



**Report Type:**  
**Targeted Groundwater Assessment**

**Project Address:**  
**51 Masons Road, Point Frederick NSW**

**Client Name:**  
**Brisbane Waters (NSW) Legacy (BWL) (c/  
Grindley Construction)**

**25 October 2021**  
**Report No: 10827-ER-1-3 Rev 2**



**alliance**  
geotechnical & environmental solutions

**Alliance Geotechnical Pty Ltd**

**Address:** 8-10 Welder Road  
Seven Hills, NSW  
**Phone:** 1800 288 188  
**Office Email:** [info@allgeo.com.au](mailto:info@allgeo.com.au)  
**Web:** [www.allgeo.com.au](http://www.allgeo.com.au)

## Document Control

Revision	Report Date	Author	Reviewer	Commissioned by	Comment
0	29 March 2021	J. Walker	N. Foster	Grindley Construction	Issued for client review
1	30 March 2021	J. Walker	N. Foster	Grindley Construction	Addressing client comments
2	25 October 2021	J. Walker	N. Foster	Grindley Construction	Addressing client comments

Author Signature



Reviewer Signature



Name

Jacob Walker

Name

Nathan Foster

Title

Environmental  
Consultant

Title

Principal Environmental  
Consultant

## Executive Summary

Alliance Geotechnical Pty Ltd (Alliance) was engaged by Brisbane Waters (NSW) Legacy (BWL) (c/ Grindley Construction) to undertake a Targeted Groundwater Assessment (TGA) at 51 Masons Road, Point Frederick NSW (refer **Figure 1**, with the 'site' boundaries & investigation area outlined in **Figure 2**).

Alliance understands that:

- Additional residential living units are proposed for the Brisbane Water Legacy (BWL) that provides seniors low-cost rental accommodation housing under the NSW Retirement Villages Act 1999, which will require demolition of existing structures, and construction of apartment style residential structures, roadways, and the installation of associated infrastructure and services.
- Previous contamination assessments have been completed for the site by Alliance in 2020 & SWE in 2021.
- Alliance (2020b) recommended that a remediation action plan (RAP) is required for the site, in order to address heavy metal in groundwater and asbestos in soil risks.
- SWE (2021) provided an Asbestos Register for all asbestos containing materials within the site, including the friable asbestos in the south of the site.
- A targeted groundwater assessment of the site is required to address groundwater contamination risks presented within the Alliance's DSI in 2020.

The objectives of this investigation were to:

- Evaluate the possibility for groundwater contamination to be present at the site as a result of current and former land use activities.
- Identify risks to both human-health and environment receptors posed by contaminants identified from intrusive investigation at the site.
- Provide advice on the suitability (in the context of land contamination) of the groundwater for the proposed land use setting at the site.
- Provide recommendations for further investigation, management and/or remediation (if warranted).

The scope of works undertaken to address the investigation objectives, included:

- A desktop review of relevant historical site information pertaining to the site.
- A site walkover to understand current site conditions.
- The preparation of a Sampling and Analysis Quality Plan (SAQP).
- Completion of an additional round of groundwater sampling from established groundwater wells to establish groundwater conditions and collect groundwater samples.
- Laboratory analysis of selected samples collected during the field investigation for contaminants of potential concern (COPC) identified by the review of site history and land use activities.
- An appraisal of the contamination status of the site and the recommendation of any further remedial requirements associated with the redevelopment of the site (if necessary).

## Conclusions

Based on the findings of desktop review information, fieldwork observations and laboratory analytical data, in the context of the proposed redevelopment scenario, Alliance makes the following conclusions:

- Three groundwater monitoring wells, installed by Alliance in (2020b), were sampled.
- Groundwater was reported at depths ranging between 2.24 to 2.7 mBGL.
- Identified COPC in the sampled groundwater, including heavy metals, are considered unlikely to present an unacceptable human health risk.
- The concentrations of heavy metals reported in groundwater monitoring wells, and exceeding the ANZG (2018) ecological criteria, are considered representative of local groundwater quality entering the site, and not related to site activities.
- The asbestos risk for the site has been noted in the asbestos register and management plan, and is outside of the area of investigation and redevelopment, and so Alliance considers that the risk of asbestos is managed, and does not impact the proposed redevelopment of the site.
- Alliance considers that, as the asbestos and groundwater risks have been managed, a remedial action plan is no longer necessary for the site, in the context of the previously identified contaminants.

Based on the findings of this assessment, the land in its current state is considered suitable for future development of the site for continued medium-density residential land use.

This report, including its conclusions and recommendations, must be read in conjunction with the statement of limitations presented in **Section 10**.

## TABLE OF CONTENTS

<b>Document Control .....</b>	<b>ii</b>
<b>Executive Summary.....</b>	<b>iii</b>
<b>TABLE OF CONTENTS .....</b>	
<b>1. Introduction .....</b>	<b>1</b>
1.1. Background .....	1
1.2. Objectives.....	1
1.3. Scope of Work.....	1
<b>2. Site Setting .....</b>	<b>2</b>
2.1. Site Identification .....	2
2.2. Ground Conditions and Surrounding Environment .....	2
2.3. Hydrogeology and Groundwater Use .....	3
<b>3. Previous Contamination Assessments .....</b>	<b>4</b>
3.1. Alliance 2020a.....	4
3.2. Alliance 2020b.....	4
3.3. Alliance 2020c.....	6
3.4. Alliance 2020d.....	8
3.5. SWE 2021 .....	8
<b>4. Data Integrity Assessment .....</b>	<b>10</b>
<b>5. Conceptual Site Model.....</b>	<b>11</b>
5.1. Sources of Contamination.....	11
5.2. Contaminants of Potential Concern .....	11
5.3. Source – Pathway – Receptor Linkages .....	11
<b>6. Sampling and Analysis Quality Plan (SAQP).....</b>	<b>13</b>
6.1. Data Quality Objectives.....	13
6.2. Data Quality Indicators .....	15
6.3. Investigation Criteria.....	17
6.4. Groundwater Investigation .....	17
6.5. Laboratory Analysis and Sample Analytical Suite.....	20
<b>7. Data Quality Assessment .....</b>	<b>21</b>
<b>8. Results and Site Characterisation .....</b>	<b>22</b>
8.1. Soil .....	22
8.1.1. Soil Characterisation .....	22
8.2. Groundwater.....	22
8.2.1. Groundwater Monitoring Well Installation .....	22

8.2.2.	Groundwater Parameters .....	22
8.2.3.	Calculated Groundwater Flow Direction.....	23
8.2.4.	Groundwater Analytical Laboratory Results.....	23
8.2.5.	Groundwater Characterisation .....	23
8.3.	Conceptual Site Model Review .....	24
<b>9.</b>	<b>Conclusions and Recommendations .....</b>	<b>25</b>
<b>10.</b>	<b>Statement of Limitations .....</b>	<b>26</b>
<b>11.</b>	<b>References .....</b>	<b>27</b>
<b>12.</b>	<b>Abbreviations .....</b>	<b>28</b>

## FIGURES

Figure 1	Site Locality
Figure 2	Site Layout
Figure 3	Groundwater Well Sample Locations
Figure 4	Inferred Groundwater Directional Flow

## TABLES

Table LAR1	Laboratory Analytical Results – Groundwater
Table LAR2	Laboratory Analytical Results – RPD

## APPENDICES

A	Groundwater Search
B	Site Photographs
C	Borehole Logs
D	Laboratory Certificates
E	Data Quality Assessment
F	Calibration Certificate

# 1. Introduction

## 1.1. Background

Alliance Geotechnical Pty Ltd (Alliance) was engaged by Brisbane Waters (NSW) Legacy (BWL) (c/ Grindley Construction) to undertake a Targeted Groundwater Assessment (TGA) at 51 Masons Road, Point Frederick NSW (refer **Figure 1**, with the 'site' boundaries & investigation area outlined in **Figure 2**).

Alliance understand that Additional residential living units are proposed for the Brisbane Water Legacy (BWL) that provides seniors low-cost rental accommodation housing under the NSW Retirement Villages Act 1999, which will require demolition of existing structures, and construction of apartment style residential structures, roadways, and the installation of associated infrastructure and services. Previous contamination assessments have been completed for the site by Alliance in 2020 & SWE in 2021. Alliance (2020b) recommended that a remediation action plan (RAP) is required for the site, in order to address heavy metal in groundwater and asbestos in soil risks. SWE (2021) provided an Asbestos Register for all asbestos containing materials within the site, including the friable asbestos in the south of the site. A targeted groundwater assessment of the site is required to address groundwater contamination reported by Alliance's Detailed Site Investigation (DSI) completed in 2020.

## 1.2. Objectives

The objectives of this project were to:

- Evaluate the possibility for groundwater contamination to be present at the site as a result of current and former land use activities.
- Identify risks to both human-health and environment receptors posed by contaminants identified from intrusive investigation at the site.
- Provide advice on the suitability (in the context of land contamination) of the groundwater for the proposed land use setting at the site.
- Provide recommendations for further investigation, management and/or remediation (if warranted).

## 1.3. Scope of Work

The following scope of works was utilised to address the project objectives:

- A desktop review of relevant historical site information pertaining to the site.
- A site walkover to understand current site conditions.
- The preparation of a Sampling and Analysis Quality Plan (SAQP).
- Completion of an additional round of groundwater sampling from established groundwater wells to establish groundwater conditions and collect groundwater samples.
- Laboratory analysis of selected samples collected during the field investigation for contaminants of potential concern (COPC) identified by the review of site history and land use activities.
- An appraisal of the contamination status of the site and the recommendation of any further remedial requirements associated with the redevelopment of the site (if necessary).

## 2. Site Setting

### 2.1. Site Identification

Site identification details and associated information is present in **Table 2-1**. The locality of the site is presented in **Figure 1**, with the general layout and site boundaries depicted in **Figure 2**.

**Table 2-1 Site Identification Information**

Site Address	51 Masons Road, Point Frederick NSW
Cadastral Identification	Lot 51 in DP732632
Geographical Coordinates	South-western corner of site (datum GDA94-MGA56): Easting: 1463519.749 Northing: 6252325.399 (Source: SixMaps - <a href="https://maps.six.nsw.gov.au/">https://maps.six.nsw.gov.au/</a> )
Site Area	The site covers 1.253 hectares, however the area of investigation covers the northern 4,900 m <sup>2</sup> of the property. (Source: Six Maps - <a href="https://maps.six.nsw.gov.au/">https://maps.six.nsw.gov.au/</a> )
Zoning	B4 – Mixed Use (State Environmental Planning Policy (Gosford City Centre) 2018)
Current Land Use	Medium-density residential
Proposed Land Use	Medium-density residential
Local Government Agency	Gosford City Council

### 2.2. Ground Conditions and Surrounding Environment

A summary of available site and local data identifying topography, geology, soils, and hydrology is provided in **Table 2-2**.

**Table 2-2 Summary of Ground Conditions and Surrounding Environment**

Geology	A review of the 1:100,000 Geological Series Sheet (1 <sup>st</sup> Edition), indicates that the site is likely underlain by Quaternary (Qa), comprising alluvium, gravel and sand.
Topography and Site Elevation	The site is located at an elevation of approximately 4 to 11 mAHD. Disturbed Terrain consists of landscape has been extensively disturbed by human activity and the features of the original landscape have been extensively modified. Includes extensive areas of coal mining in the Hunter Valley and past coastal sand mining areas. Also occurs as numerous quarries and garbage tips, industrial sites and other areas where excavation and deposition of material has occurred. (Source: <a href="https://www.environment.nsw.gov.au/eSpade2WebApp">https://www.environment.nsw.gov.au/eSpade2WebApp</a> )



Acid Sulfate Soil Risk	<p>A review of NSW Department of Land and Water Conservation Acid Sulfate Soil Risk Map for the site indicates that the site lies in an area mapped as <i>No known occurrence</i> with respect to acid sulfate soils (ASS). However, the site is within close proximity to disturbed terrain to the west (Brisbane Waters).</p> <p>Further assessment of ASS, in the context of this investigation is considered warranted.</p> <p>(Source: <a href="https://www.environment.nsw.gov.au/eSpade2WebApp">https://www.environment.nsw.gov.au/eSpade2WebApp</a>)</p>
Potential Depth of Site Filling	<1.5 m
Site Drainage	Drainage in hardstand areas is likely to be collected and discharged to the municipal stormwater system. Drainage in unsealed areas is likely to consist of direct soil infiltration and overland flow.
Nearest Surface Waterbody	<p>An unnamed creek immediately north of the site.</p> <p>Brisbane Waters, approximately 160 m to the west of the site.</p>

## 2.3. Hydrogeology and Groundwater Use

Available hydrogeological data and records of groundwater use, obtained for this investigation, are summarised below in **Table 2-3**.

**Table 2-3 Background Hydrogeological Information**

Depth to Watertable <sup>1</sup>	Approximately 2.2 – 2.7m BGSL
Inferred Groundwater Flow Direction	Based on prevailing site topography, groundwater flow direction in the vicinity of the site is inferred to be towards the south to west.
Local Groundwater Bore Records (≤ 500 m of site)	<p>Review of the Water NSW groundwater database identified no registered groundwater bores within a 500 m radius of the site.</p> <p>The Water NSW search records are presented in <b>Appendix A</b>.</p> <p>(Source: <a href="http://www.realtimedata.watarnsw.com.au/water.stm">www.realtimedata.watarnsw.com.au/water.stm</a>, accessed on 9 June 2020)</p>
Potential Groundwater Receptors (including vapour flux receptors)	<p>Potential groundwater receptors include:</p> <ul style="list-style-type: none"> <li>▪ Proposed users of the site (vapour).</li> <li>▪ Neighbouring residential properties and schools (vapour).</li> <li>▪ Brisbane Waters.</li> </ul>

**Notes:**

<sup>1</sup> Sourced from <https://www.environment.nsw.gov.au/eSpade2WebApp>

### 3. Previous Contamination Assessments

For the purposes of this assessment, the following reports, with the original investigation dates referenced, were considered during the development of this plan:

- Alliance (2020a), 'Sampling, Analytical and Quality Plan (SAQP) , Lot 51 in DP732632, 51 Masons Parade, Point Frederick NSW', dated May 2020, Ref: 10827-ER-1-1.
- Alliance (2020b), 'Detailed Site Investigation, Lot 51 in DP732632, 51 Masons Parade, Point Frederick NSW', dated June 2020, Ref: 10827-ER-1-2.
- Alliance (2020c), 'Acid Sulfate Soils Assessment, Lot 51 in DP732632, 51 Masons Parade, Point Frederick NSW', dated July 2020, Ref: 10827-ER-2-1.
- Alliance (2020d), 'Indicative Waste Classification Report, Lot 51 in DP732632, 51 Masons Parade, Point Frederick NSW', dated July 2020, Ref: 10827-ER-1-2.
- SWE (2021), 'Hazardous Materials Survey & Management Plan, Lot 51 in DP732632, 51 Masons Parade, Point Frederick NSW', Ref: S109616, dated March 2021.

The reports itemised above are discussed in the sections below.

#### 3.1. Alliance 2020a

Alliance Geotechnical Pty Ltd (AG) was engaged by Grindley Constructions, to prepare a Sampling and Analysis Quality Plan (SAQP) for 51 Masons Parade, Point Frederick NSW.

AG understand that the current redevelopment proposal for the site will result in future use for high density residential purposes. It is understood that the proposed development will include demolition of current structures, and construction of a seven (7) storey apartment complex, on-ground carparking, an administration office and a community hall facility.

In light of the proposal, a contamination assessment of the site is required in accordance with SEPP55.

The objectives of this investigation were to:

- Provide a sampling framework for the proposed intrusive investigation of the site.

The scope of works undertaken to address the investigation objectives, included:

- The preparation of a Sampling, Analysis and Quality Plan (SAQP) to direct intrusive investigation of potential contamination in soil and groundwater onsite.

Based on the findings of desktop review information, in the context of the proposed redevelopment scenario, AG made the following conclusions:

- An SAQP has been generated to inform the intrusive detailed site investigation for the site, which when followed will assess the site's suitability, in the context of land contamination.

#### 3.2. Alliance 2020b

Alliance Geotechnical Pty Ltd (AG) was engaged by Brisbane Waters (NSW) Legacy (BWL) (c/ Grindley Construction), to undertake a Detailed Site Investigation for 51 Masons Parade, Point Frederick, NSW.

- The northern portion of the site is being considered for redevelopment, comprising demolition of existing structures and construction of apartments over seven (7) levels and ground level parking structures; and
- A contamination assessment of the site is required in accordance with the SEPP55.

The objectives of this investigation were to:

- Evaluate the possibility for contamination to be present at the site as a result of current and former land use activities;
- Identify risks to both human-health and environment receptors posed by contaminants identified from intrusive investigation at the site;
- Provide advice on the suitable (in the context of land contamination) of the soil and groundwater for the proposed land use setting at the site; and
- Provide recommendations for further investigation, management and/or remediation (if warranted).

The scope of works undertaken to address the investigation objectives, included:

- A desktop review of relevant information pertaining to the site;
- A site walkover to understand current site conditions;
- The preparation of a Sampling and Analysis Quality Plan (SAQP);
- Conduct an intrusive site investigation to establish ground conditions and to facilitate the collection of representative soil and groundwater samples;
- Laboratory analysis of selected samples collected during the field investigation; and
- An assessment of the contamination status of the site and the recommendation of any further remedial requirements associated with the redevelopment of the site (if necessary).

## Conclusions

Based on the findings of desktop review information, fieldwork observations and laboratory analytical data, in the context of the proposed redevelopment scenario, AG makes the following conclusions:

- Site history records indicate that the site has been used historically for residential purposes;
- Based on the findings of the site history and land use, the most plausible sources of contamination were associated with historic filling, the weathering of building structures, pesticide use, and demolition of structures;
- Intrusive investigation at the site utilised 21 sampling locations for the description of site soils and collection of soil samples for laboratory analysis;
- A further 3 boreholes across the proposed development portion of the site were advanced, and groundwater wells installed for the description of site groundwater and collection of groundwater samples for laboratory analysis;
- Laboratory analytical results for TRH, BTEXN, PAH, OCP, OPP, PCB, HM, and Phenols reported concentrations below adopted investigation criteria in fill and natural soils;
- Asbestos was reported in soil sample TP19 analysed by the testing laboratory, in the form of friable asbestos;

- Laboratory analytical results for TRH, BTEXN, PAH, OCP, OPP, PCB, Phenols and Cations/Anions reported concentrations below adopted investigation criteria within groundwater; and
- Priority metals were reported at concentrations in groundwater below adopted investigation criteria, except for lead and zinc which exceeded the ANZG 95% protection of Marine Water criteria in GWM1, GWM3, GWM4 & DUP01, zinc in DUP01A, and nickel which exceeded the NEPM ASC health criteria in GWM3 & GWM4.

### Recommendations

Based on the above conclusions, from a contamination perspective, the land in its current state is not suitable for the proposed development. The land could potentially be made suitable for the proposed residential subdivision subject to the following recommendations being undertaken:

- A remedial action plan (RAP) should be prepared for the site, to address potentially unacceptable friable asbestos in soil related human health exposure risks at the site and nickel, lead and zinc in groundwater related exposure risks;
- The RAP should be prepared by a suitably experienced environmental consultant with reference to NSW EPA (2020) and include (but not be limited to) the following:
  - a remedial goal for the site;
  - an assessment of remedial options available to address the identified asbestos risks. These options may include removal offsite, in-situ containment, ex-situ containment, or a combination of these;
  - the proposed testing to validate the site after remediation;
  - a contingency plan to address unexpected finds or if the selected remedial strategy fails; and
  - a site management plan (for the remediation works).
- Consideration should be given to undertaking lateral delineation assessment works around detected asbestos contamination, as well as a more detailed groundwater assessment across the site, should there be a need to obtain further certainty around the nature and extent of remedial works required. The delineation work could be undertaken
  - prior to preparation of the RAP; or
  - following preparation of the RAP, with a RAP addendum issued incorporating the findings of the delineation assessment;
- Records of the lawful transport and disposal of asbestos containing materials and any other wastes removed from site, should be retained.

### 3.3. Alliance 2020c

Alliance Geotechnical Pty Ltd (AG) was engaged by Brisbane Waters (NSW) Legacy (BWL) (c/ Grindley Construction) to undertake an Acid Sulfate Soils Assessment at 51 Masons Road, Point Frederick NSW.

AG understands that additional residential living units are proposed for the Legacy seniors living facility, which will require demolition of existing structures, and construction of an apartment style residential seniors living facility, roadways, and the installation of associated infrastructure and services. A contamination assessment of the site is required in accordance with the SEPP55.

The objectives of this project were to:

- Provide an assessment of acid sulfate soils on the site; and
- Provide recommendations on further assessment, management of remediation of acid sulfate soils (if identified).

AG undertook the following scope of works to address the project objective:

- A desktop review of relevant acid sulfate soils risk planning maps, previous investigation reports and other relevant information relating to the site;
- Conduct an intrusive site investigation to establish ground conditions and to facilitate the collection of representative soil samples;
- Laboratory analysis of selected samples collected during the field investigations; and
- Report the findings in accordance with Acid Sulfate Soils Manual 1998 (ASSMAC 1998) and the National Acid Sulfate Soil Guidance (Australian Government 2018) ASS and potential ASS risk across the project footprint.

## Conclusions

Based on the desktop review data, fieldwork observations, and the laboratory analytical results, AG concludes that:

- Potential ASS were identified by preliminary laboratory analysis in eighteen (18) soil samples collected across the site, indicating that the soil materials which were encountered at depths between 0.5m and 4.5m bgl are potentially impacted by ASS;
- A further six (6) soil samples were submitted for CRS analysis and returned results indicating the presence of AASS and PASS collected from boreholes MW01-0.5, MW01-3.0, MW03-3.5, MW04-2.0, MW04-3.0 and MW04-4.5, indicating the presence of AASS and PASS from site surface to depths excavation across the site;
- The liming rate required for remediation of the AASS and PASS across the site is between 2.2 kgCaCO<sub>3</sub>/tonne to 79 kgCaCO<sub>3</sub>/tonne; and
- The identified potential ASS at the site are likely to be disturbed by the construction phase of the works.

Based on these conclusions, AG makes the following recommendations:

- An acid sulfate soils management plan (ASSMP) should be developed for the site so to:
  - Document the procedures and standards to be followed to manage the risks posed by potential ASS identified during construction;
  - Outline the management measures to be implemented to minimise the potential for adverse human health or environmental impacts resulting from the disturbance of ASS; and
  - Manage the offsite disposal of excavated materials aligned to the NSW EPA Waste Classification Guidelines Part 1: Classifying Waste, November 2014 (NSW EPA, 2014a) and Waste Classification Guidelines Part 4: Acid Sulfate Soils (NSW EPA, 2014b).

### **3.4. Alliance 2020d**

Alliance Geotechnical Pty Ltd (AG) was engaged by Grindley Construction Pty Ltd (the Client) to provide an indicative waste classification of in-situ soil material located at 51 Masons Parade, Point Frederick NSW (the site).

An appropriately experienced environmental consultant from AG visited the site on the 1 June 2020 and collected a total of thirty-five (35) soil samples. Samples were collected within the area of the site's proposed excavation to provide understanding of possible soil waste streams requiring future offsite disposal.

#### **Indicative Material Classification**

Based on Alliance Geotechnical Pty Ltd.'s (AG) assessment of fieldwork observations and laboratory analytical data, and as of the date of this report, the material is chemically consistent with General Solid Waste (Non-putrescible) from site surface to depth of excavation. However, based on the previously completed Acid Sulfate Soils Assessment (10827-ER-2-1) by AG, for material to be suitable for offsite disposal, the soil material will require treatment with lime to neutralise any potential acidity generated by the oxidation of ASS. Lime treatment is to be completed in accordance with the site ASS Management Plan prior to offsite disposal.

### **3.5. SWE 2021**

Safe Work and Environments Pty Ltd (SWE) was commissioned by Alliance Geotechnical (Alliance) on behalf of Grindley Construction Pty Ltd to carry out a Hazardous Materials Survey of the site located at 51 Masons Parage, Point Frederick NSW, 2250.

The survey was undertaken by Alexandar- Mitevski (Senior Hazardous Materials Consultant) between Wednesday 17<sup>th</sup> March 2021 to Monday the 22<sup>nd</sup> of March 2021 over three days.

The purpose of the survey was to identify the following hazardous construction materials:

- asbestos containing materials (ACM);
- lead based paints;
- synthetic Mineral Fibre (SMF); and
- polychlorinated biphenyls (PCBs).

The scope of works involved the following:

- Development of a task specific Safe Work Method Statement (SWMS);
- Walkthrough inspection of the site building/s;
- Identification of all visible and accessible hazardous materials including asbestos, lead, SMF & PCBs;
- Sampling of suspect materials where necessary/possible;
- Laboratory analysis of the samples where the inspector suspected the presence of asbestos containing materials; and
- Preparation of a Hazardous Materials Register and Management Plan in accordance with all relevant legislative requirements.

The objectives of the Hazardous Materials Survey and Management Plan are to:

- Identify hazardous materials within the building(s);
- Detail the survey methodology;
- Provide a qualitative risk assessment of the identified hazardous materials and provide information regarding health risks;
- Provide recommendations for control measures and management strategies;
- Prepare a Hazardous Materials Register for the site to ensure legislative compliance;
- Outline the responsible persons and details those persons responsibilities in relation to managing on site Asbestos Containing Materials;
- Detail the principles of hazardous materials management;
- Detail management strategies for insitu asbestos and other hazardous materials;
- Provide information about Safe Working Practices for work involving asbestos and other hazardous materials;
- Detail the requirements for removal of Asbestos Containing Materials (ACM);
- Provide a template for Emergency Response Procedures; and
- Outline Asbestos Training and Awareness.

#### **Site Assessment:**

The majority ACM encountered on Site was in good condition and therefore are considered **Low Risk**.

Friable linoleum paper backing was found in villas 57-64, however this material was generally in good condition, this was conserved **Medium Risk**. If disturbed, please follow the control measures presented in **Section 7.2**.

Synthetic Mineral Fibres identified on site were considered **Low Risk**. The material is in good condition, with limited accessibility, it is unlikely to present a risk to health unless damaged, tooled, cut, sanded or machined.

The Lead based paint systems identified on site varied in condition. It recommended that flaking and caulking sections of paint in high access area be removed and replaced with a lead-free substitute.

The settled dust containing elevated levels identified on flat surfaces was generally in low traffic areas. It is recommended that high traffic areas have the excess dust removed by a licensed contractor. Polychlorinated biphenyls were assumed to be present in various light fixtures in occupation, confirm the status of these once power has been isolated.

A full listing of all hazardous items identified, including a risk assessment of these has been included in the Hazardous Materials Register section of this report. It is recommended that all hazardous materials should be removed prior to any demolition or refurbishment works that would disturb these materials. All asbestos removal works are to be carried out in accordance with the National Code of Practice for the Safe Removal of Asbestos [NOHSC:2002 (2005)].

This survey was limited to accessible areas of the building with limited intrusive sampling carried out. Hence further inspection of building materials that may be concealed behind other building materials may be required in conjunction with future demolition, or similar work.

## 4. Data Integrity Assessment

Alliance has relied on the following sources of data while undertaking this investigation:

- Alliance field observations during the site walkover;
- Gosford Council;
- Department of Land and Water Conservations;
- Department of Primary Industries – Water;
- Australian Soil Resource Information System;
- Google Earth;
- National Environment Protection Council;
- Nearmap;
- NSW Environment Protection Authority;
- NSW Land and Property Information;
- NSW Spatial Services; and
- Water NSW.

Based on Alliance's experience and professional judgement, the data obtained from the sources relied upon, is considered to be adequately precise, accurate, representative, complete and comparable within the objectives of this investigation and for the purpose of drawing conclusions regarding land contamination risks at the site.



## 5. Conceptual Site Model

A Conceptual Site Model (CSM) has been developed using information gathered from a review of site history records and from observation compiled during the completion of the site walkover. The methods used in the CSM follow the Contaminated Land Management risk-based approach, with the potential environmental risk assessed qualitatively using the 'source-pathway-target pollutant linkage' concept. For a site to be designated as Contaminated Land, a plausible linkage between the identified Sources, Pathways and Receptors must be demonstrated. A summary of the CSM developed for the site is provided below.

### 5.1. Sources of Contamination

Potential sources of contamination that have been identified during review of site history records include:

- Off-site contamination sources.

### 5.2. Contaminants of Potential Concern

Potential sources of contamination were revealed, with potential to contaminate the site. Given the above sources, the COPC are:

- Groundwater – Priority metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc).

### 5.3. Source – Pathway – Receptor Linkages

A summary of potential source – pathway – receptor linkages identified for the site and proposed redevelopment is presented in **Table 5-1**.

**Table 5-1 Summary of Source – Pathway – Receptor Linkages for the Site**

Potential Sources	Impacted Media	Contaminants of Potential Concern	Transport mechanism	Exposure pathway	Potential receptor
Uncontrolled Demolition and/or Filling within the vicinity of TP18 & TP19	Soil	Asbestos	Disturbance of surface and subsurface soils during site redevelopment, future site maintenance and future use of the site post-redevelopment	Ingestion Dermal contact Inhalation of dust particulates Mechanical transport	Site Users and Visitors. Future Construction and maintenance personal
Contaminated groundwater potentially derived from offsite	Groundwater	8 Priority Heavy Metals	Interaction during construction & landscaping	Dermal contact Ingestion	Site Users and Visitors. Future Construction and maintenance personnel  Downstream end users of groundwater, including potential recreational and drinking water uses

## 6. Sampling and Analysis Quality Plan (SAQP)

### 6.1. Data Quality Objectives

NEPC (2013b) *Schedule B(2) Guideline on Site Characterisation* and EPA (2017) *Guidelines for the NSW Site Auditor Scheme* provide guidance on the development of data quality objectives (DQO) using a seven-step process. The DQO developed for the project are set out in **Table 6-1**.

**Table 6-1 Data Quality Objectives**

Step	Commentary
1. State the Problem	<p>The first step involves summarising the contamination problem that requires new environmental data and identifying resources available to solve the problem.</p> <p>The objectives of this project are to:</p> <ul style="list-style-type: none"> <li>▪ Evaluate the possibility for groundwater contamination to be present at the site as a result of current and former land use activities.</li> <li>▪ Identify risks to both human-health and environment receptors posed by contaminants identified from intrusive investigation at the site.</li> <li>▪ Provide advice on the suitability (in the context of land contamination) of the groundwater for the proposed land use setting at the site.</li> <li>▪ Provide recommendations for further investigation, management and/or remediation (if warranted).</li> </ul> <p>The project is being undertaken because:</p> <ul style="list-style-type: none"> <li>▪ A targeted groundwater assessment of the site is required to address groundwater contamination presented within the Alliance's DSI in 2020.</li> </ul> <p>The project team identified for this project consists of suitably experienced environmental consultants from Alliance.</p> <p>The regulatory authorities identified for this project include NSW EPA and Council.</p>
2. Identify the Decision / Goals of the Study	<p>The second step involves identifying decisions that need to be made about the contamination problem and the new environmental data required to make them.</p> <p>The decisions that need to be made during this project include:</p> <ul style="list-style-type: none"> <li>▪ Is the environmental data collected for the project, suitable for assessing relevant land contamination exposure risks?</li> <li>▪ Do the concentrations of identified COPC present an unacceptable exposure risk to identified receptors, for the proposed land use setting?</li> <li>▪ Is the site suitable for the proposed land use setting, in the context of land contamination?</li> </ul>

Step	Commentary
3. Identify the Information Inputs	<p>The third step involves identifying the information needed to support decisions and whether new environmental data will be needed.</p> <p>The inputs required to make the decisions set out in will include:</p> <ul style="list-style-type: none"> <li>Proposed land use and layout of the development;</li> <li>Information gathered during previous investigations (Alliance 2020a, Alliance 2020b, Alliance 2020c, Alliance 2020d &amp; SWE 2021);</li> <li>The CSM developed for the site;</li> <li>Sampling of groundwater;</li> <li>The measured physical and/or chemical parameters of the site media samples (including field screening and laboratory analysis, where relevant); and</li> <li>Assessment criteria adopted for the media sampled.</li> </ul>
4. Define the Study Boundaries	<p>The fourth step involves specifying the spatial and temporal aspects of the environmental media that the data must represent to support decisions.</p> <p>The spatial extent of the project will be limited to the subject investigation area as defined by its boundaries (refer <b>Figure 2</b>).</p> <p>The temporal boundaries of the project include:</p> <ul style="list-style-type: none"> <li>The project timeframe presented in the Alliance proposal for this project;</li> <li>Unacceptable weather conditions at the time of undertaking fieldwork, including rainfall, cold and/or heat; and</li> <li>Access availability to the site (to be defined by the site owner/representative).</li> </ul> <p>Constraints which may affect the carrying out of this project may include access limitations, presence of above and below ground infrastructure, and hazards creating health and safety risks.</p>
5. Develop the Analytical Approach (or Decision Rules)	<p>The fifth step involves defining the parameter of interest, specifying the action level, and integrating information from Steps 1 to 4 into a single statement that gives a logical basis for choosing between alternative actions.</p> <p>Quality Assurance / Quality Control (QA/QC)</p> <p>The analytical laboratory QA/QC program will typically include laboratory method blank samples, matrix spike samples, surrogate spike samples, laboratory control samples, and laboratory duplicate samples.</p> <p>If / Then Decision Rules</p> <p>Alliance has adopted the following 'if / then' decision rules for this project:</p> <ul style="list-style-type: none"> <li>If the result of the assessment of field and laboratory analytical data is considered acceptable, then that field data and laboratory analytical data will be considered suitable for interpretation (within the scope of this project); and</li> <li>If field and laboratory analytical data is within the constraints of the assessment criteria adopted for this project (refer <b>Section 6.3</b>), then the contamination exposure risks to identified receptors, are considered acceptable.</li> </ul> <p>In the event field and/or laboratory analytical data is considered not to be suitable for interpretation purposes, then a decision regarding collection additional data will be required. In the event that field data and/or laboratory analytical data exceed adopted assessment criteria, an assessment of the exceedance in the context of the project objectives will be completed to establish if additional data, management, and/or remediation is required.</p>

Step	Commentary
6. Specify the Performance or Acceptance Criteria	<p>The sixth step involves specifying the decision maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainties in the data. When assessing contaminated land, there are generally two types of errors in decision making:</p> <ul style="list-style-type: none"> <li>Contamination exposure risks for a specific land use setting are acceptable, when they are not; and</li> <li>Contamination exposure risks for a specific land use setting are not acceptable, when they are.</li> </ul> <p>The risk of decision error(s) will be mitigated by:</p> <ul style="list-style-type: none"> <li>Assignment of fieldwork tasks to suitably experienced Alliance consulting staff, and suitably experienced contractors;</li> <li>Assignment of laboratory analytical tasks to reputable NATA accredited analytical laboratories; and</li> <li>Assignment of data interpretation tasks to suitably experienced Alliance consulting staff, and outsourcing to technical experts where required.</li> </ul> <p>Alliance will also adopt a range of data quality indicators (DQI) to facilitate assessment of the completeness, comparability, representativeness, precision, and accuracy (bias), as presented in <b>Table 6-2</b>.</p>
7. Develop the Plan for Obtaining Data	<p>The seventh step involves identifying the most resource effective sampling and analysis design for generating the data that is required to satisfy the DQOs. The SAQP for this investigation encompasses <b>Section 6</b>.</p>

## 6.2. Data Quality Indicators

Data Quality Indicators (DQI) adopted for the project are summarised below in **Table 6-2**.

**Table 6-2 Data Quality Indicators**

Completeness			
Field Considerations	Assessment Criterion	Laboratory Considerations	Assessment Criterion
Critical locations sampled	Refer to <b>Section 6.4</b>	Critical samples analysed according to DQO	Refer to <b>Section 6.5</b>
Critical samples collected	Refer to <b>Section 6.4</b>	Analytes analysed according to DQO	Refer to <b>Section 6.5</b>
SOPs appropriate and complied with	100%	Appropriate laboratory analytical methods and LORs	Refer to <b>Section 6.5</b>
Field documentation complete	All sampling point logs, calibration logs and chain of custody forms	Sample documentation complete	All sample receipt advices, all certificates of analysis
-	-	Sample extraction and holding times complied with	Refer to <b>Section 6.5</b>

<b>Comparability</b>			
<b>Field Considerations</b>	<b>Assessment Criterion</b>	<b>Laboratory Considerations</b>	<b>Assessment Criterion</b>
Same SOPs used on each occasion	100%	Same analytical methods used by primary laboratory	Refer to <b>Section 6.5</b>
Climatic conditions	Samples stored in insulated containers with ice, immediately after collection	Same LORs at primary laboratory	Refer to <b>Section 6.5</b>
Same types of samples collected, and handled/preserved in same manner	All soil samples same size, all stored in insulated containers with ice	Same laboratory for primary sample analysis	All primary samples to Eurofins   mgt
-	-	Same analytical measurement units	Refer to <b>Section 6.5</b>
<b>Representativeness</b>			
<b>Field Considerations</b>	<b>Assessment Criterion</b>	<b>Laboratory Considerations</b>	<b>Assessment Criterion</b>
Appropriate media sampled according to DQO	Refer to <b>Section 6.1</b>	Samples analysed according to DQO	Refer to <b>Section 6.5</b>
Media identified in DQO sampled	Refer to <b>Section 6.1</b>		
<b>Precision</b>			
<b>Field Considerations</b>	<b>Assessment Criterion</b>	<b>Laboratory Considerations</b>	<b>Assessment Criterion</b>
Field duplicate / triplicate RPD	Minimum 5% duplicates and triplicates No limit for analytical results <10 times LOR 50% for analytical results 10-20 times LOR 30% for analytical results >10 times LOR	Laboratory duplicates	No exceedances of laboratory acceptance criteria
SOPs appropriate and complied with	100%		

<b>Accuracy (bias)</b>			
<b>Field Considerations</b>	<b>Assessment Criterion</b>	<b>Laboratory Considerations</b>	<b>Assessment Criterion</b>
Field trip spikes	Recoveries between 60% and 140%	Matrix spike recovery	No exceedances of laboratory acceptance criteria
Field trip blanks	Analyte concentration <LOR	Surrogate spike recovery	No exceedances of laboratory acceptance criteria

### 6.3. Investigation Criteria

Taking into consideration the objectives of this project, and the CSM and land use setting presented in **Section 5** of this project, the following soil and groundwater investigation criteria relevant to the proposed land use setting have been adopted for this project:

**Table 6-3 Tier 1 Investigation Criteria**

<b>Soil</b>	
Human Health Criteria	Human health (asbestos) – absence / presence for preliminary screening, and no visible ACM on surface.
Aesthetics	Aesthetics – no highly malodorous site media (e.g. strong residual petroleum hydrocarbon odours, hydrogen sulfide (H <sub>2</sub> S) in site media, organosulfur compounds), no hydrocarbon sheen on surface water, no discoloured chemical deposits or soil staining with chemical waste other than of a very minor nature, no large monolithic deposits of otherwise low risk material (e.g. gypsum as powder or plasterboard, cement kiln dust), no presence of putrescible refuse including material that may generate hazardous levels of methane such as a deep-fill profile of green waste or large quantities of timber waste, and no soils containing residue from animal burial (e.g. former abattoir sites).
<b>Groundwater</b>	
Human Health Criteria	Australian Drinking Water Guidelines (NHMRC, 2011) have been utilised for assessing potential risk associated with a direct groundwater contact scenario (dermal contact and ingestion).
Ecological Criteria	ANZG (2018) criteria for marine water ecosystems were adopted for assessment of potential impacts to ecological receptors within the nearest potential surface water receptors, Brisbane Waters. Trigger Values (TVs) for the 95% level of protection of were selected, however, 99% TV were applied for the bio-accumulative metals cadmium and mercury.

### 6.4. Groundwater Investigation

The methodology employed during the groundwater investigation is outlined below in **Table 6-4**. Sampling locations utilised for the investigation are present in **Figure 3**.

**Table 6-4 Groundwater Investigation Methodology**

Sampling Rationale	<p>The sampling rationale developed for the groundwater investigation was based upon the findings of the previous contamination assessments, site walkover, CSM and DQOs developed. Based upon this approach the following scope of works was adopted to target potential contamination onsite and offsite sources:</p> <ul style="list-style-type: none"> <li>▪ A program of additional groundwater sampling from three (3) monitoring well locations installed during Alliance (2020b) for characterisation of groundwater.</li> </ul> <p>All wells located onsite are shown in <b>Figure 3</b>.</p>
Fieldworks	<p>Groundwater monitoring well water-level gauging, purging, field testing, and sampling was performed on 12 March 2021.</p>
Monitoring Well Construction	<p>Three (3) groundwater monitoring wells were constructed during the Alliance (2020b), and a summary of the well construction are as follows:</p> <ul style="list-style-type: none"> <li>▪ GMW01 – 3.44m depth and hydraulically down-gradient.</li> <li>▪ GMW03 – 3.52m depth and hydraulically down-gradient;</li> <li>▪ GMW04 – 3.05m depth and hydraulically up-gradient.</li> </ul> <p>Groundwater monitoring wells were drilled by Stratacore Drilling using a geoprobe drilling rig. Screening intervals of 2.5 m used for screening the unconfined sand aquifer, with the upper 1 m of screen positioned above the water table to identify possible LNAPL presence.</p> <p>Monitoring well construction was conducted in general accordance with the standards described in NUDLC (2012):</p> <ul style="list-style-type: none"> <li>▪ 50 mm, Class 18 uPVC, threaded, machine-slotted screen and casing, with slotted intervals set to screen at least 500 mm above standing water-level to allow for the identification and sampling of Light Non-aqueous Phase Liquid where present.</li> <li>▪ Base and top of each well was sealed with a uPVC cap and torque plug, respectively.</li> <li>▪ Annular, graded sand filter installed to approximately 300 mm above the top of the machine slotted screen.</li> <li>▪ Granular bentonite (minimum 500 mm) was applied above the annular filter to seal the screen interval.</li> <li>▪ Drill cuttings were used to backfill the bore annulus to just below ground level.</li> <li>▪ Surface completion comprised of a standpipe, set in concrete protruding above the ground surface.</li> </ul> <p>Well construction details are presented in borehole logs provided in <b>Appendix D</b>.</p>
Monitoring Well Development	<p>Each monitoring well was developed on the morning of 12 March 2021. Development involved agitation and removal of stagnant water and accumulated sediment using Waterra foot valve. Pumping continued until no further groundwater was observed within the wells.</p>
Well Survey	<p>The surface elevation of each well and standpipe was extrapolated from spot height elevations surveyed by a licensed surveyor. Well elevations were recorded in metres relative to Australian Height Datum (mAHD).</p>



Well Gauging and Groundwater Flow Direction	Monitoring wells were gauged for standing water level (SWL – depth to groundwater) and LNAPL using an interface probe prior to the commencement of purging and the groundwater monitoring event on the afternoon of 12 March 2021. SWL for each monitoring well is presented in within the logs.
Purging, Field Testing and Groundwater Sampling	<p>A low flow sampling method, utilising a peristaltic pump, fitted with low-density polyethylene (LDPE) and silicon tubing, was utilised for purging purposes and collection of groundwater samples.</p> <p>Field measurements for Dissolved Oxygen (DO), Electrical Conductivity (EC) and pH of the sampled water were conducted using an attached water quality meter (WQM Professional Plus). Samples were taken when the readings of all parameters were stabilised within the acceptance range, and the readings at time of sampling, along with the total purged volume were recorded onto field data sheets.</p> <p>Volatile organic odours were not detected during any stage of well purging.</p>
Decontamination	<p>Dedicated nitrile gloves were used at each monitoring well location.</p> <p>Decontamination was not required as factory supplied dedicated silicon tubing was used for collection of the groundwater sample.</p> <p>All sampling containers were supplied by the laboratory and only opened immediately prior to sample collection.</p> <p>Water-level probe was decontaminated between monitoring well locations by washing in a solution of Decon 90™ and potable water, followed by rinsing with potable water. Water quality meter probes were rinsed with potable water between locations.</p>
Water Sample Identification, Storage, and Handling	<p>Sample identification was based on sampling point number, and date the sample was collected.</p> <p>Samples were stored in a refrigerated (ice-brick) cooler box and transported to the relevant analytical laboratory, with chain of custody (COC) documentation that includes the following information:</p> <ul style="list-style-type: none"> <li>▪ Alliance project identification number;</li> <li>▪ Each sample identifier;</li> <li>▪ Date each sample was collected;</li> <li>▪ Sample type (e.g. soil or water);</li> <li>▪ Container type/s for each sample collected;</li> <li>▪ Preservation method used for each sample (e.g. ice);</li> <li>▪ Analytical requirements for each sample and turnaround times; and</li> <li>▪ Date and time of dispatch and receipt of samples (including signatures).</li> </ul>
Quality Assurance / Quality Control	All groundwater samples were submitted for analysis of previously-identified COPC by Eurofins   Mgt. QA/QC testing comprised intra-laboratory duplicates ('field duplicates') tested blind by Eurofins   Mgt and an inter-laboratory field duplicate tested blind by Australian Laboratory Services. All samples were transported under strict COC conditions and COC certificates and laboratory sample receipt documentation were provided to Alliance for confirmation purposes.
Laboratory Analysis	An SRA was provided by each laboratory to document sample condition upon receipt. The laboratory holding times, analytical methods and limits of reporting (LOR) being used for this project, are presented in <b>Appendix E</b> .

## 6.5. Laboratory Analysis and Sample Analytical Suite

All groundwater samples were forwarded to NATA accredited laboratories for analysis of the analytes listed below. Eurofins | Mgt was used for the analysis of primary samples and Australian Laboratory Services (ALS) for the analysis of inter-laboratory samples.

The samples collected were transported to the analytical laboratory, using chain of custody (COC) protocols. A selection of these samples was scheduled for analysis, with reference to the relevant COPC identified for the areas of the site that the samples were collected from. **Table 6-5** details the analysis undertaken upon groundwater samples.

**Table 6-5 Groundwater Analytical Schedule**

Sample ID	Analytical Suite
	8 Metals*
GMW01, GMW03, GMW04	X
DUP01, DUP01A	X

**Notes:**

\*Metals: As, Cd, Cr, Cu, Hg, Ni, Pb, Zn

Analytical laboratory certificates are presented in **Appendix D** and sample analytical results are tabulated and presented in the attached **Table LAR1, LAR2**.

The laboratory holding times, analytical methods and limits of reporting (LOR) being used for this project, are presented in **Table 6-6**.

**Table 6-6 Laboratory Holding Times, Analytical Methods and Limits of Reporting**

Analyte	Holding Time	Analytical Method	Limit of Reporting
Metals (ex. Hg & CrVI)	6 months	USEPA 8015B & C	0.05 – 2 (mg/kg) 0.1-5 (µg/L)

## 7. Data Quality Assessment

An assessment of the completeness of data collected was undertaken, and the results presented in **Appendix F**.

It is concluded that the data collected is adequately accurate and within the objectives and constraints of the project.

## 8. Results and Site Characterisation

### 8.1. Soil

#### 8.1.1. Soil Characterisation

The findings of the intrusive soil investigation carried out by Alliance (2020b) identified localised non-friable asbestos containing material contamination within the soils surrounding sampling point TP18, and friable asbestos containing material contamination within the soils surrounding sampling point TP19. These two areas are outside of the redevelopment area, being located in the southern portion of the site, as presented in **Figure 3**.

The SWE 2021 HazMat Survey placed these two areas on the Asbestos Register for the site. As the current redevelopment of the site only affects the northern portion of the site, and that the asbestos risk has been placed on the register and included on the Management Plan, Alliance considers that the asbestos risk for the site has been managed appropriately, and any future redevelopments of the site are to do so with consideration of this register.

### 8.2. Groundwater

#### 8.2.1. Groundwater Monitoring Well Installation

Details of groundwater monitoring well construction are summarised from Alliance (2020b) below in **Table 8-1**. Monitoring well construction details are also presented diagrammatically on concomitant borehole logs in **Appendix D**.

**Table 8-1 – Monitoring Well Construction Details**

Monitoring Well	Surface Level (mAHD) <sup>1</sup>	Top of Casing (mBGL)	Depth of Well (mBGL)	Screening Interval (mBGL)	Lithology Screened
GWM01	1.20	1.13	3.5	2.5	Fill, Clayey Sand
GWM03	2.01	1.94	3.5	2.5	Fill, Sand, Clayey Sand
GWM04	2.02	1.95	3.2	2.5	Fill, Clayey Sand

**Notes:**

<sup>1</sup> surface elevation was estimated from a site survey provided by the client.

#### 8.2.2. Groundwater Parameters

Data collected during the completion of the GME, including standing water levels, volume purged, final water quality parameters, and other observations, is summarised below in **Table 8-2**.

**Table 8-2 Summary of Groundwater Parameters**

MW	SWL (mBGL)	Vol. Purged (L)	DO	pH	EC	mV	Temp.	Comments
GMW01	2.56	3.0	1.81	5.04	778	-74.4	22.1	Clear
GMW03	2.70	2.7	0.43	6.81	6,404	-130.5	22.7	Clear
GMW04	2.24	1.9	0.24	5.1	1,102	131.2	23.1	Clear

**Notes:**

MW – Monitoring well  
mBGL – Metres below ground level  
mAHD – Metres Australian Height Datum  
L - Litres  
SWL – Standing water level (as mBGL and mAHD)  
DO – Dissolved Oxygen  
EC – Electrical Conductivity  
mV – Millivolts

Groundwater parameters obtained during sampling indicate that across the site, groundwater pH was circumneutral to moderately acidic, fresh to brackish (salinity), with redox potential ranging from reducing to oxidising.

### 8.2.3. Calculated Groundwater Flow Direction

Given the south elevations of the land and standing water levels, groundwater is inferred to flow toward the south west or west. This is presented in **Figure 4**.

### 8.2.4. Groundwater Analytical Laboratory Results

Groundwater analytical results, with respect to assessment criteria, are discussed below. Analytical results with associated criteria are presented in **Table LAR1** at the end of this report.

Concentrations of arsenic, cadmium, chromium, copper, nickel, lead, zinc, and mercury were below laboratory detection limit and adopted ANZG (2018) criteria in samples analysed, except for the following:

- Copper (130 µg/L), lead (5 µg/L), and zinc (120 µg/L) in sample GMW03.
- Copper (12 µg/L) and zinc (24 µg/L) in sample GMW04.

Summary groundwater results tables, with respect to assessment criteria, are included in **Tables LAR1**.

### 8.2.5. Groundwater Characterisation

Background groundwater quality entering the site from the east, and reported in GMW04, indicates generally low metal concentrations in groundwater, with copper and zinc exceeding ANZG (2018) marine water criteria. Similarly, this characteristic has been expressed in onsite / hydraulically down-gradient monitoring wells (GWM01 and GWM03) where concentrations of copper and/or zinc (and instances of nickel and lead), over both monitoring events, have been recorded at concentrations exceeding ANZG (2018) criteria. Further, the findings of this investigation indicate the zinc concentration reported by Alliance (2020b) in GMW01 (3,200 µg/L) to be anomalous, with zinc concentrations reported in this investigation at <LOR. It is understood that dewatering activities for basement construction were being undertaken immediately to the north of the site at the time of sampling by Alliance (2020b), and it is possible that elevated zinc reported in GWM01 at this time may have related to this activity.

Previous findings reported in the DSI (Alliance, 2020b) did not identify evidence of historical intensive land use consistent with metal working or use of metals in processing activities, and elevated heavy metal concentrations were also not reported in analysed soil samples. We note that elevated concentrations of metals, particularly copper and zinc, are ubiquitous in groundwater within long-standing urban environments, and considering elevated groundwater concentrations were reported in the site's hydraulically up-gradient monitoring well (GMW04), metals concentrations in groundwater are likely representative of local groundwater quality entering the site.

### 8.3. Conceptual Site Model Review

The CSM for the site was developed on the basis of site history, historic land use, and walkover observations (**Section 4**), and was considered to satisfactorily identify potential contamination sources, migration mechanisms, and exposure pathways for the purposes of investigating the site and data gap closure. Based on the results of site observations, sampling, and analytical data, contamination at concentrations posing a risk to sensitive receptors and future users of the site was not identified in areas of environmental interest or in association with potential contamination sources.

Based on the results of sampling and site observations, soils and groundwater remaining at the site are suitable for residential (with access to soil) land use.

## 9. Conclusions and Recommendations

Based on the findings of desktop review information, fieldwork observations and laboratory analytical data, in the context of the proposed redevelopment scenario, Alliance makes the following conclusions:

- Three groundwater monitoring wells, installed by Alliance in (2020b), were sampled.
- Groundwater was reported at depths ranging between 2.24 to 2.7 mBGL.
- Identified COPC in the sampled groundwater, including heavy metals, are considered unlikely to present an unacceptable human health risk.
- The concentrations of heavy metals reported in groundwater monitoring wells, and exceeding the ANZG (2018) ecological criteria, are considered representative of local groundwater quality entering the site, and not related to site activities.
- The asbestos risk for the site has been noted in the asbestos register and management plan, and is outside of the area of investigation and redevelopment, and so Alliance considers that the risk of asbestos is managed, and does not impact the proposed redevelopment of the site.
- Alliance considers that, as the asbestos and groundwater risks have been managed, a remedial action plan is no longer necessary for the site, in the context of the previously identified contaminants.

Based on the findings of this assessment, the land in its current state is considered suitable for future development of the site for continued medium-density residential land use.

This report, including its conclusions and recommendations, must be read in conjunction with the statement of limitations presented in **Section 10**.

## 10. Statement of Limitations

The findings presented in this report are based on specific searches of relevant, government historical databases and anecdotal information that were made available during the course of this investigation. To the best of our knowledge, these observations represent a reasonable interpretation of the general condition of the site at the time of report completion.

This report has been prepared solely for the use of the client to whom it is addressed, and no other party is entitled to rely on its findings.

No warranties are made as to the information provided in this report. All conclusions and recommendations made in this report are of the professional opinions of personnel involved with the project and while normal checking of the accuracy of data has been conducted, any circumstances outside the scope of this report or which are not made known to personnel and which may impact on those opinions is not the responsibility of Alliance Geotechnical Pty Ltd. Should information become available regarding conditions at the site including previously unknown sources of contamination, Alliance reserves the right to review the report in the context of the additional information.

This report must be reviewed in its entirety and in conjunction with the objectives, scope, and terms applicable to Alliance's engagement. The report must not be used for any purpose other than the purpose specified at the time Alliance was engaged to prepare the report.

Logs, figures, and drawings are generated for this report based on individual Alliance consultant interpretations of nominated data, as well as observations made at the time site walkover/s were completed.

Data and/or information presented in this report must not be redrawn for its inclusion in other reports, plans or documents, nor should that data and/or information be separated from this report in any way.

Should additional information that may impact on the findings of this report be encountered or site conditions change, Alliance reserves the right to review and amend this report.



## 11. References

- Alliance 2020a, 'Sampling, Analytical and Quality Plan (SAQP), Lot 51 in DP732632, 51 Masons Parade, Point Frederick NSW', dated May 2020, ref: 10827-ER-1-1;
- Alliance 2020b, 'Detailed Site Investigation, Lot 51 in DP732632, 51 Masons Parade, Point Frederick NSW', dated June 2020, ref: 10827-ER-1-2;
- Alliance 2020c, 'Acid Sulfate Soils Assessment, Lot 51 in DP732632, 51 Masons Parade, Point Frederick NSW', dated July 2020, ref: 10827-ER-2-1;
- Alliance 2020d, 'Indicative Waste Classification Report, Lot 51 in DP732632, 51 Masons Parade, Point Frederick NSW', dated July 2020, ref: 10827-ER-1-2;
- ANZG 2018, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, Australia.
- CRC CARE 2017, *Risk-based management and remediation guidance for benzo(a)pyrene*, CRC CARE Technical Report No. 39, CRC for Contamination Assessment and Remediation of the Environment, Newcastle, Australia.
- EnRisks 2016, *Proposed Decision Tree for Prioritising Sites Potentially Contaminated with PFASs*, dated 25 February 2016.
- Environmental Investigation Services (EIS) 2009, 'Stage 1 Environmental Site Assessment for Proposed Part 3A Concept Plan Development at the Corner of King Street and Carillon Avenue, Newtown, NSW', dated June, Ref: E21871K-RPT.
- Friebel, E and Nadebaum, P 2011, *Health screening levels for petroleum hydrocarbons in soil and groundwater. Part 1: Technical development document*, CRC CARE Technical Report No. 10, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.
- National Environment Protection Council (NEPC) 2013a, *Schedule B(1) Guideline on Investigation Levels for Soil and Groundwater*, National Environment Protection (Assessment of Site Contamination) Measure (NEPM) as amended in May 2013.
- National Environment Protection Council (NEPC) 2013b, *Schedule B(2) Guideline on Site Characterisation*, National Environment Protection (Assessment of Site Contamination) Measure (NEPM) as amended in May 2013.
- NSW EPA 1995, *Contaminated Sites: Sampling Design Guidelines*.
- NSW EPA 2017, *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme*.
- NSW EPA 2020, *Consultants Reporting on Contaminated Sites: Contaminated Land Guidelines*.
- SWE 2021, 'Hazardous Materials Survey & Management Plan, Lot 51 in DP732632, 51 Masons Parade, Point Frederick NSW', dated March 2021

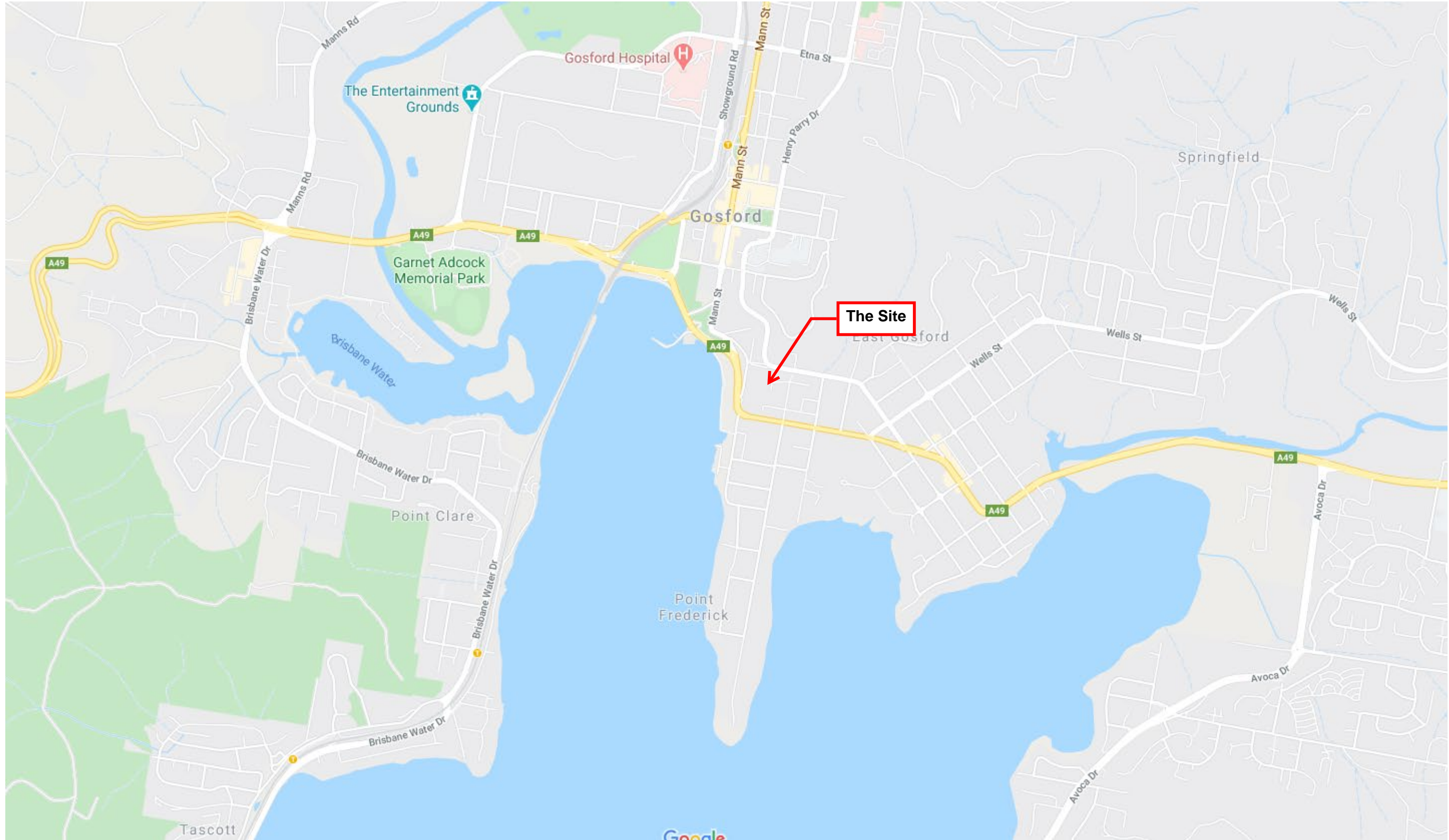
## 12. Abbreviations

ABC	Ambient Background Concentration
ACL	Added Contaminant Limit
ACM	Asbestos Containing Material
AEC	Areas of Environmental Concern
AF	Asbestos Fines
AS	Australian Standard
ASS	Acid Sulfate Soils
B(α)P	Benzo(α)pyrene
BTEXN	Benzene, Toluene, Ethylbenzene, Xylene, Naphthalene
CEC	Cation Exchange Capacity
COC	Chain of Custody
COPC	Contaminants of Potential Concern
CSM	Conceptual Site Model
CRC CARE	Cooperative Research Centre for Contamination Assessment and Remediation of the Environment
DA	Development Application
DCP	Development Control Plan
DNAPL	Dense Non-aqueous Phase Liquid
DO	Dissolved Oxygen
DP	Deposited Plan
DQI	Data Quality Indicators
DQO	Data Quality Objectives
DSI	Detailed Site Investigation
EIL	Ecological Investigation Level
ESL	Ecological Screening Level
F1	TRH C <sub>6</sub> -C <sub>10</sub>
F2	TRH >C <sub>10</sub> -C <sub>16</sub>
F3	TRH >C <sub>16</sub> -C <sub>34</sub>
F4	TRH >C <sub>34</sub> -C <sub>40</sub>
FA	Friable Asbestos
HIL	Health Investigation Levels
HSL	Health Screening Levels
LEP	Local Environmental Plan



---

LOR	Limit of Reporting
mAHD	Metres Australian Height Datum
mBGL	Metres Below Ground Level
µg/L	Micrograms per litre
mg/kg	Milligrams per kilogram
mg/L	Milligrams per litre
NATA	National Association of Testing Authorities
NEMP	National Environmental Management Plan
NEPC	National Environmental Protection Council
NEPM	National Environmental Protection Measure
NL	Not Limiting
NSW DEC	New South Wales Department of Environment and Conservation
NSW OEH	New South Wales Office of Environment and Heritage
NSW EPA	New South Wales Environmental Protection Authority
OCP	Organochlorine Pesticides
OPP	Organophosphorus Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PFAS	Polyfluorinated Alkyl Sulfonate
ppm	Parts per million
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance / Quality Control
RAP	Remedial Action Plan
SAQP	Sampling, Analysis, and Quality Plan
SEPP	State Environmental Protection Plan
SRA	Sample Receipt Advice
TEQ	Toxicity Equivalent Quotient
TPH	Total Petroleum Hydrocarbon
TRH	Total Recoverable Hydrocarbons
UCL	Upper Confidence Limit
VOC	Volatile Organic Compounds
WA DOH	Western Australian Department of Health

## FIGURES



Site Locality

	Client Name:	Grindley Constructions	Figure Number:	1	
	Project Name:	Targeted Groundwater Assessment	Figure Date:	23 March 2021	
	Project Location:	51 Masons Parade, Point Frederick NSW	Report Number:	10827-ER-1-3	





Site Layout

	Client Name:	Grindley Constructions	Figure Number:	2	
	Project Name:	Targeted Groundwater Assessment	Figure Date:	23 March 2021	
	Project Location:	51 Masons Parade, Point Frederick NSW	Report Number:	10827-ER-1-3	





**Legend**

- Site boundary
- Area of investigation
- Groundwater well locations
- Asbestos impacted soil sampling points (Alliance 2020b), outside the area of investigation



Groundwater Well Sampling Locations

	Client Name:	Grindley Constructions	Figure Number:	3	
	Project Name:	Targeted Groundwater Assessment	Figure Date:	23 March 2021	
	Project Location:	51 Masons Parade, Point Frederick NSW	Report Number:	10827-ER-1-3	





Inferred Groundwater Directional Flow

	Client Name:	Grindley Constructions	Figure Number:	4	
	Project Name:	Targeted Groundwater Assessment	Figure Date:	23 March 2021	
	Project Location:	51 Masons Parade, Point Frederick NSW	Report Number:	10827-ER-1-3	



## TABLES

Table LAR 1  
51 Masons Parade, Point Frederick NSW  
Groundwater Results Summary  
10827-ER-1-3

Table LAR 1 51 Masons Parade, Point Frederick NSW Groundwater Results Summary 10827-ER-1-3			Initial Groundwater Sampling Event (11 June 2020)					Supplementary Groundwater Sampling Event (14 March 2021)					
			Sample ID	GWM1	GWM3	GWM4	DUP01	DUP01A	GMW01	GMW03	GMW04	DUP01	DUP01A
			Reference	S20-Jn21475	S20-Jn21535	S20-Jn21536	S20-Jn21537	S20-Jn21538	S21-Ma25617	S21-Ma25618	S21-Ma25619	S21-Ma25620	ES2109102001
			Date Sampled	11/6/2020	11/6/2020	11/6/2020	11/6/2020	11/6/2020	14/3/2021	14/3/2021	14/3/2021	14/3/2021	14/3/2021
			Sample Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Analytes	Drinking Water Guideline Values		ANZG (2018)										
	Health - NEPM ASC 2013	Aesthetic - NHMRC 2008	Marine Waters 95%										
	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)		
Arsenic, As (III)	10	-	-	3	13	3	3	3	2	8	7	8	7
Cadmium, Cd	2	-	5.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.8	< 0.2	< 0.1
Chromium, (unspeciated), Cr	50	-	27	< 1	2	< 1	< 1	< 1	< 1	1	1	1	< 1
Copper, Cu	2000	1000	1.3	13	31	20	18	< 1	< 1	130	12	2	< 1
Lead, Pb	10	-	4.4	< 1	3	1	1	< 1	< 1	5	1	< 1	< 1
Mercury (Total), Hg	1	-	0.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1
Nickel, Ni	20	-	70	19	21	27	13	3	2	12	6	2	3
Zinc, Zn	-	3000	15	3200	110	140	790	720	< 5	120	24	32	29

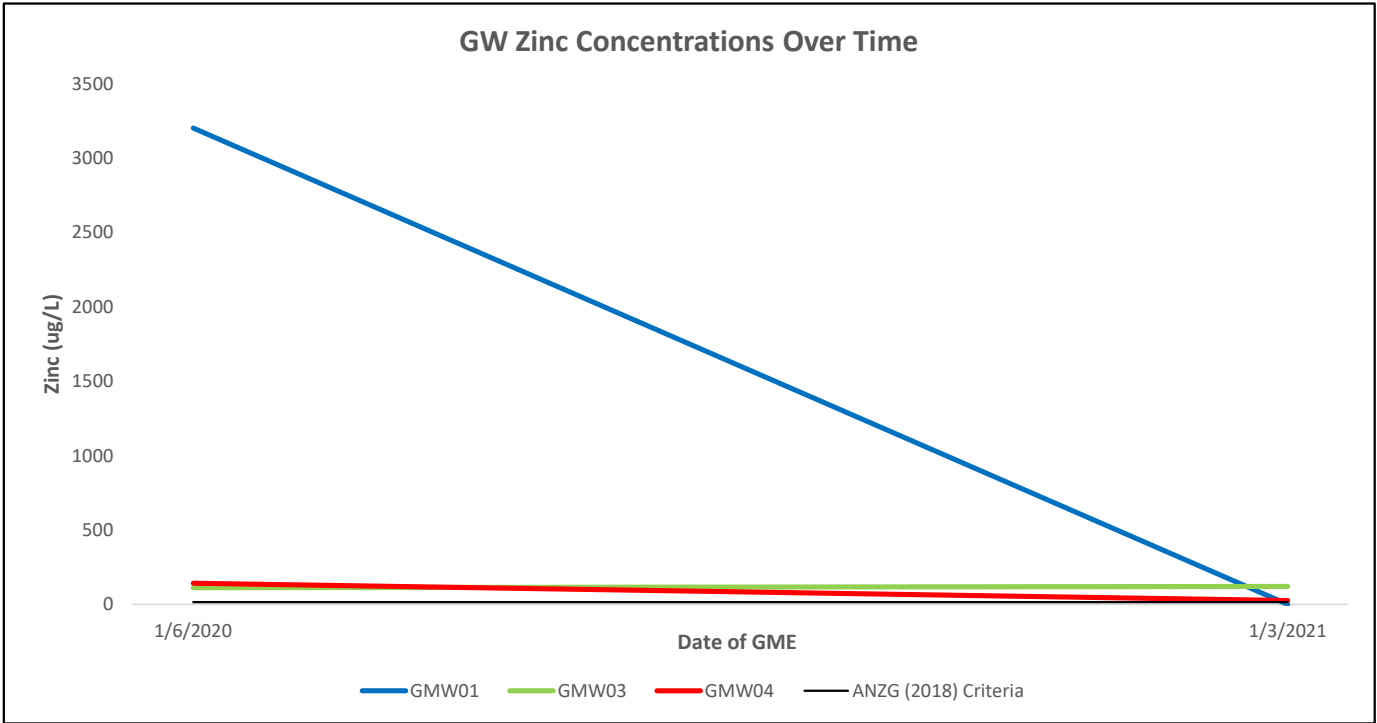
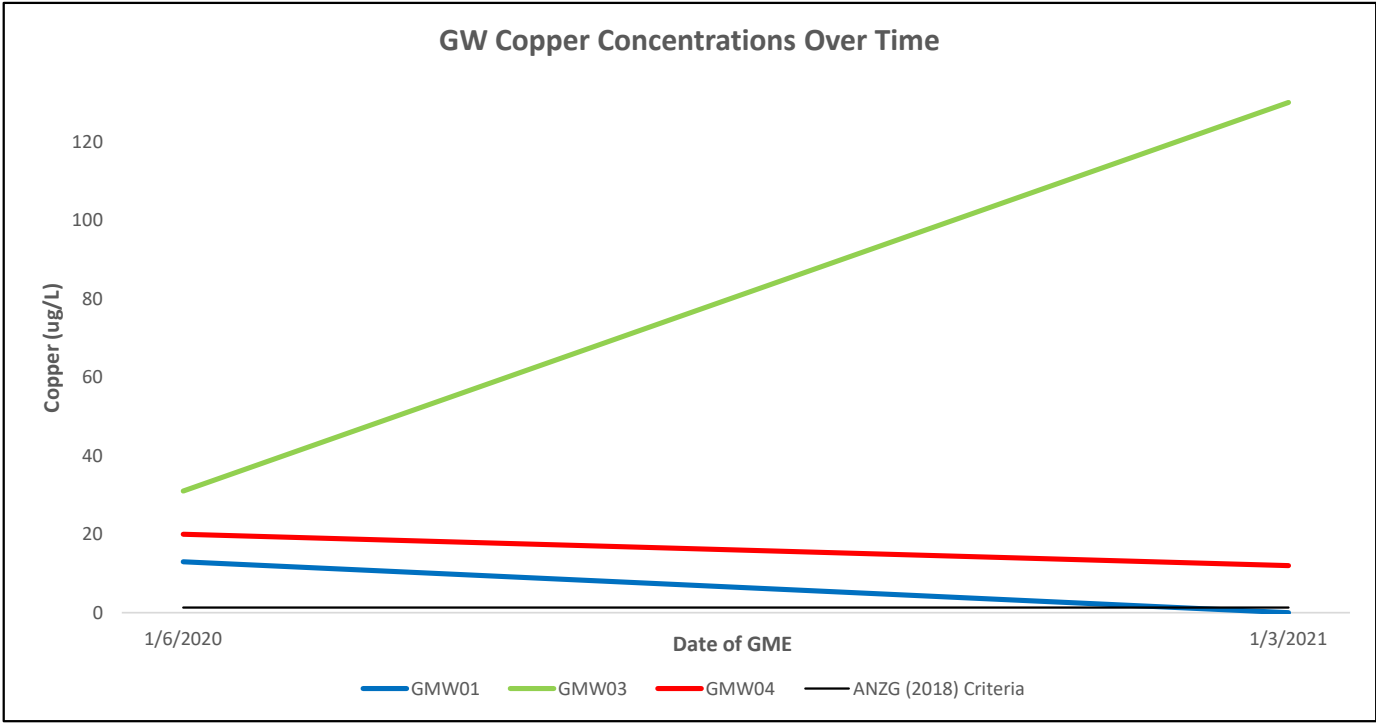


Table LAR2  
51 Masons Parade, Point Frederick NSW  
RPD Table  
10827-ER-1-3

			Sample ID	GMW03	DUP01		GMW03	DUP01A	
			Reference	S21-Ma25618	S21-Ma25620		S21-Ma25618	ES2109102001	
			Date Sampled	14/3/2021	14/3/2021		14/3/2021	14/3/2021	
			Sample Matrix	Water	Water		Water	Water	
Group	Analyte	Units	LOR			RPD (%)			RPD (%)
Metals	Arsenic	ug/L	1	8	8	0	8	7	13
	Cadmium	ug/L	0.2	< 0.2	< 0.2	#VALUE!	< 0.2	< 0.1	#VALUE!
	Chromium	ug/L	1	1	1	0	1	< 1	#VALUE!
	Copper	ug/L	1	130	2	194	130	< 1	#VALUE!
	Lead	ug/L	1	5	< 1	#VALUE!	5	< 1	#VALUE!
	Mercury	ug/L	0.1	< 0.1	< 0.1	#VALUE!	< 0.1	<0.1	#VALUE!
	Nickel	ug/L	1	12	2	143	12	3	120
	Zinc	ug/L	5	120	32	116	120	29	122

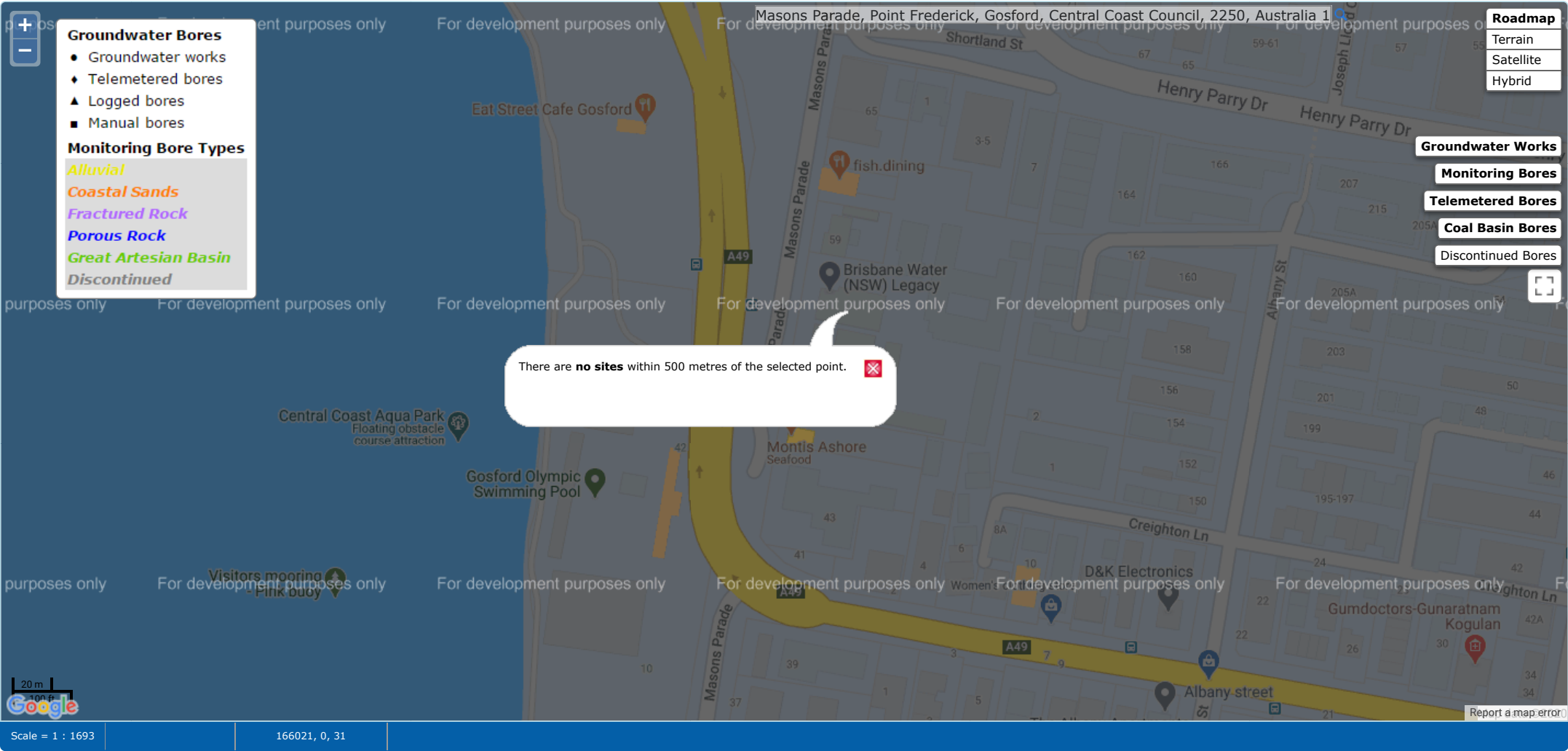
RPD exceeding criteria

RPD not exceeding criteria

## **APPENDIX A**

### **GROUNDWATER SEARCH**

All data times are Eastern Standard Time



## **APPENDIX B**

### **SITE PHOTOGRAPHS**



**Image 1 View of the centre of the site and residential buildings, facing south**



**Image 2 View of open area surrounded by residential flats, within the south western portion of site, within the vicinity of TP18 & TP19**



**Image 3 View of driveway along the northern boundary of site, near GMW04**





**Image 4 View of GMW03, within the central western portion of the site.**



**Image 5 View of monitoring well GMW01 prior to sampling.**



## **APPENDIX C**

### **BOREHOLE LOGS**



## Borehole Log

**Client:** Brisbane Waters NSW Legacy (BWL)

**Started:** 3/06/2020

**Project:** Legacy Redevelopment

**Finished:** 3/06/2020

**Location:** 51 Masons Parade, Point Frederick, NSW

**Hole Location:** Refer Drawing 10827-GR-1-A

**Borehole Size:** 110 mm

**Rig Type:** Geoprobe 6712DT

**Hole Coordinates** E, N

**Driller:** DC

**Logged:** JA

**RL Surface:** 1.20m

**Contractor:** Stratacore Pty Ltd

**Bearing:** ---

**Checked:** SM

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations
ADT			1			--	FILL: Silty Sand, fine to medium grained, dark grey, with medium to high plasticity clay, trace fine rounded gravel.	ES 0.5	M	--	FILL
			0	1		SC	Clayey SAND, fine to medium grained, grey, with shell fragments, low to medium plasticity clay.	ES 1.0	W	VL	QUATERNARY DEPOSITS
				2		SC	Clayey SAND, fine to medium grained, brown and dark grey, low to medium plasticity clay, with shell fragments.	SPT 0, 0, 0 N=0 ES 1.5	W	VL	
			-1					ES 2.0			
				3				ES 2.5			
			-2					SPT 0, 0, 0 N=0 ES 3.0			
				4			Borehole MW01 terminated at 3.5m	ES 3.5			
			-3								
				5							
			-4								
				6							
			-5								
				7							
			-6								
				8							



## Borehole Log

Client: Brisbane Waters NSW Legacy (BWL)						Started: 3/06/2020					
Project: Legacy Redevelopment						Finished: 3/06/2020					
Location: 51 Masons Parade, Point Frederick, NSW				Hole Location: Refer Drawing 10827-GR-1-A				Borehole Size: 110 mm			
Rig Type: Geoprobe 6712DT				Hole Coordinates E, N				Driller: DC		Logged: JA	
RL Surface: 2.00m				Contractor: Stratacore Pty Ltd				Bearing: ---		Checked: SM	
Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations
ADT			1	1		--	FILL: Sandy Gravel, fine to medium, dark grey, fine to medium grained sand.	ES 0.5	D	--	FILL
							SAND, fine to medium grained, pale brown.	ES 1.0	M	L	POSSIBLE FILL
								SPT 3, 3, 3 N=6 ES 1.5			
							Clayey SAND, fine to medium grained, grey, with shell fragments, low to medium plasticity clay.		ES 2.0	W	VL
							Clayey SAND, fine to medium grained, brown and dark grey, low to medium plasticity clay, with shell fragments.	ES 2.5	W	VL	
			-1	3			SPT 2, 1, 1 N=2 ES 3.0				
			-2	4		Borehole MW03 terminated at 3.5m	ES 3.5				
			-3	5							
			-4	6							
			-5	7							
			-6	8							



**BH No: MW04**  
**Sheet: 1 of 1**  
**Job No: 10827**

NON CORED BOREHOLE 10827 GINT.GPJ GINT STD AUSTRALIA.GDT 23/3/21

## **APPENDIX D**

### **LABORATORY CERTIFICATE**

**Alliance Geotechnical**  
**10 Welder Road**  
**Seven Hills**  
**NSW 2147**



**NATA Accredited**  
**Accreditation Number 1261**  
**Site Number 18217**

Accredited for compliance with ISO/IEC 17025 – Testing  
 NATA is a signatory to the ILAC Mutual Recognition  
 Arrangement for the mutual recognition of the  
 equivalence of testing, medical testing, calibration,  
 inspection and proficiency testing scheme providers  
 reports.

**Attention:** **Aidan Rooney**

**Report** **780174-W**  
**Project name** **POINT FREDERICK GW**  
**Project ID** **10827.1**  
**Received Date** **Mar 12, 2021**

Client Sample ID			<b>GMW01</b>	<b>GMW03</b>	<b>GMW04</b>	<b>DUP01</b>
Sample Matrix			<b>Water</b>	<b>Water</b>	<b>Water</b>	<b>Water</b>
Eurofins Sample No.			<b>S21-Ma25617</b>	<b>S21-Ma25618</b>	<b>S21-Ma25619</b>	<b>S21-Ma25620</b>
Date Sampled			<b>Mar 12, 2021</b>	<b>Mar 12, 2021</b>	<b>Mar 12, 2021</b>	<b>Mar 12, 2021</b>
Test/Reference	LOR	Unit				
<b>Heavy Metals</b>						
Arsenic (filtered)	0.001	mg/L	0.002	0.008	0.007	0.008
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	0.0008	< 0.0002
Chromium (filtered)	0.001	mg/L	< 0.001	0.001	0.001	0.001
Copper (filtered)	0.001	mg/L	< 0.001	0.13	0.012	0.002
Lead (filtered)	0.001	mg/L	< 0.001	0.005	0.001	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	0.002	0.012	0.006	0.002
Zinc (filtered)	0.005	mg/L	< 0.005	0.12	0.024	0.032

**Sample History**

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

**Description**

Metals M8 filtered

**Testing Site**

Sydney

**Extracted**

Mar 12, 2021

**Holding Time**

28 Days

- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS

## Australia

**Melbourne**  
6 Monterey Road  
Dandenong South VIC 3175  
Phone : +61 3 8564 5000  
NATA # 1261  
Site # 1254 & 14271

**Sydney**  
Unit F3, Building F  
16 Mars Road  
Lane Cove West NSW 2066  
Phone : +61 2 9900 8400  
NATA # 1261 Site # 18217

**Brisbane**  
1/21 Smallwood Place  
Murarrie QLD 4172  
Phone : +61 7 3902 4600  
NATA # 1261 Site # 20794

**Perth**  
2/91 Leach Highway  
Kewdale WA 6105  
Phone : +61 8 9251 9600  
NATA # 1261  
Site # 23736

**Newcastle**  
4/52 Industrial Drive  
Mayfield East NSW 2304  
PO Box 60 Wickham 2293  
Phone : +61 2 4968 8448

## New Zealand

**Auckland**  
35 O'Rorke Road  
Penrose, Auckland 1061  
Phone : +64 9 526 45 51  
IANZ # 1327

**Christchurch**  
43 Detroit Drive  
Rolleston, Christchurch 7675  
Phone : 0800 856 450  
IANZ # 1290

ABN: 50 005 085 521 web: www.eurofins.com.au email: EnviroSales@eurofins.com

**Company Name:** Alliance Geotechnical  
**Address:** 10 Welder Road  
Seven Hills  
NSW 2147  
  
**Project Name:** POINT FREDERICK GW  
**Project ID:** 10827.1

**Order No.:**  
**Report #:** 780174  
**Phone:** 1800 288 188  
**Fax:** 02 9675 1888

**Received:** Mar 12, 2021 7:00 PM  
**Due:** Mar 19, 2021  
**Priority:** 5 Day  
**Contact Name:** Aidan Rooney

**Eurofins Analytical Services Manager : Andrew Black**

Sample Detail						Metals M8 filtered
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						X
Brisbane Laboratory - NATA Site # 20794						
Perth Laboratory - NATA Site # 23736						
Mayfield Laboratory						
External Laboratory						
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID	
1	GMW01	Mar 12, 2021		Water	S21-Ma25617	X
2	GMW03	Mar 12, 2021		Water	S21-Ma25618	X
3	GMW04	Mar 12, 2021		Water	S21-Ma25619	X
4	DUP01	Mar 12, 2021		Water	S21-Ma25620	X
Test Counts						4



## Internal Quality Control Review and Glossary

### General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

### Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

**\*\*NOTE:** pH duplicates are reported as a range NOT as RPD

### Units

**mg/kg:** milligrams per kilogram

**mg/L:** milligrams per litre

**ug/L:** micrograms per litre

**ppm:** Parts per million

**ppb:** Parts per billion

**%:** Percentage

**org/100mL:** Organisms per 100 millilitres

**NTU:** Nephelometric Turbidity Units

**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

### Terms

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>SPIKE</b>	Addition of the analyte to the sample and reported as percentage recovery.
<b>RPD</b>	Relative Percent Difference between two Duplicate pieces of analysis.
<b>LCS</b>	Laboratory Control Sample - reported as percent recovery.
<b>CRM</b>	Certified Reference Material - reported as percent recovery.
<b>Method Blank</b>	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
<b>Surr - Surrogate</b>	The addition of a like compound to the analyte target and reported as percentage recovery.
<b>Duplicate</b>	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
<b>USEPA</b>	United States Environmental Protection Agency
<b>APHA</b>	American Public Health Association
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>COC</b>	Chain of Custody
<b>SRA</b>	Sample Receipt Advice
<b>QSM</b>	US Department of Defense Quality Systems Manual Version 5.3
<b>CP</b>	Client Parent - QC was performed on samples pertaining to this report
<b>NC</b>	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
<b>TEQ</b>	Toxic Equivalency Quotient

### QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

### QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

## Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Method Blank</b>									
<b>Heavy Metals</b>									
Arsenic (filtered)			mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)			mg/L	< 0.0002			0.0002	Pass	
Chromium (filtered)			mg/L	< 0.001			0.001	Pass	
Copper (filtered)			mg/L	< 0.001			0.001	Pass	
Lead (filtered)			mg/L	< 0.001			0.001	Pass	
Mercury (filtered)			mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)			mg/L	< 0.001			0.001	Pass	
Zinc (filtered)			mg/L	< 0.005			0.005	Pass	
<b>LCS - % Recovery</b>									
<b>Heavy Metals</b>									
Arsenic (filtered)			%	96			80-120	Pass	
Cadmium (filtered)			%	91			80-120	Pass	
Chromium (filtered)			%	104			80-120	Pass	
Copper (filtered)			%	104			80-120	Pass	
Lead (filtered)			%	106			80-120	Pass	
Mercury (filtered)			%	114			80-120	Pass	
Nickel (filtered)			%	104			80-120	Pass	
Zinc (filtered)			%	99			80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Spike - % Recovery</b>									
<b>Heavy Metals</b>				Result 1					
Arsenic (filtered)	S21-Ma26113	NCP	%	103			75-125	Pass	
Cadmium (filtered)	S21-Ma26113	NCP	%	93			75-125	Pass	
Chromium (filtered)	S21-Ma26113	NCP	%	92			75-125	Pass	
Copper (filtered)	S21-Ma26113	NCP	%	84			75-125	Pass	
Lead (filtered)	S21-Ma26113	NCP	%	91			75-125	Pass	
Mercury (filtered)	S21-Ma26113	NCP	%	106			75-125	Pass	
Nickel (filtered)	S21-Ma26113	NCP	%	85			75-125	Pass	
Zinc (filtered)	S21-Ma26113	NCP	%	80			75-125	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Duplicate</b>									
<b>Heavy Metals</b>				Result 1	Result 2	RPD			
Arsenic (filtered)	S21-Ma25617	CP	mg/L	0.002	0.002	13	30%	Pass	
Cadmium (filtered)	S21-Ma25617	CP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium (filtered)	S21-Ma25617	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper (filtered)	S21-Ma25617	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Lead (filtered)	S21-Ma25617	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury (filtered)	S21-Ma25617	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	S21-Ma25617	CP	mg/L	0.002	0.002	9.0	30%	Pass	
Zinc (filtered)	S21-Ma25617	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass	

## Comments

### Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

### Authorised by:

Ryan Gilbert	Analytical Services Manager
John Nguyen	Senior Analyst-Metal (NSW)



**Glenn Jackson**  
**General Manager**

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

\* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.





# CHAIN OF CUSTODY RECORD

ABN 50 005 085 521

Sydney Laboratory  
Unit F3 Bld.F, 16 Mars Rd, Lane Cove West, NSW 2066  
02 9900 8400 EnviroSampleNSW@eurofins.com

Brisbane Laboratory  
Unit 1, 21 Smallwood Pl., Murarie, QLD 4172  
07 3902 4900 EnviroSampleQLD@eurofins.com

Perth Laboratory  
Unit 2, 91 Leach Highway, Kewdale WA 6105  
08 9251 9600 EnviroSampleWA@eurofins.com

Melbourne Laboratory  
2 Kingston Town Close, Oakleigh, VIC 3166  
03 8564 5000 EnviroSampleVic@eurofins.com

Company	ALLIANCE GEOTECHNICAL			Project No	10827.1				Project Manager	A. ROONEY				Sampler(s)	Jacob Walker					
Address	10 WELDER ROAD, SEVEN HILLS NSW			Project Name	Point Frederick GW				EDD Format (ESdat, EQUIS, Custom)					Handed over by						
Contact Name	Jacob Walker			Analyses (Note: Where matrix is requested, please specify "Total" or "Filtered" / SUITE code must be used in matrix SUITE group)	8 Heavy Metals									Email for Invoice	Enviro@allgeo.com.au					
Phone No	0424066612															Email for Results	Enviro@allgeo.com.au			
Special Directions																Containers				
Purchase Order																	Turnaround Time (TAT) Requirements (Default will be 5 days if not ticked)			
Quote ID No															Overnight (9am)*					
No	Client Sample ID	Sampled Date/Time (dd/mm/yy hh:mm)	Matrix (Solid (S) Water (W))												1 Day* 2 Day*					
1	GMW01	12/03/21	w	X											3 Day* 5 Day					
2	GMW03	12/03/21	w	X											Other ( )					
3	GMW04	12/03/21	w	X											Sample Comments / Dangerous Goods Hazard Warning					
4	DUP01	12/03/21	w	X											PLEASE SEND TO ALS					
5	DUP01A	12/03/21	w	X																
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				
Total Counts				5																
Method of Shipment	Courier (#)	Hand Delivered	Postal	Name	Ayodeji Awopetu	Signature		Date	44441	Time										
Eurofins   mgt Laboratory Use Only	Received By	MBIRUETI			Signature		Date		Time	7pm	Temperature	18.5C								
	Received By				Signature		Date		Time		Report No									

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

Eurofins Environment Testing Australia Pty Ltd trading as Eurofins | mgt

12/03/21

780174

## CERTIFICATE OF ANALYSIS

**Work Order** : **ES2109102**  
**Client** : **ALLIANCE GEOTECHNICAL**  
**Contact** : AIDAN ROONEY  
**Address** : 10 Welder Road, Seven Hills, NSW  
**Telephone** : ----  
**Project** : 10827.1 Point Frederick GW  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : ----  
**Quote number** : EN/222  
**No. of samples received** : 1  
**No. of samples analysed** : 1

**Page** : 1 of 2  
**Laboratory** : Environmental Division Sydney  
**Contact** : Customer Services ES  
**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164  
**Telephone** : +61-2-8784 8555  
**Date Samples Received** : 15-Mar-2021 15:00  
**Date Analysis Commenced** : 18-Mar-2021  
**Issue Date** : 19-Mar-2021 18:24



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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

**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
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

## Analytical Results

Sub-Matrix: **WATER**  
 (Matrix: **WATER**)

Sample ID

				DUP01A	----	----	----	----
Sampling date / time				12-Mar-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2109102-001	-----	-----	-----	-----
Result					----	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Arsenic	7440-38-2	0.001	mg/L	<b>0.007</b>	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<b>0.003</b>	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<b>0.029</b>	----	----	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----



## QUALITY CONTROL REPORT

**Work Order** : **ES2109102**

**Page** : 1 of 3

**Client** : **ALLIANCE GEOTECHNICAL**  
**Contact** : AIDAN ROONEY  
**Address** : 10 Welder Road, Seven Hills, NSW  
**Telephone** : ----  
**Project** : 10827.1 Point Frederick GW  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : ----  
**Site** : ----  
**Quote number** : EN/222  
**No. of samples received** : 1  
**No. of samples analysed** : 1

**Laboratory** : Environmental Division Sydney  
**Contact** : Customer Services ES  
**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164  
**Telephone** : +61-2-8784 8555  
**Date Samples Received** : 15-Mar-2021  
**Date Analysis Commenced** : 18-Mar-2021  
**Issue Date** : 19-Mar-2021



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, unless the sampling was conducted by ALS. 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
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3570520)									
ES2108903-001	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	0.006	0.005	27.4	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	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: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
ES2108931-001	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: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	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: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3570521)									
ES2108903-004	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
ES2108930-006	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit





## Method Blank (MB) and Laboratory Control Sample (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 Sample (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: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) LowHigh	
Method: Compound	CAS Number	LOR	Unit	Result				
EG020F: Dissolved Metals by ICP-MS (QCLot: 3570520)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	86.8	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	88.8	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	88.8	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	88.8	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	93.1	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	90.2	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	84.6	81.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 3570521)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	85.7	83.0	105

## 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: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	Spike Recovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3570520)							
ES2108903-003	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	95.1	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	93.8	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	94.7	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	74.5	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	95.7	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	88.4	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	93.0	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3570521)							
ES2108903-002	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	77.1	70.0	130

## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES2109102	Page	: 1 of 4
Client	: ALLIANCE GEOTECHNICAL	Laboratory	: Environmental Division Sydney
Contact	: AIDAN ROONEY	Telephone	: +61-2-8784 8555
Project	: 10827.1 Point Frederick GW	Date Samples Received	: 15-Mar-2021
Site	: ----	Issue Date	: 19-Mar-2021
Sampler	: ----	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.
- **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

- **NO** Quality Control Sample Frequency Outliers exist.



## 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: **WATER**

Evaluation: ✖ = 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
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F) DUP01A	12-Mar-2021	----	----	----	18-Mar-2021	08-Sep-2021	✔
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F) DUP01A	12-Mar-2021	----	----	----	19-Mar-2021	09-Apr-2021	✔



## 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: **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	20	10.00	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
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	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	20	5.00	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	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard



## 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
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 (SnCl <sub>2</sub> )(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 SnCl <sub>2</sub> which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).

## SAMPLE RECEIPT NOTIFICATION (SRN)

**Work Order : ES2109102**

<p>Client : <b>ALLIANCE GEOTECHNICAL</b></p> <p>Contact : AIDAN ROONEY</p> <p>Address : 10 Welder Road, Seven Hills, NSW</p> <p>E-mail : aidan@allgeo.com.au</p> <p>Telephone : ----</p> <p>Facsimile : ----</p> <p>Project : 10827.1 Point Frederick GW</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler :</p>	<p>Laboratory : Environmental Division Sydney</p> <p>Contact : Customer Services ES</p> <p>Address : 277-289 Woodpark Road Smithfield NSW Australia 2164</p> <p>E-mail : ALSEnviro.Sydney@ALSGlobal.com</p> <p>Telephone : +61-2-8784 8555</p> <p>Facsimile : +61-2-8784 8500</p> <p>Page : 1 of 2</p> <p>Quote number : ES2019ALLGEOT0001 (EN/222)</p> <p>QC Level : NEPM 2013 B3 &amp; ALS QC Standard</p>
--	--

### Dates

<p>Date Samples Received : 15-Mar-2021 15:00</p> <p>Client Requested Due : 19-Mar-2021</p> <p>Date :</p>	<p>Issue Date : 15-Mar-2021</p> <p>Scheduled Reporting Date : <b>19-Mar-2021</b></p>
--	--

### Delivery Details

<p>Mode of Delivery : Undefined</p> <p>No. of coolers/boxes : 1</p> <p>Receipt Detail :</p>	<p>Security Seal : Intact.</p> <p>Temperature : 5.4 - Ice Bricks present</p> <p>No. of samples received / analysed : 1 / 1</p>
---	--

### 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 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.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.



## 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: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - W-02 8 Metals
ES2109102-001	12-Mar-2021 00:00	DUP01A	✓

## Proactive Holding Time Report

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

## Requested Deliverables

### AIDAN ROONEY

- \*AU Certificate of Analysis - NATA (COA)
- \*AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- \*AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- A4 - AU Tax Invoice (INV)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - ESDAT (ESDAT)

Email aidan@allgeo.com.au  
Email aidan@allgeo.com.au  
Email aidan@allgeo.com.au  
Email aidan@allgeo.com.au  
Email aidan@allgeo.com.au  
Email aidan@allgeo.com.au  
Email aidan@allgeo.com.au  
Email aidan@allgeo.com.au

### Enviro ALLIANCE GEO

- \*AU Certificate of Analysis - NATA (COA)
- \*AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)
- \*AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)
- A4 - AU Tax Invoice (INV)
- Chain of Custody (CoC) (COC)
- EDI Format - ENMRG (ENMRG)
- EDI Format - ESDAT (ESDAT)

Email enviro@allgeo.com.au  
Email enviro@allgeo.com.au  
Email enviro@allgeo.com.au  
Email enviro@allgeo.com.au  
Email enviro@allgeo.com.au  
Email enviro@allgeo.com.au  
Email enviro@allgeo.com.au  
Email enviro@allgeo.com.au

### INVOICES

- A4 - AU Tax Invoice (INV)

Email admin@allgeo.com.au



# CHAIN OF CUSTODY RECORD

ABN 50 095 085 521

## Sydney Laboratory

Unit F3 Bld F, 16 Mars Rd, Lane Cove West, NSW 2066  
02 9900 8400 EnviroSampleNSW@eurofins.com

## Brisbane Laboratory

Unit 1, 21 Smallwood Pl, Murarie, QLD 4172  
07 3902 4600 EnviroSampleQLD@eurofins.com

## Perth Laboratory

Unit 2, 51 Leach Highway, Kewdale WA 6105  
08 9251 9500 EnviroSampleWA@eurofins.com

## Melbourne Laboratory

2 Kingsdon Town Close, Oakleigh, VIC 3166  
03 8564 5000 EnviroSampleVic@eurofins.com

Company		ALLIANCE GEOTECHNICAL		Project No	10827.1		Project Manager	A. ROONEY		Sampler(s)	Jacob Walker			
Address		10 WELDER ROAD, SEVEN HILLS NSW		Project Name	Point Frederick GW		EDD Format (ESdat, EQulS, Custom)			Handed over by				
Contact Name		Jacob Walker		Analyses (Note: Heavy Metals are separate, please select 'Test for Plated / SUITE' code that is relevant to your sample)	8 Heavy Metals				Email for Invoice		Enviro@allgeo.com.au			
Phone No		0424066612							Email for Results		Enviro@allgeo.com.au			
Special Directions														
Purchase Order														
Quote ID No										Containers		Turnaround Time (TAT) Requirements (minimum will be 5 days if not ticked)		
										1L Plastic 250mL Plastic 125mL Plastic 200mL Amber Glass 40mL VOA vial 500mL PFAS Bottle Jar (Glass or HDPE) Other (Kubotex AS084, WA Guidelines)		Overnight (8am)* 1 Day* 3 Day* 5 Day* Other ( ) * Surcharges apply		
No	Client Sample ID	Sampled Date/Time (dd/mm/yy hh:mm)	Matrix (Solid (S) Water (W))	Sample Comments / Dangerous Goods Hazard Warning										
1	GMW01	12/03/21	w	X	Please note all samples are field filtered to .45 microns									
2	GMW03	12/03/21	w	X										
3	GMW04	12/03/21	w	X										
4	DUP01	12/03/21	w	X										
5	DUP01A	12/03/21	w	X	PLEASE SEND TO ALS									
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
Total Counts				5										
Method of Shipment		Courier (#)	Hand Delivered	Postal	Name	Ayodeji Awopetu	Signature	Date	44441	Time				

Environmental Division  
Sydney

Work Order Reference

ES2109102



Telephone + 61-2-8784 8555

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

Eurofins Environment Testing Australia Pty Ltd trading as Eurofins | mgt

780174

12/03/21

rec. FAD: 15/7/21



## **APPENDIX E**

### **DATA QUALITY ASSESSMENT**

## E. Data Quality Assessment

### E.1 Completeness

An assessment of the completeness of data collected was undertaken, and the results presented in **Table E-1**.

**Table E-1 Completeness DQI**

Field Considerations	Target	Actual	Comment
Critical locations sampled	95%	100%	Performance against indicator considered acceptable.
Critical samples collected	95%	100%	Performance against indicator considered acceptable.
SOPs appropriate and complied with	100%	100%	Performance against indicator considered acceptable.
Field documentation complete	All sampling point logs, calibration logs and chain of custody forms	All sampling point logs, calibration logs and chain of custody forms	Performance against indicator considered acceptable.
Laboratory Considerations	Target	Actual	Comment
Critical samples analysed according to DQO	Refer to Section 7.6	100%	Performance against indicator considered acceptable.
Analytes analysed according to DQO	Refer to Section 7.6	100%	Performance against indicator considered acceptable.
Appropriate laboratory analytical methods and LORs	Refer to Section 7.6	100%	Performance against indicator considered acceptable.
Sample documentation complete	All sample receipt advices, all certificates of analysis	100%	Performance against indicator considered acceptable.
Sample extraction and holding times complied with	Refer to Section 7.6	100%	Performance against indicator considered acceptable.

The data collected is considered to be complete and within the objectives and constraints of the project.

### E.2 Comparability

An assessment of the comparability of data collected was undertaken, and the results presented in **Table E-2**.

**Table E-2 Comparability DQI**

Field Considerations	Target	Actual	Comment
Same SOPs used on each occasion	100%	100%	Performance against indicator considered acceptable.
Climatic conditions	Samples stored in insulated containers with ice, immediately after collection	100%	Performance against indicator considered acceptable.
Same types of samples collected, and handled/preserved in same manner	All soil samples same size, all stored in insulated containers with ice	100%	Performance against indicator considered acceptable.
Laboratory Considerations	Target	Actual	Comment
Same analytical methods used by primary laboratory	Refer to Section 7.6	100%	Performance against indicator considered acceptable.
Same LORs at primary laboratory	Refer to Section 7.6	100%	Performance against indicator considered acceptable.
Same laboratory for primary sample analysis	All primary samples to Eurofins   mgt	100%	Performance against indicator considered acceptable.
Same analytical measurement units	Refer to Section 7.6	100%	Performance against indicator considered acceptable.

The data collected is considered to be adequately comparable and within the objectives and constraints of the project.

### E.3 Representativeness

An assessment of the representativeness of data collected was undertaken, and the results presented in **Table E-3**.

**Table E-3 Representativeness DQI**

Field Considerations	Target	Actual	Comment
Appropriate media sampled according to DQO	Refer to Section 7.1	100%	Performance against indicator considered acceptable.
Media identified in DQO sampled	Refer to Section 7.1	100%	Performance against indicator considered acceptable.
Laboratory Considerations	Target	Actual	Comment
Samples analysed according to DQO	Refer to Section 7.6	Refer comments	Performance against indicator considered acceptable.

The data collected is considered to be adequately complete within the objectives and constraints of the project.

## E.4 Precision

An assessment of the precision of data collected was undertaken, and the results presented in **Table E-4**.

**Table E-4 Precision DQI**

Field Considerations	Target	Actual	Comment
Field duplicate / triplicate RPD	Minimum 5% duplicates and triplicates  No limit for analytical results <10 times LOR  50% for analytical results 10-20 times LOR  30% for analytical results >20 times LOR	33.3% duplicates and 33.3% triplicates  Nil  Nil  Nil	<p>Parent duplicate/triplicate relationships are as follows:</p> <ul style="list-style-type: none"> <li>▪ <i>DUP01/DUP01A</i> – GMW03</li> </ul> <p>Exceedances were recorded for groundwater RPD's for:</p> <ul style="list-style-type: none"> <li>▪ Copper in <i>DUP01</i>;</li> <li>▪ Nickel in <i>DUP01/DUP01A</i>; and</li> <li>▪ Zinc in <i>DUP01/DUP01A</i>.</li> </ul> <p>Alliance considers these exceedances are likely to be attributable to heterogeneity in each of the discrete groundwater samples, as the parent sample may not be homogenised. As a conservative measure, the sample reporting the higher concentration of the relevant analyte should be used when making decisions regarding contamination risks on the site.</p> <p>Refer to <b>Table LAR2</b>.</p>
SOPs appropriate and complied with	100%	100%	Performance against indicator considered acceptable.
Laboratory Considerations	Target	Actual	Comment
Laboratory duplicates	No exceedances of laboratory acceptance criteria	No exceedances	Performance against indicator considered acceptable.

The data collected is considered to be adequately precise within the objectives and constraints of the project.

## E-5 Accuracy

An assessment of the precision of data collected was undertaken, and the results presented in **Table E-5**.

**Table E-5 Accuracy DQI**

<b>Field Considerations</b>	<b>Target</b>	<b>Actual</b>	<b>Comment</b>
Rinsate blanks	Less than laboratory limit of reporting	-	Performance against indicator considered acceptable.
Field trip spikes	Recoveries between 60% and 140%	-	Performance against indicator considered acceptable.
Field trip blanks	Analyte concentration <LOR	-	Performance against indicator considered acceptable.
<b>Laboratory Considerations</b>	<b>Target</b>	<b>Actual</b>	<b>Comment</b>
Laboratory method blank	No exceedances of laboratory acceptance criteria	No exceedances of laboratory acceptance criteria	Performance against indicator considered acceptable.
Matrix spike recovery	No exceedances of laboratory acceptance criteria	No exceedances of laboratory acceptance criteria	Performance against indicator considered acceptable.
Surrogate spike recovery	No exceedances of laboratory acceptance criteria	No exceedances of laboratory acceptance criteria	Performance against indicator considered acceptable.
Laboratory control sample recovery	No exceedances of laboratory acceptance criteria	No exceedances of laboratory acceptance criteria	Performance against indicator considered acceptable.

The data collected is considered to be adequately accurate and within the objectives and constraints of the project.

## **APPENDIX F**

### **CALIBRATION CERTIFICATES**

## Multi Parameter Water Meter

Instrument **YSI Quatro Pro Plus**  
Serial No. **11K101263**



Air-Met Scientific Pty Ltd  
1300 137 067

Item	Test	Pass	Comments
<b>Battery</b>	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
<b>Switch/keypad</b>	Operation	✓	
<b>Display</b>	Intensity	✓	
	Operation (segments)	✓	
<b>Grill Filter</b>	Condition	✓	
	Seal	✓	
<b>PCB</b>	Condition	✓	
<b>Connectors</b>	Condition	✓	
<b>Sensor</b>	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
<b>Alarms</b>	Beeper		
	Settings		
<b>Software</b>	Version		
<b>Data logger</b>	Operation		
<b>Download</b>	Operation		
<b>Other tests:</b>			

## Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00		330737	pH 7.04
2. pH 4.00		pH 4.00		351412	pH 4.10
3. pH 10.00		pH 10.00		355386	pH 9.66
4. mV		231.8mV		358632/358634	231.9mV
5. EC		2.76mS		350510	2.75mS
6. D.O		0.00ppm		10959	0.00ppm
7. Temp		21.0°C		MultiTherm	21.1°C

**Calibrated by:** Lauren Tompkins

**Calibration date:** **11/03/2021**

**Next calibration due:** **10/04/2021**