PHC in groundwater through deployment of monitoring wells	Determining PVI risk based on groundwater is inherently conservative when interpreting vapour risk to account for not readily discernable preferential pathways. Reference may be drawn to alternative assessment approaches: 1) Application of site specific conditions to the CRC CARE model for assessing PVI risk 2) Soil gas interpretation for areas where a PVI risk is identified from groundwater analysis.	Secondary
Soil	Concentrations of PHC in soil	Concentrations in soil may be subject variability due to soil moisture, organic content and oxygen ingress all which create significant bias in threshold values. Reliance is place on utilizing groundwater analysis over soil.	Tertiary

11.2 Land Use Class

For surrounding properties, the potential PVI risk is characterized through application of CRC CARE HSL's for each individual properties based on their existing land use (NEPM 2013; Friebel & Nadebaum 2010). The CRC CARE guidelines have been referenced to ensure that the correct land use and density category has been adopted for surrounding land use to ensure health risks are consistent with the HSL models. Aspects considered include the:

- Sensitivity of the existing or potential land use;
- Percentage of paved area for defining potential vapour migration risk;
- Type of basement garage which may influence the confinement of PHC vapors;
- Presence of a slab or cavity for discerning vapour intrusion risk.

If hydrocarbon impacted soil is discerned at the site, consideration is given to downgradient receptors. Where applicable, land use class therefore considers:

- Downgradient receptors where onsite HSL exceedances have been identified in soil; and
- Variations in land use for different parts of the proposed development.

The following land use classes are applied:

- *HSL D for all commercial spaces including the proposed Level 1 gym area, car parking and café areas;*
- *HSL D for all residential development above the Level 1 carpark (as per NEPM 2013) which identifies need for adequate ventilation in the basement which attenuates the hazard to residential spaces above the carpark; and*
- *HSL B for apartments located directly on bare earth to the north of the site.*

11.3 Vapour Barrier Assessment

Soil and soil vapour HSL's are specific to each sample location and involves characterisation based on the following variables:

- Land use class;
- Average grain size class of material above the sample point based on USCS partitioning into either sand, silt or clay and making adjustment to the grain class according to the following:
    - Excluding the proposed excavated material;
    - Including the dominant grain class of any backfill; and
    - Making allowance for a slab vapour barrier which is considered to have equivalent vapour barrier qualities to clay material.
- Sample depths are defined by the final finished floor level at that location relative to the:
    - Soil - above the soil sample;
    - Soil vapour - above the passive sampler borehole vapour barrier;
- Classifying vapour intrusion risk based on depth ranges:
    - Soil - 0 to 1 m; 1 to 2 m; 2 to 4 m; greater than 4 m; and
    - Soil vapour - 0 to 1 m; 1 to 2 m; 2 to 4 m; 4 to 8, greater than 8 m

Table 24 summarises soil and soil vapour bores and land use classification used to characterise PVI risk for various properties near the site.

Table 24 Classification Used to Assess Petroleum Vapour Intrusion Risk to Local Receptors from Soil

Location	Soil Bores	Soil Vapour	Land Use Class
Level 1 car Park Basement, Gym & Cafe	All Soil Bores	VP1 to VP4	D
Apartment on Level 2	BH10, BH16 & BH17	VP4	B

11.4 Soil Assessment Findings

Soil sampling results, Certificate of Analysis is presented in Appendix 5. Soil samples have been assessed against the elected NEPM (2013) HSL D (Table 25) and HSL B (Table 26) to determine potential hydrocarbon vapour risk to site users. Specific grain, depth and land use classes are presented in both tables.

Specific grain, depth and land use classes are presented with the tables. Concentrations which exceeded laboratory LOR are highlighted in bold, and HSL exceedances are highlighted with a colored cell. Samples within the excavation do not have a depth class and have been leveled 'Excavate".

There no HSL D or HSL B exceedances in any of the soil samples for indoor vapour assessment.

Table 25 Soil Analytical Results Compared Against HSL D

Soil Hydrocarbon HSL's for Assessing Indoor Vapour Intrusion (NEPM 2013) **Soil Sample Analysis**					EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances Colour Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x					Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	F1	F2
Sample ID	Sample Date	Depth Class	Grain Class	HSL	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
					LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
BH1 0.10m	17/06/2017	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH1 0.9m	17/06/2017	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH2 0.1m	17/06/2017	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH2 0.9m	17/06/2017	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH3 0.5m	17/06/2017	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH3 2.3m	17/06/2017	2 - 4	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH4 0.5m	17/06/2017	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	**7**	**256**	**1780**
BH4 1.0m	17/06/2017	0 - 1	SAND	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH5 0.1m	17/06/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	**50**
BH5 3.0m	17/06/2017	2 - 4	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH6 0.2m	17/06/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH6 2.0m	17/06/2017	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH6 3.0m	17/06/2017	1 - 2	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH7 0.2m	17/06/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH7 1.0m	17/06/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH7 3.0m	17/06/2017	1 - 2	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH8 1.0m	17/06/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH8 0.5m	17/06/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH9 0.2m	17/06/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH9 3.0m	17/06/2017	1 - 2	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH10 0.1m	17/06/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH10 1.0m	17/06/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH11 0.1m	17/06/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
DUP	17/06/2017	2 - 4	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH12 0.5m	12/12/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH12 1.0m	12/12/2017	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH13 0.4-0.5m	12/12/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH14 0.3-0.4m	12/12/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH14 1.0-1.1m	12/12/2017	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH15 0.5-0.6m	12/12/2017	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 1.0-1.1m	12/12/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 2.0-2.1m	12/12/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 2.9-3.0m	12/12/2017	0 - 1	SAND	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH17 0.5-0.6m	12/12/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH17 1.9-2.0m	12/12/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH18 0.2-0.3m	12/12/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH18 0.9-1.0m	12/12/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH19 0.2-0.3m	12/12/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH19 0.9-1.0m	12/12/2017	EXCAVATE	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH20 0.5m	12/12/2017	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH21 0.5m	12/12/2017	0 - 1	SAND	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50

Table 26 Soil Analytical Results Compared Against HSL B

Soil Hydrocarbon HSL's for Assessing Indoor Vapour Intrusion (NEPM 2013) **Soil Sample Analysis**					EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances Colour Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x					Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	F1	F2
Sample ID	Sample Date	Depth Class	Grain Class	HSL	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
					LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
BH10 0.1m	17/06/2017	0 - 1	CLAY	B	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH10 1.0m	17/06/2017	0 - 1	CLAY	B	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 1.0-1.1m	12/12/2017	1 - 2	CLAY	B	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 2.0-2.1m	12/12/2017	2 - 4	CLAY	B	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 2.9-3.0m	12/12/2017	2 - 4	CLAY	B	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH17 0.5-0.6m	12/12/2017	0 - 1	SAND	B	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH17 1.9-2.0m	12/12/2017	1 - 2	CLAY	B	<0.2	<0.5	<0.5	<0.5	<1	<10	<50

11.5 Soil Vapour Assessment Findings

Soil vapour intrusion risk to indoor receptors is best characterised through installation of soil vapour probes. Soil vapour analytical results are presented in Appendix 9. Soil samples have been assessed against the elected NEPM (2013) HSL D and HSL B

Table 27 to determine potential hydrocarbon vapour risk to site users. Specific grain, depth and land use classes are presented in both tables. Detected results are presented in, guideline exceedances are represented in a coloured cell and samples results that were non-detect but above the HSL guideline are bold.

All soil vapour samples collected from the selected depths do not exceed the NEPM HSL guidelines for PHC vapour exposure risk to indoor vapour intrusion risk.

Table 27 Soil Vapour Analytical Results Compared Against NEPM HSLs for Assessing Petroleum Vapour Intrusion Risk (NEPM2013)

Soil Hydrocarbon Vapour HSL's for Assessing Indoor Vapour Intrusion (NEPM 2013) **Passive Soil Vapour Analysis**						EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances Colour Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x						Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	F1	F2
Sample ID	Sample Date	Depth Class	Grain Class	HSL	Deployment Duration (hours)	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3
						LOR 0.019	LOR 0.013	LOR 0.01	LOR 0.01	LOR 0.012	LOR 2.5	LOR 1
VP1	11/12/2017	1 - 2	CLAY	D	69.33	<0.019	**0.017**	<0.01	**0.017**	<0.012	<2.5	<1.0
VP2	11/12/2017	1 - 2	CLAY	D	68.83	<0.019	<0.013	<0.01	0.01	<0.012	<2.5	<1.0
VP3	11/12/2017	0 - 1	CLAY	D	68.17	<0.019	**0.014**	**0.047**	**0.131**	<0.012	**13**	**2.4**
VP4	11/12/2017	1 - 2	SAND	D	67.75	<0.019	<0.013	<0.01	0.01	<0.012	<2.5	<1.0
VP4	11/12/2017	2 - 4	CLAY	B	67.75	<0.019	<0.013	<0.01	0.01	<0.012	<2.5	<1.0
Dup	11/12/2017	1 - 2	SAND	D	67.95	<0.019	<0.013	<0.01	0.01	<0.012	<2.5	<1.0

12 TRENCH WORKER PVI ASSESSMENT – HSL's

12.1 Classification

The following Health Screening Assessment is based on hydrocarbon vapour intrusion risk to subsurface excavation workers within excavations. This is assessed through analysis of vapors from soil and soil vapours. Groundwater is generally not used to assess risk as threashold limits for all depth and grain classes are non-limiting. Land use classes are not applicable when assessing vapour intrusion into trenches.

Soil and soil vapour HSL's for assessing hydrocarbon risk to maintenance workers are based on CRC CARE Technical Report 10 guidelines (Friebel & Nadebaum 2011) and the following variables:

- Average grain size class of material above the sample point based on USCS partitioning into either sand, silt or clay;
- Sample depths are defined by proposed elevation of the development ground surface at that location relative to the:
    - Soil sample depth
    - Soil vapour point depth
- Classifying vapour intrusion risk based on depth ranges:
    - Soil - 0 to 1 m; 1 to 2 m; 2 to 4 m; greater than 4 m; and
    - Soil vapour - 0 to 1 m; 1 to 2 m; 2 to 4 m; 4 to 8, greater than 8 m

12.2 Soil Assessment Findings

Laboratory analytical results are presented in Appendix 5. Table 28 compares soil analytical results for residual samples (non-excavated soil which is to remain at the site) against relevant CRC CARE HSLs for shallow intrusive maintenance workers. Concentrations which exceeded laboratory LOR are highlighted in bold, and ESL exceedances are highlighted with a colored cell, and soil proposed to be excavated from the site are marked "Excavate".

None of the soil samples collected at the site exceeds the hydrocarbon HSL's for shallow intrusive maintenance workers.

Table 28 Summary of Soil Analytical Results Compared against HSL's for Assessing PVI Risk to Trench Workers

CRC CARE Health Screening Level Assessment for PHC Inhalation Risk To Trench Workers From Soil Sample Analysis				EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances				Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction
Dark Grey Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, * 20-50 x, **** >50 x**										
Sample ID	Sample Date	Depth Class	Grain Class	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
BH1 0.10m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH1 0.9m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH2 0.1m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH2 0.9m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH3 0.5m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH3 2.3m	17/06/2017	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH4 0.5m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	**7**	**256**	**1790**
BH4 1.0m	17/06/2017	0 to 2m	SAND	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH5 0.1m	17/06/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	**50**
BH5 3.0m	17/06/2017	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH6 0.2m	17/06/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH6 2.0m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH6 3.0m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH7 0.2m	17/06/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH7 1.0m	17/06/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH7 3.0m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH8 1.0m	17/06/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH8 0.5m	17/06/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH9 0.2m	17/06/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH9 3.0m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH10 0.1m	17/06/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH10 1.0m	17/06/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH11 0.1m	17/06/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH12 0.5m	12/12/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH12 1.0m	12/12/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH13 0.4-0.5m	12/12/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH14 0.3-0.4m	12/12/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH14 1.0-1.1m	12/12/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH15 0.5-0.6m	12/12/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 1.0-1.1m	12/12/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 2.0-2.1m	12/12/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 2.9-3.0m	12/12/2017	0 to 2m	SAND	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH17 0.5-0.6m	12/12/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH17 1.9-2.0m	12/12/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH18 0.2-0.3m	12/12/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH18 0.9-1.0m	12/12/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH19 0.2-0.3m	12/12/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH19 0.9-1.0m	12/12/2017	EXCAVATE	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH20 0.5m	12/12/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH21 0.5m	12/12/2017	0 to 2m	SAND	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH10 0.1m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH10 1.0m	17/06/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 1.0-1.1m	12/12/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 2.0-2.1m	12/12/2017	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH16 2.9-3.0m	12/12/2017	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH17 0.5-0.6m	12/12/2017	0 to 2m	SAND	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH17 1.9-2.0m	12/12/2017	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50

12.3 Soil Vapour Assessment Findings

Laboratory analytical results are presented in Appendix 9. Table 29 compares soil vapour analytical results against relevant CRC CARE HSLs for shallow intrusive maintenance workers. Concentrations which exceeded laboratory LOR are highlighted in bold, and ESL exceedances are highlighted with a colored cell. All soil vapour samples collected from the selected depths do not exceed the CRC CARE (Friebel & Nadebaum, 2011) guidelines for PHC vapour exposure risk to trench workers (Table 29).

Table 29 Soil Vapour Analytical Results Compared Against CRC CARE Guidelines for Assessing Petroleum Vapour Intrusion Risk to Trench Workers (CRC CARE - Friebel & Nadebaum, 2011)

CRC CARE Health Screening Level Assessment for PHC Inhalation Risk To Trench Workers Passive Soil Vapour Analysis				EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances										
Dark Grey Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, * 20-50 x, **** >50 x**				Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction
				mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3	mg/m3
Sample ID	Sample Date	Depth Class	Grain Class	LOR 0.019	LOR 0.013	LOR 0.01	LOR 0.01	LOR 0.012	LOR 2.5	LOR 1
VP1	11/12/2017	0 to 2m	CLAY	<0.019	**0.017**	<0.01	**0.017**	<0.012	<2.5	<1.0
VP2	11/12/2017	0 to 2m	CLAY	<0.019	<0.013	<0.01	0.01	<0.012	<2.5	<1.0
VP3	11/12/2017	0 to 2m	CLAY	<0.019	**0.014**	**0.047**	**0.131**	<0.012	**13**	**2.4**
VP4	11/12/2017	0 to 2m	SAND	<0.019	<0.013	<0.01	0.01	<0.012	<2.5	<1.0
VP4	11/12/2017	2 to 4m	CLAY	<0.019	<0.013	<0.01	0.01	<0.012	<2.5	<1.0
Dup	11/12/2017	0 to 2m	SAND	<0.019	<0.013	<0.01	0.01	<0.012	<2.5	<1.0

13 SOIL DISPOSAL ASSESSSMENT

13.1 Guidelines

Soil which is excavated from the site for landfill disposal is to be assessed against Information Bulletin 105 (IB105) for Classification and Management of Contaminated Soil for Disposal. The EPA uses 4 categories to classify contaminated soil as per Table 30:

- (Level 1) Fill Material;
- (Level 2) Low Level Contaminated Soil;
- (Level 3) Contaminated Soil; and
- (Level 4) Contaminated Soil.

Fixed numerical values are presented for soil concentrations and leachable fraction concentrations.

13.2 Findings

The soil samples have been compared against IB105 guidelines for soil disposal see Table 31 and Table 32.. On average, the proposed excavated soil is classified as Level 2 contaminated based on barium, lead, zinc & benzo(a)pyrene. Most of this impact occurs at a shallow depth at the site. Barium is likely to be an artefact of background soils in the area and not a contaminant of concern at the site which may deem it as being classified Level 2.

The bulk of the impact occurs in shallow fill material at the site, and care should be taken to scraping the top 0.3 m from the site and stockpiling is separately from the remaining deep excavations. This is likely to bring the bulk excavations below 0.3 m BGS to Level 1.

Elevated lead concentrations in BH4 0.5 bring the soil classification to Level 4 (Table 31). However, when all soil hydrocarbon concentrations are averaged, the soil is reduced to level 2 classification. GES therefore recommends that any soil excavated at the site is stockpiled, sampled, analysised and transported to a licensed storage and handling facility for management of contaminated soil.

Table 30 Summary of IB105 Classification Guidelines

	Classification (with reference to Table 2)	Controlled Waste[1]	Comments
Fill Material[2] (Level 1)	Soil that exhibits levels of contaminants below the limits defined under *Fill Material* in Table 2.	Unlikely	Soil classified as *Fill Material* can still be a 'pollutant' under the *Environmental Management and Pollution Control Act 1994* and needs to be responsibly managed.
Low Level Contaminated Soil (Level 2)	Soil that exhibits levels of contaminants above the limits defined under *Fill Material* but below the limits defined under *Low Level Contaminated Soil* in Table 2.	Likely	Where leachable concentrations have not been prescribed, maximum total concentrations will be used to classify the soil.
Contaminated Soil (Level 3)	Soil that exhibits levels of contaminants above the limits defined under *Low Level Contaminated Soil* but below the limits defined under *Contaminated Soil* in Table 2.	Yes	Where leachable concentrations have not been prescribed, maximum total concentrations will be used to classify the soil.
Contaminated Soil for Remediation (Level 4)	Soil that exhibits levels of contaminants above the limits defined under *Contaminated Soil* in Table 2 (regardless of the maximum total concentrations) is generally ***not*** considered acceptable for off-site disposal without prior treatment.	Yes	Soil that contains contaminants that do not have criteria for leachable concentrations (*e.g.* petroleum hydrocarbons), and the levels of contaminants exceed the maximum total concentrations listed in *Contaminated Soil*, are generally classified as *Contaminated Soil for Remediation*.

[1] Controlled Waste is defined in the *Environmental Management and Pollution Control Act 1994*.
[2] Criteria for *Fill Material* are the limits set by the Director for the purposes of R.9(2)(a)(ii) in the *Regulations*.

Table 31 All Soil Analytical Results Compared Against IB105 Investigation Limits for soil Disposal

Information Bulletin 105 Classification and Management of Contaminated Soil For Disposal X - Below Proposed Finished Floor Level		EG005T: Total Metals by ICP-AES											EG035T	EP075(SIM)A		EP080: BTEX				EP080/071: TRH	
		Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Zinc	Mercury	Benzo(a)pyrene	Sum of polycyclic aromatic hydrocarbons	Benzene	Toluene	Ethylbenzene	Total Xylenes	C6 - C9 Fraction	C10 - C36 Fraction (sum)
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		5	10	1	1	2	2	5	5	5	2	5	0.1	0.5	0.5	0.2	0.5	0.5	0.5	10	50
Investigation Level Selected																					
IB105 Level 1		20	300	2	3	50	100	100	300	500	60	200	1	0.08	20	1	1	3	14	65	1000
IB105 Level 2		200	3000	40	40	500	200	2000	1200	5000	600	14000	30	2	40	5	100	100	180	650	5000
IB105 Level 3		750	30000	400	400	5000	1000	7500	3000	25000	3000	50000	110	20	200	50	1000	1080	1800	1000	10000
IB105 Level 4		>750	>30000	>400	>400	>5000	>1000	>7500	>3000	>25000	>3000	>50000	>110	>20	>200	>50	>1000	>1080	>1800	>1000	>10000
17/06/2017	BH1 0.10m	<5	80	<1	18	30	13	172	362	275	28	390	0.6	0.8	7.1	<0.2	<0.5	<0.5	<0.5	<10	300
17/06/2017	BH1 0.9m	<5	50	<1	<1	7	4	16	26	148	6	17	0.2	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH2 0.1m	<5	140	<1	<1	23	6	53	364	176	22	329	0.2	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH2 0.9m	<5	80	<1	<1	5	6	20	359	256	6	26	0.9	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH3 0.5m	<5	40	<1	<1	4	21	83	9	262	9	36	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH3 2.3m	<5	170	1	<1	8	19	16	11	125	20	65	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH4 0.5m	17	400	1	<1	10	13	116	4570	512	16	473	1	2.2	22.3	<0.2	<0.5	<0.5	<0.5	132	9550
17/06/2017	BH4 1.0m	<5	120	1	<1	13	6	17	16	80	8	25	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH5 0.1m X	<5	80	<1	1	16	8	69	208	217	18	184	0.5	3.6	44.2	<0.2	<0.5	<0.5	<0.5	<10	770
17/06/2017	BH5 3.0m	18	10	<1	<1	23	4	8	13	554	6	24	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH6 0.2m X	8	900	<1	2	20	11	122	1430	248	20	941	1.5	3.5	33.3	<0.2	<0.5	<0.5	<0.5	<10	540
17/06/2017	BH6 2.0m	6	30	<1	<1	13	8	8	11	1680	11	23	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH6 3.0m	16	<10	<1	<1	10	<2	8	12	70	4	33	0.3	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH7 0.2m X	8	820	<1	1	16	10	101	1140	213	18	614	2.1	3.8	37.8	<0.2	<0.5	<0.5	<0.5	<10	310
17/06/2017	BH7 1.0m X	<5	1090	5	<1	15	67	28	16	198	50	47	0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH7 3.0m	<5	10	<1	<1	6	3	<5	5	121	3	13	1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH8 1.0m X	<5	20	<1	<1	14	3	<5	<5	37	7	18	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH8 0.5m X	<5	10	<1	<1	13	2	<5	<5	51	3	28	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH9 0.2m X	10	500	1	<1	17	17	76	852	366	16	588	1.6	2.3	23.7	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH9 3.0m	<5	30	<1	<1	8	4	5	<5	55	3	13	0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH10 0.1m X	<5	30	<1	<1	5	15	90	60	279	11	99	0.1	1	9.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH10 1.0m X	6	110	1	<1	11	32	19	9	1490	28	23	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH11 0.1m X	7	50	1	<1	11	32	27	17	2260	30	79	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	380
12/12/2017	BH12 0.5m X	5	220	1	<1	18	13	32	10	116	14	28	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH12 1.0m	8	660	4	<1	16	368	39	11	1690	72	45	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH13 0.4-0.5m X	<5	20	1	<1	7	6	16	<5	268	13	53	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH14 0.3-0.4m X	35	180	<1	<10	20	12	80	314	825	22	728	0.8	5.2	42.1	<0.2	<0.5	<0.5	<0.5	<10	420
12/12/2017	BH14 1.0-1.1m	<5	480	1	<1	14	14	17	11	54	13	14	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH15 0.5-0.6m	<5	10	<1	<1	11	13	57	<5	350	15	34	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 1.0-1.1m X	<5	230	<4	<2	<4	33	67	<5	1050	100	13	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 2.0-2.1m X	9	90	1	<1	4	13	46	8	760	18	48	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 2.9-3.0m	<5	<10	<1	<1	6	<2	<5	<5	10	3	13	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH17 0.5-0.6m X	<5	50	1	<1	17	16	24	12	115	16	32	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH17 1.9-2.0m X	<5	220	<1	<1	16	45	32	6	2410	38	75	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH18 0.2-0.3m X	<5	130	1	<1	10	14	72	144	167	14	104	1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH18 0.9-1.0m X	<5	180	<5	<3	13	17	15	<5	1100	29	30	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH19 0.2-0.3m X	<5	220	<1	<1	21	9	44	341	208	12	227	1.5	3.6	35.1	<0.2	<0.5	<0.5	<0.5	<10	610
12/12/2017	BH19 0.9-1.0m X	<5	2770	3	<1	11	37	13	14	255	19	17	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH20 0.5m	<5	40	<1	<1	12	3	10	9	59	4	12	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH21 0.5m	6	170	<1	<1	12	11	49	238	301	15	157	0.8	2.8	24	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH10 0.1m	<5	30	<1	<1	5	15	90	60	279	11	99	0.1	1	9.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH10 1.0m	6	110	1	<1	11	32	19	9	1490	28	23	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 1.0-1.1m	<5	230	<4	<2	<4	33	67	<5	1050	100	13	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 2.0-2.1m	9	90	1	<1	4	13	46	8	760	18	48	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 2.9-3.0m	<5	<10	<1	<1	6	<2	<5	<5	10	3	13	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH17 0.5-0.6m	<5	50	1	<1	17	16	24	12	115	16	32	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH17 1.9-2.0m	<5	220	<1	<1	16	45	32	6	2410	38	75	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50

Table 32 Proposed excavated Soil Analytical Results only Compared Against IB105 Investigation Limits for soil Disposal With Averages Included

Information Bulletin 105 Classification and Management of Contaminated Soil For Disposal X - Below Proposed Finished Floor Level		EG005T: Total Metals by ICP-AES											EG035T	EP075(SIM)A		EP080: BTEX				EP080/071: TRH	
		Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Zinc	Mercury	Benzo(a)pyrene	Sum of polycyclic aromatic hydrocarbons	Benzene	Toluene	Ethylbenzene	Total Xylenes	C6 - C9 Fraction	C10 - C36 Fraction (sum)
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		5	10	1	1	2	2	5	5	5	2	5	0.1	0.5	0.5	0.2	0.5	0.5	0.5	10	50
Investigation Level Selected																					
IB105 Level 1		20	300	2	3	50	100	100	300	500	60	200	1	0.08	20	1	1	3	14	65	1000
IB105 Level 2		200	3000	40	40	500	200	2000	1200	5000	600	14000	30	2	40	5	100	100	180	650	5000
IB105 Level 3		750	30000	400	400	5000	1000	7500	3000	25000	3000	50000	110	20	200	50	1000	1080	1800	1000	10000
IB105 Level 4		>750	>30000	>400	>400	>5000	>1000	>7500	>3000	>25000	>3000	>50000	>110	>20	>200	>50	>1000	>1080	>1800	>1000	>10000
17/06/2017	BH5 0.1m X	<5	80	<1	1	16	8	69	208	217	18	184	0.5	3.6	44.2	<0.2	<0.5	<0.5	<0.5	<10	770
17/06/2017	BH6 0.2m X	8	900	<1	2	20	11	122	1430	248	20	941	1.5	3.5	33.3	<0.2	<0.5	<0.5	<0.5	<10	540
17/06/2017	BH7 0.2m X	8	820	<1	1	16	10	101	1140	213	18	614	2.1	3.8	37.8	<0.2	<0.5	<0.5	<0.5	<10	310
17/06/2017	BH7 1.0m X	<5	1090	5	<1	15	67	28	16	198	50	47	0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH8 1.0m X	<5	20	<1	<1	14	3	<5	<5	37	7	18	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH8 0.5m X	<5	10	<1	<1	13	2	<5	<5	51	3	28	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH9 0.2m X	10	500	1	<1	17	17	76	852	366	16	588	1.6	2.3	23.7	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH10 0.1m X	<5	30	<1	<1	5	15	90	60	279	11	99	0.1	1	9.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH10 1.0m X	6	110	1	<1	11	32	19	9	1490	28	23	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH11 0.1m X	7	50	1	<1	11	32	27	17	2260	30	79	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	380
12/12/2017	BH12 0.5m X	5	220	1	<1	18	13	32	10	116	14	28	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH13 0.4-0.5m X	<5	20	1	<1	7	6	16	<5	268	13	53	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH14 0.3-0.4m X	35	180	<1	<10	20	12	80	314	825	22	728	0.8	5.2	42.1	<0.2	<0.5	<0.5	<0.5	<10	420
12/12/2017	BH16 1.0-1.1m X	<5	230	<4	<2	<4	33	67	<5	1050	100	13	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 2.0-2.1m X	9	90	1	<1	4	13	46	8	760	18	48	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH17 0.5-0.6m X	<5	50	1	<1	17	16	24	12	115	16	32	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH17 1.9-2.0m X	<5	220	<1	<1	16	45	32	6	2410	38	75	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH18 0.2-0.3m X	<5	130	1	<1	10	14	72	144	167	14	104	1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH18 0.9-1.0m X	<5	180	<5	<3	13	17	15	<5	1100	29	30	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH19 0.2-0.3m X	<5	220	<1	<1	21	9	44	341	208	12	227	1.5	3.6	35.1	<0.2	<0.5	<0.5	<0.5	<10	610
12/12/2017	BH19 0.9-1.0m X	<5	2770	3	<1	11	37	13	14	255	19	17	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
Averaging		4	321	0.8	0.3	14	18	48	312	479	19	225	0.5	1.2	12.4	0.0	0.0	0.0	0.0	0	167

14 CONCEPTUAL SITE MODEL

14.1 Potential & Identified Sources of Contamination

14.1.1 Potential Primary Sources

The primary potential sources of contamination impact at the site includes:

- Heavy metal and hydrocarbon impacted fill from historical site activities. Despite residential use, many older building sites around Hobart have background zinc, lead and PAH contamination;
- UST T1, T2, T3 and T4 and associated bowsers and fuel lines;
- Truck service pits within workshop;
- Interceptor trap and associated pipework;
- Vehicle wash-down areas; and
- Potential historical industrial activities occurring at the site including metalworks, and possible use of the site for servicing and storage of vehicles.

There may be other unknown potential sources of onsite or offsite impact (outside of the sampling areas) which GES are unaware of and therefore have not been investigated within this assessment.

Contaminates of potential concern associated with these potential sources have already been identified in a previous section.

14.1.2 Identified Primary Sources

Identified primary sources include:

- Soil impact has been identified around the historical interceptor trap which is no longer in use but was in use until recently (within last 5 years);
- GES are not aware of any site tank decommissioning and it needs to be assumed that all tanks (identified or not identified) remain at the site. The tanks may present geotechnical hazards with ground instability issues if they are to remain, and therefore the UST's should be formally decommissioned.
- UST T1, T2 and the former bowser in Area B as well as Area C have not been investigated given the presence of the building obstructions. These are not an identified primary source and data gaps remain for this area of the site; and
- Heavy metal and hydrocarbon impacted fill has been identified within the upper 0.4 m of the site.

14.1.3 Identified Secondary Sources

The following contaminants have been identified in soil at the site:

- Heavy metal and hydrocarbon impacted fill to depths of 0.4 m BGS; and
- Heavy metal and hydrocarbon impacted fill around the interceptor trap.
- There may be secondary soil impact around UST T1 and T2, as well as in Area C. This needs to be further investigated whilst the site is being excavated.

14.2 Potential Receptors

The following presents a summary of all potential receptors considered in the assessment.

14.2.1 Potential Future Onsite Receptors

Potential future onsite receptors including slab demolition, earth removal, development and occupancy stages are presented in Table 33.

Table 33 Summary of Potential Future Onsite Receptors

Medium	Specific Onsite Receptor
Soil	Site earthworks including soil removal
	Future trench workers
	Onsite inhabitants which may be exposed to: • Excavated soil during trenching works; • Petroleum vapours sourcing from impacted soil
Groundwater/Vapour	Onsite inhabitants which may be exposed to petroleum vapours sourcing from impacted groundwater

14.2.2 Potential Offsite Receptors

Heavy metal impacted groundwater may only pose a risk if it:

- Shallows and discharge into an inhabitable area where people may be in direct contact with it. Given groundwater is unlikely to shallow within 500 m of the site, this risk is considered low;
- Is used as a drinking water sourced which has been ruled out based on PEV's and higher salinity groundwater typical within the identified geological units;
- If it is to discharge into a nearby ecosystem. Given there are no nearby sensitive ecosystems within a 500m radius of the site, provided that a soil and water is managed during development works, there is a low risk that heavy metal and hydrocarbon impacted soil identified by EIL's and ESL exceedances will present a risk to ecosystem receptors.

Hydrocarbons may present a risk to offsite receptors if the hydrocarbons present a vapour intrusion risk.

Hydrocarbon or heavy metal impacted soil may present a risk to offsite receptors if it is not managed appropriately and allowed to erode from the site. The heavy metals, are unlikely to concentrate to the extent that they will cause heightened risk to receptors beyond what has been identified within this ESA.

Table 34 presents a summary of potential offsite receptors

Table 34 Summary of Potential Offsite Receptors

Medium	Specific Offsite Receptor
Groundwater	PVI risk in downgradient first floor residential units
	PVI risk in downgradient ground floor commercial spaces
	Shallowing into backyards downgradient
	Drinking water use
	Ecosystem
Soil	Ecosystem impact from erosion and stormwater runoff

14.3 Transport Mechanisms and Exposure Routes

14.3.1 Incomplete Contaminant Exposure Pathways

Incomplete contaminant exposure pathways relate to present unmanaged risk. Table 35 presents a summary of potential receptors identified in desktop assessment of the site, with incomplete exposure pathways deducted based on the soil investigations. All offsite exposure pathways have been ruled out.

Table 35 Summary of Incomplete Contaminant Exposure Pathways

Medium	Specific Receptor	Pathways Ruled Out	Basis
Groundwater	Onsite residential and commercial receptors	Vapour inhalation sourcing from the site	PVI risk not identified in passive vapour samplers
	Downgradient residential	Shallowing into backyards	No shallowing groundwater within 500 m radius
	Human health	Drinking groundwater	Typical salinity values and reticulated water rule out groundwater as a drinking water PEV
	Ecosystem	Shallowing into nearby rivulet	No ecosystem receptors identified at least within 500 m of the site
Soil	Onsite residential and commercial receptors	Vapour inhalation sourcing from the site	PVI risk not identified in passive vapour samplers

14.3.2 Potential Pathways

Potential and plausible transport mechanisms and exposure routes are presented in Table 36 and Figure 7 model. Incomplete exposure pathways are not included in Figure 7.

Although potential onsite receptors to petroleum vapour intrusion risk have been ruled out, a vapour intrusion risk to offsite receptors cannot be ruled out on the basis that:

- It is not known if there is impact sourcing from UST T1 & T2; and
- Onsite and offsite groundwater has not been investigated.

Table 36 Summary of Potential Complete Contaminant Exposure Pathways

Medium	Specific Pathway	Receptors
Soil	Dust inhalation, soil ingestion & dermal contact	Construction workers*
		Onsite residential inhabitants*
		Future trench workers*
	Soil erosion and stormwater transport during construction phase	Marine ecosystem*
Groundwater	Indoor vapour intrusion	Downgradient residential or commercial receptors

* See Recommendations for Managed Risk Options

14.3.3 Plausible Contaminant Exposure Pathway Details

Provided that the soil is adequately managed as indicated in the recommendations, plausible exposure pathways are not identified at the site.

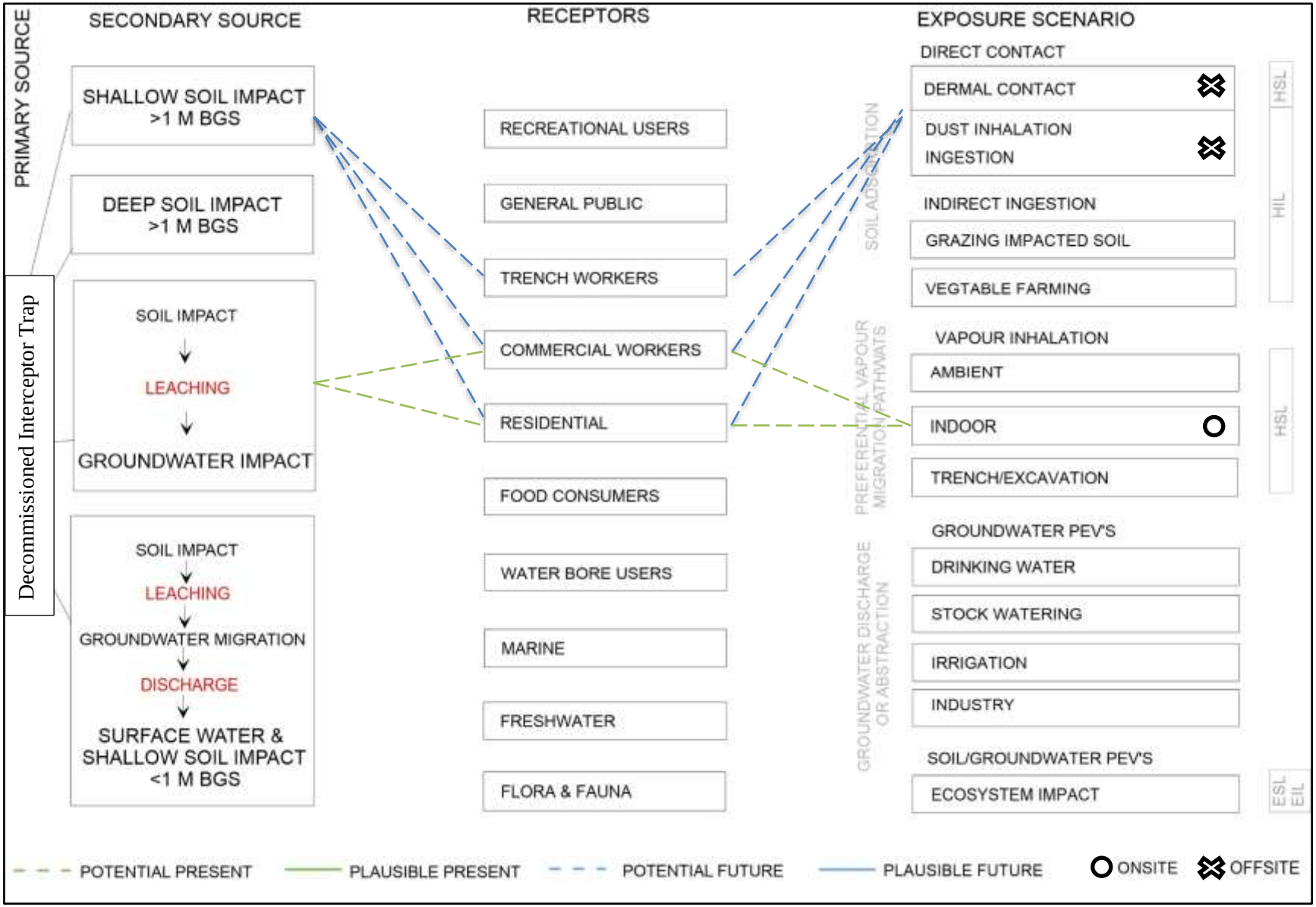

Figure 7 Conceptual Site Model Identifying Contamination Source, Receptors and Transport Mechanisms/Exposure Routes

15 CONCLUSIONS

15.1 Adopted Land Use Settings

The following investigation limits were adopted for the site:

- Ecosystem – Residential land use;
- Future land users soil direct contact risk– limited soil access (all paved) therefore:
    - HIL B for soil ingestion and dust inhalation risk to residence;
    - HIL D for soil ingestion and dust inhalation risk to commercial workers
- Future land users vapour inhalation risk –
    - HSL D for Level 1 commercial workers
    - HSL D for residence living above Level 1 carpark
    - HSL B for residence living on Level 2 built on ground surface
- Site development works and future (post development) trench workers:
    - Standard guidelines for assessing trench worker vapour intrusion risk;
    - Standard guidelines for assessing dermal contact risk; and
    - HIL D for assessing dust inhalation and soil ingestion risk

15.2 Invasive Soil Assessment

The following conclusions can be made from the invasive soil assessment.

- GES are not aware of any tank decommissioning and it needs to be assumed that all tanks (identified or not identified) remain at the site.
- Site contamination findings are summarised:
    - Shallow soil impact has been identified in fill throughout the site within the top 0.3 to 0.4 m of the soil profile. Most of the identified impact is proposed to be excavated with a smaller amount to remain which is predominantly within guideline limits:
        - ESL exceedances have been identified based on a residential setting comprising benzo(a)pyrene and heavy oil compounds. Eight (8) exceedances are in the proposed excavation areas and three (3) which are to remain at the site beneath the new slab. Provided management measures are put in place, there is a LOW risk that the soil will present an environmental hazard;
        - EIL exceedances have been identified based on a residential setting comprising copper, nickel, zinc and lead. Ten (10) exceedances are in the proposed excavation areas and seven (7) which are to remain at the site beneath the new slab. Soil which is to remain at the site exceeds guidelines for copper and zinc. Provided management measures are put in place, there is a LOW risk that the soil will present an environmental hazard;
        - HIL B guidelines for assessing soil ingestion and dust inhalation risk are exceeded in six (6) samples at the site for assessing risk to future site users, of which all samples are proposed to be excavated except for BH4 0.5 m near the interceptor trap which exceeds HIL D. If the areas around the interceptor trap are excavated, there is an exposure risk to commercial workers, however based on available information, a risk to ongoing site users will be mitigated;
        - HSL D guidelines for assessing dermal contact risk to commercial workers have been identified in BH4 0.5 m near the interceptor trap (the same HIL D exceedance). Provided this impacted soil is removed, risk to future trench workers can be mitigated.
    - **Investigation Area A** – Other than the identified site fill, no impact has been identified in the truck service area nor around UST T3 and T4;
    - **Investigation Area B -** Other than the identified site fill, and impact around the interceptor trap, no impact has been identified. There remain data gaps in this Area B. Areas around former UST T1 and T2 as well as the nearby former bowser area have not been investigated given the presence of the building obstructions;

- **Investigation Area C** - has not been investigated given the presence of the building and infrastructure obstructions; and
- **Investigation Area D** – no soil impact has been identified in this area.
- Areas where data gaps have been identified will need to be addressed in a site contamination management plan (CMP);

- It has been identified that the bulk of the proposed excavated material averages out to Level 2 based on IB105 due to barium, lead, zinc and benzo(a)pyrene in the proposed excavation material. Barium is likely to be an artefact of background soils in the area and not a contaminant of concern at the site which may deem it as being classified Level 2. The bulk of the impact occurs in shallow fill material at the site, and care should be taken to scraping the top 0.3 m from the site and stockpiling is separately from the remaining deep excavations. This is likely to bring the bulk excavations below 0.3 m BGS to Level 1.

15.3 Potentially Contaminated Land Code

2015 Interim Statewide Planning Scheme codes for assessing development on contaminated site have been assessed.

15.3.1 Change of Use Standards

A contamination management plan (CMP) must be developed to manage contamination and associated risk to human health or the environment that will ensure the land is suitable for the intended use. Table 38 presents change of use standard performance criteria codes for assessing the proposed change of use from a commercial/industrial site to a residential development.

Table 37 Interim Planning Scheme Development Standard Codes for Proposed Site Excavation Works

Performance Criteria E2.5 P1 **Land is suitable for the intended use, having regard to:**	**Relevance**	**Management Options**	**Risk**
(a) an environmental site assessment that demonstrates there is no evidence the land is contaminated; or	Given management measures, the subject land is not deemed to present a contamination risk .	Management options are presented in a separated contamination management plan (CMP) document.	LOW
(b) an environmental site assessment that demonstrates that the level of contamination does not present a risk to human health or the environment; or	An ESA document has been produced which has adequately addressed all foreseeable data gaps relating to site contamination impact on human health or the environment.	Risks are identified as being LOW provided that the CMP is followed.	LOW
(c) a plan to manage contamination and associated risk to human health and the environment that includes:			
(i) an environmental site assessment;	Recommendations herein and a formalized contamination management plan	The CMP is to address potential environmental and human health risks	LOW
(ii) any specific remediation and protection measures required to be implemented before excavation commences; and	No specific remediation measures are recommended. Protection measures identified in the CMP.	Appropriate excavation management, protection measures and soil erosion controls identified in CMP.	LOW
(iii) a statement that the excavation does not adversely impact on human health or the environment.	Proposed excavation works will not adversely impact on human health or the environment given CMP management recommendations.	Excavation stormwater runoff and erosion control measures are presented within the CMP.	LOW

15.3.2 Development Standards

There are no acceptable solutions to developing on potentially contaminated lands. Table 38 presents development standard performance criteria codes for assessing proposed site excavation works.

Table 38 Interim Planning Scheme Development Standard Codes for Proposed Site Excavation Works

Performance Criteria E2.6.2 P1 **Excavation does not adversely impact on health and the environment, having regard to:**	**Relevance**	**Management Options**	**Risk**
(a) an environmental site assessment that demonstrates there is no evidence the land is contaminated; or	Given management measures, the subject land is not deemed to present a contamination risk.	Management options are presented in a separated contamination management plan (CMP) document.	LOW
(b) a plan to manage contamination and associated risk to human health and the environment that includes:			
(i) an environmental site assessment;	Recommendations herein and a formalized contamination management plan	The CMP is to address potential environmental and human health risks	LOW
(ii) any specific remediation and protection measures required to be implemented before excavation commences; and	No specific remediation measures are recommended. Protection measures identified in the CMP.	Appropriate excavation management, protection measures and soil erosion controls identified in CMP.	LOW
(iii) a statement that the excavation does not adversely impact on human health or the environment.	Proposed excavation works will not adversely impact on human health or the environment given CMP management recommendations.	Excavation stormwater runoff and erosion control measures are presented within the CMP.	LOW

16 RECOMMENDATIONS

When redevelopment work commences for the site, GES recommends that the following actions should be undertaken:

- A Contamination Management Plan will be required for the site to manage any potential risks during site works and should comply with the Hobart Interim Planning scheme.
- Further site assessment which should include but not be limited to;
    - All four USTs should be formally decommissioned as the USTs may present geotechnical hazards with ground instability issues if they remain. The removal of the USTs must comply with workplace standards and EPA reporting requirements. Note: The tank location plans should be used as a guide only and tank locations may be discerned by looking for signs of fill (sand or gravel), used to pack around the USTs;
    - Once USTs, associated infrastructure and surrounding soil have been removed the tank pits should be validated.
    - The interceptor trap should be removed, and remaining soil should be validated; and
    - Further investigations will be required under the footprint of the buildings, at a minimum in Area C for contamination.
- All excavated soil at the site should be stockpiled and assessed against IB105 guidelines for Classification and Management of Contaminated Soil for Disposal before it is transported to a licensed storage and handling facility for managing contaminated soil.
- Note the bulk of the contaminated soil impact occurs in shallow fill material. GES recommends separating stockpiles; and keeping the shallow material 0.0-0.4 m bgs separate. All remaining material is likely to be classified as Level 1 clean fill (with proof of analytical results).

Yours faithfully,

Sarah Joyce BSc (Hons)

Environmental Geologist

REFERENCES

Andrew and Mckellar design, 2017. Proposed Residential Unit Development – 66 Burnett Street, North Hobart for Hobart Properties & Securities Pty Ltd. And + design, Noosaville, Queensland (Aug, 2017).

ANZECC, 1992. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

ANZECC, 2000. *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*. Australian and New Zealand Environment and Conservation Council and National Health and Medical Research Council.

AS/NZS 1726:1993. Geotechnical Site Investigations. Standards Australia, 1993.

AS 4482:2005 Guide to the sampling and investigation of potentially contaminated soil – Part 1: Non-volatile and semi-volatile compounds, Standards Australia, 2005.

AS/NZS 5667.1:1998 Water quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples, Standards Australia, 1998.

AS/NZS 5667.11:1998 Water quality – Sampling, Part 11: *Guidance on the sampling of groundwater*, Standards Australia, 1998.

CRC CARE 2013, Petroleum Petroleum Vapour Intrusion assessment: Australian guidance, CRC CARE Technical Report no. 23, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

Davis, GB, Merrick, NP & McLaughlan, RG 2006, Protocols and techniques for characterising sites with subsurface petroleum hydrocarbons – a review, Technical Report no. 2, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

Davis, GB, Patterson, BM & Trefry, MG 2009a, Biodegradation of petroleum hydrocarbon vapours, Technical Report no. 12, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

Davis, GB, Wright, J & Patterson, BM 2009, Field assessment of vapours, CRC CARE Technical Report no. 13, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

Enrisks 2013. Review of Site Investigation Reports for 66 Regent Street, Sandy Bay. Environmental Risk Sciences. November 2013.

Freeze, R.A., and Cherry, J.A., 1979, Groundwater: Englewood Cliffs, NJ, Prentice-Hall, 604 p.

Friebel, E & Nadebaum, 2011, 'Health screening levels for petroleum hydrocarbons in soil and groundwater. Part 1: Technical development document', CRC for Contamination Assessment and Remediation of the Environment, CRC CARE Technical Report no. 10, Adelaide.

GES 2017. *Preliminary Environmental Site Assessment* 281a Elizabeth Street, North Hobart. Geo-Environmental Solutions. July 2017.

NEPC, 1999. Guideline on Data Collection, Sample Design and Reporting Schedule B (2), National Environmental Protection Measure (Assessment of Site Contamination), National Environment Protection Council, 1999. Measures as amended, taking into account amendments up to National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)

NEPM, 1999.Guideline on Investigation Levels for Soil and Groundwater, Schedule B (1), National Environment Protection (Assessment of Site Contamination) Measure, National Environment Protection Council, 1999. Measures as amended, taking into account amendments up to National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)

Queensland Government Natural Resources and Water 'Land Series' bulletin, Measuring Salinity. 2007. Managing Queensland's natural resources for today and tomorrow.

SGS, 2017: Waterloo Membrane Sampler *Installation Methodology*. SGS Environment, Health and Safety: www.sgs.com.au. December 2017.

LIMITATIONS STATEMENT

This monitoring Report has been prepared in accordance with the scope of services between Geo-Environmental Solutions Pty. Ltd. (GES) and Hobart Properties & Securities Pty Ltd ('the Client'). To the best of GES's knowledge, the information presented herein represents the Client's requirements at the time of printing of the Report. However, the passage of time, manifestation of latent conditions or impacts of future events may result in findings differing from that described in this Report. In preparing this Report, GES has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations referenced herein. Except as otherwise stated in this Report, GES has not verified the accuracy or completeness of such data, surveys, analyses, designs, plans and other information.

The scope of this study does not allow for the review of every possible soil and groundwater contaminant over the whole area of the site. Samples collected from the investigation area are assumed to be representative of the areas from where they were collected and indicative of the contamination status of the site at that point in time. The conclusions described within this report are based on these samples, the results of their analysis and an assessment of their contamination status.

This report does not purport to provide legal advice. Readers of the report should engage professional legal practitioners for this purpose as required.

No responsibility is accepted for use of any part of this report in any other context or for any other purpose by third party.

Appendix 1 GES Staff

Geo-Environmental Solutions (GES) is a specialist geotechnical and environmental consultancy providing advice on all aspects of soils, geology, hydrology, and soil and groundwater contamination across a diverse range of industries.

Geo Environmental Solutions Pty Ltd:

- ACN – 115 004 834
- ABN – 24 115 004 834

GES STAFF - ENGAGED IN SITE INVESTIGATION WORKS

Dr John Paul Cumming B.Agr.Sc (Hons) Phd CPSS GAICD

- Principle Author and Principle Environmental Consultant
- PhD in Environmental Soil Chemistry from the University of Tasmania in 2007
- 15 years' experience in environmental contamination assessment and site remediation.

Ms Sarah Joyce BSc (Hons)

- Senior Environmental Scientist
- Honours in Geography and Environmental Science at the University of Tasmania in 2003;
- Undergraduate Degree Double Major in Geology and Geography & Environmental Science
- 15 years professional work experience and six years contaminated site assessment

Mr Kris Taylor Bsc (Hons)

- Senior Environmental & Engineering Geologist
- Honours in Environmental Geology at the University of Tasmania in 1998
- 15 years' experience in environmental contamination assessments and hydrogeology (including honours in mine site tailing pollution assessment)

Mr Aaron Plummer(Cert. IV)

- Soil Technician
- 3 years' experience in hydrocarbon and heavy metal contamination sampling of soils and groundwater.

GES STAFF – WITH CONTAMINATED SITES EXPERIENCE

Mr Grant McDonald (Adv. cert. hort.)

- Soil Technician
- 6 years' experience in hydrocarbon and heavy metal contamination sampling of soils and groundwater.

Appendix 2 Proposed Residential Unit Development Plans

PROPOSED RESIDENTIAL UNIT DEVELOPMENT

66 BURNETT ST
NORTH HOBART
FOR
HOBART PROPERTIES & SECURITIES PTY LTD

DRAWING SCHEDULE

1.0 TITLE PAGE AND DRAWING SCHEDULE
1.1 LEVEL1
1.2 LEVEL 2
1.3 LEVEL 3
1.4 LEVEL4
1.5 LEVEL5
1.6 LEVEL6
1.7 LEVEL 7
1.8 ROOF PLAN
2.1 ELEVATIONS 1
2.2 ELEVATIONS 2
3.1 SECTION A

no.	date	amendments

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andrew mckellar design
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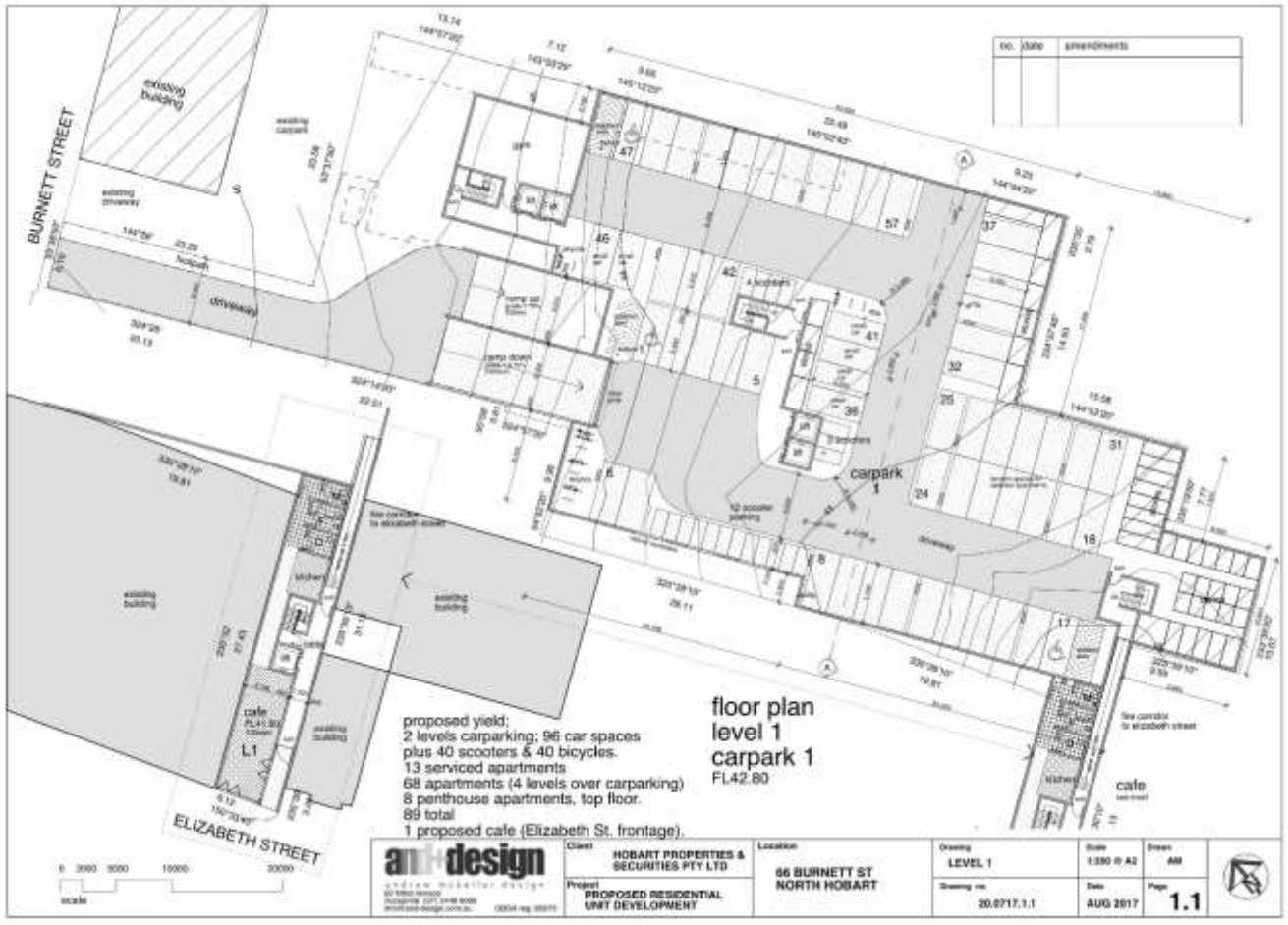
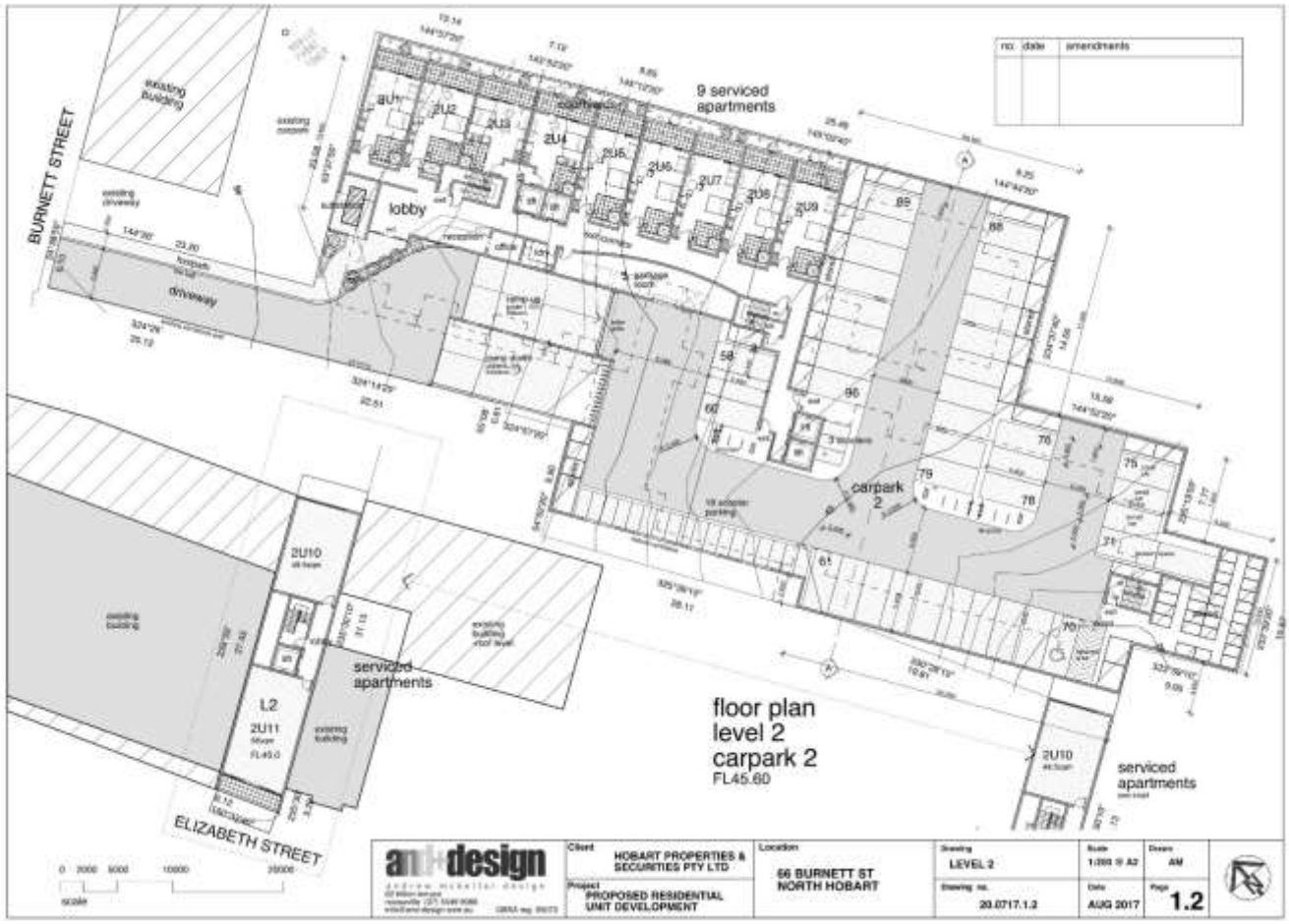
noosaville (07) 5449 9066
www.and-design.com.au
info@and-design.com.au

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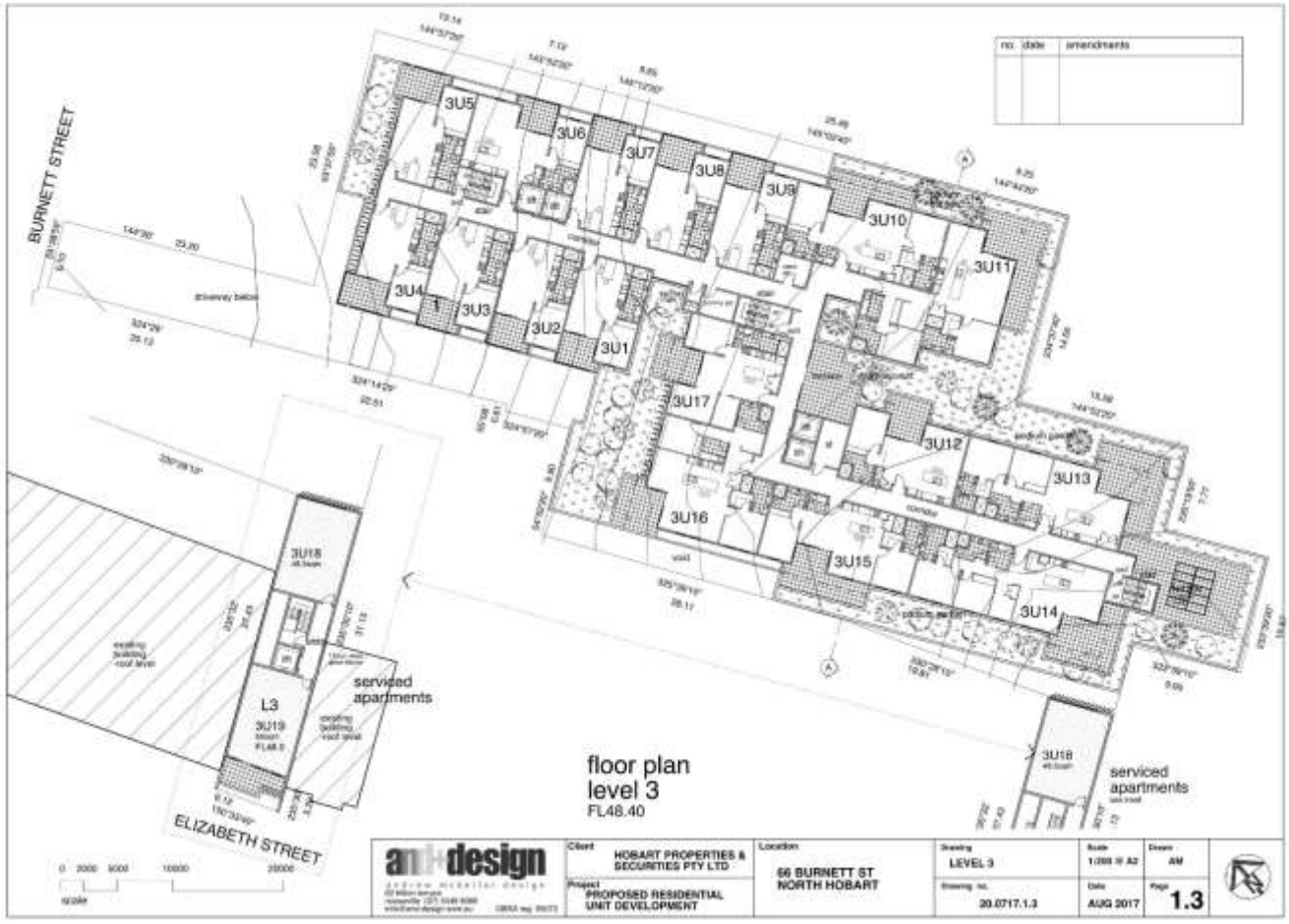
9 serviced apartments
lobby
driveway
carpark 2
serviced apartments
L2
2U11
ELIZABETH STREET
floor plan
level 2
carpark 2
FL45.60
serviced apartments
HOBART PROPERTIES & SECURITIES PTY LTD
PROPOSED RESIDENTIAL UNIT DEVELOPMENT
66 BURNETT ST NORTH HOBART
LEVEL 2
20.0717.1.2
AUG 2017
1.2


BURNETT STREET
serviced apartments
L3
3U19
ELIZABETH STREET
floor plan
level 3
FL48.40
serviced apartments
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PROPOSED RESIDENTIAL UNIT DEVELOPMENT
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LEVEL 3
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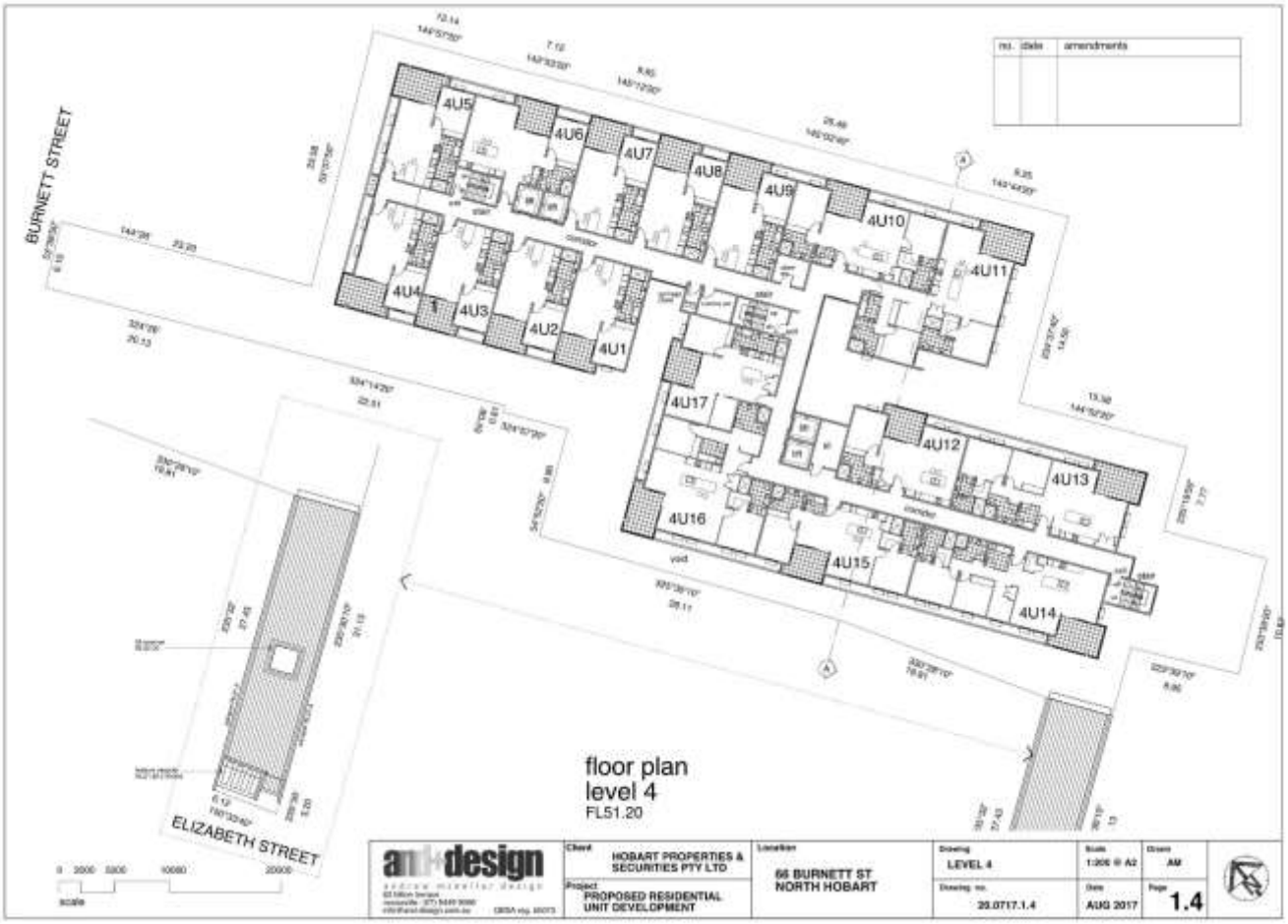
BURNETT STREET
ELIZABETH STREET
4U1
4U2
4U3
4U4
4U5
4U6
4U7
4U8
4U9
4U10
4U11
4U12
4U13
4U14
4U15
4U16
4U17
floor plan
level 4
FL51.20
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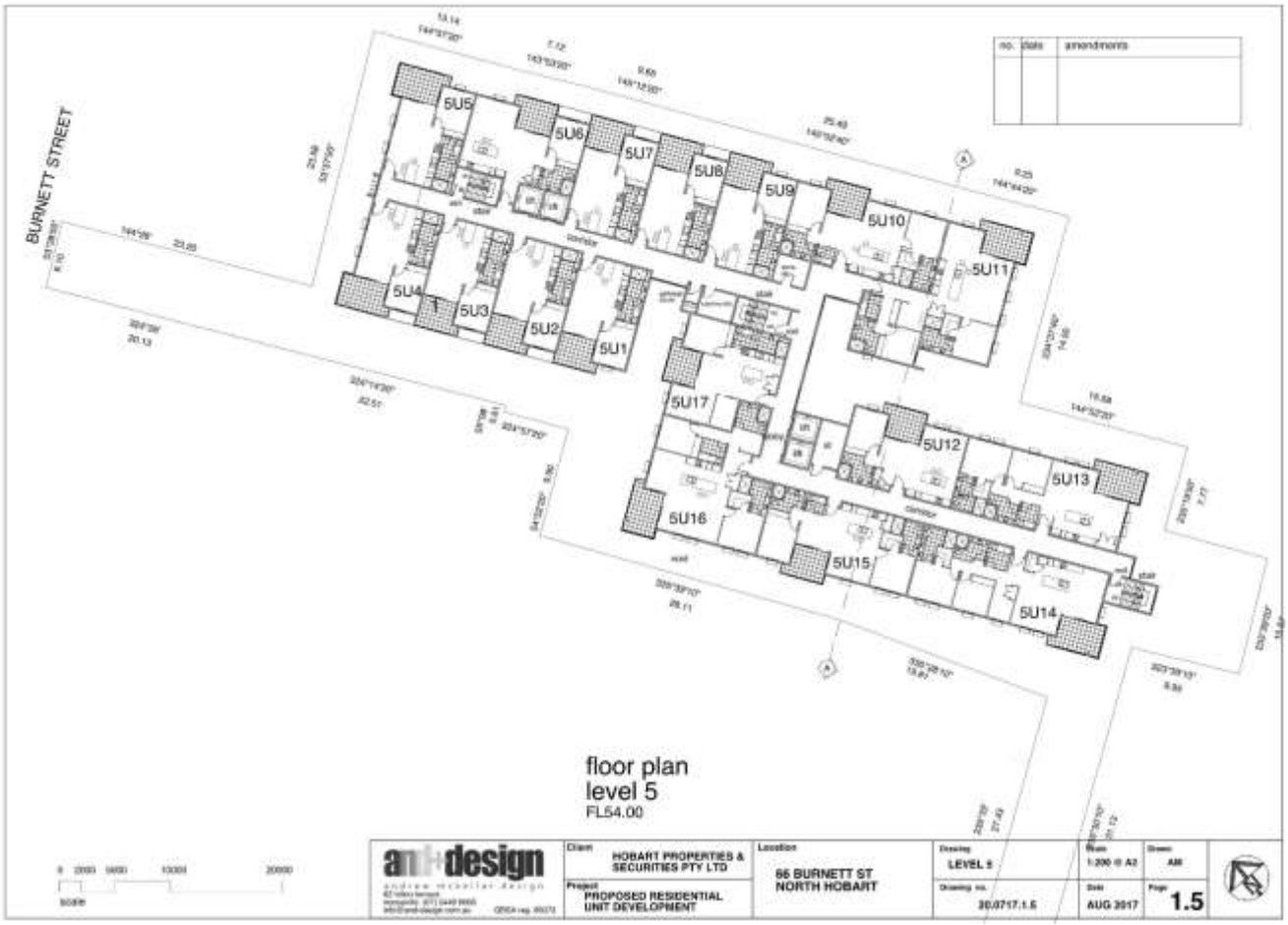
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5U1
5U2
5U3
5U4
5U5
5U6
5U7
5U8
5U9
5U10
5U11
5U12
5U13
5U14
5U15
5U16
5U17
floor plan
level 5
FL54.00
HOBART PROPERTIES & SECURITIES PTY LTD
PROPOSED RESIDENTIAL UNIT DEVELOPMENT
66 BURNETT ST NORTH HOBART
LEVEL 5
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AUG 2017
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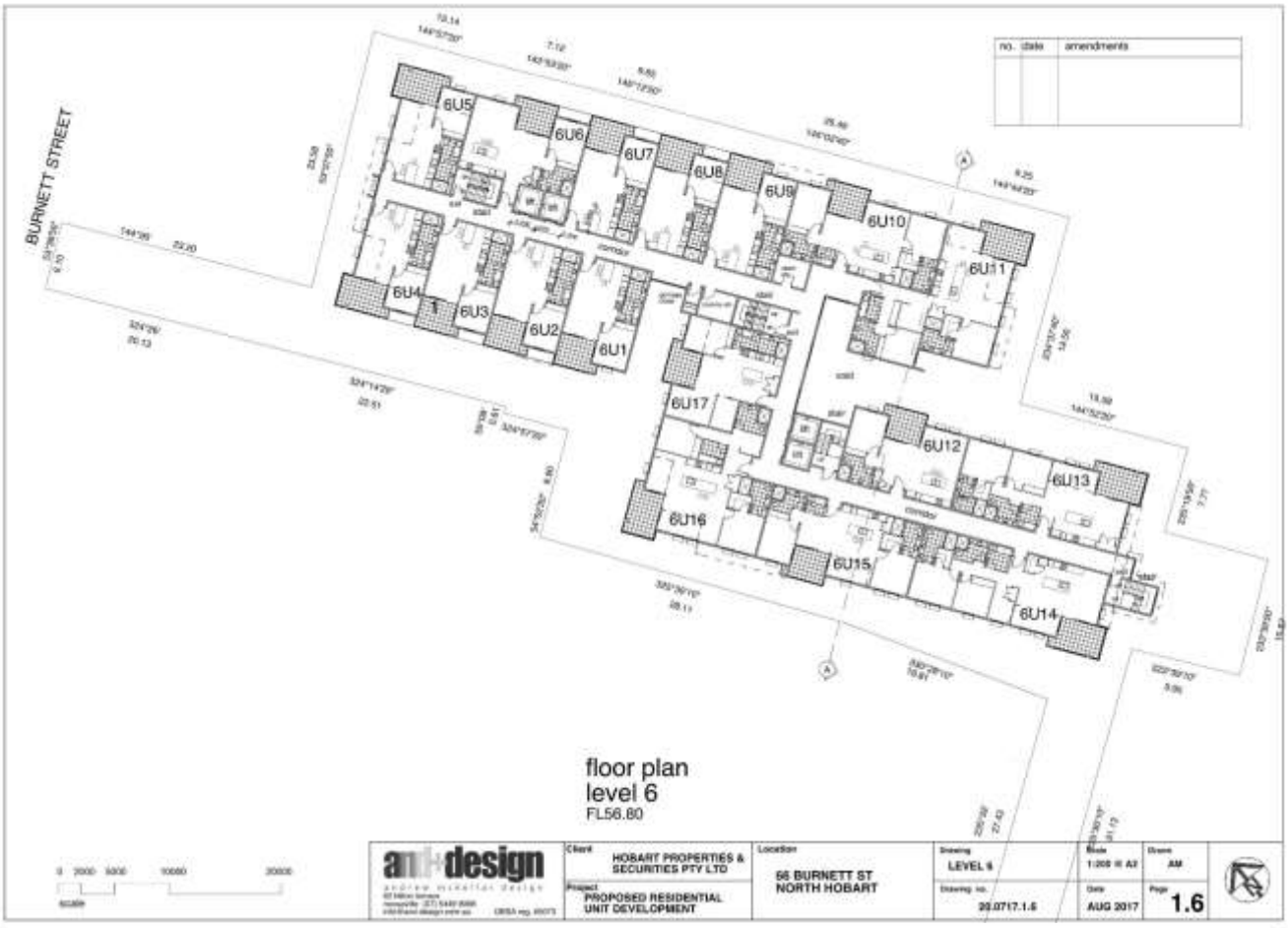
BURNETT STREET
6U1
6U2
6U3
6U4
6U5
6U6
6U7
6U8
6U9
6U10
6U11
6U12
6U13
6U14
6U15
6U16
6U17
floor plan
level 6
FL56.80
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PROPOSED RESIDENTIAL UNIT DEVELOPMENT
66 BURNETT ST NORTH HOBART
LEVEL 6
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AUG 2017
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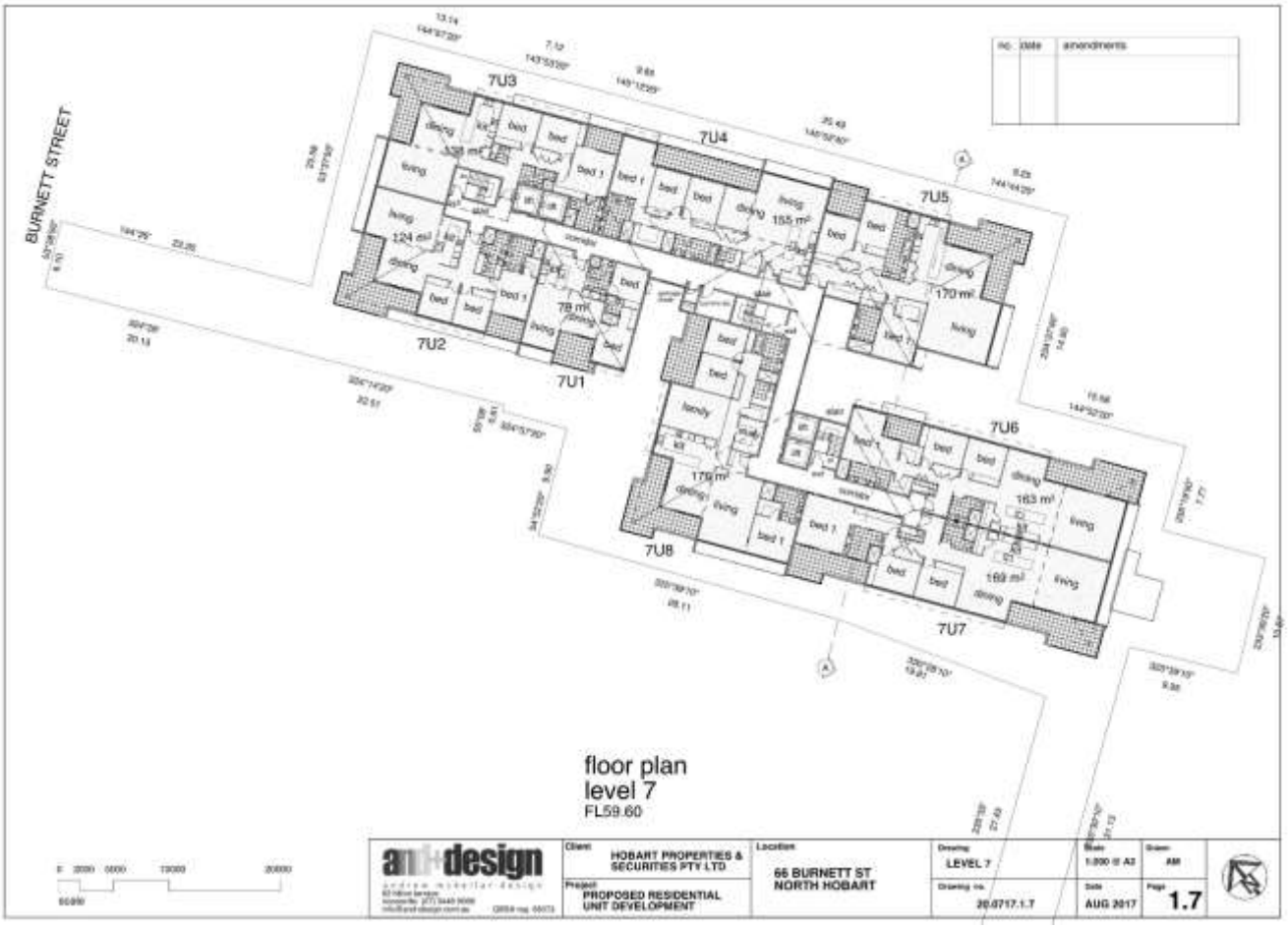
BURNETT STREET
7U1
7U2
7U3
7U4
7U5
7U6
7U7
7U8
floor plan
level 7
FL59.60
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PROPOSED RESIDENTIAL UNIT DEVELOPMENT
66 BURNETT ST NORTH HOBART
LEVEL 7
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AUG 2017
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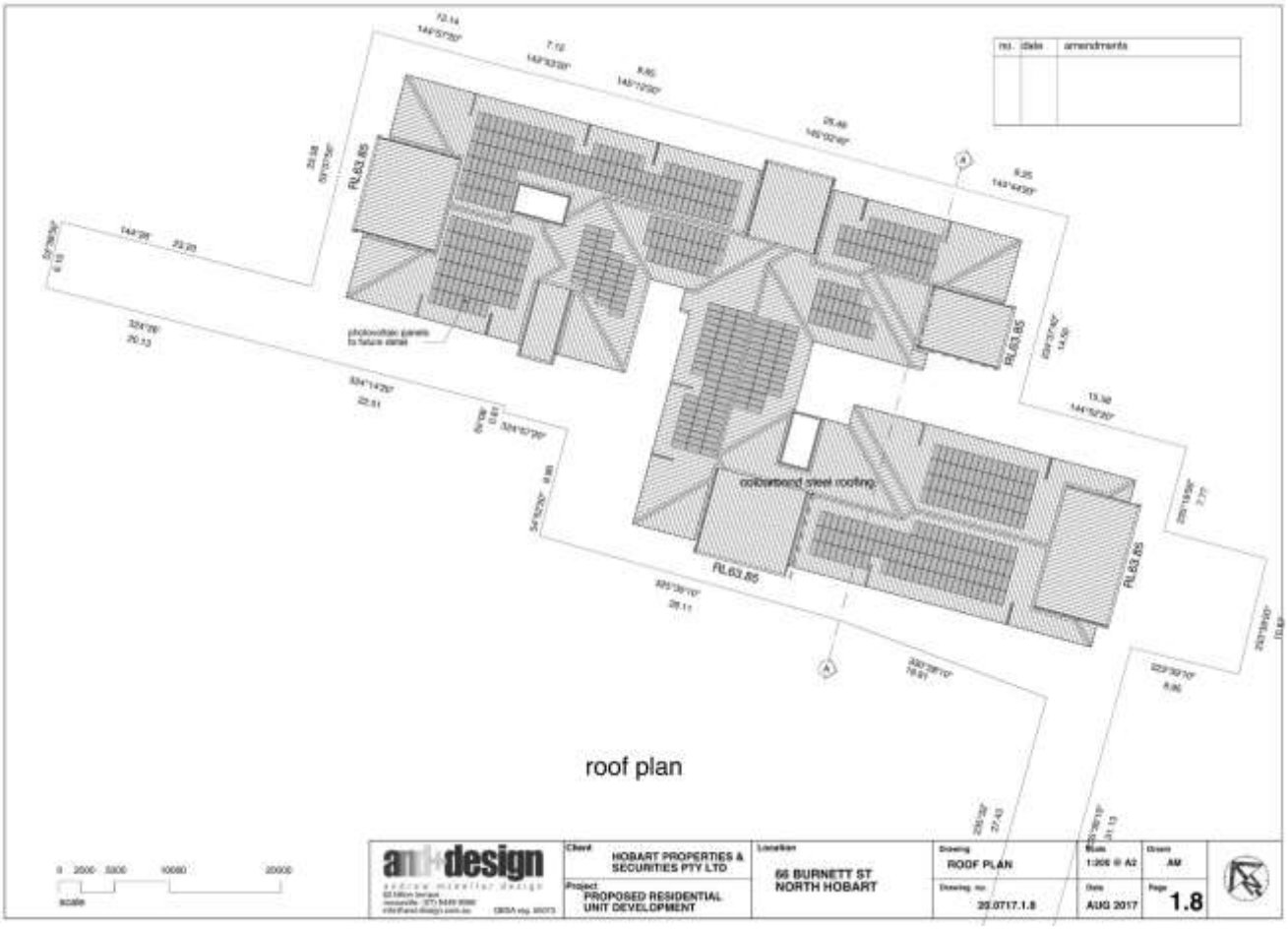
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colorbond steel roofing
RL63.85
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ROOF PLAN
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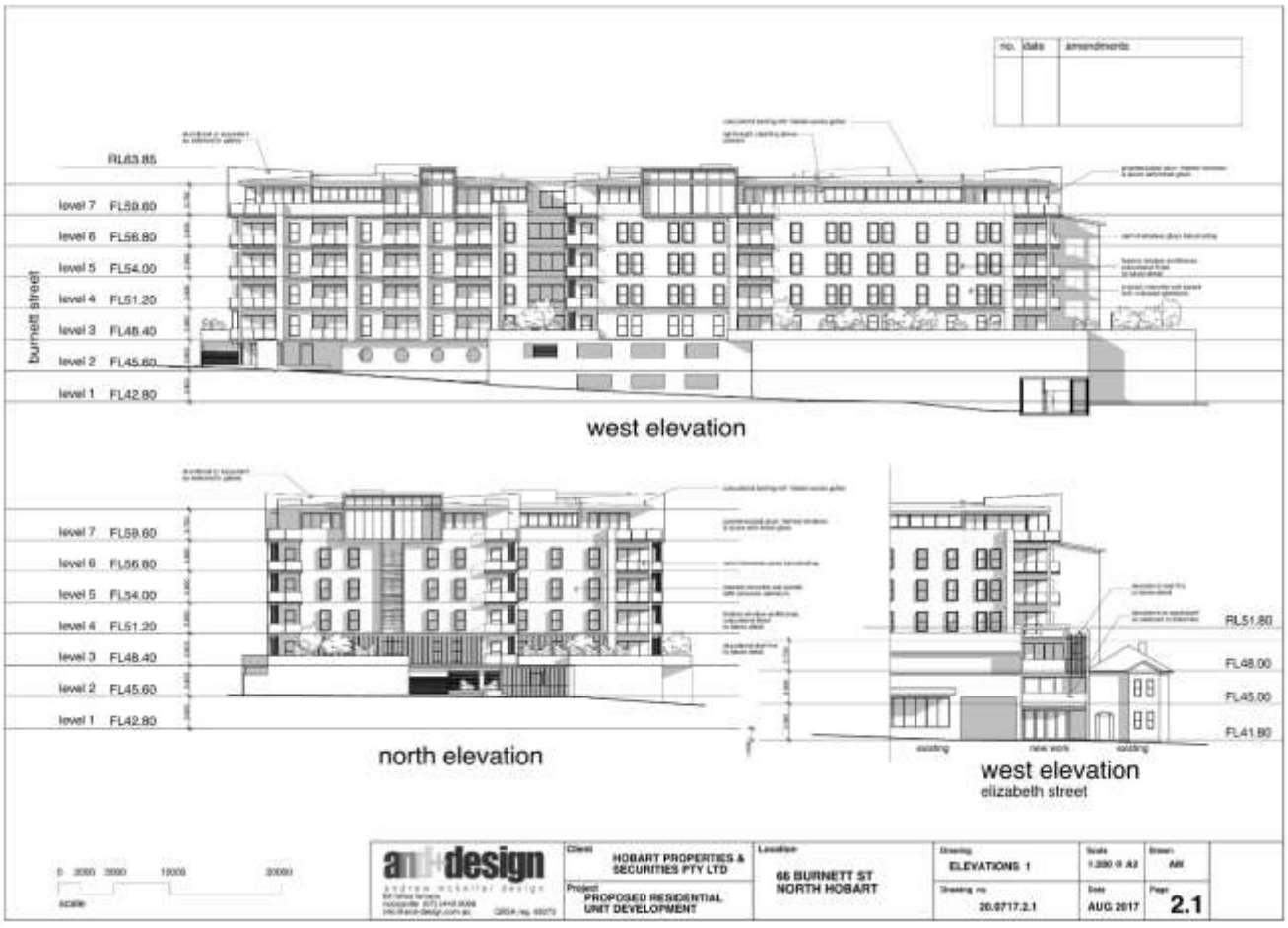
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north elevation
west elevation
elizabeth street
burnett street
level 7 FL59.60
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level 2 FL45.60
level 1 FL42.80
RL63.85
RL51.80
FL48.00
FL45.00
FL41.80
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AUG 2017
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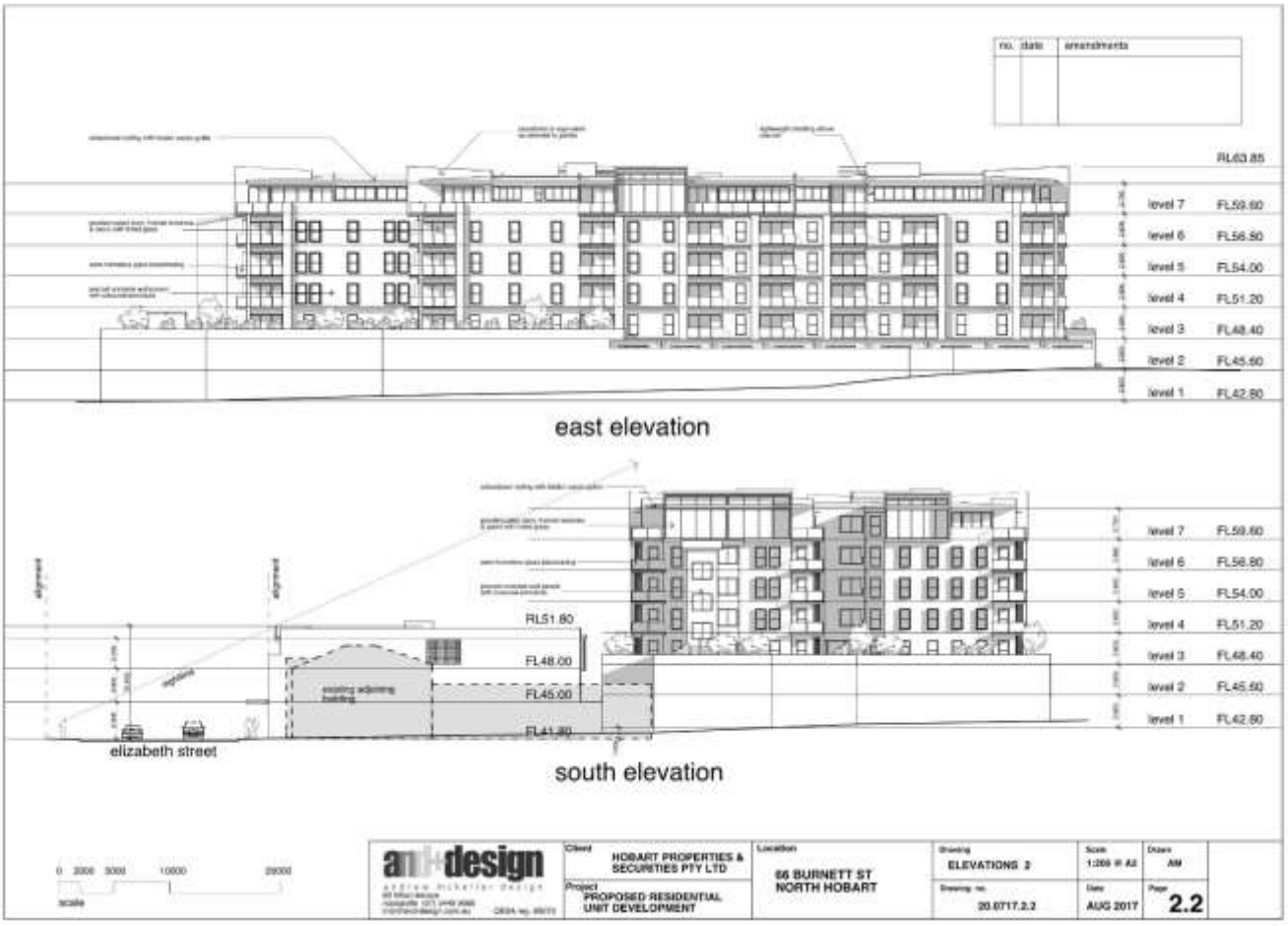
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level 6 FL56.80
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level 4 FL51.20
level 3 FL48.40
level 2 FL45.60
level 1 FL42.80
east elevation
RL51.80
FL48.00
FL45.00
FL41.80
existing adjoining building
elizabeth street
south elevation
andrew mcarthur design
HOBART PROPERTIES & SECURITIES PTY LTD
PROPOSED RESIDENTIAL UNIT DEVELOPMENT
66 BURNETT ST NORTH HOBART
ELEVATIONS 2
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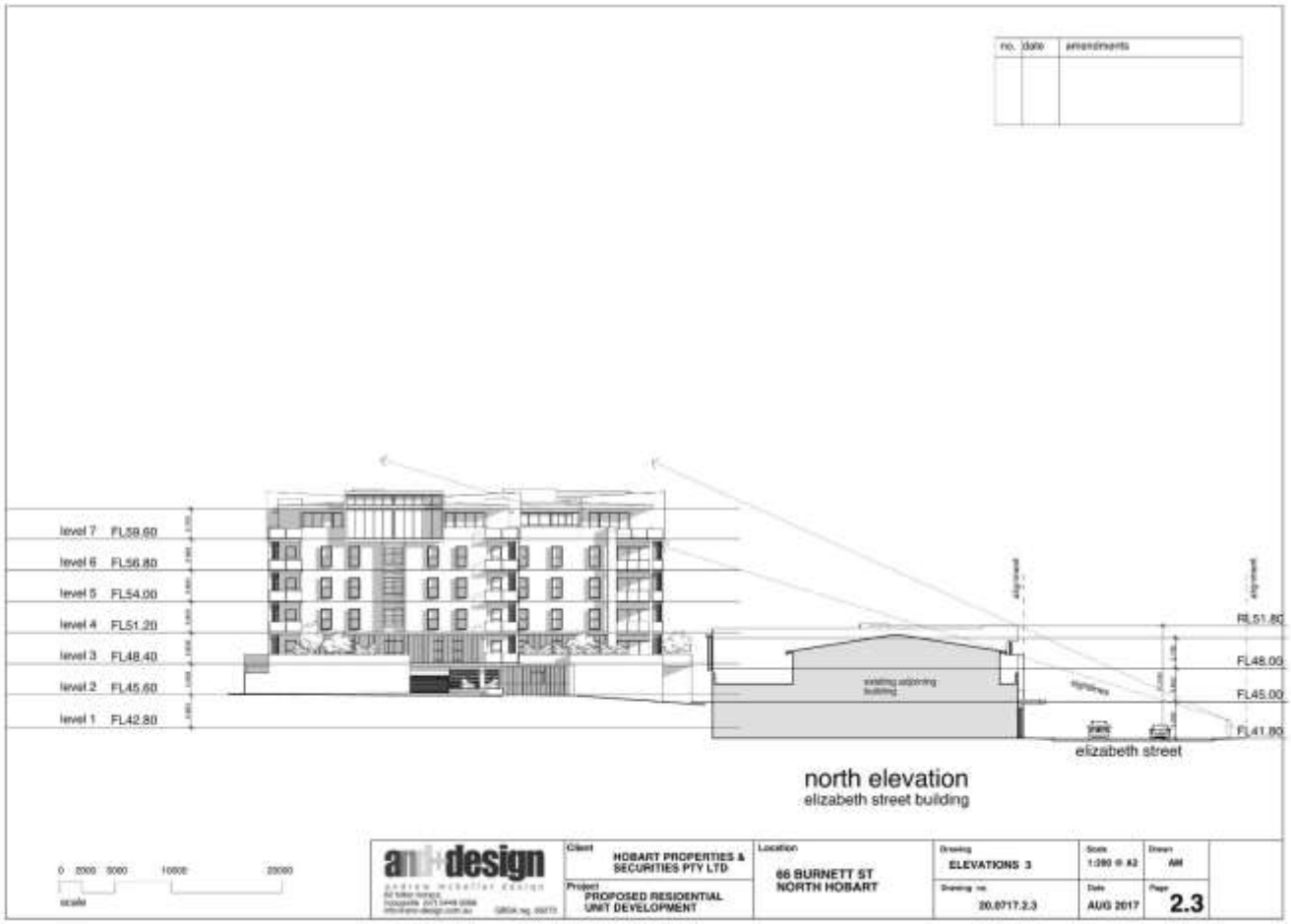
AUG 2017
AM
2.2
scale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level 1 FL42.80
RL51.80
FL48.00
FL45.00
FL41.80
existing adjoining building
elizabeth street
north elevation
elizabeth street building
andrew mcarthur design
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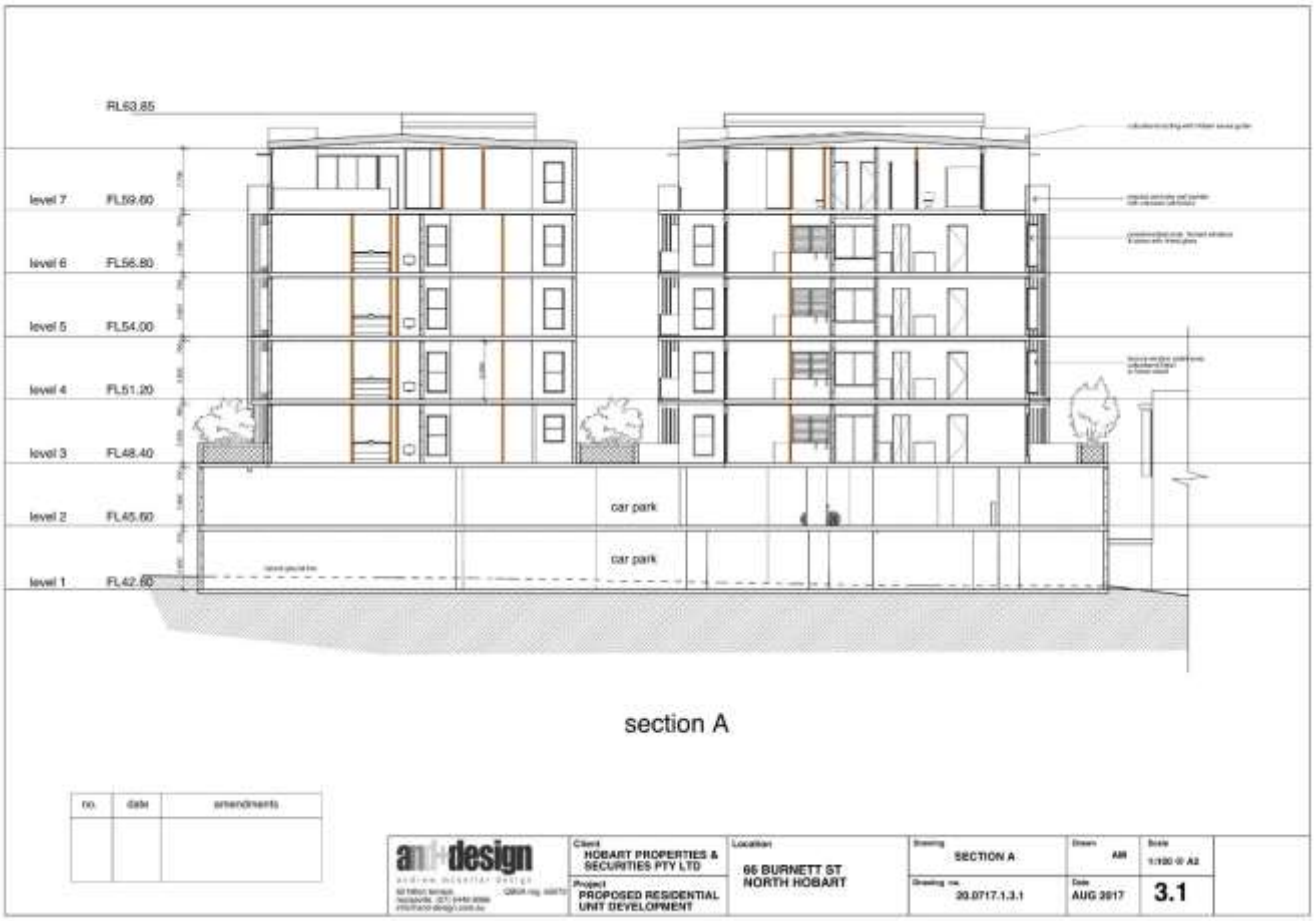

section A

no.	date	amendments

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Type 1

1 BR

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Units 5U1,5U2,5U3,5U4, 5U5,5U7,5U8,5U9
Units 6U1,6U2,6U3,6U4, 6U5,6U7,6U8,6U9

Type 2A

1 BR plus

Units 3U6,4U6, 5U6,6U6

Type 3

1 BR plus study

Units 3U17,4U17, 5U17,6U17

Type 4

2 BR

Units 3U10,3U15,4U10,4U15 5U10,5U15,6U10,6U15

Type 2B

1 BR plus

Units 3U12,4U12, 5U12,6U12

Type 5

2 BR plus

Units 3U13,4U13,5U13,6U13

typical floor plans

no.	date	amendments

andrewwheatland design	Client: HOBART PROPERTIES & SECURITIES PTY LTD Project: PROPOSED RESIDENTIAL UNIT DEVELOPMENT	Location: 66 BURNETT ST NORTH HOBART	Drawing: TYPICAL FLOOR PLANS	Drawn: AM	Scale: 1:100 @ A2	
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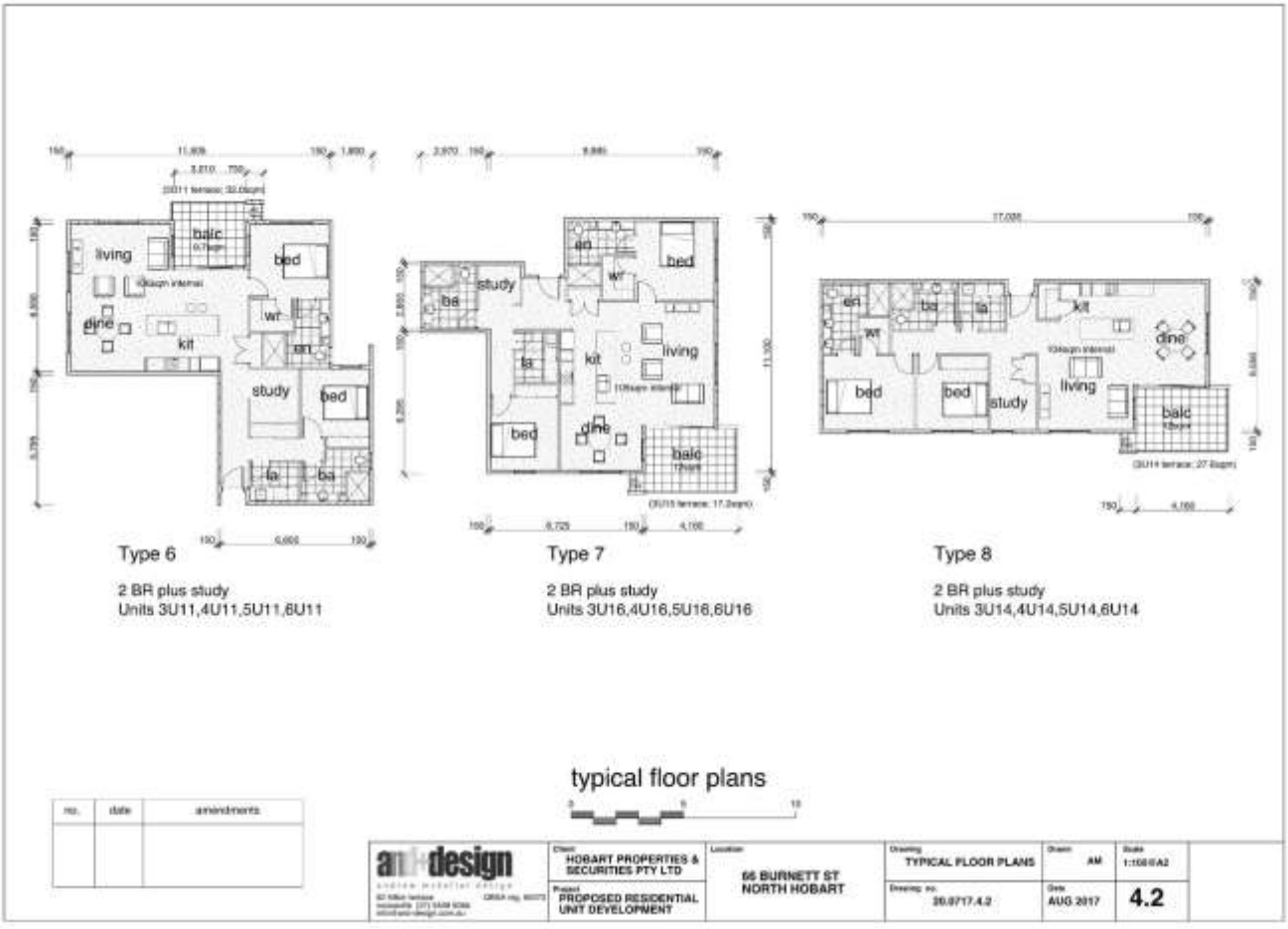
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study
bed
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ba
Type 6
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balc
Type 7
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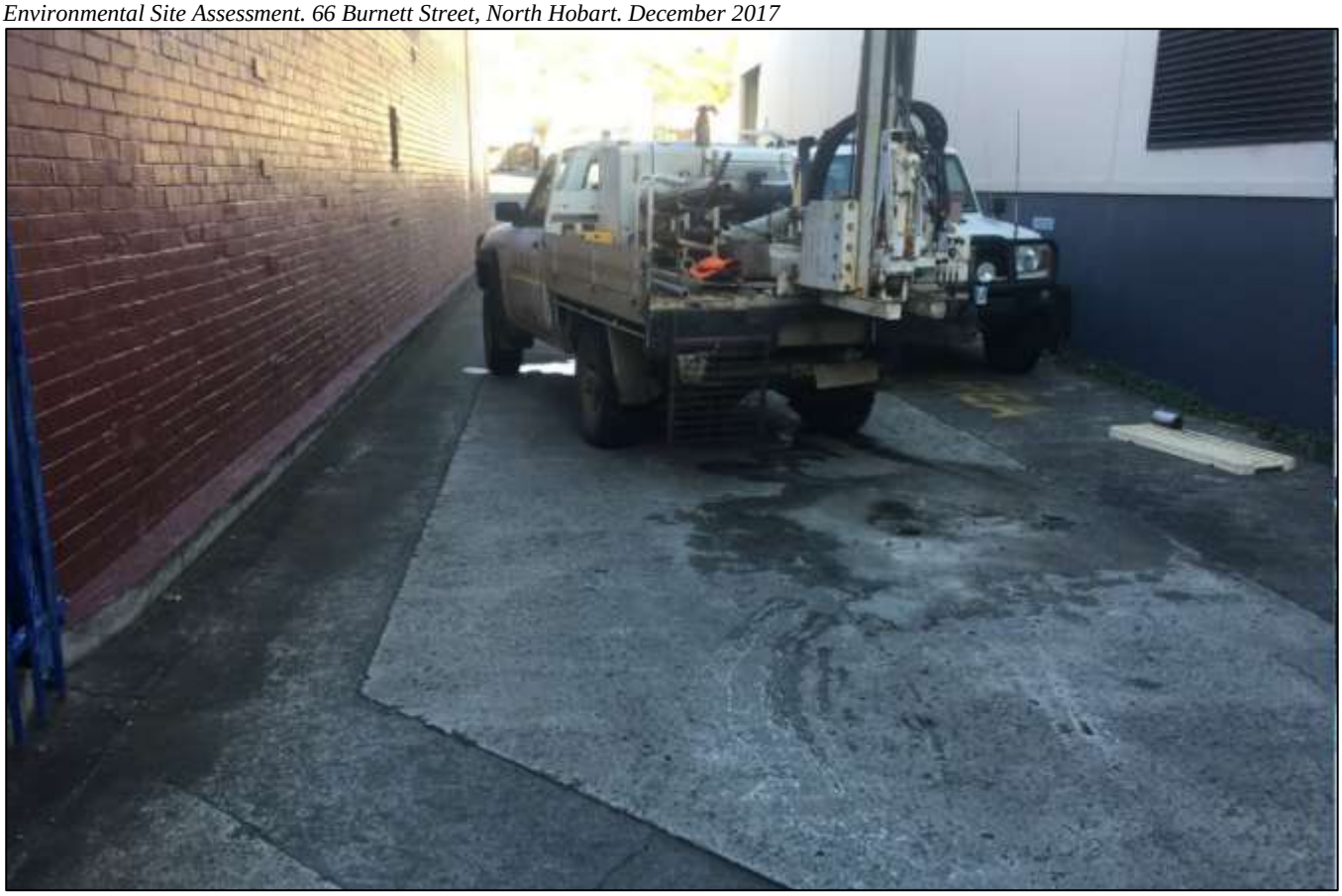
kit
wr
dine
bed
bed
study
living
balc
Type 8
2 BR plus study
Units 3U14,4U14,5U14,6U14
typical floor plans
no.
date
amendments
design
HOBART PROPERTIES & SECURITIES PTY LTD
PROPOSED RESIDENTIAL UNIT DEVELOPMENT
66 BURNETT ST NORTH HOBART
TYPICAL FLOOR PLANS
AM
AUG 2017
4.2

Appendix 3 Site Photographs

Location of BH2

Location of BH1

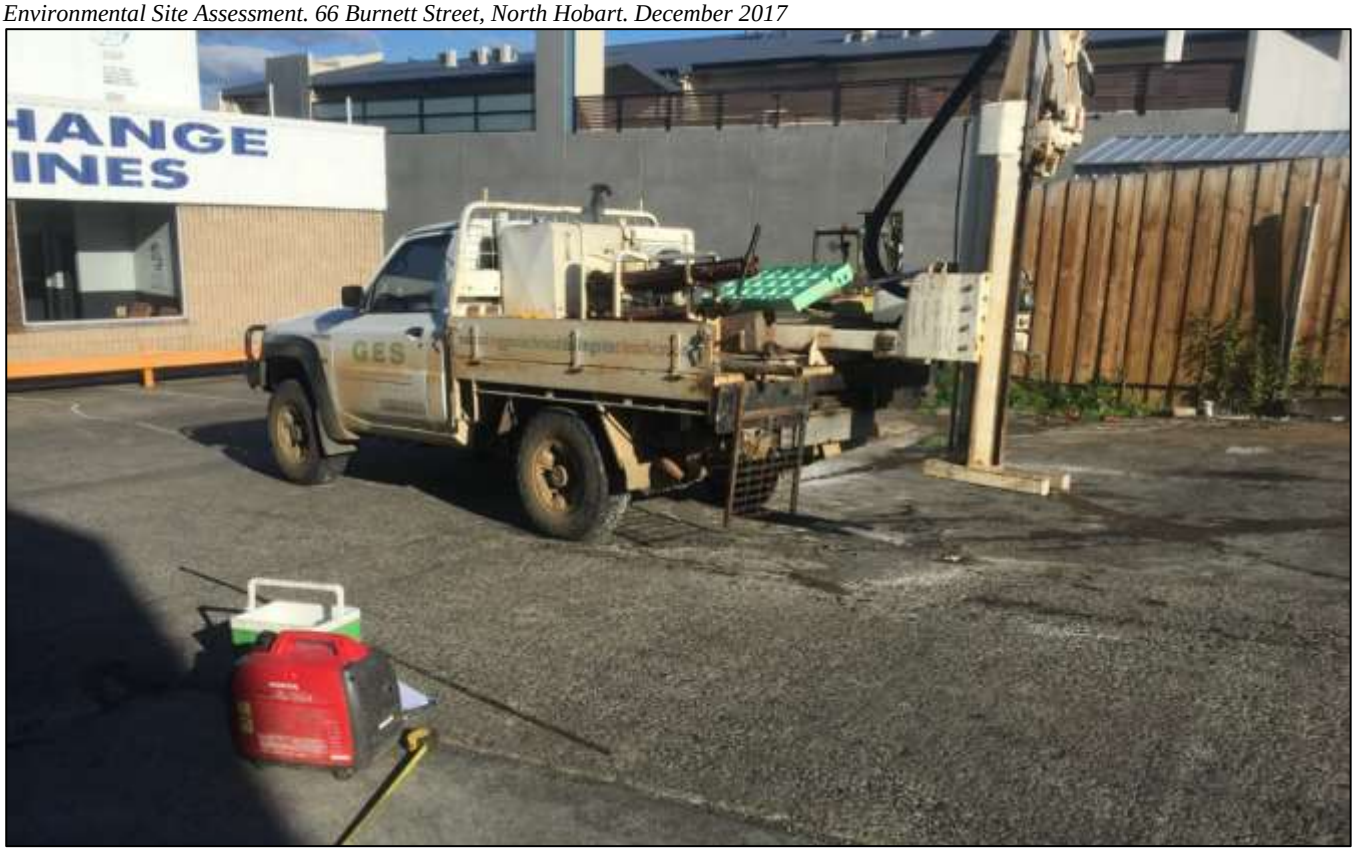


Location of BH3

Interceptor Trap

Interceptor Trap

View north, adjacent to office building, location of BH adjacent interceptor trap



Location of USTs – T3 and T4

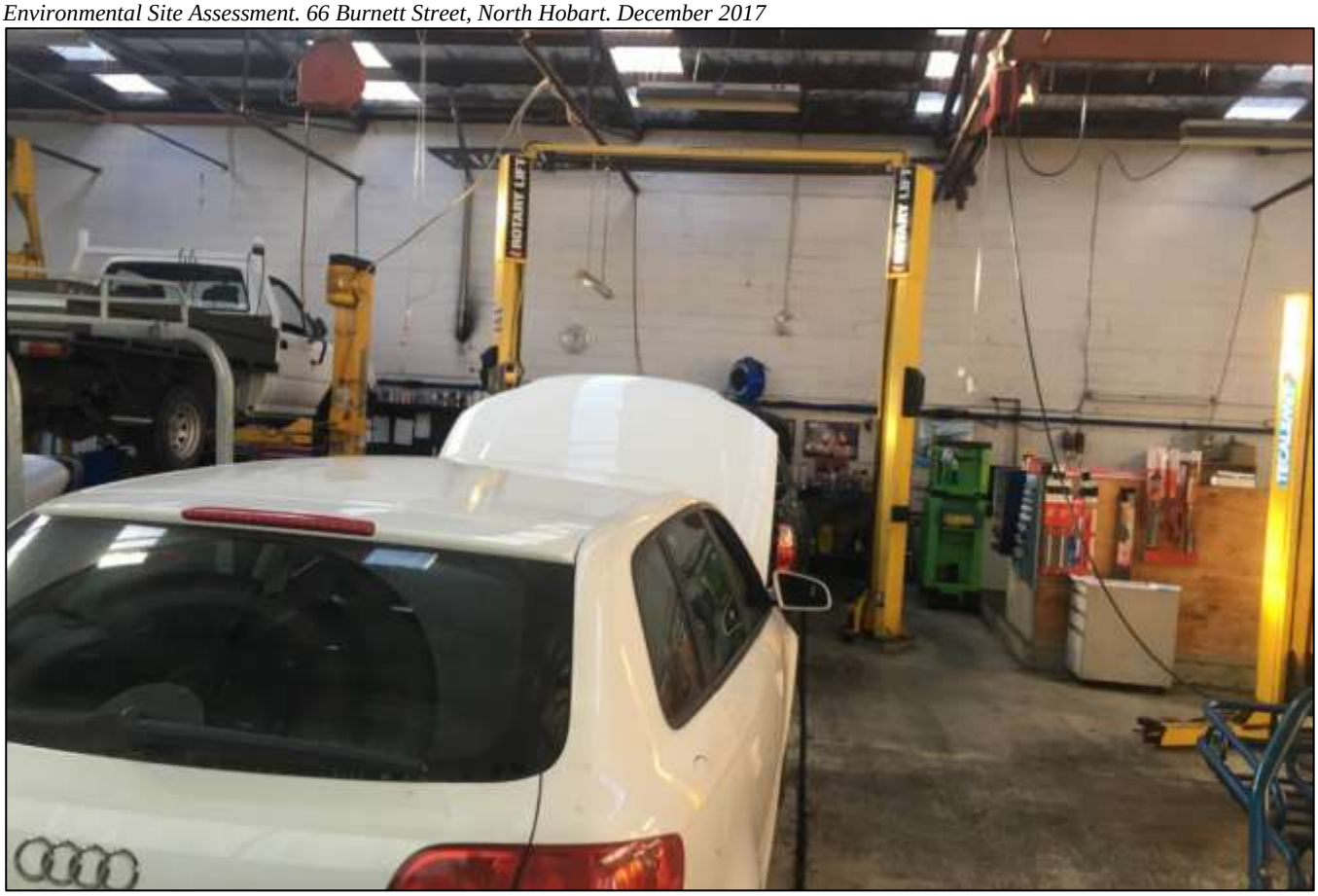
Location of BH10

Location of BH10

Site Office

View South from Interceptor Trap

Workshop



Workshop

Vehicle Service Pit, Location of BH11

Appendix 4 Laboratory Chain of Custody (COC) and Sample Receipt Notification

CHAIN OF CUSTODY (ALS)

ALS Laboratory: please tick →

FREIGHT **URGENT**

CLIENT:	Geoenvironmental Solutions
OFFICE:	29 Kirksway Place, Battery Point, 7004
PROJECT:	Gorringe
ORDER NUMBER:	
PROJECT MANAGER:	Kris Taylor ~~Sarah Joyce~~ — CONTACT PH: 0438255259
SAMPLER:	Aaron Plummer — SAMPLER MOBILE:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):
Email Reports to:	sjoyce@geosolutions.net.au jcumming@geosolutions.net.au ktaylor@geosolutions.net.au
Email Invoice to:	jcumming@geosolutions.net.au; miran@geosolutions.net.au, sjoyce@geosolutions.net.au

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) — ☒ Standard TAT (List due date): 3 days; ☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: N/A

COC SEQUENCE NUMBER (Circle) — COC: (1) 2 3 4 5 6 7; OF: 1 (2) 3 4 5 6 7

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
SS/AP			Marvu (An)
DATE/TIME: 11/12/17	DATE/TIME:	DATE/TIME:	DATE/TIME: 12/12, 10:10

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	TPH/BTEX/PAH	15 Metals					Hold	Extract & Hold	Additional Information
1	BH12 0.5m	11/12/17	Soil	jar	1	✓	✓							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
2	BH12 1.0m				1	✓	✓							
3	BH13 0.4-0.5m				1	✓	✓							
4	BH14 0.3-0.4m				1	✓	✓							
5	BH14 1.0-1.1m				1	✓	✓							
6	BH15 0.5-0.6m				1	✓	✓							
7	BH16 1.0-1.1m				1	✓	✓							
8	BH16 2.0-2.1m				1	✓	✓							
9	BH16 2.9-3.0m				1	✓	✓							
10	BH17 0.5-0.6m				1	✓	✓							
11	BH17 1.9-2.0m				1	✓	✓							
12	BH18 0.2-0.3m				1	✓	✓							
				TOTAL	12									

Environmental Division Melbourne
Work Order Reference
EM1717027
Telephone: + 61-3-8549 9600

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass.
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY

ALS Laboratory: please tick →

Sydney: 277 Woodpark Rd, Smithfield NSW 2170 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
Brisbane: 32 Shand St, Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph: 07 4796 0600 E: samples.townsville@alsenviro.com
Melbourne: 24 Westall Rd, Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E: samples.adelaide@alsenviro.com
Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: samples.launceston@alsenviro.com

CLIENT:	Geoenvironmental Solutions	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	★ Standard TAT (List due date): 3 days	FOR LABORATORY USE ONLY (Circle)	
OFFICE:	29 Kirksway Place, Battery Point, 7004		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	Yes / No / N/A
PROJECT:	66 Burnett	ALS QUOTE NO.: N/A	COC SEQUENCE NUMBER (Circle)	Free ice/cooling agents present upon receipt?	Yes / No / N/A
ORDER NUMBER:			COC: 1 2 3 4 5 6 7	Random Sample Temperature Record:	°C
PROJECT MANAGER:	Kris Taylor-Joyce	CONTACT PH: 0438255259	OF: 1 2 3 4 5 6 7	Other comments:	
SAMPLER:	Aaron Cumming	SAMPLER MOBILE:	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY: Ronnie (ALS)
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	DATE/TIME:	DATE/TIME:	DATE/TIME:	DATE/TIME: 12/12 10:00
Email Reports to:	sjoyce@geosolutions.net.au jcumming@geosolutions.net.au					
Email Invoice to:	jcumming@geosolutions.net.au; miran@geosolutions.net.au, sjoyce@geosolutions.net.au					

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS (MATRIX: Solid(S) Water(W))			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) (Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).)								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	TPH/BTEX/PAH	15 Metals					Hold	Extract & Hold	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	BH18 0.9-1.0m	11/12/17	Soil	Jar	1	✓	✓							
14	BH19 0.2-0.3m				1	✓	✓							
15	BH19 0.9-1.0m				1	✓	✓							
16	BH20 0.5m				1	✓	✓							
17	BH21 0.5m				1	✓	✓							
18	Duplicate				1	✓	✓							
19	Rinsate	✓	Water	2SAV,1AG,1AP	4	✓	✓							
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass.
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

Rebatch

Client / Client code: Geo Environmental Solutions
Project: Gorringe
Project Manager: Kris Taylor / Sarah Joyce
Date /time sample rec: Tuesday, 12 December 2017
Date/time Instructions rec: 15/12/17 @ 3:45pm
Due date: Tuesday 19th December
Due date surcharge: 2 day TAT - approved by Sam

CS Contact: **C.Walsh**
Additional Information:
sample 17 (BH21 0.5m) is sample ID but for rebatch client requested it be called Duplicate. Client is aware that volatile TPH may be compromised

URGENT

Sample information							Analysis								
							Standard					Leach				
New Lab ID	Client ID	Sampling Date / Time	Previous Work Order Reference	Previous ALS ID	Tray Number(s)	Container	Number of Containers	S3 (15 metals)	S7 (TPH/BTEX/PAH)							Shortest Holding time expiry
	Duplicate	12/12/2017 0:00	EM1717027	17	MS: 4424-4425	250ml Jar	1	X	X							26-Dec-17
							1									

Environmental Division
Melbourne
Work Order Reference
EM1717330

Telephone : +61-3 8549 9600

COC Melbourne

From: Carol Walsh
Sent: Friday, 15 December 2017 4:28 PM
To: COC Melbourne
Subject: Re-batch RE: EM1717027 - GEOENVSOL - Gorringe - 2 day TAT
Attachments: EM1717027 - REBATCH.xlsm

Importance: High

SR

Please organise attached rebatch

Regards

Carol

From: Sarah Joyce [mailto:sjoyce@geosolutions.net.au]
Sent: Friday, 15 December 2017 3:45 PM
To: Carol Walsh <Carol.Walsh@alsglobal.com>
Cc: JP Cumming <jcumming@geosolutions.net.au>; Kris Taylor <ktaylor@geosolutions.net.au>
Subject: re-batch RE: EM1717027 - GEOENVSOL - Gorringe

Hi Carol,

As discussed, please collect a second sample from BH21 0.5m, your ID EM171027017 and rename it Duplicate.

As per the primary sample please analyse for TPH/BTEX/PAH and 15 Metals.

As will the primary samples, we need a quick turnaround. Please provide results as soon as practically possible. I understand there will be an additional charge associated with a rapid turnaround.

Thanks very much for your help.

Kind Regards,

Sarah Joyce
GEO-ENVIRONMENTAL SOLUTIONS P/L
29 Kirksway Place, Battery Point, 7004
P: 0362231839
E: sjoyce@geosolutions.net.au

From: Carol Walsh [mailto:Carol.Walsh@alsglobal.com]
Sent: Friday, 15 December 2017 3:15 PM
To: Sarah Joyce <sjoyce@geosolutions.net.au>
Subject: FW: EM1717027 - GEOENVSOL - Gorringe

1

Joyce

Please find attached updated COC showing Duplicate samples was "not received".

Kind regards,

Carol Walsh
Senior Client Services, Environmental

Springvale - Victoria

T +61 3 8549 9600 D +61 3 8549 9608
F +61 3 8549 9626
carol.walsh@alsglobal.com
4 Westall Road
Springvale VIC 3171
AUSTRALIA

From: Isaac Banko
Sent: Tuesday, 12 December 2017 11:53 AM
To: Shirley LeCornu <shirley.lecornu@alsglobal.com>
Cc: Samples Melbourne <Samples.Melbourne@alsglobal.com>
Subject: EM1717027 - GEOENVSOL - Gorringe

Hi Shirley,

Just a quick FYI regarding the attached batch – sample "Duplicate" was not received.

Regards,

Isaac Banko
Sample Receipt Officer – Springvale
Environmental

T +61 3 8549 9600 D +61 3 8549 9633
F +61 3 8549 9626
isaac.banko@alsglobal.com

2-4 Westall Rd
Springvale Vic 3171
Australia

We are keen for your feedback! Please click here for your 1 question survey

EnviroMail™ 113 - Amoeba Confirmation PCR
EnviroMail™ 112 - Algal Capabilities
EnviroMail™ 111 - Analysis of VOCs by Thermal Desorption Analysis
EnviroMail™ 110 - Identifying Hidden PFAS Chemicals in Environmental Samples and Firefighting Foams
EnviroMail™ 00 - Summary of all EnviroMails™ by Category

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SGS

Chain of Custody Record

Dispatch samples to: Unit 10/585 Blackburn Road, Notting Hill, Victoria 3168, Australia

Attn: Sample Reception - Contact Ph: +613 9574 3311 Email: au.samplereceipt.melbourne@sgs.com

Sheet 1 of 1

CLIENT NAME: GES
CLIENT ADDRESS: 29 Kirksway Place Battery Point
CONTACT: Sarah Joyce
PROJECT REF. Corringe - 66 Burnett St
PURCHASE ORDER No:

CONTACT PHONE No: 62231839
SAMPLED BY: Aaron Plummer
RESULTS REQUIRED BY: 48 hour turn around @ 50% surcharge
EMAIL ADDRESS: S.joyce@geosolutions.net.au; jcumming@geosolutions.net.au; Miran@geosolutions.net.au (invoice)

ABN: 24 115 004 834
LAB QUOTE NUMBER:

Containers/Preservation (please mark with X) (G=glass, P=plastic)

Client Sample ID	Date Sampled	Matrix: Soil	Matrix: Water	Matrix: Other Soil Vapour	0.1-1L Jar(G) n.a.	0.1-1.0 litre(G) Nat.	0.1-1.0 litre(P) Nat.	40ml Vial(G) Nat.	40ml Vial(G) H2SO4	01-1L (P) H2SO4	125mL (P) HCl acid washed	125mL (P) Zn Acet. NaOH	125mL (P) Filtered Yes/No HNO3	125mL (P) NaOH	0.1-1.0 litre (P) sterilised	Analyses Required (Analyte + Method Code): NEPM Hydrocarbons
VP1 (1730-AN-LV-067)	11-14 Dec			✓												✓
VP2 (1730-AN-LV-070)	"			✓												✓
VP3 (1730-AN-LV-066)	"			✓												✓
VP4 (1730-AN-LV-068)	"			✓												✓
Dup (1730-AN-LV-069)	"			✓												✓
----------	Totals:															

CHAIN OF CUSTODY RECORD

Chill method used for transport (sender to complete): Not chilled.			Chill method used for transport (sender to complete):		
RELEASED BY: (Name)	(Signature)	(Date / Time)	RELEASED BY: (Name)	(Signature)	(Date / Time)
Sarah Joyce		14-12-17 1230			
RECEIVED BY: (Name)	(Signature)	(Date / Time)	RECEIVED BY: (Name)	(Signature)	(Date / Time)
Benedict Robinson		15/12/17 9:00am			
Temperature on sample receipt: °C	Custody Seals Intact? Y/N		Temperature on sample receipt: °C	Custody Seals Intact? Y/N	

Please Note: Dissolved metals require filtering in the field.

Comments: (eg. Highly contaminated samples, reporting requirements etc)

Notes: NEPM Hydrocarbon + BTEX, Naphthalene TPH F1 + F2 Fractions
Container 1 x waterloo Membrane Sampler per sample.

PF-AU-ENV-NHC-QU-007.xlsx / Ver 5 / 08.02.2017 / Page 1 of 1

A.B.N. 44 000 964 278
10 / 585 Blackburn Road
Notting Hill, Vic, 3168
Telephone: (03) 9574 3200

A.B.N. 44 000 964 278

Sample Receipt Acknowledgement

To:	Sarah Joyce	From:	Sample Reception
Fax:		Pages:	(1) including this page
Co:	Geo-Environmental Solutions	Date:	15/12/2017
Email	sjoyce@geosolutions.net.au	Ref:	M171189

SGS has received your samples from the project listed below. If you have any enquiries please contact us quoting our reference number.

Project/Reference No.:	Supply & Analysis of WMS
Our Reference Number:	**M171189**
Date Received:	15-Dec-2017
Estimated date of report:	19-Dec-2017

This work is subject to COD terms. The report will not be released until payment has been received

Additional Information:

Samples received after 4 pm are considered as received on the next working day for turnaround purposes.
Samples with a 24hr or 48hr TAT are considered as received on the next working day if received after 2:30pm.
Surcharges for urgent turnaround requests may apply.
All analytical work is conducted at our Melbourne office.
Sample Storage - All aqueous samples are stored for **two weeks** after reporting.
- All soils and other samples are stored for **one month** after reporting.
Please direct any technical or turnaround queries to Adam Atkinson at our Melbourne office.

SGS

Specialist Laboratory Services

Website: www.sgs.com.au
Email: AU.SampleReceipt.Melbourne@sgs.com

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order	: **EM1717027**		
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: KRIS TAYLOR	Contact	: Shirley LeComu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: ktaylor@geosolutions.net.au	E-mail	: shirley.lecomu@Alsglobal.com
Telephone	: +61 03 6223 1839	Telephone	: +61-3-8549 9630
Facsimile	: +61 03 6223 4539	Facsimile	: +61-3-8549 9601
Project	: Gorringe	Page	: 1 of 3
Order number	: ----	Quote number	: EB2017GEOENVSOL0001 (EN/222/17)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: AARON PLUMMER		

Dates

Date Samples Received	: 12-Dec-2017 10:10	Issue Date	: 12-Dec-2017
Client Requested Due Date	: 15-Dec-2017	Scheduled Reporting Date	: **15-Dec-2017**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 10.1°C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 18 / 18

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**

RIGHT SOLUTIONS | RIGHT PARTNER

Issue Date	: 12-Dec-2017
Page	: 2 of 3
Work Order	: EM1717027 Amendment 0
Client	: GEO-ENVIRONMENTAL SOLUTIONS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)	SOIL - S-07 TRH/BTEX/PAH (SIM)
EM1717027-001	12-Dec-2017 00:00	BH12 0.5m	✓	✓	✓
EM1717027-002	12-Dec-2017 00:00	BH12 1.0m	✓	✓	✓
EM1717027-003	12-Dec-2017 00:00	BH13 0.4-0.5m	✓	✓	✓
EM1717027-004	12-Dec-2017 00:00	BH14 0.3-0.4m	✓	✓	✓
EM1717027-005	12-Dec-2017 00:00	BH14 1.0-1.1m	✓	✓	✓
EM1717027-006	12-Dec-2017 00:00	BH15 0.5-0.6m	✓	✓	✓
EM1717027-007	12-Dec-2017 00:00	BH16 1.0-1.1m	✓	✓	✓
EM1717027-008	12-Dec-2017 00:00	BH16 2.0-2.1m	✓	✓	✓
EM1717027-009	12-Dec-2017 00:00	BH16 2.9-3.0m	✓	✓	✓
EM1717027-010	12-Dec-2017 00:00	BH17 0.5-0.6m	✓	✓	✓
EM1717027-011	12-Dec-2017 00:00	BH17 1.9-2.0m	✓	✓	✓
EM1717027-012	12-Dec-2017 00:00	BH18 0.2-0.3m	✓	✓	✓
EM1717027-013	12-Dec-2017 00:00	BH18 0.9-1.0m	✓	✓	✓
EM1717027-014	12-Dec-2017 00:00	BH19 0.2-0.3m	✓	✓	✓
EM1717027-015	12-Dec-2017 00:00	BH19 0.9-1.0m	✓	✓	✓
EM1717027-016	12-Dec-2017 00:00	BH20 0.5m	✓	✓	✓
EM1717027-017	12-Dec-2017 00:00	BH21 0.5m	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - W-03 15 Metals (NEPM Suite)	WATER - W-07 TRH/BTEX/PAH
EM1717027-019	11-Dec-2017 00:00	Rinsate	✓	✓

Proactive Holding Time Report

Issue Date	: 12-Dec-2017
Page	: 3 of 3
Work Order	: EM1717027 Amendment 0
Client	: GEO-ENVIRONMENTAL SOLUTIONS

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

All Invoices		
- A4 - AU Tax Invoice (INV)	Email	smcintosh@geosolutions.net.au
JOHN PAUL CUMMING		
- *AU Certificate of Analysis - NATA (COA)	Email	jcumming@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jcumming@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jcumming@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jcumming@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	jcumming@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	jcumming@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	jcumming@geosolutions.net.au
- EDI Format - XTab (XTAB)	Email	jcumming@geosolutions.net.au
KRIS TAYLOR		
- *AU Certificate of Analysis - NATA (COA)	Email	ktaylor@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ktaylor@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ktaylor@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ktaylor@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	ktaylor@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	ktaylor@geosolutions.net.au
- EDI Format - XTab (XTAB)	Email	ktaylor@geosolutions.net.au
M IRAN		
- A4 - AU Tax Invoice (INV)	Email	miran@geosolutions.net.au
SARAH JOYCE		
- *AU Certificate of Analysis - NATA (COA)	Email	sjoyce@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	sjoyce@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	sjoyce@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	sjoyce@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	sjoyce@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	sjoyce@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	sjoyce@geosolutions.net.au
- EDI Format - XTab (XTAB)	Email	sjoyce@geosolutions.net.au

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order	: **EM1717330**		
Client	: GEO-ENVIRONMENTAL SOLUTIONS	Laboratory	: Environmental Division Melbourne
Contact	: KRIS TAYLOR	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: ktaylor@geosolutions.net.au	E-mail	: shirley.lecornu@Alsglobal.com
Telephone	: +61 03 6223 1839	Telephone	: +61-3-8549 9630
Facsimile	: +61 03 6223 4539	Facsimile	: +61-3-8549 9601
Project	: Gorringe	Page	: 1 of 3
Order number	: ----	Quote number	: EB2017GEOENVSOL0001 (EN/222/17)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: AARON PLUMMER		

Dates

Date Samples Received	: 12-Dec-2017 10:10	Issue Date	: 15-Dec-2017
Client Requested Due Date	: 19-Dec-2017	Scheduled Reporting Date	: **19-Dec-2017**

Delivery Details

Mode of Delivery	: Samples On Hand	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **This is a rebatch of EM1717027**

RIGHT SOLUTIONS | RIGHT PARTNER

Issue Date	: 15-Dec-2017
Page	: 2 of 3
Work Order	: EM1717330 Amendment 0
Client	: GEO-ENVIRONMENTAL SOLUTIONS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: SOIL

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)	SOIL - S-07 TRH/BTEX/PAH (SIM)
EM1717330-001	12-Dec-2017 00:00	Duplicate	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Issue Date	: 15-Dec-2017
Page	: 3 of 3
Work Order	: EM1717330 Amendment 0
Client	: GEO-ENVIRONMENTAL SOLUTIONS

Requested Deliverables

All Invoices		
- A4 - AU Tax Invoice (INV)	Email	smcintosh@geosolutions.net.au
JOHN PAUL CUMMING		
- *AU Certificate of Analysis - NATA (COA)	Email	jcumming@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jcumming@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jcumming@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jcumming@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	jcumming@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	jcumming@geosolutions.net.au
- EDI Format - XTab (XTAB)	Email	jcumming@geosolutions.net.au
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- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ktaylor@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ktaylor@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	ktaylor@geosolutions.net.au
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- EDI Format - XTab (XTAB)	Email	ktaylor@geosolutions.net.au
M IRAN		
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- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	miran@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	miran@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	miran@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	miran@geosolutions.net.au
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- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	sjoyce@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	sjoyce@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	sjoyce@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	sjoyce@geosolutions.net.au
- EDI Format - XTab (XTAB)	Email	sjoyce@geosolutions.net.au

Vapour Laboratory Chain of Custody (COC) and Sample Receipt Notification

Appendix 5 Soil Quality Control Documentation

Quality Control Blanks

Date	Sample	EG020F: Dissolved Metals by ICP-MS													
		Arsenic	Beryllium	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Boron
Unit		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR		0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.01	0.005	0.05
17/06/2017	Rinsate	<0.001	<0.001	<0.001	0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.005	<0.05
11/12/2017	Rinsate	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.017	<0.05

Date	Sample	EP080					EP080/071					EP080/071						
		EP080: BTEXN	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Total Xylenes	0	EP080/071: Total Petroleum Hydrocarbons	C6 - C9 Fraction	C10 - C14 Fraction	C10 - C36 Fraction (sum)	0	EP080/071: Total Recoverable Hydrocarbons -	C6 - C10 Fraction	C6 - C10 Fraction minus BTEX (F1)	>C34 - C40 Fraction	>C10 - C40 Fraction (sum)	>C10 - C16 Fraction minus Naphthalene (F2)
Unit		0	µg/L	µg/L	µg/L	µg/L	0	0	µg/L	µg/L	µg/L	0	0	µg/L	µg/L	µg/L	µg/L	µg/L
LOR		0	2	2	2	2	0	0	20	50	50	0	0	20	20	100	100	100
17/06/2017	Rinsate	<0.00	<1	<2	<2	<2	<2	<2	<1	<5	<20	<50	<100	<50	<50	<20	<20	<100
11/12/2017	Rinsate	<0.00	<1	<2	<2	<2	<2	<2	<1	<5	<20	<50	<100	<50	<50	<20	<20	<100

Date	Sample	Naphthalene	Acenaphthylene	Acenaphthene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b+j)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	Sum of polycyclic aromatic hydrocarbons	Benzo(a)pyrene TEQ (zero)	0	EP068A: Organochlorine Pesticides (OC)	alpha-BHC	Hexachlorobenzene (HCB)
Unit		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	0	0	mg/kg	mg/kg
LOR		1	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	0.5	0.5	0	0	0.05	0.05
17/06/2017	Rinsate	<100	<100	<100	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<0.5	<0.5
11/12/2017	Rinsate	<100	<100	<100	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<0.5	<0.5

Duplicate Comparrison		EA055: Moisture Content	EG005T: Total Metals by ICP-AES												EG035	EP075(SIM)B: Polynuclear Aromatic Hydrocarbons																		EP080: BTEX						EP080: BTEXN			EP080/071: Total Petroleum Hydrocarb					EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft										EP004: Organic Matter
		Moisture Content (dried @ 103°C)	Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Vanadium	Zinc	Mercury	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene	Sum of polycyclic aromatic hydrc	Benzo(a)pyrene TEQ (WHO)	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Sum of BTEX	Total Xylenes	Naphthalene	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	C6 - C10 Fraction	F1	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	>C10 - C40 Fraction (sum)	Aliphatic > C35	Aromatic C16-C35	Aromatic > C35	2-Bromonaphthalene	2-Fluorobiphenyl	Total Organic Carbon
17/06/2017	BH7 3.0m	22.8	<5	10	<1	<1	6	3	<5	5	121	3	24	13	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	<100	<100	<50	<10	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1
17/06/2017	DUP	22.2	<5	<10	<1	<1	6	6	5	7	98	5	24	13	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	<100	<100	<50	<10	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1
Relative Percentage Difference (RPD) %		2.7	NA	NA	NA	NA	0.0	66.7	NA	33.3	21.0	50.0	0.0	0.0	0.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Method Detection Limit (MDL)		100	NA	NA	NA	NA	40	40	NA	NA	500	40	100	100	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MDL Class		MED	NONE	NONE	NONE	NONE	LOW	LOW	NONE	NONE	MED	LOW	LOW	LOW	LOW	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
RPD Compliance With MDL?		YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Deviation from MDL (%)		27	NONE	NONE	NONE	NONE	50	-17	NONE	NONE	9	0	50	50	50	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
12/12/2017	BH21 0.5m	20.1	6	170	<1	<1	12	11	49	238	301	15	29	157	0.8	<0.5	<0.5	<0.5	<0.5	1.5	<0.5	3.5	3.7	2.6	2.1	3.4	1.1	2.8	1.5	<0.5	1.8	24	3.7	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	<100	<100	<50	<10	<10	<50	140	<100	140	<0.2	<0.5	<0.5	<0.5	<0.5	<1
12/12/2017	Duplicate	20.5	7	140	<1	<1	13	16	35	166	320	19	22	173	0.7	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	2.4	2.7	1.8	1.6	2.2	1	1.8	1	<0.5	1.1	16.4	2.4	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	<100	<100	<50	<10	<10	<50	120	<100	120	<0.2	<0.5	<0.5	<0.5	<0.5	<1
Relative Percentage Difference (RPD) %		2.0	15.4	19.4	NA	NA	8.0	37.0	33.3	35.6	6.1	23.5	27.5	9.7	13.3	NA	NA	NA	NA	60.9	NA	37.3	31.3	36.4	27.0	42.9	9.5	43.5	40.0	NA	48.3	37.6	42.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15.4	NA	15.4	NA	NA	NA	NA	NA	NA	NA
Method Detection Limit (MDL)		100	100	1000	NA	NA	40	40	100	500	500	40	100	500	2	NA	NA	NA	NA	10	NA	10	10	10	10	10	10	10	10	NA	10	50	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1000	NA	NA	NA	NA	NA	NA	NA
MDL Class		MED	LOW	MED	NONE	NONE	LOW	LOW	LOW	MED	MED	LOW	LOW	MED	LOW	NONE	NONE	NONE	NONE	LOW	NONE	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	NONE	LOW	MED	LOW	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	LOW	NONE	NONE	NONE	NONE	NONE	NONE	NONE
RPD Compliance With MDL?		YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Deviation from MDL (%)		28	35	11	NONE	NONE	42	13	17	-6	24	26	23	20	37	NONE	NONE	NONE	NONE	-11	NONE	13	19	14	23	7	40	7	10	NONE	2	-8	7	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	35	NONE	NONE	NONE	NONE	NONE	NONE	NONE

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM1717027**	Page	: 1 of 11
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: KRIS TAYLOR	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6223 1839	Telephone	: +61-3-8549 9630
Project	: Gorringe	Date Samples Received	: 12-Dec-2017
Order number	: ----	Date Analysis Commenced	: 12-Dec-2017
C-O-C number	: ----	Issue Date	: 15-Dec-2017
Sampler	: AARON PLUMMER		
Site	: ----		
Quote number	: EN/222/17		
No. of samples received	: 18		
No. of samples analysed	: 18		

ilac-MRA NATA

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

Page	: 2 of 11
Work Order	: EM1717027
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 1308993)									
EM1717027-001	BH12 0.5m	EA055: Moisture Content	----	1	%	22.0	22.3	1.61	0% - 20%
EM1717027-011	BH17 1.9-2.0m	EA055: Moisture Content	----	1	%	18.1	19.4	6.99	0% - 50%
EG005T: Total Metals by ICP-AES (QC Lot: 1308787)									
EM1716985-001	Anonymous	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	50	50	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	13	13	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	2	2	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	5	5	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	6	6	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	11	11	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	41	41	0.00	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Vanadium	7440-62-2	5	mg/kg	37	37	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	16	16	0.00	No Limit
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
EM1717027-007	BH16 1.0-1.1m	EG005T: Beryllium	7440-41-7	1	mg/kg	<4	<4	0.00	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<2	<2	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	230	230	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	<4	<4	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	33	33	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	100	102	1.98	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	67	69	3.05	0% - 50%

Page : 3 of 11
Work Order : EM1717027
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG005T: Total Metals by ICP-AES (QC Lot: 1308787) - continued									
EM1717027-007	BH16 1.0-1.1m	EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	1050	1080	2.64	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	7	29.3	No Limit
		EG005T: Vanadium	7440-62-2	5	mg/kg	69	71	2.70	0% - 50%
		EG005T: Zinc	7440-66-6	5	mg/kg	13	13	0.00	No Limit
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1308788)									
EM1716985-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EM1717027-007	BH16 1.0-1.1m	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1308779)									
EM1717027-001	BH12 0.5m	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EM1717027-011	BH17 1.9-2.0m	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit

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Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1308779) - continued									
EM1717027-011	BH17 1.9-2.0m	EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1308575)									
EM1717027-001	BH12 0.5m	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
EM1717027-011	BH17 1.9-2.0m	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1308778)									
EM1717027-001	BH12 0.5m	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
		EP071: C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	0.00	No Limit
EM1717027-011	BH17 1.9-2.0m	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
		EP071: C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1308575)									
EM1717027-001	BH12 0.5m	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EM1717027-011	BH17 1.9-2.0m	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1308778)									
EM1717027-001	BH12 0.5m	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
		EP071: >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	0.00	No Limit
EM1717027-011	BH17 1.9-2.0m	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
		EP071: >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	0.00	No Limit
EP080: BTEXN (QC Lot: 1308575)									
EM1717027-001	BH12 0.5m	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit
EM1717027-011	BH17 1.9-2.0m	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit

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Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080: BTEXN (QC Lot: 1308575) - continued									
EM1717027-011	BH17 1.9-2.0m	EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 1308955)									
EM1717028-002	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.005	0.005	0.00	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.022	0.023	0.00	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.013	0.013	0.00	0% - 50%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.010	0.011	0.00	0% - 50%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.046	0.049	6.56	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.00	No Limit
EM1716909-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.031	0.032	3.47	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.088	0.089	0.00	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.029	0.031	7.12	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.018	0.017	0.00	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	3.71	3.76	1.31	0% - 20%
EG035F: Dissolved Mercury by FIMS (QC Lot: 1308954)									
EM1716909-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EM1717033-003	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1309271)									
EM1716909-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit

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Project : Gorringe

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1309271) - continued									
EM1717034-005	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1309271)									
EM1716909-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit
EM1717034-005	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit
EP080: BTEXN (QC Lot: 1309271)									
EM1716909-001	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit
EM1717034-005	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit

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Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 1308787)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	94.9	79	113
EG005T: Barium	7440-39-3	10	mg/kg	<10	143 mg/kg	96.9	79	110
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	5.63 mg/kg	112	85	120
EG005T: Boron	7440-42-8	50	mg/kg	<50	33.2 mg/kg	102	82	126
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	98.5	85	109
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	103	83	109
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	16 mg/kg	107	78	112
EG005T: Copper	7440-50-8	5	mg/kg	<5	32 mg/kg	101	78	108
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	94.9	78	106
EG005T: Manganese	7439-96-5	5	mg/kg	<5	130 mg/kg	98.7	82	107
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55 mg/kg	104	82	111
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5.37 mg/kg	98.7	93	109
EG005T: Vanadium	7440-62-2	5	mg/kg	<5	29.6 mg/kg	103	80	109
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	103	82	111
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1308788)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	98.4	77	104
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1308779)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	97.4	75	131
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	94.5	70	132
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	99.3	80	128
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	99.0	70	128
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	103	80	128
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	1.5 mg/kg	103	72	126
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	101	70	128
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	104	80	125
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	87.8	70	130
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	106	80	126
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	86.3	71	124
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	84.5	75	125
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	93.6	70	125
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	94.8	71	128
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	95.0	72	126
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	94.9	68	127

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Project : Gorringe

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1308575)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	36 mg/kg	92.6	70	127
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1308778)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	806 mg/kg	107	65	131
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	3006 mg/kg	109	70	126
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	1584 mg/kg	104	70	122
EP071: C10 - C36 Fraction (sum)	----	50	mg/kg	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1308575)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	45 mg/kg	92.7	68	125
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1308778)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	1160 mg/kg	109	68	130
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	3978 mg/kg	108	72	116
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	313 mg/kg	93.9	38	132
EP071: >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	----	----	----	----
EP080: BTEXN (QCLot: 1308575)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	2 mg/kg	87.7	74	124
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	2 mg/kg	99.0	77	125
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2 mg/kg	92.7	73	125
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	4 mg/kg	103	77	128
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2 mg/kg	106	81	128
EP080: Naphthalene	91-20-3	1	mg/kg	<1	0.5 mg/kg	94.7	66	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 1308955)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	100	91	107
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	101	82	113
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	98.2	84	106
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	101	84	104
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	96.6	83	103
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	96.2	83	106
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	97.2	82	103
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	97.4	83	105
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	98.0	83	105
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	93.8	82	106
EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	96.3	82	109
EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	97.3	83	106
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	99.1	85	109

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Project : Gorringe

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 1308955) - continued								
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	102	84	116
EG035F: Dissolved Mercury by FIMS (QCLot: 1308954)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	93.3	81	114
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1309020)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	10 µg/L	90.7	48	110
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	10 µg/L	100	49	124
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	10 µg/L	95.6	53	117
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	10 µg/L	101	54	118
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	10 µg/L	101	57	119
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	5 µg/L	86.5	51	113
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	10 µg/L	96.2	59	123
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	10 µg/L	89.0	58	123
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	10 µg/L	87.5	52	126
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	10 µg/L	95.8	55	123
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	10 µg/L	93.1	52	131
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	10 µg/L	92.4	57	126
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	10 µg/L	85.2	56	126
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	10 µg/L	95.2	53	123
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	10 µg/L	96.7	53	125
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	10 µg/L	93.2	53	125
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1309021)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	3368 µg/L	58.1	58	134
EP071: C15 - C28 Fraction	----	100	µg/L	<100	14735 µg/L	68.0	60	133
EP071: C29 - C36 Fraction	----	50	µg/L	<50	7856 µg/L	66.3	54	137
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1309271)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	360 µg/L	80.9	68	125
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1309021)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	5225 µg/L	63.7	58	122
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	19994 µg/L	66.7	56	132
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	1449 µg/L	67.8	58	137
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1309271)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	450 µg/L	77.3	66	123
EP080: BTEXN (QCLot: 1309271)								
EP080: Benzene	71-43-2	1	µg/L	<1	20 µg/L	87.1	74	123
EP080: Toluene	108-88-3	2	µg/L	<2	20 µg/L	87.7	77	128
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	20 µg/L	82.9	73	126

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Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Sub-Matrix: **WATER**				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP080: BTEXN (QCLot: 1309271) - continued								
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	40 µg/L	85.8	72	131
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	20 µg/L	84.0	74	131
EP080: Naphthalene	91-20-3	5	µg/L	<5	5 µg/L	90.0	74	124

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 1308787)							
EM1716985-002	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	87.6	78	124
		EG005T: Barium	7440-39-3	50 mg/kg	100	71	135
		EG005T: Beryllium	7440-41-7	50 mg/kg	103	85	125
		EG005T: Cadmium	7440-43-9	50 mg/kg	94.7	84	116
		EG005T: Chromium	7440-47-3	50 mg/kg	89.3	79	121
		EG005T: Copper	7440-50-8	50 mg/kg	95.1	82	124
		EG005T: Lead	7439-92-1	50 mg/kg	90.1	76	124
		EG005T: Manganese	7439-96-5	50 mg/kg	78.8	68	136
		EG005T: Nickel	7440-02-0	50 mg/kg	95.4	78	120
		EG005T: Selenium	7782-49-2	50 mg/kg	85.8	71	125
		EG005T: Vanadium	7440-62-2	50 mg/kg	82.1	76	124
		EG005T: Zinc	7440-66-6	50 mg/kg	92.3	74	128
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1308788)							
EM1716985-002	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	93.5	76	116
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1308779)							
EM1717027-003	BH13 0.4-0.5m	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	95.9	67	117
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	104	52	148
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1308575)							
EM1717027-002	BH12 1.0m	EP080: C6 - C9 Fraction	----	28 mg/kg	83.0	42	131
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1308778)							
EM1717027-002	BH12 1.0m	EP071: C10 - C14 Fraction	----	806 mg/kg	116	53	123
		EP071: C15 - C28 Fraction	----	3006 mg/kg	118	70	124
		EP071: C29 - C36 Fraction	----	1584 mg/kg	112	64	118
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1308575)							

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Project	: Gorringe

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1308575) - continued							
EM1717027-002	BH12 1.0m	EP080: C6 - C10 Fraction	C6_C10	33 mg/kg	81.5	39	129
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1308778)							
EM1717027-002	BH12 1.0m	EP071: >C10 - C16 Fraction	----	1160 mg/kg	117	65	123
		EP071: >C16 - C34 Fraction	----	3978 mg/kg	116	67	121
		EP071: >C34 - C40 Fraction	----	313 mg/kg	101	44	126
EP080: BTEXN (QCLot: 1308575)							
EM1717027-002	BH12 1.0m	EP080: Benzene	71-43-2	2 mg/kg	85.4	50	136
		EP080: Toluene	108-88-3	2 mg/kg	94.9	56	139

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 1308955)							
EM1716909-001	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	111	85	131
		EG020A-F: Beryllium	7440-41-7	0.2 mg/L	90.2	73	141
		EG020A-F: Barium	7440-39-3	0.2 mg/L	107	75	127
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	101	81	133
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	99.2	71	135
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	107	78	132
		EG020A-F: Copper	7440-50-8	0.2 mg/L	101	76	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	100	75	133
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	97.4	64	134
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	102	73	131
		EG020A-F: Vanadium	7440-62-2	0.2 mg/L	101	73	131
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	97.1	75	131
EG035F: Dissolved Mercury by FIMS (QCLot: 1308954)							
EM1716914-001	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	93.2	70	120
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1309271)							
EM1717005-001	Anonymous	EP080: C6 - C9 Fraction	----	280 µg/L	60.8	43	125
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1309271)							
EM1717005-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	330 µg/L	58.3	44	122
EP080: BTEXN (QCLot: 1309271)							
EM1717005-001	Anonymous	EP080: Benzene	71-43-2	20 µg/L	76.3	68	130
		EP080: Toluene	108-88-3	20 µg/L	80.0	72	132

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM1717027**	Page	: 1 of 9
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: KRIS TAYLOR	Telephone	: +61-3-8549 9630
Project	: Gorringe	Date Samples Received	: 12-Dec-2017
Site	: ----	Issue Date	: 15-Dec-2017
Sampler	: AARON PLUMMER	No. of samples received	: 18
Order number	: ----	No. of samples analysed	: 18

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

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Client	: GEO-ENVIRONMENTAL SOLUTIONS
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Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	7	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	7	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	7	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	7	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container* / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
BH12 0.5m,	BH12 1.0m,	**12-Dec-2017**	**----**	----	----	**12-Dec-2017**	26-Dec-2017	✓
BH13 0.4-0.5m,	BH14 0.3-0.4m,							
BH14 1.0-1.1m,	BH15 0.5-0.6m,							
BH16 1.0-1.1m,	BH16 2.0-2.1m,							
BH16 2.9-3.0m,	BH17 0.5-0.6m,							
BH17 1.9-2.0m,	BH18 0.2-0.3m,							
BH18 0.9-1.0m,	BH19 0.2-0.3m,							
BH19 0.9-1.0m,	BH20 0.5m,							
BH21 0.5m								
EG005T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved (EG005T)								
BH12 0.5m,	BH12 1.0m,	**12-Dec-2017**	**12-Dec-2017**	10-Jun-2018	✓	**13-Dec-2017**	10-Jun-2018	✓
BH13 0.4-0.5m,	BH14 0.3-0.4m,							
BH14 1.0-1.1m,	BH15 0.5-0.6m,							
BH16 1.0-1.1m,	BH16 2.0-2.1m,							
BH16 2.9-3.0m,	BH17 0.5-0.6m,							
BH17 1.9-2.0m,	BH18 0.2-0.3m,							
BH18 0.9-1.0m,	BH19 0.2-0.3m,							
BH19 0.9-1.0m,	BH20 0.5m,							
BH21 0.5m								

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Work Order	: EM1717027
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Matrix: **SOIL** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035T)								
BH12 0.5m,	BH12 1.0m,	**12-Dec-2017**	**12-Dec-2017**	09-Jan-2018	✓	**13-Dec-2017**	09-Jan-2018	✓
BH13 0.4-0.5m,	BH14 0.3-0.4m,							
BH14 1.0-1.1m,	BH15 0.5-0.6m,							
BH16 1.0-1.1m,	BH16 2.0-2.1m,							
BH16 2.9-3.0m,	BH17 0.5-0.6m,							
BH17 1.9-2.0m,	BH18 0.2-0.3m,							
BH18 0.9-1.0m,	BH19 0.2-0.3m,							
BH19 0.9-1.0m,	BH20 0.5m,							
BH21 0.5m								
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP075(SIM))								
BH12 0.5m,	BH12 1.0m,	**12-Dec-2017**	**12-Dec-2017**	26-Dec-2017	✓	**13-Dec-2017**	21-Jan-2018	✓
BH13 0.4-0.5m,	BH14 0.3-0.4m,							
BH14 1.0-1.1m,	BH15 0.5-0.6m,							
BH16 1.0-1.1m,	BH16 2.0-2.1m,							
BH16 2.9-3.0m,	BH17 0.5-0.6m,							
BH17 1.9-2.0m,	BH18 0.2-0.3m,							
BH18 0.9-1.0m,	BH19 0.2-0.3m,							
BH19 0.9-1.0m,	BH20 0.5m,							
BH21 0.5m								
EP080/071: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved (EP071)								
BH12 0.5m,	BH12 1.0m,	**12-Dec-2017**	**12-Dec-2017**	26-Dec-2017	✓	**13-Dec-2017**	21-Jan-2018	✓
BH13 0.4-0.5m,	BH14 0.3-0.4m,							
BH14 1.0-1.1m,	BH15 0.5-0.6m,							
BH16 1.0-1.1m,	BH16 2.0-2.1m,							
BH16 2.9-3.0m,	BH17 0.5-0.6m,							
BH17 1.9-2.0m,	BH18 0.2-0.3m,							
BH18 0.9-1.0m,	BH19 0.2-0.3m,							
BH19 0.9-1.0m,	BH20 0.5m,							
BH21 0.5m								
Soil Glass Jar - Unpreserved (EP080)								
BH12 0.5m,	BH12 1.0m,	**12-Dec-2017**	**12-Dec-2017**	26-Dec-2017	✓	**14-Dec-2017**	26-Dec-2017	✓
BH13 0.4-0.5m,	BH14 0.3-0.4m,							
BH14 1.0-1.1m,	BH15 0.5-0.6m,							
BH16 1.0-1.1m,	BH16 2.0-2.1m,							
BH16 2.9-3.0m,	BH17 0.5-0.6m,							
BH17 1.9-2.0m,	BH18 0.2-0.3m,							
BH18 0.9-1.0m,	BH19 0.2-0.3m,							
BH19 0.9-1.0m,	BH20 0.5m,							
BH21 0.5m								

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Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Matrix: **SOIL** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP071)							
BH12 0.5m, BH12 1.0m, BH13 0.4-0.5m, BH14 0.3-0.4m, BH14 1.0-1.1m, BH15 0.5-0.6m, BH16 1.0-1.1m, BH16 2.0-2.1m, BH16 2.9-3.0m, BH17 0.5-0.6m, BH17 1.9-2.0m, BH18 0.2-0.3m, BH18 0.9-1.0m, BH19 0.2-0.3m, BH19 0.9-1.0m, BH20 0.5m, BH21 0.5m	12-Dec-2017	12-Dec-2017	26-Dec-2017	✓	13-Dec-2017	21-Jan-2018	✓
Soil Glass Jar - Unpreserved (EP080)							
BH12 0.5m, BH12 1.0m, BH13 0.4-0.5m, BH14 0.3-0.4m, BH14 1.0-1.1m, BH15 0.5-0.6m, BH16 1.0-1.1m, BH16 2.0-2.1m, BH16 2.9-3.0m, BH17 0.5-0.6m, BH17 1.9-2.0m, BH18 0.2-0.3m, BH18 0.9-1.0m, BH19 0.2-0.3m, BH19 0.9-1.0m, BH20 0.5m, BH21 0.5m	12-Dec-2017	12-Dec-2017	26-Dec-2017	✓	14-Dec-2017	26-Dec-2017	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
BH12 0.5m, BH12 1.0m, BH13 0.4-0.5m, BH14 0.3-0.4m, BH14 1.0-1.1m, BH15 0.5-0.6m, BH16 1.0-1.1m, BH16 2.0-2.1m, BH16 2.9-3.0m, BH17 0.5-0.6m, BH17 1.9-2.0m, BH18 0.2-0.3m, BH18 0.9-1.0m, BH19 0.2-0.3m, BH19 0.9-1.0m, BH20 0.5m, BH21 0.5m	12-Dec-2017	12-Dec-2017	26-Dec-2017	✓	14-Dec-2017	26-Dec-2017	✓

Matrix: **WATER** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
Rinsate	11-Dec-2017	----	----	----	13-Dec-2017	09-Jun-2018	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
Rinsate	11-Dec-2017	----	----	----	13-Dec-2017	08-Jan-2018	✓

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Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
Rinsate	**11-Dec-2017**	**12-Dec-2017**	18-Dec-2017	✓	**13-Dec-2017**	21-Jan-2018	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071)							
Rinsate	**11-Dec-2017**	**12-Dec-2017**	18-Dec-2017	✓	**13-Dec-2017**	21-Jan-2018	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
Rinsate	**11-Dec-2017**	**13-Dec-2017**	25-Dec-2017	✓	**13-Dec-2017**	25-Dec-2017	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071)							
Rinsate	**11-Dec-2017**	**12-Dec-2017**	18-Dec-2017	✓	**13-Dec-2017**	21-Jan-2018	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
Rinsate	**11-Dec-2017**	**13-Dec-2017**	25-Dec-2017	✓	**13-Dec-2017**	25-Dec-2017	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080)							
Rinsate	**11-Dec-2017**	**13-Dec-2017**	25-Dec-2017	✓	**13-Dec-2017**	25-Dec-2017	✓

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Work Order	: EM1717027
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Dissolved Mercury by FIMS	EG035F	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	8	25.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	7	0.00	10.00	×	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	7	0.00	10.00	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Mercury by FIMS	EG035F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

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Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	7	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	7	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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Project	: Gorringe

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015A Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM amended 2013.
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270D. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260B. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM amended 2013.
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)

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Project	: Gorringe

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for sparging.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM1717330**	Page	: 1 of 7
Client	: GEO-ENVIRONMENTAL SOLUTIONS	Laboratory	: Environmental Division Melbourne
Contact	: KRIS TAYLOR	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6223 1839	Telephone	: +61-3-8549 9630
Project	: Gorringe	Date Samples Received	: 12-Dec-2017
Order number	: ----	Date Analysis Commenced	: 12-Dec-2017
C-O-C number	: ----	Issue Date	: 19-Dec-2017
Sampler	: AARON PLUMMER		
Site	: ----		
Quote number	: EN/222/17		
No. of samples received	: 1		
No. of samples analysed	: 1		

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Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Nancy Wang	2IC Organic Chemist	Melbourne Organics, Springvale, VIC
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics, Springvale, VIC

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Work Order	: EM1717330
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 1323072)									
EM1717330-001	Duplicate	EA055: Moisture Content	----	1	%	20.5	19.8	3.64	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 1322930)									
EM1717311-011	Anonymous	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	60	50	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	20	20	0.00	0% - 50%
		EG005T: Cobalt	7440-48-4	2	mg/kg	6	6	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	8	8	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	14	14	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	36	32	12.9	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	58	55	5.30	0% - 50%
		EG005T: Manganese	7439-96-5	5	mg/kg	208	223	6.72	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Vanadium	7440-62-2	5	mg/kg	24	23	5.05	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	194	213	9.41	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 1322931)									
EM1717311-011	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1322995)									
EM1717330-001	Duplicate	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	0.8	0.6	21.0	No Limit

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Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Sub-Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report: LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 1322995) - continued									
EM1717330-001	Duplicate	EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	2.4	1.9	23.5	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	2.7	2.1	25.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	1.8	1.3	27.5	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	1.6	1.2	29.6	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	2.2	1.7	25.3	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	1.0	0.6	41.1	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	1.8	1.3	32.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	1.0	0.7	35.4	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	1.1	0.8	31.7	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1320673)									
EM1716847-048	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
EM1717328-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1322994)									
EM1717330-001	Duplicate	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
		EP071: C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1320673)									
EM1716847-048	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EM1717328-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1322994)									
EM1717330-001	Duplicate	EP071: >C16 - C34 Fraction	----	100	mg/kg	120	<100	14.5	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
		EP071: >C10 - C40 Fraction (sum)	----	50	mg/kg	120	<50	82.4	No Limit
EP080: BTEXN (QC Lot: 1320673)									
EM1716847-048	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit
EM1717328-001	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit

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Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Sub-Matrix: SOIL

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP080: BTEXN (QC Lot: 1320673) - continued									
EM1717328-001	Anonymous	EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit

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Project	: Gorringe

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 1322930)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	86.4	79	113
EG005T: Barium	7440-39-3	10	mg/kg	<10	143 mg/kg	83.4	79	110
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	5.63 mg/kg	92.5	85	120
EG005T: Boron	7440-42-8	50	mg/kg	<50	33.2 mg/kg	96.8	82	126
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	94.3	85	109
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	90.7	83	109
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	16 mg/kg	86.4	78	112
EG005T: Copper	7440-50-8	5	mg/kg	<5	32 mg/kg	82.9	78	108
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	88.7	78	106
EG005T: Manganese	7439-96-5	5	mg/kg	<5	130 mg/kg	86.3	82	107
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55 mg/kg	88.4	82	111
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5.37 mg/kg	96.8	93	109
EG005T: Vanadium	7440-62-2	5	mg/kg	<5	29.6 mg/kg	84.9	80	109
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	87.6	82	111
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1322931)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	83.6	77	104
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 1322995)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	96.4	75	131
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	97.6	70	132
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	98.4	80	128
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	108	70	128
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	104	80	128
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	1.5 mg/kg	110	72	126
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	111	70	128
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	115	80	125
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	100	70	130
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	106	80	126
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	92.5	71	124
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	103	75	125
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	84.5	70	125
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	85.2	71	128
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	89.8	72	126
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	81.0	68	127

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Work Order : EM1717330
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Sub-Matrix: SOIL

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1320673)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	36 mg/kg	86.8	70	127
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1322994)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	806 mg/kg	95.1	80	120
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	3006 mg/kg	98.2	84	115
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	1584 mg/kg	98.9	80	112
EP071: C10 - C36 Fraction (sum)	----	50	mg/kg	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1320673)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	45 mg/kg	84.6	68	125
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1322994)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	1160 mg/kg	96.8	83	117
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	3978 mg/kg	99.1	82	114
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	313 mg/kg	100	73	115
EP071: >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	----	----	----	----
EP080: BTEXN (QCLot: 1320673)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	2 mg/kg	88.1	74	124
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	2 mg/kg	88.9	77	125
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2 mg/kg	85.8	73	125
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	4 mg/kg	89.7	77	128
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2 mg/kg	92.9	81	128
EP080: Naphthalene	91-20-3	1	mg/kg	<1	0.5 mg/kg	81.0	66	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EG005T: Total Metals by ICP-AES (QCLot: 1322930)							
EM1717330-001	Duplicate	EG005T: Barium	7440-39-3	50 mg/kg	80.4	71	135
		EG005T: Lead	7439-92-1	50 mg/kg	94.5	76	124
EM1717330-001	Duplicate	EG005T: Arsenic	7440-38-2	50 mg/kg	96.6	78	124
		EG005T: Beryllium	7440-41-7	50 mg/kg	101	85	125
		EG005T: Cadmium	7440-43-9	50 mg/kg	92.4	84	116
		EG005T: Chromium	7440-47-3	50 mg/kg	100	79	121
		EG005T: Copper	7440-50-8	50 mg/kg	94.4	82	124

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Work Order : EM1717330
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 1322930) - continued							
EM1717330-001	Duplicate	EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	68	136
		EG005T: Nickel	7440-02-0	50 mg/kg	90.4	78	120
		EG005T: Selenium	7782-49-2	50 mg/kg	88.8	71	125
		EG005T: Vanadium	7440-62-2	50 mg/kg	94.7	76	124
		EG005T: Zinc	7440-66-6	50 mg/kg	84.6	74	128
EG035T: Total Recoverable Mercury by FIMS (QCLot: 1322931)							
EM1717330-001	Duplicate	EG035T: Mercury	7439-97-6	5 mg/kg	97.6	76	116
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1320673)							
EM1716847-050	Anonymous	EP080: C6 - C9 Fraction	----	28 mg/kg	67.8	42	131
EP080/071: Total Petroleum Hydrocarbons (QCLot: 1322994)							
EM1717330-001	Duplicate	EP071: C10 - C14 Fraction	----	806 mg/kg	95.7	53	123
		EP071: C15 - C28 Fraction	----	3006 mg/kg	97.1	70	124
		EP071: C29 - C36 Fraction	----	1584 mg/kg	97.0	64	118
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1320673)							
EM1716847-050	Anonymous	EP080: C6 - C10 Fraction	C6_C10	33 mg/kg	64.5	39	129
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1322994)							
EM1717330-001	Duplicate	EP071: >C10 - C16 Fraction	----	1160 mg/kg	97.2	65	123
		EP071: >C16 - C34 Fraction	----	3978 mg/kg	97.6	67	121
		EP071: >C34 - C40 Fraction	----	313 mg/kg	94.4	44	126
EP080: BTEXN (QCLot: 1320673)							
EM1716847-050	Anonymous	EP080: Benzene	71-43-2	2 mg/kg	81.2	50	136
		EP080: Toluene	108-88-3	2 mg/kg	85.7	56	139

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM1717330**	Page	: 1 of 5
Client	: GEO-ENVIRONMENTAL SOLUTIONS	Laboratory	: Environmental Division Melbourne
Contact	: KRIS TAYLOR	Telephone	: +61-3-8549 9630
Project	: Gorringe	Date Samples Received	: 12-Dec-2017
Site	: ----	Issue Date	: 19-Dec-2017
Sampler	: AARON PLUMMER	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Page	: 2 of 5
Work Order	: EM1717330
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005T: Total Metals by ICP-AES	EM1717330--001	Duplicate	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS)					
PAH/Phenols (SIM)	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: x = Holding time breach ; ✓ = Within holding time.

Method	*Sample Date*	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		*Date extracted*	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
Duplicate	12-Dec-2017	----	----	----	18-Dec-2017	26-Dec-2017	✓
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
Duplicate	12-Dec-2017	18-Dec-2017	10-Jun-2018	✓	18-Dec-2017	10-Jun-2018	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
Duplicate	12-Dec-2017	18-Dec-2017	09-Jan-2018	✓	18-Dec-2017	09-Jan-2018	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
Duplicate	12-Dec-2017	18-Dec-2017	26-Dec-2017	✓	18-Dec-2017	27-Jan-2018	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080)							
Duplicate	12-Dec-2017	12-Dec-2017	26-Dec-2017	✓	14-Dec-2017	26-Dec-2017	✓
Soil Glass Jar - Unpreserved (EP071)							
Duplicate	12-Dec-2017	18-Dec-2017	26-Dec-2017	✓	18-Dec-2017	27-Jan-2018	✓

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Work Order	: EM1717330
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Matrix: **SOIL**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080)							
Duplicate	12-Dec-2017	12-Dec-2017	26-Dec-2017	✓	14-Dec-2017	26-Dec-2017	✓
Soil Glass Jar - Unpreserved (EP071)							
Duplicate	12-Dec-2017	18-Dec-2017	26-Dec-2017	✓	18-Dec-2017	27-Jan-2018	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
Duplicate	12-Dec-2017	12-Dec-2017	26-Dec-2017	✓	14-Dec-2017	26-Dec-2017	✓

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Work Order	: EM1717330
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	0	1	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	2	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Page	: 5 of 5
Work Order	: EM1717330
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015A Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM amended 2013.
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270D. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260B. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM amended 2013.

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

Appendix 6 Soil Vapour Quality Control Documentation

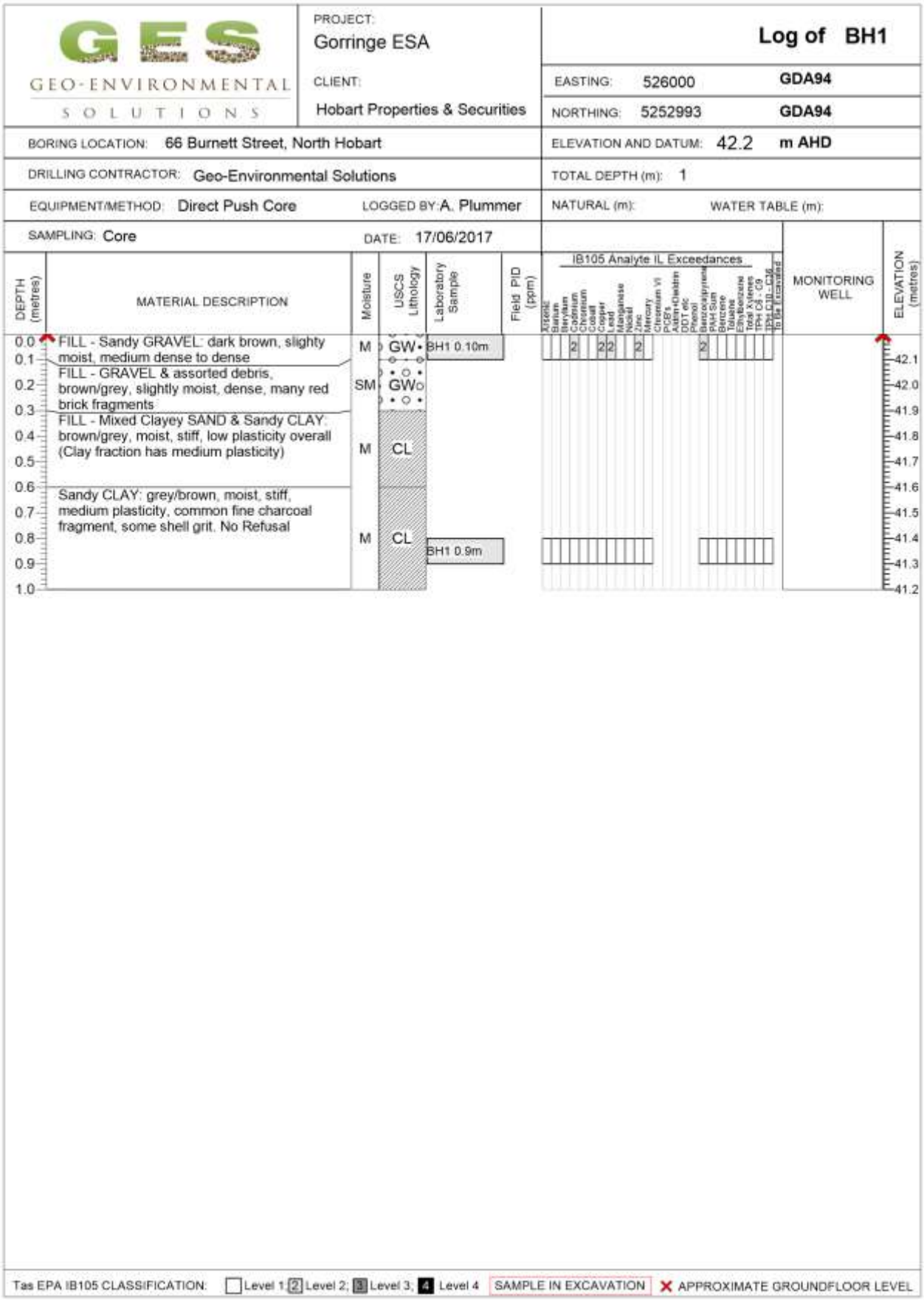
SGS

Report N°: M171189

QUALIFIERS / NOTES FOR REPORTED RESULTS

PQL	Practical Quantitation Limit
nd	Not Detected – The analyte was not detected above the reported PQL
ni	Insufficient Sample to perform this analysis.
T	Tentative identification based on computer library search of mass spectra.
NC	Not calculated and/or Results below PQL
NV	No Vacuum. Canister received above standard atmospheric pressure
nr	Not Requested for analysis.
R	Rejected Result – results for this analysis failed QC checks
SQ	Semi-Quantitative result – quantitation based on a generic response factor for this class of analyte
IM	Inappropriate method of analysis for this compound
U	Unable to provide Quality Control data – high levels of compounds in sample interfered with analysis of QC results.
UT	Unable to provide Quality Control data- Surrogates failed QC checks due to sample matrix effects
L	Analyte detected at a level above the linear response of calibration curve.
E	Estimated result. NATA accreditation does not cover estimated results.
C1	These compounds co-elute.
–	Parameter Not Determined
ET	Elevated concentration. Results reported from carbon tube analysis
**	Sample shows non-petroleum hydrocarbon profile

Appendix 7 Soil Bore logs



GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH2

EASTING: 525998 **GDA94**

NORTHING: 5252990 **GDA94**

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42.1 **m AHD**

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0 – 0.1	FILL - Sandy GRAVEL: dark brown, slighty moist, medium dense to dense	M	GW	BH2 0.1m		Lead: 2; Nickel: 2		42.0
0.1 – 0.2	FILL - GRAVEL & assorted debris, brown/grey, slightly moist, dense, many red brick fragments	SM	GWo					41.9
0.2 – 0.3								41.8
0.3 – 0.4	FILL - Mixed Clayey SAND & Sandy CLAY: brown/grey, moist, stiff, low plasticity overall (Clay fraction has medium plasticity)							41.7
0.4 – 0.5		M	CL					41.6
0.5 – 0.6								41.5
0.6 – 0.7	Sandy CLAY: grey/brown, moist, stiff, medium plasticity, common fine charcoal fragment, some shell grit. No Refusal							41.4
0.7 – 0.8		M	CL	BH2 0.9m		Lead: 2		41.3
0.8 – 0.9								41.2
0.9 – 1.0								41.1

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐ Level 2: ☐ Level 3: ■ Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH3

EASTING: 525984 GDA94

NORTHING: 5252989 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 41.5 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium VI, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, 10 BE Examples

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete		P				41.4
0.3	FILL - Clayey GRAVEL: grey/brown, slightly moist, medium dense	SM	GC	BH3 0.5m			41.1
0.6	Silty CLAY: dark grey-brown, moist, stiff, high plasticity	M	CH				40.8
1.0	Silty CLAY: pale brown, moist, stiff, high plasticity - plasticity decreasing with depth	M	CH	BH3 2.3m			40.5
2.3	Silty GRAVEL: yellow/pale brown, dry, very dense, weathered silt/mudstone. No Refusal	D	GM				39.2
2.9							38.5

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐ Level 2: ☐ Level 3: ■ Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH4

EASTING: 525982 **GDA94**

NORTHING: 5253010 **GDA94**

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42.8 **m AHD**

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 2

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0–0.1	FILL - Concrete		P					42.7
0.1–0.9	FILL - Clayey GRAVEL: grey/brown, slightly moist, medium dense, many red brick fragments	SM	GC	BH4 0.5m		2 2 4 2 2 2 3 2 2 3		42.6–42.0
0.9–1.4	Silty CLAY: dark grey-brown, moist, firm to stiff, high plasticity	M	CH	BH4 1.0m				41.9–41.4
1.4–1.9	Silty CLAY: pale brown, moist, stiff, high plasticity. No Refusal	M	CH					41.3–40.8

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH5

EASTING: 525979 GDA94

NORTHING: 5253010 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42.9 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0–0.1	FILL - Sandy GRAVEL: brown/grey, slighty moist, medium dense to dense, some small brick fragments	M	GW	BH5 0.1m		3 (Benzo(a)pyrene PAH Sum)		42.8
0.2–0.4	FILL - Gravelly CLAY: dark brown/black, moist, stiff, medium plasticity	M	CL					42.7–42.5
0.5–1.3	Silty CLAY: pale brown, moist, stiff, high plasticity	M	CH					42.4–41.6
1.4–2.4	Silty CLAY: red/orange, moist, stiff, high plasticity	M	CH					41.5–40.5
2.5–2.9	Silty Sandy CLAY: red/orange/yellow, moist, very stiff, medium plasticity. No Refusal	M	CL	BH5 3.0m		2		40.4–39.9

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH6

EASTING: 525966 GDA94

NORTHING: 5253047 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 44.3 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete		P					44.2
0.2	FILL - Clayey SAND: dark brown/black, moist, medium dense	M	SC	BH6 0.2m		2 2 3 2 2 3 2		44.1
0.4	FILL - Silty Sandy CLAY: dark brown/black, moist, stiff, medium plasticity, 10% fine gravel & brick fragments	M	CL					44.0
0.6	Silty CLAY: brown, moist, firm, high plasticity	M	CH					43.7
1.0	Silty CLAY: mottled pale brown/grey/red, moist, stiff, high plasticity, lense of fine Quartz gravel from 1.95-2.0m containing f							43.3
1.5	✕						✕	42.8
2.0		M	CH	BH6 2.0m		2		42.3
2.9				BH6 3.0m				41.4
3.0								41.3

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH7

EASTING: 525973 GDA94

NORTHING: 5253042 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 44.4 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete		P					44.4
0.2	FILL - Clayey SAND: dark brown/black, moist, medium dense	M	SC	BH7 0.2m		2 2 2 2 3 2		44.2
0.4	FILL - Silty Sandy CLAY: dark brown/black, moist, stiff, medium plasticity, 10% fine gravel & brick fragments	M	CL					44.0
0.6	Silty CLAY: brown, moist, stiff, high plasticity							43.8
0.9				BH7 1.0m		2 2		43.5
1.0		M	CH					43.4
1.5	Silty CLAY: mottled pale brown/grey/red, moist, stiff, high plasticity. No Refusal							42.9
1.6								42.8
2.2		M	CH					42.2
3.0				BH7 3.0m		2		41.4

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH8

EASTING: 525969 GDA94

NORTHING: 5253040 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 44.6 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0 – 0.1	FILL - Concrete		P					44.5
0.2 – 0.3	FILL - SAND some clay (Packing/Fat Sand), orange/grey-brown, moist, medium dense							44.4 – 44.3
0.4 – 0.5				BH8 0.5m				44.2 – 44.1
0.6 – 0.8								44.0 – 43.8
0.9 – 1.0		M	SC	BH8 1.0m				43.7 – 43.6
1.1 – 1.6								43.5 – 43.0
1.7 – 1.8	Silty CLAY: mottled pale brown/grey/red, moist, stiff, high plasticity. No Refusal							42.9 – 42.8
1.9 – 2.9		M	CH					42.7 – 41.6

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH9

EASTING: 525965 GDA94

NORTHING: 5253042 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 44.6 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0–0.1	FILL - Concrete		P					44.5
0.1–0.5	FILL - Clayey SAND: dark brown/black, moist, medium dense	M	SC	BH9 0.2m		2 2 2 2 3 2		44.4–44.1
0.5–1.0	Silty CLAY: brown, moist, stiff, high plasticity	M	CH					44.0–43.6
1.0–2.1	Silty Sandy CLAY: pale brown, moist, very stiff, medium plasticity, 20% fine to coarse gravel	M	CL					43.5–42.5
1.8	✕						✕	42.8
2.1–2.5	Silty CLAY: mottled pale brown/grey/red, moist, stiff, high plasticity	M	CH					42.4–42.1
2.5–2.8	FILL - SAND some clay (Packing/Fat Sand), orange/grey-brown, moist, medium dense. Side wall of Tank Pit has been scalloped out	M	SC					42.0–41.8
2.8–2.9	Silty CLAY: mottled pale brown/grey/red, moist, stiff, high plasticity. No Refusal	M	CH	BH9 3.0m				41.7–41.6

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH10

EASTING: 525970 GDA94

NORTHING: 5253045 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 45.5 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

IB105 Analyte IL Exceedances

Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, Phenol, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, 10 B/E Examples

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	MONITORING WELL	ELEVATION (metres)
0.0	FILL - GRAVEL: brown/grey, slightly moist, dense	SM	GW	BH10 0.1m			45.4
0.1							45.3
0.2	Sandy Silty CLAY: brown, moist, very stiff, medium plasticity						45.2
0.3							45.1
0.4							45.0
0.5							44.9
0.6		M	CL				44.8
0.7							44.7
0.8							44.6
0.9							44.5
1.0				BH10 1.0m			

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH11

EASTING: 525967 GDA94

NORTHING: 5253067 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 43.9 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 0.15

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete		P	BH11 0.1m				
0.1	Silty CLAY: yellow/orange/brown, moist, stiff, medium to high plasticity. Sudden Refusal	M	CH					43.8

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH12

EASTING: 525994 GDA94

NORTHING: 5253042 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 43.7 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1.2

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete Slab		P					43.6
0.1								43.5
0.2	FILL - CLAYEY GRAVEL: brown/grey, slightly moist, dense	SM	GC					43.4
0.3								43.3
0.4	Sandy SILTY CLAY: brown/grey/orange, moist, stiff, medium plasticity	M	CI	BH12 0.5m				43.2
0.5								43.1
0.6	SILTY CLAY: brown/grey, moist, stiff, high plasticity. End							43.0
0.7								42.9
0.8		M	CH					42.8
0.9				BH12 1.0m		2 2 3 2 2		42.7
1.0								42.6
1.1								42.5
1.2								

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH13

EASTING: 526000 GDA94

NORTHING: 5253030 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 43.3 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 0.55

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete Slab		P					43.2
0.1								43.1
0.2								43.0
0.3	Extremely Weathered SILTSTONE (Clayey SILT): orange/trace pale purple mottles, dry to slightly moist, dense, very low rock stre	SM	ML	BH13 0.4-0.5m				42.9
0.4								42.8
0.5								

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH14

EASTING: 525987 GDA94

NORTHING: 5253023 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 43.2 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1.5

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete Slab		P					43.1
0.3	FILL - GRAVEL: blue/grey, slightly moist, loose, medium to coarse (20-40mm) clean angular Dolerite gravel	SM	GW					43.0
0.4				BH14 0.3-0.4m		2 2 2 2 3 3		42.9
0.5	FILL - SANDY CLAY: dark brown, moist, stiff, medium plasticity, few fine gravels	M	CI					42.8
0.6								42.7
0.7	Sandy SILTY CLAY: mottled dark brown/orange, moist, stiff, medium plasticity	M	CI					42.6
0.8								42.5
0.9								42.4
1.0	SILTY CLAY: olive-brown, moist, firm to stiff, high plasticity. END							42.3
1.1				BH14 1.0-1.1m		2		42.2
1.2		M	CH					42.1
1.3								42.0
1.4								41.9
								41.8
								41.7

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH15

EASTING: 525995 GDA94

NORTHING: 5252997 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42.25 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 0.6

EQUIPMENT/METHOD: Geoprobe 540UD LOGGED BY: A. Plummer

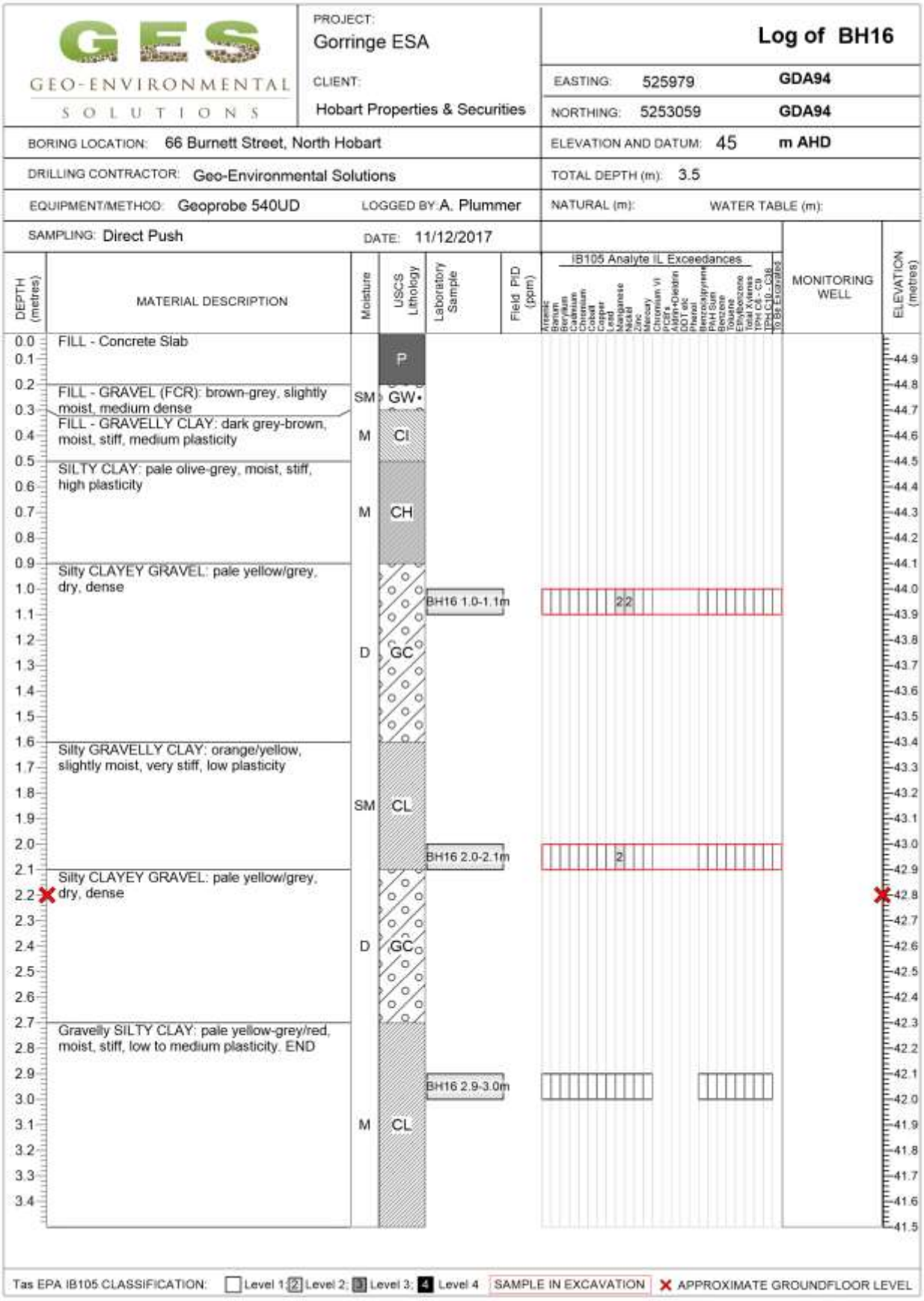
NATURAL (m): WATER TABLE (m):

SAMPLING: Direct Push DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete Slab		P					42.2
0.1								42.1
0.2	FILL - SAND: yellow-grey, slightly moist, loose		SW					42.0
0.3								41.9
0.4	FILL - CLAYEY GRAVEL: yellow-brown/grey, slightly moist, dense. Refusal	SM	GC	BH15 0.5-0.6m				41.8
0.5								41.7
0.6								

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCBs, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL


GES
GEO-ENVIRONMENTAL SOLUTIONS
PROJECT: Gorringe ESA
CLIENT: Hobart Properties & Securities
Log of BH16
EASTING: 525979 GDA94
NORTHING: 5253059 GDA94
BORING LOCATION: 66 Burnett Street, North Hobart
ELEVATION AND DATUM: 45 m AHD
DRILLING CONTRACTOR: Geo-Environmental Solutions
TOTAL DEPTH (m): 3.5
EQUIPMENT/METHOD: Geoprobe 540UD
LOGGED BY: A. Plummer
NATURAL (m):
WATER TABLE (m):
SAMPLING: Direct Push
DATE: 11/12/2017
DEPTH (metres)
MATERIAL DESCRIPTION
Moisture
USCS Lithology
Laboratory Sample
Field PID (ppm)
IB105 Analyte IL Exceedances
MONITORING WELL
ELEVATION (metres)
FILL - Concrete Slab
FILL - GRAVEL (FCR): brown-grey, slightly moist, medium dense
FILL - GRAVELLY CLAY: dark grey-brown, moist, stiff, medium plasticity
SILTY CLAY: pale olive-grey, moist, stiff, high plasticity
Silty CLAYEY GRAVEL: pale yellow/grey, dry, dense
Silty GRAVELLY CLAY: orange/yellow, slightly moist, very stiff, low plasticity
Silty CLAYEY GRAVEL: pale yellow/grey, dry, dense
Gravelly SILTY CLAY: pale yellow-grey/red, moist, stiff, low to medium plasticity. END
BH16 1.0-1.1m
BH16 2.0-2.1m
BH16 2.9-3.0m
Tas EPA IB105 CLASSIFICATION: Level 1 Level 2: Level 3: Level 4
SAMPLE IN EXCAVATION
APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH17

EASTING: 525973 GDA94

NORTHING: 5253069 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 45.5 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 2.7

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0–0.1	FILL - SANDY GRAVEL: grey/brown, slightly moist, dense	SM	GW					45.4
0.2–0.3	FILL - Gravelly CLAYEY SAND: dark brown, slightly moist, medium dense	SM	SC					45.3–45.2
0.4–0.5								45.1–45.0
0.5–0.6	SILTY CLAY: olive brown/orange/trace red, moist, stiff, high plasticity			BH17 0.5-0.6m				45.0–44.9
0.6–0.8		M	CH					44.9–44.7
0.9–1.1								44.6–44.4
1.1–1.8	Extremely Weathered SANDSTONE/SILTSTONE (banded): yellow/orange, slightly moist, dense, lense of medium plasticity clay at 1.8							44.3–43.7
1.9–2.0		SM		BH17 1.9-2.0m		2		43.6–43.5
2.1–2.6								43.4–42.8

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH18

EASTING: 525981 GDA94

NORTHING: 5253041 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 43.8 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 2

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0 – 0.1	FILL - Concrete Slab		P					43.7
0.2 – 0.3	SILTY CLAY: dark grey/black, moist, stiff, high plasticity			BH18 0.2-0.3m		2		43.6 – 43.5
0.4 – 0.5		M	CH					43.4 – 43.3
0.6 – 0.7	Sandy SILTY CLAY: dark brown, moist, very stiff, high plasticity							43.2 – 43.1
0.8 – 0.9		M	CH					43.0 – 42.9
1.0	✕			BH18 0.9-1.0m		2		42.8
1.1 – 1.2	Silty GRAVELLY CLAY: pale yellow-grey, slightly moist, very stiff, low to meidum plasticity							42.7 – 42.6
1.3 – 1.4		M	CI					42.5 – 42.4
1.5 – 1.6								42.3 – 42.2
1.7 – 1.8	SILTY CLAY: orange/yellow/grey, moist, very stiff, medium plasticity, high silt content. END							42.1 – 42.0
1.9		M	CI					41.9 – 41.8

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ▨ Level 2: ▨ Level 3: ■ Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH19

EASTING: 525964 GDA94

NORTHING: 5253033 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 44.1 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 2

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete Slab		P					44.0
0.2	FILL - GRAVEL: dark brown-grey, moist, dense	M	GW	BH19 0.2-0.3m		2, 2, 2, 3		43.9
0.4	SILTY CLAY: olive-brown, moist, stiff, high plasticity							43.7
0.6		M	CH					43.5
0.8								43.3
0.9				BH19 0.9-1.0m		2, 2		43.2
1.0	SILTY CLAY: orange/red, moist, stiff, high plasticity. END							43.1
1.2								43.0
1.3								42.9
1.4								42.8
1.5		M	CH					42.7
1.6								42.6
1.8								42.4
1.9								42.3
								42.2
								42.1

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH20

EASTING: 525973 **GDA94**

NORTHING: 5252982 **GDA94**

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42 **m AHD**

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1.1

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete		P					41.9
0.1								41.8
0.2	FILL - Clayey GRAVEL: grey/brown, slightly moist, medium dense							41.7
0.3								41.6
0.4		SM	GC	BH20 0.5m				41.5
0.5								41.4
0.6	Silty CLAY: dark grey-brown, moist, stiff, high plasticity							41.3
0.7								41.2
0.8		M	CH					41.1
0.9								41.0
1.0								40.9
1.1								

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, 16 B/E Examples

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH21

EASTING: 526002 GDA94

NORTHING: 5252990 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42.7 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1.1

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Sandy GRAVEL: dark brown, slighty moist, medium dense to dense	M	GW					42.6
0.1								42.5
0.2	FILL - GRAVEL & assorted debris, brown/grey, slightly moist, dense, many red brick fragments	SM	GWo					42.4
0.3								42.3
0.4	FILL - Mixed Clayey SAND & Sandy CLAY: brown/grey, moist, stiff, low plasticity overall (Clay fraction has medium plasticity)	M	CL	BH21 0.5m		3,2		42.2
0.5								42.1
0.6								42.0
0.7	Sandy CLAY: grey/brown, moist, stiff, medium plasticity, common fine charcoal fragment, some shell grit. No Refusal							41.9
0.8								41.8
0.9		M	CI					41.7
1.0								41.6
1.1								

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 ☐2 Level 2: ☐3 Level 3: ■4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

Appendix 8 Soil Analytical Results - Certificate of Analysis

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EM1717027	Page	: 1 of 18
Client	: GEO-ENVIRONMENTAL SOLUTIONS	Laboratory	: Environmental Division Melbourne
Contact	: KRIS TAYLOR	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6223 1839	Telephone	: +61-3-8549 9630
Project	: Gorringe	Date Samples Received	: 12-Dec-2017 10:10
Order number	: ----	Date Analysis Commenced	: 12-Dec-2017
C-O-C number	: ----	Issue Date	: 15-Dec-2017 13:29
Sampler	: AARON PLUMMER		
Site	: ----		
Quote number	: EN/222/17		
No. of samples received	: 18		
No. of samples analysed	: 18		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

RIGHT SOLUTIONS | RIGHT PARTNER

Page	: 2 of 18
Work Order	: EM1717027
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG005T:EM1717027_004, 007 and 013 have been diluted prior to metal analysis due to sample matrix. LORs have been raised for Beryllium, Cadmium and Chromium
- EG020F: Zinc results for EM1717027-019 have been confirmed by re-preparation and re-analysis.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.

Page : 3 of 18
Work Order : EM1717027
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH12 0.5m	BH12 1.0m	BH13 0.4-0.5m	BH14 0.3-0.4m	BH14 1.0-1.1m
			Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	EM1717027-001	EM1717027-002	EM1717027-003	EM1717027-004	EM1717027-005
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	22.0	19.5	14.3	28.9	23.2
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	5	8	<5	35	<5
Barium	7440-39-3	10	mg/kg	220	660	20	180	480
Beryllium	7440-41-7	1	mg/kg	1	4	1	<1	1
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<10	<1
Chromium	7440-47-3	2	mg/kg	18	16	7	20	14
Cobalt	7440-48-4	2	mg/kg	13	368	6	12	14
Copper	7440-50-8	5	mg/kg	32	39	16	80	17
Lead	7439-92-1	5	mg/kg	10	11	<5	314	11
Manganese	7439-96-5	5	mg/kg	116	1690	268	825	54
Nickel	7440-02-0	2	mg/kg	14	72	13	22	13
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Vanadium	7440-62-2	5	mg/kg	85	65	23	61	59
Zinc	7440-66-6	5	mg/kg	28	45	53	728	14
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	0.8	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	0.6	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	2.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	0.8	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	5.1	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	5.9	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	3.3	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	3.1	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	5.4	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	1.8	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	5.2	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	3.1	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	0.9	<0.5

Page : 4 of 18
Work Order : EM1717027
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH12 0.5m	BH12 1.0m	BH13 0.4-0.5m	BH14 0.3-0.4m	BH14 1.0-1.1m
				Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		EM1717027-001	EM1717027-002	EM1717027-003	EM1717027-004	EM1717027-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	**4.4**	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	**42.1**	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	**7.5**	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	**7.5**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	**7.5**	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	**210**	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	**210**	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	**420**	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	**370**	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	**110**	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	**480**	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**87.4**	**84.6**	**87.9**	**75.4**	**102**
2-Chlorophenol-D4	93951-73-6	0.5	%		**74.5**	**76.8**	**80.8**	**71.1**	**88.0**
2.4.6-Tribromophenol	118-79-6	0.5	%		**55.5**	**51.6**	**51.7**	**62.3**	**64.0**

Page	: 5 of 18
Work Order	: EM1717027
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH12 0.5m	BH12 1.0m	BH13 0.4-0.5m	BH14 0.3-0.4m	BH14 1.0-1.1m
				Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		EM1717027-001	EM1717027-002	EM1717027-003	EM1717027-004	EM1717027-005
					Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		79.3	78.4	80.3	87.6	92.2
Anthracene-d10	1719-06-8	0.5	%		107	110	113	92.7	91.1
4-Terphenyl-d14	1718-51-0	0.5	%		107	106	109	103	117
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		79.6	73.7	77.5	82.1	75.3
Toluene-D8	2037-26-5	0.2	%		78.6	82.0	78.7	90.4	87.0
4-Bromofluorobenzene	460-00-4	0.2	%		99.7	105	94.6	103	110

Page : 6 of 18
Work Order : EM1717027
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH15 0.5-0.6m	BH16 1.0-1.1m	BH16 2.0-2.1m	BH16 2.9-3.0m	BH17 0.5-0.6m
			Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	EM1717027-006	EM1717027-007	EM1717027-008	EM1717027-009	EM1717027-010
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	6.0	18.5	27.0	16.7	23.2
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	9	<5	<5
Barium	7440-39-3	10	mg/kg	10	230	90	<10	50
Beryllium	7440-41-7	1	mg/kg	<1	<4	1	<1	1
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<2	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	11	<4	4	6	17
Cobalt	7440-48-4	2	mg/kg	13	33	13	<2	16
Copper	7440-50-8	5	mg/kg	57	67	46	<5	24
Lead	7439-92-1	5	mg/kg	<5	<5	8	<5	12
Manganese	7439-96-5	5	mg/kg	350	1050	760	10	115
Nickel	7440-02-0	2	mg/kg	15	100	18	3	16
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Vanadium	7440-62-2	5	mg/kg	39	69	66	10	70
Zinc	7440-66-6	5	mg/kg	34	13	48	13	32
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

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Work Order : EM1717027
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH15 0.5-0.6m	BH16 1.0-1.1m	BH16 2.0-2.1m	BH16 2.9-3.0m	BH17 0.5-0.6m
				Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		EM1717027-006	EM1717027-007	EM1717027-008	EM1717027-009	EM1717027-010
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	0.6	0.6	0.6	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	1.2	1.2	1.2	1.2
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		87.4	87.1	83.5	78.2	82.4
2-Chlorophenol-D4	93951-73-6	0.5	%		80.4	77.7	78.0	69.6	82.6
2.4.6-Tribromophenol	118-79-6	0.5	%		65.0	49.6	56.1	54.2	55.5

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Work Order	: EM1717027
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH15 0.5-0.6m	BH16 1.0-1.1m	BH16 2.0-2.1m	BH16 2.9-3.0m	BH17 0.5-0.6m
				Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		EM1717027-006	EM1717027-007	EM1717027-008	EM1717027-009	EM1717027-010
					Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		80.3	81.2	87.3	84.7	81.1
Anthracene-d10	1719-06-8	0.5	%		85.8	82.5	99.4	110	106
4-Terphenyl-d14	1718-51-0	0.5	%		108	111	107	103	112
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		87.0	78.7	80.5	83.7	81.9
Toluene-D8	2037-26-5	0.2	%		91.5	75.6	89.7	88.5	90.7
4-Bromofluorobenzene	460-00-4	0.2	%		111	91.6	105	106	106

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Work Order : EM1717027
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH17 1.9-2.0m	BH18 0.2-0.3m	BH18 0.9-1.0m	BH19 0.2-0.3m	BH19 0.9-1.0m
			Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	EM1717027-011	EM1717027-012	EM1717027-013	EM1717027-014	EM1717027-015
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	18.1	22.1	17.3	19.0	19.6
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Barium	7440-39-3	10	mg/kg	220	130	180	220	2770
Beryllium	7440-41-7	1	mg/kg	<1	1	<5	<1	3
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<3	<1	<1
Chromium	7440-47-3	2	mg/kg	16	10	13	21	11
Cobalt	7440-48-4	2	mg/kg	45	14	17	9	37
Copper	7440-50-8	5	mg/kg	32	72	15	44	13
Lead	7439-92-1	5	mg/kg	6	144	<5	341	14
Manganese	7439-96-5	5	mg/kg	2410	167	1100	208	255
Nickel	7440-02-0	2	mg/kg	38	14	29	12	19
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Vanadium	7440-62-2	5	mg/kg	61	53	43	29	43
Zinc	7440-66-6	5	mg/kg	75	104	30	227	17
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	1.0	<0.1	1.5	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	1.7	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	1.0	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	6.1	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	6.6	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	2.9	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	2.7	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	4.1	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	1.4	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	3.6	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	1.9	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

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Work Order : EM1717027
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH17 1.9-2.0m	BH18 0.2-0.3m	BH18 0.9-1.0m	BH19 0.2-0.3m	BH19 0.9-1.0m
				Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		EM1717027-011	EM1717027-012	EM1717027-013	EM1717027-014	EM1717027-015
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	**2.6**	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	**35.1**	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	**4.7**	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	**4.9**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	**5.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	**310**	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	**300**	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	**610**	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	**530**	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	**160**	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	**690**	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**85.2**	**99.4**	**93.4**	**95.5**	**87.3**
2-Chlorophenol-D4	93951-73-6	0.5	%		**84.6**	**86.3**	**81.1**	**81.5**	**80.1**
2.4.6-Tribromophenol	118-79-6	0.5	%		**58.0**	**69.9**	**64.2**	**76.2**	**61.4**

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Work Order	: EM1717027
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH17 1.9-2.0m	BH18 0.2-0.3m	BH18 0.9-1.0m	BH19 0.2-0.3m	BH19 0.9-1.0m
				Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00	12-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		EM1717027-011	EM1717027-012	EM1717027-013	EM1717027-014	EM1717027-015
					Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		88.2	87.1	89.5	86.7	82.2
Anthracene-d10	1719-06-8	0.5	%		81.7	92.6	82.3	93.1	82.9
4-Terphenyl-d14	1718-51-0	0.5	%		111	106	106	103	98.1
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		80.9	72.5	78.3	82.9	77.2
Toluene-D8	2037-26-5	0.2	%		86.8	76.1	86.7	90.9	81.3
4-Bromofluorobenzene	460-00-4	0.2	%		106	93.3	105	109	103

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Work Order : EM1717027
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH20 0.5m	BH21 0.5m	----	----	----
			Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EM1717027-016	EM1717027-017	--------	--------	--------
				Result	Result	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	22.1	20.1	----	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	6	----	----	----
Barium	7440-39-3	10	mg/kg	40	170	----	----	----
Beryllium	7440-41-7	1	mg/kg	<1	<1	----	----	----
Boron	7440-42-8	50	mg/kg	<50	<50	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	----	----	----
Chromium	7440-47-3	2	mg/kg	12	12	----	----	----
Cobalt	7440-48-4	2	mg/kg	3	11	----	----	----
Copper	7440-50-8	5	mg/kg	10	49	----	----	----
Lead	7439-92-1	5	mg/kg	9	238	----	----	----
Manganese	7439-96-5	5	mg/kg	59	301	----	----	----
Nickel	7440-02-0	2	mg/kg	4	15	----	----	----
Selenium	7782-49-2	5	mg/kg	<5	<5	----	----	----
Vanadium	7440-62-2	5	mg/kg	48	29	----	----	----
Zinc	7440-66-6	5	mg/kg	12	157	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	0.8	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	----	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	1.5	----	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3.5	----	----	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	3.7	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	2.6	----	----	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	2.1	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3.4	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	1.1	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	2.8	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	1.5	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	----	----	----

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Work Order : EM1717027
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH20 0.5m	BH21 0.5m	----	----	----
				Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM1717027-016	EM1717027-017	--------	--------	--------
					Result	Result	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	1.8	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	24.0	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	3.7	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	3.9	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	4.2	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	----	----	----
C10 - C14 Fraction	----	50	mg/kg		<50	<50	----	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	<100	----	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	<100	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	----	----	----
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		<100	140	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	140	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	----	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	----	----	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	----	----	----
Naphthalene	91-20-3	1	mg/kg		<1	<1	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		89.3	85.4	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		80.5	73.1	----	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%		68.0	71.6	----	----	----

Page	: 14 of 18
Work Order	: EM1717027
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH20 0.5m	BH21 0.5m	----	----	----
				Client sampling date / time	12-Dec-2017 00:00	12-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM1717027-016	EM1717027-017	--------	--------	--------
					Result	Result	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		83.6	83.4	----	----	----
Anthracene-d10	1719-06-8	0.5	%		82.7	91.7	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		101	102	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		93.4	73.0	----	----	----
Toluene-D8	2037-26-5	0.2	%		106	82.5	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		123	98.9	----	----	----

Page : 15 of 18
Work Order : EM1717027
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	Rinsate	----	----	----	----
			Client sampling date / time	11-Dec-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM1717027-019	--------	--------	--------	--------
				Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Boron	7440-42-8	0.05	mg/L	<0.05	----	----	----	----
Barium	7440-39-3	0.001	mg/L	<0.001	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.017**	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	----	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	----	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	----	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	----	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	----	----	----	----

Page : 16 of 18
Work Order : EM1717027
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	Rinsate	----	----	----	----
				Client sampling date / time	11-Dec-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM1717027-019	--------	--------	--------	--------
					Result	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L		<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L		<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L		<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	----	----	----	----
Toluene	108-88-3	2	µg/L		<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	----	----	----	----
^ Total Xylenes	----	2	µg/L		<2	----	----	----	----
^ Sum of BTEX	----	1	µg/L		<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		30.6	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		70.7	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		74.4	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		80.6	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%		85.4	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		83.6	----	----	----	----

Page	: 17 of 18
Work Order	: EM1717027
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**Rinsate**	----	----	----	----
				Client sampling date / time	11-Dec-2017 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EM1717027-019**	--------	--------	--------	--------
					Result	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**102**	----	----	----	----
Toluene-D8	2037-26-5	2	%		**103**	----	----	----	----
4-Bromofluorobenzene	460-00-4	2	%		**104**	----	----	----	----

Page	: 18 of 18
Work Order	: EM1717027
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Surrogate Control Limits

Sub-Matrix: **SOIL**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	54	125
2-Chlorophenol-D4	93951-73-6	65	123
2.4.6-Tribromophenol	118-79-6	34	122
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	61	125
Anthracene-d10	1719-06-8	62	130
4-Terphenyl-d14	1718-51-0	67	133
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	51	125
Toluene-D8	2037-26-5	55	125
4-Bromofluorobenzene	460-00-4	56	124

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	46
2-Chlorophenol-D4	93951-73-6	23	104
2.4.6-Tribromophenol	118-79-6	28	130
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	36	114
Anthracene-d10	1719-06-8	51	119
4-Terphenyl-d14	1718-51-0	49	127
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	129
Toluene-D8	2037-26-5	70	125
4-Bromofluorobenzene	460-00-4	71	129

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM1717330**	Page	: 1 of 6
Client	: GEO-ENVIRONMENTAL SOLUTIONS	Laboratory	: Environmental Division Melbourne
Contact	: KRIS TAYLOR	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6223 1839	Telephone	: +61-3-8549 9630
Project	: Gorringe	Date Samples Received	: 12-Dec-2017 10:10
Order number	: ----	Date Analysis Commenced	: 12-Dec-2017
C-O-C number	: ----	Issue Date	: 19-Dec-2017 15:12
Sampler	: AARON PLUMMER		
Site	: ----		
Quote number	: EN/222/17		
No. of samples received	: 1		
No. of samples analysed	: 1		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Nancy Wang	2IC Organic Chemist	Melbourne Organics, Springvale, VIC
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics, Springvale, VIC

Page	: 2 of 6
Work Order	: EM1717330
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- This is a rebatch of EM1717027
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.

Page	: 3 of 6
Work Order	: EM1717330
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Duplicate	----	----	----	----
			Client sampling date / time	12-Dec-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM1717330-001	--------	--------	--------	--------
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	20.5	----	----	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	7	----	----	----	----
Barium	7440-39-3	10	mg/kg	140	----	----	----	----
Beryllium	7440-41-7	1	mg/kg	<1	----	----	----	----
Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	13	----	----	----	----
Cobalt	7440-48-4	2	mg/kg	16	----	----	----	----
Copper	7440-50-8	5	mg/kg	35	----	----	----	----
Lead	7439-92-1	5	mg/kg	166	----	----	----	----
Manganese	7439-96-5	5	mg/kg	320	----	----	----	----
Nickel	7440-02-0	2	mg/kg	19	----	----	----	----
Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
Vanadium	7440-62-2	5	mg/kg	22	----	----	----	----
Zinc	7440-66-6	5	mg/kg	173	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	0.7	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	----	----	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	----	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg	0.8	----	----	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	----	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg	2.4	----	----	----	----
Pyrene	129-00-0	0.5	mg/kg	2.7	----	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	1.8	----	----	----	----
Chrysene	218-01-9	0.5	mg/kg	1.6	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	2.2	----	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	1.8	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	----	----	----	----

Page : 4 of 6
Work Order : EM1717330
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	Duplicate	----	----	----	----
				Client sampling date / time	12-Dec-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM1717330-001	--------	--------	--------	--------	
				Result	----	----	----	----	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	1.1	----	----	----	----	
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	16.4	----	----	----	----	
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	2.4	----	----	----	----	
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	2.7	----	----	----	----	
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	2.9	----	----	----	----	
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg	<10	----	----	----	----	
C10 - C14 Fraction	----	50	mg/kg	<50	----	----	----	----	
C15 - C28 Fraction	----	100	mg/kg	<100	----	----	----	----	
C29 - C36 Fraction	----	100	mg/kg	<100	----	----	----	----	
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	----	----	----	----	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	----	----	----	----	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	----	----	----	----	
>C10 - C16 Fraction	----	50	mg/kg	<50	----	----	----	----	
>C16 - C34 Fraction	----	100	mg/kg	120	----	----	----	----	
>C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----	
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	120	----	----	----	----	
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	----	----	----	----	
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg	<0.2	----	----	----	----	
Toluene	108-88-3	0.5	mg/kg	<0.5	----	----	----	----	
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	----	----	----	----	
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	----	----	----	----	
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	----	----	----	----	
^ Sum of BTEX	----	0.2	mg/kg	<0.2	----	----	----	----	
^ Total Xylenes	----	0.5	mg/kg	<0.5	----	----	----	----	
Naphthalene	91-20-3	1	mg/kg	<1	----	----	----	----	
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%	89.7	----	----	----	----	
2-Chlorophenol-D4	93951-73-6	0.5	%	85.3	----	----	----	----	
2.4.6-Tribromophenol	118-79-6	0.5	%	75.6	----	----	----	----	

Page	:	5 of 6
Work Order	:	EM1717330
Client	:	GEO-ENVIRONMENTAL SOLUTIONS
Project	:	Gorringe

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	Duplicate	----	----	----	----
				Client sampling date / time	12-Dec-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM1717330-001	--------	--------	--------	--------	
				Result	----	----	----	----	
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%	110	----	----	----	----	
Anthracene-d10	1719-06-8	0.5	%	113	----	----	----	----	
4-Terphenyl-d14	1718-51-0	0.5	%	110	----	----	----	----	
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%	73.0	----	----	----	----	
Toluene-D8	2037-26-5	0.2	%	82.5	----	----	----	----	
4-Bromofluorobenzene	460-00-4	0.2	%	98.9	----	----	----	----	

Page	:	6 of 6
Work Order	:	EM1717330
Client	:	GEO-ENVIRONMENTAL SOLUTIONS
Project	:	Gorringe

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	54	125
2-Chlorophenol-D4	93951-73-6	65	123
2.4.6-Tribromophenol	118-79-6	34	122
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	61	125
Anthracene-d10	1719-06-8	62	130
4-Terphenyl-d14	1718-51-0	67	133
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	51	125
Toluene-D8	2037-26-5	55	125
4-Bromofluorobenzene	460-00-4	56	124

Appendix 9 Soil Vapour Analytical Results

A.B.N. 44 000 964 278
10 / 585 Blackburn Road
Notting Hill, Vic, 3168
Telephone: (03) 9574 3200

Chartered Chemists

19-Dec-2017

REPORT NUMBER: M171189

Site/Client Ref: Supply & Analysis of WMS

Geo-Environmental Solutions
86 Queen Street
Sandy Bay
TAS 7005
Attention: Sarah Joyce

CERTIFICATE OF ANALYSIS

SAMPLES:	Five samples were received for analysis
DATE RECEIVED:	**15-Dec-2017**
DATE COMMENCED:	**15-Dec-2017**
METHODS:	See Attached Results
RESULTS:	Please refer to attached pages for results.

Note: Results are based on samples as received at SGS laboratories
Results in airbourne concentrations are calculated using data provided by the client

REPORTED BY:

Majid Abdolali
Chemist

NATA Accredited Laboratory Number: 2562
Corporate Site Number: 14420
Accredited for compliance
with ISO/IEC 17025.

Page 1 of 5

SGS

Report N°: M171189

ANALYTICAL RESULTS

Matrix: Passive Sampler
Method: MA-5.WL.04 Volatile Organics
Sample units are expressed in µg/m³ — Test Started: 15/12/2017

	Leeder ID	2017016059	2017016060	2017016061	2017016062	2017016063
	Client ID	VP1 1730-AN-LU-067	VP2 1730-AN-LU-070	VP3 1730-AN-LU-066	VP4 1730-AN-LU-068	Dup 1730-AN-LU-069
Analyte Name	**Sampled Date**	14/12/2017	14/12/2017	14/12/2017	14/12/2017	14/12/2017
	PQL					
Benzene		<19	<19	<18	<19	<18
Ethylbenzene		<10	<10	47	<10	<9.9
Naphthalene		<13	<12	<12	<13	<12
Toluene		17	<13	14	<13	<12
o-Xylene		<10	<10	21	<10	<10
m&p-Xylenes		17	<10	110	<10	<10

Matrix: Passive Sampler
Method: MA-5.WL.03 Volatile Organics
Sample units are expressed in µg total — Test Started: 15/12/2017

	Leeder ID	2017016064
	Client ID	Method
Analyte Name	**Sampled Date**	
	PQL	Blank
Benzene	0.05	nd
Ethylbenzene	0.05	nd
Naphthalene	0.05	nd
Toluene	0.05	nd
o-Xylene	0.05	nd
m&p-Xylenes	0.05	nd

Matrix: Passive Sampler
Method: MA-30.AIR.04 Total Recoverable Hydrocarbons
Sample units are expressed in mg/m³ — Test Started: 15/12/2017

	Leeder ID	2017016059	2017016060	2017016061	2017016062	2017016063
	Client ID	VP1 1730-AN-LU-067	VP2 1730-AN-LU-070	VP3 1730-AN-LU-066	VP4 1730-AN-LU-068	Dup 1730-AN-LU-069
Analyte Name	**Sampled Date**	14/12/2017	14/12/2017	14/12/2017	14/12/2017	14/12/2017
	PQL					
C6-C10		<2.5	<2.5	14	<2.5	<2.5
C6-C10 (ex BTEX)		<2.5	<2.5	13	<2.5	<2.5
>C10-C16		<1.0	<1.0	2.4	<1.0	<1.0
>C10-C16 (less Naphthalene)		<1.0	<1.0	2.4	<1.0	<1.0

SGS

Report N°: M171189

ANALYTICAL RESULTS

Matrix: Passive Sampler
Method: MA-30.AIR.03 Total Recoverable Hydrocarbons
Sample units are expressed in µg total

Test Started: 15/12/2017

	Leeder ID	2017016064
	Client ID	Method
Analyte Name	**Sampled Date**	
	PQL	Blank
C6-C10	5	nd
C6-C10 (ex BTEX)	5	nd
>C10-C16	5	nd
>C10-C16 (less Naphthalene)	5	nd

Page 3 of 5

SGS

Report N°: M171189

QA/QC RESULTS

Matrix: Passive Sampler
Method: MA-5.WL.03 Volatile Organics
Quality Control Results are expressed in Percent Recovery of expected result

Test Started: 15/12/2017

	Leeder ID	2017016065	2017016066
	Client ID	Method	Method
Analyte Name	**Sampled Date**		
	PQL	Spike	Spike Dup
Benzene		114	113
Ethylbenzene		100	96
Toluene		106	104
o-Xylene		100	98
m&p-Xylenes		102	99

Report N°: M171189

QUALIFIERS / NOTES FOR REPORTED RESULTS

PQL	Practical Quantitation Limit
nd	Not Detected – The analyte was not detected above the reported PQL.
is	Insufficient Sample to perform this analysis.
T	Tentative identification based on computer library search of mass spectra.
NC	Not calculated and/or Results below PQL
NV	No Vacuum, Canister received above standard atmospheric pressure
nr	Not Requested for analysis.
R	Rejected Result – results for this analysis failed QC checks.
SQ	Semi-Quantitative result – quantitation based on a generic response factor for this class of analyte.
IM	Inappropriate method of analysis for this compound
U	Unable to provide Quality Control data – high levels of compounds in sample interfered with analysis of QC results.
UF	Unable to provide Quality Control data- Surrogates failed QC checks due to sample matrix effects
L	Analyte detected at a level above the linear response of calibration curve.
E	Estimated result. NATA accreditation does not cover estimated results.
C1	These compounds co-elute.
--	Parameter Not Determined
CT	Elevated concentration. Results reported from carbon tube analysis
**	Sample shows non-petroleum hydrocarbon profile

APPENDIX ONE.

CHAIN OF CUSTODY DOCUMENT

SGS

Chain of Custody Record

Dispatch samples to: Unit 10/585 Blackburn Road, Notting Hill, Victoria 3168, Australia

Attn: Sample Reception - Contact Ph: +613 9574 3311 Email: au.samplereceipt.melbourne@sgs.com

Sheet 1 of 1

CLIENT NAME: GES
CLIENT ADDRESS: 29 Kirksway Place Battery Point
CONTACT: Sarah Joyce
PROJECT REF. Corringe - 66 Burnett St
PURCHASE ORDER No:

CONTACT PHONE No: 62231839
SAMPLED BY: Aaron Plummer
RESULTS REQUIRED BY: 48 hour turn around @ 50% surcharge
EMAIL ADDRESS: S.joyce@geosolutions.net.au; jcumming@geosolutions.net.au; Miran@geosolutions.net.au (invoice)

ABN: 24 115 004 834
LAB QUOTE NUMBER:

Client Sample ID	Date Sampled	Matrix: Soil	Matrix: Water	Matrix: Other (Soil Vapour)	Containers/Preservation (please mark with X) (G=glass, P=plastic): 0.1-1L Jar(G) n.a.	0.1-1.0 litre(G) Nat.	0.1-1.0 litre(P) Nat.	40ml Vial(G) Nat.	40ml Vial(G) H2SO4	01-1L (P) H2SO4	125mL (P) HCl acid washed	125mL (P) Zn Acet. NaOH	125mL (P) Filtered Yes/No HNO3	125mL (P) NaOH	0.1-1.0 litre (P) sterilised	Analyses Required (Analyte + Method Code): NEPM Hydrocarbon + BTEX
VP1 (1730-AN-LU-067)	11-14 Dec			✓												✓
VP2 (1730-AN-LU-070)	"			✓												✓
VP3 (1730-AN-LU-066)	"			✓												✓
VP4 (1730-AN-LU-068)	"			✓												✓
Dup (1730-AN-LU-069)	"			✓												✓
----------	Totals:															

CHAIN OF CUSTODY RECORD

Chill method used for transport (sender to complete): Not chilled.	Chill method used for transport (sender to complete):
RELEASED BY: (Name) Sarah Joyce (Signature) (Date / Time) 14-12-17 1230	RELEASED BY: (Name) (Signature) (Date / Time)
RECEIVED BY: (Name) Benedict Robinson (Signature) (Date / Time) 15/12/17 9:00am	RECEIVED BY: (Name) (Signature) (Date / Time)
Temperature on sample receipt: ___°C Custody Seals Intact? Y/N	Temperature on sample receipt: ___°C Custody Seals Intact? Y/N

Please Note: Dissolved metals require filtering in the field.

Comments: (eg. Highly contaminated samples, reporting requirements etc)

Notes: NEPM Hydrocarbon + BTEX, Naphthalene TPH F1 + F2 Fractions
Container 1 x water-loo Membrane Sampler per sample.

CONTAMINATION MANAGEMENT PLAN

66 BURNETT STREET

NORTH HOBART

DECEMBER 2017 (AMENDED 29 MARCH 2018)

GEO-ENVIRONMENTAL

SOLUTIONS

Geo-Environmental Solutions P/L 29 Kirksway Place, Battery Boint7005. Ph 6223 1839 Fax 6223 4539

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1 Introduction

This Contamination Management Plan (CMP) is written for the proposed redevelopment of the property at 66 Burnett Street, North Hobart, Hobart - hereby referred to as 'The Site' (Figure 1). Geo-Environmental Solutions Pty. Ltd. (GES) were engaged to prepare a site the CMP. A copy of the document should be accessible by the project manager at all times during site development work.

This CMP has been prepared by a suitably qualified and experience practitioner in accordance with procedures and practices detailed in NEPM (2013) guidelines and key regulations and policies identified in the References section of this document.

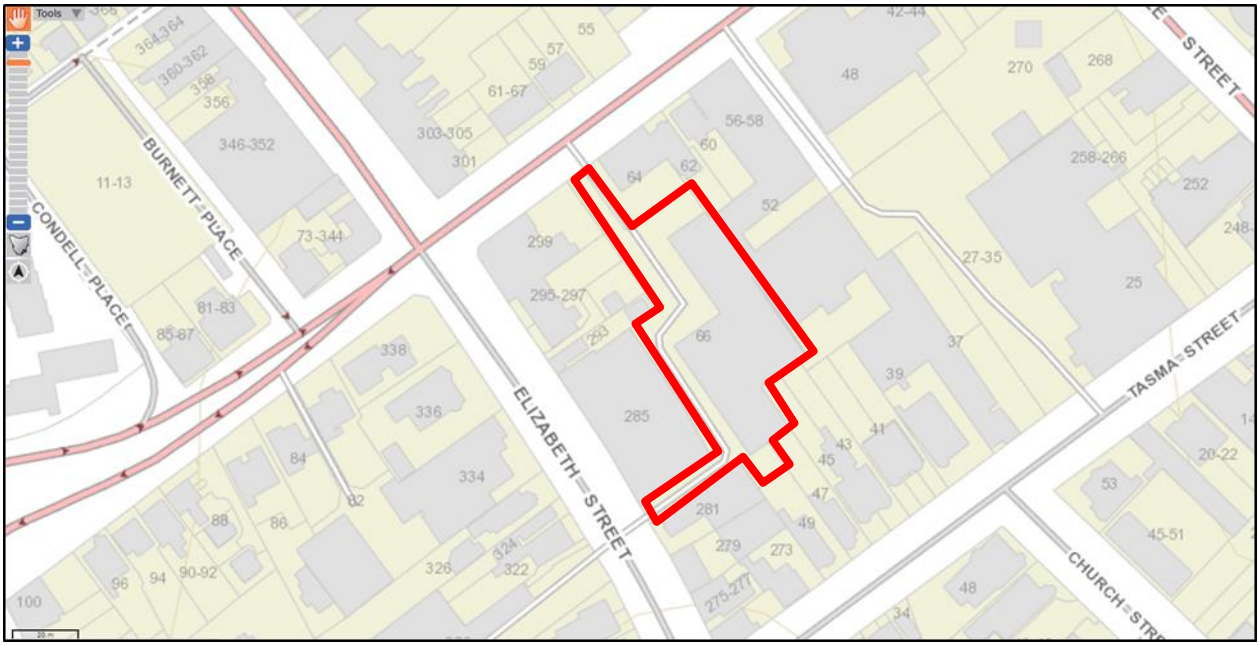


Figure 1-The LISTMap showing the location of the site, site outlined in Red.

1.1 Site Details

Site details are presented in Table 1.

Table 1 Site Details

SITE LOCATION: 66 Burnett Street, North Hobart. Identified as 281a Elizabeth Street, North Hobart in the PESA (GES 2017)
INVESTIGATION AREA 281a Elizabeth Street which has a second entrance at 66 Burnett Street. Limits approximately defined by borehole extent
SITE ELEVATION & GRADIENT 41.7 to 46.2 m Australian Height Datum (AHD) over 110m with a 2.5º or 4.5% increase to the northern end of the site.
SITE SURFACING The surface of the site is 95 % concrete and 5% gravel fill.
TITLE REFERENCES The investigation area includes the following title reference for 66 Burnett Street, North Hobart: CT 26099/4
SITE OWNER Hobart Properties & Securities Pty Ltd
PREVIOUS LANDUSE Residential Properties
SITE SURROUNDING LAND ZONING Tasmanian Interim Planning Scheme 2015 The majority of the site is zone '23.0 Commercial' Drive way from Elizabeth Street is Zoned '15.0 Urban Mixed Use'
SITE LAND USE Commercial Land Use for the maintenance and repairs of a range of cars and trucks
SURROUNDING LAND USE: NE: Commercial Properties; SE to NW: Mixed Urban use – Café's and Restaurants; N Light Industrial premises.

1.2 Background

GES completed a *Preliminary Environmental Site Assessment* (PESA) in July 2017 (GES 2017a) and an *Environmental Site Assessment* (ESA) in December 2017 (GES, 2017b) at the site which included a Tier 1 Health Risk Assessment (HRA) to assess any potential soil contamination risks which may arise due to proposed site building development works.

The ESA assessed the site based on its sensitive land use and concluded that the proposed works are acceptable and will not adversely impact upon human health or the environment provisional to implementation of measures identified within this CMP.

The following recommendations were presented in the original ESA document:

When redevelopment work commences for the site, GES recommends that the following actions should be undertaken:

- A Contamination Management Plan will be required
- Further Environmental Site Assessment which should include but not be limited to;
    - All four underground storage tanks (confirmed and suspected) should be formally decommissioned and tank pits should be validated.
    - The interceptor trap should be removed, and remaining soil should be validated; and
    - Further investigations will be required under the footprint of the buildings, at a minimum in Area C for contamination.
- All excavated soil at the site should be stockpiled and assessed against IB105 guidelines
- GES recommends separating stockpiles; and keeping the shallow material 0.0-0.4 m bgs separate. All remaining material is likely to be classified as Level 1 clean fill (with proof of analytical results).

1.3 Objectives

The purpose of this CMP is to identify the site hazards associated with residual contamination from soil, minimise risks to site workers and the environment, and advise of safety measures to implement during any future excavation or construction works that may occur at the site.

The CMP includes information and guidance in relation to:

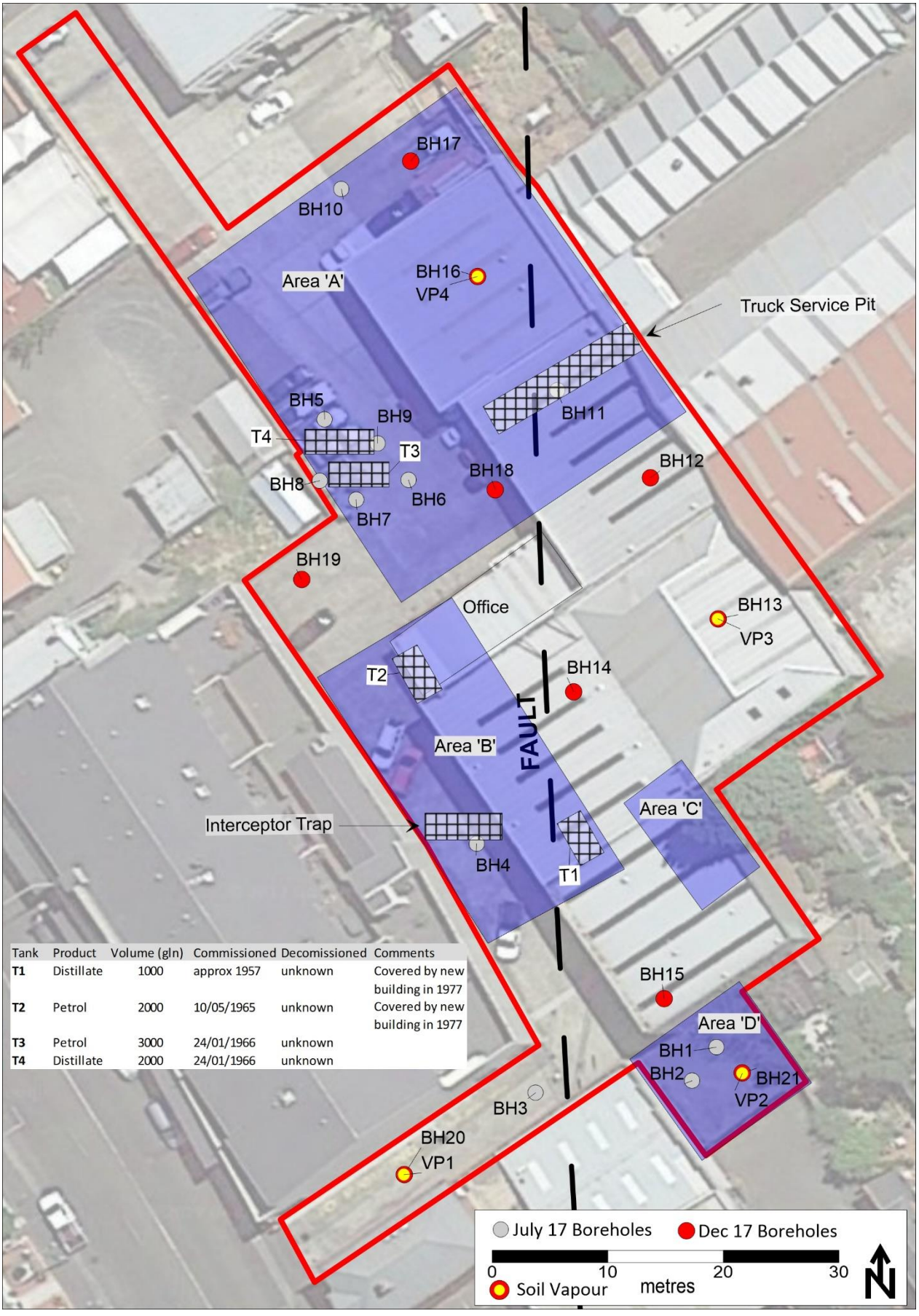
- Identifying measures to minimise human health hazards and potential environmental impacts during site excavation works.
- Outlining procedures to be followed relating to excavation during construction or maintenance works.
- Providing information relating to management of exposed soil surfaces and off-site soil disposal.

1.4 Implementing the Contamination Management Plan

It will be the responsibility of the owner(s) of the site to implement of this CMP. The owner(s) of the site may at times expressly delegate responsibility for site management as appropriate. The site owner(s) retains overall responsibility for implementation of this CMP and any modifications required should site conditions change.

The owner(s) of the site are responsible for the distribution of this CMP to any building or development contractors working on site and these contractors must also comply with the requirements of this CMP.

To manage potential health risks, the advice stipulated in this CMP should be followed by all persons involved in works or other activities at the site that may result in the disturbance and/or excavation of soil within the ESA investigation areas.



Tank	Product	Volume (gln)	Commissioned	Decomissioned	Comments
T1	Distillate	1000	approx 1957	unknown	Covered by new building in 1977
T2	Petrol	2000	10/05/1965	unknown	Covered by new building in 1977
T3	Petrol	3000	24/01/1966	unknown	
T4	Distillate	2000	24/01/1966	unknown	

Figure 2 Site Plan

2 Soil Contamination Assessment

Given that petroleum hydrocarbons are a contaminate of concern at the site, Health Screening Level (HSL) limits were applicable to the assessment in addition to Health Investigation levels (HIL's) for heavy metals.

There was no observed tiles or asbestos sheeting fragments within the soils which may have warranted the need to collect samples for asbestos analysis.

2.1 Assessment Criteria

The reported soil analytical results were compared to the following relevant investigation guidelines suitable for assessment of soil contamination:

NEPM (2013) Schedule B1, Guideline on Investigation Levels for Soil.

- Health Screening Levels (HSL's) –setting D for current commercial use and for mixed use with ground floor parking/commercial space and setting B residential for a small area of the proposed development;
- Health Investigation Limit (HIL B) – residential with full paving;
- Environmental Investigation Levels (EIL's) - have been developed for selected metal and organic substances in an urban residential and public open space setting based on the following soil properties:
    - Fine grained soil class
    - Soil pH of 6.0
    - Cation Exchange Capacity of 25 cmol/kg
    - 30% Clay

EPA Tasmania (2010) Information Bulletin 105 (IB105) – Classification and Management of Contaminated Soil for Disposal, November 2010.

2.2 Soil Assessment Results

2.2.1 Health Investigation Levels

Soil samples were collected during borehole drilling works across the site. A total of 20 primary samples were collected from locations across the site and submitted to a National Association of Testing Authorities (NATA) registered laboratory for analysis of identified contaminants of potential concern (COPC) which included the following.

Soil analytical results are compared against the HIL's.

- There was one exceedance of HIL B guidelines for hydrocarbons for High Density Residential in BH4 0.5 of TPH $C^{16} – C^{34}$. BH4 is located near the historical interceptor trap.
- Several samples exceed HIL B guidelines for heavy metals and B(a)P for High Density Residential use and one sample exceeded HIL D

Mitigation measures relating to the identified risks are detailed in Section 3 & 4.

2.2.2 Health Screening Levels

Soil hydrocarbon analytical results were compared against CRC CARE HSL guidelines for assessing dermal contact hazard as per guidelines for intrusive maintenance workers and HSL B guidelines for residential use.

None of the soil samples collected at the site exceeds the hydrocarbon HSL's for assessing vapour intrusion risk to shallow intrusive maintenance workers or site inhabitants.

2.2.3 IB105 Investigation Limits for Soil Disposal

The soil samples have been compared against IB105 guidelines for soil disposal. Elevated lead & TPH, and B(a)P concentrations on site in a number of samples show level 2 & 3 contaminated material (Table 2). The bulk of the impact occurs in shallow fill material at the site, and care should be taken to excavate the top 0.3 m from the site and stockpiling separately from the

remaining deep excavations. This is likely to bring the bulk excavations below 0.3 m BGS to Level 1. GES therefore recommends that all soil excavated at the site is sorted, stockpiled, and transported to a licensed storage and handling facility for managing contaminated soil as required.

The borehole logs in appendix 1 highlight the depths of contaminates detected and the material consistency, type and colour to aid identification on site.

Information Bulletin 105 Classification and Management of Contaminated Soil For Disposal X - Below Proposed Finished Floor Level		EG005T: Total Metals by ICP-AES											EG035T	EP075(SIM)A		EP080: BTEX				EP080/071: TRH	
		Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Zinc	Mercury	Benzo(a)pyrene	Sum of polycyclic aromatic hydrocarbons	Benzene	Toluene	Ethylbenzene	Total Xylenes	C6 - C9 Fraction	C10 - C36 Fraction (sum)
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		5	10	1	1	2	2	5	5	5	2	5	0.1	0.5	0.5	0.2	0.5	0.5	0.5	10	50
Investigation Level Selected																					
IB105 Level 1		20	300	2	3	50	100	100	300	500	60	200	1	0.08	20	1	1	3	14	65	1000
IB105 Level 2		200	3000	40	40	500	200	2000	1200	5000	600	14000	30	2	40	5	100	100	180	650	5000
IB105 Level 3		750	30000	400	400	5000	1000	7500	3000	25000	3000	50000	110	20	200	50	1000	1080	1800	1000	10000
IB105 Level 4		>750	>30000	>400	>400	>5000	>1000	>7500	>3000	>25000	>3000	>50000	>110	>20	>200	>50	>1000	>1080	>1800	>1000	>10000
17/06/2017	BH1 0.10m	<5	80	<1	18	30	13	172	362	275	28	390	0.6	0.8	7.1	<0.2	<0.5	<0.5	<0.5	<10	300
17/06/2017	BH1 0.9m	<5	50	<1	<1	7	4	16	26	148	6	17	0.2	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH2 0.1m	<5	140	<1	<1	23	6	53	364	176	22	329	0.2	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH2 0.9m	<5	80	<1	<1	5	6	20	359	256	6	26	0.9	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH3 0.5m	<5	40	<1	<1	4	21	83	9	262	9	36	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH3 2.3m	<5	170	1	<1	8	19	16	11	125	20	65	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH4 0.5m	17	400	1	<1	10	13	116	4570	512	16	473	1	2.2	22.3	<0.2	<0.5	<0.5	<0.5	132	9550
17/06/2017	BH4 1.0m	<5	120	1	<1	13	6	17	16	80	8	25	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH5 0.1m X	<5	80	<1	1	16	8	69	208	217	18	184	0.5	3.6	44.2	<0.2	<0.5	<0.5	<0.5	<10	770
17/06/2017	BH5 3.0m	18	10	<1	<1	23	4	8	13	554	6	24	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH6 0.2m X	8	900	<1	2	20	11	122	1430	248	20	941	1.5	3.5	33.3	<0.2	<0.5	<0.5	<0.5	<10	540
17/06/2017	BH6 2.0m	6	30	<1	<1	13	8	8	11	1680	11	23	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH6 3.0m	16	<10	<1	<1	10	<2	8	12	70	4	33	0.3	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH7 0.2m X	8	820	<1	1	16	10	101	1140	213	18	614	2.1	3.8	37.8	<0.2	<0.5	<0.5	<0.5	<10	310
17/06/2017	BH7 1.0m X	<5	1090	5	<1	15	67	28	16	198	50	47	0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH7 3.0m	<5	10	<1	<1	6	3	<5	5	121	3	13	1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH8 1.0m X	<5	20	<1	<1	14	3	<5	<5	37	7	18	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH8 0.5m X	<5	10	<1	<1	13	2	<5	<5	51	3	28	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH9 0.2m X	10	500	1	<1	17	17	76	852	366	16	588	1.6	2.3	23.7	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH9 3.0m	<5	30	<1	<1	8	4	5	<5	55	3	13	0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH10 0.1m X	<5	30	<1	<1	5	15	90	60	279	11	99	0.1	1	9.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH10 1.0m X	6	110	1	<1	11	32	19	9	1490	28	23	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH11 0.1m X	7	50	1	<1	11	32	27	17	2260	30	79	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	380
12/12/2017	BH12 0.5m X	5	220	1	<1	18	13	32	10	116	14	28	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH12 1.0m	8	660	4	<1	16	368	39	11	1690	72	45	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH13 0.4-0.5m X	<5	20	1	<1	7	6	16	<5	268	13	53	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH14 0.3-0.4m X	35	180	<1	<10	20	12	80	314	825	22	728	0.8	5.2	42.1	<0.2	<0.5	<0.5	<0.5	<10	420
12/12/2017	BH14 1.0-1.1m	<5	480	1	<1	14	14	17	11	54	13	14	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH15 0.5-0.6m	<5	10	<1	<1	11	13	57	<5	350	15	34	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 1.0-1.1m X	<5	230	<4	<2	<4	33	67	<5	1050	100	13	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 2.0-2.1m X	9	90	1	<1	4	13	46	8	760	18	48	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 2.9-3.0m	<5	<10	<1	<1	6	<2	<5	<5	10	3	13	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH17 0.5-0.6m X	<5	50	1	<1	17	16	24	12	115	16	32	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH17 1.9-2.0m X	<5	220	<1	<1	16	45	32	6	2410	38	75	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH18 0.2-0.3m X	<5	130	1	<1	10	14	72	144	167	14	104	1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH18 0.9-1.0m X	<5	180	<5	<3	13	17	15	<5	1100	29	30	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH19 0.2-0.3m X	<5	220	<1	<1	21	9	44	341	208	12	227	1.5	3.6	35.1	<0.2	<0.5	<0.5	<0.5	<10	610
12/12/2017	BH19 0.9-1.0m X	<5	2770	3	<1	11	37	13	14	255	19	17	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH20 0.5m	<5	40	<1	<1	12	3	10	9	59	4	12	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH21 0.5m	6	170	<1	<1	12	11	49	238	301	15	157	0.8	2.8	24	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH10 0.1m	<5	30	<1	<1	5	15	90	60	279	11	99	0.1	1	9.5	<0.2	<0.5	<0.5	<0.5	<10	<50
17/06/2017	BH10 1.0m	6	110	1	<1	11	32	19	9	1490	28	23	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 1.0-1.1m	<5	230	<4	<2	<4	33	67	<5	1050	100	13	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 2.0-2.1m	9	90	1	<1	4	13	46	8	760	18	48	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH16 2.9-3.0m	<5	<10	<1	<1	6	<2	<5	<5	10	3	13	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH17 0.5-0.6m	<5	50	1	<1	17	16	24	12	115	16	32	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50
12/12/2017	BH17 1.9-2.0m	<5	220	<1	<1	16	45	32	6	2410	38	75	<0.1	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<10	<50

Table 2 – All soil results compared to IB105 for disposal

3 Minimization of Potential Environmental Impacts

Potential health exposure risks during any excavations or subsurface works may be associated with:

- Soil excavation and management
- Movement of soil
- Stormwater management and sedimentation

To minimise potential environmental impacts, all work must be conducted in accordance with the guidance set out in this plan as well as any relevant EPA Tasmania guidelines. A site specific soil and water management plan has also been prepared by the building designer for the site.

3.1 Soil Excavation and Management

The following procedures must be carried out prior to, during and following the completion of any soil excavation and/or surface cover disturbance at the site.

3.1.1 Prior to Commencement

- Contractors and workers must be made aware of the potential soil contamination and be familiar with the requirements of the CMP.
- Contractors must prepare a site-specific Health and Safety Plan covering their workers at the site for any anticipated risks.

3.1.2 During Excavation Works – Stockpile Management

Soil from the site must be managed so as not to cause environmental harm in accordance with the Environmental Management and Pollution Control (Waste Management) Regulations, 2000 and the Environmental Management and Pollution Control Act (EMPCA, 1994). Harm can be caused from contaminated soils leaching further underground, leaving the site through wind (as dust) or carried off site with rain (as runoff stormwater).

It will be necessary for the soil to be classified for disposal or reuse in accordance with *IB 105* (EPA Tasmania, 2010). The initial soil laboratory results (Table 2) indicate that the material is Level 2 to 3 material and suitable for remediation and disposal at a licensed facility;

To prevent contaminated soil leaving the site (by wind or water), excavated soil, if being stored for greater than 12 hours, must be stockpiled in or on an impervious surface or in a water tight skip bin and covered with an impermeable layer (such as PVC plastic 2mm thick).

Alternately if soil is to be removed off site to an approved storage and handling facility, it should only be done by a licensed contractor.

Site Operator should consider separating the most contaminated soil (0.0 to 0.3m bgs from across the entire site plus the soil around the historical interceptor trap) during excavation works to limit the cost of soil disposal and/or remediation required.

3.1.3 Dust Control

Generation of dust can spread contaminated soil or create a nuisance. Measures that can be undertaken to assist in minimising the generation of dust include:

- Minimise movement of equipment on the site.
- Minimise excavation and movement of soils.
- Use a water spray only as required to dampen work areas if excess dust is generated.
- Use a water spray only as required to dampen soil prior to and during excavation if excess dust is generated.
- Avoid soil excavations that create dust on windy days.

- Keep soil stockpiles covered at all times possible, with an impermeable membrane (eg. plastic sheeting) to minimise generation of dust and to limit runoff of sediment.
- Avoid extended stockpiling of soil.

3.2 Stormwater Management and Sediment Control

Measures to minimise the potential for contamination of stormwater and migration of contaminants include:

- Install drainage and/or grade soil surfaces to minimise pooling of water on exposed soils. Exposed surfaces should ideally be covered with clean aggregate to minimize trafficking of mud, vehicle washdown procedures, reduce soil erosion, and general site disturbance.
- Place sediment control devices around stormwater drains and stockpiles as required.
- Ensure vehicles and equipment are free from excess soil when leaving the site, to avoid tracking soil off-site.
- Establish an equipment wash down area if necessary.
- Keep stockpiles covered and sealed at all times possible
- Avoid extended stockpiling of soil.
- Clean up any soil spilt on roads adjoining the site.
- Avoid conducting vehicle or machinery maintenance on-site.
- Ensure any fuel, oil or other chemicals are stored safely and securely and are prevented from leaking.
- Repair or remove any leaking containers or machinery from the site.
- Clean up any spilt fuel, oil or other chemicals as soon as possible.
- Check sediment control measures regularly (at least daily) and clean and maintain as necessary.
- Inspect sediment control measures more frequently during rain periods, to check they are adequate for site conditions.

4 Minimization of Potential Health Risks

Work procedures conducted on the site must be in accordance with relevant Occupational Health and Safety (OH&S) Regulations. It is the responsibility of the principal contractor that site workers are made aware of the OH&S issues at the site.

Engaged companies/contractors must prepare a site-specific Health and Safety Plan covering their workers at the site.

4.1 Exposure Routes

Potential hazards for site workers associated with the presence of contaminants in isolated areas of soil which may be encountered during excavation or construction works must be considered as part of the overall Health and Safety Plan for the site, including:

- Ingestion of contaminated soil.
- Inhalation of dust or vapours.
- Dermal (skin) contact.

4.2 Control Measures

Personnel working at or visiting the site during any construction (including demolition and excavation) works must be provided with an induction briefing, based on the example Site Induction Record provided in Appendix 2. This induction record may be incorporated into the general site induction procedure. The principal contractor may delegate responsibility for the induction briefing to their environmental consultant.

Measures that must be undertaken to manage exposure of site workers to contaminants include:

- Avoid handling of potentially contaminated soil and/or water.
- Wash hands before eating, drinking or smoking.
- Avoid activities that may introduce soil and/or water to the mouth, such as nail biting.
- Remove soiled clothing and footwear before entering a designated clean area and before leaving the site.
- Use personal protective equipment (PPE) as required. In addition to hard hats, safety boots, safety glasses and hearing protection, this equipment may include:
    - Long sleeved shirt and long trousers
    - Dust masks

The principal contractor must ensure that site workers and visitors are provided with:

- Site safety induction briefing.
- Adequate hand washing facilities.
- A designated clean area for storage and consumption of food and drink.

All excavations in the area of underground fuel infrastructure must be screened with a LEL meter and/or PID to screen the area for explosive and potentially harmful hydrocarbon vapours. No hot works are permitted on site without clearance by a suitability qualified person that the area or infrastructure is free of vapours.

LIMITATIONS STATEMENT

This Management Plan has been prepared in accordance with the scope of services between Geo-Environmental Solutions Pty. Ltd. (GES) and Hobart Properties & Securities (‘the Client’). To the best of GES's knowledge, the information presented herein represents the Client's requirements at the time of printing of the Report. However, the passage of time, manifestation of latent conditions or impacts of future events may result in findings differing from that described in this Report. In preparing this Report, GES has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations referenced herein. Except as otherwise stated in this Report, GES has not verified the accuracy or completeness of such data, surveys, analyses, designs, plans and other information.

The scope of this study does not allow for the review of every possible soil and groundwater contaminant over the whole area of the site. Soil samples collected from the investigation area are assumed to be representative of the areas from where they were collected and indicative of the contamination status of the site. The conclusions described within this report are based on these samples, the results of their analysis and an assessment of their contamination status.

This report does not purport to provide legal advice. Readers of the report should engage professional legal practitioners for this purpose as required.

No responsibility is accepted for use of any part of this report in any other context or for any other purpose by third party.

REFERENCES

Key regulations, legislation and policies considered most applicable to soil and groundwater management during any intrusive site works (excavation, construction or maintenance) include:

Australian Standard: AS 4482.1-2005 Guide to the investigation and sampling of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds

Australian Standard: AS 4482.2-1999 Guide to the sampling and investigation of potentially contaminated soil. Part 2: Volatile substances

CRC CARE 2013, Petroleum Petroleum Vapour Intrusion assessment: Australian guidance, CRC CARE Technical Report no. 23, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

DPIWE (1997) – State Policy on Water Quality Management, 1997.

Environmental Management and Pollution Control (Waste Management) Regulations 2000.

Environmental Management and Pollution Control Act (1994).

Friebel, E & Nadebaum, 2011, 'Health screening levels for petroleum hydrocarbons in soil and groundwater. Part 1: Technical development document', CRC for Contamination Assessment and Remediation of the Environment, CRC CARE Technical Report no. 10, Adelaide.

Geo-Environmental Solutions (2017a). Preliminary Environmental Site Assessment. 281a Elizabeth Street, North Hobart. Geo Environmental Solutions, 86 Queen Street, Sandy Bay, 7005. July 2017.

Geo-Environmental Solutions (2017b). Environmental Site Assessment. 66 Burnett Street, North Hobart. Geo Environmental Solutions, 29 Kirskway Place, Battery Point, 7004. December 2017.

Information Bulletin 105: Classification and Management of Contaminated Soil for Disposal (November 2010), EPA Tasmania.

NEPM, 1999. Guideline on Investigation Levels for Soil and Groundwater, Schedule B (1), National Environment Protection (Assessment of Site Contamination) Measure, National Environment Protection Council, 1999. Measures as amended, taking into account amendments up to National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)

APPENDIX 1 Borehole Logs

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH1

EASTING: 526000 **GDA94**

NORTHING: 5252993 **GDA94**

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42.2 **m AHD**

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1

EQUIPMENT/METHOD: Direct Push Core LOGGED BY: A. Plummer

NATURAL (m): WATER TABLE (m):

SAMPLING: Core DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Sandy GRAVEL: dark brown, slighty moist, medium dense to dense	M	GW	BH1 0.10m				42.1
0.1								
0.2	FILL - GRAVEL & assorted debris, brown/grey, slightly moist, dense, many red brick fragments	SM	GW					42.0
0.3								41.9
0.4	FILL - Mixed Clayey SAND & Sandy CLAY: brown/grey, moist, stiff, low plasticity overall (Clay fraction has medium plasticity)	M	CL					41.8
0.5								41.7
0.6								41.6
0.7	Sandy CLAY: grey/brown, moist, stiff, medium plasticity, common fine charcoal fragment, some shell grit. No Refusal							41.5
0.8		M	CL	BH1 0.9m				41.4
0.9								41.3
1.0								41.2

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCBs, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH2

EASTING: 525998 GDA94

NORTHING: 5252990 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42.1 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Sandy GRAVEL: dark brown, slighty moist, medium dense to dense	M	GW	BH2 0.1m				42.0
0.1								41.9
0.2	FILL - GRAVEL & assorted debris, brown/grey, slightly moist, dense, many red brick fragments	SM	GW					41.8
0.3								41.7
0.4	FILL - Mixed Clayey SAND & Sandy CLAY: brown/grey, moist, stiff, low plasticity overall (Clay fraction has medium plasticity)	M	CL					41.6
0.5								41.5
0.6								41.4
0.7	Sandy CLAY: grey/brown, moist, stiff, medium plasticity, common fine charcoal fragment, some shell grit. No Refusal	M	CL	BH2 0.9m				41.3
0.8								41.2
0.9								41.1
1.0								

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Lead: 2 (BH2 0.1m); Nickel: 2 (BH2 0.1m); Lead: 2 (BH2 0.9m)

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH3

EASTING: 525984 GDA94

NORTHING: 5252989 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 41.5 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete		P				41.4
0.2	FILL - Clayey GRAVEL: grey/brown, slightly moist, medium dense	SM	GC	BH3 0.5m			41.3 / 41.2 / 41.1
0.6	Silty CLAY: dark grey-brown, moist, stiff, high plasticity	M	CH				41.0 / 40.9 / 40.8 / 40.7
1.0	Silty CLAY: pale brown, moist, stiff, high plasticity - plasticity decreasing with depth	M	CH	BH3 2.3m			40.6 / 40.5 / 40.4 / 40.3 / 40.2 / 40.1 / 40.0 / 39.9 / 39.8 / 39.7 / 39.6 / 39.5 / 39.4 / 39.3
2.3	Silty GRAVEL: yellow/pale brown, dry, very dense, weathered silt/mudstone. No Refusal	D	GM				39.2 / 39.1 / 39.0 / 38.9 / 38.8 / 38.7 / 38.6 / 38.5
3.0							

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH4

EASTING: 525982 GDA94

NORTHING: 5253010 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42.8 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 2

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete		P					42.7
0.2	FILL - Clayey GRAVEL: grey/brown, slightly moist, medium dense, many red brick fragments	SM	GC	BH4 0.5m		2 2 4 2 2 2 3 2 2 3		42.4
0.9	Silty CLAY: dark grey-brown, moist, firm to stiff, high plasticity	M	CH	BH4 1.0m				41.9
1.4	Silty CLAY: pale brown, moist, stiff, high plasticity. No Refusal	M	CH					41.4
1.9								40.8

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH5

EASTING: 525979 GDA94

NORTHING: 5253010 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42.9 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)
0.0–0.1	FILL - Sandy GRAVEL: brown/grey, slighty moist, medium dense to dense, some small brick fragments	M	GW	BH5 0.1m	
0.2–0.4	FILL - Gravelly CLAY: dark brown/black, moist, stiff, medium plasticity	M	CL		
0.5–1.3	Silty CLAY: pale brown, moist, stiff, high plasticity	M	CH		
1.4–2.4	Silty CLAY: red/orange, moist, stiff, high plasticity	M	CH		
2.5–2.9	Silty Sandy CLAY: red/orange/yellow, moist, very stiff, medium plasticity. No Refusal	M	CL	BH5 3.0m	

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Chromium VI, Mercury, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

3 3

2

MONITORING WELL

ELEVATION (metres): 42.8, 42.7, 42.6, 42.5, 42.4, 42.3, 42.2, 42.1, 42.0, 41.9, 41.8, 41.7, 41.6, 41.5, 41.4, 41.3, 41.2, 41.1, 41.0, 40.9, 40.8, 40.7, 40.6, 40.5, 40.4, 40.3, 40.2, 40.1, 40.0, 39.9

Tas EPA IB105 CLASSIFICATION: Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH6

EASTING: 525966 GDA94

NORTHING: 5253047 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 44.3 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete		P					44.2
0.2	FILL - Clayey SAND: dark brown/black, moist, medium dense	M	SC	BH6 0.2m		2 2 3 2 2 3 2		44.1
0.4	FILL - Silty Sandy CLAY: dark brown/black, moist, stiff, medium plasticity, 10% fine gravel & brick fragments	M	CL					43.9
0.6	Silty CLAY: brown, moist, firm, high plasticity	M	CH					43.7
1.0	Silty CLAY: mottled pale brown/grey/red, moist, stiff, high plasticity, lense of fine Quartz gravel from 1.95-2.0m containing f							43.3
1.5							✕	42.8
1.9		M	CH	BH6 2.0m		2		42.4
2.9				BH6 3.0m				41.4

Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Chromium VI, Mercury, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH7

EASTING: 525973 GDA94

NORTHING: 5253042 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 44.4 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)
0.0	FILL - Concrete		P		
0.2	FILL - Clayey SAND: dark brown/black, moist, medium dense	M	SC	BH7 0.2m	
0.4	FILL - Silty Sandy CLAY: dark brown/black, moist, stiff, medium plasticity, 10% fine gravel & brick fragments	M	CL		
0.6	Silty CLAY: brown, moist, stiff, high plasticity				
1.0		M	CH	BH7 1.0m	
1.5	Silty CLAY: mottled pale brown/grey/red, moist, stiff, high plasticity. No Refusal				
1.6					
2.2		M	CH		
2.9				BH7 3.0m	

IB105 Analyte IL Exceedances

Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Zinc	Chromium VI	Mercury	PCB's	Aldrin+Dieldrin	DDT etc	Phenol	Benzo(a)pyrene	PAH Sum	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH C6 - C9	TPH C10 - C36	To Be Excavated
2						2	2			2	2						3	2							
2	2																								
												2													

MONITORING WELL

ELEVATION (metres): 44.3, 44.2, 44.1, 44.0, 43.9, 43.8, 43.7, 43.6, 43.5, 43.4, 43.3, 43.2, 43.1, 43.0, 42.9, 42.8, 42.7, 42.6, 42.5, 42.4, 42.3, 42.2, 42.1, 42.0, 41.9, 41.8, 41.7, 41.6, 41.5, 41.4

Tas EPA IB105 CLASSIFICATION: Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH8

EASTING: 525969 GDA94

NORTHING: 5253040 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 44.6 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	MONITORING WELL	ELEVATION (metres)
0.0 – 0.1	FILL - Concrete		P				44.5
0.2 – 1.7	FILL - SAND some clay (Packing/Fat Sand), orange/grey-brown, moist, medium dense			BH8 0.5m			44.4 – 44.2
		M	SC	BH8 1.0m			44.1 – 43.7
1.8 – 2.9	Silty CLAY: mottled pale brown/grey/red, moist, stiff, high plasticity. No Refusal	M	CH				43.6 – 41.6

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH9

EASTING: 525965 GDA94

NORTHING: 5253042 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 44.6 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0–0.1	FILL - Concrete		P	BH9 0.2m		2 2 2 3 2		44.5
0.2–0.5	FILL - Clayey SAND: dark brown/black, moist, medium dense	M	SC					44.4–44.1
0.5–1.0	Silty CLAY: brown, moist, stiff, high plasticity	M	CH					44.0–43.6
1.0–2.1	Silty Sandy CLAY: pale brown, moist, very stiff, medium plasticity, 20% fine to coarse gravel	M	CL					43.5–42.5
2.1–2.5	Silty CLAY: mottled pale brown/grey/red, moist, stiff, high plasticity	M	CH					42.4–42.1
2.5–2.8	FILL - SAND some clay (Packing/Fat Sand), orange/grey-brown, moist, medium dense. Side wall of Tank Pit has been scalloped out	M	SC					42.0–41.8
2.8–2.9	Silty CLAY: mottled pale brown/grey/red, moist, stiff, high plasticity. No Refusal	M	CH	BH9 3.0m				41.7–41.6

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH10

EASTING: 525970 GDA94

NORTHING: 5253045 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 45.5 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - GRAVEL: brown/grey, slightly moist, dense	SM	GW	BH10 0.1m		2		45.4
0.1								45.3
0.2	Sandy Silty CLAY: brown, moist, very stiff, medium plasticity							45.2
0.3								45.1
0.4								45.0
0.5								44.9
0.6		M	CL					44.8
0.7								44.7
0.8								44.6
0.9				BH10 1.0m		2		44.5
1.0								

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH11

EASTING: 525967 GDA94

NORTHING: 5253067 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 43.9 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 0.15

EQUIPMENT/METHOD: Direct Push Core

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Core

DATE: 17/06/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete		P	BH11 0.1m		2		
0.1	Silty CLAY: yellow/orange/brown, moist, stiff, medium to high plasticity. Sudden Refusal	M	CH					43.8

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH12

EASTING: 525994 GDA94

NORTHING: 5253042 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 43.7 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1.2

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete Slab		P					43.6
0.1								43.5
0.2	FILL - CLAYEY GRAVEL: brown/grey, slightly moist, dense	SM	GC					43.4
0.3	Sandy SILTY CLAY: brown/grey/orange, moist, stiff, medium plasticity	M	CI	BH12 0.5m				43.3
0.4								43.2
0.5	SILTY CLAY: brown/grey, moist, stiff, high plasticity. End							43.1
0.6								43.0
0.7								42.9
0.8		M	CH					42.8
0.9				BH12 1.0m		2 2 3 2 2		42.7
1.0								42.6
1.1								42.5
1.2								

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH13

EASTING: 526000 GDA94

NORTHING: 5253030 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 43.3 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 0.55

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete Slab		P					43.2
0.1								43.1
0.2								43.0
0.3	Extremely Weathered SILTSTONE (Clayey SILT): orange/trace pale purple mottles, dry to slightly moist, dense, very low rock stre	SM	ML	BH13 0.4-0.5m				42.9
0.4								42.8
0.5								

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH14

EASTING: 525987 GDA94

NORTHING: 5253023 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 43.2 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1.5

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)
0.0	FILL - Concrete Slab		P		
0.3	FILL - GRAVEL: blue/grey, slightly moist, loose, medium to coarse (20-40mm) clean angular Dolerite gravel	SM	GW	BH14 0.3-0.4m	
0.4	FILL - SANDY CLAY: dark brown, moist, stiff, medium plasticity, few fine gravels	M	Cl		
0.6	Sandy SILTY CLAY: mottled dark brown/orange, moist, stiff, medium plasticity	M	Cl		
0.9	SILTY CLAY: olive-brown, moist, firm to stiff, high plasticity. END	M	CH	BH14 1.0-1.1m	

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

BH14 0.3-0.4m: 2 2 2 2 3 3

BH14 1.0-1.1m: 2

MONITORING WELL

ELEVATION (metres): 43.1, 43.0, 42.9, 42.8, 42.7, 42.6, 42.5, 42.4, 42.3, 42.2, 42.1, 42.0, 41.9, 41.8, 41.7

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH15

EASTING: 525995 GDA94

NORTHING: 5252997 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42.25 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 0.6

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete Slab		P					42.2
0.1								42.1
0.2	FILL - SAND: yellow-grey, slightly moist, loose		SW					42.0
0.3								41.9
0.4	FILL - CLAYEY GRAVEL: yellow-brown/grey, slightly moist, dense. Refusal	SM	GC					41.8
0.5								41.7
0.6				BH15 0.5-0.6m				

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH16

EASTING: 525979 GDA94

NORTHING: 5253059 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 45 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 3.5

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete Slab		P					44.9
0.2	FILL - GRAVEL (FCR): brown-grey, slightly moist, medium dense	SM	GW					44.8
0.3	FILL - GRAVELLY CLAY: dark grey-brown, moist, stiff, medium plasticity	M	CI					44.7
0.5	SILTY CLAY: pale olive-grey, moist, stiff, high plasticity	M	CH					44.5
0.9	Silty CLAYEY GRAVEL: pale yellow/grey, dry, dense	D	GC	BH16 1.0-1.1m		2 2		44.1
1.6	Silty GRAVELLY CLAY: orange/yellow, slightly moist, very stiff, low plasticity	SM	CL	BH16 2.0-2.1m		2		43.4
2.1	Silty CLAYEY GRAVEL: pale yellow/grey, dry, dense	D	GC					43.0
2.7	Gravelly SILTY CLAY: pale yellow-grey/red, moist, stiff, low to medium plasticity. END	M	CL	BH16 2.9-3.0m				42.4

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Chromium VI, Mercury, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH17

EASTING: 525973 GDA94

NORTHING: 5253069 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 45.5 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 2.7

EQUIPMENT/METHOD: Geoprobe 540UD LOGGED BY: A. Plummer

NATURAL (m): WATER TABLE (m):

SAMPLING: Direct Push DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0–0.1	FILL - SANDY GRAVEL: grey/brown, slightly moist, dense	SM	GW					45.4
0.2–0.4	FILL - Gravelly CLAYEY SAND: dark brown, slightly moist, medium dense	SM	SC					45.3–45.1
0.5–1.0	SILTY CLAY: olive brown/orange/trace red, moist, stiff, high plasticity	M	CH	BH17 0.5-0.6m				45.0–44.5
1.1–1.8	Extremely Weathered SANDSTONE/SILTSTONE (banded): yellow/orange, slightly moist, dense, lense of medium plasticity clay at 1.8							44.4–43.7
1.9–2.6		SM		BH17 1.9-2.0m		2		43.6–42.8

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Chromium VI, Mercury, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH18

EASTING: 525981 GDA94

NORTHING: 5253041 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 43.8 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 2

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0 – 0.1	FILL - Concrete Slab		P					43.7
0.2 – 0.3 – 0.4	SILTY CLAY: dark grey/black, moist, stiff, high plasticity	M	CH	BH18 0.2-0.3m		2		43.6 – 43.5 – 43.4
0.5 – 0.6 – 0.7 – 0.8	Sandy SILTY CLAY: dark brown, moist, very stiff, high plasticity	M	CH					43.3 – 43.2 – 43.1 – 43.0
0.9 – 1.0				BH18 0.9-1.0m		2		42.9 – 42.8
1.1 – 1.2 – 1.3 – 1.4 – 1.5 – 1.6	Silty GRAVELLY CLAY: pale yellow-grey, slightly moist, very stiff, low to meidum plasticity	M	CI					42.7 – 42.6 – 42.5 – 42.4 – 42.3 – 42.2
1.7 – 1.8 – 1.9	SILTY CLAY: orange/yellow/grey, moist, very stiff, medium plasticity, high silt content. END	M	CI					42.1 – 42.0 – 41.9 – 41.8

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH19

EASTING: 525964 GDA94

NORTHING: 5253033 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 44.1 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 2

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete Slab		P				44.0
0.2	FILL - GRAVEL: dark brown-grey, moist, dense	M	GW	BH19 0.2-0.3m			43.9
0.3	SILTY CLAY: olive-brown, moist, stiff, high plasticity						43.8
0.6		M	CH				43.5
0.9				BH19 0.9-1.0m			43.2
1.0	SILTY CLAY: orange/red, moist, stiff, high plasticity. END						43.1
1.3							42.8
1.5		M	CH				42.6
1.9							42.1

IB105 Analyte IL Exceedances

Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

BH19 0.2-0.3m: 2 2 2 3 2

BH19 0.9-1.0m: 2 2

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH20

EASTING: 525973 GDA94

NORTHING: 5252982 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1.1

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Concrete		P					41.9
0.1								41.8
0.2	FILL - Clayey GRAVEL: grey/brown, slightly moist, medium dense							41.7
0.3								41.6
0.4		SM	GC	BH20 0.5m				41.5
0.5								41.4
0.6	Silty CLAY: dark grey-brown, moist, stiff, high plasticity							41.3
0.7								41.2
0.8		M	CH					41.1
0.9								41.0
1.0								40.9
1.1								

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Gorringe ESA

CLIENT: Hobart Properties & Securities

Log of BH21

EASTING: 526002 GDA94

NORTHING: 5252990 GDA94

BORING LOCATION: 66 Burnett Street, North Hobart

ELEVATION AND DATUM: 42.7 m AHD

DRILLING CONTRACTOR: Geo-Environmental Solutions

TOTAL DEPTH (m): 1.1

EQUIPMENT/METHOD: Geoprobe 540UD

LOGGED BY: A. Plummer

NATURAL (m):

WATER TABLE (m):

SAMPLING: Direct Push

DATE: 11/12/2017

DEPTH (metres)	MATERIAL DESCRIPTION	Moisture	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0	FILL - Sandy GRAVEL: dark brown, slighty moist, medium dense to dense	M	GW					42.6
0.1								42.5
0.2	FILL - GRAVEL & assorted debris, brown/grey, slightly moist, dense, many red brick fragments	SM	GW					42.4
0.3								42.3
0.4	FILL - Mixed Clayey SAND & Sandy CLAY: brown/grey, moist, stiff, low plasticity overall (Clay fraction has medium plasticity)	M	CL	BH21 0.5m		3 2		42.2
0.5								42.1
0.6								42.0
0.7	Sandy CLAY: grey/brown, moist, stiff, medium plasticity, common fine charcoal fragment, some shell grit. No Refusal							41.9
0.8		M	CI					41.8
0.9								41.7
1.0								41.6
1.1								

IB105 Analyte IL Exceedances: Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Nickel, Zinc, Mercury, Chromium VI, PCB's, Aldrin+Dieldrin, DDT etc, Phenol, Benzo(a)pyrene, PAH Sum, Benzene, Toluene, Ethylbenzene, Total Xylenes, TPH C6 - C9, TPH C10 - C36, To Be Excavated

Tas EPA IB105 CLASSIFICATION: ☐ Level 1; 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

APPENDIX 2 – Site Induction Form

66 Burnett Street, North Hobart

I …… of ……..…… have been inducted to the site at 66 Burnett Street, Hobart Tasmania and have been informed of the CMP and its contents on ……...(date)

I have been informed of the contents of the CMP and the responsibilities I have in ensuring that the CMP is adhered to relating to the following issues:

- Understanding the site contamination status
- Understanding the potential health impacts for site workers associated with site contamination
- Understanding the potential environmental impacts associated with site contamination
- Understanding how to reduce the risks to human health and the environment
- Maintaining documentation related to upholding the CMP

SOIL MANAGEMENT

- Excavation and stockpiling of soil at the site
- Movement of soil around the site
- Off-site disposal of soil
- Import of fill to the site
- Dust control

WATER MANAGEMENT

- Stormwater management and sediment control

I HEREBY ACCEPT THESE RESPONSIBILITIES.

NAME: ……COMPANY:…….……

SIGNED ……..……DATE ……..…

INDUCTED BY: ……DATE ……

RECORD OF SITE INDUCTION AND APPRECIATION OF CMP

Please sign on once you have read the CMP

Date	Name/ Company	Signature

TASARC

ARCHAEOLOGICAL SERVICES

433 Dorans Road
Sandford
Hobart
Tasmania

Mobile: 0408 561 934
Email: parryk@netspace.net.au
Web site www.arctas.com.au

STATEMENT OF ARCHAEOLOGICAL POTENTIAL & ARCHAEOLOGICAL METHOD STATEMENT

66 BURNETT STREET, NORTH HOBART

Report prepared for Hobart Properties & Securities Pty Ltd
By IRENE INC. & TASARC
5th June 2018

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PART 1 STATEMENT OF ARCHAEOLOGICAL POTENTIAL

5.0 HISTORIC STRUCTURAL DEVELOPMENTS

This section seeks to summarise the known physical developments on the subject site including all known structures throughout the known period of historical occupancy. A site plan overleaf shows the locations of these structures.

5.1 Pre-1830's

There do not appear to have been any permanent structures erected on the site prior to the mid to late 1830's which is consistent with the known site history of the bulk of the North Hobart area. At this time, only the frontages onto major thoroughfares such as Elizabeth Street were being developed leaving areas to the rear structurally empty.

5.2 Late 1830's

The land settlement pattern in north Hobart started to change however in the late 1830's as properties rearward of street side allotments were taken up as semi-rural venues for the purposes of food production or light industry. The land comprising the subject area was a beneficiary of this expansion as street side properties on Elizabeth street saw the construction of more infrastructure such as sheds and cottages to the rear of the main street. These now encroached and occupied the western edge of the subject area. However, at the same time the bulk of the property remained the domain of orchards and market gardens.

5.3 1850's-1900

This period was one of intensification whereby yet more buildings were added to the western periphery of the subject site. Older out-buildings and cottages dating from the pre-1840's were demolished and new additions erected in their stead. But the bulk of the site remained planted with various food stuffs.

5.4 Post 1900

The first half of the 20th century saw limited developments occur on the previously un-utilised farm lands. These were limited to sheds providing additional storage capacity for grown products and related equipment. However, from the 1950's the previously empty farmland allotments were acquired and developed by industry, most notably Gorringe's Garage complex. The arrival of industry also required the demolition of the rearward historic features related to the Elizabeth Street allotments for more substantive vehicle access. The present day structural landscape is a direct reflection of this period with no subsequent developments evident.

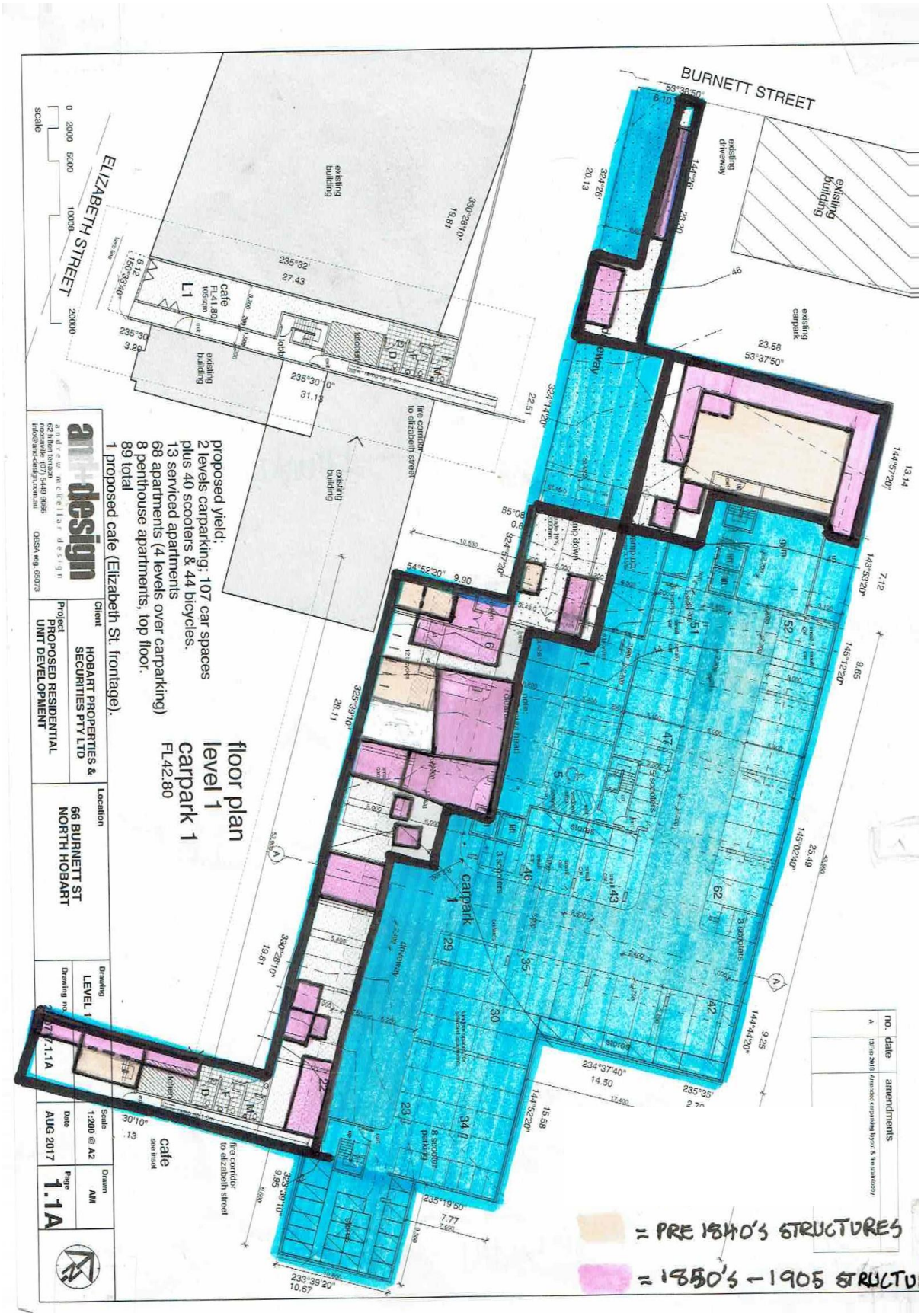

FIGURE 1. SITE PLAN SHOWING LOCATIONS AND EXTENT OF KNOWN HISTORIC FEATURES

6.0 HISTORICAL ARCHAEOLOGICAL POTENTIAL ZONING

This section seeks to summarise the various zones of archaeological potential within the subject property based on:

- Areas of known historic (19th century) structural occupancy
- Areas of known mid-20th century industrial structural occupancy
- The probability that resident historic structures and features have survived mid-20th century re-developments throughout the subject area

Two differing zone types have been adopted for the subject area. These have been based on the fact the site only exhibits two distinct areas of historic land usage:

1) The western periphery where culturally significant developments related to those properties on Elizabeth Street occurred between the late 1830's and 1900 (Section 6.1 below).

2) The remainder of the site where food production activities and associated lack of structural development prevailed until the 1950's when culturally insignificant industrial activities moved in (Section 6.2 below).

6.1 Medium to High Archaeological potential

This area encompasses the western periphery of the subject area that accommodated a large number of out-buildings and small cottage-based domiciles related to adjacent properties on Elizabeth Street which they former a part of. These were erected between the late 1830's and 1900 and potentially consist of two generations of layered structural occupancy; hence its rating as an area of MEDIUM/HIGH Archaeological potential.

6.2 Minimal to Low Archaeological potential

This area encompasses those parts of the subject area that hosted only open area agricultural pursuits between the early 19th and mid-20th centuries. Such areas comprise the greater bulk of the subject area (in excess of 55%). Because very little building related activity occurred here (in favour of planted food crops), this zone has been deemed to be of MINIMAL/LOW Archaeological potential.

Both zones are defined overleaf in Figure 2.

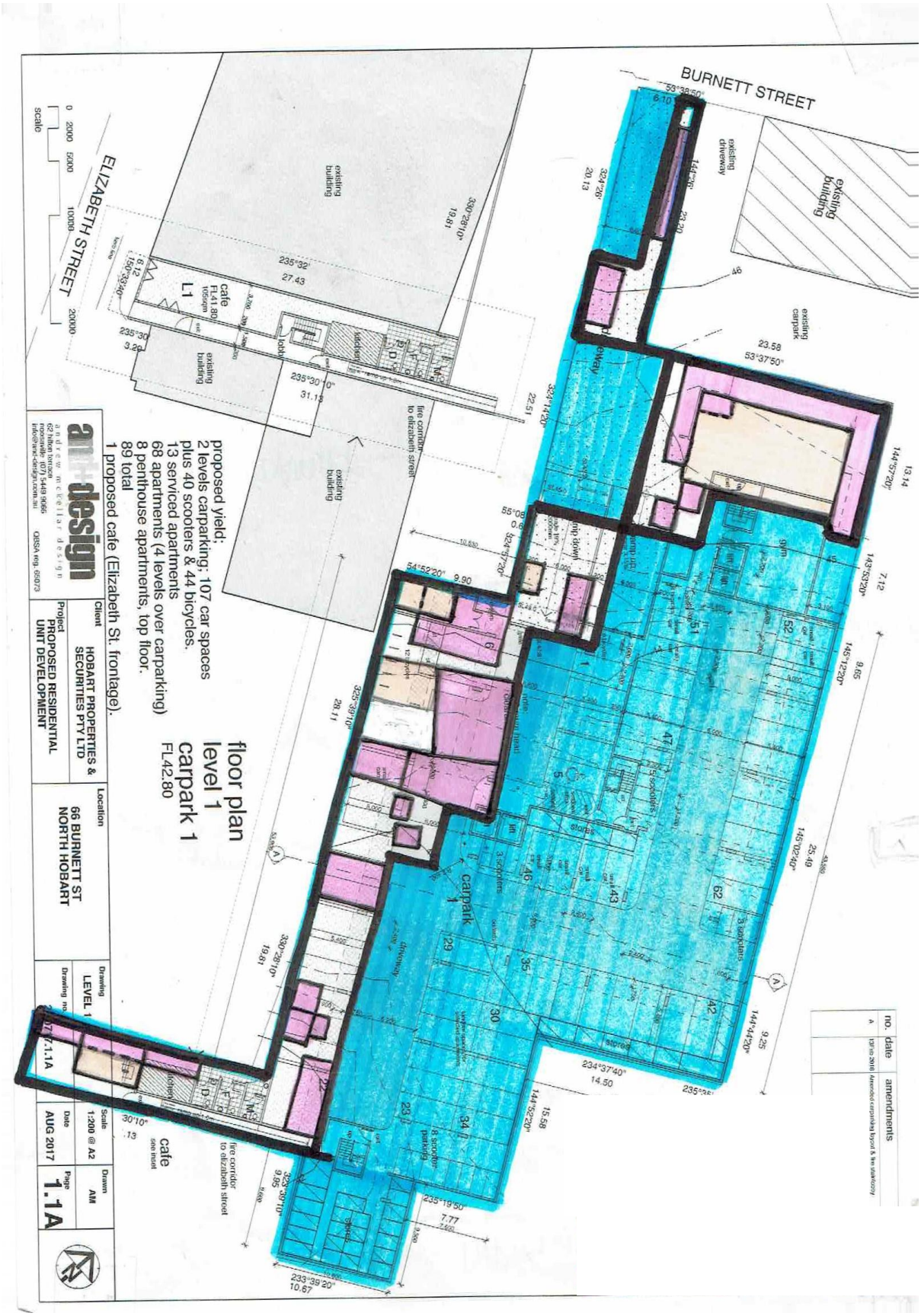

FIGURE 2. SITE PLAN SHOWING ARCHAEOLOGICAL POTENTIAL ZONES WITHIN SUBJECT AREA
Aqua blue solid areas are Minimal/Low potential zones requiring no additional works
Clear areas defined by solid black outlines are Medium/High potential zones requiring excavation

7.0 TYPICAL TYPES OF HISTORICAL ARCHAEOLOGY ENCOUNTERED IN URBAN CONTEXTS

This section seeks to clarify the types of archaeological features likely to be encountered within the area of Medium to High Archaeological Significance.

7.1 Structural footings

These features typically consist of the stone or brick footings of buildings that have survived the demolition process. Although all fabric from the roof line down to the wall bases was generally demolished, any trenched or otherwise buried features such as footings were generally left *in situ* and a new construction level laid down over these remains as a labour-saving device. This method prevailed until mechanisation allowed machinery to remove elements of the building landscape more efficiently.

7.2 Sub-floor archaeological deposits

During occupancy, detritus inevitably slipped through the timber floors of that period and gathered beneath alongside the bearers. This material included those items associated with the actual construction (worker's items) but more commonly the occupants. These deposits survived because they occurred at the same lower level as the adjacent building footings (7.1). Deposited contents include personal items such as women's personal items (jewellery, buttons, beads) children's toys (ceramic dolls, game tokens, marbles) and men's effects such as gambling items, smoking paraphernalia and concealed alcohol or pharmaceutical elixirs.

7.3 Cellars

Underground cellars and basements occurring on sloping ground are often revealed in association with dwellings, public houses and public buildings. Demolition works tended to merely backfill these with resident soils and rubbish. As such their excavation often reveals information about the surrounding building fabric and style that is not revealed at the ground level.

7.4 Privy cesspits

Although ostensibly serving as utilitarian toilet venues, these pits also offered a good locale to dispose of unwanted rubbish. Rubbish disposal often included items such as contraband, things specific to the resident trade or business, and treasured items that had become broken; hence their untimely disposal. These features inevitably survive because they too were sub-surface features.

7.5 Rubbish pits

Because rubbish disposal had not yet become a civic responsibility, any opportunity was taken to dispose of unwanted items including kitchen rubbish. Although unwanted at the time these things often help in better understanding the lifestyles and personalities of the residents. Once again, as sub-surface features these pits tended to survive the historic demolition process.

7.6 Hard landscaped areas

In addition to the structures erected on an allotment, adjacent yard-spaces were laid out to accommodate garden areas or high traffic thoroughfares involving carts, coaches and horses. These areas were often defined by paved sandstone and brick, compacted surfaces (crushed shell, ash, timber) or cobbling. As flat surfaces these features also generally survived the demolition process and serve to better define the location of historic activities on site.

7.7 Drainage features

Historic attempts to better drain the Hobartian landscape often involved very labour intensive and exotic solutions involving underground engineering and use of all manner of materials. Once described and mapped these features can even assist in the dating of the site if all other indicators have been removed by demolition works.

8.0 ABORIGINAL ARCHAEOLOGY

The presence of Aboriginal archaeological remnants is not overly anticipated at the subject site due to:

- The expected intensity of disturbance between the current ground level and the historic layers beneath

- The absence of landscape components such as water sources and promontories that might have made the subject area attractive to Aboriginal occupancy

However, protocols related to the discovery of Aboriginal archaeological discoveries are emplaced in the attached Archaeological Method Statement (Part 2).

9.0 RECOMMENDATIONS

The results of this desk top investigation recommend that:

- Construction proceed in all areas deemed to be of **Minimal/Low Archaeological potential** without previous archaeological investigation. However, the discovery of any archaeological features during said activities should be reported to the consultant archaeologist for immediate assessment and mitigation.

- Areas deemed to be of **Medium/High Archaeological potential** be subject to a pre-determined archaeological excavation strategy involving ground clearance and excavation of exposed historic features as defined in the attached 'Archaeological Method Statement' (Part 2).

Both these areas are delineated in Figure 2.

PART 2 ARCHAEOLOGICAL METHOD STATEMENT

This document seeks to provide both a justification and methodology for the safe and ethical excavation of archaeological elements situated within the subject area.

10.0 STATUTORY COMPLIANCE

In association with the attached Statement of Archaeological Potential (SOAP), this Method Statement must form part of the relevant Development Application to the Hobart City Council (HCC). No construction or archaeological based works should occur without a permit.

11.0 CLIENT RESPONSIBILITIES

Unless otherwise negotiated the client is responsible for the provision of the following:

- On site running water
- Perimeter fencing around the defined subject area
- Results from any and all engineering assessments of the site's sub-surface
- All 'Dial and Dig' data pertaining to the location and disposition of all services
- The safe demolition of all requisite above ground features without impacting on the sub-surface that may contain sensitive archaeology
- Any traffic management responses
- A safe and currently rated mechanised excavator of no less than 5-ton capacity
- The engagement of a suitably qualified surveyor to locate and record the locations of all significant archaeological features
- Payment for on site excavation works and 'post dig' analysis, report authorship and printing

12.0 ARCHAEOLOGICAL CONSULTANCY RESPONSIBILITIES

Unless otherwise negotiated the Archaeological consultant is responsible for the provision of the following:

- A licenced excavator operator to undertake mechanised excavation at the archaeologist's discretion
- The preparation of a Safe Work Method Statement (SWMS) addressing responsible and safe work practices for the consultancy's management and staff
- Archaeological excavation works as recommended in this report or subsequent negotiations based on up-dated construction-based information

13.0 JOB VARIATIONS/CONSTRAINTS

The following factors are considered 'circumstances beyond the legal control of the archaeological consultant' and may result in the calendrical or financial alteration of the negotiated contract.

- Inclement weather that prevents safe or professionally responsible excavation activities
- Alteration to the existing excavation footprint by third parties
- Contamination issues relating to any evident chemical/bio hazards based on site-based evidence or prior advisement
- The discovery of Aboriginal materials that may require consultation with the relevant statutory body (Aboriginal Heritage Tasmania) or its nominees

- The discovery of any unanticipated (extraordinary discoveries) will require the immediate notification of the appropriate authorities
- The discovery of any human forensic remains will likewise require the immediate notification of the Tasmanian Police and the State Coroner

14.0 SITE RESEARCH DESIGN

The excavation of archaeological sites not only expose physical fabric and artefacts. The disposition of both entities offers additional information about the physical development of the site that may assist in providing further information on the following:

- The urban development of Hobart (Town) during the 19th century
- The development of North Hobart as a satellite suburb of Hobart during the first generations of European settlement
- The nature of occupancy of the resident buildings within the subject area
- The nature and identities of the occupants themselves
- The professional activities that may have occurred on the site that are not evident in the historic record

The recovery of such information may also have broader implications for other research fields.

15.0 SITE BASED METHODOLOGY

In order to most efficiently expose, excavate, record and recover portable items of significance from the subject area, the following activities will be undertaken:

- A mechanical excavator will be used to strip all existing hard surfaces and overburden above the archaeological layers and deposits
- Any archaeological features and deposits will be hand stripped and excavated
- All features will be recorded in a field note book and digitally photographed
- The location and extent of all features will be recorded by a licenced surveyor
- All excavated artefacts will be bagged according to location and removed off site for analysis (See Section 16.0 below)

16.0 ANALYSIS OF RECOVERED ARTEFACTS

After recovery, all artefacts will be assessed for their capacity to impart information about their identity and relevance to the site. Unrevealing (non-diagnostic) artefacts will be discarded leaving a core collection that will undergo a cleaning and analysis process which will:

- attempt to identify and date the artefacts
- draw meaning from their presence on site
- explain their ultimate relevance to the site and the historic activities undertaken there

17.0 COMPLETION OF FINAL REPORT

The results of the historical research, on-site excavation and artefact analysis will be combined to best explain the nature and contents of the subject area's archaeology. This will be collectively written up in a report that will be distributed to all interested parties.

18.0 POTENTIAL FOR ON SITE INTERPRETATION OF ARCHAEOLOGICAL DISCOVERIES

Some of Hobart's recent private and public building developments now include displays relating to the resident archaeological investigations undertaken there. These displays include:

- Interesting artefacts that may uniquely relate to the site or the history of Hobart
- Text and images explaining the historical/physical development of the site
- Biographical 'cameos' of interesting persons and/or activities known to have occurred at the site

Such a display would be housed sympathetically within a publicly accessible area within the development. It would also be designed and displayed in a professional manner.

19.0 POTENTIAL FOR I*N SITU* PRESERVATION OF ARCHAEOLOGICAL DISCOVERIES

In the event that sub-surface remains discovered during the archaeological excavation are found to be sufficiently unusual or interesting to the broader community, consideration should be given to their retention and ultimate display within the new development.

20.0 APPENDIX

20.1 Site History report

66 BURNETT STREET, NORTH HOBART

Site History Report

Last Updated – 19 December 2017

Author – Jacqui Blowfield

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Fax (03) 6231 4727
Mob 0418 346 283
Email planning@ireneinc.com.au

ireneinc PLANNING & URBAN DESIGN

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1. INTRODUCTION

1.1 SCOPE

Ireneinc Planning have been engaged to prepare a report which details the history of the subject land in light of the proposed development at 66 Burnett Street, North Hobart.

1.2 SITE AND EXISTING DEVELOPMENT

The land comprising the site is 66 Burnett Street (Title ref: 26099/4).

This property currently contains large existing buildings currently operating as Donald Gorringe Reconditioning and Spare Parts Pty Ltd, an automotive repair centre and machining workshop. The proposal will include demolition of the existing buildings.

1.3 PROPOSED DEVELOPMENT

The proposed use and development will provide a multistorey apartment building which will provide residential and visitor accommodation and include a 3 storey building in the Elizabeth Street access which will include a ground commercial, and residential accommodation above.

The main part of the development will be comprised of a 2 level podium with parking, storage, visitor accommodation and gym, above this there will be 5 levels of apartments.

The development will include some extent of site excavation for approximately 1/3 the site area with a depth between 1-2m, with the maximum cut required in the area of the L1 Gym to approximately 2.5m as detailed in the architectural plans.

2. SITE DESCRIPTION

Figure 1: Topographic Plan with site highlighted (LISTMap)

Figure 2: Aerial Plan with site highlighted (LISTMap)

The following images provide a description of the site, its existing development and surrounds.

Figure 3: Elizabeth Street accessway from entry

Figure 4: from inside site viewing southeast along boundary with 285 Elizabeth Street

Figure 5: from inside site viewing north, to 64 Burnet Street office building and beyond, to buildings located opposite in Burnett Street

Figure 6: from inside site viewing along rear boundary of 285 Elizabeth Street southeast towards Tasma Street

Figure 7: from inside site viewing northwest towards rear of 297 Elizabeth Street & Republic including sandstone wall along boundary

Figure 8: Burnett St accessway, showing existing shared access and parking area

3. STATUTORY CONTROLS

3.1 TASMANIAN HERITAGE REGISTER

The area around the site contains a substantial number of heritage listed places (mapped in the figure below), the subject land is not listed. The nearest built fabric of heritage significance, is the rear boundary wall of 299 Elizabeth Street (the Republic Bar & Café, formally the Empire Hotel) which is located adjacent to the access to the subject land.

Figure 9: The subject land is outlined in red, THC listed places outlined in dark blue, HIPS Heritage Places are shaded in dark blue, HIPS Heritage Precincts are outlined in mid blue and HIPS Places of Archaeological Potential shaded in light blue.

3.2 HOBART INTERIM PLANNING SCHEME 2015

The Historic Heritage Code of the *Hobart Interim Planning Scheme 2015* contains provisions related to Heritage Places, Heritage Precincts, Cultural Landscape Precincts and Places of Archaeological Potential.

The preceding figure identifies the various listed places (including the THC listed places) in and around the subject land.

The Purpose of the Historic Heritage Code is:

E13.1.1 To recognise and protect the historic cultural heritage significance of places, precincts, landscapes and areas of archaeological potential by regulating development that may impact on their values, features and characteristics.

The subject land is not a Heritage Place. The adjacent sandstone wall at the rear of the Republic (previously Empire Hotel) is, however the proposal does not intend buildings or works which would impact on the heritage fabric, as the area adjacent to this boundary is being retained as access utilising the existing crossover.

The majority of the subject land is not within a Heritage Precinct, the exception being the access strip from Elizabeth Street which is within the NH6 -Elizabeth Street - Precinct.

The majority of the site (all area except the Elizabeth Street access area) is at the north-eastern edge of the mapped area of Archaeological Potential, also as detailed in the preceding figure.

3.2.1 DEVELOPMENT STANDARDS FOR PLACES OF ARCHAEOLOGICAL POTENTIAL

The following provisions are relevant to the site, except the Elizabeth Street access strip which falls outside.

E13.10.1 Building, Works and Demolition	
Objective: *To ensure that building, works and demolition at a place of archaeological potential is planned and implemented in a manner that seeks to understand, retain, protect, preserve and otherwise appropriately manage significant archaeological evidence.*	
A1 *Building and works do not involve excavation or ground disturbance.*	***P1*** *Buildings, works and demolition must not unnecessarily impact on archaeological resources at places of archaeological potential, having regard to:* *(a) the nature of the archaeological evidence, either known or predicted;* *(b) measures proposed to investigate the archaeological evidence to confirm predictive statements of potential;* *(c) strategies to avoid, minimise and/or control impacts arising from building, works and demolition;* *(d) where it is demonstrated there is no prudent and feasible alternative to impacts arising from building, works and demolition, measures proposed to realise both the research potential in the archaeological evidence and a meaningful public benefit from any archaeological investigation;* *(e) measures proposed to preserve significant archaeological evidence 'in situ'.*

4. SITE HISTORY

4.1 HISTORY OF SETTLEMENT IN THE AREA

The history of the area is detailed in *North Hobart Heritage Areas - A detailed Assessment*, Prepared by Katheryn Bennett for Hobart City Council:

> *The section of Elizabeth Street that crosses this part of North Hobart was laid out by 1828, as were the intersecting cross streets of Warwick, Burnett, and Colville Streets.*[33] *It was in the later years of the nineteenth century that Tasma, Pitt, Lefroy, and Swan Streets were created.*
>
> *Development along Elizabeth Street appears to have been considerably advanced by the late 1830s, particularly between Warwick Street and Arthur Street (which was the northern town boundary). The importance of Elizabeth Street grew as it became the 'Road to the Interior", for it was by this road that places further north could be reached …*
>
> *Despite this development, land further north between Arthur and Federal Streets was still largely rural in function by the 1840s. William Shoobridge's farm, part of which fronted onto Elizabeth Street, was established in 1822, and operated until the 1860s. There were also several dairies within the area, one was located at the corner of Elizabeth and Burnett Streets in the 1830s. Market gardens and orchards were also established in the early years. In the 1820s, for example, the licensee of the Dallas Arms Inn (now 313A Elizabeth Street) applied for a further three acres to enable him to establish a market garden.*[35]
>
> *Numerous industries were established from the early days. In the 1820s, Henry Condell established a brewery at a site now occupied by Condell Place. A plough manufactory run by Mr Holdship was operating from what is now 279 Elizabeth Street in the 1830s; and a blacksmith's shop was started by Benjamin Holroyd at 350 Elizabeth Street in the 1860s*[36]*. …*
>
> *In the 1890s, the area became increasingly built up due to the introduction of a tram service to the area, the main line ran along Elizabeth Street. By the early 1900s, both sides of Elizabeth Street were substantially built upon, and had become a densely packed commercial/residential strip. Stores were to be found on nearly every corner, and family businesses, such as Soundy's Department Store (established in 1883), were regularly patronised by the locals.*

33 Vincent, R., 1999, North Hobart Heritage Study, p38.
35 Vincent, R., 1999, North Hobart Heritage Study, pp41-42.
36 Ibid, pp48-49.

The site originally formed part of a number of grants, to Robert Frost, Ann Maria Chandler, John Brown and Abraham Rheuben as detailed in the following extract from the former Lands

Department Town Grant Charts:

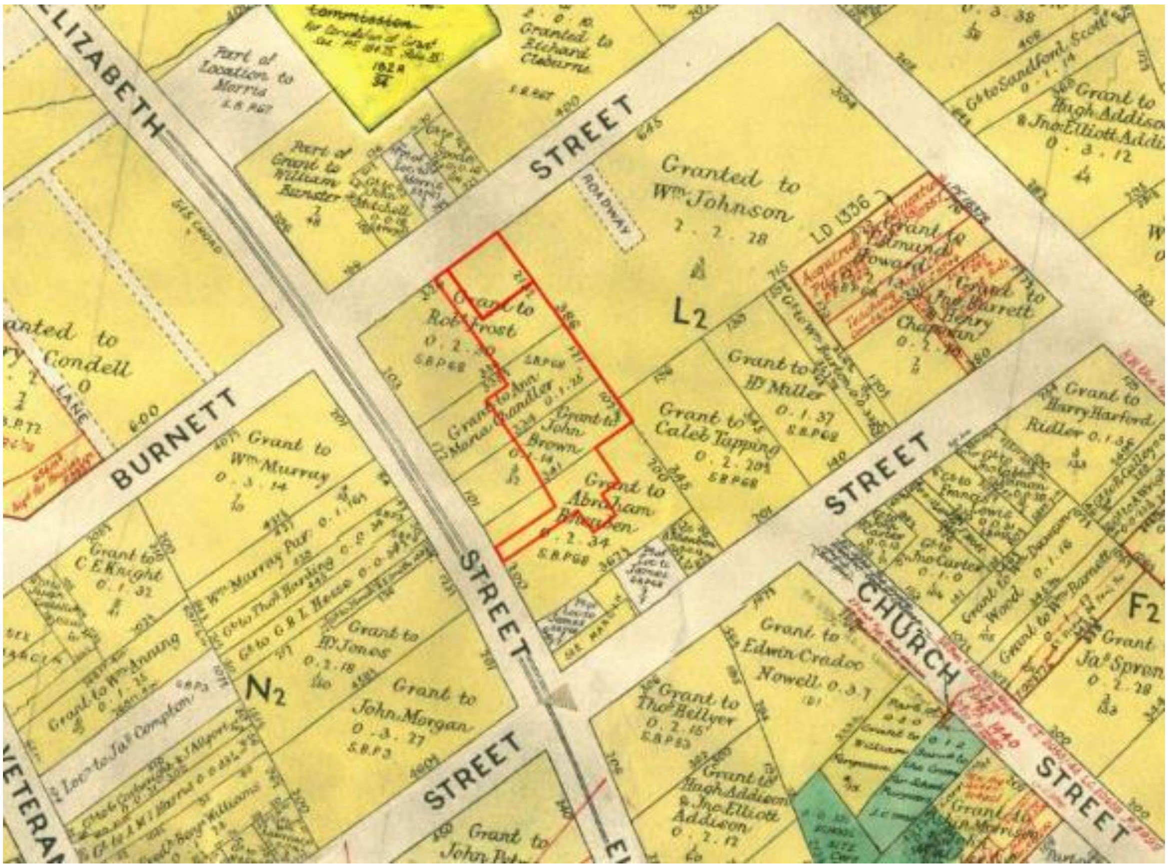

Figure 10: Town Grants Chart with subject land outlined in red (LISTMap)

The pattern of development for the area is also described in Sprent's Book of the 1840's described in the following figures:

Figure 11: Sprents Book with subject land outlined in red (LISTMap)

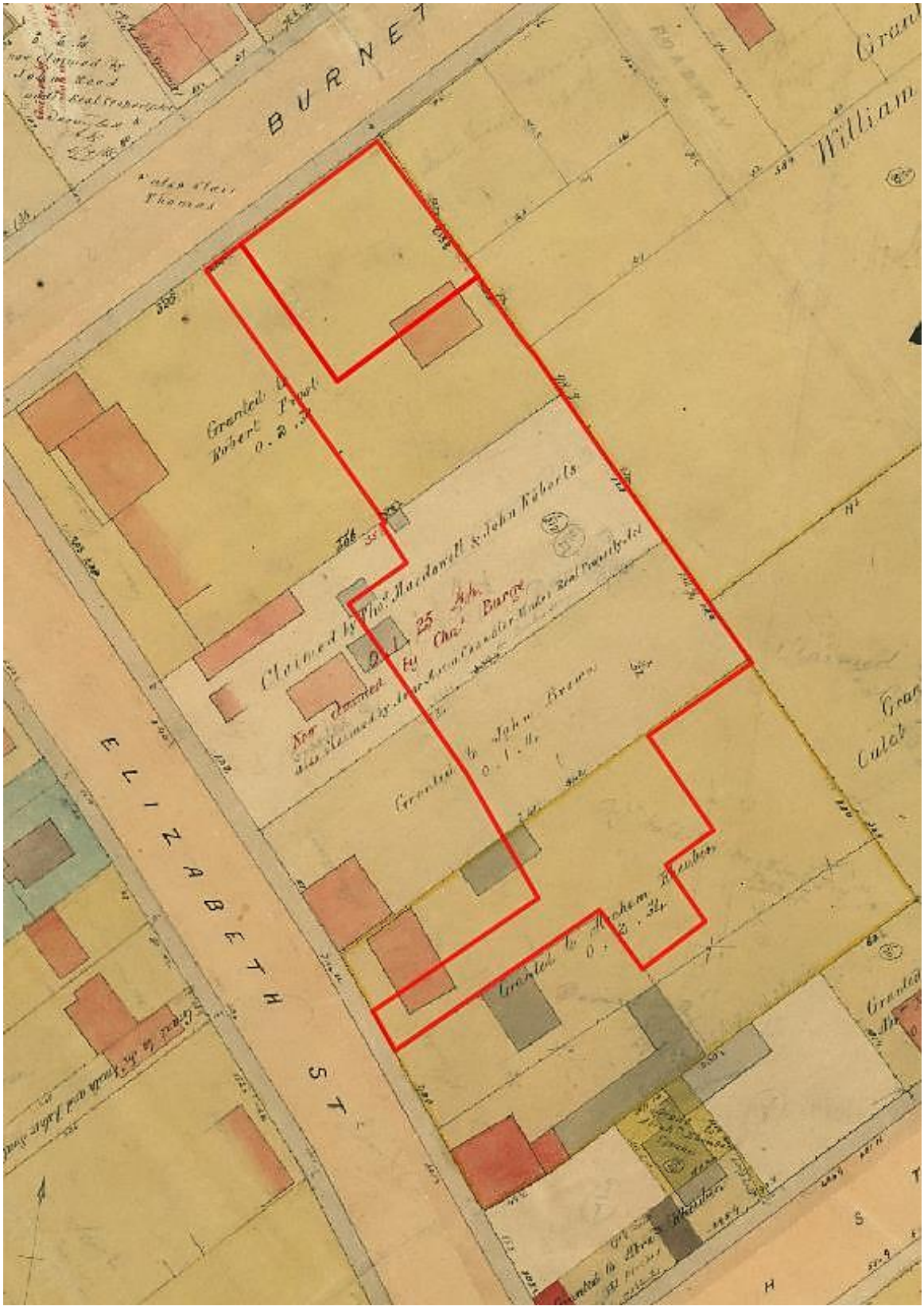

Figure 12: Sprents Book with subject land outlined in red (LISTMap)

The above figure describes the subject land located aligning with the rear of boundary of the 4 grant lots with buildings largely clustered towards Elizabeth Street, although there is a building indicated which may have been a cottage located at the boundary of 64 & 66 Burnett Street.

4.2 HISTORICAL PHASES

In George Frankland's 1836 Plan of Hobart, with the town boundary extending north to Arthur Street, the streets surrounding the subject land are laid out and buildings are evident along the Elizabeth Street, Tasma Street (then High Street) and Argyle Street edges, with no structures indicated within the central area of the block, as described in the following figure:

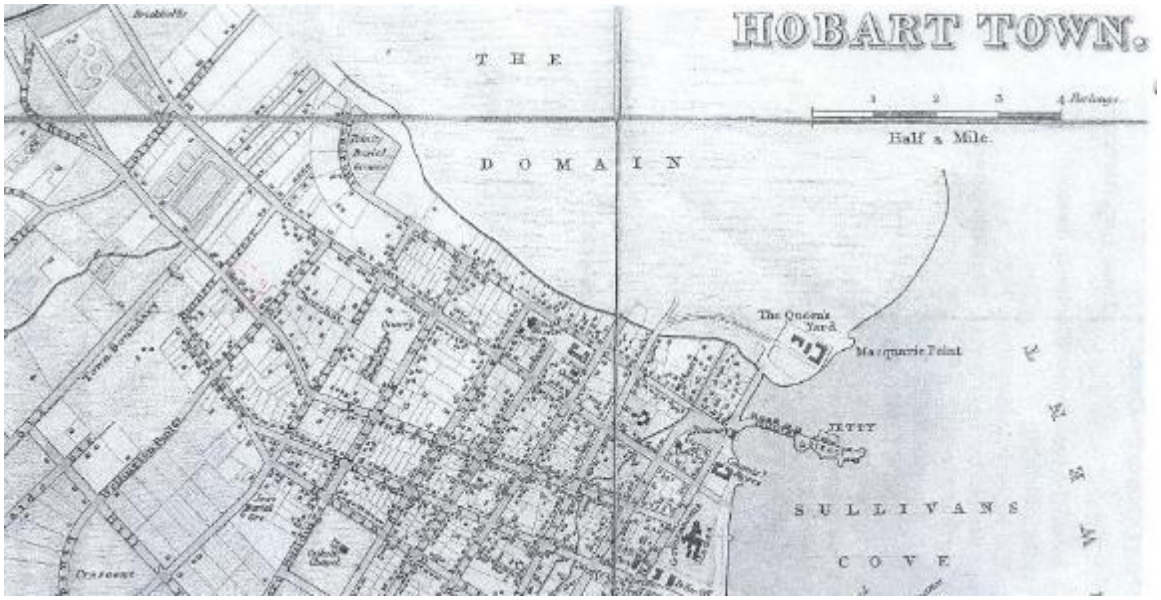

Figure 13: Extract from Hobart Town Plan, George Frankland Surveyor General C.1836-7

Figure 14: Extract with indicative site location, from Hobart Town Plan, George Frankland Surveyor General C.1836-7

A slightly later Frankland Map (1838) further describes the development of the town including the block containing the subject land, as follows:

Figure 15: Hobart Town Plan, George Frankland 1838

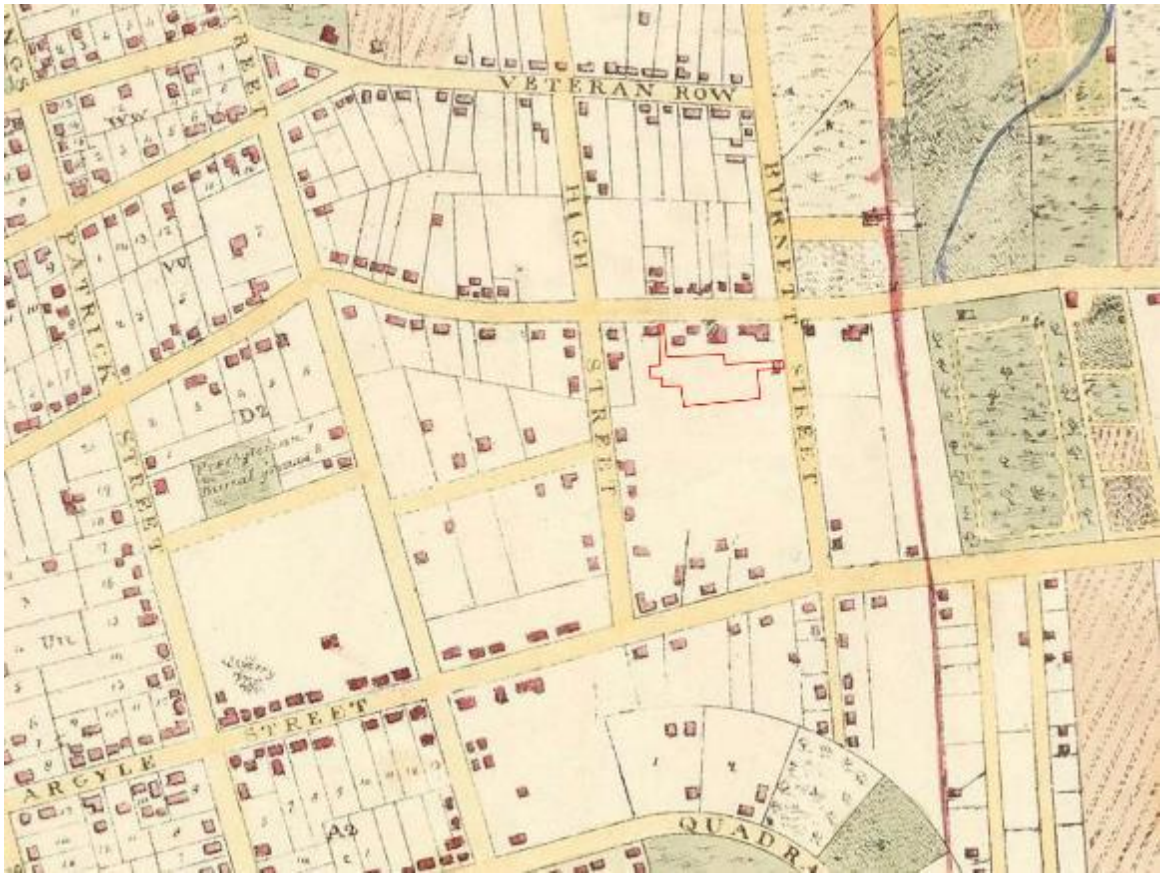

Figure 16: Extract - Hobart Town Plan, George Frankland 1838

Figure 17 & 18: Aerial of existing site development and overlay with Sprents Book (LISTMap)

No buildings identified in Sprents Book are located under the existing buildings on the site. The building which was located across the boundary of 64 & 66 Burnett is located in part of the site which forms part of the paved areas surrounding the existing buildings used to park and store vehicles.

The other buildings described are what appear as small outbuilding and a dwelling across the shared boundaries with 285 Elizabeth Street which has been redeveloped in recent years.

To the north west of the subject land the warehouse development apparent today to a great degree aligns with lot boundaries detailed by Sprent of the original grant to William Johnson. This historic layout includes reference to a roadway which remains the access to these lots presently.

A little later with the town expanding north development was increasing in North Hobart as described in Richard Jarman's plan of 1858, as follows:

Figure 19: extract from Map of Hobart Town, Richard Jarman 1858

The following figure describes the Metropolitan Drainage Board Detail Plan for the block in 1905-10.

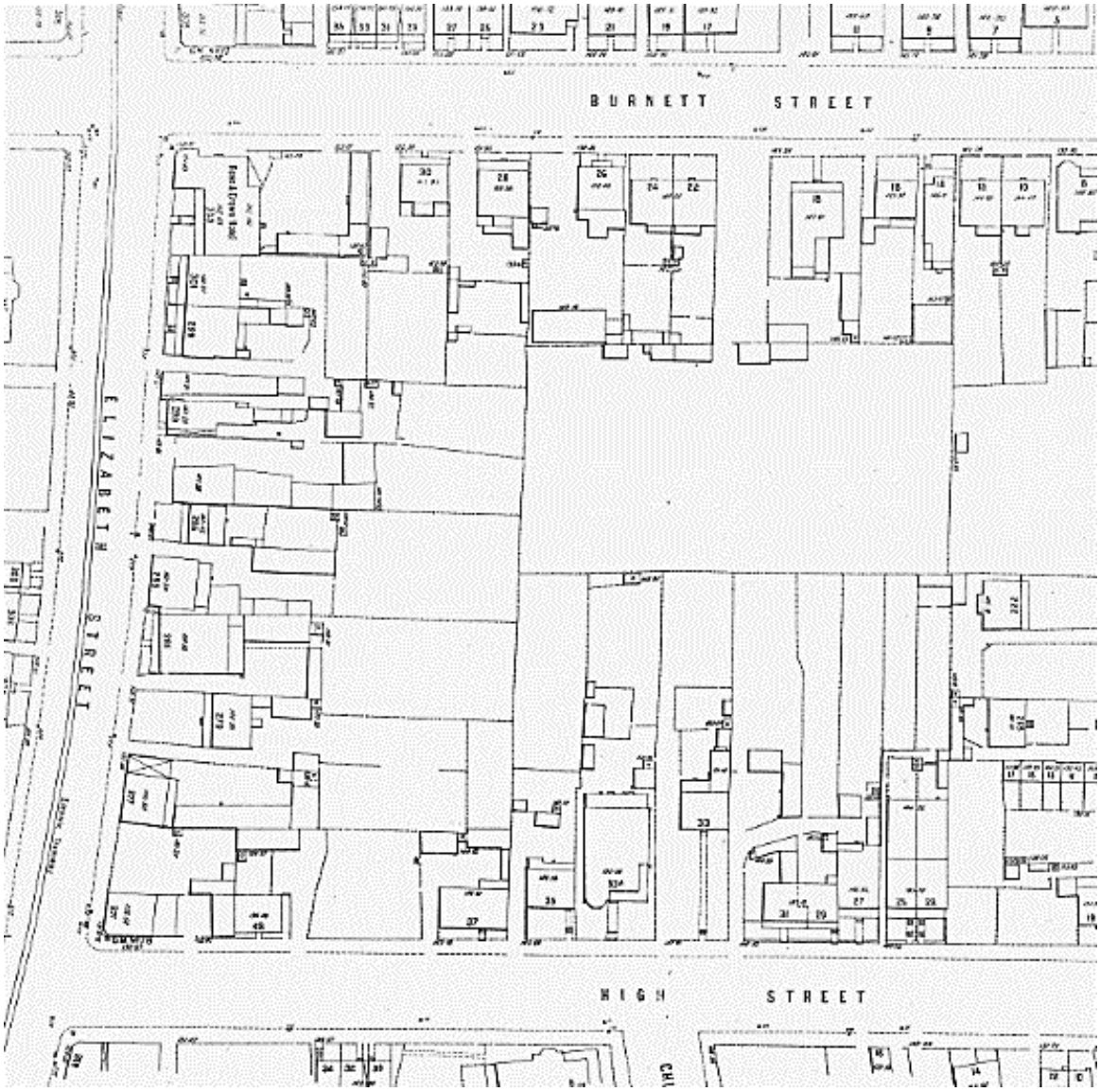

Figure 20: extract Hobart Detail Plan No. 20, Metropolitan Drainage Board c1905-10

At this date this above plan indicates the subject land still largely vacant with the exception of some outbuilding in the rear yards of the Elizabeth Street properties and 2 dwellings at the front of what would now be 64 Burnett Street.

Additionally, in the above plan the area where a building was indicated on the Sprent plan, at the rear of 64 Burnett (across the boundary with 66 Burnett) is no longer shown indicating it had already been demolished. For garden and outbuildings for these 2 houses.

Through the 1900's the area of the site and surrounds went through a number of developments and redevelopments as various commercial businesses, including Gorringe's on the subject land and the previous service station on Elizabeth Street, were established and further developed.

These phases are detailed in the aerial photo history of the area collated from DPIPWE, the following diagrams are from the report *'Preliminary Environmental Site Assessment'* by Geo-Environmental Solutions.

Figure 21: Plate 3 Historical Aerial Photograph, The Site 1946 (Geo Environmental Solutions)

Figure 22: Plate 5 Historical Aerial Photograph, The Site 1957 (Geo Environmental Solutions)

Figure 23: Plate 7 Historical Aerial Photograph, The Site 1965 (Geo Environmental Solutions)

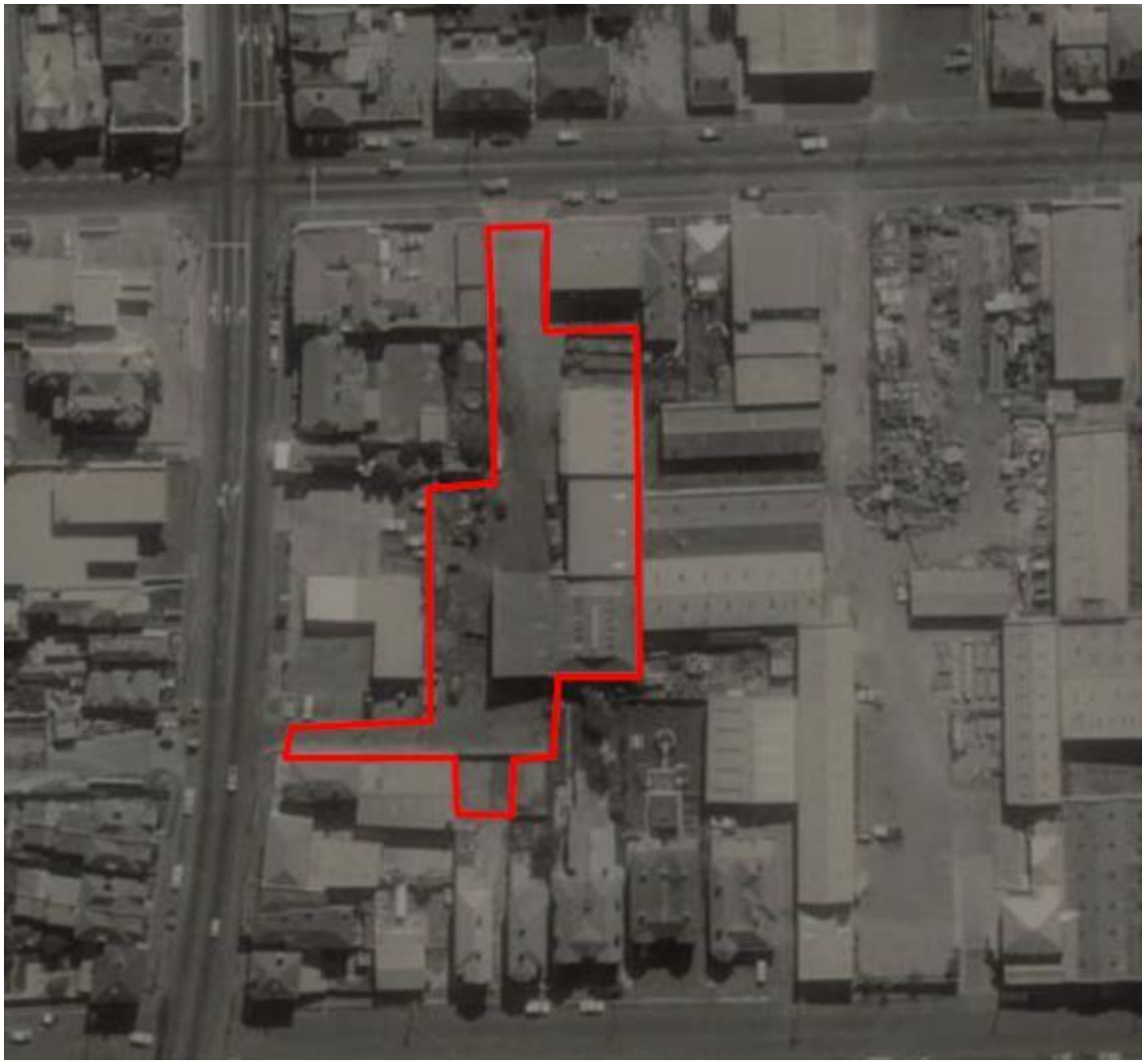

Figure 24: Plate 9 Historical Aerial Photograph, The Site 1973 (Geo Environmental Solutions)

4.3 DISTURBANCE HISTORY

As detailed in the above history the disturbance to building in and around the subject land includes:

- The demolition of a previous earlier building, construction of 2 dwellings located on lots now 64 Burnett and entry to 66 Burnett (along with small associated outbuildings) and their subsequent demolition for the current office building at 64 Burnett Street between 1965 and 1969.
- Demolition of buildings within 5 properties which now form 285 Elizabeth Street, sometime between 1957 and 1965 for the development of the service station, then the more recent demolition site decontamination and redevelopment for the existing Elizabeth Mews mixed use development in 2012.
- Demolition at 281 Elizabeth Street of an original building (from Sprents 1940's plan) and construction after 1905-10 of a dwelling and later rear warehouse.
- Demolition and replacement of the hotel (originally Rose and Crown, licenced in 1930 name changed to Empire Hotel in 1921) at 299 Elizabeth Street in 1938, now the Republic. The redevelopment in 1938 retained the sandstone yard wall adjacent to the subject land.

4.4 ARCHAEOLOGICAL SIGNIFICANCE AND POTENTIAL

Based on the history of the site and surrounds, which show limited if any development of the main body of the lot through earlier settlement phases through the 1800's, it appears there is a very low likelihood of important archaeological evidence being located within the body of the lot and developable area within the mapped potential area.

It is also appears that, given the extensive development and redevelopment of both the subject land and neighbouring land along the road frontages through the 1900's there is a high potential that any previous earlier archaeological evidence from the previous rear yards and outbuildings would have been removed or significantly disturbed through these development phases.

5. CONCLUSION

5.1.1 DEVELOPMENT STANDARDS FOR PLACES OF ARCHAEOLOGICAL POTENTIAL

The proposed development is required to meet the following standard:

> ***E13.10.1 Building, Works and Demolition***
>
> ***P1*** *Buildings, works and demolition must not unnecessarily impact on archaeological resources at places of archaeological potential, having regard to:*
>
> *(a) the nature of the archaeological evidence, either known or predicted;*
>
> *(b) measures proposed to investigate the archaeological evidence to confirm predictive statements of potential;*
>
> *(c) strategies to avoid, minimise and/or control impacts arising from building, works and demolition;*
>
> *(d) where it is demonstrated there is no prudent and feasible alternative to impacts arising from building, works and demolition, measures proposed to realise both the research potential in the archaeological evidence and a meaningful public benefit from any archaeological investigation;*
>
> *(e) measures proposed to preserve significant archaeological evidence 'in situ'.*

As detailed in the history and chronology of the development of the area of both the subject land and surrounds the site and proposed development meet this standard as follows:

a) The subject land is adjacent to Elizabeth Street which formed an early development corridor northward out of the early settlement area of Hobart towards the interior and further to Launceston. There is therefore reasonable documented history of the development of the area.
Much of the early development of the area was for agriculture and later for residential buildings with accompanying services aimed at travellers heading out of town. Later phases then became more used for industrial and warehousing activities.
The sequence of maps through the history of Hobart's development describe the land and detail how most of the build development remained along the road frontages not extending back in to the area of the existing building on the site.

b) Given the history it is not considered that any specific measures are necessary to investigate archaeological evidence within the development area.

c) The development area avoids previously documented areas of significant heritage fabric within the mapped potential area and therefore the site minimises the potential for impact on archaeology.

d) Any material or artefacts discovered in the demolition and excavation phase of the development could be retained for research purposes.

e) No measures are considered necessary to preserve 'in situ' archaeology given the history undertaken indicated a very low likelihood of built heritage within the development area.