Intended for
Hydro Aluminium Kurri Kurri Pty Ltd

Document type
Report

Date
February 2020

HYDRO ALUMINIUM SMELTER CAPPED WASTE STOCKPILE, 2019 ANNUAL GROUNDWATER MONITORING REPORT

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HYDRO ALUMINIUM SMELTER
2019 ANNUAL GROUNDWATER MONITORING REPORT

Revision	**Final**
Date	**17 February 2020**
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Description	**2019 Annual Groundwater Monitoring Report for the leachate plume associated with the Capped Waste Stockpile at the former Hydro Aluminium Kurri Kurri Smelter, Loxford, NSW.**

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ABBREVIATIONS

Abbreviation	Description
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines (Water Quality)
bgl	below ground level
btoc	below top of casing
CN	Cyanide (total or free)
CoC	Chain of Custody
CoPC	Contaminant of Potential Concern
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objective
EC	Electrical Conductivity
EHP	Queensland Department of Environment and Heritage Protection, now DES
EIL	Ecological Investigation Level
EPA	Environmental Protection Authority
EPO	Environmental Protection Order
ESA	Environmental Site Assessment
ESL	Ecological Screening Level
GME	Groundwater Monitoring Event
GMP	Groundwater Monitoring Plan
ha	hectare
km	kilometre
L	litre
LOR	Limit of Reporting
m	metre
µg/L	micrograms per litre
mg/L	milligrams per litre
NATA	National Association of Testing Authorities
NC	Not calculated
ND	Not detected
NEHF	National Environmental Health Forum
NEPM	National Environment Protection (Assessment of Contamination) Measure (amended 2013)
NHMRC	National Health and Medical Research Council
n	Number of samples
OH&S	Occupational health & safety
pH	Measure of acidity, hydrogen ion activity
PQL	Practical Quantitation Limit
RPD	Relative Percentage Difference
QA/QC	quality assurance/quality control
SPL	Spent Pot Lining
UCL	Upper Confidence Limit
µg/L	Micrograms per Litre

EXECUTIVE SUMMARY

Twenty-five groundwater monitoring events (GMEs) have been completed between July 2013 and December 2019 to monitor a leachate impacted groundwater plume associated with the Capped Waste Stockpile (CWS) at the former Hydro Aluminium Kurri Kurri Smelter, located off Hart Road, Loxford, NSW. Monitoring of the groundwater down gradient of the CWS was initiated to assess the impacts to groundwater from leachate and to provide a temporal and spatial evaluation of the plume behaviour. Leachate from the CWS has high pH and high dissolved fluoride characteristics.

Each GME included the sampling and analysis of groundwater from a network of 25 shallow and deep wells located on five sections along the length of the leachate plume down-gradient of the CWS. In 2016, two additional shallow wells and two additional deep wells were added to the network. These wells are located adjacent to Swamp Creek, the nearest surface water receptor. Physico-chemical parameters were recorded, and groundwater samples analysed for soluble fluoride, total and free cyanide as well as total and dissolved aluminium.

Groundwater downgradient of the CWS is shallow and within a former sand filled river channel. Geological constraints limited the movement of groundwater and cause groundwater discharge to the surface following rainfall events. Groundwater wells monitoring the upper phreatic surface, or shallow part of the aquifer, and a deeper part of the aquifer. The monitoring depth of the deeper well is variable and depending on geological stratum.

Evaluation of 2019 GME data has identified the following:

- Groundwater flow is interpreted to be north to north-east in both the shallow and deep aquifer. This is consistent with historical observations.
- The trend for pH in the shallow aquifer was generally 'stable' or 'decreasing'. An 'increasing' trend was identified at one well, N8, located on Section 5. pH values at N8 remain low compared to wells that contain leachate. Further, the increasing trend appears marginal, with pH increasing from pH 6.36 in July 2013 to pH 6.67 in December 2019.
- The trend for soluble fluoride in the shallow aquifer was generally 'stable' or 'no trend'. An 'increasing' trend was identified at one well, N8, where the fluoride concentration remains below 1 mg/L. Fluoride concentrations in N8 remain below the site criteria for the receiving waters and pH at this location is not characteristic of leachate impact.
- Longitudinally along the length of the plume, the most elevated fluoride concentrations on the western edge were in well A7 on Section 3 and on the eastern edge were in well E4 on Section 2, this is consistent with 2018 observations.
- The trend for free cyanide in the shallow aquifer was generally 'decreasing', 'stable' or 'no trend'. No 'increasing' trends were identified. Free cyanide concentrations remained below the site criteria for 95% Protection of Aquatic Ecosystems (0.007 mg/L) aside from at wells PUMP, W7M and W3S.
- The trend for pH in the deep aquifer was generally 'decreasing', 'probably decreasing' or 'stable'. An 'increasing' trend was identified for pH in two wells in the deep aquifer – W1D and G2. The pH levels in both wells remain indicative of natural levels at the site and further assessment of pH at these locations identified a marginal increase in pH between July 2013 and December 2019 (0.18 pH units and 0.09 pH units respectively).
- The trend for soluble fluoride in the deep aquifer was generally 'no trend' or 'decreasing'. An 'increasing' trend was identified for soluble fluoride in two wells in the deep aquifer – W2D and G2. Well W2D is the most leachate impacted well, with fluoride concentrations at 1200 mg/L. Fluoride concentrations in well G2 remain below levels identified in leachate impacted groundwater and further review of soluble fluoride concentrations at this location indicate a marginal increase between July 2013 (0.28 mg/L) and December 2019 (0.3 mg/L).
- The trend for free cyanide in the deep aquifer was 'stable', except for W2D which had a 'decreasing' trend. Free cyanide at W2D exceeded the assessment criteria for 95% Protection of Aquatic Ecosystems during September and December only, all other deep wells reported free cyanide concentrations below the limit of reporting.
- The most leachate impacted well remains W2D, in the deep aquifer on Section 1. Fluoride concentrations in this well have consistently exceeded 1200 mg/L since February 2015.

- Fluoride concentrations in the deep aquifer down-gradient of Section 1 remain low, indicating a semi-continuous connection between the shallow and deep aquifer.
- Groundwater data from the two pairs of shallow and deep wells adjacent to Swamp Creek, the nearest surface water receptor, show no impact from the leachate plume. This result is anticipated based on the presence of high plasticity clays, which limit the migration of the leachate plume in this direction toward Swamp Creek.

1. INTRODUCTION

Ramboll Australia Pty Ltd (Ramboll) was commissioned by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to undertake quarterly groundwater monitoring events (GMEs) on a portion of the Hydro Aluminium Kurri Kurri Smelter, located off Hart Road, Loxford, New South Wales (NSW), Australia.

The portion of the Smelter subject to the quarterly groundwater monitoring comprises the former smelter waste storage area known as the 'Capped Waste Stockpile' (CWS) and an associated area of leachate impacted groundwater (the leachate plume). The CWS and associated leachate impacted groundwater were identified as Area of Concern (AEC) 1 in the Phase 2 Environmental Site Assessment completed by Ramboll in 2012. The location of AEC 1 is shown in **Figure 1, Appendix 1**.

Results of previous groundwater monitoring events completed between July 2013 and December 2018 have been reported in the following reports:

- 'Hydro Aluminium Kurri Kurri Smelter, Capped Waste Stockpile, 12 Month Groundwater Monitoring Report', by Environ (now Ramboll), dated February 2015
- 'Hydro Aluminium Smelter, Capped Waste Stockpile, 2015 Annual Groundwater Monitoring Report' by Ramboll Environ (now Ramboll), dated April 2016
- 'Hydro Aluminium Smelter, Capped Waste Stockpile, 2016-2017 Annual Groundwater Monitoring Report', by Ramboll, dated February 2018
- 'Hydro Aluminium Kurri Kurri Smelter, Capped Waste Stockpile, 2018 Annual Groundwater Monitoring Report', by Ramboll, dated February 2019

This report presents the results of four quarterly GMEs, completed in March, June, September and December of 2019, as well as a trend analysis of the results from the twenty-five monitoring events completed between 2013 and 2019.

1.1 Objective and Scope of Work

The objective of each quarterly GME was to:

- Assess the current status of leachate impacts to groundwater occurring from the CWS
- Compare the current status of leachate impacts to historical data to assess changes in groundwater quality.

The objective of this 2019 Groundwater Monitoring Report is to:

- Tabulate results for depth to groundwater, physico-chemical parameters and analytical data collected in 2019
- Complete trend analysis of monitored parameters in key wells incorporating data collected since July 2013
- Complete trend analysis with rainfall data
- Contour contaminant concentrations in the shallow and deep aquifers
- Assess the impact of the leachate interception trench on groundwater quality
- Assess the relationship between leachate generation and rainfall infiltration
- Provide conclusions and recommendations

The scope of work for each quarterly GME included:

- Gauging, purging and sampling of 29 groundwater monitoring wells on five sections through the plume plus two additional shallow wells and two additional deep wells located adjacent to Swamp Creek

- Measurement of groundwater physico-chemical properties during purging, including pH, temperature, electrical conductivity (EC), redox (mV), total dissolved solids (TDS) and dissolved oxygen
- Laboratory analysis of groundwater samples for soluble fluoride, total and free cyanide and total and dissolved aluminium

1.2 Limitations

Ramboll Australia Pty Ltd (Ramboll) prepared this report in accordance with the scope of work as outlined in our proposal to Hydro Aluminium Kurri Kurri Pty Ltd dated 21 January 2019 and in accordance with our understanding and interpretation of current regulatory standards.

A representative program of sampling and laboratory analyses was undertaken as part of this investigation, based on past and present known uses of the site. While every care has been taken, concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. We cannot therefore preclude the presence of materials that may be hazardous. Site conditions may change over time. This report is based on conditions encountered at the Site at the time of the report and Ramboll disclaims responsibility for any changes that may have occurred after this time.

The conclusions presented in this report represent Ramboll's professional judgment based on information made available during the course of this assignment and are true and correct to the best of Ramboll's knowledge as at the date of the assessment.

Ramboll did not independently verify all of the written or oral information provided to Ramboll during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to Ramboll was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

1.3 User Reliance

This report has been prepared exclusively for Hydro Aluminium Kurri Kurri Pty Ltd and may not be relied upon by any other person or entity without Ramboll's express written permission.

2. BACKGROUND

2.1 Site Background

The Hydro Aluminium Kurri Kurri Smelter is located approximately 30 km west of the city of Newcastle and 150 km north of Sydney, in NSW, Australia. The smelter includes a 60-hectare (ha) plant area and a 2,000 ha buffer zone.

The CWS is a repository of waste arising during the operations of the aluminium smelter and includes spent pot lining, anodes, scrubber bags, concrete, brick, bulky waste, fines and other smelter wastes. The CWS is located near the eastern boundary of the smelter footprint and adjacent to the surrounding Hydro owned buffer land.

The CWS was maintained as an uncapped bunded waste repository prior to being capped with clay under development consent in the mid-1990s. At this time, impacts to vegetation in the buffer zone downgradient of the CWS were observed. Leachate from the CWS, caused by rainwater and groundwater coming in to contact with the CWS contents, was also known to have impacted on groundwater and investigations commenced to explore the extent of groundwater impact. These investigations identified that leachate impacted groundwater likely originated from the north east corner of the CWS and extended approximately 250 meters (m) north east. The CWS and associated leachate impacted groundwater were identified as AEC 1 in the Phase 2 Environmental Site Assessment completed by Environ (now Ramboll) in 2012. The location of AEC 1 is shown in **Figure 1, Appendix 1**. Ramboll assessed AEC 1 as part of the following investigations:

- 'Phase 2 Environmental Site Assessment, Kurri Kurri Aluminium Smelter', dated 1 November 2012;
- 'Environmental Site Assessment, Capped Waste Stockpile, Kurri Kurri Aluminium Smelter', dated 13 December 2012; and
- 'Plume Delineation Report, Capped Waste Stockpile', dated 6 November 2013.

Following these investigations, a Groundwater Monitoring Programme was developed that included monitoring 25 wells on five cross sections along the length of the plume. A summary of the Plume Delineation Report was included in Section 2.2 of the 12 Month Groundwater Monitoring Report (ENVIRON June 2016) and further information regarding the development of the Program is presented in Section 2.4 of that report.

Interim mitigation measures were taken in 2013, 2016 and 2017 to intercept the shallow movement and daylighting of leachate impacted groundwater. Measures involved the installation of passive or active shallow trenches, extending approximately 2 m below the ground surface perpendicular to the plume migration and providing pipe conveyance of the leachate impacted groundwater to the surface.

Planning approval is currently being sought for the remediation of the site including the CWS. The proposal for remediation is the consolidation of all contaminated materials within one centralised containment cell located to the west of the current CWS site and within residual clay soils. It is anticipated that remediation will be completed within the next year. Remediation of the CWS will result in the removal of the source of leachate to the groundwater system. Remediation involves some removal of leachate impacted groundwater with the remaining groundwater remediation occurring through natural processes following subsequent rainfall.

2.2 Characterisation of the Leachate Plume

A conceptual site model was developed following Stage 1 and Stage 2 of the investigations and was included in 12 Month Groundwater Summary Report, 2014.

The Hydro aluminium smelter and surrounding land generally comprises flat, low lying swampy ground that is at an elevation of between 12 m AHD and 15 m AHD. The CWS is located within

the smelter portion of the site and is approximately 170 m in length by 130 m in width and is up to 11 m high and currently comprises a grassed clay cap. The eastern portion of the site within the buffer zone retains natural bushland vegetation with minor surface filling using refractory bricks along the buffer zone fence line. Two areas of vegetation impact, known as the northern and southern vegetation impact areas are located in the north eastern portion of the site.

The CWS comprises stockpiled spent pot lining wastes and other wastes including cryolite, alumina, floor sweepings, shot blast dust, cement and pot lining mix. The waste is not leachate generating of itself (i.e. not putrescible) however, the uncapped storage of waste and subsequent infiltration of rainwater through the waste stockpile led to the generation of leachate over a period of approximately 25 years. Prior to capping, the leachate was collected behind bund walls surrounding the spent pot lining stockpile. During capping, leachate was suspected to have been entrapped within the fill in the north eastern corner of the CWS.

The CWS was capped in 1995 to prevent further infiltration. The suspected burial of leachate during capping and the ongoing contact between waste material and shallow groundwater beneath the CWS is considered to result in the ongoing leachate generation.

Major contaminants in the leachate are sodium (4,800 mg/L to 15,300 mg/L), fluoride (1,100 mg/L to 3,420 mg/L), sulphate (4,000 mg/L to 6,740 mg/L) and cyanide (70 mg/L to 200 mg/L) based on data obtained from leachate ponded within the bunded area of the CWS prior to capping (Reference: Dames & Moore (1992) 'Environmental Impact Statement, Upgrades to Waste Storage Facilities at the Alcan Australia Limited Kurri Kurri Smelter'). Leachate impacted groundwater is observed to be brown in colour.

The leachate plume originates from beneath the eastern side of the CWS where seepage into shallow groundwater within a semi-continuous sand aquifer has occurred. The shallow sand aquifer has been delineated as an elongate and sinuous sand lens approximately 50 m wide and 250 m in length extending to the north east of the CWS. The shallow sand aquifer is surrounded vertically and horizontally by a discontinuous clay aquitard that has been less impacted by leachate in close proximity to the plume and not been impacted by leachate at a distance from the plume. The configuration of the aquifer is a result of the nature of the deposition of sediments within a former estuary during periods of sea level rise and fall. A schematic cross section of the site is included as **Attachment 1**, **Appendix 2**.

The location of the plume within the semi-continuous shallow sand aquifer constrained by the surrounding discontinuous clay aquitard suggests that the movement of the leachate groundwater plume is limited by the geology. The complex interbedded Quaternary sediments comprise estuarine muds (high plasticity clay), fluvial channel sands (fine grained and coarse-grained sands), sandy levee deposits (clayey sand/sandy clay) and high energy flood deposits (coarse grained quartz sand).

Delineation investigations show that the groundwater plume remains confined within one main sand filled channel which directs flow to the north east. This finding is consistent with observations of a heavily vegetated area evident in the 1961 historical aerial photograph (**Attachment 2**, **Appendix 2**). The heavy vegetation is a reflection of surface and subsurface drainage lines and likely represents the shallow groundwater table present in the sand filled channel. The 1961 aerial photograph depicts the vegetation extending further to the north east and connecting with Swamp Creek. Given the correlation between the plume extent and the vegetation, it is reasonable to conclude that the groundwater flow path will continue along the vegetation alignment toward Swamp Creek and that, should the plume migration reach the surface water receptor, the discharge point will occur approximately 750 m to 1,000 m north-east of the plume, as shown in **Attachment 2**, **Appendix 2**. Fate and transport modelling to predict

the migration of the plume along this channel has been undertaken, as summarised in **Section 2.5**.

The shallow nature of the semi-continuous sand aquifer results in the exfiltration of leachate impacted groundwater within topographically low areas of the site and following high rainfall events. The impacts of exfiltration are observed on the eastern edge of the plume where dieback of vegetation has occurred (southern and northern vegetation impact areas). Brown coloured seepage is observed and evaporation of exfiltrated groundwater has left a white salt crust on surface soils in this area. The high electrical conductivity of the exfiltrated groundwater (up to 15,000 µs/cm) exceeds the limit (12,200 µs/cm) at which conditions are generally too saline for plant growth (ANZECC, 2000).

The semi-continuous shallow sand aquifer that is impacted with leachate is characterised by high pH (pH >9), electrical conductivity (>5,000 µS/cm), fluoride (>200 mg/L) and total cyanide (>6 mg/L) concentrations and is brown in colour. Historical data indicates fluoride concentrations within the leachate plume have been decreasing since the CWS was capped in 1995. Fluoride concentrations near the CWS, the source of the plume, peaked in 1997. Mid-way along the plume, fluoride concentrations peaked around 2000 and at the leading edge, fluoride concentrations peaked between 2004 and 2006, as shown in **Figure 2-1**.

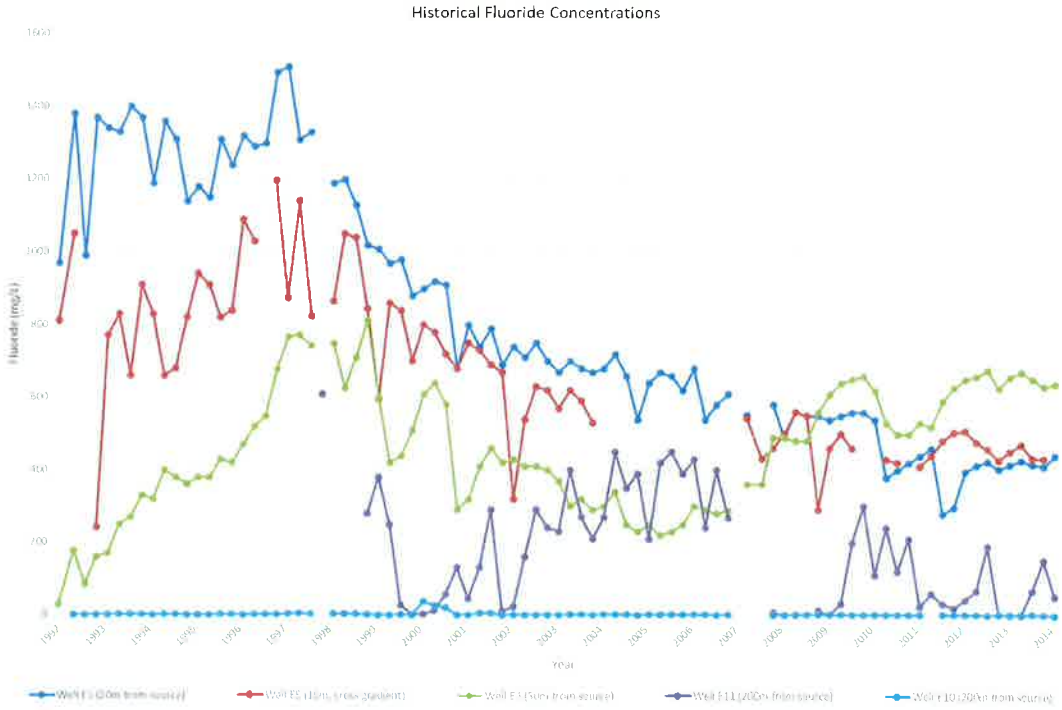

Figure 2-1: Historical Fluoride Concentrations Along the Plume

Ex-filtrated leachate impacted groundwater is observed to become overland flow discharging along a surface water flow path to a small dam. During periods of high rainfall, surface water within this dam is able to flow through a culvert structure to a larger dam which discharges to Swamp Creek. The overland flow path is shown in **Attachment 3**, **Appendix 2**.

Fluoride concentrations at the semi-permanent dam, located between the leachate impacted groundwater plume and Swamp Creek, typically vary between 15 mg/L and 25 mg/L. It is considered that the elevated fluoride concentrations in the semi-permanent dam are due to

overland flow of exfiltrated groundwater from their source at the southern and northern vegetation impact areas. Sampling found the fluoride concentrations in Swamp Creek vary between 0.49 mg/L up stream of the smelter and 1.2 mg/L down-stream. Adjacent to the semi-permanent dam discharge to Swamp Creek, fluoride concentrations were 1.6 mg/L. The Stage 2 Aquatic Assessment - Ecological Risk Assessment completed by ENVIRON in June 2013 indicated there is no discernible impact to the aquatic ecology within the semi-permanent dam as a result of elevated concentrations of fluoride in surface water and sediment.

2.3 Aquifer Characterisation

A sand aquifer within the buffer zone of the Hydro Aluminium Smelter has been impacted by leachate from the CWS. An underlying deep aquifer has also been impacted in close proximity to the contamination source. The characteristics of this sand aquifer and the underlying deep aquifer are critical to the understanding of the site CSM. Aquifer characteristics have been identified as outlined in **Table 2-1**.

Table 2-1: Aquifer Characteristics

Characteristic	Comment
Aquifer Type	Unconsolidated sediment (estuarine)
Aquifer Depth	Shallow: Approximately 0.3 m bgs to 2.5 m bgs Deep: Approximately 3.5 m bgs to 7 m bgs
Confined/Unconfined	Shallow: Unconfined Deep: Confined by high plasticity clays in some areas
Groundwater Flow Direction	Shallow: North to north east Deep: North east
Recharge Mechanism	Shallow: Infiltration Deep: Infiltration
Porosity	Shallow: Variable due to variable nature of the sediments. High porosity quartz gravels identified at north east corner of the Capped Waste Stockpile. Mid to low porosity tightly packed sands identified along plume length. Deep: Mid to low porosity poorly sorted, tightly packed fine-grained sand.

The most important characteristic for the movement of leachate through the shallow aquifer is the nature of the materials, in particular the complex and variable nature of the unconsolidated sediments. The nature of the sediments impacts the porosity, with high porosity quartz gravels, mid to low porosity tightly packed sands and high plasticity clays with very low porosity, all identified within the unconsolidated estuarine sediments. The leachate from the CWS moves through the sediments with mid to high porosity but is retarded by high plasticity clays. Where these barriers to flow coincide with changes in topography, discharge of groundwater to the surface can occur.

2.4 Leachate Interception Trenches

2.4.1 Section 2 – Passive Trench

Prior to the completion of the Stage 1 and Stage 2 investigations in early 2013, a leachate interception trench was installed to collect leachate that was daylighting to the north of Section 2 and flowing into the southern vegetation impact area. This interception trench was a passive system, with the trench installed at a depth of approximately 0.3 m bgs and leachate collecting in the trench flows into a sump tank and is then pumped into a nearby water tank as required. The location of this interception trench is shown in **Attachment 4**, **Appendix 2.**

2.4.2 Section 1- Active Trench

At the completion of the Stage 1 and Stage 2 investigations, a recommendation was made to install a leachate interception trench down gradient of the north eastern toe of the CWS within the coarse-grained sand strata identified in well W7M.

The leachate interception trench was installed at the toe of the CWS immediately upgradient of the wells on Section 1 in April 2014. The leachate interception trench was designed to intercept and collect shallow, perched leachate impacted groundwater through a slotted pipe under vacuum. The pipe was installed using horizontal trenching equipment (ditch witch trencher) to a depth of 3 m in order to remain above any confining layers. The location of the interception trench is shown in **Attachment 4**, **Appendix 2** and a conceptual cross section of the trench is included in **Attachment 5**, **Appendix 2**.

A vacuum pump was connected to the horizontal pipe to create a vacuum along the pipe length. Groundwater monitoring bores immediately down-gradient of the pipe are regularly monitored for drawdown to assess pipe effectiveness.

The leachate interception trench operated from May 2014 until March 2016 when the discharge rate dropped to 0 L/minute. During this time, the leachate interception trench had an impact on the leachate plume by lowering the groundwater table and removing leachate at the location of the trench. Groundwater levels on Section 1 have not yet recovered.

2.4.3 Section 4 – Passive Trench

A second passive interception trench was installed north of Section 4 in October 2017. This trench was installed along the western edge of the northern vegetation impact area to collect leachate daylighting in this area. The location of this interception trench is shown in **Attachment 4**, **Appendix 2.**

2.4.4 Outcome

The purpose of the leachate interception trenches was as interim remediation measures to reduce daylighting and overland discharge of leachate down gradient of the CWS. The performance of the interception trenches was reviewed in 2016 and it was concluded that the trenches have been effective due to the following:

- Water quality improvements in the down gradient environment;
- Regeneration of vegetation along the targeted flow paths; and
- Declining of groundwater levels to a point where the active trench along the toe of the CWS has remained dry since March 2016.

2.5 Fate and transport modelling

ENVIRON (February 2015) conducted a hydrogeological review and analytical groundwater contaminant transport modelling to assess the fate and transport of the leachate plume within the shallow aquifer. The assessment and modelling included a review of site investigation data and the construction of a conceptual hydrogeological model of AEC 1 and its surrounds.

A one-dimensional model (UK EA Remedial Targets Worksheet) was used to simulate the groundwater flow and contaminant transport conditions to predict contaminant (fluoride) concentrations from the source to the nearest down-gradient receptor (Swamp Creek).

The model was calibrated against observed fluoride concentrations from the existing groundwater monitoring well network to the east and north-east of the capped waste stockpile. The groundwater fluoride concentration at the receptor impact point was then evaluated under the simulated model and compared with the guideline criteria.

The following conclusions were drawn from the results of the modelling:

- Based on the existing hydrogeological conditions and the presence of an ongoing source from the CWS, the model estimated a fluoride concentration of 4.3 mg/L at the receptor distance (1,000 m), compared to the guideline criteria of 1.5 mg/L;
- This value is considered a conservative estimate given the model assumes a continuous source, however, historical, more recent and proposed works are considered to have mitigated the source contribution. Future remedial works are proposed to ultimately remove the source (spent Pot Liner, anodes, scrubber bags, concrete, brick, bulky waste, fines and other smelter wastes stockpiled within the CWS); and
- The model demonstrates sensitivity to a number of input parameters including the soil partition coefficient, (Kd). Future studies may include site specific determination of the soil partition coefficient in order to improve model calibration.

2.6 Conceptual Site Model

A Conceptual Site Model (CSM) is a site-specific qualitative description of the source(s) of contamination, the pathway(s) by which a contaminant may migrate through environmental media and the populations (human and/or ecological) that may potentially be exposed. This relationship is commonly known as a Source-Pathway-Receptor (SPR) linkage. Where one or elements of the SPR linkage are missing, the exposure pathway is considered to be incomplete and no further assessment is required.

A CSM was developed for the CWS leachate plume based on details provided in the sections above.

2.6.1 Contaminant Sources

The contaminant sources at the CWS leachate plume is the aluminium smelter wastes disposed in the CWS, primarily spent pot lining and cryolite.

2.6.2 Contaminants of Concern

Contaminants of Concern associated with spent pot lining and cryolite include fluoride, cyanide, aluminium, sodium, sulphate and aluminium.

2.6.3 Potential Human and Ecological Receptors

Identified potential receptors of contaminants of concern, should a complete exposure pathway be present, include:

- Maintenance personnel (brush cutting is completed in this area)
- Hydro employees who access the buffer zone
- Vegetation growing in the area of the leachate plume
- Transitory fauna that traverse through the area of the leachate plume
- The ecology of the semi-permanent dam located adjacent to Swamp Creek, the nearest down gradient receptor
- The ecology of Swamp Creek

Limited human receptors were identified as the site is located in a portion of the buffer zone that is fenced and not accessible to the general public or Hydro employees aside from those who work in the buffer zone.

2.6.4 Potential Transport Mechanisms

Identified potential transport mechanisms by which contaminants of concern may migrate from the source include:

- Migration through groundwater
- Daylighting of groundwater and overland flow

Infiltration as a transport mechanism was stopped by the capping of the CWS with high plasticity clay in the mid-1990s.

2.6.5 Exposure Pathways

In order for a receptor to be exposed to a chemical contaminant derived from a site, there must be an exposure pathway linking the source of contamination and the exposed receptor. An exposure pathway described the course a chemicals or physical agent takes from the source to the exposed receptor and generally includes the following elements (US EPA 1989):

- A source and mechanism of chemical release;
- A retention or transport medium (or media where chemicals are transferred between media);
- A point of potential human contact with the contaminated media; and
- And exposure route (e.g. ingestion, inhalation) at the point of exposure.

An evaluation of exposure pathways at the site is outlined in **Table 2-2**.

Table 2-2: Source-Pathway-Receptor Linkages

	Source-Pathway-Receptor Link? (Yes/No/Potential (P), Not Relevant (NR))						
	Maintenance Personnel	**Hydro Employees**	**Vegetation**	**Transitory fauna**	**Ecology of dam down gradient**	**Ecology of Swamp Creek**	**Justification**
Soil							
Dermal contact with impacted soil	No	No	NR	No	NR	NR	The contents of the CWS and underlying 0.5 m of soil are impacted by elevated concentrations of fluoride, asbestos, PAHs and petroleum hydrocarbons (Ramboll 2016). Natural soils more than 0.5 m below the waste are not impacted. The contamination is no longer accessible following capping of the CSW with low plasticity clay in the mid-1990s.
Incidental ingestion of impacted soil	No	No	NR	No	NR	NR	
Outdoor dust inhalation	No	No	NR	No	NR	NR	
Surface Water							
Dermal contact with impacted surface water	**P**	**P**	NR	**P**	No	No	Groundwater within the leachate plume can daylight and flow across overland flow paths, providing a pathway between contaminated groundwater and human and ecological receptors. The Ecological Risk Assessment (Environ 2013) indicates there is no discernible impact to aquatic ecology in the semi-permanent dam.
Incidental ingestion of impacted surface water	**P**	**P**	NR	**P**	No	No	
Uptake of impacted surface water	NR	NR	**Yes**	NR	NR	NR	
Groundwater							
Dermal contact with impacted groundwater	No	No	No	No	No	No	Groundwater within the leachate plume is not accessible aside from uptake of impacted water by vegetation, as evidenced by the two vegetation impact areas in the down gradient portion of the plume. High plasticity clays located east of the leachate plume prevent groundwater migration east towards Swamp Creek.
Incidental Ingestion of impacted groundwater	No	No	No	No	No	No	
Uptake of impacted groundwater	NR	NR	**Yes**	NR	NR	NR	

3. SAMPLING, ANALYSIS AND QUALITY PLAN

3.1 Objective

The objective of each quarterly GME is to collect water quality data to inform the behaviour of the plume over time. The groundwater monitoring network is shown in **Figure 2, Appendix 1**.

3.2 Scope of Works

The scope of works included the following:

- The collection of groundwater samples and measurement of water levels and physico-chemical parameters (including pH temperature, EC, redox, TDS and dissolved oxygen) in wells on the following five sections:
  - Section 1: Wells E5, E5D, W7S, W7M, PUMP, W2S, W2D;
  - Section 2: Wells E5, E5D, E4, W1S, W1D;
  - Section 3: Wells A7, W3S, W3D, ~~W3SA~~, W4S, ~~W4D~~;
  - Section 4: Wells E11, W5S, W5D, N2;
  - Section 5: Wells G2, N8, N9, W6S, W6D.
- The collection of groundwater samples and measurement of water level in two pairs of shallow and deep wells adjacent to Swamp Creek (F5/G5 and F6/G6), which were added to the sampling program in 2016.
- Laboratory analysis of groundwater samples for soluble fluoride, total and free cyanide and total and dissolved aluminium. Dissolved aluminium was included as part of laboratory analysis from June 2018.

Wells W3SA and W4D were damaged in the April 2015 storm. Well W3SA was destroyed by flood water and has not been replaced as this shallow well was dry for the majority of the 2013/2014 sampling events. Well W4D was damaged below the ground with a kink in the standpipe but was able to be sampled until October 2016. This well has not been replaced. As such, the scope of work for 2019 included sampling of 29 wells.

3.3 Fieldwork Methodology

The fieldwork methodology for the collection of groundwater samples is outlined in **Table 3-1**.

Table 3-1: Field Methodology for Quarterly Groundwater Monitoring

Activity	Details
Well Gauging	Monitoring wells were gauged using a water interface probe.
Well Purging	Monitoring wells were purged prior to sampling by pumping water from the wells until the physico-chemical parameters stabilised to within 10 % of the previous reading.
Decontamination	The majority of the sampling equipment used during low flow sampling was dedicated and disposable, such as the dedicated and disposable sampling tube. Non-disposable sampling equipment, including the interface probe and flexible pump tubing was decontaminated by washing in a Decon90® solution and rinsing with water between samples.
Sample Collection and Storage	Groundwater samples were collected into laboratory-supplied bottles with the appropriate preservative for the analysis undertaken. The bottles were stored in an ice-filled esky in the field and in transit to the laboratory.
Chain of Custody	Groundwater samples were dispatched to the laboratory under chain of custody conditions.

3.4 Data Quality Objectives

Data quality objectives (DQOs) are outlined in **Table 3-2.**

Table 3-2: Data Quality Objectives

DQO	Outcome
State the Problem	To collect on-going monitoring data from a network of wells to understand the temporal and spatial behaviour of the aquifer in the area of leachate impacted groundwater.
Identify the Decision	• Is the data collected from the monitoring well network of sufficient quality to meet the project objectives? • Is the data collected from the monitoring well network of sufficient quality to be comparable between events?
Identify Inputs to the Decision	• Record physico-chemical parameters and collect samples from the groundwater monitoring well network (see **Figure 2, Appendix 1**) over four quarterly GMEs; • Complete analysis of collected groundwater samples for soluble fluoride, total and free cyanide, total and dissolved aluminium; and • Analyse the data and compare with historical results.
Define the Study Boundaries	AEC 1 identified in **Figure 1**, **Appendix 1** plus the surface water receptors identified down gradient of AEC 1, including a semi-permanent dam and Swamp Creek. The investigation relates to groundwater.
Develop a Decision Rule	The statistical parameters of interest are the concentrations of the fluoride, cyanide, aluminium, pH and EC identified historically and in the current investigations. The Assessment Criteria outlined in **Section 5** and the historical groundwater concentrations where available for the monitoring wells. The Decision Rules for groundwater are: • Groundwater concentrations were assessed against the acceptance criteria outlined in **Section 5** in combination with a comparison against background criteria where applicable. An evaluation of significance was also undertaken; and • Recommendations were made for further evaluation for concentrations above criteria or background concentrations.
Specify Limits on Decision Errors	As this investigation involves a series of GMEs to monitor the state of a groundwater leachate plume, decision errors relate to the comparability of data between monitoring events. As such, all 29 wells should be sampled during each GME, unless wells are found to be dry. Standard operating procedures, including consistent use of low flow techniques, should be implemented to ensure comparability of data between events. The same primary and secondary laboratories should be used for analysis and laboratory QA/QC should be assessed to ensure comparability between events.
Optimise the Design for Obtaining Data	Low flow sampling techniques will be used to collect groundwater samples to optimise the quality of the samples. Field samples for each round were collected using the same sampling procedures to ensure comparability between GMEs.

3.5 Data Quality Indicators

Project data quality indicators (DQI) have been established to set acceptance limits on field and laboratory data collected as part of the quarterly groundwater monitoring program. The data quality indicators are outlined in **Table 3-3.**

Table 3-3: Data Quality Indicators

DQI	Field	Laboratory
Completeness – a measure of the amount of useable data from a data collection activity	All critical locations sampled. All samples collected, aside from dry wells. Experienced sampler. Documentation correct.	All critical samples analysed. All analysis completed according to standard operating procedures. Appropriate methods Appropriate Practical Quantitation Limits (PQLs).
Comparability – the confidence that data may be considered to be equivalent for each sampling and analytical event	Experienced sampler. Climatic conditions appropriate for the type of analyte. Climatic conditions noted during sampling. Same types of samples collected using same sampling methods.	Same analytical methods used. Same sample PQLs. Same NATA accredited laboratories used. Same units.
Representativeness – the confidence that data are representative of each medium present on site.	Appropriate media sampled. Groundwater sampled following stabilisation of physico-chemical parameters	All samples analysed according to standard operating procedures.
Precision – a quantitative measure of the variability of the data.	Collection of intra-laboratory duplicates at a rate of 1 in 10 primary samples. Collection of inter-laboratory duplicate samples at a rate of 1 in 20 primary samples.	Analysis of field duplicate samples, relative percent difference (RPDs) to be less than 30%. Laboratory duplicates analysed, RPDs to be less than 30%.
Accuracy – a quantitative measure of the closeness of the reported data to the "true" value.	Sampling methodologies appropriate and complied with. Collection of rinsate samples from non-disposable sampling equipment.	Analysis of: Rinsate blanks Method blanks Matrix spikes Surrogate spikes Laboratory control samples Reagent blanks. Results for blank samples to be non-detect. Results for spike samples to be between 70% and 130%.

4. QUALITY ASSURANCE / QUALITY CONTROL

Four quarterly groundwater monitoring events were completed in March 2019, June 2019, September 2019 and December 2019. A quality assurance/quality control assessment is provided in **Table 4-1** and **Table 4-2**.

Table 4-1: QA/QC Sampling and Analysis Methodology Assessment

Sampling Methodology	Ramboll Assessment
Sampling Pattern and Locations	Prior to the commencement of the GMEs, the leachate plume originating from the CWS was delineated through staged fieldwork and reporting in ENVIRON (2013) 'Plume Delineation Report, Alcan Mound'. From the delineation work, 19 new groundwater wells were installed along the length of the plume to assist with groundwater monitoring. The five sections are approximately 60 m apart and extend from the toe of the CWS to the leading edge of the leachate plume. Groundwater wells target both the shallow and deep aquifer. Groundwater wells located on five sections were selected for the 2019 GMEs. Each section provides a cross section of the leachate plume at different lengths along the known location of the plume. One of the wells, W3SA, was destroyed in the April 2015 storm and has not been replaced. Another well, W4D, was also damaged in this storm but was able to be sampled until the October 2016 GME. This well can no longer be sampled and has not been replaced. In 2016, an additional two shallow and deep pairs of wells (F5/G5 and G6/F6) were added to the monitoring network. These wells are located adjacent to Swamp Creek, the nearest surface water receptor.
Sampling Density	Twenty-nine groundwater wells were selected for sampling for the 2019 quarterly GMEs on five sections along the length of the leachate plume and adjacent to the nearest surface water receptor. As the leachate plume is approximately 300 m in length, there is one section per 60 m. One primary groundwater sample was collected from each well (unless dry).
Sample Depths	Both shallow groundwater (the leachate plume) and the deep aquifer were sampled as part of the 2019 quarterly GMEs.
Sample Collection Method	For the 2019 quarterly GMEs, groundwater samples were collected using low flow methods (peristaltic pump and LDPE tubing). Groundwater samples were collected directly into laboratory-supplied bottles. Disposable gloves were worn during sample collection.
Decontamination Procedures	Dedicated disposable tubing was used to collect the groundwater samples. A short piece of silicone tubing was retained in the peristaltic pump and used for all wells. This tubing along with all non-disposable sampling equipment (i.e. interface probe, water quality meter) was decontaminated between sampling locations by washing with a solution of Decon90® and potable water.
Sample Handling and Containers	Samples were placed into laboratory supplied sampling containers, dosed with the correct preservative (where relevant) and immediately placed into an eksy chilled with ice and/or ice bricks while in the field and during transportation to the laboratory.
Detailed Description of Field Screening Protocols	A water quality meter was used to collect field data, including temperature, pH, electrical conductivity, reduction/oxidation potential, total dissolved solids and dissolved oxygen. These parameters were recorded during purging until they stabilised, with subsequent readings within 10% of each other.
Chain of Custody	Samples were transported to the laboratory under chain of custody conditions. The chain of custody forms were signed by the laboratory on receipt of the samples.

Table 4-2: QA/Q Assessment

Data Quality Indicator	Ramboll Comments
Field Quality Control Samples	In general, intra-laboratory duplicate samples were analysed at a rate of 10% and inter-laboratory duplicate samples were analysed at a rate of 5% during the 2019 GMEs. At least one rinsate sample was collected per GME. A summary of the field quality control sampled collected during the 2019 GMEs is outlined below: • March 2019: two intra-laboratory duplicates (QA101, QA103), one inter-laboratory duplicate (QA102) and one rinsate (QC101); • June 2019: two intra-laboratory duplicates (QA101, QA102), one inter-laboratory duplicate (QA103) and one rinsate (R01); • September 2019: two intra-laboratory duplicates (QA101, QA102), one inter-laboratory duplicate (QA103) and one rinsate (QC101); • December 2019: two intra-laboratory duplicates (QA101, QA102), one inter-laboratory duplicate (QA103) and one rinsate (QC101).
Field Quality Control Results	Intra-laboratory and inter-laboratory duplicate results for each GME are presented in **Table M**, **Appendix 3**. Relative percentage differences (RPDs) were calculated for intra-laboratory and inter-laboratory duplicate pairs of samples. For the assessment of RPDs, it is noted that concentrations close to the practical quantitation limit (PQL) will have higher RPDs. As such, a range of RPDs were considered as requiring further assessment as follows: • Intra-laboratory RPD <50 and inter-laboratory RPD of <60 where both sample results exceed ten times the PQL • Intra-laboratory RPD <75 and inter-laboratory RPD of <85 where both sample results are within five to ten times the PQL • Intra-laboratory RPD <100 and inter-laboratory RPD of <100 where both sample results are within two to five times the PQL Assessment of duplicate performance identified no RPDs outside the acceptance range. Rinsate sample results were all reported at less than the limit of reporting (<LOR) for the four 2019 GMEs.
Equipment Calibration	The water quality meter was calibrated prior to hire. Standard practice it to rely on pre-calibration for short sampling periods. Calibration certificates were provided by the hire company and are included in **Appendix 6**.
NATA registered laboratory and NATA endorsed methods	Envirolab was the primary analytical laboratory and ALS was used as the secondary laboratory. The laboratory certificates are NATA stamped.
Analytical methods	Summary analytical methods were included in the laboratory test certificates.
Holding times	Review of the CoCs and laboratory certificates indicate that holding times were met.
Practical Quantitation Limits (PQLs)	PQLs for all groundwater analytes were below the assessment criteria.
Laboratory quality control samples	Laboratory quality control samples were undertaken by the laboratories at appropriate frequencies.
Laboratory quality control results	The results for laboratory duplicates and laboratory control samples were within the limit of reporting. The results for laboratory soil duplicates, laboratory control samples, matrix spikes and surrogates were acceptable, noting that reporting of percentage recovery was not possible in some samples over the four quarters due to high concentrations of elements in the samples however, an acceptable recovery was obtained for the Laboratory Control Sample (LCS).

Ramboll makes the following conclusions regarding the DQIs:

- Completeness: The data for the 2019 GMEs is considered to be complete as the selected 29 groundwater wells were located and dipped for depth to groundwater during each GME and groundwater samples were collected from wells containing sufficient water to sample. Dry wells were not able to be sampled.

- Comparability: The groundwater data collected during the four 2019 GMEs is considered to be comparable to previous results as the sampling protocols, analysis methods, quality control methods and monitoring well locations are consistent between sampling events and with prior events. The four 2019 GMEs were completed by the same sampler, Jordyn Kirsch, a Ramboll environmental scientist.
- Representativeness: The selection of shallow and deep wells on sections along the length of the leachate plume is considered to provide data that is representative of the leachate plume in shallow groundwater and representative of the underlying deep aquifer. Groundwater was sampled following purging to ensure groundwater samples are representative of the aquifer sampled.
- Precision: In the field, Ramboll achieved precision by using standard operating procedures for the collection of groundwater samples and by collecting duplicate and triplicate samples for analysis. Relative percent difference (RPD) results for duplicate samples were acceptable. Laboratory quality control results indicate precision was achieved at the primary and secondary laboratories.
- Accuracy: In the field, Ramboll achieved accuracy by using Ramboll's standard operating procedures for the collection of groundwater samples. Laboratory quality control results indicate accuracy was achieved at the primary and secondary laboratories.

In general, the DQIs outlined above have been met and Ramboll considers that the data is of suitable quality to meet the project objectives.

5. ASSESSMENT CRITERIA

5.1 Groundwater Assessment Criteria

The assessment criteria adopted for the assessment of groundwater contamination were sourced from the following references:

- NSW DEC (2007) Guidelines for the Assessment and Management of Groundwater Contamination;
- ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality;
- ANZG (2018) Guidelines for Fresh and Marine Water Quality; and
- ENVIRON (March 2013) Tier 2 Ecological Risk Assessment, Kurri Kurri Aluminium Smelter.

5.2 Potential Beneficial Uses

NSW DEC (2007) indicates that for assessing groundwater quality, it is first necessary to assess the beneficial uses of groundwater and surface water down gradient of the site.

The closest surface water receptor to the site is a dam and then Swamp Creek located approximately 1.5 km to the north-east of the site within an area of the buffer zone used for farming. This drainage area discharges into Wentworth Swamp, which in turn discharges to the Hunter River approximately 15 km north-east of the site near Maitland.

Surface water acidity/alkalinity within the Swamp Creek is described as generally neutral with pH ranging between 7.0 and 7.8 and conductivity is generally fresh, ranging from 626 µS/cm to 1,520 µS/cm. This surface water body is considered to be a freshwater receptor.

Groundwater is expected to follow a subsurface drainage line through a sand filled channel and flow north east towards Swamp Creek. Water level gauging completed during previous investigations confirmed the groundwater flow direction to the north east.

According to the Office of Industry and Investment, NSW, there are 17 licensed groundwater abstractions (bores) located within the site, which are known to be associated with monitoring of groundwater impact. There are no other licensed groundwater bores within 2 km of the site.

Potential beneficial uses of groundwater down gradient of the site include:

- Discharge into Swamp Creek, which supports aquatic ecosystems, is used for recreational fishing and flows into Wentworth Swamp, which potentially flows into the Hunter River; and
- Extraction of water from Swamp Creek may also be used for stock watering and/ or irrigation.

Drinking water has not been included as a potential beneficial use of water from Swamp Creek for the following reasons:

- Drinking water supply to the local communities is reticulated and originates from Chichester Dam on the Chichester River; and
- The Kurri Wastewater Treatment Works is located up gradient of the site. The works has a licensed discharge point into Swamp Creek.

5.3 Appropriate Criteria for Groundwater

Based on the review of potential beneficial uses of groundwater and surface water within the closest receptor, the criteria for protection of aquatic ecosystems, irrigation, stock watering and recreational use will be used.

The investigation levels presented in ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality are considered applicable for the protection of aquatic ecosystems of receiving waters. ANZG (2018) advocates a site-specific approach to developing guideline trigger values based on such factors as local biological affects data and the current levels of disturbance of the ecosystem. The guidelines present 'low risk trigger values' which are defined as concentrations of key performance parameters below which there is a low risk of adverse biological effects. If these trigger values are exceeded, then further action is required which may include further site-specific investigations to assess potential contamination or management and remedial actions.

Low risk trigger values are presented in ANZG (2018) for the protection of 80-99% of species in fresh and marine waters, with trigger values depending on the health of the receiving waters.

Groundwater results will be compared against trigger values for the protection of 95% of freshwater species. A 95% protection of freshwater species was selected due to the indication from the Hunter Catchment Management Trust that declining stream water quality and a reduction in diversity of native plants and animals has occurred in the last ten years.

A guideline for fluoride that is protective of the environment has not been developed in Australia.

A summary of the assessment criteria for groundwater is presented in **Table 5-1**.

Table 5-1: Groundwater Assessment Criteria

Contaminant	95% Protection for Aquatic Ecosystems	Irrigation	Stock Watering	Recreational
Aluminium (mg/L)	0.055	5	5	9
Fluoride (mg/L)	No guideline	1	2	1.5
Free Cyanide (mg/L)	0.007	No guideline	No guideline	0.1
pH (pH Units)	6.5 - 8**	No guideline	No guideline	5 - 9
Electrical Conductivity (µS/cm)	No guideline	4,500 – 7,700*** >12,200****	No guideline	No guideline

** Values for lowland rivers from Table 3.3.2 in ANZECC (2000).
*** Values for tolerant crops from Table 4.2.4 in ANZECC (2000).
**** Value from Table 4.2.4 in ANZECC (2000) for where electrical conductivity is 'generally too saline' for plant growth.

6. TREND ANALYSIS JULY 2013 TO DECEMBER 2018

Twenty-five groundwater monitoring events have been assessed as part of this trend analysis as presented in **Table 6-1**.

Table 6-1: Quarterly Groundwater Monitoring Events

GME	Date	Sample Type
1	July 2013	Field parameters, soluble fluoride, total aluminium, total cyanide
2	November 2013	Field parameters, soluble fluoride, total aluminium, total cyanide
3	February 2014	Field parameters, soluble fluoride, total aluminium, total cyanide
4	July 2014	Field parameters, soluble fluoride, total aluminium, total cyanide
5	November 2014	Field parameters, soluble fluoride, total aluminium, total cyanide
6	February 2015	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
7	June 2015	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
8	September 2015	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
9	December 2015	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
10	April 2016	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
11	July 2016	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
12	October 2016	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
13	December 2016	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
14	March 2017	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
15	June 2017	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
16	September 2017	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
17	December 2017	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
18	March 2018	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide
19	June 2018	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide, dissolved aluminium
20	September 2018	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide, dissolved aluminium
21	December 2018	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide, dissolved aluminium
22	March 2019	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide, dissolved aluminium
23	June 2019	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide, dissolved aluminium
24	September 2019	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide, dissolved aluminium
25	December 2019	Field parameters, soluble fluoride, total aluminium, total cyanide, free cyanide, dissolved aluminium

The following parameters have been assessed in the following sections:

- Section 6.1: Shallow aquifer – groundwater elevation and flow direction;
- Section 6.2: Shallow aquifer - pH levels;
- Section 6.3: Shallow aquifer - key chemical concentrations;
- Section 6.4: Deep aquifer - groundwater elevation and flow direction;
- Section 0: Deep aquifer – pH levels; and
- Section 6.6: Deep aquifer – key chemical concentrations.

A summary of groundwater elevation, pH and laboratory results for the past twenty-five GMEs, including the four quarterly GMEs from 2019 are included in **Appendix 3**. Groundwater field parameter forms are included in **Appendix 4**, laboratory reports are included in **Appendix 5** and calibration certificates for the groundwater quality meter are included in **Appendix 6**.

The identified contaminants of concern associated with the leachate are fluoride, cyanide and aluminium. Fluoride has been selected as the primary contaminant of concern as a result of its persistence observed in groundwater and its concentration range in comparison with the adopted guideline criteria. Aluminium was not selected due to its ubiquity in the environment generally.

6.1 Shallow Aquifer – Groundwater Elevation and Flow Direction

Groundwater elevation for the shallow wells between July 2013 and December 2019 are included in **Figure 6-1.**

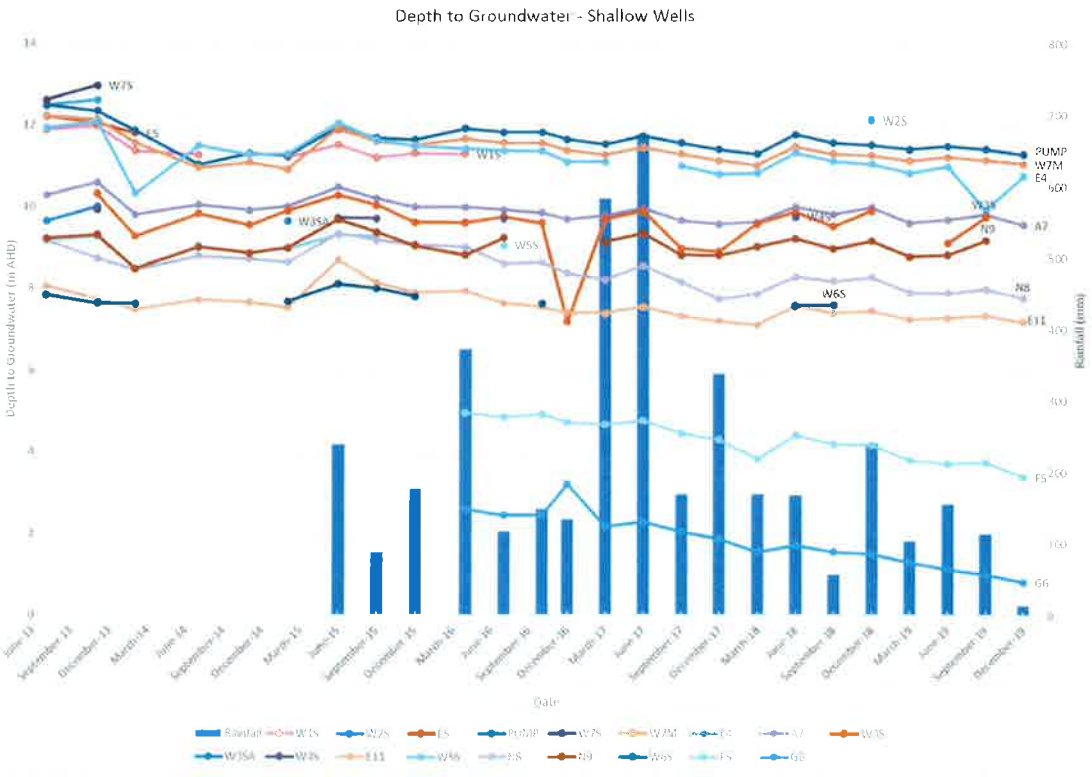

Figure 6-1: Groundwater Elevation - Shallow Wells

Groundwater levels within the shallow aquifer have generally decreased between June 2015 and December 2019, particularly at F5 and G6 which have decreased by 1.56 and 1.78 m respectively between April 2016 and December 2019.

Rainfall appears to have a influence on groundwater levels in the shallow aquifer with most wells reporting an increase in groundwater level following heavy rainfall between March and June 2017 (674.5 mm). Similarly, a decrease in groundwater level was reported in majority of the shallow wells following a significant reduction in rainfall between September and December 2019 (13.8 mm).

Interpreted groundwater flow directions in the shallow aquifer for 2019 are shown in **Figure 6-2**. Historical groundwater flow directions for 2013 to 2018 are included in **Appendix 7**.

Groundwater flow in the shallow aquifer is generally to the north and north east and has remained relatively consistent since the first GME in July 2013.

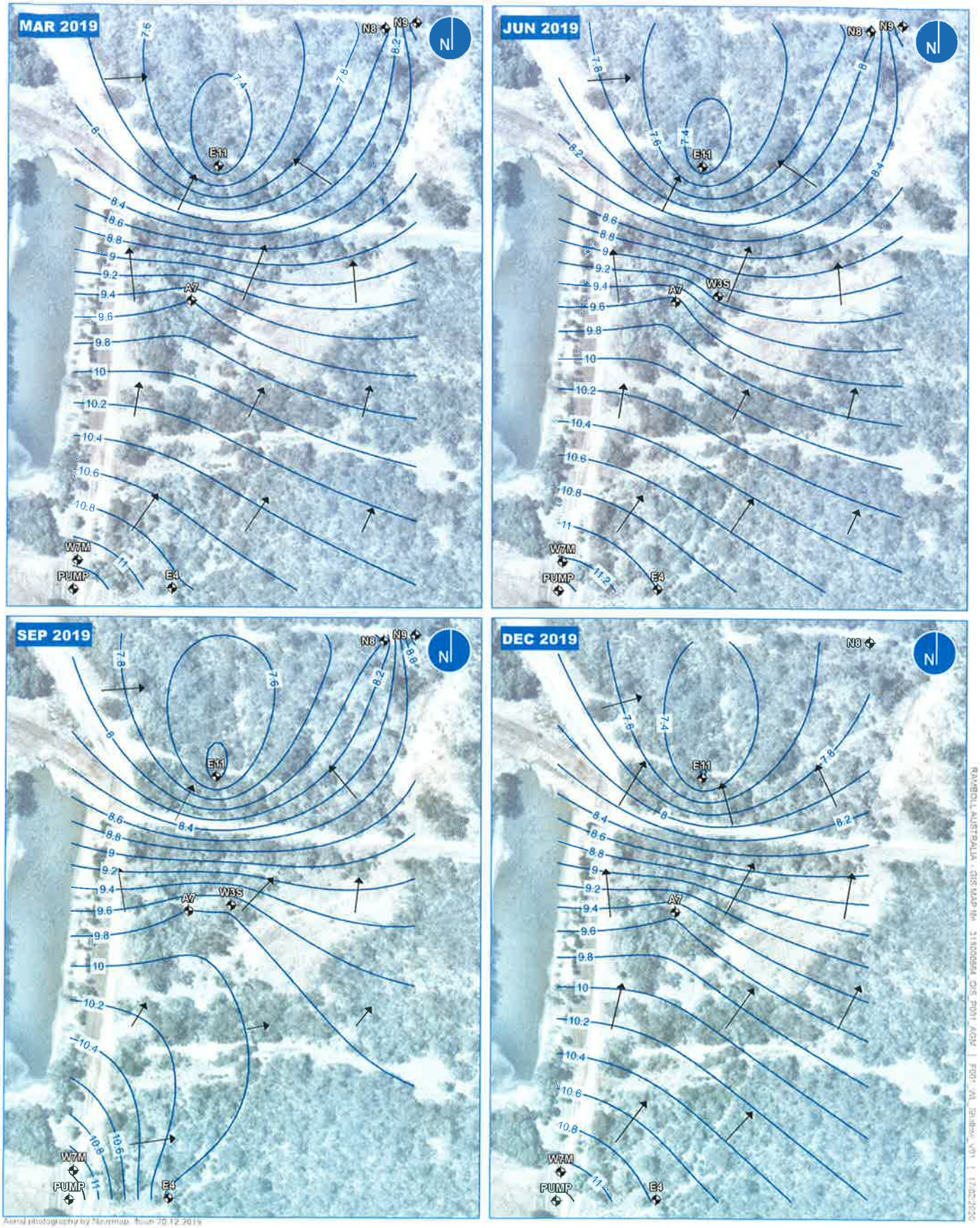

Figure 6-2: Water Level Contours and Flow Direction – Shallow Wells 2019

6.2 Shallow Aquifer – pH

Comparison of pH values for the twenty-five GMEs completed between July 2013 and December 2019 are shown in **Figure 6-3**. Anomalous pH levels were recorded at wells Pump, W7M, E11, N8, N9 and G5 during the September 2018 GME. The recorded pH values were high compared to previous rounds and pH levels in December 2018 returned to usual values. The anomalous pH levels were not included for comparison.

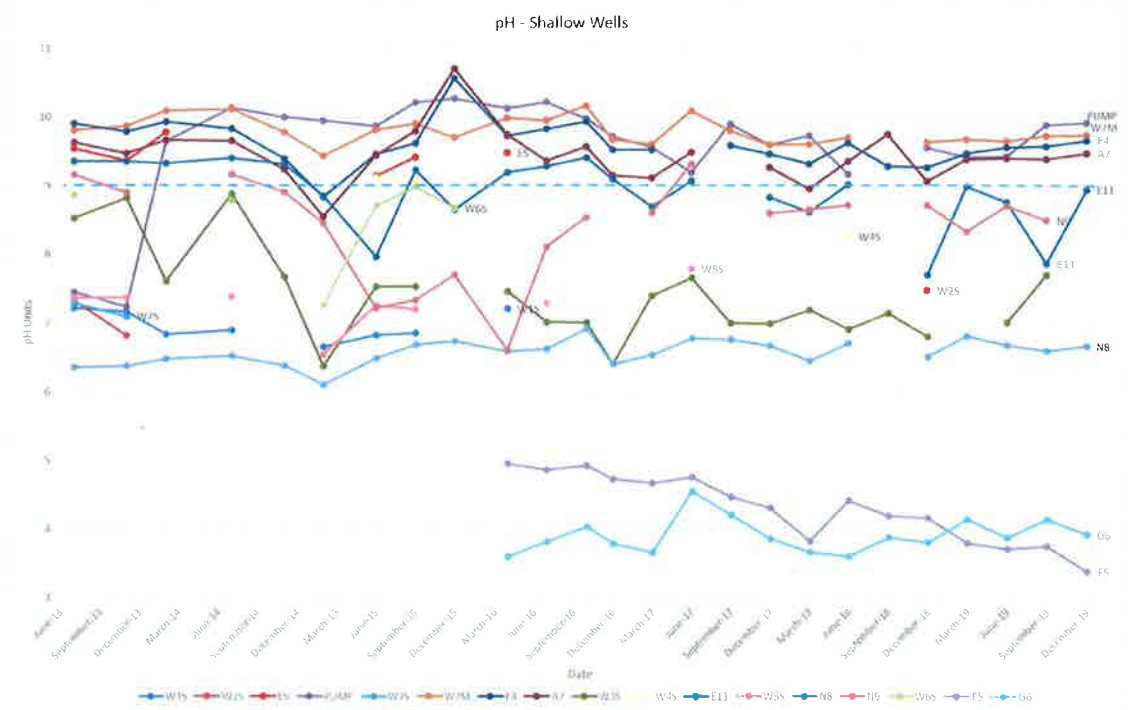

Figure 6-3: pH - Shallow Wells (blue dashed line trigger value for leachate impacted groundwater (pH>9))

Groundwater pH results for Section 1 shallow wells show consistent trends over the past five years. PUMP, located directly adjacent the CWS to the east, increased from pH 7.45 in July 2013 to pH 10.14 in July 2014 before subsequently decreasing to pH 9.93 in December 2019. pH at Section 1 wells W7M and PUMP have exceeded the assessment criteria since January 2013 and February 2014, respectively with pH values characteristic of leachate impacted groundwater.

Section 2 well E4 increased from pH 9.91 in July 2013 to pH 10.57 in December 2015 before subsequently decreasing to pH 9.67 in December 2019. pH values at E4 exceed site assessment criteria and are characteristic of leachate impacted groundwater.

Section 3 well W3S shows an overall decrease from pH 8.53 in July 2013 to pH 7.70 in December 2019 and currently falls below site assessment criteria. In contrast, Section 3 well A7 increased from pH 9.63 in July 2013 to pH 10.71 in December 2015 before subsequently decreasing to pH 9.48 in December 2019. pH values at A7 exceed site assessment criteria and are characteristic of leachate impacted groundwater.

Section 4 well E11 has shown an overall decrease from pH 9.36 in July 2013 to pH 8.95 in December 2019. pH at E11 currently exceeds site assessment criteria for 95% Protection for Aquatic Ecosystems but generally falls below the trigger value for leachate impacted groundwater (pH 9).

Section 5 well N9 has shown varying pH since July 2013, with values fluctuating above and below the assessment criteria. During December 2019, pH at N9 exceeded the assessment criteria for 95% Protection for Aquatic Ecosystems but did not exhibit pH values characteristic of leachate impacted groundwater. pH at Section 5 well N8 has remained consistent since July 2013 with values generally falling between pH 6 and pH 7. In December 2019, pH at N8 was 6.67, below the assessment criteria and below the trigger value for leachate impacted groundwater (pH 9).

The lateral extent of high pH impacted groundwater in the shallow aquifer during 2019 is presented in **Figure 6-4**.

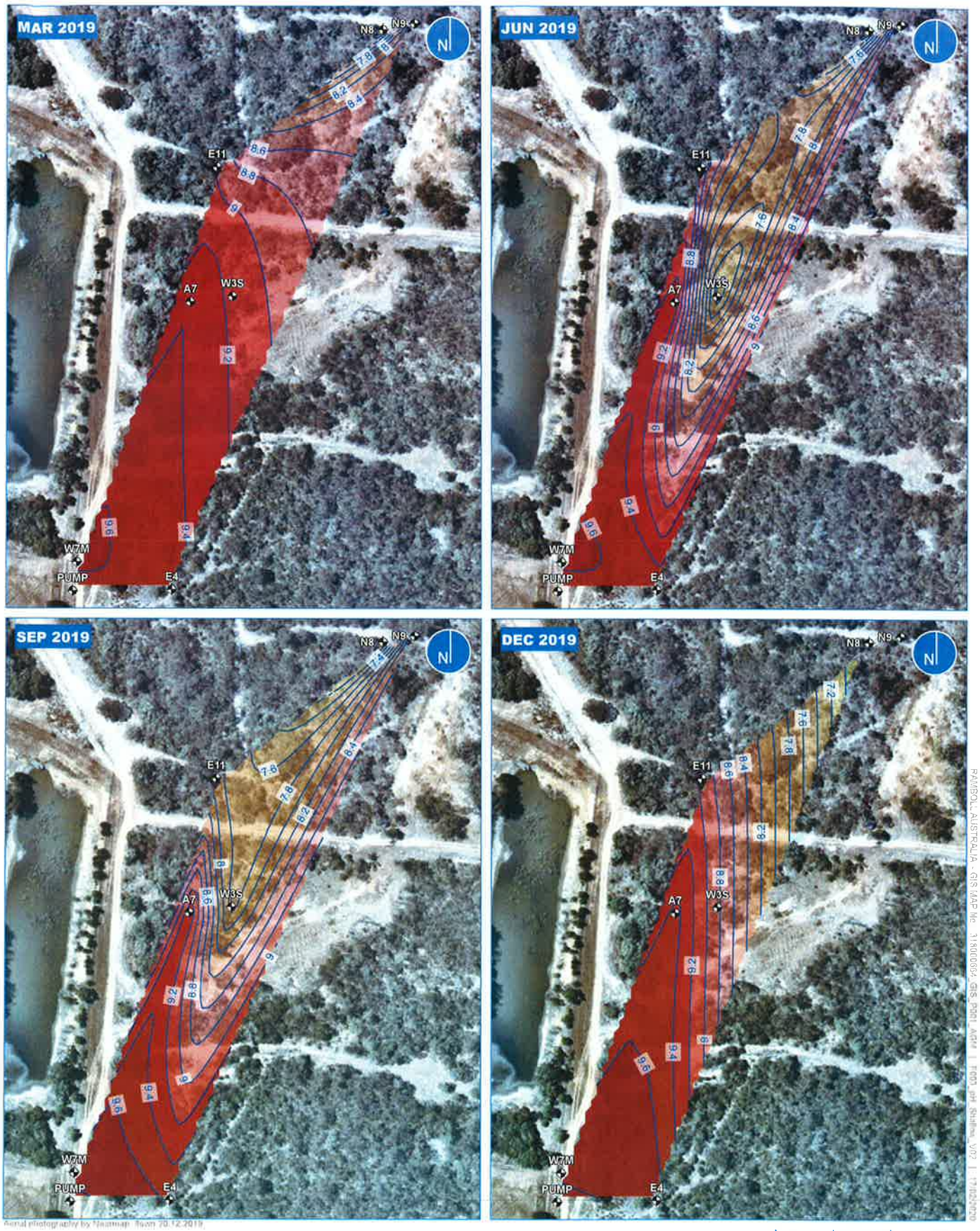

Figure 6-4: pH – Shallow Wells 2019

Mann-Kendall trend analysis was employed to statistically assess each of the shallow monitoring locations to determine increasing, stable or decreasing levels of pH, soluble fluoride and free cyanide. Trend analysis was carried out using the GSI Environmental Mann-Kendall Toolkit (GSI 2012). The outputs from the Mann-Kendall Toolkit are provided in **Appendix 8**.

Data from July 2013 to December 2019 (25 sampling events) were included for the purpose of Mann-Kendall trend analysis of pH, a summary is provided in **Table 6-2**.

Table 6-2: Mann-Kendall pH Trends in Shallow Wells

Section	Well	Previous Trend 2013 to 2018	Current Trend 2013 to 2019	pH >Assessment Criteria	Leachate Impacted
1	PUMP	Stable	Stable	**Yes**	**Yes**
1	W7M	Prob. Decreasing	**Decreasing**	**Yes**	**Yes**
2	E4	**Decreasing**	**Decreasing**	**Yes**	**Yes**
3	W3S	**Decreasing**	**Decreasing**	No	No
3	A7	Prob. Decreasing	Stable	**Yes**	**Yes**
4	E11	**Decreasing**	**Decreasing**	**Yes[1]**	No
5	N8	**Increasing**	**Increasing**	No	No
5	N9	No trend	Stable	**Yes[2]**	No
NA	F5	Prob. Decreasing	Prob. Decreasing	No	No
NA	G6	Stable	No Trend	No	No

Note: Leachate impacted wells exhibit a pH >9. Anomalous pH levels recorded at wells Pump, W7M, E11, N8, N9 and G5 during the September 2018 GME were not included in the Mann-Kendall analysis.
NA Not Applicable
[1] 95% Protection of Aquatic Ecosystems - March, June, December 2019 only
[2] 95% Protection of Aquatic Ecosystems - June and September 2019 only

Mann-Kendall pH trend analysis of shallow wells indicates an increasing trend at N8, located on Section 5. pH values at N8 remain low compared to wells that contain leachate. Further, the increasing trend appears marginal, with pH increasing from pH 6.36 in July 2013 to pH 6.67 in December 2019 (refer **Figure 6-3**).

Mann-Kendall trend analysis of pH in shallow wells at Section 1, 2, 3 and 4 show either 'stable' or 'decreasing' trends.

6.3 Shallow Aquifer – Key Chemical Concentrations

6.3.1 Soluble Fluoride

Comparison of soluble fluoride concentrations for the twenty-five GMEs completed between July 2013 and December 2019 are shown in **Figure 6-5**.

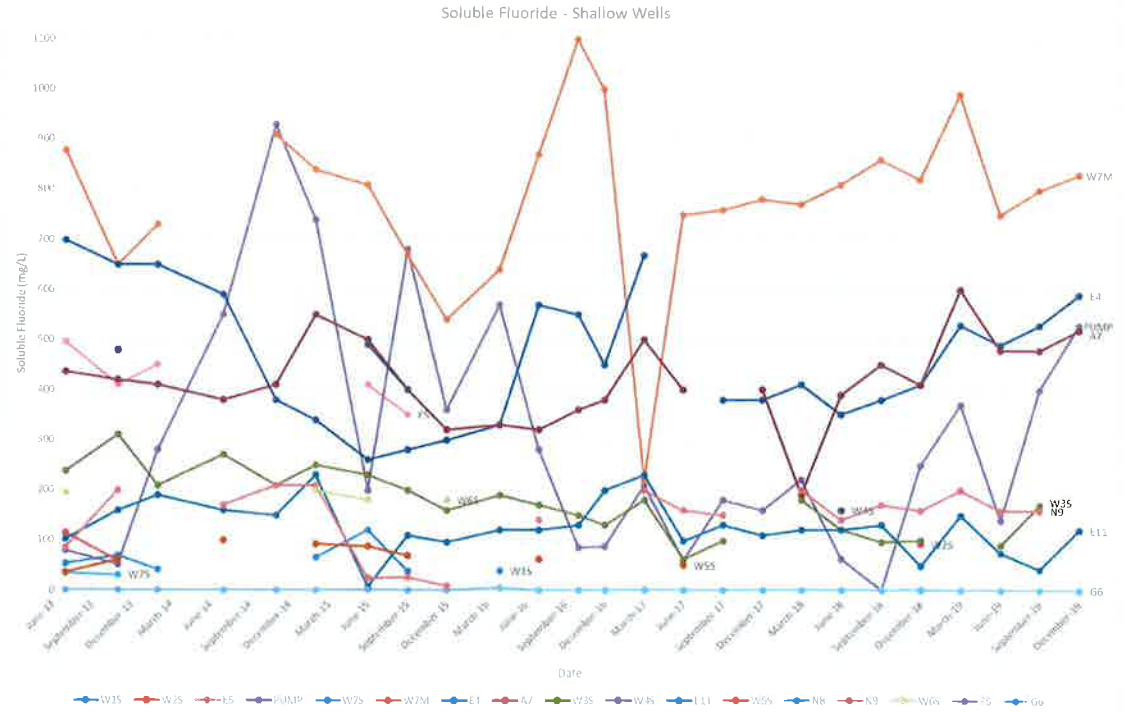

Figure 6-5: Soluble Fluoride Concentrations - Shallow Wells (mg/L)

Soluble fluoride concentrations within the shallow aquifer show varying concentrations between July 2013 and December 2019.

During 2019, soluble fluoride concentrations exceeded site assessment criteria at Section 1 (PUMP, W7M), Section 2 (E4), Section 3 (A7, W3S) and Section 4 (E11). Of the six wells that exceeded site assessment criteria, four wells (PUMP, W7M, E4 and A7) reported pH values characteristic of leachate impacted groundwater.

Wells F5 and G6, located adjacent to the nearest surface water receptor (Swamp Creek), have consistently reported fluoride concentrations below 1 mg/L, indicating no impact from the leachate plume.

The migration of fluoride longitudinally along the length of the plume can be assessed by looking at fluoride concentrations in the shallow wells on each section from Section 1 to Section 5. Analysis of the most recent data from December 2019 indicates that on the western edge of the plume, the highest fluoride concentration is at well A7 (520 mg/L) on Section 3. To the north of Section 3, the fluoride concentration in well E11 was 120 mg/L. On the eastern edge of the plume, the highest fluoride concentration is in well E4 (590 mg/L) on Section 2. To the north of Section 2, wells W3S, W5S and N9 were dry.

The lateral extent of soluble fluoride in the shallow aquifer for the previous four monitoring events (March, June, September and December 2019) is presented in **Figure 6-6.**

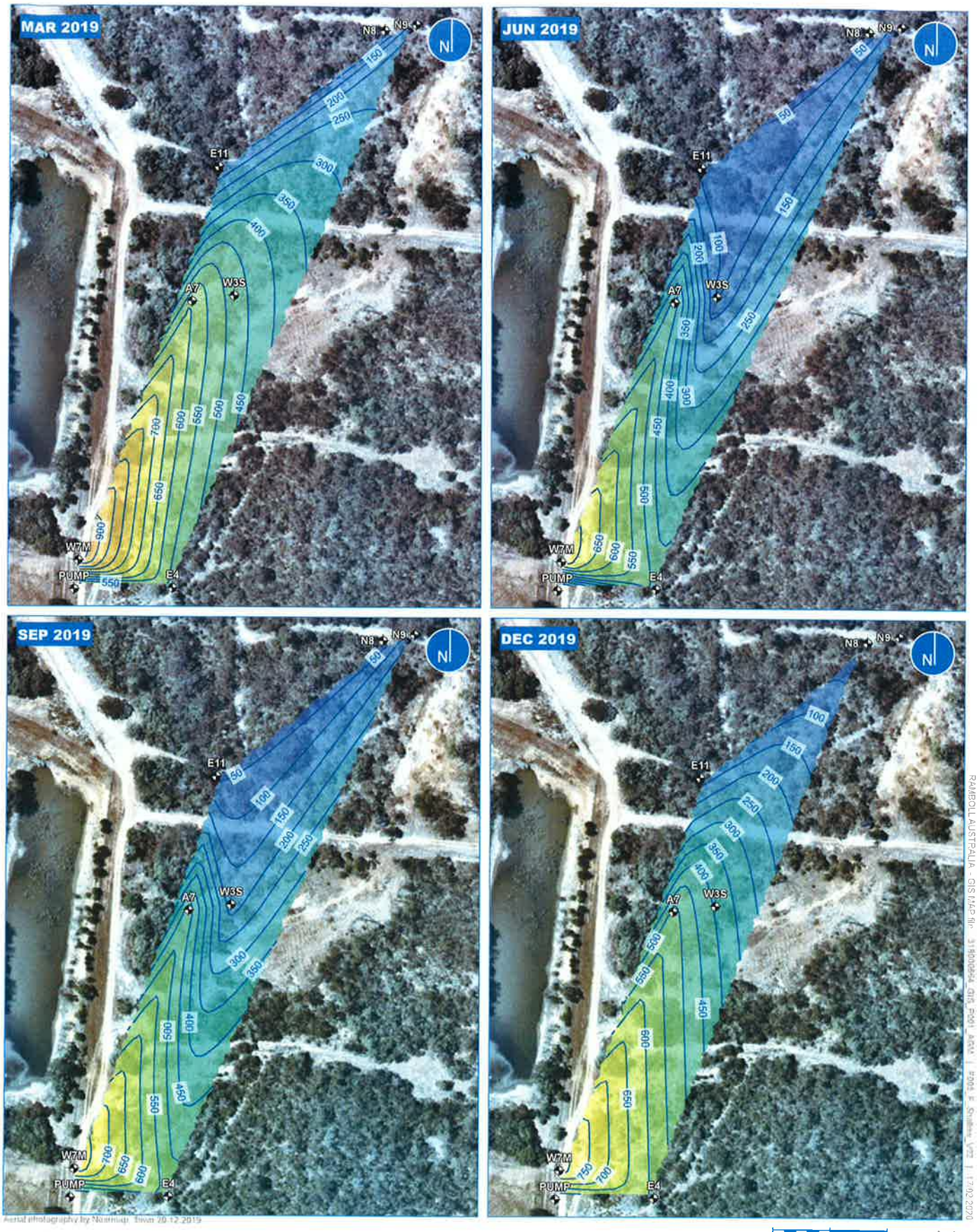

Figure 6-6: Soluble Fluoride – Shallow Wells 2019

Data from July 2013 to December 2019 (25 sampling events) were included for the purpose of Mann-Kendall trend analysis of soluble fluoride, a summary is provided in **Table 6-3**.

Table 6-3: Mann-Kendall Trend Analysis of Soluble Fluoride in Shallow Wells

Section	Well	Previous Trend 2013 to 2018	Current Trend 2013 to 2019	Soluble Fluoride >Assessment Criteria	Leachate Impacted
1	PUMP	Stable	Stable	**Yes**	**Yes**
1	W7M	No trend	No Trend	**Yes**	**Yes**
2	E4	Stable	Stable	**Yes**	**Yes**
3	W3S	**Decreasing**	**Decreasing**	**Yes**	No
3	A7	Stable	No Trend	**Yes**	**Yes**
4	E11	Stable	Prob. Decreasing	**Yes**	No
5	N8	**Increasing**	**Increasing**	No	No
5	N9	Stable	No Trend	**Yes**	No
NA	F5	Stable	No Trend	No	No
NA	G6	Prob. Increasing	No Trend	No	No

NA Not Applicable

Mann-Kendall soluble fluoride trend analysis of shallow wells indicates an increasing trend at N8 only. Further review of soluble fluoride concentrations at N8 reveal the increase to be minor, from 0.27 mg/L in July 2013 to 0.4 mg/L in September 2019. Soluble fluoride concentrations subsequently decreased to 0.2 mg/L during December 2019. Soluble fluoride concentrations at N8 do not currently exceed the site assessment criteria and pH is not characteristic of leachate impacted groundwater.

6.3.2 Free Cyanide

Both total and free cyanide were included for analysis in the 2019 GMEs. Free cyanide was introduced for analysis in 2015, as there are no Australian guidelines for total cyanide. Comparison of free cyanide concentrations for twenty GMEs completed between February 2015 and December 2019 are shown in **Figure 6-7**.

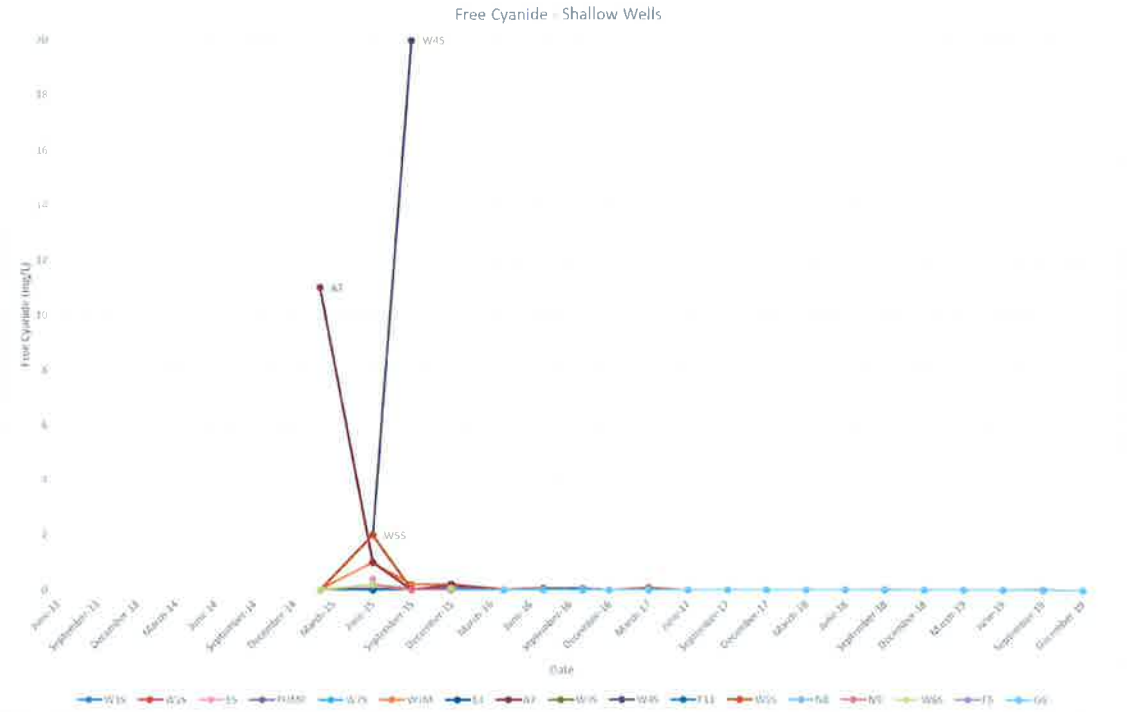

Figure 6-7: Free Cyanide Concentrations - Shallow Wells (mg/L)

During 2019, free cyanide concentrations exceeded site assessment criteria for 95% Protection for Aquatic Ecosystems at Section 1 (PUMP, W7M) and Section 3 (W3S). PUMP and W7M also exceeded site assessment criteria for soluble fluoride and reported pH values characteristic of leachate impacted groundwater.

Section 3 well W3S, does not exhibit pH values characteristic of leachate impact and exceeded site assessment criteria (95% Protection of Aquatic Ecosystems) during September only. W3S was dry during March and December 2019 and in June 2019 reported free cyanide concentrations <LOR.

Free cyanide concentrations did not exceed the recreational criteria of 0.1 mg/L in any of the wells during 2019.

Wells F5 and G6, located adjacent to the nearest surface water receptor (Swamp Creek), have consistently reported free cyanide concentrations <LOR, indicating no impact from the leachate plume.

Data from February 2015 to December 2019 (20 sampling events) were included for the purpose of Mann-Kendall trend analysis of free cyanide, a summary is provided in **Table 6-4**.

Table 6-4: Mann-Kendall Trend Analysis of Free Cyanide Trends - Shallow Wells

Section	Well	Previous Trend 2013 to 2018	Current Trend 2013 to 2019	Free Cyanide >Assessment Criteria	Leachate Impacted? (pH >9)
1	PUMP	**Decreasing**	**Decreasing**	**Yes[1]**	**Yes**
1	W7M	**Decreasing**	**Decreasing**	**Yes[1]**	**Yes**
2	E4	No trend	Prob. Decreasing	No	**Yes**
3	W3S	Stable	Stable	**Yes[2]**	No
3	A7	Prob. Decreasing	**Decreasing**	No	**Yes**
4	E11	No trend	No Trend	No	No
5	N8	Stable	Stable	No	No
5	N9	No trend	No Trend	No	No
NA	F5	Stable	Stable	No	No
NA	G6	Stable	Stable	No	No

[1]95% Protection for Aquatic Ecosystems
[2]95% Protection for Aquatic Ecosystems September only
NA Not Applicable

Mann-Kendall free cyanide trend analysis of shallow wells indicates no increasing trends.

Mann-Kendall trend analysis of free cyanide in shallow wells at Section 1 show 'decreasing' trends.

6.4 Deep Aquifer – Groundwater Elevation and Flow Direction

Comparison of groundwater elevation between the twenty-five GMEs completed between July 2013 GME and December 2019 is included in **Figure 6-8**.

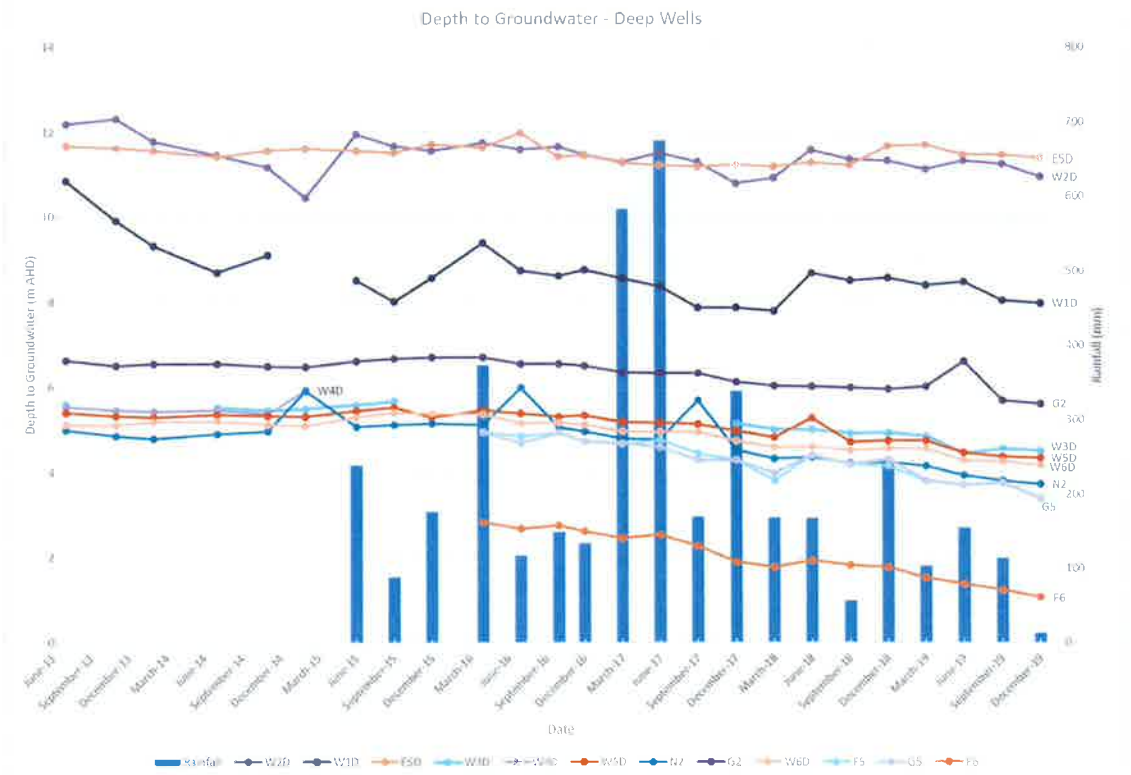

Figure 6-8: Groundwater Elevation - Deep Wells (m AHD)

Groundwater levels within the deep aquifer have generally decreased between July 2013 and December 2019, with the most significant decrease identified at Section 2 well W1D (2.86 m).

Rainfall appears to have some effect on groundwater levels though within the deep aquifer with minor decreasing trends identified in groundwater and rainfall from June 2017. Rainfall appears to have a delayed effect on groundwater levels in the deep aquifer with minimal change in groundwater levels immediately following heavy rainfall between March and June 2017.

Interpreted groundwater flow directions in the deep aquifer for 2019 are shown in **Figure 6-9**. Historical groundwater flow directions are included in **Appendix 7**.

Groundwater flow direction in the deep aquifer is consistently to the north east. The deep aquifer contours show little variation between June 2013 and December 2019. There is a consistent gradient from approximately 11 m bgs near E5D to approximately 6 m bgs near W4D, then the gradient shallows through the northern vegetation impact area.

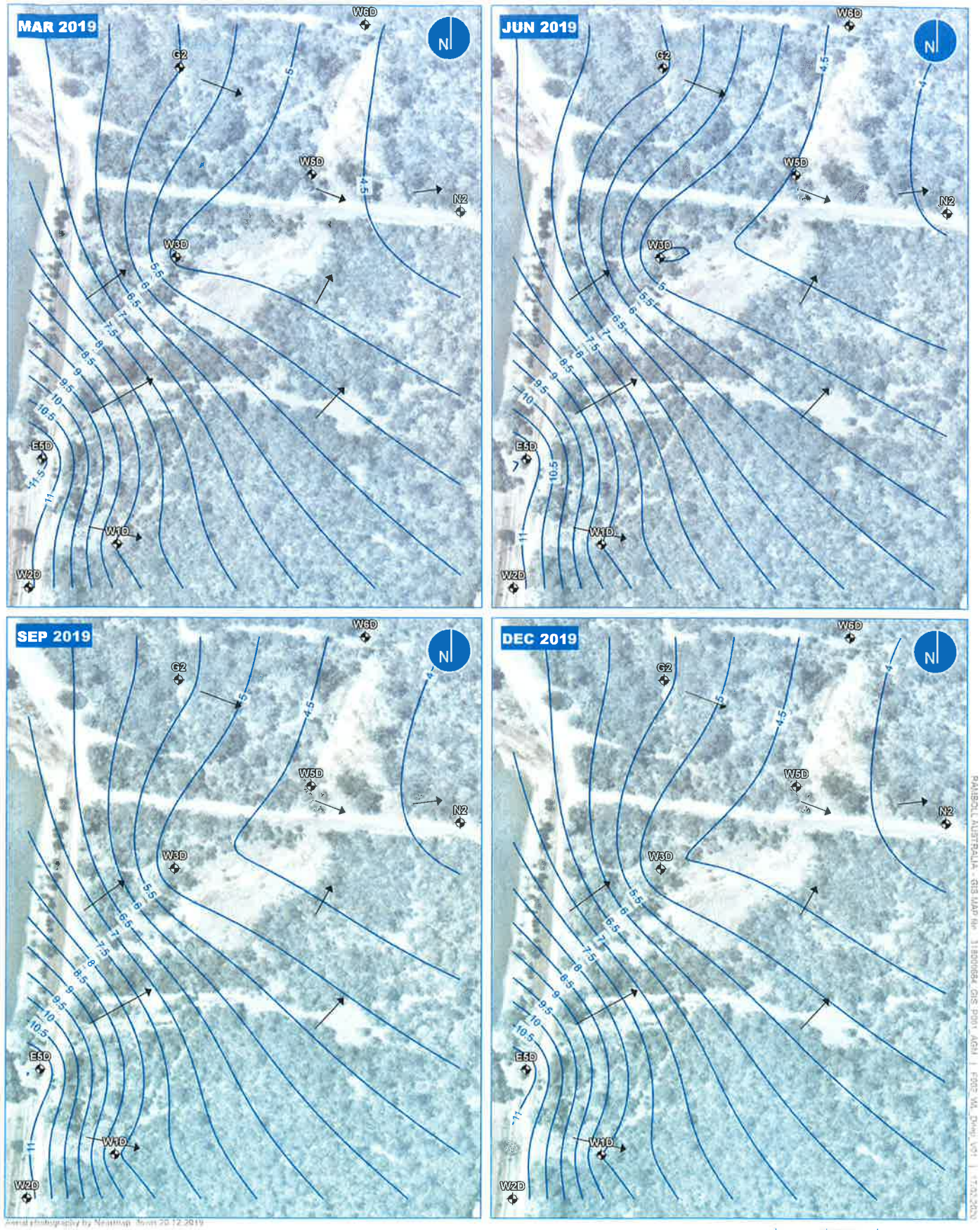

Figure 6-9: Water Level Contours and Flow Direction – Deep Wells 2019

6.5 Deep Aquifer – pH

Comparison of pH values for the twenty-five GMEs completed between July 2013 and December 2019 are shown in **Figure 6-10.** Wells E5D, W5D and W6D recorded pH levels greater than 9 during September 2018. The recorded pH values were high compared to previous rounds and pH levels in December 2018 returned to usual values. The anomalous pH levels were not included for comparison.

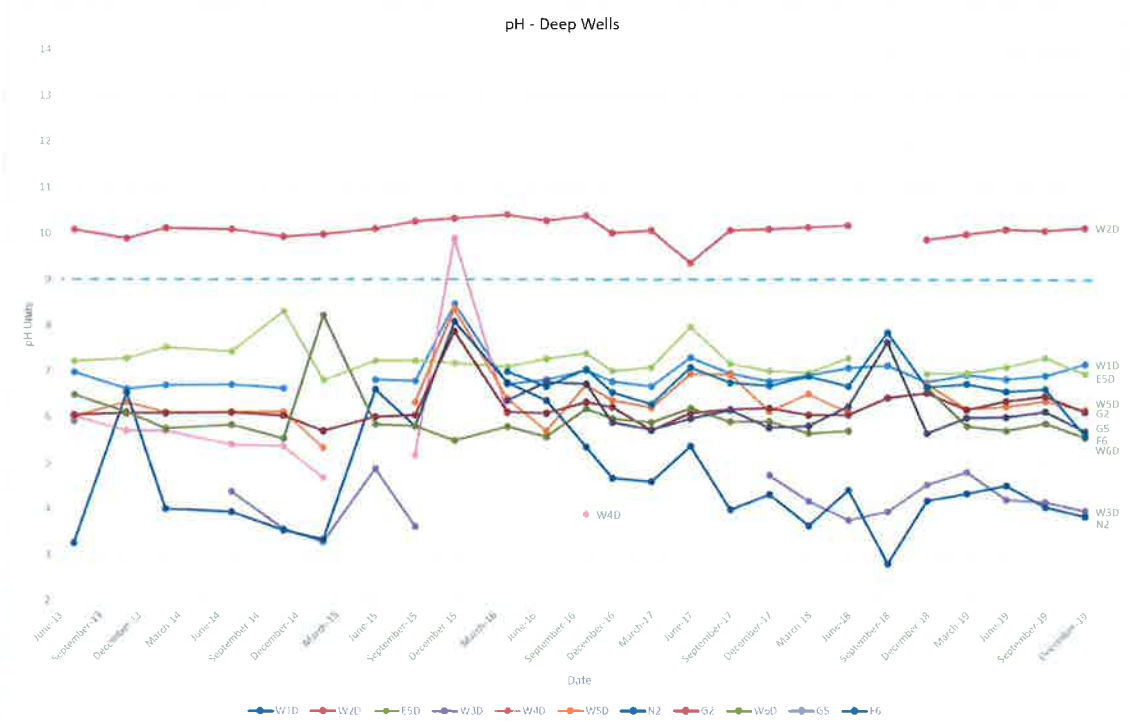

Figure 6-10: pH - Deep Wells (blue dotted line trigger value for leachate impacted groundwater (pH>9))

The deep aquifer has generally not been impacted by leachate with pH levels largely below 8, aside from W2D located on Section 1. The pH at W2D has consistently been greater than 9 indicating leachate impact.

The natural pH conditions in the deep aquifer are slightly acidic to neutral, with pH conditions generally within or below the trigger values for lowland rivers of 6.5 to 8 (ANZECC 2000).

pH values recorded in 2019 remain fairly consistent with previous years, noting a slight decrease in pH in majority of the deep wells between September and December 2019.

The lateral extent of high pH impacted groundwater in the deep aquifer during 2019 is presented in **Figure 6-11**.

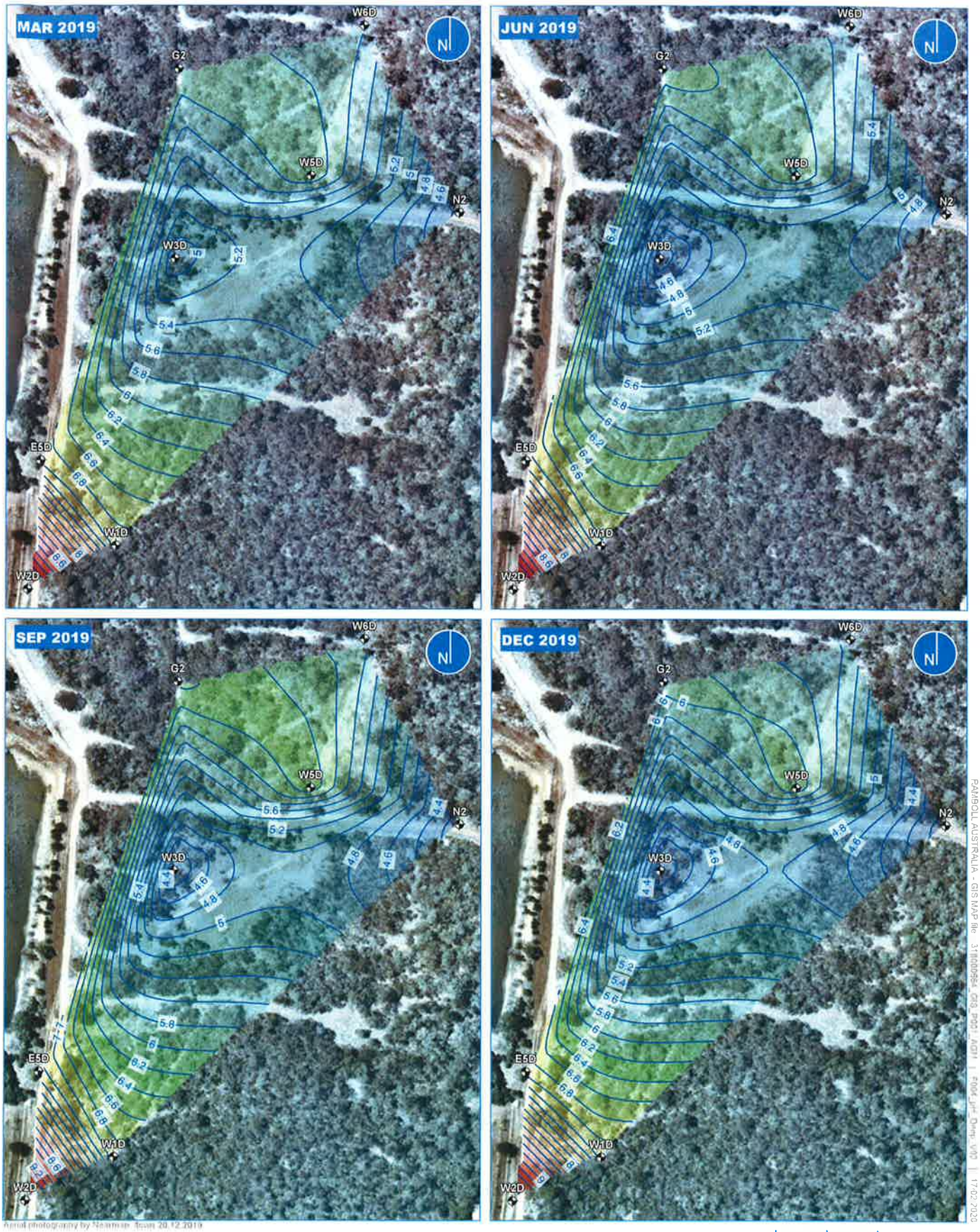

Figure 6-11: pH – Deep Wells 2019

Mann-Kendall trend analysis was employed to statistically assess each of the deep monitoring locations to determine increasing, stable or decreasing levels of pH, soluble fluoride and free cyanide. Trend analysis was carried out using the GSI Environmental Mann-Kendall Toolkit (GSI 2012). The outputs of the Mann-Kendall Toolkit are provided in **Appendix 8**.

Data from July 2013 to December 2019 (25 sampling events) were included for the purpose of Mann-Kendall trend analysis of pH, a summary is provided in

Table *6-5*.

Table 6-5: Mann-Kendall pH Trends - Deep Wells

Section	Well	Previous Trend 2013 to 2018	Current Trend 2013 to 2019	pH >Assessment Criteria	Leachate Impacted
1	W2D	No trend	No Trend	**Yes**	**Yes**
1/2	E5D	**Decreasing**	**Decreasing**	No	No
2	W1D	Stable	**Increasing**	No	No
3	W3D	Stable	Stable	No	No
3	~~W4D~~	Destroyed	Destroyed	Destroyed	Destroyed
4	W5D	**Increasing**	Prob. Increasing	No	No
4	N2	Stable	Stable	No	No
5	G2	**Increasing**	**Increasing**	No	No
5	W6D	No trend	Stable	No	No
NA	G5	**Decreasing**	Prob. Decreasing	No	No
NA	F6	Stable	Prob. Decreasing	No	No

NA Not Applicable

Mann-Kendall pH trend analysis of deep wells indicates an increasing trend at Section 2 (W1D) and Section 5 (G2). pH at W1D and G2 does not exceed site assessment criteria, nor is it characteristic of leachate impacted groundwater. Further assessment of pH at these locations identified a marginal increase in pH between July 2013 and December 2019 (0.18 pH units and 0.09 pH units respectively).

W2D, located on Section 1 reported 'no trend'. W2D is located directly adjacent to the CWS and is the only well targeting the deep aquifer that shows effect from the leachate plume.

6.6 Deep Aquifer – Key Chemical Concentrations

6.6.1 Soluble Fluoride

Comparison of soluble fluoride concentrations for the twenty-five GMEs completed between July 2013 and December 2019 are shown in **Figure 6-12** with concentrations for W2D only shown in **Figure 6-13**.

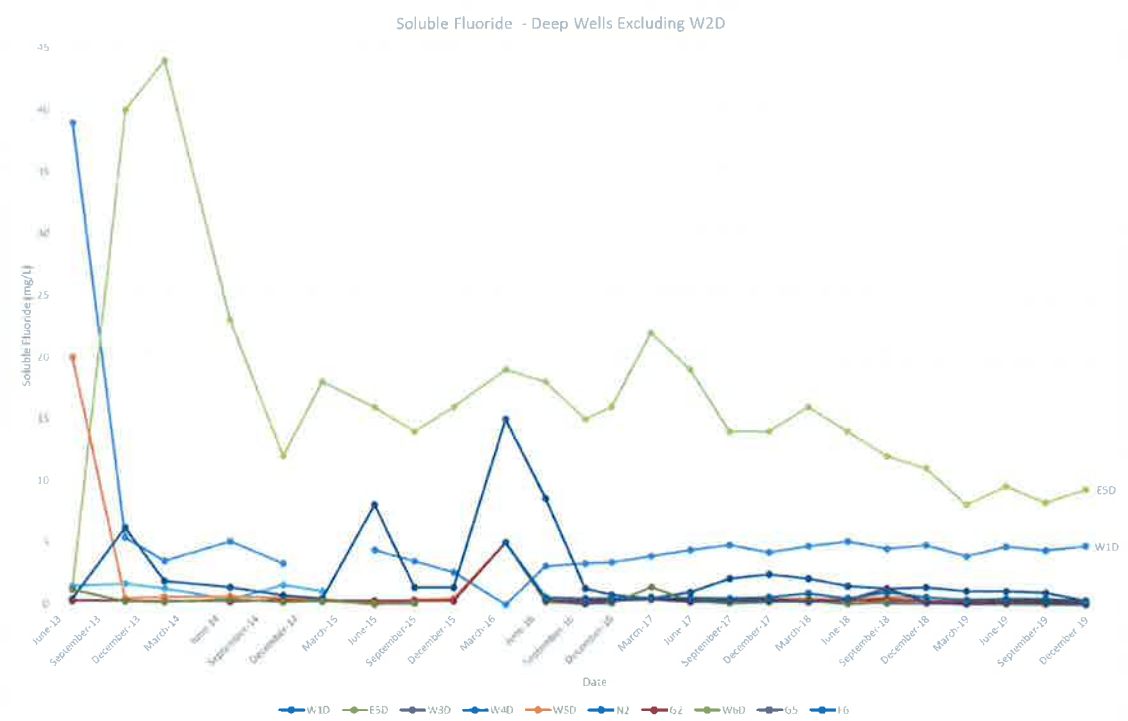

Figure 6-12: Soluble Fluoride - Deep Wells Excluding W2D (mg/L)

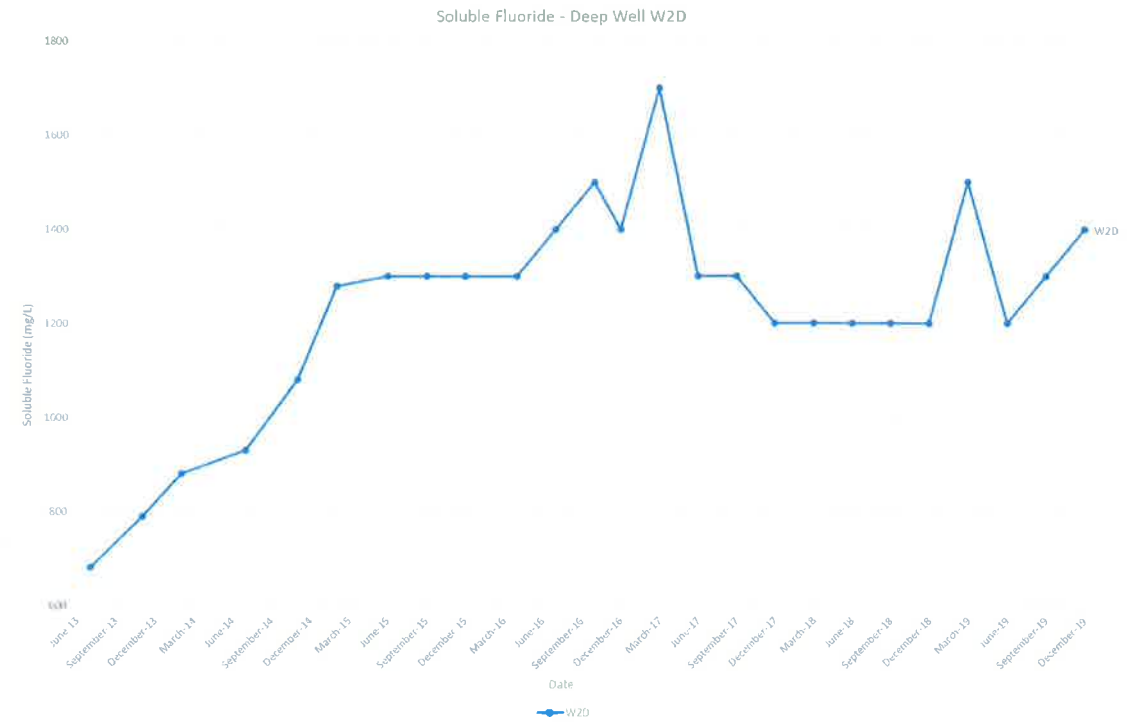

Figure 6-13: Soluble Fluoride – Deep Well W2D Only (mg/L)

Soluble fluoride concentrations at E5D, located on Section 1 increased from 1.21 mg/L in July 2013 to 44 mg/L in February 2014 and then subsequently decreased to 9.4 mg/L during December 2019. Similarly, W2D, also located on Section 1 increased from 682 mg/L in July 2013 to 1,700 mg/L in March 2017 and then subsequently decreased to 1,400 mg/L during December 2019. Concentrations of soluble fluoride at W2D and E5D exceed site assessment criteria and exhibit elevated pH values characteristic of leachate impacted groundwater.

On Section 2, soluble fluoride concentrations at W1D decreased from 39 mg/L in July 2013 to 5.4 mg/L in November 2013, with concentrations generally falling below 5 mg/L. In December 2019, W1D reported a soluble fluoride concentration of 41 mg/L, which was inconsistent with previous results and eight times higher than data collected by Hydro during the same month. For this reason, the December 2019 soluble fluoride concentration at W1D was determined to be anomalous and the concentration reported by Hydro (4.8 mg/L) was adopted.

On Section 4, soluble fluoride concentrations at N2 show varying results from July 2013 to October 2016 when concentrations stabilised, generally falling below 2.4 mg/L. Soluble fluoride concentrations at N2 have generally exceeded site assessment criteria for irrigation however pH values were not characteristic of leachate impacted groundwater.

Section 5 well, W6D consistently reported soluble fluoride concentrations <LOR during 2019.

The lateral extent of soluble fluoride in the deep aquifer for the previous four monitoring events (March, June, September and December 2019) is presented in **Figure 6-14.**

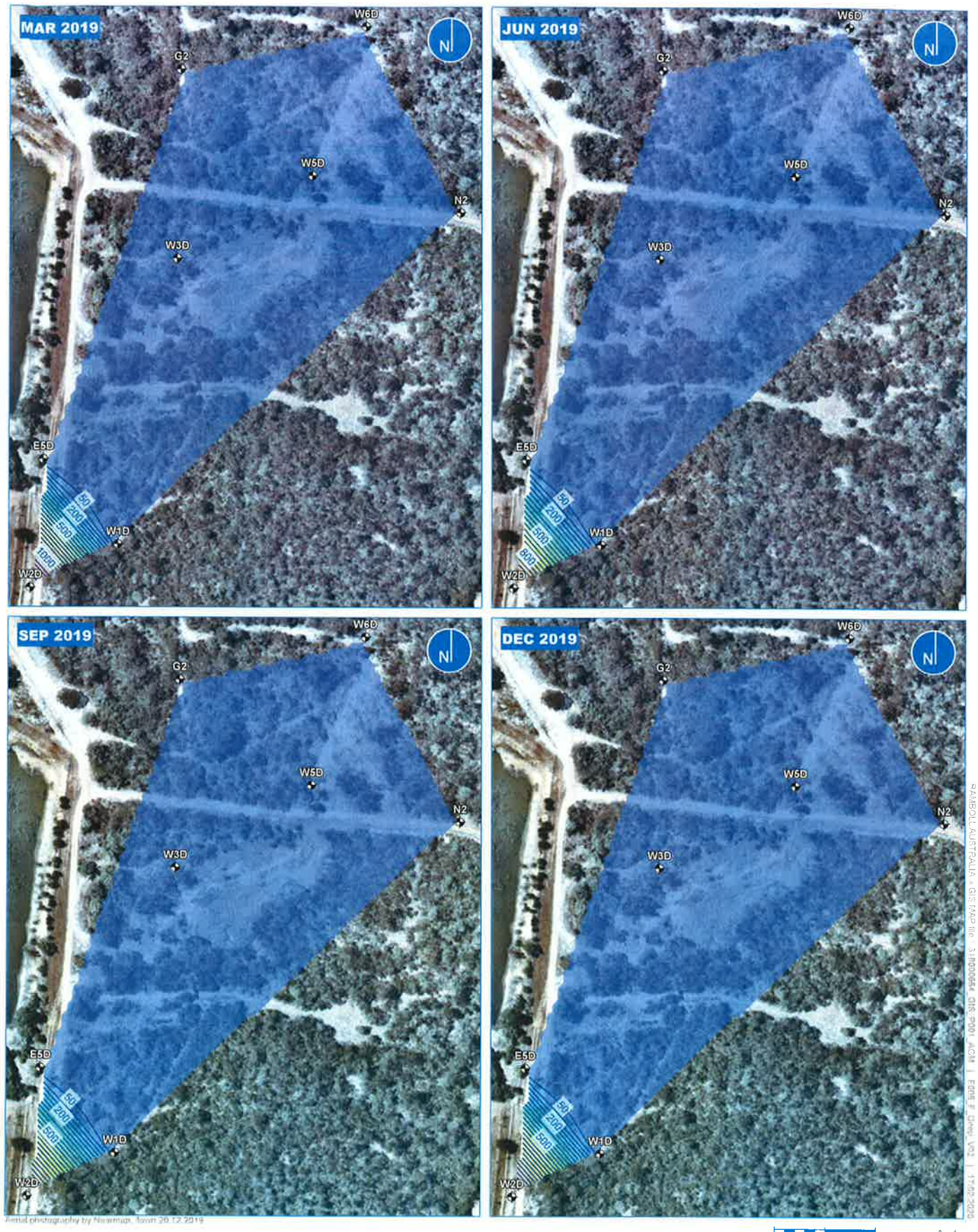

Figure 6-14: Soluble Fluoride – Deep Wells 2019

Data from July 2013 to December 2019 (25 sampling events) were included for the purpose of Mann-Kendall trend analysis of soluble fluoride, a summary is provided in **Table 6-6**.

Table 6-6: Mann-Kendall Soluble Fluoride Trends - Deep Wells

Section	Well	Previous Trend 2013 to 2018	Current Trend 2013 to 2019	Soluble Fluoride >Assessment Criteria	Leachate Impacted
1	W2D	**Increasing**	**Increasing**	**Yes**	**Yes**
1/2	E5D	**Decreasing**	**Decreasing**	**Yes**	No
2	W1D	No trend	No Trend	**Yes**	No
3	W3D	Stable	**Decreasing**	No	No
3	~~W4D~~	Destroyed	Destroyed	Destroyed	Destroyed
4	W5D	No trend	**Decreasing**	No	No
4	N2	No trend	No trend	**Yes**[1]	No
5	G2	**Increasing**	**Increasing**	No	No
5	W6D	No trend	**Decreasing**	No	No
NA	G5	No trend	**Decreasing**	No	No
NA	F6	Prob. increasing	Prob. Decreasing	No	No

[1] March, June and September 2019 only
NA Not Applicable

Mann-Kendall soluble fluoride trend analysis of deep wells indicates an increasing trend at Section 1 (W2D) and Section 5 (G2). Soluble fluoride at W2D increased from 682 mg/L in July 2013 to 1,279 mg/L in February 2015 and has since remained stable with concentrations generally ranging between 1,200 and 1,400 mg/L. W2D consistently reports the highest soluble fluoride concentration of all the wells, exceeding the assessment criteria and demonstrating pH values characteristic of leachate impacted groundwater. Soluble fluoride concentrations at G2, located on Section 5 have increased marginally between July 2013 (0.28 mg/L) and December 2019 (0.3 mg/L). Groundwater at G2 does not exceed the assessment criteria, nor is it characteristic of leachate impacted groundwater.

A decreasing trend was identified at Section 1 well E5D during December 2018 and December 2019. Soluble fluoride concentrations at E5D exceed site assessment criteria however concentrations have decreased from a peak of 40 mg/L in November 2013 to 9.4 mg/L in December 2019.

6.6.2 Free Cyanide

Comparison of free cyanide concentrations for twenty GMEs completed between February 2015 and December 2019 are shown in **Figure 6-15** with concentrations for W2D only shown in **Figure 6-16**.

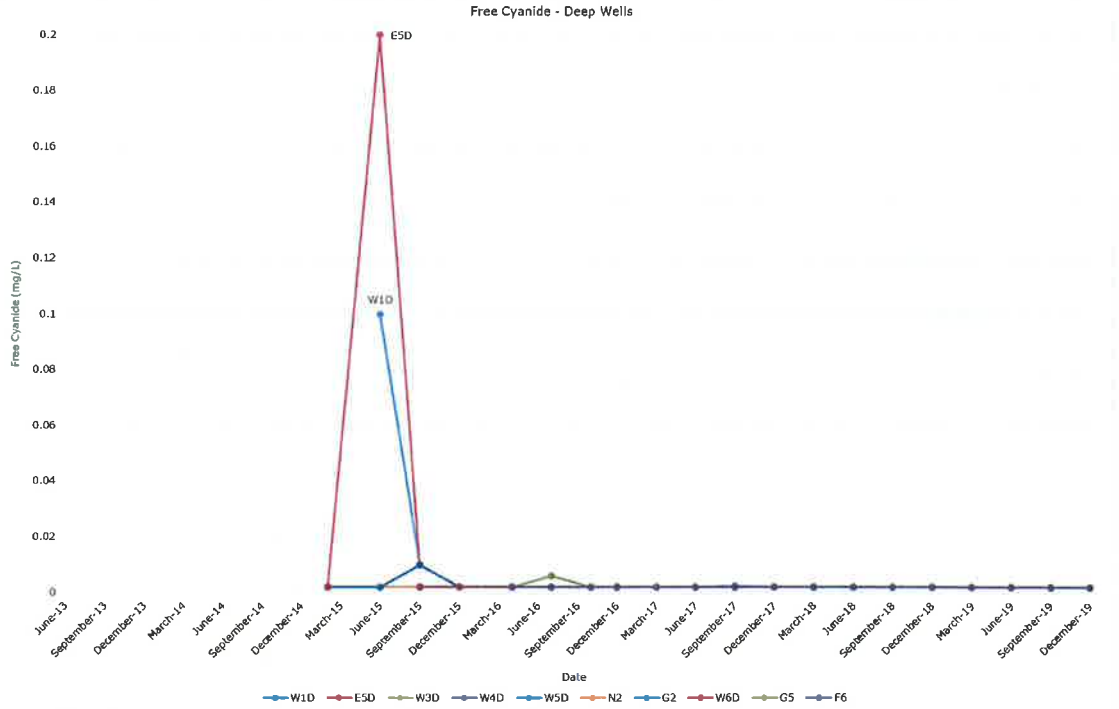

Figure 6-15: Free Cyanide Concentrations – Deep Wells (mg/L)

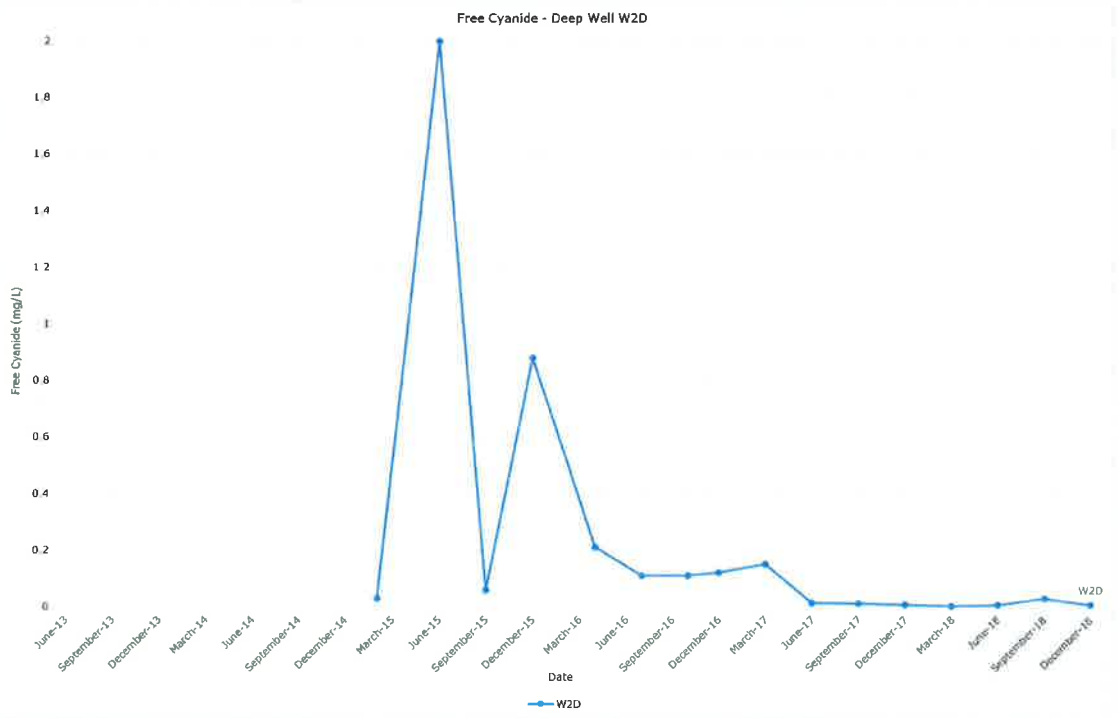

Figure 6-16: Free Cyanide Concentrations – Deep Well W2D Only (mg/L)

Free cyanide concentrations exceeded site assessment criteria for 95% Protection for Aquatic Ecosystems at W2D during September and December only. Free cyanide concentrations at W2D have been varied overtime but have generally shown a decrease from 0.058 mg/L in September 2015 to 0.018 mg/L in December 2019.

W1D, E5D, W3D, W5D, N2, G2, W6D, G5 and F6 all reported free cyanide concentrations <LOR during 2019.

Data from February 2015 to December 2019 (20 sampling events) were included for the purpose of Mann-Kendall trend analysis of free cyanide, a summary is provided in **Table 6-7**.

Table 6-7: Mann-Kendall Free Cyanide Trends - Deep Wells

Section	Well	Previous Trend 2013 to 2018	Current Trend 2013 to 2019	Free Cyanide >Assessment Criteria	Leachate Impacted
1	W2D	**Decreasing**	**Decreasing**	**Yes[1]**	**Yes**
1/2	E5D	Stable	Stable	No	No
2	W1D	Stable	Stable	No	No
3	W3D	Stable	Stable	No	No
3	~~W4D~~	Destroyed	Destroyed	Destroyed	Destroyed
4	W5D	Stable	Stable	No	No
4	N2	Stable	Stable	No	No
5	G2	Stable	Stable	No	No
5	W6D	Stable	Stable	No	No
NA	G5	Stable	Stable	No	No
NA	F6	Stable	Stable	No	No

[1]95% Protection of Aquatic Ecosystems September and December only
NA Not Applicable

Mann-Kendall trend analysis of free cyanide in deep wells showed no increasing trends. Notably, Section 1 well W2D reported a decreasing trend despite exceeding the site assessment criteria for 95% Protection of Aquatic Ecosystems in September and December. pH at W2D is also characteristic of leachate impacted groundwater.

Mann-Kendall trend analysis of free cyanide in deep wells at Section 2, 3, 4 and 5 show 'stable' trends.

7. HYDRO DATA

Hydro collect groundwater samples for analysis from the monitoring well network in between the Ramboll quarterly groundwater monitoring events. Twenty-four (24) sampling events have been completed by Hydro between May 2014 and December 2019. Hydro personnel gauged the depth to water and collected groundwater samples for pH, conductivity, fluoride and total cyanide.

Fluoride concentrations for wells sampled by Hydro are included in Error! Reference source not found. with a graphic representation provided in **Figure 7-1**.

Wells W2S and W7M have been dry for all sampling rounds. Wells W1S, W7S, W4S, W5S and W6S have been dry for the majority of sampling rounds. Fluoride concentrations have been most elevated in W2D. Elevated fluoride concentrations in wells W1S, W2D, W3S, W4S, W5S and W6S show impact from the leachate plume. Fluoride concentrations in wells W1D and E5D are also elevated but to a lesser extent. Fluoride concentrations in W6D were marginally above site assessment criteria (irrigation and recreation) during December 2017. The results from the Hydro sampling are similar to the results of the quarterly sampling completed by Ramboll.

Table 7-1: Fluoride Concentrations in Wells Sampled by Hydro (mg/L)

Date	W1S	W1D	W2S	W2D	W7S	W7M	E5D	W3S	W4S	W5S	W6S	W6D
May 2014	70	8.9	-	840	39	-	39	410	610	180	-	-
June 2014	75	5.7	-	660	-	-	36	310	400	87	-	1.1
September 2014	79	3	-	1,200	-	-	15	270	460	110	-	0.7
December 2014	58	2	-	1,200	-	-	10	230	-	89	-	0.7
March 2014	-	2	-	1,200	-	-	10	230	-	-	-	<0.5
June 2014	-	3.4	-	1,300	-	-	14	240	500	95	150	0.7
September 2015	-	2	-	1,300	-	-	7	220	-	77	-	<0.5
December 2015	-	<5	-	1,100	-	-	9	180	-	8.3	-	<0.5
March 2016	-	8.3	-	1,200	-	-	14	230	-	-	-	0.9
June 2016	-	3.7	-	1,600	-	-	<0.5	160	-	-	-	<0.5
September 2016	-	4.1	-	1,100	-	-	12	130	-	-	-	<0.5
December 2016	-	7.5	-	1,400	-	-	15	-	-	-	-	<0.5
March 2017	-	5.3	-	1,200	-	-	14	220	-	-	-	<0.5
June 2017	-	4.5	-	1,300	-	-	18	140	-	-	-	<0.5
September 2017	-	4.2	-	1,200	-	-	20	90	-	-	-	<0.5
December 2017	-	6.7	-	1,600	-	-	200	1,100	-	-	-	1.7
March 2018	-	15.0	-	1,700	-	-	25	1,700	-	-	-	-
June 2018	-	6.4	-	2,200	-	-	30	120	-	-	-	-
September 2018	-	4.5	-	860	-	-	12	96	-	-	-	-
December 2018	-	4.3	-	1,100	-	-	10	87	-	-	-	-
March 2019	-	5.5	-	1,100	-	-	20	-	-	-	-	-
June 2019	-	5.2	-	1,500	-	-	10	120	-	-	-	-
September 2019	-	7.7	-	1,200	-	-	12	140	-	-	-	-
December 2019	-	4.8	-	1,200	-	-	7.3	-	-	-	-	-

\- *Not sampled*

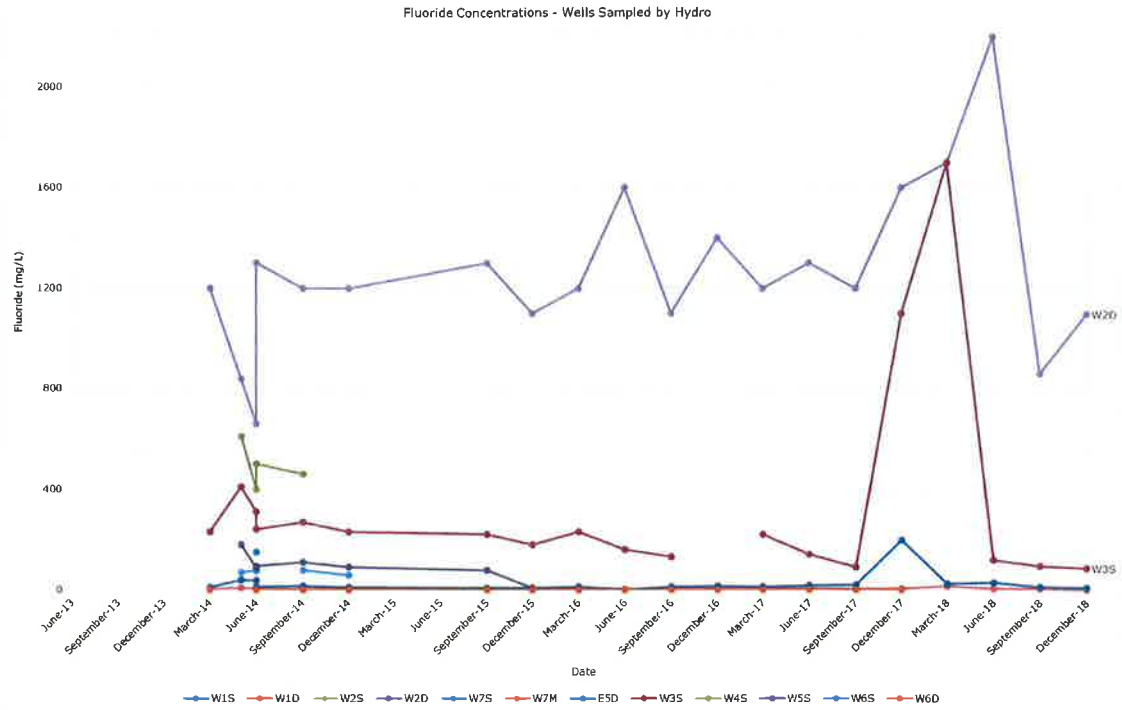

Figure 7-1: Fluoride Concentrations in Wells Sampled by Hydro (mg/L)

8. CONCLUSIONS AND RECOMMENDATIONS

Twenty-five groundwater monitoring events (GMEs) have been completed within a leachate impacted groundwater plume associated with the CWS (AEC 1) at the former Hydro Aluminium Kurri Kurri Smelter. The four most recent events were completed in March, June, September and December 2019.

Each GME included the sampling and analysis of groundwater from a network of 25 shallow and deep wells located on five sections along the length of the leachate plume down-gradient of the Capped Waste Stockpile. In 2016, two additional shallow wells and two additional deep wells were added to the network. These wells are located adjacent to Swamp Creek, the nearest surface water receptor. Physico-chemical parameters were recorded, and groundwater samples were collected and analysed for soluble fluoride, total and free cyanide as well as total and dissolved aluminium.

Evaluation of 2019 GME data has identified the following:

- Groundwater flow is interpreted to be north to north-east in both the shallow and deep aquifer. This is consistent with historical observations.
- The trend for pH in the shallow aquifer was generally 'stable' or 'decreasing'. An 'increasing' trend was identified at only one well, N8, located on Section 5. pH values at N8 remain low compared to wells that contain leachate. Further, the increasing trend appears marginal, with pH increasing from pH 6.36 in July 2013 to pH 6.67 in December 2019.
- The trend for soluble fluoride in the shallow aquifer was generally 'stable' or 'no trend'. An 'increasing' trend was only identified at one well, N8. Fluoride concentrations in N8 remain below the site criteria for the receiving waters and pH at this location is not characteristic of leachate impact.
- Longitudinally along the length of the plume, the most elevated fluoride concentrations on the western edge were in well A7 on Section 3 and on the eastern edge were in well E4 on Section 2, this is consistent with 2018 observations.
- The trend for free cyanide in the shallow aquifer was generally 'decreasing', 'stable' or 'no trend'. No 'increasing' trends were identified. Free cyanide concentrations remained below the site criteria for 95% Protection of Aquatic Ecosystems (0.007 mg/L) aside from at wells PUMP, W7M and W3S.
- An 'increasing' trend was identified for pH in two wells in the deep aquifer – W1D and G2. The pH levels in both wells remain indicative of natural levels at the site and further assessment of pH at these locations identified a marginal increase in pH between July 2013 and December 2019 (0.18 pH units and 0.09 pH units respectively).
- An 'increasing' trend was identified for soluble fluoride in two wells in the deep aquifer – W2D and G2. Well W2D is the most leachate impacted well, with fluoride concentrations at 1200 mg/L. Fluoride concentrations in well G2 remain below levels identified in leachate impacted groundwater and further review of soluble fluoride concentrations at this location indicate a marginal increase between July 2013 (0.28 mg/L) and December 2019 (0.3 mg/L).
- The trend for free cyanide in the deep aquifer was 'stable', except for W2D which had a 'decreasing' trend.
- The most leachate impacted well remains W2D, in the deep aquifer on Section 1. Fluoride concentrations in this well doubled over the fourteen monitoring rounds from July 2013 (682 mg/L) to March 2017 (1,700 mg/L) before reducing to 1,200 mg/L in December 2017. Soluble fluoride concentrations have remained consistent over the last five quarters (December 2017 to December 2019).
- Fluoride concentrations in the deep aquifer down-gradient of Section 1 remain low, indicating a semi-continuous connection between the shallow and deep aquifer.

- Groundwater data from the two pairs of shallow and deep wells adjacent to Swamp Creek, the nearest surface water receptor, show no impact from the leachate plume. This result is anticipated based on the location of high plasticity clays, which limit the migration of the leachate plume in this direction toward Swamp Creek.

Monitoring of groundwater and operation of the toe leachate interception trench is proposed to continue until remediation of the Capped Waste Stockpile is completed.

9. REFERENCES

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ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality

ENVIRON (March 2013) Tier 2 Ecological Risk Assessment, Kurri Kurri Aluminium Smelter

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ENVIRON (June 2016) Hydro Aluminium Kurri Kurri Smelter, Capped Waste Stockpile, 12 Month Groundwater Monitoring Report

ENVIRON (September 2016) Plume Delineation Report, Capped Waste Stockpile

GSI (2012) Groundwater Services Inc., GSI Man-Kendall Toolkit for Constituent Trend Analysis, Version 1.0, November 2012

NSW DEC (2007) Guidelines for the Assessment and Management of Groundwater Contamination

Ramboll (April 2016) Hydro Aluminium Smelter, Capped Waste Stockpile, 2015 Annual Groundwater Monitoring Report

APPENDIX 1
FIGURES

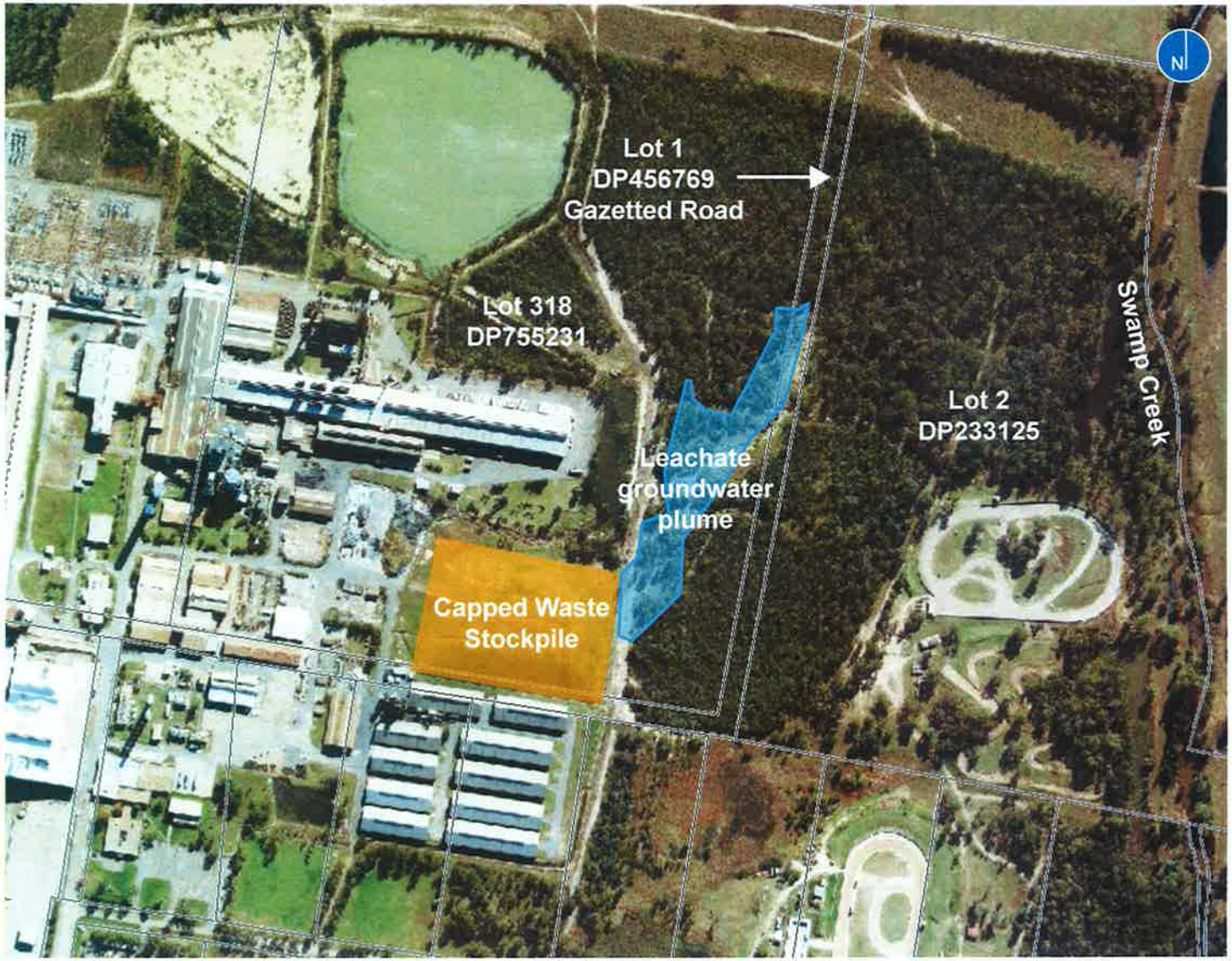
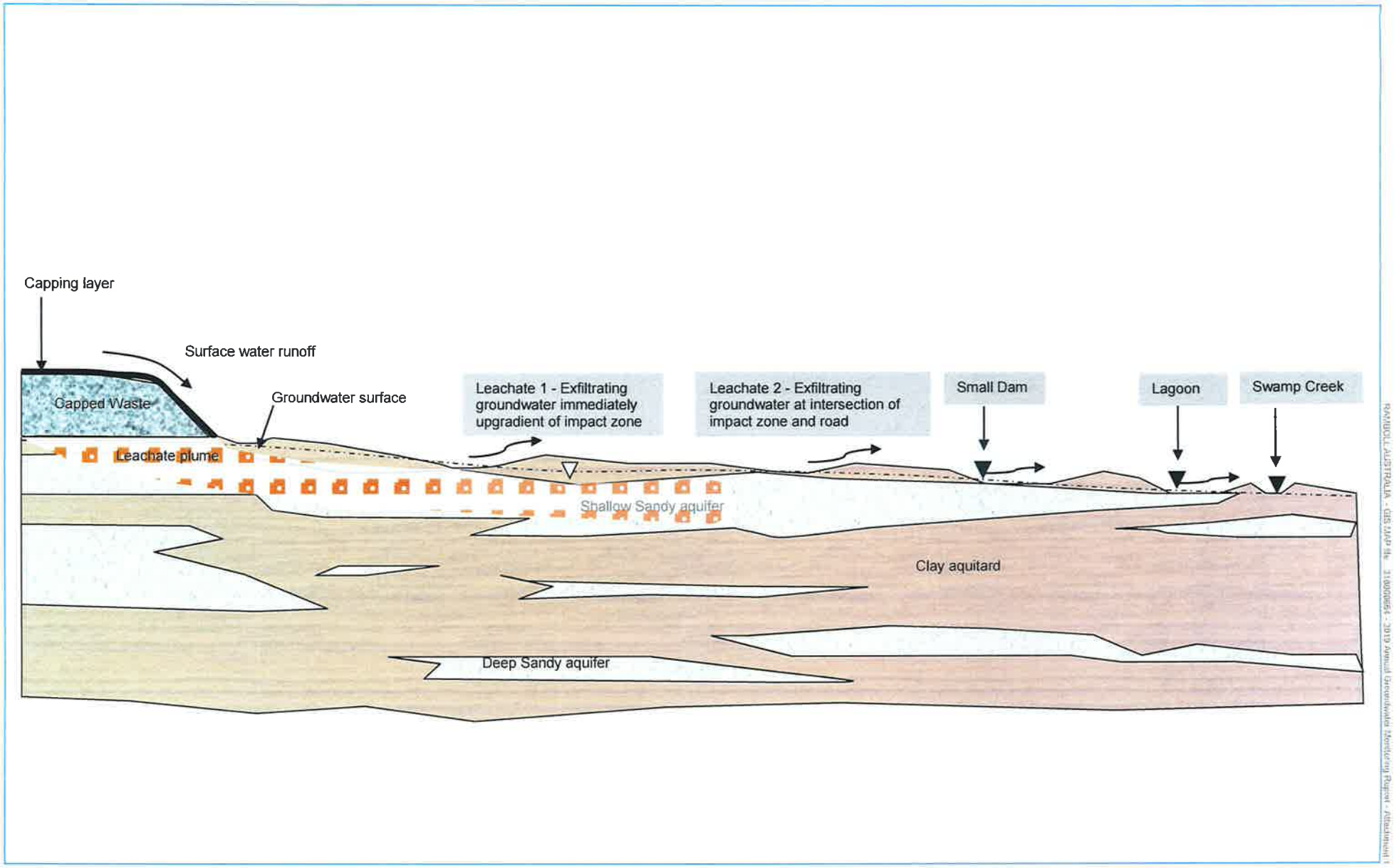


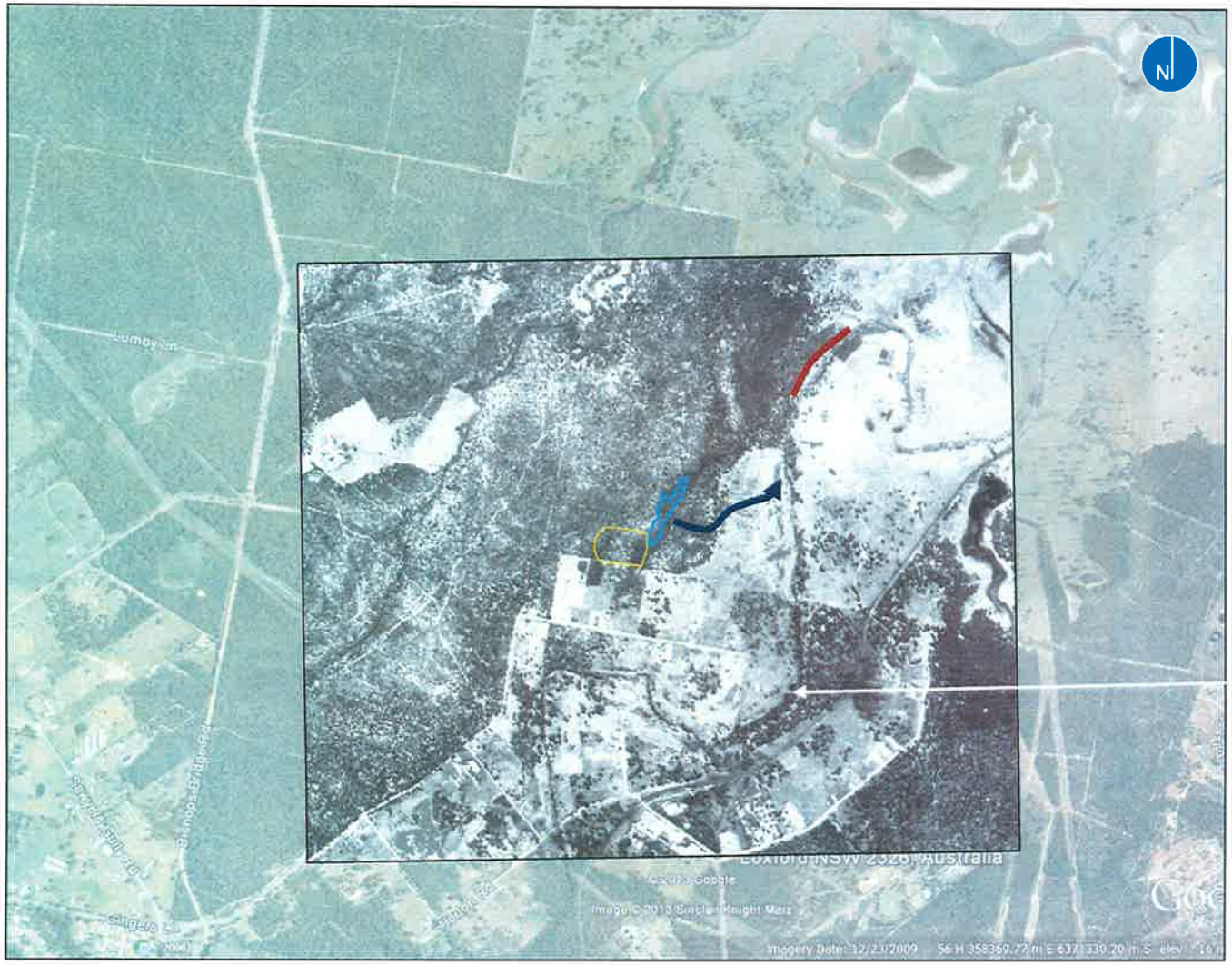
Figure 1 | AEC 1: Site Location Plan, 2019 Annual Groundwater Monitoring Report

RAMBOLL AUSTRALIA - GIS MAP file - 31900664 - 2019 Annual Groundwater Monitoring Report - Figure 2

Figure 2 ¦ Groundwater Monitoring Well Network, 2019 Annual Groundwater Monitoring Report

APPENDIX 2
ATTACHMENTS


Capping layer
Surface water runoff
Capped Waste
Groundwater surface
Leachate 1 - Exfiltrating groundwater immediately upgradient of impact zone
Leachate 2 - Exfiltrating groundwater at intersection of impact zone and road
Small Dam
Lagoon
Swamp Creek
Leachate plume
Shallow Sandy aquifer
Clay aquitard
Deep Sandy aquifer



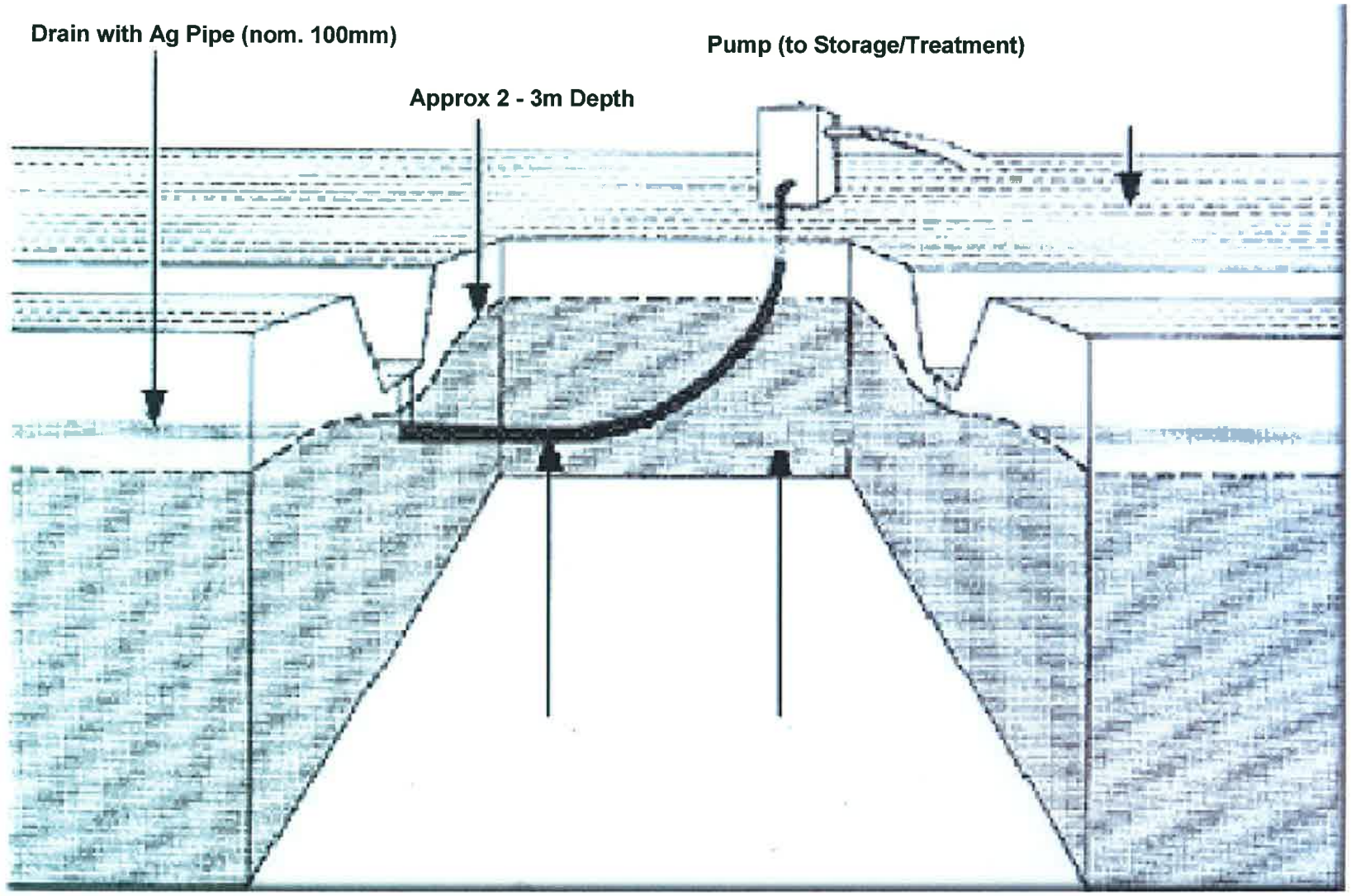
RAMBOLL AUSTRALIA - GIS MAP file: 318000064 - 2019 Annual Groundwater Monitoring Report - Attachment 2

RAMBOLL AUSTRALIA - GIS MAP file 318000564 - 2019 Annual Groundwater Monitoring Report - Attachment 3

13

Topographic Contours mAHD (based on 1m Lidar)

RAMBOLL AUSTRALIA - GIS MAP file 318000664 2019 Annual Groundwater Monitoring Report - Attachment 4



RAMBOLL AUSTRALIA - GIS MAP file: 318000864 - 2019 Annual Groundwater Monitoring Report - Attachment 5

APPENDIX 3
2013-2019 GME HISTORICAL DATA

Table A: Groundwater Elevation – Shallow Wells (m AHD)

Date	W1S	W2S	E5	PUMP	W7S	W7M	E4	A7	W3S	W4S	E11	W5S	N8	N9	W6S	F5	G6
July 2013	11.89	12.49	12.21	12.49	12.61	12.22	11.93	10.28	9.97	9.52	8.06	9.19	9.18	9.22	7.85	NS	NS
November 2013	11.98	12.62	12.05	12.35	12.97	12.14	12.09	10.60	10.31	9.93	7.74	9.27	8.74	9.31	7.65*	NS	NS
February 2014	11.37	-	11.80	11.86	-	11.57	10.53	9.81	9.28	-	7.48	-	8.46	8.48*	7.64*	NS	NS
June 2014	11.28*	-	-	11.04	12.06*	10.60*	11.51	10.06	9.83	9.51*	7.72	9.05	8.80	9.01	7.65*	NS	NS
November 2014	-	-	11.53*	11.30	11.96*	11.09	11.28	9.92	9.55	9.51*	7.67	8.79*	8.73	8.87	7.65*	NS	NS
February 2015	11.22	-	-	11.26	-	10.92	11.31	10.02	9.90	-	7.54	8.99	8.65	9.00	7.69	NS	NS
June 2015	11.53	12.06*	11.90	11.95	-	11.94	12.07	10.49	10.29	9.74	8.70	9.32	9.35	9.69	8.12	NS	NS
September 2015	11.21	11.80*	11.61	11.70	-	11.61	11.65	10.22	10.05	9.73	8.15	9.29	9.19	9.38	8.01*	NS	NS
December 2015	11.32*	-	-	11.65	-	11.52	11.73	10.00	9.63	-	7.90	-	9.09	9.06	7.82	NS	NS
April 2016	11.30	-	11.75	11.93	-	11.67	11.44	10.00	9.62	-	7.94	-	9.03	8.83	-	4.95	2.59
July 2016	-	-	11.60	11.84	-	11.58	11.39	9.93	9.76	9.72	7.64	9.06	8.61	9.25	-	4.86	2.45
October 2016	-	-	-	11.84	-	11.56	11.38	9.86	9.60	-	7.55	-	8.64	-	7.63	4.93	2.45
December 2016		-	-	11.66	-	11.39	11.11	9.70	*7.18*	-	7.41	-	8.38	-	-	4.73	*3.21*
March 2017	-	-	-	11.54	-	11.28	11.11	9.80	9.70	-	7.40	-	8.22	9.14	-	4.67	2.17
June 2017	-	-	-	11.74	-	11.46	-	9.97	9.90	-	7.56	-	8.56	9.35	-	4.76	2.28
September 2017	-	-	-	11.57	-	11.30	11.01	9.67	8.98	-	7.33	-	8.16	8.82	-	4.46	2.04
December 2017	-	-	-	11.41	-	11.13	10.81	9.58	-	-	7.20	-	7.75	-	-	4.30	1.86
March 2018	-	-	-	11.30	-	11.02	10.83	9.63	9.58	-	7.11	-	7.87	9.02	-	3.82	1.55
June 2018	-	-	-	11.77	-	11.48	11.33	10.00	9.87	-	7.56	-	8.29	9.22	7.59	4.41	1.7
September 2018	-	-	-	11.57	-	11.30	11.12	9.82	9.52	-	7.40	-	8.18	8.97	7.6	4.19	1.55
December 2018	-	12.14	-	11.52	-	11.27	11.06	9.99	9.90	-	7.46	-	8.28	9.17	-	4.16	1.49
March 2019	-	-	-	11.42	-	11.14	10.84	9.61	-	-	7.25	-	7.90	8.79	-	3.80	1.29
June 2019	-	-	-	11.50	-	11.23	11.0	9.69	9.12	-	7.29	-	7.89	8.83	-	3.71	1.13
September 2019	-	-	-	11.43	-	11.16	9.94	9.82	9.75	-	7.34	-	7.99	9.18	-	3.75	0.99
December 2019	-	-	-	11.30	-	11.07	10.77	9.57	-	-	7.18	-	7.77	-	-	3.39	0.81

- Well dry
NS Not Sampled
*Well pumped dry during purging, no sample collected
Results in *italics* are considered not reliable

Table B: pH – Shallow Wells (pH Units)

Date	W1S	W2S	E5	PUMP	W7S	W7M	E4	A7	W3S	W4S	E11	W5S	N8	N9	W6S	F5	G6
July 2013	7.22	7.33	9.54	7.45	7.29	9.81	9.91	9.63	8.53	-	9.36	7.37	6.36	9.16	8.87	NS	NS
November 2013	7.17	6.82	9.37	7.24	7.1	9.87	9.79	9.47	8.82	9.13	9.36	7.37	6.38	8.9	-	NS	NS
February 2014	6.84	-	9.78	9.65	-	10.1	9.94	9.67	7.61	-	9.33	-	6.48	-	-	NS	NS
June 2014	6.90	-	-	10.14	-	10.12	9.84	9.66	8.89	-	9.41	7.39	6.53	9.17	8.79	NS	NS
November 2014	-	-	-	10.01	-	9.78	9.4	9.24	7.68	-	9.32	-	6.39	8.91	-	NS	NS
February 2015	6.66	-	-	9.95	-	9.44	8.84	8.56	6.38	-	8.86	6.55	6.11	8.46	7.27	NS	NS
June 2015	6.83	-	9.14	9.87	-	9.82	9.46	9.45	7.53	9.13	7.97	7.26	6.49	7.22	8.72	NS	NS
September 2015	6.86	-	9.42	10.22	-	9.91	9.62	9.8	7.53	9.07	9.23	7.2	6.69	7.34	8.98	NS	NS
December 2015	-	-	-	10.27	-	9.7	10.57	10.71	Dry	-	8.65	-	6.74	7.7	8.67	NS	NS
April 2016	7.21	-	9.48	10.13	-	9.99	9.73	9.75	7.46	-	9.2	-	6.59	6.61	-	7.38	3.6
July 2016	-	-	-	10.22	-	9.95	9.83	9.37	7.02	5.11	9.29	7.29	6.63	8.11	-	5.58	3.82
October 2016	-	-	-	9.98	-	10.17	9.94	9.57	7.01	-	9.41	-	6.92	8.54	-	5.25	4.04
December 2016	-	-	-	9.72	-	9.68	9.53	9.15	6.4	-	9.1	-	6.4	-	-	4.46	3.79
March 2017	-	-	-	9.56	-	9.61	9.53	9.12	7.4	-	8.7	-	6.54	8.61	-	4.11	3.66
June 2017	-	-	-	9.2	-	10.1	-	9.49	7.66	-	9.07	7.79	6.78	9.32	-	5.08	4.55
September 2017	-	-	-	9.9	-	9.8	9.59	2.65	7	-	3.51	-	6.76	-	-	4.21	4.21
December 2017	-	-	-	9.6	-	9.6	9.46	9.27	6.99	-	8.83	-	6.67	8.6	-	4.57	3.86
March 2018	-	-	-	9.73	-	9.61	9.32	8.96	7.19	-	8.62	-	6.45	8.65	-	4.3	3.66
June 2018	-	-	-	9.17	-	9.7	9.62	9.36	6.91	8.26	9.02	-	6.71	8.72	-	4.46	3.6
September 2018	-	-	-	13.68	-	13.24	9.29	9.75	7.14	-	10.45	-	10.53	12.9	-	4.35	3.88
December 2018	-	7.47	-	9.55	-	9.63	9.27	9.06	6.8	-	7.7	-	6.51	8.72	-	5.02	3.81
March 2019	-	-	-	9.42	-	9.68	9.47	9.38	-	-	8.99	-	6.81	8.33	-	4.96	4.14
June 2019	-	-	-	9.43	-	9.65	9.56	9.4	7.01	-	8.76	-	6.68	8.71	-	4.71	3.88
September 2019	-	-	-	9.89	-	9.73	9.58	9.39	7.7	-	7.87	-	6.6	8.5	-	4.6	4.14
December 2019	-	-	-	9.93	-	9.75	9.67	9.48	Dry	-	8.95	-	6.67	-	-	4.54	3.93

- Well dry
NS Not Sampled
*Well pumped dry during purging, no sample collected
Results in *italics* are considered not reliable

Table C: Soluble Fluoride – Shallow Wells (mg/L)

Date	W1S	W2S	E5	PUMP	W7S	W7M	E4	A7	W3S	W4S	E11	W5S	N8	N9	W6S	F5	G6
July 2013	53	115	495	79	34	878	699	436	237	-	102	35	0.27	85	195	NS	NS
November 2013	69	58	410	51	31	650	650	420	310	480	160	61	0.17	200	-	NS	NS
February 2014	42	-	450	280	-	730	650	410	210	-	190	-	0.26	-	-	NS	NS
June 2014	-	-	-	550	-	-	590	380	270	-	160	100	0.27	170	-	NS	NS
November 2014	-	-	-	930	-	910	380	410	210	-	150	-	0.29	210	-	NS	NS
February 2015	66	-	-	740	-	840	340	550	250	-	230	93	0.35	210	200	NS	NS
June 2015	120	-	410	200	-	810	260	500	230	490	7.4	88	0.90	24	180	NS	NS
September 2015	38	-	350	680	-	670	280	400	200	400	110	70	0.30	25	-	NS	NS
December 2015	-	-	-	360	-	540	300	320	160	-	96	-	0.40	9	180	NS	NS
April 2016	39	-	330	570	-	640	330	330	190	-	120	-	<10	-	-	<10	<10
July 2016	-	-	-	280	-	870	570	320	170	-	120	62	0.4	140	-	<0.1	<0.1
October 2016	-	-	-	85	-	1100	550	360	150	-	130	-	0.6	-	-	<0.1	<0.1
December 2016	-	-	-	88	-	1000	450	380	130	-	200	-	0.4	-	-	<0.1	<0.1
March 2017	-	-	-	210	-	220	670	500	180	-	230	-	1	200	-	<0.1	<0.1
June 2017	-	-	-	60	-	750	-	400	62	-	99	50	0.4	160	-	0.2	0.4
September 2017	-	-	-	180	-	760	380	390	99	-	130	-	0.4	150	-	0.2	0.4
December 2017	-	-	-	160	-	780	380	400	-	-	110	-	0.4	-	-	0.2	0.5
March 2018	-	-	-	220	-	770	410	190	180	-	120	-	0.4	200	-	0.2	0.4
June 2018	-	-	-	62	-	810	350	390	120	160	120	-	0.5	140	-	0.2	0.4
September 2018	-	-	-	N/A	-	860	380	450	96	-	130	-	0.4	170	-	0.2	0.4
December 2018	-	-	-	250	-	820	410	410	100	-	49	-	0.4	160	-	0.2	0.7
March 2019	-	-	-	370	-	990	530	600	-	-	150	-	0.4	200	-	0.1	0.6
June 2019	-	-	-	140	-	750	490	480	90	-	74	-	0.4	160	-	0.2	0.3
September 2019	-	-	-	400	-	800	530	480	170	-	41	-	0.4	160	-	0.2	0.3
December 2019	-	-	-	530	-	830	590	520	-	-	120	-	0.2	-	-	<0.1	0.2

- Well dry
NS Not Sampled
*Well pumped dry during purging, no sample collected
Results in *italics* are considered not reliable

Table D: Total Cyanide – Shallow Wells (mg/L)

Date	W1S	W2S	E5	PUMP	W7S	W7M	E4	A7	W3S	W4S	E11	W5S	N8	N9	W6S	F5	G6
July 2013	1.7	0.41	42	17.1	0.096	63	130	96	34	-	17	1.7	4	4.5	19	NS	NS
November 2013	0.98	0.49	43	0.76	0.45	78	140	88	38	41	17	1.7	0.34	12	-	NS	NS
February 2014	0.87	-	43	6.2	-	86	130	90	36	-	21	-	0.44	-	-	NS	NS
June 2014	-	-	-	-	37	-	160	89	53	-	32	2	0.54	13	-	NS	NS
November 2014	-	-	-	120	-	200	65	110	41	-	17	-	0.53	21	-	NS	NS
February 2015	15	-	-	58	-	130	41	78	25	-	7.7	9.3	6.6	13	12	NS	NS
June 2015	1.1	-	69	9.3	-	180	25	100	24	330	0.49	2.3	0.69	1.2	14	NS	NS
September 2015	-	-	-	110	-	100	99	66	28	34	9.4	3	0.6	0.95	-	NS	NS
December 2015	-	-	-	48	-	83	35	62	19	7.4	-	0.63	1.2	-	19	NS	NS
April 2016	1.5	-	-	140	-	140	45	38	20	-	15	-	<0.004	-	-	<0.004	<0.004
July 2016	-	-	-	38	-	250	160	63	21	-	16	3.5	0.75	18	-	<0.004	<0.004
October 2016	-	-	-	4.7	-	200	95	73	12	-	9.9	-	0.47	-	-	0.021	<0.004
December 2016	-	-	-	4.3	-	250	69	85	17	-	31	-	0.5	-	-	<0.004	<0.004
March 2017	-	-	-	15	-	180	63	70	18	-	17	-	0.81	14	-	<0.004	<0.004
June 2017	-	-	-	2.6	-	73	-	39	14	-	5.2	5.3	<0.004	6.2	-	<0.004	<0.004
September 2017	-	-	-	7.7	-	110	45	72	13	-	9.6	-	0.41	5.9	-	<0.004	<0.004
December 2017	-	-	-	11	-	140	63	56	-	-	9.7	-	0.45	35	-	<0.004	<0.004
March 2018	-	-	-	20	-	140	61	15	20	-	7.4	-	0.54	15	-	<0.004	<0.004
June 2018	-	-	-	4.1	-	190	69	87	24	12	10	-	0.67	6.7	-	0.013	<0.004
September 2018	-	-	-	44	-	160	41	80	14	-	8	-	0.56	7.2	-	<0.004	<0.004
December 2018	-	3.9	-	14	-	130	48	54	15	-	0.65	-	0.6	7.4	-	<0.004	<0.004
March 2019	-	-	-	21	-	150	57	100	-	-	18	-	0.61	6.6	-	<0.004	<0.004
June 2019	-	-	-	9.8	-	130	74	82	15	-	3.8	-	0.55	9.2	-	<0.004	<0.004
September 2019	-	-	-	35	-	160	130	88	20	-	0.3	-	0.47	8	-	<0.004	<0.004
December 2019	-	-	-	57	-	160	130	90	-	-	20	-	0.63	-	-	<0.004	<0.004

- Well dry
NS Not Sampled
*Well pumped dry during purging, no sample collected
Results in *italics* are considered not reliable

Table E: Free Cyanide Concentrations – Shallow Wells (mg/L)

Date	W1S	W2S	E5	PUMP	W7S	W7M	E4	A7	W3S	W4S	E11	W5S	N8	N9	W6S	F5	G6
July 2013	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
November 2013	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
February 2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
June 2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
November 2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
February 2015	0.004	-	-	0.021	-	0.02	<0.004	11	<0.004	-	0.005	<0.004	<0.004	<0.004	0.019	NS	NS
June 2015	<4	-	<0.8	<0.08	-	<2	<0.4	<2	<0.4	<4	<0.004	<4	<0.4	<0.4	<0.4	NS	NS
September 2015	-	-	-	0.029	-	<0.4	<0.04	<0.020	<0.02	<40	<0.004	<0.02	<0.02	<0.02	-	NS	NS
December 2015	-	-	-	0.1	-	0.21	0.032	0.19	0.023	-	0.033	-	0.005	<0.004	0.058	NS	NS
April 2016	-	-	-	0.01	-	0.013	0.004	<0.004	0.007	-	<0.004	-	<0.004	-	-	<0.004	<0.004
July 2016	-	-	-	0.018	-	0.072	0.049	0.026	0.005	-	0.009	-	0.004	<0.004	-	<0.004	<0.004
October 2016	-	-	-	<0.004	-	-	0.045	0.032	0.014	-	0.016	-	<0.004	-	-	<0.004	<0.004
December 2016	-	-	-	0.006	-	0.007	<0.004	<0.004	<0.004	-	0.004	-	<0.004	-	-	<0.004	<0.004
March 2017	-	-	-	0.006	-	0.09	0.029	0.039	0.007	-	0.015	-	0.006	<0.004	-	<0.004	<0.004
June 2017	-	-	-	<0.004	-	0.007	-	<0.004	<0.004	-	<0.004	<0.004	<0.004	<0.004	-	<0.004	<0.004
September 2017	-	-	-	<0.005	-	0.005	0.008	<0.005	<0.005	-	<0.005	-	<0.005	<0.005	-	<0.004	<0.004
December 2017	-	-	-	0.009	-	0.006	<0.004	<0.004	-	-	<0.004	-	<0.004	<0.004	-	<0.004	<0.004
March 2018	-	-	-	<0.004	-	<0.004	<0.004	<0.004	<0.004	-	<0.004	-	<0.004	<0.004	-	<0.004	<0.004
June 2018	-	-	-	<0.004	-	0.008	<0.004	0.007	0.007	<0.004	<0.004	-	<0.004	0.004	-	<0.004	<0.004
September 2018	-	-	-	0.01	-	0.017	<0.004	0.009	0.004	-	<0.004	-	<0.004	<0.004	-	<0.004	<0.004
December 2018	-	0.01	-	0.009	-	0.007	0.006	<0.004	0.008	-	<0.004	-	<0.004	<0.004	-	<0.004	<0.004
March 2019	-	-	-	<0.004	-	0.006	<0.004	<0.004	-	-	0.004	-	<0.004	<0.004	-	<0.004	<0.004
June 2019	-	-	-	<0.004	-	<0.004	<0.004	<0.004	<0.004	-	<0.004	-	<0.004	<0.004	-	<0.004	<0.004
September 2019	-	-	-	0.014	-	0.006	<0.004	<0.004	0.013	-	<0.004	-	<0.004	<0.004	-	<0.004	<0.004
December 2019	-	-	-	0.007	-	0.009	0.006	0.004	-	-	0.004	-	<0.004	-	-	<0.004	<0.004

- Well dry
NS Not Sampled
NA Not Applicable
*Well pumped dry during purging, no sample collected
Results in *italics* are considered not reliable

Table F: Total Aluminium Concentrations – Shallow Wells (mg/L)

Date	W1S	W2S	E5	PUMP	W7S	W7M	E4	A7	W3S	W4S	E11	W5S	N8	N9	W6S	F5	G6
July 2013	121	91.5	0.33	58.1	415	11.4	0.379	0.208	11.7	-	23	13	0.102	14.7	60.1	NS	NS
November 2013	130	33	0.52	60	42	2.3	0.89	4.7	2.6	3.6	23	13	12	62	-	NS	NS
February 2014	27	-	2.5	17	-	45	0.4	0.7	7.1	-	4	-	0.11	-	-	NS	NS
June 2014	-	-	-	-	210	-	3.2	0.26	9.2	-	7.8	15	0.3	9	-	NS	NS
November 2014	-	-	-	310	-	21	35	0.71	5.3	-	3.6	-	91	130	-	NS	NS
February 2015	120	-	-	370	-	0.99	46	1.7	34	-	5	22	1.8	8	3.5	NS	NS
June 2015	1200	-	3	120	-	32	49	2.7	4.4	2.3	2.5	7	29	14	7.7	NS	NS
September 2015	-	-	-	610	-	8.7	53	0.61	24	13	11	31	5.3	22	-	NS	NS
December 2015	-	-	-	97	-	7.8	18	0.72	92	-	2.7	-	3.4	0.89	22	NS	NS
April 2016	15	-	-	280	-	4.4	14	14	15	-	7.6	-	34	-	-	2.2	28
July 2016	-	-	-	93	-	0.08	9.9	2.9	6.9	-	23	10	0.47	5.5	-	2.1	0.78
October 2016	-	-	-	90	-	6.2	2.6	2.1	21	-	22	-	1.6	-	-	0.89	0.13
December 2016	-	-	-	120	-	11	36	3	90	-	15	-	1	-	-	2.3	29
March 2017	-	-	-	740	-	3.4	12	25	48	-	89	-	34	-	-	2.3	25
June 2017	-	-	-	39	-	1.3	-	3.7	15	-	5.6	6.2	3.9	1.6	-	4.6	23
September 2017	-	-	-	160	-	1.2	32	5.9	110	-	120	-	25	-	-	2.9	21
December 2017	-	-	-	45	-	3.6	37	4.1	-	-	49	-	4	-	-	3.2	27
March 2018	-	-	-	82	-	10	37	8.9	80	-	4.4	-	5.1	0.54	-	3	27
June 2018	-	-	-	46	-	0.76	13	24	16	71	4.9	-	4.3	17	-	2.2	25
September 2018	-	-	-	23	-	6.6	22	4.4	23	-	9.3	-	0.22	0.95	-	2.1	23
December 2018	-	37	-	5.4	-	0.31	1.7	1	21	-	6.4	-	0.35	0.28	-	2	25
March 2019	-	-	-	9.3	-	7.5	5.2	0.44	-	-	11	-	0.9	1.5	-	1.4	16
June 2019	-	-	-	38	-	1.5	1.3	0.5	33	-	1.8	-	0.76	2	-	1.7	17
September 2019	-	-	-	93	-	2	0.98	0.4	3.8	-	3.9	-	1.1	0.64	-	2.3	9.8
December 2019	-	-	-	77	-	10	1.8	0.33	-	-	1.5	-	1.7	-	-	1.9	9

- Well dry
NS Not Sampled
*Well pumped dry during purging, no sample collected
Results in *italics* are considered not reliable

Table G: Groundwater Elevation – Deep Wells (m AHD)

Date	W1D	W2D	E5D	W3D	~~W4D~~	W5D	N2	G2	W6D	G5	F6
July 2013	10.85	12.19	11.67	5.61	5.54	5.40	4.99	6.63	5.13	NS	NS
November 2013	10.91	12.31	11.63	-	5.46	5.32	4.86	6.50	5.11	NS	NS
February 2014	9.33	11.79	11.56	-	5.44	5.30	4.79	6.55	5.19	NS	NS
June 2014	8.70	11.46	11.43	5.53	5.46	5.36	4.90	6.55	5.20	NS	NS
November 2014	9.11	11.18	11.56	5.46	5.37	5.32	4.96	6.49	5.12	NS	NS
February 2015	-	10.46	11.61	5.50	5.94	5.31	5.92	6.48	5.09	NS	NS
June 2015	8.51	11.96	11.57	5.59	-	5.45	5.08	6.62	5.30	NS	NS
September 2015	8.02	11.68	11.52	5.68	-	5.52	5.12	6.68	5.40	NS	NS
December 2015	8.58	11.57	11.72	-	-	5.30	5.15	6.71	5.39	NS	NS
April 2016	9.41	11.75	11.65	-	-	5.47	5.12	6.71	5.37	4.95	2.84
July 2016	8.75	11.60	11.99	-	-	5.38	5.99	6.55	5.16	4.69	2.68
October 2016	-	11.66	11.42	-	-	5.31	5.05	6.55	5.17	4.93	2.75
December 2016	8.72	11.48	11.46	-	Destroyed	5.34	4.97	6.50	5.13	4.73	2.62
March 2017	8.56	11.30	11.28	-	Destroyed	5.19	4.79	6.35	4.96	4.69	2.46
June 2017	8.37	11.52	11.23	-	Destroyed	5.17	4.78	6.34	4.95	4.60	2.53
September 2017	7.87	11.30	11.19	-	Destroyed	5.14	5.70	6.34	4.95	4.29	2.28
December 2017	7.88	10.81	11.24	5.16	Destroyed	4.98	4.52	6.14	4.75	4.29	1.90
March 2018	7.80	10.93	11.20	5.02	Destroyed	4.83	4.32	6.04	4.59	3.99	1.78
June 2018	8.69	11.58	11.29	5.01	Destroyed	5.27	4.36	6.03	4.61	4.41	1.93
September 2018	8.51	11.37	11.23	4.92	Destroyed	4.72	4.22	5.99	4.51	4.19	1.82
December 2018	8.57	11.33	11.67	4.94	Destroyed	4.75	4.24	5.96	4.56	4.32	1.77
March 2019	8.41	11.13	11.70	4.86	Destroyed	4.74	4.16	6.02	4.57	3.82	1.52
June 2019	8.48	11.33	11.48	4.45	Destroyed	4.47	3.93	6.61	4.29	3.72	1.38
September 2019	8.05	11.25	11.48	4.57	Destroyed	4.38	3.81	5.70	4.27	3.76	1.25
December 2019	7.99	10.96	11.39	4.52	Destroyed	4.35	3.73	5.62	4.17	3.42	1.07

- Well dry
NS Not Sampled
*Well pumped dry during purging, no sample collected
Results in *italics* are considered not reliable

Table H: pH – Deep Wells (pH Units)

Date	W1D	W2D	E5D	W3D	~~W4D~~	W5D	N2	G2	W6D	G5	F6
July 2013	6.98	10.09	7.22	5.91	6.02	6.02	3.26	6.04	6.49	NS	NS
November 2013	6.62	9.9	7.29	-	5.7	6.32	6.54	6.09	6.11	NS	NS
February 2014	6.7	10.13	7.53	-	5.7	6.1	4.01	6.09	5.75	NS	NS
June 2014	6.71	10.10	7.44	4.38	5.4	6.11	3.94	6.1	5.83	NS	NS
November 2014	6.63	9.94	8.32	3.56	5.36	6.11	3.54	6.03	5.54	NS	NS
February 2015	-	9.99	6.8	3.29	4.69	5.34	3.34	5.7	8.22	NS	NS
June 2015	6.82	10.11	7.23	4.89	-	-	6.61	6.01	5.84	NS	NS
September 2015	6.79	10.27	7.23	3.62	5.18	6.32	5.81	6.04	5.81	NS	NS
December 2015	*8.48*	10.34	7.18	-	*9.9*	*8.37*	*8.09*	7.84	5.5	NS	NS
April 2016	6.73	10.42	7.1	-	6.08	6.4	6.75	6.11	5.79	6.36	6.99
July 2016	6.82	10.29	7.27	-	-	5.7	6.37	6.09	5.58	6.77	6.67
October 2016	7.02	10.40	7.42	-	3.89	6.52	5.33	6.32	6.17	6.72	7.06
December 2016	6.78	10.02	7	-	Destroyed	6.37	4.67	6.22	5.96	5.88	6.56
March 2017	6.67	10.07	7.08	-	Destroyed	6.21	4.59	5.71	5.88	5.73	6.29
June 2017	7.3	9.37	7.97	-	Destroyed	6.94	5.37	6.08	6.19	5.96	7.08
September 2017	6.95	10.08	7.16	-	Destroyed	6.93	3.98	6.16	5.9	6.15	6.75
December 2017	6.78	10.1	7	4.72	Destroyed	6.13	4.31	6.19	5.9	5.77	6.68
March 2018	6.91	10.14	6.97	4.16	Destroyed	6.5	3.63	6.05	5.65	5.8	6.88
June 2018	7.07	10.18	7.29	3.75	Destroyed	6.1	4.41	6.05	5.7	6.23	6.67
September 2018	7.12	13.74	*12.79*	3.94	Destroyed	10.2	2.8	6.42	*10.47*	7.63	7.85
December 2018	6.76	9.87	6.95	4.53	Destroyed	6.72	4.18	6.53	6.65	5.64	6.66
March 2019	6.92	9.99	6.96	4.81	Destroyed	6.18	4.34	6.16	5.81	5.99	6.73
June 2019	6.83	10.1	7.1	4.21	Destroyed	6.23	4.51	6.35	5.71	6	6.57
September 2019	6.91	10.08	7.3	4.15	Destroyed	6.35	4.05	6.46	5.87	6.13	6.62
December 2019	7.16	10.14	6.95	3.96	Destroyed	6.16	3.85	6.13	5.56	5.7	5.61

- Well dry
NS Not Sampled
*Well pumped dry during purging, no sample collected
Results in *italics* are considered unreliable

Table I: Soluble Fluoride – Deep Wells (mg/L)

Date	W1D	W2D	E5D	W3D	~~W4D~~	W5D	N2	G2	W6D	G5	F6
July 2013	39	682	1.21	1.23	1.48	20	0.43	0.28	1.19	NS	NS
November 2013	5.4	790	40	-	1.7	0.51	6.2	0.28	0.25	NS	NS
February 2014	3.5	880	44	-	1.3	0.59	1.9	0.25	0.21	NS	NS
June 2014	5.1	930	23	0.19	0.41	0.65	1.4	0.28	0.4	NS	NS
November 2014	3.3	1080	12	0.41	1.6	0.53	0.74	0.28	0.19	NS	NS
February 2015	-	1279	18	0.22	1.1	0.44	0.49	0.28	0.3	NS	NS
June 2015	4.4	1300	16	0.3	-	-	8.1	0.3	0.1	NS	NS
September 2015	3.5	1300	14	0.3	0.2	0.4	1.4	0.3	0.1	NS	NS
December 2015	2.6	1300	16	-	-	0.5	1.4	0.3	-	NS	NS
April 2016	<10	1300	19	-	-	<10	15	<10	<10	<10	<10
July 2016	3.1	1400	18	-	-	0.5	8.6	0.3	0.2	0.4	0.6
October 2016	3.3	1500	15	-	<0.1	0.5	1.3	0.3	0.1	<0.1	0.5
December 2016	3.4	1400	16	-	Destroyed	0.5	0.8	0.3	0.1	0.3	0.5
March 2017	3.9	1700	22	-	Destroyed	0.4	0.5	0.4	1.4	0.6	0.5
June 2017	4.4	1300	19	-	Destroyed	0.6	1	0.2	0.3	0.3	0.5
September 2017	4.8	1300	14	-	Destroyed	0.5	2.1	0.3	0.1	0.3	0.5
December 2017	4.2	1200	14	0.3	Destroyed	0.4	2.4	0.4	0.2	0.3	0.6
March 2018	4.7	1200	16	0.3	Destroyed	0.5	2.1	0.3	0.3	0.2	0.9
June 2018	5.1	1200	14	0.5	Destroyed	0.4	1.5	0.3	<0.1	0.4	0.5
September 2018	4.5	1200	12	0.1	Destroyed	0.6	1.3	0.4	0.2	1.3	1
December 2018	4.8	1200	11	0.1	Destroyed	0.6	1.4	0.3	0.2	0.2	0.6
March 2019	3.9	1500	8.1	0.1	Destroyed	0.3	1.1	0.2	<0.1	<0.1	0.4
June 2019	4.7	1200	9.6	0.1	Destroyed	0.4	1.1	0.3	<0.1	0.2	0.5
September 2019	4.4	1300	8.3	0.2	Destroyed	0.4	1	0.3	<0.1	0.2	0.5
December 2019	4.8	1400	9.4	0.1	Destroyed	0.1	0.4	0.3	<0.1	0.1	0.4

- Well dry
NS Not Sampled
*Well pumped dry during purging, no sample collected
Results in *italics* are considered unreliable
Result underlined are adopted from Hydro data

Table J: Total Cyanide – Deep Wells (mg/L)

Date	W1D	W2D	E5D	W3D	~~W4D~~	W5D	N2	G2	W6D	G5	F6
July 2013	1.3	170	4.4	0.038	0.16	0.025	<0.004	<0.004	0.013	NS	NS
November 2013	0.67	160	14	-	0.13	0.039	0.077	0.028	0.016	NS	NS
February 2014	0.54	170	17	-	0.011	0.069	0.005	<0.004	0.01	NS	NS
June 2014	0.57	240	8.8	0.005	<0.004	0.016	0.004	<0.004	0.017	NS	NS
November 2014	1.3	260	4.4	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	NS	NS
February 2015	1.3	200	6.8	0.08	0.007	0.005	0.009	<0.004	0.008	NS	NS
June 2015	0.77	270	2.9	0.013	-	-	0.021	<0.004	<0.004	NS	NS
September 2015	0.77	290	1.2	0.008	-	0.005	0.05	<0.004	<0.004	NS	NS
December 2015	0.71	290	3	-	-	0.008	0.032	<0.004	-	NS	NS
April 2016	0.61	360	1.9	-	-	0.033	0.97	0.046	0.007	<0.004	<0.004
July 2016	0.76	290	1.6	-	-	0.007	0.91	<0.004	<0.004	<0.004	<0.004
October 2016	0.53	220	0.94	-	-	0.005	0.047	<0.004	0.009	<0.004	<0.004
December 2016	0.73	360	1.2	-	Destroyed	0.009	0.12	<0.004	0.005	0.005	<0.004
March 2017	0.77	330	5.5	-	Destroyed	<0.004	0.029	<0.004	0.043	<0.004	<0.004
June 2017	0.23	330	1.6	-	Destroyed	0.018	0.02	<0.004	<0.004	<0.004	<0.004
September 2017	17	300	2.1	-	Destroyed	<0.004	0.043	<0.004	<0.004	<0.004	<0.004
December 2017	0.21	200	0.7	<0.004	Destroyed	<0.004	0.054	<0.004	<0.004	<0.004	<0.004
March 2018	0.34	300	0.6	<0.004	Destroyed	<0.004	0.054	<0.004	0.01	<0.004	0.024
June 2018	0.69	330	1.6	0.036	Destroyed	0.004	0.013	0.005	0.005	<0.004	<0.004
September 2018	0.59	280	1.2	<0.004	Destroyed	0.01	0.01	0.006	0.006	0.01	0.032
December 2018	0.67	330	0.81	<0.004	Destroyed	<0.004	0.005	<0.004	<0.004	<0.004	0.005
March 2019	0.64	300	1.1	<0.004	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
June 2019	0.47	230	0.92	<0.004	Destroyed	<0.004	0.005	<0.004	<0.004	<0.004	<0.004
September 2019	0.046	240	0.68	<0.004	Destroyed	<0.004	0.007	<0.004	<0.004	<0.004	<0.004
December 2019	0.67	270	1.1	<0.004	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004

- Well dry
NS Not Sampled
*Well pumped dry during purging, no sample collected
Results in *italics* are considered unreliable

Table K: Free Cyanide – Deep Wells (mg/L)

Date	W1D	W2D	E5D	W3D	~~W4D~~	W5D	N2	G2	W6D	G5	F6
July 2013	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
November 2013	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
February 2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
June 2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
November 2014	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
February 2015	-	0.03	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	NS	NS
June 2015	<0.2	<4	<0.4	<0.004	-	-	<0.004	<0.004	-	NS	NS
September 2015	<0.02	0.058	<0.02	<0.004	-	<0.004	<0.004	<0.02	<0.004	NS	NS
December 2015	-	0.88	<0.004	-	-	<0.004	<0.004	<0.004	<0.004	NS	NS
April 2016	<0.004	0.21	<0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
July 2016	<0.004	0.11	<0.004	-	-	<0.004	<0.004	<0.004	<0.004	0.006	<0.004
October 2016	<0.004	0.11	<0.004	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
December 2016	<0.004	0.12	<0.004	-	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
March 2017	<0.004	0.15	<0.004	-	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
June 2017	<0.004	0.012	<0.004	-	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
September 2017	<0.005	0.01	<0.004	-	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
December 2017	<0.004	0.006	<0.004	<0.004	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
March 2018	<0.004	<0.004	<0.004	<0.004	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
June 2018	<0.004	0.007	<0.004	<0.004	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
September 2018	<0.004	0.029	<0.004	<0.004	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
December 2018	<0.004	0.009	<0.004	<0.004	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
March 2019	<0.004	0.004	<0.004	<0.004	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
June 2019	<0.004	0.004	<0.004	<0.004	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
September 2019	<0.004	0.03	<0.004	<0.004	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
December 2019	<0.004	0.018	<0.004	<0.004	Destroyed	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004

- Well dry
NS Not Sampled
NA Not Applicable
*Well pumped dry during purging, no sample collected
Results in *italics* are considered not reliable

Table L: Total Aluminium – Deep Wells (mg/L)

Date	W1D	W2D	E5D	W3D	~~W4D~~	W5D	N2	G2	W6D	G5	F6
July 2013	21.2	2.86	1.697	0.7	0.794	0.323	5.771	0.115	1.087	NS	NS
November 2013	0.9	0.6	1.5	-	0.48	0.04	3	0.1	0.06	NS	NS
February 2014	2.4	0.67	110	-	0.19	0.02	4.6	0.04	0.04	NS	NS
June 2014	2.4	1.4	2.2	0.58	0.27	0.02	4.5	1.2	1.2	NS	NS
November 2014	0.26	44	3.3	0.72	0.5	0.05	6.7	2.1	0.5	NS	NS
February 2015	0.26	0.03	3.4	0.76	0.35	0.16	28	2.9	0.12	NS	NS
June 2015	4	0.19	2.1	0.81	-	Dry	3.4	2	0.19	NS	NS
September 2015	0.95	0.03	2.1	0.04	-	0.99	2.4	4.1	0.74	NS	NS
December 2015	0.4	3.5	4.3	-	-	0.54	9.1	1.8	-	NS	NS
April 2016	1.5	0.06	3.6	-	-	0.39	24	9.6	0.08	1.8	0.57
July 2016	0.66	0.09	2.7	-	-	0.23	3.2	1.2	0.08	24	0.7
October 2016	0.87	0.92	1.9	-	-	0.14	3.7	1.6	0.17	0.14	0.15
December 2016	18	31	4.2	-	Destroyed	0.05	5.9	1.2	-	0.17	0.12
March 2017	89	1	64	-	Destroyed	0.01	23	1.2	1.1	6.2	0.33
June 2017	120	0.08	2.8	-	Destroyed	0.05	10	6.6	0.09	3.6	0.08
September 2017	4.1	1.6	5	-	Destroyed	0.02	23	1.8	25	4.9	0.11
December 2017	1.4	0.28	2.2	1.4	Destroyed	0.2	5.7	1.7	2.7	0.26	7.6
March 2018	0.46	1.1	3.4	1.2	Destroyed	0.03	5.2	0.5	0.47	0.19	0.16
June 2018	0.88	0.71	4.1	1.5	Destroyed	0.16	6.9	2.4	19	0.9	0.06
September 2018	0.38	0.39	2.2	0.9	Destroyed	0.09	4.7	0.57	0.96	0.04	0.03
December 2018	0.43	1	0.72	1	Destroyed	0.04	5	1.5	2.4	0.21	0.05
March 2019	0.48	0.61	1.3	0.81	Destroyed	0.44	4.2	1	3.6	0.29	0.06
June 2019	0.69	0.72	1.2	1	Destroyed	0.04	6.2	0.68	0.98	0.12	0.05
September 2019	0.71	0.83	1.2	1	Destroyed	0.24	8.4	1.1	3.6	0.29	0.12
December 2019	0.23	1.2	2.5	1.1	Destroyed	0.28	7.7	1.3	1.9	0.41	0.07

- Well dry
NS Not Sampled
*Well pumped dry during purging, no sample collected
Results in *italics* are considered not reliable

Table M: Intra-Laboratory and Inter-Laboratory Duplicate Results

Date	Analyte	Intra-Laboratory Duplicate Pair			Intra-Laboratory Duplicate Pair			Inter-Laboratory Duplicate Pair			Rinsate
March 2019		**W5D**	**QA101**	***RPD %***	**G5**	**QA103**	***RPD %***	**W5D**	**QA102**	***RPD %***	**QC101**
	Fluoride	0.3	0.3	*0*	<0.1	0.1	*NC*	0.3	0.5	***50***	<0.1
	Total Cyanide	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
	Free Cyanide	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
	Dissolved Aluminium	<0.01	<0.01	*NC*	30	30	*0*	<0.01	<0.01	*NC*	<0.01
	Total Aluminium	0.44	0.38	*14.6*	0.29	0.33	*13*	0.44	0.36	*20*	<0.01
June 2019		**G2**	**QA101**	***RPD %***	**F6**	**QA102**	***RPD %***	**F6**	**QA103**	***RPD %***	**R01**
	Fluoride	0.3	0.3	*0*	0.5	0.5	*0*	0.5	0.5	*0*	<0.1
	Total Cyanide	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
	Free Cyanide	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
	Dissolved Aluminium	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01
	Total Aluminium	0.68	0.68	*0*	0.05	0.04	*22*	0.05	0.08	*46*	<0.01
September 2019		**F6**	**QA101**	***RPD %***	**G5**	**QA102**	***RPD %***	**G5**	**QA103**	***RPD %***	**QC101**
	Fluoride	0.5	0.5	*0*	0.2	0.3	***40***	0.2	0.3	***40***	<0.1
	Total Cyanide	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
	Free Cyanide	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
	Dissolved Aluminium	<0.01	<0.01	*NC*	0.01	<0.01	*NC*	0.01	<0.01	*NC*	<0.01
	Total Aluminium	0.12	0.18	*40*	0.29	0.32	*10*	0.29	0.48	*49*	<0.01
December 2019		**G2**	**QA101**	***RPD %***	**G5**	**QA102**	***RPD %***	**G5**	**QA103**	***RPD %***	**QC101**
	Fluoride	0.3	<0.1	*NC*	0.1	<0.1	*NC*	0.1	0.1	*0*	<0.1
	Total Cyanide	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
	Free Cyanide	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
	Dissolved Aluminium	<0.01	<0.01	*NC*	0.02	0.02	*0*	0.02	0.02	*0*	<0.01
	Total Aluminium	1.3	1.2	*8*	0.41	0.37	*10*	0.41	0.29	*34*	<0.01

Italicised BOLD indicates RPD exceedance

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Low Flow Groundwater Sampling Field Parameter Form

WGD

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch
Project No:	318000664		J.Blackwell
Date:	12/3/19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.72	m	YSI Quatro Pro Plus.
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	Oil/water Interface Meter
Thickness to Immiscible layer:		m	
Well Depth	8.84	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10:24	22.5	6.05	1.55	0.73	7.1	~~864.5~~	0.1	Slightly yellow.
10:25	22.1	5.92	1.35	0.61	13.3	~~864.5~~	0.2	
10:26	21.8	5.87	1.32	0.54	16.0	~~858~~	0.3	
10:27	21.8	5.81	1.32	0.50	14.0	858	0.4.	

Miscellaneous Field Comments

Well Head Integrity: 6.30 m

Samples Filtered:

Weather Conditions:

Other:

PERTH
Level 2, 200 Adelaide Terrace
East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
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Low Flow Groundwater Sampling Field Parameter Form

WBS

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	Oil/water Interface Meter
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments Dry.

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

MW9

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.74	m	YSI Quatro Pro Plus
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	Oil/water Interface Meter
Thickness to Immiscible layer:		m	
Well Depth	2.84	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: 10:00 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10:06	25.4	8.29	10.87	1.06	-68.8	7059	-0.05	light brown, sediments
10:08	25.6	8.33	10.90	1.02	-72.7	7098	-0.15	strong sulphidic odour.
	25.9							

Water depth 2.84m insufficient depth for Sample.

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other: Well sampled during stabilisation.

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Low Flow Groundwater Sampling Field Parameter Form

GZ

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	8.32	m	YSI Quatro Pro Plus
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	O,I/water interface meter
Thickness to Immiscible layer:		m	
Well Depth	13.40	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9:34 End Sampling: 9:48

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9:35	21.9	6.29	6.23	0.59	12.6	4056	0.1	Clear, no odour.
9:36	21.8	6.23	6.24	0.55	18.4	4056	0.2	
9:37	21.7	6.20	6.24	0.51	19.1	4056	0.3	
9:38	21.6	6.16	6.24	0.83	16.7	4056	0.4	

Miscellaneous Field Comments

Well Head Integrity: ~~8.35m~~ 8.36m

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

N8

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.25	m	YSI Quatro Pro Plus
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	Oil/water interface meter
Thickness to Immiscible layer:		m	
Well Depth	5.31	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 10.48 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11.00	28.3	6.84	9.99	1.20	-77.0	6500	0.1	Slightly brown/ yellow
11.01	28.1	6.83	10.07	1.13	-79.3	6584.5	0.1	no odour
11.02	28.6	6.83	10.20	1.45	-79.9	6669.0	0.1	" " "
11.03	26.5	6.81	10.20	1.58	-79.5	6636.5	0.1	" " "

Miscellaneous Field Comments

Well Head Integrity: 9.51 pump at lowest capacity.

Samples Filtered: metals

Weather Conditions:

Other:

PERTH
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Low Flow Groundwater Sampling Field Parameter Form

ES

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	~~YSI Quatro Pro Plus~~
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	Oil/water Interface Meter
Thickness to Immiscible layer:	m	
Well Depth 2.57	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other: Dry

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Low Flow Groundwater Sampling Field Parameter Form

E11

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.59	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.74	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 11:24 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11:25	24.1	8.94	13.03	0.20	-239.3	8489	0.1	
11:26	23.6	8.97	13.02	0.09	-239.9	8482	0.1	
11:27	23.5	8.99	13.05	—	-244	8489	0.1	
11:28	23.2	8.99	13.06	—	-245	8491	0.1	

Miscellaneous Field Comments

Well Head Integrity: 3.65

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

E5D

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:	8:46	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.48	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.42	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8:55	24.4	7.00	15.25	0.68	-92.4	9899.5	0.1	Clear to slightly yellow, -
8:56	24.3	6.98	15.23	1.42	-94.3	9899.5	0.2	No odour
8:57	24.3	6.97	15.23	2.09	-94.8	9899.5	0.3	" "
8:58	24.3	6.96	15.24	2.24	-95.6	9912.5	0.4	" "

Miscellaneous Field Comments

Well Head Integrity: 2.64 m

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

W2D

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:	7.15	Subcontractors:	N/A
Finish time:	7.25		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.90	m	YSI Pro Plus
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	Geotech Interface Probe
Thickness to Immiscible layer:		m	
Well Depth	6.57	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 7:15 End Sampling: 7.25

Sample Appearance: Dark brown, odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
7:16	23.2	9.94	40.93	6.49	-406.1	26604.5	0.2	Dark brown
7:17	23.2	9.97	40.93	6.41	-409.5	26598	0.4	" "
7:18	23.2	9.97	40.93	6.37	-410.8	26604	0.6	" "
7:19	23.2	9.98	40.92	6.34	-413.4	26598	0.8	" "
7:20	25.2	9.99	40.93	6.29	-417.4	26604	1.0	" "

Miscellaneous Field Comments

Well Head Integrity: 3:54m pump at lowest capacity

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

W75

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater		m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.32	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
DRY								

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Pump

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12 - 3 - 19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.88	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.48	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 7:53 End Sampling: 8:06

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
7:54	24.0	9.32	5.56	0.57	-283.5	3614	0.1	Slightly brown, slight sulphidic odour
7:55	24.2	9.39	5.58	0.32	-284.0	3627.0	0.2	"
7:56	24.3	9.42	5.56	0.55	-283.2	3614	0.3	
7:57	24.4	9.42	5.52	0.26	-281.4	3575	0.4	

Miscellaneous Field Comments

Well Head Integrity: 2.97

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

W7m

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.18	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.73	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 8:26 End Sampling: 8:36

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8:26	24.2	9.67	25.82	0.01	-267.9	16770	0.1	slightly brown
8:27	24.1	9.71	25.70	"	-265.0	16601	0.2	
8:28	24.1	9.70	25.36	"	-260.9	16406	0.3	
8:29	24.1	9.68	25.08	"	-263.8	16263	0.4	

Miscellaneous Field Comments

Well Head Integrity: 3.64 m

Samples Filtered: Metals

Weather Conditions: Sunny.

Other:

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W25

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12/3/19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	N/A	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.4	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
DRY								

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

WID

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	13-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.76	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.42	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 11:58 End Sampling: 12:09

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
12:00	21.2	6.99	11.02	0.89	-125.5	7150.0	0.1	clear to slightly brown
12:01	21.1	6.93	10.89	0.64	-127.6	7124.0	0.1	slight sulphidic odour
12:02	20.6	6.93	10.99	0.57	-128.7	7104.5	0.1	" " " "
12:03	20.4	6.92	10.93	0.39	-136.4	7098.0	0.1	" " " "

Miscellaneous Field Comments

Well Head Integrity: 5.27

Samples Filtered: metals

Weather Conditions: Cloudy, slight breeze.

Other:

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Low Flow Groundwater Sampling Field Parameter Form

E4.

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	13-3-19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.97	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.40	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 12.25 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
12.30	22.6	9.40	15.77	0.62	-254.6	10224.5	0.1	slightly brown, slight
12.31	22.5	9.45	15.67	0.01	-258.9	10172.5	0.1	sulphidic odour
12.32	22.6	9.46	15.63	---	-256.3	10153.0	0.1	" " " "
12.33	22.6	9.47	15.55	---	-249.8	10099.5	0.1	" " " "

Miscellaneous Field Comments

Well Head Integrity: 3 14.

Samples Filtered: metals

Weather Conditions: overcast

Other: QC101 (rinsate on flexi tubing).

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Low Flow Groundwater Sampling Field Parameter Form

W45

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	13-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.1	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.1	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments

Dry

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

W35

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	13-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.13	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.53	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 11:25 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11:29	22.6	7.10	7.85	6.45	148.9	5102.5	0.1	Pale brown, turbid silty.

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: cloudy

Other: Insufficient water to complete reading / collect sample.

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Low Flow Groundwater Sampling Field Parameter Form

W31

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	13-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.43	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.9	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 11 01 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11.04	20.9	5.73	2.69	0.77	2.5	1742.00	0.1	clear, no odour
11.05	20.6	5.23	2.66	0.71	0.7	1729.00	0.1	" " "
11.06	20.4	5.01	2.67	0.51	7.3	1735.50	0.1	" " "
11.07	20.3	4.88	2.66	0.96	9.1	1729.0	0.1	" " "
11.08	20.3	4.81	2.66	0.90	5.4	1729.0	0.1	" " "

Miscellaneous Field Comments

Well Head Integrity: 7.29m

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

A7

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	13-3-19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.71	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.33	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10:43	22.3	9.28	19.4	—	-381.9	12642	0.1	Slightly brown, sulphidic odour
10:44	22.3	9.34	19.48	—	-384.9	12675	0.1	
10:45	22.0	9.37	19.61	→	-398.9	12746.5	0.1	
10:46	22.0	9.38	19.61	→	-400.6	12753	0.1	

Miscellaneous Field Comments

Well Head Integrity: 2.84m

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

FS

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	13-3-19		
Start time:	10.08	Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.83	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.40	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.11	21.5	5.64	10.00	1.66	-19.5	6506.0	0.1	clear, no odour
10.12	21.0	5.27	10.05	0.90	-19.8	6532.5	0.1	" " "
10.13	20.9	5.09	10.05	-29.8 ↔ 0.63		6532.50	0.1	" " "
10.14	20.8	5.01	10.05	0.60	-27.9	6532.5	0.1	" " "
10.15	20.6	4.96	10.05	0.47	-29.5	6532.5	0.1	" " "

Miscellaneous Field Comments

Well Head Integrity: 4.1

Samples Filtered: metals.

Weather Conditions: cloudy.

Other:

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Low Flow Groundwater Sampling Field Parameter Form

WIS

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	13-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 2.43	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments Dry

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

G5

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	13-3-19		
Start time:	9:32	Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.77	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	11.36	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling: 9.57.

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND. mS/cm	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.41	20.9	6.82	5.89	1.26	-114.0	3958.5	0.1	clear, slight sulphidic odour
9.42	20.4	6.91	6.63	0.68	-109.2	4374.5	0.1	" " " "
9.43	20.3	6.17	6.78	0.50	-101.8	4420.0	0.1	" " " "
9.44	20.2	6.06	6.84	0.42	-99.3	4439.0	0.1	" " " "
9.45	20.2	5.99	6.84	0.40	-96.4	4446.0	0.1	" " " "

Miscellaneous Field Comments QA103

Well Head Integrity: 4.40 pump at lowest capacity

Samples Filtered:

Weather Conditions:

Other:

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No.	Well ID	Well Depth (m)	Notes March 2019	Notes June 2019
1	A7	5		26-6-19
2	E11	4.8		25-6-19
3	E4	3.4		26-6-19.
4	E5	2	DRY	DRY
5	E5D	5.44		25-6-19
6	F5	7.4		26-6-19
7	F6	15.6		25-6-19
8	G2	13.46		25-6-19
9	G5	11.37		26-6-19
10	G6	7.15		25--6-19
11	N2	5.6		25-6-19
12	N8	5.34		25-6-19
13	N9	2.8	Insufficient Water	sampled during stabilisation on 25-6-19
14	PUMP	3.46		25-6-19.
15	W1D	11.5		26-6-19.
16	W1S	2	DRY	DRY
17	W2D	8.5		6.37 25-6-19
18	W2S	2.38	DRY	DRY
19	W3D	11		26-5-19.
20	W3S	2.5	Insufficient Water	26-5-19.
21	W3SA	0.5	destroyed	destroyed
22	W4D	10	destroyed	destroyed.
23	W4S	0.4		DRY
24	W5D	10.5		25-6-19
25	W5S	0.65	DRY 1.7	DRY
26	W6D	9.5		25-6-19
27	W6S	2	DRY	DRY
28	W7M	3.72		25-6-19.
29	W7S	1.8	DRY	DRY

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

E4

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	26-6-19		
Start time:	10.50	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.81	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.90	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.54	17.1	9.43	18174	0.92	-224.4	11843.0	0.1	Slightly yellow, sulphuric
10.55	17.2	9.51	18295	0.96	-232.9	11895.0	0.2	odour " "
10.56	17.2	9.55	18308	0.33	-233.6	11901.5	0.3	" " "
10.57	17.3	9.56	18320	0.25	-233.7	11908.0	0.4	" " "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WID

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	26-6-19		
Start time:	10.21	Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.63	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.38	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 10.30 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.31	17.8	6.76	7952	1.91	-126.5	6513.0	0.1	clear, slightly
10.32	18.2	6.79	10269	0.73	-148.9	6682.0	0.2	cloudy, sulphidic
10.33	18.2	6.80	10315	0.93	-154.7	6719.5	0.3	odour
10.34	18.2	6.82	10345	0.83	-159.8	6727.5	0.4	" " " "
10.35	18.2	6.83	10360	0.55	-162.5	6739.0	0.5	" " " "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WIS

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	26-6-19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 2.13	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
	DRY							

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WMS

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:			
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.11	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.12	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
	DRY.							

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W35

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	26-6-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.23	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.53	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.54	16.1	7.31	7166	2.58	237.7	4680.0	0.1	clear to yellow,
9.55	16.0	7.12	7279	2.18	248.3	4738.5	0.2	slightly turbid, cloudy
9.56	15.9	7.05	7328	2.38	259.6	4771.0	0.3	" " " " "
9.57	15.9	7.02	7348	2.46	269.5	4777.5	0.4	" " " " "
9.58	15.9	7.01	7355	2.45	276.8	4784.	0.5	" " "

Miscellaneous Field Comments

Well Head Integrity:	2.91 purged dry
Samples Filtered:	metals
Weather Conditions:	
Other:	

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W3D

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	26-6-19		
Start time:	9.25	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.84	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth		m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.28	16.2	6.01	2953	1.07	51.8	1605.5	0.1	Clear, slight sulphidic odour
9.29	16.7	5.27	2580	0.96	65.7	1677.0	0.2	" " "
9.30	16.9	4.97	2581	0.84	73.2	1683.5	0.3	" " "
9.31	16.9	4.73	2589	0.70	77.7	1677.0	0.4	" " "
9.32	17.1	4.54	2583	0.56	87.7	1670.5	0.5	" " "
9.33	17.2	4.40	2555	0.50	96.6	1657.5	0.6	" " "
9.34	17.3	4.30	2592	0.47	97.8	1694.5	0.7	" " "
9.35	17.2	4.26	2525	0.50	100.9	1638.0	0.8	" " "
9.36	17.3	4.21	2502	0.48	106.1	1625.0	0.9	" " "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

A7

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	26-5-19		
Start time:	8.58	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.63	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.31	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: Red / brown, strong sulphidic odour.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.05	16.2	9.29	18125	0.06	-336.9	11843	0.1	Slightly brown, sulphidic
9.06	16.9	9.37	18391	0.09	-367.0	11990.5	0.2	" " odour
9.07	16.4	9.38	18430	0.05	-383.7	12044.5	0.3	" " "
9.08	16.7	9.40	18467	0.02	-397.4	12012.0	0.4	" " "

Miscellaneous Field Comments

Well Head Integrity: 2.79

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

F5

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	26-6-19		
Start time:	8 10	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.92	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.36	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8.12	14.6	6.14	9108	2.52	56.5	5967.0	0.1	clear, slight sulphidic
8.13	15.2	5.53	9360	1.80	72.2	6110.0	0.2	" " " odour
8.14	15.1	5.25	9945	1.71	70.2	6149.0	0.3	" " "
8.15	15.4	5.08	9948	1.49	67.0	6162.0	0.4	" " "
8.16	15.9	4.91	9508	0.84	63.0	6181.5	0.5	" " "
8.17	16.2	4.83	9503	0.71	61.2	6175.0	0.6	" " "
8.18	16.2	4.78	9536	0.65	59.2	6207.5	0.7	" " "
8.19	16.3	4.79	9573	0.58	56.4	6214.0	0.8	" " "
8.20	16.4	4.71	9555	0.53	55.5	6220.5	0.9	" " "

Miscellaneous Field Comments

Well Head Integrity:	4.14
Samples Filtered:	metals
Weather Conditions:	overcast
Other:	

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

GS

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	26·5·19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3·57	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	11·34·	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
7 49	15 9	7 20	5972	1·55	-95 9	3776·5	0·1	Clear, sulphidic odour
7 50	16·2	6·70	6647	1·15	-51·6	4926·5	0·2	" " "
7 51	16·2	6·51	6992	0·99	-35·0	4615·0	0·3	" " "
7 52	16·2	6·36	7242	0·78	-21·4	4732·0	0·4	" " "
7·53	16·2	6·20	7327	0·66	-11·5	4769·5	0·5	" " "
7·54	16·3	6·09	7300	0·61	-7·4	4795·0	0·6	" " "
7·55	16·3	6·09	7297	-0·88	-5·4	4732·0	0·7	" " "
7·56	16·3	6·0	7258	0·84	-4·7	4712·5	0·8	" " "

Miscellaneous Field Comments

Well Head Integrity: 4 S1

Samples Filtered: metals

Weather Conditions: overcast

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

G6

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.42	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.15	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: clear, sulphidic odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
1.36	17.6	5.52	7687	2.75	197.7	5031.0	0.1	clear, sulphidic odour
1.37	17.9	4.77	7779	0.99	149.5	5076.5	0.2	" " "
1.38	18.0	4.93	7866	0.70	147.1	5115.5	0.3	" " "
1.39	18.0	4.23	7889	0.68	144.5	5128.5	0.4	" " "
1.40	18.1	4.05	7900	0.64	142.7	5135.0	0.5	" " "
1.41	18.1	3.97	7906	0.53	140.2	5141.5	0.6	" " "
1.42	18.2	3.91	7912	0.48	136.2	5141.5	0.7	" " "
1.43	18.3	3.88	7923	0.42	133.1	5148.0	0.8	" " "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other: R01

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

F 6

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.30	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	15.66	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
1.02	17.8	6.47	8995	2.03	-43.4	5882.0	0.1	Clear, sulphidic odour
1.03	18.0	6.51	9141	0.92	-48.6	5967.0	0.2	" " "
1.04	18.1	6.54	9232	0.72	-49.7	6006.0	0.3	" " "
1.05	18.1	6.55	9273	0.63	-52.0	6032.0	0.4	" " "
1.06	18.1	6.57	9289	0.55	-54.0	6038.5	0.5	" " "

Miscellaneous Field Comments

Well Head Integrity: 6.39

Samples Filtered: metals.

Weather Conditions: Sunny

Other: QA102, QA103

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N 2

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	12.16 pm	Subcontractors:	N/A
Finish time:	12.42 pm		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.92	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.61	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: clear to grey, cloudy, very turbid

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
12.28	17.9	4.09	7160	2.57	306.2	4654.0	0.1	clear to grey, no odour
12.29	17.9	4.07	7266	2.11	304.8	4719.0	0.2	" " " "
12.30	17.5	4.94	7228	1.09	213.3	4699.5	0.3	" " " "
12.31	17.6	4.59	7229	0.66	202.0	4699.5	0.4	" " " "
12.32	17.7	4.51	7229	0.60	211.4	4699.5	0.5	" " " "

Miscellaneous Field Comments

Well Head Integrity:	5.35
Samples Filtered:	metals
Weather Conditions:	Sunny
Other:	

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WSD

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	11:42	Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.10	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.54	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11:53	17.2	7.32	6038	1.06	-52.9	3952.0	0.1	clear, no odour
11:54	17.4	6.93	6096	0.80	-21.2	3997.0	0.2	" " "
11:55	17.8	6.73	6192	0.68	-12.8	4056.0	0.3	" " "
11:56	18.0	6.55	6266	0.63	-8.0	4088.5	0.4	" " "
11:57	18.0	6.42	6303	0.50	-5.8	4108.0	0.5	" " "
11:58	18.0	6.30	6330	0.44	-5.1	4119.5	0.6	" " "
11:59	18.0	6.26	6330	0.42	-4.9	4119.5	0.7	" " "
12:00	18.0	6.23	6329	0.39	-4.7	4119.5	0.8	" " "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: Overcast

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WSS

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	11:40	Subcontractors:	N/A
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
	DRY							

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

E11

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	11:07	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.55	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.81	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11.20	17.0	8.60	12320	2.25	-176.5	8035	0.1	clear, sulphidic odour
11.21	17.5	8.73	12713	0.42	-191.8	8274	0.2	" " "
11.22	17.5	8.78	12720	0.37	-192.7	8248.5	0.3	" " "
11.23	17.5	8.77	12596	0.45	-191.0	8183.5	0.4	" " "
11.24	17.6	8.76	12535	0.35	-189.5	8138.0	0.5	" " "

Miscellaneous Field Comments

Well Head Integrity: 3.55.

Samples Filtered: metals

Weather Conditions: rainy

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N8

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	10.40	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.26	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.30	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.50	16.7	7.08	9183	0.79	-102.5	5986.5	0.1	clear to yellow,
10.51	17.1	6.82	9383	0.95	-102.4	6123.0	0.2	" " "
10.52	17.3	6.76	9498	0.50	-101.9	6181.5	0.3	" " "
10.53	17.6	6.71	9586	0.56	-101.9	6266.0	0.4	" " "
10.54	17.6	6.69	9675	0.59	-101.7	6292.0	0.5	" " "
10.55	17.7	6.68	9705	0.56	-101.8	6311.5	0.6	" " "

Miscellaneous Field Comments

Well Head Integrity:	S.T.T
Samples Filtered:	Metals
Weather Conditions:	rainy
Other:	

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WGD

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19	Subcontractors:	N/A
Start time:	10.12		
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.0	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	8.80	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: clear to slightly yellow, slightly turbid sulphidic odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.15	16.5	7.01	1237	1.59	18.0	806.0	0.1	clear, slight odour
10.16	16.9	6.58	1239	1.27	10.8	806.0	0.2	" " "
10.17	17.1	6.15	1242	1.35	95.6	806.0	0.3	" " "
10.18	17.3	6.0	1245	1.50	97.5	812.5	0.4	" " "
10.19	17.4	5.90	1246	1.58	99.6	812.5	0.5	" " "
10.20	17.4	5.83	1247	1.56	99.8	812.5	0.6	" " "
10.21	17.4	5.78	1246	1.56	99.2	812.5	0.7	" " "
10.22	17.5	5.73	1242	1.56	97.2	806.0	0.8	" " "
10.23	17.5	5.71	1241	1.56	94.5	806.0	0.9	" " "

Miscellaneous Field Comments

Well Head Integrity: 6.14

Samples Filtered:

Weather Conditions: Rainy

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W65

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	10.00	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:	ppm	Measurement device:	
Depth to Groundwater	m		
Correction:	m		
Groundwater Elevation:	m	Measurement device:	
Depth to Immiscible Layer	m		
Thickness to Immiscible layer:	m		
Well Depth 3.11	m	Measurement device:	
Thickness to Groundwater Column:	m		

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
	DRY							

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N9

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	9 45	Subcontractors:	N/A
Finish time:	9.55		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.70	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.83	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: Clear to slightly brown, sediments; sulphide odour.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.48	15.1	8.68	5252	1.53	-158.7	3581.5	0.1	clear, sediments
9.49	15.2	8.70	10152	1.26	-165.3	6578.5	0.2	" "
9.50	15.9	8.71	10384	1.10	-185.1	6753.5	0.3	" "
9.51	16.0	8.71	10380	1.03	-189.0	6779.5	0.4	" "

Miscellaneous Field Comments

Well Head Integrity: 2.83 purged dry

Samples Filtered: metals

Weather Conditions:

Other: Sampled during stabilisation

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

42

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	9.05	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	7.73	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	13.50	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.07	15.4	7.16	5620	1.05	-33.7	3659.5	0.1	clear, no odour
9.08	16.0	6.84	5602	0.96	-13.7	3646.5	0.2	" " "
9.09	15.9	6.70	5609	0.94	-8.0	3666.0	0.3	" " "
9.10	16.3	6.53	5653	0.83	-6.0	3679.0	0.4	" " "
9.11	16.5	6.43	5712	0.75	-3.8	3729.50	0.5	" " "
9.12	16.7	6.35	5733	0.64	-2.7	3731.0	0.6	" " "

Miscellaneous Field Comments

Well Head Integrity: S.G.

Samples Filtered: metals

Weather Conditions:

Other: QA101

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WTM

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	8:03	Subcontractors:	N/A
Finish time:	8:19		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.09	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.73	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: Dark brown, red, sulphidic odour, turbid.

TIME	TEMP (°C)	pH	SPEC. COND.	DO ppm	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8:06	16.2	9.52	21271	0.99	-97.8	14891.5	0.1	Brown, no odour
8:07	16.6	9.73	22834	0.34	-108.9	19735.5	0.2	" " "
8:08	16.5	9.71	22301	0.31	-152.7	19971.5	0.3	" " "
8:09	16.6	9.69	22028	0.28	-186.1	19212.0	0.4	" " "
8:10	16.7	9.66	21913	0.26	-213.5	19257.5	0.5	" " "
8:11	16.8	9.65	21955	0.22	-223.5	19261.0	0.6	" " "

Miscellaneous Field Comments

Well Head Integrity: 3.95

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W7S

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater		m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.32	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
	DRY.							

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

Pump

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	7.39	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.80	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.45	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: cloudy, turbid, clear to slightly yellow.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
7.41	14.0	9.51	2699	2.91	-84.7	1768.0	0.1	clear, slightly turbid,
7.42	14.4	9.46	2709	1.65	-124.7	1761.5	0.2	no odour
7.43	14.7	9.45	2711	1.20	-137.2	1761.5	0.3	" " "
7.44	14.8	9.44	2712	1.07	-153.8	1761.5	0.4	" " "
7.45	15.0	9.43	2701	1.05	-162.8	1755.0	0.5	" " "

Miscellaneous Field Comments

Well Head Integrity: 2.80
Samples Filtered: Metals
Weather Conditions: cloudy
Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W20
WBH

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-06-19		
Start time:	7.01	Subcontractors:	N/A
Finish time:	7.25		

Field Measurements

Organic Vapours in Well:		ppm	Measurement device: YSI Pro
Depth to Groundwater	2.70	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device: Peri Pump
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	6.37	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 7.13 End Sampling: 7.25

Sample Appearance: Dark brown / red, non turbid.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
7.13	15.6	10.07	37930	2.47	-244.8	24732.5	0.1	Brown, very slight
7.14	16.6	10.09	37999	2.38	-277.6	24791.0	0.2	sulphidic odour
7.15	16.7	10.10	38202	2.33	-299.8	24862.5	0.3	" " "
7.16	16.8	10.10	38303	2.37	-304.0	24927.5	0.4	" " "

Miscellaneous Field Comments

Well Head Integrity: 3.28 pump at lowest capacity

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by: J kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

ES

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	8:25	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater		m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.58	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
	DRY							

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: J kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W25

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25/06/19		
Start time:	6:57	Subcontractors:	N/A
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 2.38	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
	DRY							

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: j kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

ESD

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	25-6-19		
Start time:	8-32	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.70	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.43	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8.35	15.4	7.55	13565	2.75	31.8	8872.5	0.1	slightly brown,
8.36	16.1	7.32	13668	0.99	-6.3	8833.0	0.2	no odour
8.37	16.4	7.23	13722	0.91	-19.3	8944.0	0.3	" " "
8.38	16.9	7.18	13680	0.96	-26.5	8934.0	0.4	" " "
8.39	17.4	7.13	13727	0.97	-29.5	8976.5	0.5	" " "
8.40	17.4	7.10	13846	0.91	-29.1	8996.0	0.6	" " "

Miscellaneous Field Comments

Well Head Integrity: 2.86

Samples Filtered: metals

Weather Conditions:

Other:

No.	Well ID	Well Depth (m)	Notes March 2019	Notes June 2019	Notes Sept 2019
1	A7	5			24/9/19.
2	E11	4.8			23/9/19
3	E4	3.4			24/9/19
4	E5	2	DRY	DRY	DRY
5	E5D	5.44			24/9/19
6	F5	7.4			24/9/19
7	F6	15.6			24/9/19
8	G2	13.46			23/9/19
9	G5	11.37			24/9/19
10	G6	7.15			24/9/19
11	N2	5.6			24/9/19 purged dry.
12	N8	5.34			23/9/19.
13	N9	2.8	Insufficient Water	Sampled during stabilisation	sampled 23/9/19. during stabilisation.
14	PUMP	3.46			24/9/19.
15	W1D	11.5			24/9/19.
16	W1S	2	DRY	DRY	DRY
17	W2D	8.5			24/9/19
18	W2S	2.38	DRY	DRY	DRY.
19	W3D	11			24/9/19
20	W3S	2.5	Insufficient Water		24/9/19.
21	W3SA	0.5	destroyed	destroyed	destroyed
22	W4D	10	destroyed	destroyed	destroyed.
23	W4S	0.4			DRY
24	W5D	10.5			24/9/19.
25	W5S	0.65	DRY	DRY	DRY
26	W6D	9.5			23/9/19.
27	W6S	2	DRY	DRY	DRY.
28	W7M	3.72			24/9/19
29	W7S	1.8	DRY	DRY	DRY

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N2

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	21/7/19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.09	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.61	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 8.00 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8.02	15.4	6.80	7.34	4.03	166.5	4771.0	0.1	clear, no odour
8.03	15.7	5.48	7.32	5.55	234.3	4769.5	0.2	" " "
8.04	15.8	4.79	7.31	5.44	270.5	4751.5	0.3	" " "
8.05	15.9	4.38	7.29	4.33	287.0	4732.0	0.4	" " "
8.06	15.9	4.12	7.24	5.82	316.3	4706.0	0.5	" " "
8.07	15.9	4.05	7.23	5.40	331.8	4706.0	0.6	
								purged dry.

Miscellaneous Field Comments: samples collected ~~after returning~~ to allow recharge. 1.38 time after 8am reading.

Well Head Integrity: 5.16 before second sample attempt 1.38 pm.

Samples Filtered: metals

Weather Conditions: sunny

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

ESD

Project Name: Quarterly GME	Ramboll Personnel: J Kirsch
Project No: 318000664	
Date: 24/9/19	
Start time:	Subcontractors: N/A
Finish time:	

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.70	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.43	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: clear to slightly brown, no odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
1.18	20.9	8.02	15.50	1.30	-24.5	10062	0.1	
1.19	20.5	7.65	15.90	0.95	-4.7	10010	0.2	
1.20	20.3	7.49	15.38	0.63	-8.1	9997.0	0.3	
1.21	20.3	7.38	15.35	0.69	-21.9	9977.5	0.4	
1.22	20.3	7.30	15.34	1.17	-27.8	9971	0.5	

Miscellaneous Field Comments

Well Head Integrity: 2.86

Samples Filtered: metals

Weather Conditions: sunny.

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

ES

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater		m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.56	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
DRY.								

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W78m

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.16	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.80	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: brown/red, slightly sulphidic odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
12.59	21.9	9.34	21.64	3.33	-125.3	16471	0.1	
13.00	19.7	9.83	25.02	0.20	-243.8	16237	0.2	
13.01	19.6	9.81	24.40	0.14	-231.8	15665	0.3	
13.02	19.3	9.73	23.31	0.11	-223.4	15138	0.4	

Miscellaneous Field Comments: sampled during stabilisation. narrow well ~ 5cm diameter

Well Head Integrity: 3.62

Samples Filtered: metals

Weather Conditions: Sunny.

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WTS

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 2.32	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
	DRY.							

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

Pump

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.87	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.47	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 12.33 End Sampling:

Sample Appearance: brown / grey. sulphidic odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
12.40	19.9	9.88	9.66	0.32	-237.5	6318.0	0.1	
12.41	20.7	9.90	9.33	0.43	-257.5	6069.5	0.2	
12.42	19.7	9.89	9.67	0.12	-262.2	6350.5	0.3	

Miscellaneous Field Comments

Well Head Integrity: 2.97.

Samples Filtered: Metals

Weather Conditions: Sunny.

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W20

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.78	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	6.37	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: brown / red, no odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
12.20	21.1	10.09	40.33	0.60	-121.0	26201.5	0.1	
12.21	20.9	10.09	40.32	0.27	-127.8	26201.5	0.2	
12.22	20.8	10.08	40.32	0.16	-134.0	26201.5	0.3	

Miscellaneous Field Comments

Well Head Integrity: 3.27

Samples Filtered: metals

Weather Conditions: Sunny.

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W25

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater		m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.39	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
DRY.								

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

E4.

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	29/9/19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.87	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	9.42.	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: brown, sulphidic odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11.57	18.0	9.52	22.17	0.04	-263.6	14278	0.1	
11.58	17.7	9.58	22.15	—	-275.8	14410.5	0.2	
11.59	17.4	9.58	22.16	—	-279.7	14397.5	0.3	

Miscellaneous Field Comments

Well Head Integrity: 2.99

Samples Filtered: metals

Weather Conditions: Sunny.

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W10

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.06	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.38	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☒ Peristalic ☐ Bailer

Start Sampling: 11.37 End Sampling:

Sample Appearance: slightly brown/yellow, sulphidic odour.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11.39	20.2	7.29	10.93	1.05	-118.5	7129.0	0.1	
11.40	19.6	7.07	10.96	0.89	-133.1	7124.0	0.2	
11.41	19.6	6.99	10.96	0.36	-135.7	7117.5	0.3	
11.42	19.6	6.91	10.94	0.22	-136.5	7111.0	0.4	

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WIS.

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:			
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 2.13	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
DRY								

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WAS.

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:			
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 1.10	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
DRY.								

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W3BS

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.60	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.54	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: Slightly brown

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11.08	17.3	7.79	9.16	7.32	263.1	5950	0.1	
11.09	17.1	7.73	9.17	8.24	268.2	5954.0	0.2	
11.10	17.1	7.70	9.15	8.56	272.5	5941.0	0.3.	

Miscellaneous Field Comments

Well Head Integrity: 1.89.

Samples Filtered: Metals

Weather Conditions: Sunny.

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W33D

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.72	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	9.98	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 10.40 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.43	19.1	6.80	3.00	0.80	-50.9	1943.5	0.1	clear
10.44	19.0	5.84	2.96	0.98	-36.1	1911.0	0.2	
10.45	19.0	5.11	2.90	0.36	-15.8	1872.0	0.3	
10.46	19.0	4.75	2.82	0.13	-4.4	1820.0	0.4	
10.47	18.9	4.48	2.75	0.74	4.34	1779.0	0.5	
10.48	18.9	4.26	2.69	1.69	84.0	1700	0.6	
10.49	19.0	4.15	2.62	1.96	104.9	1696	0.7	

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

A7

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	29/9/19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.50	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.30	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: brown / red, odour.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.22	18.5	9.36	19.29	–	-327.2	12558.	0.1	brown, sulphidic odour
10.23	18.2	9.35	19.41	–	-349.7	12623.	0.2	
10.24	18.1	9.39	19.44	–	-360.7	12836	0.3	

Miscellaneous Field Comments

Well Head Integrity:	2.63
Samples Filtered:	metals
Weather Conditions:	sunny
Other:	

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

FS

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.88	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.38	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.45 End Sampling:

Sample Appearance: clear, no odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.47	17.1	7.99	10.15	1.70	80.2	6610.5	0.1	
9.48	17.4	6.41	10.24	1.22	86.4	6682.0	0.2	
9.49	17.4	5.85	10.29	1.03	93.4	6695.0	0.3	
9.50	17.5	5.44	10.31	0.66	102.8	6701.5	0.4	
9.51	17.6	5.05	10.29	0.47	117.4	6695.0	0.5	
9.52	17.7	4.84	10.29	0.45	133.7	6695.0	0.6	
9.53	17.6	4.70	10.29	0.46	147.0	6688.5	0.7	
9.54	17.6	4.60	10.29	0.51	157.5	6688.5	0.8	

Miscellaneous Field Comments

Well Head Integrity: 4.06

Samples Filtered: metals

Weather Conditions: sunny.

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

GS

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.83	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	11.34	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 9.17 End Sampling:

Sample Appearance: very slight sulphidic odour, clear

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.19	17.1	6.01	5.58	3.37	-6.9	3945	0.1	black particulate
9.20	17.4	5.91	8.00	1.82	-11.4	5271.5	0.2	
9.21	17.6	5.98	9.35	0.40	-39.9	6097.0	0.3	
9.22	17.5	6.07	9.41	0.41	-47.1	6123.0	0.4	
9.23	17.5	6.13	9.40	0.39	-52.8	6077.0	0.5	

Miscellaneous Field Comments QA102
QA103

Well Head Integrity: 4.08

Samples Filtered: metals

Weather Conditions: sunny.

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

GB

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.56	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.14	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 8.48 End Sampling:

Sample Appearance: slightly brown, strong sulphidic odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8.49	17.3	7.17	7.09	0.94	85.1	4691.0	0.1	
8.50	17.3	6.07	7.20	0.56	81.3	4686.5	0.2	
8.51	17.3	5.30	7.20	0.54	73.3	4699.5	0.3	
8.52	17.4	4.67	7.26	0.46	69.6	4725.5	0.4	
8.53	17.5	4.42	7.30	0.39	69.9	4751.5	0.5	
8.54	17.5	4.22	7.35	0.36	69.9	4777.5	0.6	
8.55	17.5	4.14	7.37	0.34	69.8	4790.5	0.7	

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

F6

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.43	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	15.54.	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: clear, sulphidic

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8.26	16.4	6.67	9.82	1.67	-45.8	6909.0	0.1	black particulate
8.27	17.1	6.65	9.88	0.73	-55.5	6428.5	0.2	sulphidic odour
8.28	17.3	6.63	9.88	0.77	-57.7	6428.5	0.3	" "
8.29	17.4	6.62	9.88	0.67	-58.7	6922.0	0.4	" "

Miscellaneous Field Comments QA101

Well Head Integrity: 5.73 [illegible] capacity.

Samples Filtered: metals

Weather Conditions: Sunny.

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W50

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.19	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.16	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 7.32 End Sampling:

Sample Appearance: Clear, no odour.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
7.34	15.2	7.58	6.39	1.03	-30.2	199	0.1	
7.35	16.2	7.05	6.61	0.27	-56.2	303.5	0.2	
7.36	16.6	6.84	6.63	0.12	-38.9	332.0	0.3	
7.37	16.7	6.65	6.67	0.0	-38.5	348.5	0.4	
7.38	16.9	6.52	6.67	0.52	-38.4	342.0	0.5	
7.39	16.9	6.44	6.68	0.10	-37.4	342.0	0.6	
7.40	16.8	6.37	6.69	0.39	-22.6	348.5	0.7	
7.41	16.9	6.35	6.68	0.18	-25.2	342.0	0.8	

Miscellaneous Field Comments

Well Head Integrity: 7.26 lowest capacity.

Samples Filtered: metals

Weather Conditions: Sunny.

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WSS

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	24/9/19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater		m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.71	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
DRY								

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

E11

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	23/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.50	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.81	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: Clear, slightly turbid.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
2.18	20.0	7.66	9.00	0.25	-27.8	5830.5	0.1	
2.19	20.0	7.82	8.99	0.19	-37.4	5893.5	0.2	
2.20	19.8	7.85	9.01	0.15	-38.3	5869.0	0.3	
2.21	19.6	7.87	9.05	0.13	-38.5	5889.0	0.4.	

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N8

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	23/9/19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.16	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.30	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: brown, turbid, no odour, yellow.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
1.52	19.9	6.92	10.10	0.80	-91.2	6571.5	0.1	
1.53	19.7	6.54	10.09	0.18	-96.5	6558.5	0.2	
1.54	19.6	6.58	10.08	0.09	-98.5	6552.0	0.3	
1.55	19.6	6.60	10.09	0.16	-98.6	6558.5	0.4	

Miscellaneous Field Comments

Well Head Integrity: 4.65

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WBS

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:			
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.09	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.11	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
DRY								

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W6D

Project Name: Quarterly GME	Ramboll Personnel: J Kirsch
Project No: 318000664	
Date: 23/9/19.	
Start time:	Subcontractors: N/A
Finish time:	

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.02	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	8.83	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: slightly brown, no odour, turbid.

TIME	TEMP (°C)	pH	SPEC. COND. mS/cm	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
1.22	19.5	7.66	1.26	3.31	17.3	819.0	0.1	
1.23	19.4	7.15	1.26	2.59	23.3	825.5	0.2	
1.24	19.1	6.69	1.27	2.56	29.6	825.5	0.3	
1.25	19.0	6.47	1.28	2.44	33.8	832.0	0.4	
1.26	18.9	6.28	1.28	2.51	36.8	832.0	0.5	
1.27	18.8	6.10	1.28	2.54	42.2	832.0	0.6	
1.28	18.7	5.93	1.28	2.17	47.5	825.5	0.7	
1.29	18.5	5.87	1.27	2.07	49.4	825.5	0.8.	

Miscellaneous Field Comments: silt at base of well

Well Head Integrity: 6.19.
Samples Filtered: metals
Weather Conditions: Sunny
Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

MW9

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	23/9/19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater ~~3~~ 2.35		m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.84	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: clear to slightly brown, sulphidic odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
1.02	17.4	7.78	11.69	~~31.96~~	-239.3	7611.5	0.1	
1.03	16.9	8.20	11.71	1.24	-246.8	7618.0	0.2	
1.04	16.8	8.30	11.71	0.96	-248.9	7592.0	0.3	
1.05	16.7	8.43	11.54	0.81	-240.0	7488.0	0.4	
1.06	16.6	8.47	11.44	1.52	-229.8	7429.5	0.5	
1.07	16.6	8.50	11.40	1.70	-222.4	7410.0	0.6	

Miscellaneous Field Comments

Well Head Integrity: 2.67

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by: J Kirsch
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

G2

Project Name:	Quarterly GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	23/9/19		
Start time:	12·31	Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	8·64	m	YSI Pro Plus.
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	13·40	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: clear, no odour

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
12·33	20·3	7·41	6.22	2·07	-19.0	4043.0	0·1	
12·34	20·2	7·21	6·20	1·88	-19·2	4036·5	0·2	
12·35	20·2	7·03	6·19	1·88	-21·4	4036·5	0·3	
12·36	20·0	6·83	6·18	1·61	-22·9	4017·0	0·4	
12·37	20·0	6.70	6·20	1·55	-23·8	4023·5	0·5	
12·38	19·9	6·57	6·19	1·36	-24·1	4017·5	0·6	
12·39	19·8	6·42	6·19	1·07	-24·2	4023·5	0·7	
12·40	19·8	6·46	6·18	1·00	-23·9	4017·0	0·8.	

Miscellaneous Field Comments

Well Head Integrity: 8·70

Samples Filtered: Metals.

Weather Conditions: Sunny.

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

E4

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	11/12/12		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.04	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.40	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.57	25.3	9.68	21539	0.73	-242.6	14098	0.1	Clear to slightly
10.58	21.6	9.70	22616	0.21	-268.7	19618.0	0.2	grey
10.59	21.6	9.68	22297	0.16	-280.5	19482.0	0.3	" " " "
11.00	21.6	9.67	22191	0.15	-280.5	19391.0	0.4	" " " "

Miscellaneous Field Comments: difficult to filter

Well Head Integrity:	3.17
Samples Filtered:	metals
Weather Conditions:	overcast
Other:	

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WID

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	11/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.12	m	
Correction:	3	m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.38.	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.34	20.4	7.19	10280	1.29	-69.9	6675.5	0.1	Slightly yellow, no odour
10.35	20.5	7.17	10215	0.87	-57.8	6656.5	0.2	" " " "
10.36	20.1	7.16	10246	0.66	-44.6	6656.0	0.3	" " " "
10.37	20.0	7.16	10220	0.47	-38.5	6693.0	0.4	" " " "

Miscellaneous Field Comments

Well Head Integrity: 5.88 pump at lowest capacity.
Samples Filtered: metals
Weather Conditions: overcast
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W15

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	11/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 2.93	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments

DRY

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W45

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	11/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 1.12	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments

DRY

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

A7.

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	11/12/19.		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.75	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immisclble Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.305	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8.49	20.5	9.49	18857	0.06	-353.6	12291.5	0.1	Slightly red/brown,
8.50	20.2	9.48	18999	0.03	-386.9	12363.0	0.2	Sulphidic odour
8.51	20.1	9.48	19052	0.01	-398.1	12389.0	0.3	" " " " "

Miscellaneous Field Comments

Well Head Integrity: 2.90.
Samples Filtered: metals
Weather Conditions: overcast
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W35

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	11/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.48	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.56	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments: insufficient water for sampling.

Well Head Integrity:

Samples Filtered:

Weather Conditions: Overcast

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W 3D

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	11/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.77	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.07	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.21	19.7	5.01	2580	0.79	252.3	1670.5	0.1	Clear, no odour
9.22	19.5	4.26	2557	0.68	290.8	1664.0	0.2	" " "
9.23	19.5	4.10	2556	0.99	308.5	1669.0	0.3	" " "
9.24	19.4	4.03	2557	0.92	317.0	1664.0	0.4	" " "
9.25	19.4	3.99	2556	0.90	323.7	1668.0	0.5	" " "
9.26	19.5	3.96	2555	0.90	325.4	1664.0	0.6	" " "

Miscellaneous Field Comments

Well Head Integrity: 7.84 pump at lowest capacity.
Samples Filtered: metals
Weather Conditions: overcast.
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

FS

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	11/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.29	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.40	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8.33	19.5	5.5	9946	1.08	93.7	6474.0	0.1	Clear, sulphidic odour
8.34	19.1	4.88	10005	0.67	89.8	6506.5	0.2	" " "
8.35	19.0	4.63	10016	0.42	86.5	6513.0	0.3	" " "
8.36	19.0	4.59	10018	0.39	86.0	6513.0	0.4	" " "
8.37	19.0	4.56	10016	0.36	85.5	6513.0	0.5	" " "
8.38	19.0	4.54	10029	0.35	85.2	6513.0	0.6	" " "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

GS

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	11/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.17	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	11.33	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
7.58	19.4	7.07	6094	1.52	-31.0	4225.0	0.1	clear, no odour
7.59	19.1	6.04	6926	0.93	-1.4	4529.0	0.2	" " "
8.00	19.0	5.90	6981	0.74	4.7	4537.0	0.3	" " "
8.01	19.0	5.83	6972	[illegible]	8.6	4529.0	0.4	" " "
8.02	19.0	5.78	6952	0.51	12.2	4517.5	0.5	" " "
8.03	19.0	5.74	6942	0.45	15.2	4511.0	0.6	" " "
8.04	19.0	5.70	6920	0.41	19.4	4491.5	0.7	" " "

Miscellaneous Field Comments

Well Head Integrity: 4.86 pump at lowest capacity.
Samples Filtered: metals
Weather Conditions:
Other: QA102, QA103.

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

46

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	11/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.74	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.14	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
7.26	19.1	4.72	7240	0.78	135.8	4719.0	0.1	clear, sulphidic odour
7.27	18.9	4.26	7257	0.81	135.0	4719.0	0.2	" " "
7.28	18.9	4.06	7263	0.57	135.3	4719.0	0.3	" " "
7.29	18.8	3.97	7263	0.55	135.0	4719.0	0.4	" " "
7.30	18.8	3.93	7262	0.99	133.8	4719.0	0.5	" " "

Miscellaneous Field Comments

Well Head Integrity: 5.77

Samples Filtered: metals

Weather Conditions: overcast

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

F6

Project Name: Hydro GME	Ramboll Personnel: J Kirsch
Project No: 318000664	
Date: 11/12/19	
Start time:	Subcontractors: 0
Finish time:	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 5.61	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 15.74	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
7.03	19.3	7.19	9703	1.20	-85.7	6298.5	0.1	clear, sulphidic odour
7.04	19.1	6.91	9673	0.76	-70.4	6285.5	0.2	" " "
7.05	19.0	6.79	9656	0.64	-77.1	6272.5	0.3	" " "
7.06	19.0	6.75	9649	0.60	-76.7	6272.5	0.4	" " "
7.07	19.0	6.73	9639	0.58	-99.3	6266.0	0.5	" " "

Miscellaneous Field Comments

Well Head Integrity: 6/8 pump at lowest capacity

Samples Filtered: metals

Weather Conditions: overcast

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N2

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.12	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.61	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11.14	27.3	6.98	7460	4.57	242.6	4816.0	0.1	Turbid, no odour
11.15	24.0	4.29	7359	4.02	276.4	4797.0	0.2	" " "
11.16	23.0	4.00	7325	4.15	298.0	4758.0	0.3	" " "
11.17	22.6	3.92	7382	4.07	316.2	4836.0	0.4	" " "
11.18	21.5	3.88	7429	4.01	328.1	4836.0	0.5	" " "
11.19	21.0	3.85	7422	4.07	343.4	4816.5	0.6	" " "

Miscellaneous Field Comments

purged dry.

Well Head Integrity:

Samples Filtered: metals.

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WSD

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/18		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.22	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.56	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.45	24.8	6.77	6594	1.50	-71.0	4249.5	0.1	clear, no odour
10.46	23.5	6.41	6501	0.82	-57.6	4244.5	0.2	" " "
10.47	23.3	6.27	6521	0.64	-50.3	4238.0	0.3	" " "
10.48	23.1	6.20	6541	0.54	-42.3	4251.0	0.4	" " "
10.49	22.9	6.16	6590	0.45	-38.9	4257.5	0.5	" " "

Miscellaneous Field Comments

Well Head Integrity: 7.14 pump at lowest capacity.
Samples Filtered: metals.
Weather Conditions: sunny, smoke haze, hot.
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WS5 ~~WS2~~

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater		m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.70	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments

DRY

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

E11

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.66	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.83	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10:20	24.7	9.03	13720	0.18	-189.1	8898.5	0.1	clear, sulphidic odour
10:21	23.1	8.98	13522	0.17	-186.5	8781.5	0.2	" " "
10:22	22.7	8.97	13479	0.15	-185.4	8768.5	0.3	" " "
10:23	22.4	8.95	13395	0.16	-183.2	8697.0	0.4	" " "

Miscellaneous Field Comments

Well Head Integrity: 3.66

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N8

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19.		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.38	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.30	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.50	25.7	6.73	9803	0.34	-123.4	6428.5	0.1	Slightly yellow,
9.51	24.5	6.68	9821	0.26	-117.9	6570.0	0.2	sulphidic odour
9.52	24.0	6.68	9833	0.59	-115.2	6596.0	0.3	" " " "
9.53	23.9	6.67	9842	0.64	-119.4	6596.0	0.4	" " " "
9.54	23.6	6.67	9845	0.66	-113.6	6589.0	0.5	" " " "

Miscellaneous Field Comments

Well Head Integrity: 4.88

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WGD

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.12	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	8.83	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.23	21.3	6.74	1262	2.48	107.3	812.5	0.1	clear, slight sulphidic odour
9.24	20.6	6.10	1231	2.01	121.5	799.5	0.2	
9.25	20.4	5.86	1224	1.92	127.2	793.0	0.3	" " " "
9.26	20.4	5.76	1222	1.74	129.0	793.0	0.4	" " " "
9.27	20.3	5.71	1224	1.69	121.2	793.0	0.5	" " " "
9.28	20.3	5.63	1226	1.53	94.3	799.5	0.6	" " " "
9.29	20.3	5.60	1229	1.36	87.1	799.5	0.7	" " " "
9.30	20.3	5.56	1223	1.36	81.5	793.0	0.9	" " " "

Miscellaneous Field Comments

Well Head Integrity:	5.80 pump at lowest capacity.
Samples Filtered:	metals
Weather Conditions:	
Other:	

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WGS

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19.		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 3.11	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments

DRY.

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N9

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.78	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments

insufficient water.

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

G2

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	8.72	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	13.37	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☒ Peristalic ☐ Bailer

Start Sampling:

End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8.41	22.7	6.56	5973	1.31	-16.1	3900	0.1	Clear, no odour
8.42	22.0	6.31	6009	1.17	-11.6	3906.5	0.2	" " "
8.43	21.6	6.22	5988	0.96	-8.7	3887.0	0.3	" " "
8.44	21.4	6.16	5981	0.74	-7.0	3893.5	0.4	" " "
8.45	21.3	6.13	5981	0.69	-5.8	3887.0	0.5	" " "

Miscellaneous Field Comments

Well Head Integrity: 8.78

Samples Filtered: metals

Weather Conditions:

Other: QA/01

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

ESD

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19.		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.79	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.44.	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8.09	22.1	7.45	13964	1.76	-107.1	9444.5	0.1	clear, no odour
8.10	21.3	7.02	14572	0.68	-116.6	9977.0	0.2	" " "
8.11	21.3	6.97	14584	0.50	-115.2	9977.0	0.3	" " "
8.12	21.4	6.95	14565	0.97	-108.9	9964.0	0.4	" " "

Miscellaneous Field Comments

Well Head Integrity: 2.94 pump at lowest capacity.
Samples Filtered: metals
Weather Conditions:
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

ES

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19		
Start time:	8.03	Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater		m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.58	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments

DRY.

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WTM / ~~WTD~~

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.25	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.81	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. µS/cm COND.	DO ppm	REDOX (mV)	TDS mg/L	Litres Removed	Comments (Appearance, Odour, etc)
7.42	21.6	9.78	22572	0.12	-122.9	14651.0	0.1	slightly brown
7.43	21.6	9.74	22480	0.14	-160.9	14597	0.2	" "
7.44	21.6	9.71	22259	0.16	-180.7	14456.0	0.3	" "
7.45	21.7	9.75	23025	0.15	-196.6	14982.5	0.4	" "

Miscellaneous Field Comments: purged dry

Well Head Integrity:

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W7S

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater		m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.325	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments

DRY

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

Pump

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.0	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.48	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
7.14	22.2	9.90	7133	0.01	-276.0	4602.0	0.1	slightly brown, turbid
7.15	22.1	9.91	7477	0.00	-272.0	4862.0	0.2	" " "
7.16	22.1	9.91	7561	0.00	-272.9	4933.5	0.3	" " "
7.17	22.2	9.93	8571	0.00	-277.1	5967.0	0.4	" " "

Miscellaneous Field Comments: silt at base of well very difficult to filter.

Well Head Integrity: 3.11

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W2D

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19.		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.07	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	6.37	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
6.50	20.6	10.14	39131	0.02	-250.1	25473.5	0.2	slightly brown/red
6.51	20.5	10.14	39215	0.02	-272.4	25499.5	0.3	" " "
6.52	20.5	10.14	39244	0.02	-294.0	25512.5	0.4	" " "
6.53	20.5	10.14	39263	0.01	-308.3	25525.5	0.5	" " "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W25

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000664		
Date:	10/12/19.		
Start time:	6.42.	Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater		m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.39	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)

Miscellaneous Field Comments DRY

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

APPENDIX 5
LABORATORY REPORTS

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000664	Envirolab Services 12 Ashley St, Chatswood, NSW 2067 Phone: 02 9910 6200 Fax :02 9910 6201 E-mail: ahie@envirolabservices.com.au Contact: Aileen Hie	
Contact person: JK	PO No.:		
Project Mgr: Kirsty Greenfield	Envirolab Quote No. :		
Sampler: JK/JB	Date results required:	Envirolab Services WA t/a MPL 16-18 Hayden Crt, Myaree WA 6154 Phone: 08 9317 2505 Fax :08 9317 4163 E-mail: lab@mpl.com.au Contact: Joshua Lim	
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	Or choose: standard / same day / 1 day / 2 day / 3 day *Note: Inform lab in advance if urgent turnaround is required - surcharge applies*		
Phone: (02) 49625444 Mob: 0421330255	Lab comments: Highly contaminated		
Fax:			
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com			

Sample information					Tests Required												Comments
Envirolab Sample ID	Client Sample ID or Information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium								Provide as much information about the sample as you can
1	W3D		13/03/2019	WATER	X	X	X	X	X								
2	W6D		12/03/2019	WATER	X	X	X	X	X								
3	F5		13/03/2019	WATER	X	X	X	X	X								
4	G5		13/03/2019	WATER	X	X	X	X	X								
5	G2		12/03/2019	WATER	X	X	X	X	X								
6	N8		12/03/2019	WATER	X	X	X	X	X								
7	W5D		12/03/2019	WATER	X	X	X	X	X								
8	F6		12/03/2019	WATER	X	X	X	X	X								
9	G6		12/03/2019	WATER	X	X	X	X	X								
10	N2		12/03/2019	WATER	X	X	X	X	X								
11	W1D		13/03/2019	WATER	X	X	X	X	X								
12	E5D		12/03/2019	WATER	X	X	X	X	X								
13	E11		12/03/2019	WATER	X	X	X	X	X								
14	PUMP		12/03/2019	WATER	X	X	X	X	X								

ENVIROLAB GROUP
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 213573
Date Received: 15/3/19
Time Received: 12:30
Received by: SZ
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company): Ramboll	Received by (company): ENS	*Lab use only:*	
Print Name: Joshua Blackwell	Print Name:	Samples Received: Cool or Ambient (circle one)	
Date & Time: 14/03/2019	Date & Time: 15/3/19	Temperature Received at: (if applicable)	
Signature:	Signature: SZ	Transported by: Hand delivered / courier	

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000664	**Envirolab Services** 12 Ashley St, Chatswood, NSW 2067 Phone: 02 9910 6200 Fax :02 9910 6201 E-mail: ahie@envirolabservices.com.au Contact: Aileen Hie
Contact person: JK	PO No.:	
Project Mgr: Kirsty Greenfield	Envirolab Quote No. :	
Sampler: JK/JB	Date results required:	**Envirolab Services WA t/a MPL** 16-18 Hayden Crt, Myaree WA 6154 Phone: 08 9317 2505 Fax :08 9317 4163 E-mail: lab@mpl.com.au Contact: Joshua Lim
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	Or choose: standard / same day / 1 day / 2 day / 3 day	
Phone: (02) 49625444 Mob: 0432184301	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*	
Fax:	Lab comments: Highly contaminated	
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com		

Sample information					Tests Required												Comments
Envirolab Sample ID	Client Sample ID or information 213573	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	dissolved aluminium								Provide as much information about the sample as you can
15 15	N9		12/03/2019	WATER	X	X	X	X	X								
16 16	A7		13/03/2019	WATER	X	X	X	X	X								
17 17	E4		13/03/2019	WATER	X	X	X	X	X								
18 18	W7M		12/03/2019	WATER	X	X	X	X	X								
19 19	W2D		12/03/2019	WATER	X	X	X	X	X								
20 20	QA101		12/03/2019	WATER	X	X	X	X	X								
21	QA102		12/03/2019	WATER	X	X	X	X	X								please send to ALS
21 22	QA103		13/03/2019	WATER	X	X	X	X	X								
22 23	QC101		13/03/2019	WATER	X	X	X	X	X								
24																	
25																	
26																	
27																	
28																	

Relinquished by (company): Ramboll	Received by (company):	*Lab use only:*
Print Name: Joshua Blackwell	Print Name:	Samples Received: Cool or Ambient (circle one)
Date & Time: 14/03/2019	Date & Time: 15/3/19	Temperature Received at: (if applicable)
Signature:	Signature:	Transported by: Hand delivered / courier

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 213573

Client Details

Client	Ramboll (Newcastle) Australia Pty Ltd
Attention	J Kirsch
Address	Suite 18, Level 2, 50 Glebe Rd, The Junction, NSW, 2291

Sample Details

Your Reference	**Hydro GW Plume Monitoring - 318000664**
Number of Samples	22 Water
Date samples received	15/03/2019
Date completed instructions received	15/03/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	22/03/2019
Date of Issue	22/03/2019

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Alexander Mitchell Maclean, Senior Chemist
Nancy Zhang, Laboratory Manager, Sydney

Authorised By

Jacinta Hurst, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		213573-1	213573-2	213573-3	213573-4	213573-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		13/03/2019	12/03/2019	13/03/2019	13/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	16/03/2019	16/03/2019	16/03/2019	16/03/2019	16/03/2019
Date analysed	-	16/03/2019	16/03/2019	16/03/2019	16/03/2019	16/03/2019
Fluoride, F	mg/L	0.1	<0.1	0.1	<0.1	0.2
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		213573-6	213573-7	213573-8	213573-9	213573-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		12/03/2019	12/03/2019	12/03/2019	12/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	16/03/2019	16/03/2019	16/03/2019	16/03/2019	16/03/2019
Date analysed	-	16/03/2019	16/03/2019	16/03/2019	16/03/2019	16/03/2019
Fluoride, F	mg/L	0.4	0.3	0.4	0.6	1.1
Total Cyanide	mg/L	0.61	<0.004	<0.004	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		213573-11	213573-12	213573-13	213573-14	213573-15
Your Reference	UNITS	W1D	E5D	E11	PUMP	N9
Date Sampled		13/03/2019	12/03/2019	12/03/2019	12/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	16/03/2019	16/03/2019	16/03/2019	16/03/2019	16/03/2019
Date analysed	-	16/03/2019	16/03/2019	16/03/2019	16/03/2019	16/03/2019
Fluoride, F	mg/L	3.9	8.1	150	370	200
Total Cyanide	mg/L	0.64	1.1	18	21	6.6
Free Cyanide in Water	mg/L	<0.004	<0.004	0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		213573-16	213573-17	213573-18	213573-19	213573-20
Your Reference	UNITS	A7	E4	W7M	W2D	QA101
Date Sampled		13/03/2019	13/03/2019	12/03/2019	12/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	16/03/2019	16/03/2019	16/03/2019	16/03/2019	16/03/2019
Date analysed	-	16/03/2019	16/03/2019	16/03/2019	16/03/2019	16/03/2019
Fluoride, F	mg/L	600	530	990	1,500	0.3
Total Cyanide	mg/L	100	57	150	300	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	0.006	0.004	<0.004

Miscellaneous Inorganics			
Our Reference		213573-21	213573-22
Your Reference	UNITS	QA103	QC101
Date Sampled		13/03/2019	13/03/2019
Type of sample		Water	Water
Date prepared	-	16/03/2019	16/03/2019
Date analysed	-	16/03/2019	16/03/2019
Fluoride, F	mg/L	0.1	<0.1
Total Cyanide	mg/L	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004

All metals in water - total						
Our Reference		213573-1	213573-2	213573-3	213573-4	213573-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		13/03/2019	12/03/2019	13/03/2019	13/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/03/2019	19/03/2019	19/03/2019	19/03/2019	19/03/2019
Date analysed	-	19/03/2019	19/03/2019	19/03/2019	19/03/2019	19/03/2019
Aluminium-Total	µg/L	810	3,600	1,400	290	1,000

All metals in water - total						
Our Reference		213573-6	213573-7	213573-8	213573-9	213573-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		12/03/2019	12/03/2019	12/03/2019	12/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/03/2019	19/03/2019	19/03/2019	19/03/2019	19/03/2019
Date analysed	-	19/03/2019	19/03/2019	19/03/2019	19/03/2019	19/03/2019
Aluminium-Total	µg/L	900	440	60	16,000	4,200

All metals in water - total						
Our Reference		213573-11	213573-12	213573-13	213573-14	213573-15
Your Reference	UNITS	W1D	E5D	E11	PUMP	N9
Date Sampled		13/03/2019	12/03/2019	12/03/2019	12/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/03/2019	19/03/2019	19/03/2019	19/03/2019	19/03/2019
Date analysed	-	19/03/2019	19/03/2019	19/03/2019	19/03/2019	19/03/2019
Aluminium-Total	µg/L	480	1,300	11,000	9,300	1,500

All metals in water - total						
Our Reference		213573-16	213573-17	213573-18	213573-19	213573-20
Your Reference	UNITS	A7	E4	W7M	W2D	QA101
Date Sampled		13/03/2019	13/03/2019	12/03/2019	12/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/03/2019	19/03/2019	19/03/2019	19/03/2019	19/03/2019
Date analysed	-	19/03/2019	19/03/2019	19/03/2019	19/03/2019	19/03/2019
Aluminium-Total	µg/L	440	5,200	7,500	610	380

All metals in water - total			
Our Reference		213573-21	213573-22
Your Reference	UNITS	QA103	QC101
Date Sampled		13/03/2019	13/03/2019
Type of sample		Water	Water
Date prepared	-	19/03/2019	19/03/2019
Date analysed	-	19/03/2019	19/03/2019
Aluminium-Total	µg/L	330	<10

All metals in water-dissolved						
Our Reference		213573-1	213573-2	213573-3	213573-4	213573-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		13/03/2019	12/03/2019	13/03/2019	13/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/03/2019	18/03/2019	18/03/2019	18/03/2019	18/03/2019
Date analysed	-	18/03/2019	18/03/2019	18/03/2019	18/03/2019	18/03/2019
Aluminium-Dissolved	µg/L	740	20	1,100	30	<10

All metals in water-dissolved						
Our Reference		213573-6	213573-7	213573-8	213573-9	213573-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		12/03/2019	12/03/2019	12/03/2019	12/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/03/2019	18/03/2019	18/03/2019	18/03/2019	18/03/2019
Date analysed	-	18/03/2019	18/03/2019	18/03/2019	18/03/2019	18/03/2019
Aluminium-Dissolved	µg/L	40	<10	<10	16,000	4,200

All metals in water-dissolved						
Our Reference		213573-11	213573-12	213573-13	213573-14	213573-15
Your Reference	UNITS	W1D	E5D	E11	PUMP	N9
Date Sampled		13/03/2019	12/03/2019	12/03/2019	12/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/03/2019	18/03/2019	18/03/2019	18/03/2019	18/03/2019
Date analysed	-	18/03/2019	18/03/2019	18/03/2019	18/03/2019	18/03/2019
Aluminium-Dissolved	µg/L	150	<10	60	1,300	270

All metals in water-dissolved						
Our Reference		213573-16	213573-17	213573-18	213573-19	213573-20
Your Reference	UNITS	A7	E4	W7M	W2D	QA101
Date Sampled		13/03/2019	13/03/2019	12/03/2019	12/03/2019	12/03/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	18/03/2019	18/03/2019	18/03/2019	18/03/2019	18/03/2019
Date analysed	-	18/03/2019	18/03/2019	18/03/2019	18/03/2019	18/03/2019
Aluminium-Dissolved	µg/L	190	1,100	280	510	<10

All metals in water-dissolved			
Our Reference		213573-21	213573-22
Your Reference	UNITS	QA103	QC101
Date Sampled		13/03/2019	13/03/2019
Type of sample		Water	Water
Date prepared	-	18/03/2019	18/03/2019
Date analysed	-	18/03/2019	18/03/2019
Aluminium-Dissolved	µg/L	30	<10

Method ID	Methodology Summary
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjsuted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hyperchlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	213573-2
Date prepared	-			16/03/2019	1	16/03/2019	16/03/2019		16/03/2019	16/03/2019
Date analysed	-			16/03/2019	1	16/03/2019	16/03/2019		16/03/2019	16/03/2019
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	0.1	0.1	0	91	90
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	110	#
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	104	82

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	213573-12
Date prepared	-				11	16/03/2019	16/03/2019		16/03/2019	16/03/2019
Date analysed	-				11	16/03/2019	16/03/2019		16/03/2019	16/03/2019
Fluoride, F	mg/L	0.1	Inorg-026		11	3.9	4.0	3	97	
Total Cyanide	mg/L	0.004	Inorg-014		11	0.64	0.62	3	115	90
Free Cyanide in Water	mg/L	0.004	Inorg-014		11	<0.004	<0.004	0	111	#

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-				21	16/03/2019	16/03/2019			
Date analysed	-				21	16/03/2019	16/03/2019			
Fluoride, F	mg/L	0.1	Inorg-026		21	0.1	0.1	0		
Total Cyanide	mg/L	0.004	Inorg-014		21	<0.004	<0.004	0		
Free Cyanide in Water	mg/L	0.004	Inorg-014		21	<0.004	<0.004	0		

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	**Units**	**PQL**	**Method**	**Blank**	**#**	**Base**	**Dup.**	**RPD**	**LCS-W2**	**213573-2**
Date prepared	-			19/03/2019	1	19/03/2019	19/03/2019		19/03/2019	19/03/2019
Date analysed	-			19/03/2019	1	19/03/2019	19/03/2019		19/03/2019	19/03/2019
Aluminium-Total	µg/L	10	Metals-022	<10	1	810	830	2	100	#

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	**Units**	**PQL**	**Method**	**Blank**	**#**	**Base**	**Dup.**	**RPD**	**LCS-W3**	**[NT]**
Date prepared	-				11	19/03/2019	19/03/2019		19/03/2019	
Date analysed	-				11	19/03/2019	19/03/2019		19/03/2019	
Aluminium-Total	µg/L	10	Metals-022		11	480	520	8	100	

QUALITY CONTROL: All metals in water-dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	213573-2
Date prepared	-			19/03/2019	1	18/03/2019	18/03/2019		19/03/2019	19/03/2019
Date analysed	-			19/03/2019	1	18/03/2019	18/03/2019		19/03/2019	19/03/2019
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	740	730	1	113	111

QUALITY CONTROL: All metals in water-dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	213573-19
Date prepared	-				10	18/03/2019	18/03/2019		19/03/2019	19/03/2019
Date analysed	-				10	18/03/2019	18/03/2019		19/03/2019	19/03/2019
Aluminium-Dissolved	µg/L	10	Metals-022		10	4200	4100	2	112	#

QUALITY CONTROL: All metals in water-dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-				18	18/03/2019	18/03/2019			
Date analysed	-				18	18/03/2019	18/03/2019			
Aluminium-Dissolved	µg/L	10	Metals-022		18	280	310	10		

Result Definitions	
NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions	
Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

All metals in water-dissolved - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Dissolved Metals: no preserved sample was received for sample 15, therefore
the unpreserved sample was filtered through 0.45um filter at the lab.
Note: there is a possibility some elements may be underestimated.

Cyanide # - Low spike recovery was obtained for this sample. This is due to matrix interferences. However, an acceptable recovery was obtained for the LCS.

All metals in water - total - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Total metals: no preserved sample was received for sample 15, therefore
analysis was conducted from the unpreserved sample bottle.
Note: there is a possibility some elements may be underestimated.

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000664
Contact person: JK	PO No.:
Project Mgr: Kirsty Greenfield	Envirolab Quote No. :
Sampler: JK/JB	Date results required:
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	Or choose: standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 Mob: 0432184301	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	Lab comments: Highly contaminated
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required													Comments
Envirolab Sample ID	Client Sample ID or information 213573	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	dissolved aluminium									Provide as much information about the sample as you can
15 15	N9		12/03/2019	WATER	X	X	X	X	X									
16 16	A7		13/03/2019	WATER	X	X	X	X	X									
17 17	E4		13/03/2019	WATER	X	X	X	X	X									
18 18	W7M		12/03/2019	WATER	X	X	X	X	X									
19 19	W2D		12/03/2019	WATER	X	X	X	X	X									
20 20	QA101		12/03/2019	WATER	X	X	X	X	X									
21	QA102		12/03/2019	WATER	X	X	X	X	X									please send to ALS
21 22	QA103		13/03/2019	WATER	X	X	X	X	X									
22 23	QC101		13/03/2019	WATER	X	X	X	X	X									
24																		
25																		
26																		
27																		
28																		

Environmental Division
Sydney
Work Order Reference
ES1908230

Telephone : + 61-2-8784 8555

Relinquished by (company):	Ramboll	ELS	
Print Name:	Joshua Blackwell	Tony Doherty	
Date & Time:	14/03/2019	18.3.19 11:50	
Signature:			

Received by (company):	ELS
Print Name:	[illegible]
Date & Time:	15/3/19
Signature:	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: (if applicable)
Transported by: Hand delivered / courier

Rec: Sofie 18/3/19 1655 9.5°C

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1908230**	Page	: 1 of 2
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Contact	: Sepan Mahamad
Address	: Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road PO Box 435 THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 49344354	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 18-Mar-2019 16:55
Order number	:	Date Analysis Commenced	: 19-Mar-2019
C-O-C number	: ----	Issue Date	: 22-Mar-2019 17:45
Sampler	: JK/JB		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QA102	----	----	----	----
				Client sampling date / time	12-Mar-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1908230-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	10	µg/L		<10	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	10	µg/L		**360**	----	----	----	----
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.004	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.5**	----	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1908230**	Page	: 1 of 3
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Contact	: Sepan Mahamad
Address	: Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road PO Box 435 THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 49344354	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 18-Mar-2019
Order number	:	Date Analysis Commenced	: 19-Mar-2019
C-O-C number	: ----	Issue Date	: 22-Mar-2019
Sampler	: JK/JB		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2242833)									
ES1908222-010	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.02	0.03	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 2242894)									
ES1908230-001	QA102	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	360 µg/L	0.33	9.73	0% - 20%
WN1901596-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.01	0.01	0.00	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 2244590)									
ES1908230-001	QA102	EK025SF: Free Cyanide	---	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2244591)									
ES1908230-001	QA102	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
ES1908386-006	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.016	<0.016	0.00	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 2243859)									
ES1908222-008	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	1.0	0.8	29.8	0% - 50%
ES1908292-006	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2242833)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	97.0	80	116
EG020T: Total Metals by ICP-MS (QCLot: 2242894)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	97.7	82	120
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2244590)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	97.5	88	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2244591)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	104	73	133
EK040P: Fluoride by PC Titrator (QCLot: 2243859)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	94.4	82	116

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**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2244590)							
ES1908230-001	QA102	EK025SF: Free Cyanide	----	0.2 mg/L	89.7	70	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2244591)							
ES1908230-001	QA102	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	84.3	70	130
EK040P: Fluoride by PC Titrator (QCLot: 2243859)							
ES1908222-008	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	95.0	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1908230**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 18-Mar-2019
Site	: ----	Issue Date	: 22-Mar-2019
Sampler	: JK/JB	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

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

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Matrix Spikes (MS)					
Dissolved Metals by ICP-MS - Suite A	0	8	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	0	18	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
QA102	**12-Mar-2019**	----	----	----	**19-Mar-2019**	08-Sep-2019	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
QA102	**12-Mar-2019**	**19-Mar-2019**	08-Sep-2019	✓	**19-Mar-2019**	08-Sep-2019	✓
EK025SF: Free CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK025SF)							
QA102	**12-Mar-2019**	----	----	----	**20-Mar-2019**	26-Mar-2019	✓
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
QA102	**12-Mar-2019**	----	----	----	**20-Mar-2019**	26-Mar-2019	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
QA102	**12-Mar-2019**	----	----	----	**19-Mar-2019**	09-Apr-2019	✓

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 Metals by ICP-MS - Suite A	EG020A-F	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	10	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	0	8	0.00	5.00	×	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	0	18	0.00	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.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. 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.
Free CN by Segmented Flow Analyser	EK025SF	WATER	In house: Referenced to ASTM D7237: Using an automated segmented flow analyser, a sample at high pH (sodium hydroxide preserved) is buffered to pH 6.0. The hydrogen cyanide present passes across a gas dialysis membrane into an acceptor stream consisting of 0.01 M sodium hydroxide. The acceptor stream mixes with a buffer at pH 5.2 and reacts with chloramine-T to form cyanogen chloride. Cyanogen chloride reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour, measured at 600nm. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000664
Contact person: JK	PO No.:
Project Mgr: Kirsty Greenfield	Envirolab Quote No. :
Sampler: JK	Date results required:
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	Or choose: standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 Mob: 0421330255	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	Lab comments: Highly contaminated
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium										Provide as much information about the sample as you can
1	W3D		26/06/2019	WATER	X	X	X	X	X										
2	W6D		25/06/2019	WATER	X	X	X	X	X										
3	F5		26/06/2019	WATER	X	X	X	X	X										
4	G5		26/06/2019	WATER	X	X	X	X	X										
5	G2		25/06/2019	WATER	X	X	X	X	X										
6	N8		25/06/2019	WATER	X	X	X	X	X										
7	W5D		25/06/2019	WATER	X	X	X	X	X										
8	F6		25/06/2019	WATER	X	X	X	X	X										
9	G6		25/06/2019	WATER	X	X	X	X	X										
10	N2		25/06/2019	WATER	X	X	X	X	X										
11	W1D		26/06/2019	WATER	X	X	X	X	X										
12	E5D		25/06/2019	WATER	X	X	X	X	X										
13	E11		25/06/2019	WATER	X	X	X	X	X										
14	W3S		26/06/2019	WATER	X	X	X	X	X										

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 220566
Date Received: 28/06/19
Time Received: 10:19
Received by: SB
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company):	Ramboll	Received by (company): ELS Syd.	*Lab use only:*
Print Name:	Jordyn Kirsch	Print Name: S. Bolton	Samples Received: Cool or Ambient (circle one)
Date & Time:	28/06/2019	Date & Time: 28/06/19 10:19	Temperature Received at: (if applicable)
Signature:		Signature:	Transported by: Hand delivered / courier

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000664	Envirolab Services 12 Ashley St, Chatswood, NSW 2067 Phone: 02 9910 6200 Fax :02 9910 6201 E-mail: ahie@envirolabservices.com.au Contact: Aileen Hie
Contact person: JK	PO No.:	
Project Mgr: Kirsty Greenfield	Envirolab Quote No. :	
Sampler: JK	Date results required:	
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	Or choose: standard / same day / 1 day / 2 day / 3 day	Envirolab Services WA t/a MPL 16-18 Hayden Crt, Myaree WA 6154
Phone: (02) 49625444 Mob: 0432184301	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*	Phone: 08 9317 2505 Fax :08 9317 4163
Fax:	Lab comments: Highly contaminated	E-mail: lab@mpl.com.au
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com		Contact: Joshua Lim

Sample information					Tests Required													Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	dissolved aluminium									Provide as much information about the sample as you can
15	PUMP		25/06/2019	WATER	X	X	X	X	X									
16	N9		25/06/2019	WATER	X	X	X	X	X									
17	A7		26/06/2019	WATER	X	X	X	X	X									
18	E4		26/06/2019	WATER	X	X	X	X	X									
19	W7M		25/06/2019	WATER	X	X	X	X	X									
20	W2D		25/06/2019	WATER	X	X	X	X	X									
21	QA101		25/06/2019	WATER	X	X	X	X	X									
22	QA102		25/06/2019	WATER	X	X	X	X	X									
~~23~~	QA103		25/06/2019	WATER	X	X	X	X	X									please send to ALS
~~24~~ 23	R01		25/06/2019	WATER	X	X	X	X	X									
25																		
26																		
27																		
28																		

Relinquished by (company): Ramboll	Received by (company): ELS Syd	*Lab use only:*
Print Name: Jordyn Kirsch	Print Name: S. Bolton	Samples Received: Cool or Ambient (circle one)
Date & Time: 28/06/2019	Date & Time: 28/07/19 10:19	Temperature Received at: (if applicable)
Signature:	Signature:	Transported by: Hand delivered / courier

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 220566

Client Details

Client	Ramboll (Newcastle) Australia Pty Ltd
Attention	J Kirsch
Address	Suite 18, Level 2, 50 Glebe Rd, The Junction, NSW, 2291

Sample Details

Your Reference	**Hydro GW Plume Monitoring - 318000664**
Number of Samples	23 Water
Date samples received	28/06/2019
Date completed instructions received	28/06/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	05/07/2019
Date of Issue	08/07/2019
Reissue Details	This report replaces R00 created on 05/07/2019 due to: result entry error

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Team Leader, Inorganics
Loren Bardwell, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		220566-1	220566-2	220566-3	220566-4	220566-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		26/06/2019	25/06/2019	26/06/2019	26/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/06/2019	28/06/2019	28/06/2019	28/06/2019	28/06/2019
Date analysed	-	28/06/2019	28/06/2019	28/06/2019	28/06/2019	28/06/2019
Fluoride, F	mg/L	0.1	<0.1	0.2	0.2	0.3
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		220566-6	220566-7	220566-8	220566-9	220566-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		25/06/2019	25/06/2019	25/06/2019	25/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/06/2019	28/06/2019	28/06/2019	28/06/2019	28/06/2019
Date analysed	-	28/06/2019	28/06/2019	28/06/2019	28/06/2019	28/06/2019
Fluoride, F	mg/L	0.4	0.4	0.5	0.3	1.1
Total Cyanide	mg/L	0.55	<0.004	<0.004	<0.004	0.005
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		220566-11	220566-12	220566-13	220566-14	220566-15
Your Reference	UNITS	W1D	E5D	E11	W3S	PUMP
Date Sampled		26/06/2019	25/06/2019	25/06/2019	26/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/06/2019	28/06/2019	28/06/2019	28/06/2019	28/06/2019
Date analysed	-	28/06/2019	28/06/2019	28/06/2019	28/06/2019	28/06/2019
Fluoride, F	mg/L	4.7	9.6	74	90	140
Total Cyanide	mg/L	0.47	0.92	3.8	15	9.8
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		220566-16	220566-17	220566-18	220566-19	220566-20
Your Reference	UNITS	N9	A7	E4	W7M	W2D
Date Sampled		25/06/2019	26/06/2019	26/06/2019	25/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/06/2019	28/06/2019	28/06/2019	28/06/2019	28/06/2019
Date analysed	-	28/06/2019	28/06/2019	28/06/2019	28/06/2019	28/06/2019
Fluoride, F	mg/L	160	480	490	750	1,200
Total Cyanide	mg/L	9.2	82	74	130	230
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	0.004

Miscellaneous Inorganics				
Our Reference		220566-21	220566-22	220566-23
Your Reference	UNITS	QA101	QA102	R01
Date Sampled		25/06/2019	25/06/2019	25/06/2019
Type of sample		Water	Water	Water
Date prepared	-	28/06/2019	28/06/2019	28/06/2019
Date analysed	-	28/06/2019	28/06/2019	28/06/2019
Fluoride, F	mg/L	0.3	0.5	<0.1
Total Cyanide	mg/L	<0.004	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004

All metals in water - total						
Our Reference		220566-1	220566-2	220566-3	220566-4	220566-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		26/06/2019	25/06/2019	26/06/2019	26/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	02/07/2019	02/07/2019	02/07/2019	02/07/2019	02/07/2019
Date analysed	-	02/07/2019	02/07/2019	02/07/2019	02/07/2019	02/07/2019
Aluminium-Total	µg/L	1,000	980	1,700	120	680

All metals in water - total						
Our Reference		220566-6	220566-7	220566-8	220566-9	220566-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		25/06/2019	25/06/2019	25/06/2019	25/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	02/07/2019	02/07/2019	02/07/2019	02/07/2019	02/07/2019
Date analysed	-	02/07/2019	02/07/2019	02/07/2019	02/07/2019	02/07/2019
Aluminium-Total	µg/L	760	40	50	17,000	6,200

All metals in water - total						
Our Reference		220566-11	220566-12	220566-13	220566-14	220566-15
Your Reference	UNITS	W1D	E5D	E11	W3S	PUMP
Date Sampled		26/06/2019	25/06/2019	25/06/2019	26/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	02/07/2019	02/07/2019	02/07/2019	02/07/2019	02/07/2019
Date analysed	-	02/07/2019	02/07/2019	02/07/2019	02/07/2019	02/07/2019
Aluminium-Total	µg/L	690	1,200	1,800	33,000	38,000

All metals in water - total						
Our Reference		220566-16	220566-17	220566-18	220566-19	220566-20
Your Reference	UNITS	N9	A7	E4	W7M	W2D
Date Sampled		25/06/2019	26/06/2019	26/06/2019	25/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	02/07/2019	02/07/2019	02/07/2019	02/07/2019	02/07/2019
Date analysed	-	02/07/2019	02/07/2019	02/07/2019	02/07/2019	02/07/2019
Aluminium-Total	µg/L	2,000	500	1,300	1,500	720

All metals in water - total				
Our Reference		220566-21	220566-22	220566-23
Your Reference	UNITS	QA101	QA102	R01
Date Sampled		25/06/2019	25/06/2019	25/06/2019
Type of sample		Water	Water	Water
Date prepared	-	02/07/2019	02/07/2019	02/07/2019
Date analysed	-	02/07/2019	02/07/2019	02/07/2019
Aluminium-Total	µg/L	680	40	<10

All metals in water-dissolved						
Our Reference		220566-1	220566-2	220566-3	220566-4	220566-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		26/06/2019	25/06/2019	26/06/2019	26/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	01/07/2019	01/07/2019	01/07/2019	01/07/2019	01/07/2019
Date analysed	-	01/07/2019	01/07/2019	01/07/2019	01/07/2019	01/07/2019
Aluminium-Dissolved	µg/L	870	20	920	<10	<10

All metals in water-dissolved						
Our Reference		220566-6	220566-7	220566-8	220566-9	220566-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		25/06/2019	25/06/2019	25/06/2019	25/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	01/07/2019	01/07/2019	01/07/2019	01/07/2019	01/07/2019
Date analysed	-	01/07/2019	01/07/2019	01/07/2019	01/07/2019	01/07/2019
Aluminium-Dissolved	µg/L	60	<10	<10	18,000	3,200

All metals in water-dissolved						
Our Reference		220566-11	220566-12	220566-13	220566-14	220566-15
Your Reference	UNITS	W1D	E5D	E11	W3S	PUMP
Date Sampled		26/06/2019	25/06/2019	25/06/2019	26/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	01/07/2019	01/07/2019	01/07/2019	01/07/2019	01/07/2019
Date analysed	-	01/07/2019	01/07/2019	01/07/2019	01/07/2019	01/07/2019
Aluminium-Dissolved	µg/L	210	10	40	3,300	4,300

All metals in water-dissolved						
Our Reference		220566-16	220566-17	220566-18	220566-19	220566-20
Your Reference	UNITS	N9	A7	E4	W7M	W2D
Date Sampled		25/06/2019	26/06/2019	26/06/2019	25/06/2019	25/06/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	01/07/2019	01/07/2019	01/07/2019	01/07/2019	01/07/2019
Date analysed	-	01/07/2019	01/07/2019	01/07/2019	01/07/2019	01/07/2019
Aluminium-Dissolved	µg/L	460	160	250	300	700

All metals in water-dissolved				
Our Reference		220566-21	220566-22	220566-23
Your Reference	UNITS	QA101	QA102	R01
Date Sampled		25/06/2019	25/06/2019	25/06/2019
Type of sample		Water	Water	Water
Date prepared	-	01/07/2019	01/07/2019	01/07/2019
Date analysed	-	01/07/2019	01/07/2019	01/07/2019
Aluminium-Dissolved	µg/L	<10	<10	<10

Method ID	Methodology Summary
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjsuted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hyperchlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	220566-2
Date prepared	-			28/06/2019	1	28/06/2019	28/06/2019		28/06/2019	28/06/2019
Date analysed	-			28/06/2019	1	28/06/2019	28/06/2019		28/06/2019	28/06/2019
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	0.1	0.2	67	92	96
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	94	87
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	93	81

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	220566-10
Date prepared	-				11	28/06/2019	28/06/2019		28/06/2019	28/06/2019
Date analysed	-				11	28/06/2019	28/06/2019		28/06/2019	28/06/2019
Fluoride, F	mg/L	0.1	Inorg-026		11	4.7	4.8	2	99	
Total Cyanide	mg/L	0.004	Inorg-014		11	0.47	0.48	2	92	
Free Cyanide in Water	mg/L	0.004	Inorg-014		11	<0.004	<0.004	0	96	

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	220566-22
Date prepared	-				21	28/06/2019	28/06/2019			28/06/2019
Date analysed	-				21	28/06/2019	28/06/2019			28/06/2019
Fluoride, F	mg/L	0.1	Inorg-026		21	0.3	0.3	0		95
Total Cyanide	mg/L	0.004	Inorg-014		21	<0.004	<0.004	0		80
Free Cyanide in Water	mg/L	0.004	Inorg-014		21	<0.004	<0.004	0		99

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	220566-2
Date prepared	-			02/07/2019	1	02/07/2019	02/07/2019		02/07/2019	02/07/2019
Date analysed	-			02/07/2019	1	02/07/2019	02/07/2019		02/07/2019	02/07/2019
Aluminium-Total	µg/L	10	Metals-022	<10	1	1000	1000	0	101	#

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	220566-10
Date prepared	-				9	02/07/2019	02/07/2019		02/07/2019	02/07/2019
Date analysed	-				9	02/07/2019	02/07/2019		02/07/2019	02/07/2019
Aluminium-Total	µg/L	10	Metals-022		9	17000	17000	0	102	#

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-				15	02/07/2019	02/07/2019			
Date analysed	-				15	02/07/2019	02/07/2019			
Aluminium-Total	µg/L	10	Metals-022		15	38000	37000	3		

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	220566-2
Date prepared	-			01/07/2019	1	01/07/2019	01/07/2019		01/07/2019	01/07/2019
Date analysed	-			01/07/2019	1	01/07/2019	01/07/2019		01/07/2019	01/07/2019
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	870	790	10	97	95

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	220566-20
Date prepared	-				11	01/07/2019	01/07/2019		01/07/2019	01/07/2019
Date analysed	-				11	01/07/2019	01/07/2019		01/07/2019	01/07/2019
Aluminium-Dissolved	µg/L	10	Metals-022		11	210	200	5	96	#

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-				19	01/07/2019	01/07/2019			
Date analysed	-				19	01/07/2019	01/07/2019			
Aluminium-Dissolved	µg/L	10	Metals-022		19	300	290	3		

Result Definitions	
NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions	
Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Report Comments

All metals in water-dissolved - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.
All metals in water - total - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

ENVIROLAB GROUP

HT

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318000664
Contact person: JK	**PO No.:**
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**
Sampler: JK	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0432184301	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	dissolved aluminium										Provide as much information about the sample as you can
15	PUMP		25/06/2019	WATER	X	X	X	X	X										
16	N9		25/06/2019	WATER	X	X	X	X	X										
17	A7		26/06/2019	WATER	X	X	X	X	X										
18	E4		26/06/2019	WATER	X	X	X	X	X										
19	W7M		25/06/2019	WATER	X	X	X	X	X										
20	W2D		25/06/2019	WATER	X	X	X	X	X										
21	QA101		25/06/2019	WATER	X	X	X	X	X										
22	QA102		25/06/2019	WATER	X	X	X	X	X										
~~23~~	QA103		25/06/2019	WATER	X	X	X	X	X										please send to ALS
23 ~~24~~	R01		25/06/2019	WATER	X	X	X	X	X										
25																			
26																			
27																			
28																			

Environmental Division
Sydney
Work Order Reference
ES1920178

Telephone : + 61-2-8784 8555

Relinquished by (company):	Ramboll	**Received by (company):**	ALS
Print Name:	Jordyn Kirsch	**Print Name:**	INC
Date & Time:	28/06/2019	**Date & Time:**	28/6/19 5:00pm
Signature:		**Signature:**	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: (if applicable)
Transported by: Hand delivered / courier

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318000664
Contact person: JK	**PO No.:**
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**
Sampler: JK	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0421330255	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com	

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12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required													Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium									Provide as much information about the sample as you can
1	W3D		26/06/2019	WATER	X	X	X	X	X									
2	W6D		25/06/2019	WATER	X	X	X	X	X									
3	F5		26/06/2019	WATER	X	X	X	X	X									
4	G5		26/06/2019	WATER	X	X	X	X	X									
5	G2		25/06/2019	WATER	X	X	X	X	X									
6	N8		25/06/2019	WATER	X	X	X	X	X									
7	W5D		25/06/2019	WATER	X	X	X	X	X									
8	F6		25/06/2019	WATER	X	X	X	X	X									
9	G6		25/06/2019	WATER	X	X	X	X	X									
10	N2		25/06/2019	WATER	X	X	X	X	X									
11	W1D		26/06/2019	WATER	X	X	X	X	X									
12	E5D		25/06/2019	WATER	X	X	X	X	X									
13	E11		25/06/2019	WATER	X	X	X	X	X									
14	W3S		26/06/2019	WATER	X	X	X	X	X									

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 220566
Date Received: 28/06/19
Time Received: 10:19
Received by: SB
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company):	Ramboll	**Received by (company):**	ELS Syd.
Print Name:	Jordyn Kirsch	**Print Name:**	S. Bolton
Date & Time:	28/06/2019	**Date & Time:**	28/06/19 10:19
Signature:		**Signature:**	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: (if applicable)
Transported by: Hand delivered / courier

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1920178**	Page	: 1 of 2
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Contact	: Sepan Mahamad
Address	: Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road PO Box 435 THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 49344354	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 28-Jun-2019 17:00
Order number	:	Date Analysis Commenced	: 01-Jul-2019
C-O-C number	: ----	Issue Date	: 05-Jul-2019 16:19
Sampler	: JK		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**QA103**	----	----	----	----
				Client sampling date / time	25-Jun-2019 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES1920178-001**	--------	--------	--------	--------
					Result	---	---	---	---
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.08**	----	----	----	----
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.004	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.5**	----	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1920178**	Page	: 1 of 3
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Contact	: Sepan Mahamad
Address	: Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road PO Box 435 THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 49344354	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 28-Jun-2019
Order number	:	Date Analysis Commenced	: 01-Jul-2019
C-O-C number	: ----	Issue Date	: 05-Jul-2019
Sampler	: JK		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2444608)									
ES1920303-004	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.20	0.17	15.9	0% - 50%
ES1920138-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 2444490)									
ES1920325-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.03	0.03	0.00	No Limit
ES1920152-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 2436070)									
ES1920141-001	Anonymous	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2436069)									
ES1920165-004	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
ES1920141-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 2435869)									
ES1920200-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	1.0	1.0	0.00	No Limit
ES1920139-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2444608)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	93.6	80	116
EG020T: Total Metals by ICP-MS (QCLot: 2444490)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	100.0	82	120
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2436070)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	101	88	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2436069)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	108	73	133
EK040P: Fluoride by PC Titrator (QCLot: 2435869)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	95.2	82	116

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**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2436070)							
ES1920141-001	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	90.0	70	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2436069)							
ES1920141-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	100	70	130
EK040P: Fluoride by PC Titrator (QCLot: 2435869)							
ES1920139-002	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	104	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1920178**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 28-Jun-2019
Site	: ----	Issue Date	: 05-Jul-2019
Sampler	: JK	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

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

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Matrix Spikes (MS)					
Dissolved Metals by ICP-MS - Suite A	0	11	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	0	3	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Natural (EG020A-F)							
QA103	**25-Jun-2019**	----	----	----	**04-Jul-2019**	22-Dec-2019	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
QA103	**25-Jun-2019**	**04-Jul-2019**	22-Dec-2019	✓	**04-Jul-2019**	22-Dec-2019	✓
EK025SF: Free CN by Segmented Flow Analyser							
Clear Plastic Bottle - NaOH (EK025SF)							
QA103	**25-Jun-2019**	----	----	----	**01-Jul-2019**	09-Jul-2019	✓
EK026SF: Total CN by Segmented Flow Analyser							
Clear Plastic Bottle - NaOH (EK026SF)							
QA103	**25-Jun-2019**	----	----	----	**01-Jul-2019**	09-Jul-2019	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
QA103	**25-Jun-2019**	----	----	----	**01-Jul-2019**	23-Jul-2019	✓

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 Metals by ICP-MS - Suite A	EG020A-F	2	11	18.18	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	3	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	3	66.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	11	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	0	11	0.00	5.00	×	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	3	33.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	0	3	0.00	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.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. 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.
Free CN by Segmented Flow Analyser	EK025SF	WATER	In house: Referenced to ASTM D7237: Using an automated segmented flow analyser, a sample at high pH (sodium hydroxide preserved) is buffered to pH 6.0. The hydrogen cyanide present passes across a gas dialysis membrane into an acceptor stream consisting of 0.01 M sodium hydroxide. The acceptor stream mixes with a buffer at pH 5.2 and reacts with chloramine-T to form cyanogen chloride. Cyanogen chloride reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour, measured at 600nm. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318000664
Contact person: JK	**PO No.:**
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**
Sampler: JK	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0421330255	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium										Provide as much information about the sample as you can
1	W3D		24/09/2019	WATER	X	X	X	X	X										
2	W6D		23/09/2019	WATER	X	X	X	X	X										
3	F5		24/09/2019	WATER	X	X	X	X	X										
4	G5		24/09/2019	WATER	X	X	X	X	X										
5	G2		23/09/2019	WATER	X	X	X	X	X										
6	N8		23/09/2019	WATER	X	X	X	X	X										
7	W5D		24/09/2019	WATER	X	X	X	X	X										
8	F6		24/09/2019	WATER	X	X	X	X	X										
9	G6		24/09/2019	WATER	X	X	X	X	X										
10	N2		24/09/2019	WATER	X	X	X	X	X										
11	W1D		24/09/2019	WATER	X	X	X	X	X										
12	E5D		24/09/2019	WATER	X	X	X	X	X										
13	E11		23/09/2019	WATER	X	X	X	X	X										
14	W3S		24/09/2019	WATER	X	X	X	X	X										

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 223132
Date Received: 27/09/19
Time Received: 1057
Received By: SB
Temp: Cool/Ambient
Cooling: Icepack
Security: Intact/Broken/None

Relinquished by (company):	Ramboll	**Received by (company):**	ELS Syd.
Print Name:	Jordyn Kirsch	**Print Name:**	S. Bolton
Date & Time:	24/09/2019	**Date & Time:**	27/09/19 1057
Signature:		**Signature:**	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: (if applicable)
Transported by: Hand delivered / courier

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000664	Envirolab Services 12 Ashley St, Chatswood, NSW 2067 Phone: 02 9910 6200 Fax :02 9910 6201 E-mail: ahie@envirolabservices.com.au Contact: Aileen Hie
Contact person: JK	PO No.:	
Project Mgr: Kirsty Greenfield	Envirolab Quote No. :	
Sampler: JK	Date results required:	
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	Or choose: standard / same day / 1 day / 2 day / 3 day	Envirolab Services WA t/a MPL 16-18 Hayden Crt, Myaree WA 6154 Phone: 08 9317 2505 Fax :08 9317 4163 E-mail: lab@mpl.com.au Contact: Joshua Lim
Phone: (02) 49625444 Mob: 0432184301	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*	
Fax:	Lab comments: Highly contaminated	
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com		

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	dissolved aluminium										Provide as much information about the sample as you can
15	PUMP		24/09/2019	WATER	X	X	X	X	X										
16	N9		23/09/2019	WATER	X	X	X	X	X										
17	A7		24/09/2019	WATER	X	X	X	X	X										
18	E4		24/09/2019	WATER	X	X	X	X	X										
19	W7M		24/09/2019	WATER	X	X	X	X	X										
20	W2D		24/09/2019	WATER	X	X	X	X	X										
21	QA101		24/09/2019	WATER	X	X	X	X	X										
22	QA102		24/09/2019	WATER	X	X	X	X	X										
—	QA103		24/09/2019	WATER	X	X	X	X	X										please send to ALS
23	QC101		24/09/2019	WATER	X	X	X	X	X										

Relinquished by (company): Ramboll	Received by (company):	*Lab use only:*
Print Name: Jordyn Kirsch	Print Name:	Samples Received: Cool or Ambient (circle one)
Date & Time: 24/09/2019	Date & Time:	Temperature Received at: (if applicable)
Signature:	Signature:	Transported by: Hand delivered / courier

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 227132

Client Details

Client	Ramboll Australia Pty Ltd
Attention	J Kirsch
Address	PO Box 560, North Sydney, NSW, 2060

Sample Details

Your Reference	**Hydro GW Plume Monitoring -318000664**
Number of Samples	23 Water
Date samples received	27/09/2019
Date completed instructions received	27/09/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	04/10/2019
Date of Issue	04/10/2019

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Loren Bardwell, Senior Chemist
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference	UNITS	227132-1	227132-2	227132-3	227132-4	227132-5
Your Reference		W3D	W6D	F5	G5	G2
Date Sampled		24/09/2019	23/09/2019	24/09/2019	24/09/2019	23/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Fluoride, F	mg/L	0.2	<0.1	0.2	0.2	0.3
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference	UNITS	227132-6	227132-7	227132-8	227132-9	227132-10
Your Reference		N8	W5D	F6	G6	N2
Date Sampled		23/09/2019	24/09/2019	24/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Fluoride, F	mg/L	0.4	0.4	0.5	0.3	1.0
Total Cyanide	mg/L	0.47	<0.004	<0.004	<0.004	0.007
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference	UNITS	227132-11	227132-12	227132-13	227132-14	227132-15
Your Reference		W1D	E5D	E11	W3S	PUMP
Date Sampled		24/09/2019	24/09/2019	23/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Fluoride, F	mg/L	4.4	8.3	41	170	400
Total Cyanide	mg/L	0.046	0.68	0.30	20	35
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	0.013	0.014

Miscellaneous Inorganics						
Our Reference	UNITS	227132-16	227132-17	227132-18	227132-19	227132-20
Your Reference		N9	A7	E4	W7M	W2D
Date Sampled		23/09/2019	24/09/2019	24/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Fluoride, F	mg/L	160	480	530	800	1,300
Total Cyanide	mg/L	8.0	88	130	160	240
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	0.006	0.030

Miscellaneous Inorganics				
Our Reference	UNITS	227132-21	227132-22	227132-23
Your Reference		QA101	QA102	QC101
Date Sampled		24/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019
Fluoride, F	mg/L	0.5	0.3	<0.1
Total Cyanide	mg/L	<0.004	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004

All metals in water - total						
Our Reference		227132-1	227132-2	227132-3	227132-4	227132-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		24/09/2019	23/09/2019	24/09/2019	24/09/2019	23/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Aluminium-Total	µg/L	1,000	3,600	2,300	290	1,100

All metals in water - total						
Our Reference		227132-6	227132-7	227132-8	227132-9	227132-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		23/09/2019	24/09/2019	24/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Aluminium-Total	µg/L	1,100	240	120	9,800	8,400

All metals in water - total						
Our Reference		227132-11	227132-12	227132-13	227132-14	227132-15
Your Reference	UNITS	W1D	E5D	E11	W3S	PUMP
Date Sampled		24/09/2019	24/09/2019	23/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Aluminium-Total	µg/L	710	1,200	3,900	3,800	93,000

All metals in water - total						
Our Reference		227132-16	227132-17	227132-18	227132-19	227132-20
Your Reference	UNITS	N9	A7	E4	W7M	W2D
Date Sampled		23/09/2019	24/09/2019	24/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Aluminium-Total	µg/L	640	400	980	2,000	830

All metals in water - total				
Our Reference		227132-21	227132-22	227132-23
Your Reference	UNITS	QA101	QA102	QC101
Date Sampled		24/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019
Aluminium-Total	µg/L	180	320	<10

All metals in water-dissolved						
Our Reference		227132-1	227132-2	227132-3	227132-4	227132-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		24/09/2019	23/09/2019	24/09/2019	24/09/2019	23/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Aluminium-Dissolved	µg/L	940	20	1,500	10	<10

All metals in water-dissolved						
Our Reference		227132-6	227132-7	227132-8	227132-9	227132-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		23/09/2019	24/09/2019	24/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Aluminium-Dissolved	µg/L	60	<10	<10	9,500	3,200

All metals in water-dissolved						
Our Reference		227132-11	227132-12	227132-13	227132-14	227132-15
Your Reference	UNITS	W1D	E5D	E11	W3S	PUMP
Date Sampled		24/09/2019	24/09/2019	23/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Aluminium-Dissolved	µg/L	190	<10	30	790	860

All metals in water-dissolved						
Our Reference		227132-16	227132-17	227132-18	227132-19	227132-20
Your Reference	UNITS	N9	A7	E4	W7M	W2D
Date Sampled		23/09/2019	24/09/2019	24/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019	30/09/2019	30/09/2019
Aluminium-Dissolved	µg/L	80	210	830	300	730

All metals in water-dissolved				
Our Reference		227132-21	227132-22	227132-23
Your Reference	UNITS	QA101	QA102	QC101
Date Sampled		24/09/2019	24/09/2019	24/09/2019
Type of sample		Water	Water	Water
Date prepared	-	30/09/2019	30/09/2019	30/09/2019
Date analysed	-	30/09/2019	30/09/2019	30/09/2019
Aluminium-Dissolved	µg/L	<10	<10	<10

Method ID	Methodology Summary
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjsuted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hyperchlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	227132-2
Date prepared	-			30/09/2019	1	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Date analysed	-			30/09/2019	1	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	0.2	0.2	0	97	93
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	96	113
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	95	95

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	227132-22
Date prepared	-				11	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Date analysed	-				11	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Fluoride, F	mg/L	0.1	Inorg-026		11	4.4	4.5	2	100	96
Total Cyanide	mg/L	0.004	Inorg-014		11	0.046	0.46	164	113	112
Free Cyanide in Water	mg/L	0.004	Inorg-014		11	<0.004	<0.004	0	90	90

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-				21	30/09/2019	30/09/2019			
Date analysed	-				21	30/09/2019	30/09/2019			
Fluoride, F	mg/L	0.1	Inorg-026		21	0.5	0.6	18		
Total Cyanide	mg/L	0.004	Inorg-014		21	<0.004	<0.004	0		
Free Cyanide in Water	mg/L	0.004	Inorg-014		21	<0.004	<0.004	0		

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	227132-2
Date prepared	-			30/09/2019	1	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Date analysed	-			30/09/2019	1	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Aluminium-Total	µg/L	10	Metals-022	<10	1	1000	1100	10	106	#

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	227132-20
Date prepared	-				11	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Date analysed	-				11	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Aluminium-Total	µg/L	10	Metals-022		11	710	690	3	108	#

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-				19	30/09/2019	30/09/2019			
Date analysed	-				19	30/09/2019	30/09/2019			
Aluminium-Total	µg/L	10	Metals-022		19	2000	2400	18		

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	227132-2
Date prepared	-			30/09/2019	1	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Date analysed	-			30/09/2019	1	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	940	970	3	96	97

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	227132-20
Date prepared	-				11	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Date analysed	-				11	30/09/2019	30/09/2019		30/09/2019	30/09/2019
Aluminium-Dissolved	µg/L	10	Metals-022		11	190	190	0	103	#

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-				19	30/09/2019	30/09/2019			
Date analysed	-				19	30/09/2019	30/09/2019			
Aluminium-Dissolved	µg/L	10	Metals-022		19	300	330	10		

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Report Comments

All metals in water- dissolved - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

All metals in water- total - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

31/10/19

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318000664
Contact person: JK	**PO No.:**
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**
Sampler: JK	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0421330255	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required													Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium									Provide as much information about the sample as you can
1	W3D		24/09/2019	WATER	X	X	X	X	X									
2	W6D		23/09/2019	WATER	X	X	X	X	X									
3	F5		24/09/2019	WATER	X	X	X	X	X									
4	G5		24/09/2019	WATER	X	X	X	X	X									
5	G2		23/09/2019	WATER	X	X	X	X	X									
6	N8		23/09/2019	WATER	X	X	X	X	X									
7	W5D		24/09/2019	WATER	X	X	X	X	X									
8	F6		24/09/2019	WATER	X	X	X	X	X									
9	G6		24/09/2019	WATER	X	X	X	X	X									
10	N2		24/09/2019	WATER	X	X	X	X	X									
11	W1D		24/09/2019	WATER	X	X	X	X	X									
12	E5D		24/09/2019	WATER	X	X	X	X	X									
13	E11		23/09/2019	WATER	X	X	X	X	X									
14	W3S		24/09/2019	WATER	X	X	X	X	X									

ENVIROLAB

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 223132
Date Received: 27/09/19
Time Received: 1057
Received by: SB
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Environmental Division
Sydney
Work Order Reference
ES1932021

Telephone : + 61-2-8784 8555

Relinquished by (company):	Ramboll	ELS Syd	**Received by (company):** ELS Syd
Print Name:	Jordyn Kirsch	Thay	**Print Name:** S. Bolton J
Date & Time:	24/09/2019	30/9/2019	**Date & Time:** 27/09/19 1057
Signature:			**Signature:**

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: (if applicable)
Transported by: Hand delivered / courier

rec: Fax: 30/9/19

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318000664
Contact person: JK	**PO No.:**
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**
Sampler: JK	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0432184301	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	dissolved aluminium										Provide as much information about the sample as you can
15	PUMP		24/09/2019	WATER	X	X	X	X	X										
16	N9		23/09/2019	WATER	X	X	X	X	X										
17	A7		24/09/2019	WATER	X	X	X	X	X										
18	E4		24/09/2019	WATER	X	X	X	X	X										
19	W7M		24/09/2019	WATER	X	X	X	X	X										
20	W2D		24/09/2019	WATER	X	X	X	X	X										
21	QA101		24/09/2019	WATER	X	X	X	X	X										
22	QA102		24/09/2019	WATER	X	X	X	X	X										
~~23~~	~~QA103~~	①	~~24/09/2019~~	WATER	X	X	X	X	X										please send to ALS
23	QC101		24/09/2019	WATER	X	X	X	X	X										

Relinquished by (company):	Ramboll	ECS Syd	**Received by (company):**
Print Name:	Jordyn Kirsch	Mat	**Print Name:**
Date & Time:	24/09/2019	30/9/2019 1220	**Date & Time:**
Signature:		BJ	**Signature:**

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: (if applicable)
Transported by: Hand delivered / courier

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1932022**	Page	: 1 of 2
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: J KIRSCH	Contact	: Customer Services ES
Address	: PO BOX 560 NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 30-Sep-2019 16:00
Order number	: ----	Date Analysis Commenced	: 01-Oct-2019
C-O-C number	: ----	Issue Date	: 08-Oct-2019 11:22
Sampler	: JK		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Client sample ID	**QA103**	----	----	----	----
			Client sampling date / time	24-Sep-2019 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES1932022-001**	--------	--------	--------	--------
				Result	---	---	---	---
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.48**	----	----	----	----
EK025SF: Free CN by Segmented Flow Analyser								
Free Cyanide	----	0.004	mg/L	<0.004	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	----	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.3**	----	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1932022**	Page	: 1 of 3
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: J KIRSCH	Contact	: Customer Services ES
Address	: PO BOX 560 NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 30-Sep-2019
Order number	: ----	Date Analysis Commenced	: 01-Oct-2019
C-O-C number	: ----	Issue Date	: 08-Oct-2019
Sampler	: JK		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2617497)									
ES1932022-001	QA103	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit
ES1932034-012	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 2622018)									
ES1932163-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit
ES1931936-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 2623884)									
ES1932022-001	QA103	EK025SF: Free Cyanide	---	0.004	mg/L	<0.004	0.005	30.5	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2623883)									
ES1931849-003	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
ES1932022-001	QA103	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.007	50.3	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 2616974)									
ES1931774-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	1.0	1.0	0.00	0% - 50%
ES1931948-003	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.8	0.8	0.00	No Limit

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2617497)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	93.4	80.0	116
EG020T: Total Metals by ICP-MS (QCLot: 2622018)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	87.9	82.0	120
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2623884)								
EK025SF: Free Cyanide	---	0.004	mg/L	<0.004	0.2 mg/L	97.7	88.0	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2623883)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	110	73.0	133
EK040P: Fluoride by PC Titrator (QCLot: 2616974)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	107	82.0	116

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**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2623884)							
ES1932022-001	QA103	EK025SF: Free Cyanide	---	0.2 mg/L	81.4	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2623883)							
ES1931849-003	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	100	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 2616974)							
ES1931739-017	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	88.4	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1932022**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: J KIRSCH	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 30-Sep-2019
Site	: ----	Issue Date	: 08-Oct-2019
Sampler	: JK	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

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

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Matrix Spikes (MS)					
Dissolved Metals by ICP-MS - Suite A	0	14	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	0	10	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
QA103	**24-Sep-2019**	----	----	----	**02-Oct-2019**	22-Mar-2020	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
QA103	**24-Sep-2019**	**04-Oct-2019**	22-Mar-2020	✓	**04-Oct-2019**	22-Mar-2020	✓
EK025SF: Free CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK025SF)							
QA103	**24-Sep-2019**	----	----	----	**04-Oct-2019**	08-Oct-2019	✓
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
QA103	**24-Sep-2019**	----	----	----	**04-Oct-2019**	08-Oct-2019	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
QA103	**24-Sep-2019**	----	----	----	**01-Oct-2019**	22-Oct-2019	✓

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 Metals by ICP-MS - Suite A	EG020A-F	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	0	14	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	0	10	**0.00**	**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.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. 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.
Free CN by Segmented Flow Analyser	EK025SF	WATER	In house: Referenced to ASTM D7237: Using an automated segmented flow analyser, a sample at high pH (sodium hydroxide preserved) is buffered to pH 6.0. The hydrogen cyanide present passes across a gas dialysis membrane into an acceptor stream consisting of 0.01 M sodium hydroxide. The acceptor stream mixes with a buffer at pH 5.2 and reacts with chloramine-T to form cyanogen chloride. Cyanogen chloride reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour, measured at 600nm. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)

CHAIN OF CUSTODY - Client

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Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318000664
Contact person: JK	**PO No.:**
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**
Sampler: JK	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0421330255	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium										Provide as much information about the sample as you can
1	W3D		11/12/2019	WATER	X	X	X	X	X										
2	W6D		10/12/2019	WATER	X	X	X	X	X										
3	F5		11/12/2019	WATER	X	X	X	X	X										
4	G5		11/12/2019	WATER	X	X	X	X	X										
5	G2		10/12/2019	WATER	X	X	X	X	X										
6	N8		10/12/2019	WATER	X	X	X	X	X										
7	W5D		10/12/2019	WATER	X	X	X	X	X										
8	F6		11/12/2019	WATER	X	X	X	X	X										
9	G6		11/12/2019	WATER	X	X	X	X	X										
10	N2		10/12/2019	WATER	X	X	X	X	X										
11	W1D		11/12/2019	WATER	X	X	X	X	X										
12	E5D		10/12/2019	WATER	X	X	X	X	X										
13	E11		10/12/2019	WATER	X	X	X	X	X										
14	PUMP		10/12/2019	WATER	X	X	X	X	X										

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 237986
Date Received: 12/12/19
Time Received: 1055
Received by: SD
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company):	Ramboll	**Received by (company):**	ES SYD
Print Name:	Jordyn Kirsch	**Print Name:**	Jordan Day
Date & Time:	11/12/2019	**Date & Time:**	12/12/19 1055
Signature:		**Signature:**	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 14.8 (if applicable)
Transported by: Hand delivered / courier

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Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000664	Envirolab Services 12 Ashley St, Chatswood, NSW 2067 Phone: 02 9910 6200 Fax :02 9910 6201 E-mail: ahie@envirolabservices.com.au Contact: Aileen Hie
Contact person: JK	PO No.:	
Project Mgr: Kirsty Greenfield	Envirolab Quote No. :	
Sampler: JK	Date results required:	
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	Or choose: standard / same day / 1 day / 2 day / 3 day *Note: Inform lab in advance if urgent turnaround is required - surcharge applies*	Envirolab Services WA t/a MPL 16-18 Hayden Crt, Myaree WA 6154 Phone: 08 9317 2505 Fax :08 9317 4163 E-mail: lab@mpl.com.au Contact: Joshua Lim
Phone: (02) 49625444 Mob: 0432184301	Lab comments: Highly contaminated	
Fax:		
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com		

Sample information					Tests Required													Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	dissolved aluminium									Provide as much information about the sample as you can
15	A7		11/12/2019	WATER	X	X	X	X	X									
16	E4		11/12/2019	WATER	X	X	X	X	X									
17	W7M		10/12/2019	WATER	X	X	X	X	X									
18	W2D		10/12/2019	WATER	X	X	X	X	X									
19	QA101		10/12/2019	WATER	X	X	X	X	X									
20	QA102		11/12/2019	WATER	X	X	X	X	X									
–	QA103		11/12/2019	WATER	X	X	X	X	X									please send to ALS
21	QC101		11/12/2019	WATER	X	X	X	X	X									
			11/12/2019	WATER	X	X	X	X	X									

Relinquished by (company): Ramboll	Received by (company): ECS 510	Lab use only: 232486
Print Name: Jordyn Kirsch	Print Name: Jason Duy	Samples Received: Cool or Ambient (circle one)
Date & Time: 11/12/2019	Date & Time: 12/12/19 1055	Temperature Received at: 14.8 (if applicable)
Signature:	Signature:	Transported by: Hand delivered / courier

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 232986

Client Details

Client	Ramboll Australia Pty Ltd
Attention	Kirsty Greenfield, J Kirsch
Address	PO Box 560, North Sydney, NSW, 2060

Sample Details

Your Reference	**Hydro GW Plume Monitoring -318000664**
Number of Samples	21 Water
Date samples received	12/12/2019
Date completed instructions received	12/12/2019

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	19/12/2019
Date of Issue	19/12/2019

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Greta Petzold, Senior Chemist
Loren Bardwell, Senior Chemist
Nick Sarlamis, Inorganics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		232986-1	232986-2	232986-3	232986-4	232986-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		11/12/2019	10/12/2019	11/12/2019	11/12/2019	10/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Date analysed	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Fluoride, F	mg/L	0.1	<0.1	<0.1	0.1	0.3
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		232986-6	232986-7	232986-8	232986-9	232986-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		10/12/2019	10/12/2019	11/12/2019	11/12/2019	10/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Date analysed	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Fluoride, F	mg/L	0.2	0.1	0.4	0.2	0.4
Total Cyanide	mg/L	0.63	<0.004	<0.004	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		232986-11	232986-12	232986-13	232986-14	232986-15
Your Reference	UNITS	W1D	E5D	E11	Pump	A7
Date Sampled		11/12/2019	10/12/2019	10/12/2019	10/12/2019	11/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Date analysed	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Fluoride, F	mg/L	41	9.4	120	530	520
Total Cyanide	mg/L	0.67	1.1	20	57	90
Free Cyanide in Water	mg/L	<0.004	<0.004	0.004	0.007	0.004

Miscellaneous Inorganics						
Our Reference		232986-16	232986-17	232986-18	232986-19	232986-20
Your Reference	UNITS	E4	W7M	W2D	QA101	QA102
Date Sampled		11/12/2019	10/12/2019	10/12/2019	10/12/2019	11/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Date analysed	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Fluoride, F	mg/L	590	830	1,400	<0.1	<0.1
Total Cyanide	mg/L	130	160	270	<0.004	<0.004
Free Cyanide in Water	mg/L	0.006	0.009	0.018	<0.004	<0.004

Miscellaneous Inorganics		
Our Reference		232986-21
Your Reference	UNITS	QC101
Date Sampled		11/12/2019
Type of sample		Water
Date prepared	-	13/12/2019
Date analysed	-	13/12/2019
Fluoride, F	mg/L	<0.1
Total Cyanide	mg/L	<0.004
Free Cyanide in Water	mg/L	<0.004

All metals in water - total						
Our Reference		232986-1	232986-2	232986-3	232986-4	232986-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		11/12/2019	10/12/2019	11/12/2019	11/12/2019	10/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	16/12/2019	16/12/2019	16/12/2019	16/12/2019	16/12/2019
Date analysed	-	16/12/2019	16/12/2019	16/12/2019	16/12/2019	16/12/2019
Aluminium-Total	µg/L	1,100	1,900	1,900	410	1,300

All metals in water - total						
Our Reference		232986-6	232986-7	232986-8	232986-9	232986-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		10/12/2019	10/12/2019	11/12/2019	11/12/2019	10/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	16/12/2019	16/12/2019	16/12/2019	16/12/2019	16/12/2019
Date analysed	-	16/12/2019	16/12/2019	16/12/2019	16/12/2019	16/12/2019
Aluminium-Total	µg/L	1,700	280	70	9,000	7,700

All metals in water - total						
Our Reference		232986-11	232986-12	232986-13	232986-14	232986-15
Your Reference	UNITS	W1D	E5D	E11	Pump	A7
Date Sampled		11/12/2019	10/12/2019	10/12/2019	10/12/2019	11/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	16/12/2019	16/12/2019	16/12/2019	16/12/2019	16/12/2019
Date analysed	-	16/12/2019	16/12/2019	16/12/2019	16/12/2019	16/12/2019
Aluminium-Total	µg/L	230	2,500	1,500	77,000	330

All metals in water - total						
Our Reference		232986-16	232986-17	232986-18	232986-19	232986-20
Your Reference	UNITS	E4	W7M	W2D	QA101	QA102
Date Sampled		11/12/2019	10/12/2019	10/12/2019	10/12/2019	11/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	16/12/2019	16/12/2019	16/12/2019	16/12/2019	16/12/2019
Date analysed	-	16/12/2019	16/12/2019	16/12/2019	16/12/2019	16/12/2019
Aluminium-Total	µg/L	1,800	10,000	1,200	1,200	370

All metals in water - total		
Our Reference		232986-21
Your Reference	UNITS	QC101
Date Sampled		11/12/2019
Type of sample		Water
Date prepared	-	16/12/2019
Date analysed	-	16/12/2019
Aluminium-Total	µg/L	<10

All metals in water-dissolved						
Our Reference		232986-1	232986-2	232986-3	232986-4	232986-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		11/12/2019	10/12/2019	11/12/2019	11/12/2019	10/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Date analysed	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Aluminium-Dissolved	µg/L	940	20	1,200	20	<10

All metals in water-dissolved						
Our Reference		232986-6	232986-7	232986-8	232986-9	232986-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		10/12/2019	10/12/2019	11/12/2019	11/12/2019	10/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Date analysed	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Aluminium-Dissolved	µg/L	60	<10	<10	8,900	3,500

All metals in water-dissolved						
Our Reference		232986-11	232986-12	232986-13	232986-14	232986-15
Your Reference	UNITS	W1D	E5D	E11	Pump	A7
Date Sampled		11/12/2019	10/12/2019	10/12/2019	10/12/2019	11/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Date analysed	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Aluminium-Dissolved	µg/L	100	<10	30	2,900	280

All metals in water-dissolved						
Our Reference		232986-16	232986-17	232986-18	232986-19	232986-20
Your Reference	UNITS	E4	W7M	W2D	QA101	QA102
Date Sampled		11/12/2019	10/12/2019	10/12/2019	10/12/2019	11/12/2019
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Date analysed	-	13/12/2019	13/12/2019	13/12/2019	13/12/2019	13/12/2019
Aluminium-Dissolved	µg/L	450	270	700	<10	20

All metals in water-dissolved		
Our Reference		232986-21
Your Reference	UNITS	QC101
Date Sampled		11/12/2019
Type of sample		Water
Date prepared	-	13/12/2019
Date analysed	-	13/12/2019
Aluminium-Dissolved	µg/L	<10

Method ID	Methodology Summary
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjsuted as required prior to analysis. Cyanides amenable to Chlorination - samples are analysed untreated and treated with hyperchlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Metals-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	232986-2
Date prepared	-			13/12/2019	1	13/12/2019	13/12/2019		13/12/2019	13/12/2019
Date analysed	-			13/12/2019	1	13/12/2019	13/12/2019		13/12/2019	13/12/2019
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	0.1	0.1	0	105	125
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	112	106
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	111	100

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	232986-15
Date prepared	-				11	13/12/2019	13/12/2019			19/12/2019
Date analysed	-				11	13/12/2019	13/12/2019			19/12/2019
Fluoride, F	mg/L	0.1	Inorg-026		11	41	40	2		103
Total Cyanide	mg/L	0.004	Inorg-014		11	0.67	0.63	6		
Free Cyanide in Water	mg/L	0.004	Inorg-014		11	<0.004	<0.004	0		

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-				21	13/12/2019	13/12/2019			
Date analysed	-				21	13/12/2019	13/12/2019			
Fluoride, F	mg/L	0.1	Inorg-026		21	<0.1	<0.1	0		
Total Cyanide	mg/L	0.004	Inorg-014		21	<0.004				
Free Cyanide in Water	mg/L	0.004	Inorg-014		21	<0.004				

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	232986-2
Date prepared	-			16/12/2019	1	16/12/2019	16/12/2019		16/12/2019	16/12/2019
Date analysed	-			16/12/2019	1	16/12/2019	16/12/2019		16/12/2019	16/12/2019
Aluminium-Total	µg/L	10	Metals-022	<10	1	1100	1100	0	96	#

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date prepared	-				11	16/12/2019	16/12/2019		16/12/2019	
Date analysed	-				11	16/12/2019	16/12/2019		16/12/2019	
Aluminium-Total	µg/L	10	Metals-022		11	230	230	0	97	

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-				18	16/12/2019	16/12/2019			
Date analysed	-				18	16/12/2019	16/12/2019			
Aluminium-Total	µg/L	10	Metals-022		18	1200	1200	0		

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W7	232986-2
Date prepared	-			13/12/2019	1	13/12/2019	13/12/2019		13/12/2019	13/12/2019
Date analysed	-			13/12/2019	1	13/12/2019	13/12/2019		13/12/2019	13/12/2019
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	940	970	3	100	102

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W8	[NT]
Date prepared	-				11	13/12/2019	13/12/2019		13/12/2019	
Date analysed	-				11	13/12/2019	13/12/2019		13/12/2019	
Aluminium-Dissolved	µg/L	10	Metals-022		11	100	110	10	103	

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-				17	13/12/2019	13/12/2019			
Date analysed	-				17	13/12/2019	13/12/2019			
Aluminium-Dissolved	µg/L	10	Metals-022		17	270	270	0		

Result Definitions	
NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions	
Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

All metals in water - total - # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318000664
Contact person: JK	**PO No.:**
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**
Sampler: JK	**Date results required:**
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0421330255	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Phone: 02 9910 6200 Fax :02 9910 6201
E-mail: ahie@envirolabservices.com.au
Contact: Aileen Hie

Envirolab Services WA t/a MPL
16-18 Hayden Crt, Myaree WA 6154
Phone: 08 9317 2505 Fax :08 9317 4163
E-mail: lab@mpl.com.au
Contact: Joshua Lim

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	Dissolved Aluminium											Provide as much information about the sample as you can
1	W3D		11/12/2019	WATER	X	X	X	X	X											
2	W6D		10/12/2019	WATER	X	X	X	X	X											
3	F5		11/12/2019	WATER	X	X	X	X	X											
4	G5		11/12/2019	WATER	X	X	X	X	X											
5	G2		10/12/2019	WATER	X	X	X	X	X											
6	N8		10/12/2019	WATER	X	X	X	X	X											
7	W5D		10/12/2019	WATER	X	X	X	X	X											
8	F6		11/12/2019	WATER	X	X	X	X	X											
9	G6		11/12/2019	WATER	X	X	X	X	X											
10	N2		10/12/2019	WATER	X	X	X	X	X											
11	W1D		11/12/2019	WATER	X	X	X	X	X											
12	E5D		10/12/2019	WATER	X	X	X	X	X											
13	E11		10/12/2019	WATER	X	X	X	X	X											
14	PUMP		10/12/2019	WATER	X	X	X	X	X											

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 237956
Date Received: 12/12/19
Time Received: 1055
Received by: SD
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Environmental Division
Sydney
Work Order Reference
ES1941359

Telephone : +61-2-8784 8555

Relinquished by (company):	Ramboll	**Received by (company):**	EIS SYD
Print Name:	Jordyn Kirsch	**Print Name:**	Jordan Day
Date & Time:	11/12/2019	**Date & Time:**	12/12/19 1055
Signature:		**Signature:**	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 14.8 (if applicable)
Transported by: Hand delivered / courier

Rec. Sophie 12/12/19 1855 ~~14.8~~ 11.3c

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318000664	**Envirolab Services** 12 Ashley St, Chatswood, NSW 2067 Phone: 02 9910 6200 Fax :02 9910 6201 E-mail: ahie@envirolabservices.com.au Contact: Aileen Hie
Contact person: JK	**PO No.:**	
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**	
Sampler: JK	**Date results required:**	**Envirolab Services WA t/a MPL** 16-18 Hayden Crt, Myaree WA 6154 Phone: 08 9317 2505 Fax :08 9317 4163 E-mail: lab@mpl.com.au Contact: Joshua Lim
Address: Level 2 Suite 18, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day	
Phone: (02) 49625444 **Mob:** 0432184301	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*	
Fax:	**Lab comments:** Highly contaminated	
Email: jkirsch@ramboll.com; kgreenfield@ramboll.com		

Sample information					Tests Required													Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	dissolved aluminium									Provide as much information about the sample as you can
15	A7		11/12/2019	WATER	X	X	X	X	X									
16	E4		11/12/2019	WATER	X	X	X	X	X									
17	W7M		10/12/2019	WATER	X	X	X	X	X									
18	W2D		10/12/2019	WATER	X	X	X	X	X									
19	QA101		10/12/2019	WATER	X	X	X	X	X									
20	QA102		11/12/2019	WATER	X	X	X	X	X									
-	QA103		11/12/2019	WATER	X	X	X	X	X									please send to ALS
21	QC101		11/12/2019	WATER	X	X	X	X	X									
			11/12/2019	WATER	X	X	X	X	X									

Relinquished by (company):	Ramboll	**Received by (company):**	ECS 540
Print Name:	Jordyn Kirsch	**Print Name:**	Jason Day
Date & Time:	11/12/2019 12/12/19 1401	**Date & Time:**	12/12/19 1055
Signature:		**Signature:**	

Lab use only: ES2486
Samples Received: (Cool) or Ambient (circle one)
Temperature Received at: 14.8 (if applicable)
Transported by: Hand delivered / courier

B

Rec- Storage 12/12/19 1855 14.8c

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1941359**	Page	: 1 of 2
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Contact	: Customer Services ES
Address	: Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road PO Box 435 THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 49344354	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 12-Dec-2019 18:55
Order number	: ----	Date Analysis Commenced	: 16-Dec-2019
C-O-C number	: ----	Issue Date	: 20-Dec-2019 11:39
Sampler	: JK		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

ilac-MRA NATA

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**QA103**	----	----	----	----
				Client sampling date / time	11-Dec-2019 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES1941359-001**	--------	--------	--------	--------
					Result	---	---	---	---
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	10	µg/L		**20**	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	10	µg/L		**290**	----	----	----	----
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	---	0.004	mg/L		<0.004	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.1**	----	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1941359**	Page	: 1 of 3
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Contact	: Customer Services ES
Address	: Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road PO Box 435 THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 49344354	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 12-Dec-2019
Order number	: ----	Date Analysis Commenced	: 16-Dec-2019
C-O-C number	: ----	Issue Date	: 20-Dec-2019
Sampler	: JK		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2771821)									
ES1940757-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit
ES1941480-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.02	0.02	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 2771854)									
ES1941349-005	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.11	0.11	0.00	0% - 50%
ES1941383-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.14	0.14	0.00	0% - 50%
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 2774653)									
ES1940809-009	Anonymous	EK025SF: Free Cyanide	---	0.004	mg/L	<0.004	<0.004	0.00	No Limit
WN1910151-004	Anonymous	EK025SF: Free Cyanide	---	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2774654)									
ES1940809-009	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
ES1942083-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	0.911	0.842	7.87	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 2768416)									
ES1940959-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.5	0.4	0.00	No Limit
ES1941592-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2771821)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	98.7	80.0	116
EG020T: Total Metals by ICP-MS (QCLot: 2771854)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	95.1	82.0	120
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2774653)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	119	88.0	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2774654)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	118	73.0	133
EK040P: Fluoride by PC Titrator (QCLot: 2768416)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	94.2	82.0	116

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**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2774653)							
ES1940809-009	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	86.8	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2774654)							
ES1940809-009	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	83.1	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 2768416)							
ES1940959-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	100	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1941359**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000664	Date Samples Received	: 12-Dec-2019
Site	: ----	Issue Date	: 20-Dec-2019
Sampler	: JK	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

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

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Matrix Spikes (MS)					
Dissolved Metals by ICP-MS - Suite A	0	9	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	0	11	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
QA103	**11-Dec-2019**	----	----	----	**18-Dec-2019**	08-Jun-2020	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T)							
QA103	**11-Dec-2019**	**18-Dec-2019**	08-Jun-2020	✓	**18-Dec-2019**	08-Jun-2020	✓
EK025SF: Free CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK025SF)							
QA103	**11-Dec-2019**	----	----	----	**19-Dec-2019**	25-Dec-2019	✓
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
QA103	**11-Dec-2019**	----	----	----	**19-Dec-2019**	25-Dec-2019	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
QA103	**11-Dec-2019**	----	----	----	**16-Dec-2019**	08-Jan-2020	✓

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 Metals by ICP-MS - Suite A	EG020A-F	2	9	**22.22**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	11	**18.18**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	11	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	0	9	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	0	11	**0.00**	**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.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. 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.
Free CN by Segmented Flow Analyser	EK025SF	WATER	In house: Referenced to ASTM D7237: Using an automated segmented flow analyser, a sample at high pH (sodium hydroxide preserved) is buffered to pH 6.0. The hydrogen cyanide present passes across a gas dialysis membrane into an acceptor stream consisting of 0.01 M sodium hydroxide. The acceptor stream mixes with a buffer at pH 5.2 and reacts with chloramine-T to form cyanogen chloride. Cyanogen chloride reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour, measured at 600nm. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C / ASTM D7511. Sodium hydroxide preserved samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)

APPENDIX 6
CALIBRATION CERTIFICATES

Multi Parameter Water Meter

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument YSI Quatro Pro Plus
Serial No. 18J104315

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

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 10.00		pH 10.00		324189	pH 9.71
2. pH 7.00		pH 7.00		320613	pH 6.97
3. pH 4.00		pH 4.00		324985	pH 4.05
4. mV		234mV		306946/308677	234mV
5. EC		2.76mS		324347	2.76mS
6. D.O		0.00ppm		10175	0.00ppm
7. Temp		20.4°C		MultiTherm	20.3°C

Calibrated by: **Maria Orlova**

Calibration date: **7/03/2019**

Next calibration due: **6/04/2019**

Oil / Water Interface Meter

Instrument Geotech Interface Meter (30M)
Serial No. 4266

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: Maria Orlova

Calibration date: 7/03/2018

Next calibration due: 6/05/2018

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 18J104331

airmet
Air-Met Scientific Pty Ltd
1300 137 067

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

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 10.00		pH 10.00		324189	pH 9.76
2. pH 7.00		pH 7.00		330737	pH 6.91
3. pH 4.00		pH 4.00		324985	pH 3.96
4. mV		231.8mV		324355/325421	230.9mV
5. EC		2.76mS		322349	2.75mS
6. D.O		0.00ppm		10175	0.04ppm
7. Temp		20.7°C		MultiTherm	19.7°C

Calibrated by: Sarah Lian

Calibration date: 21/06/2019

Next calibration due: 21/07/2019

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 10H100317

airmet
Air-Met Scientific Pty Ltd
1300 137 067

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

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 10.00		pH 10.00		324189	pH 9.66
1. pH 7.00		pH 7.00		330737	pH 6.93
2. pH 4.00		pH 4.00		330734	pH 4.07
3. mV		231.8mV		325420/325421	231.5mV
4. EC		2.76mS		329027	2.78mS
5. D.O		0.00ppm		329994	0.05ppm
6. Temp		21.2°C		MultiTherm	20.7°C

Calibrated by: Sarah Lian

Calibration date: 12/09/2019

Next calibration due: 12/10/2019

Oil / Water Interface Meter

Instrument Geotech Interface Meter (30M)
Serial No. 3983

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: Olivia Vlant

Calibration date: 5/09/2019

Next calibration due: 4/11/2019

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 18L101819

airmet
Air-Met Scientific Pty Ltd
1300 137 067

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

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 10.00		pH 10.00		330734	pH 9.74
2. pH 7.00		pH 7.00		320613	pH 7.00
3. pH 4.00		pH 4.00		330734	pH 4.06
4. mV		231.8mV		338782/337308	231.7mV
5. EC		2.76mS		333787	2.76mS
6. D.O		0.00ppm		329994	0.02ppm
7. Temp		20.7°C		MultiTherm	21.2°C

Calibrated by: Sarah Lian

Calibration date: 6/12/2019

Next calibration due: 5/01/2020

Oil / Water Interface Meter

Instrument Geotech Interface Meter (30M)
Serial No. 3910

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: **Sarah Lian**

Calibration date: **6/12/2019**

Next calibration due: **4/02/2020**

APPENDIX 7
HISTORICAL GROUNDWATER CONTOURS

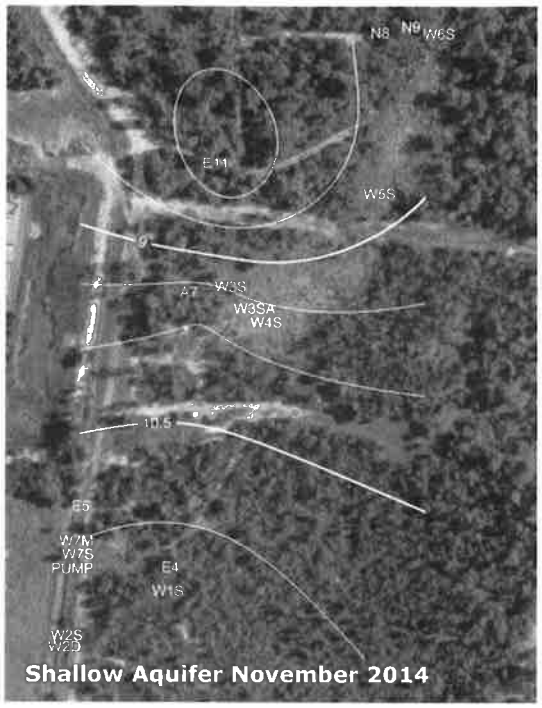
Groundwater Contours - Shallow Aquifer 2013 -2018

Shallow Aquifer July 2013

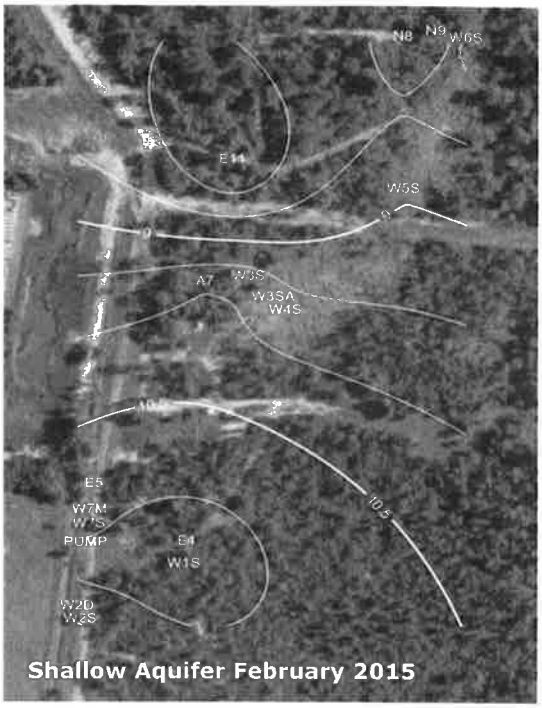
Shallow Aquifer November 2013

Shallow Aquifer February 2014

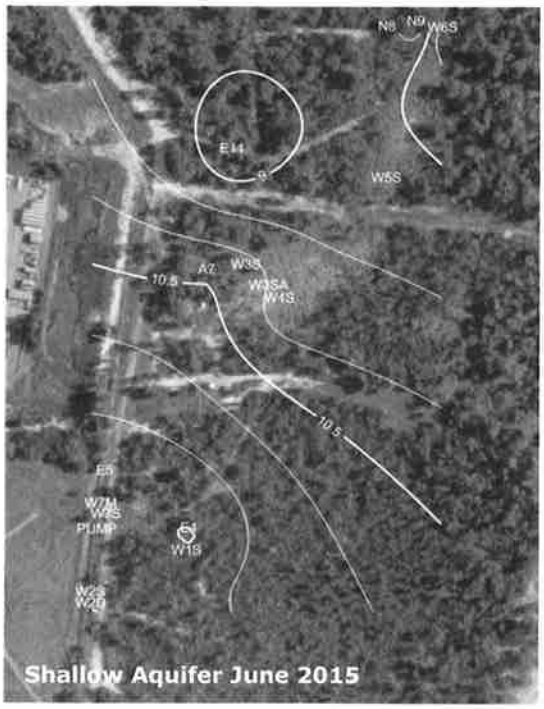
Shallow Aquifer June 2014



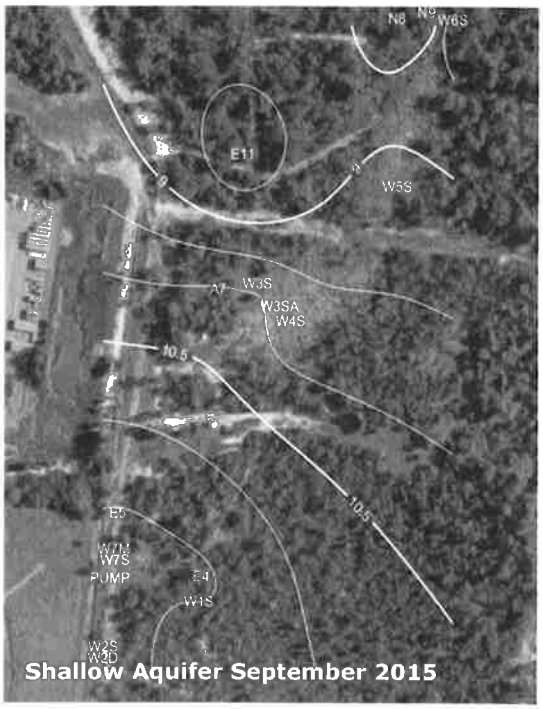
Shallow Aquifer November 2014



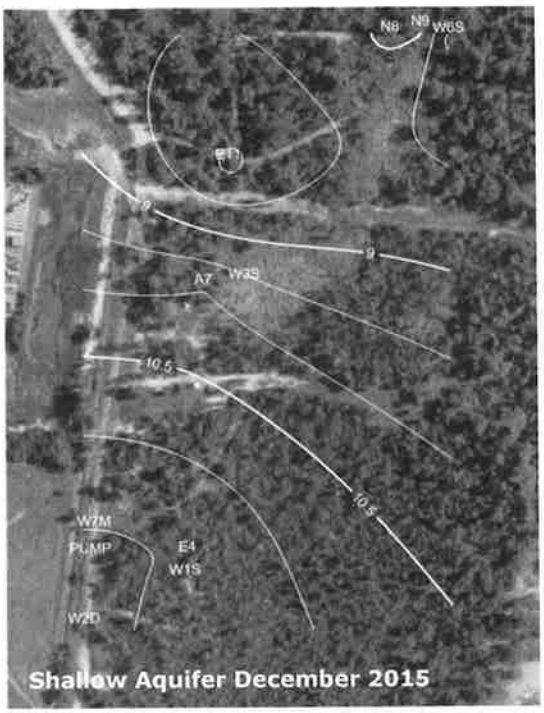
Shallow Aquifer February 2015



Shallow Aquifer June 2015

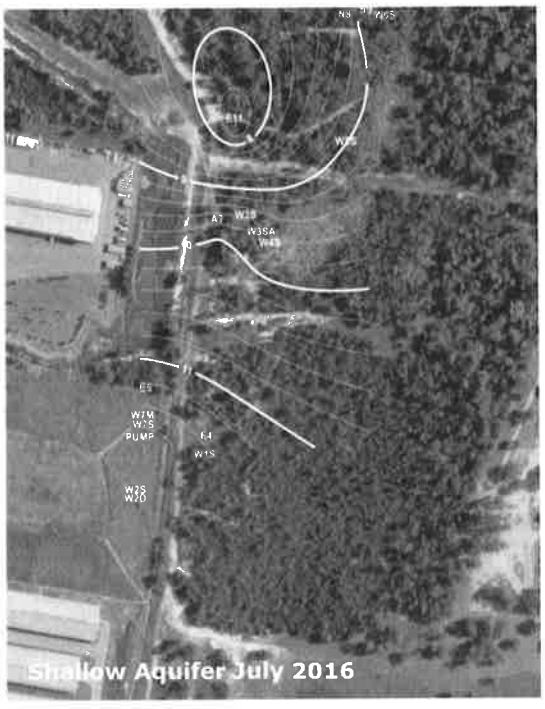


Shallow Aquifer September 2015

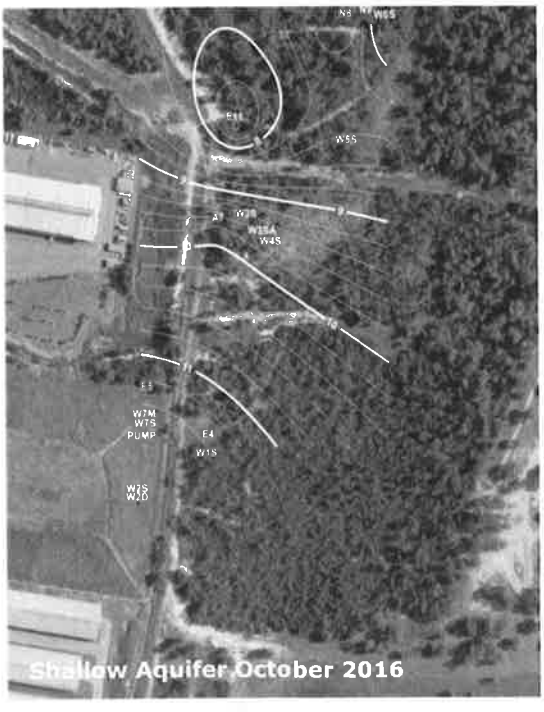


Shallow Aquifer December 2015

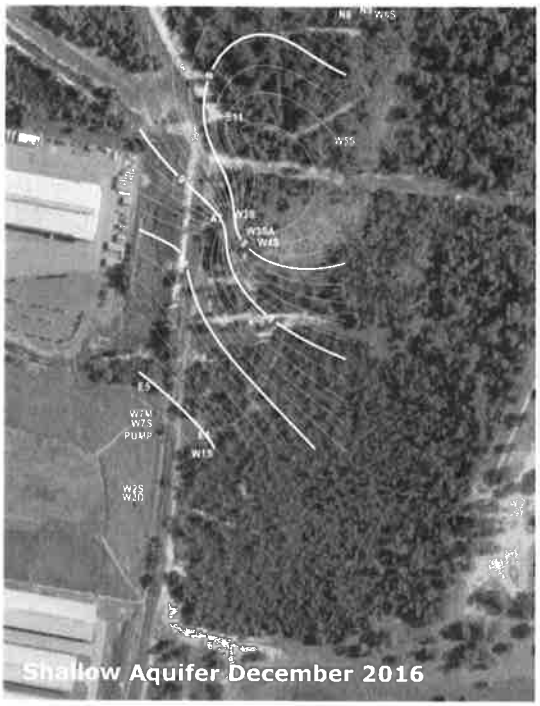
Shallow Aquifer April 2016

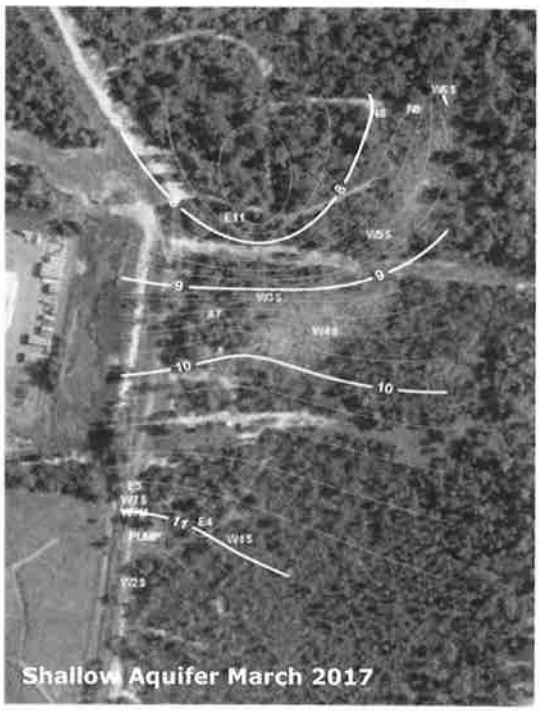


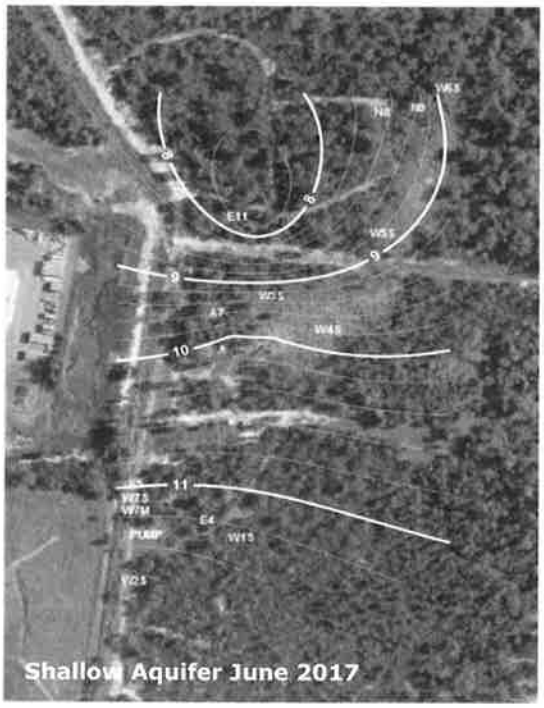
Shallow Aquifer July 2016

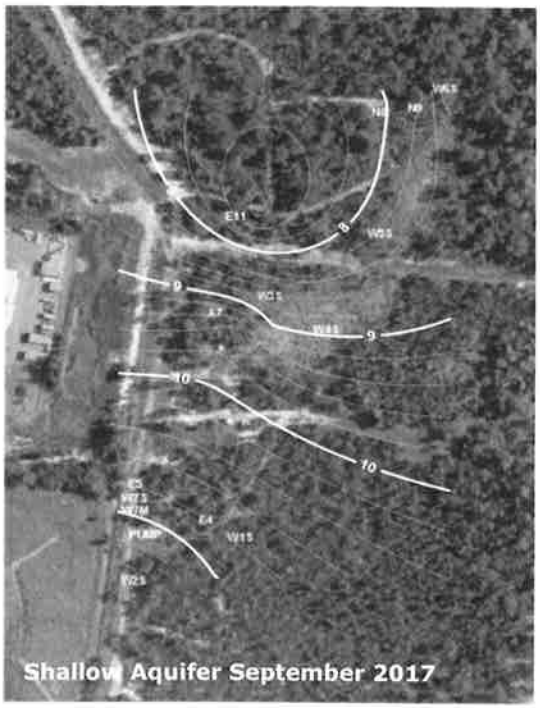


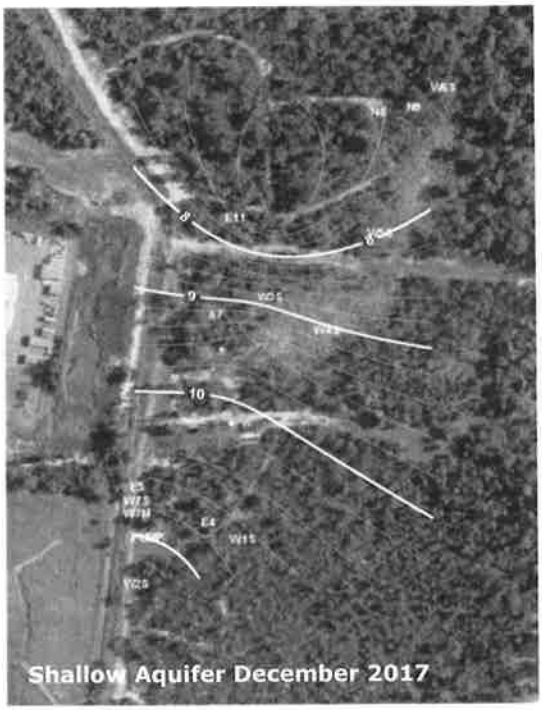
Shallow Aquifer October 2016


Shallow Aquifer December 2016


Shallow Aquifer March 2017


Shallow Aquifer June 2017


Shallow Aquifer September 2017


8
9
10
E11
W65
W25
E4
W15
Shallow Aquifer December 2017

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E11
W65
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E4
W15
Shallow Aquifer March 2018

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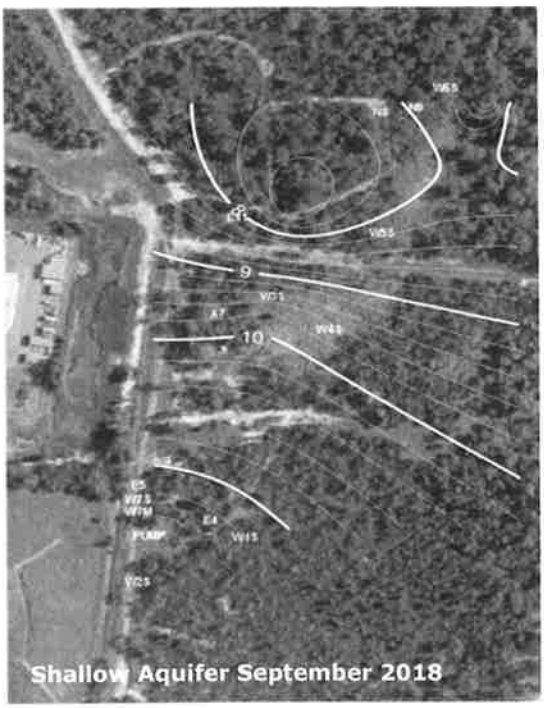
E11
W65
W25
E4
W15
Shallow Aquifer June 2018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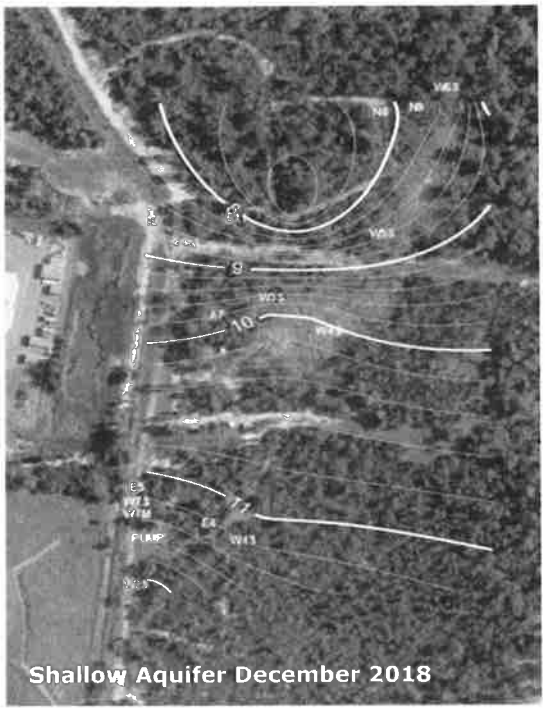
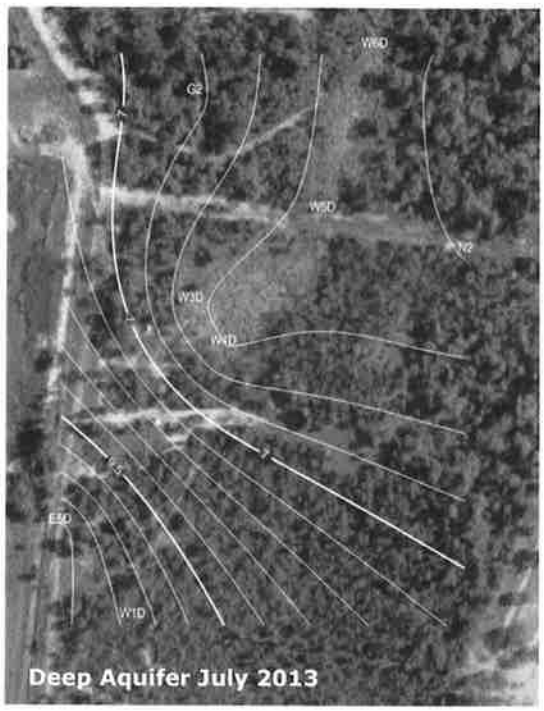
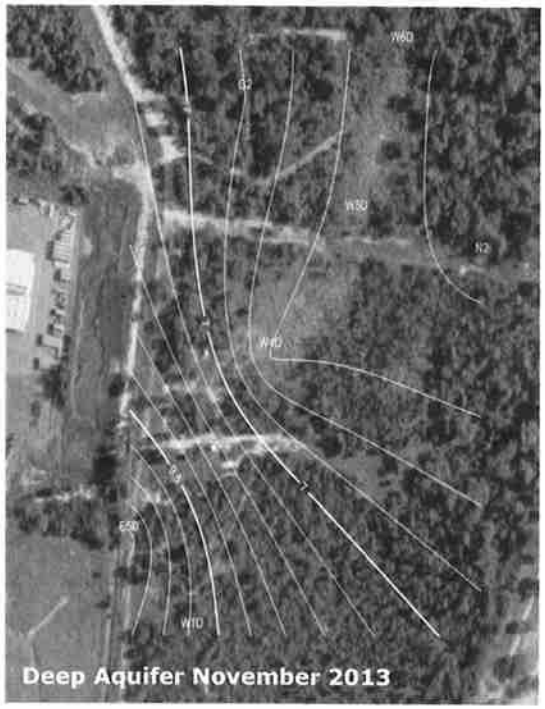
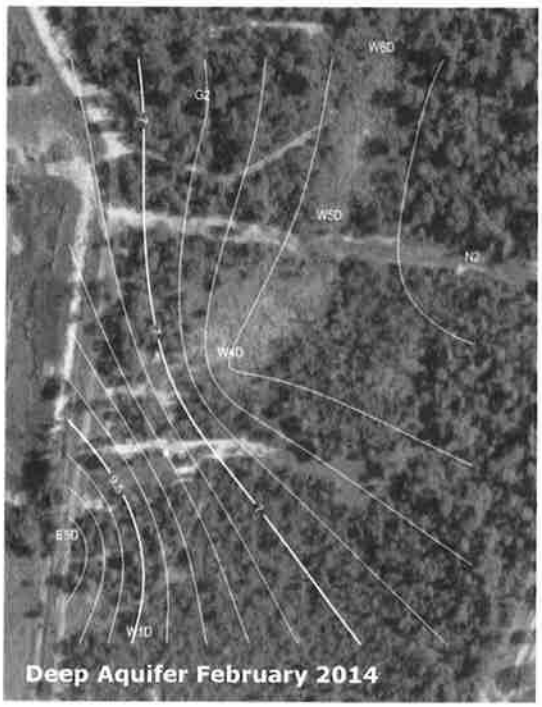
E11
W65
W25
E4
W15
Shallow Aquifer September 2018

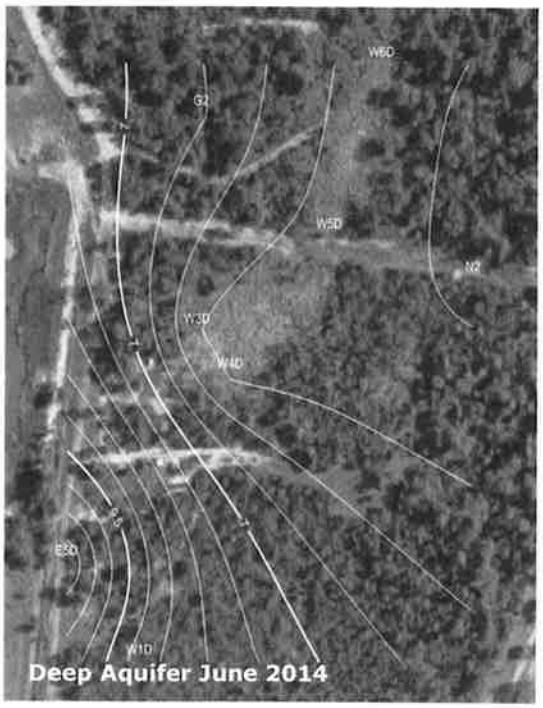

9
10
11
Shallow Aquifer December 2018

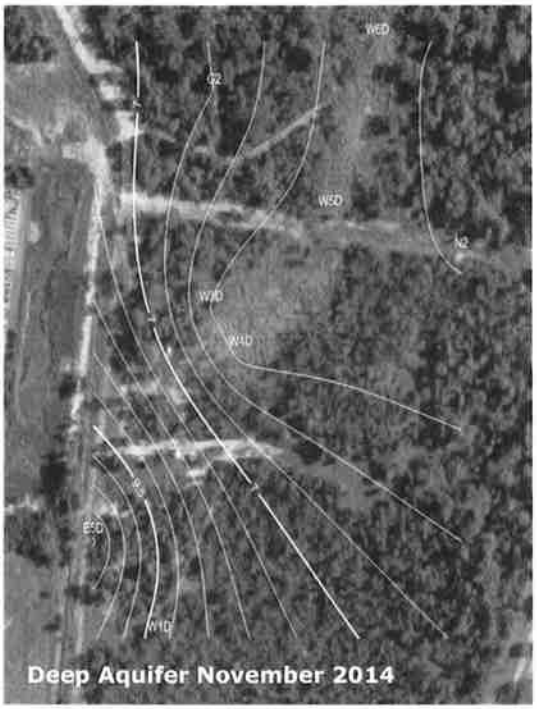
Groundwater Contours – Deep Aquifer 2013 -2018







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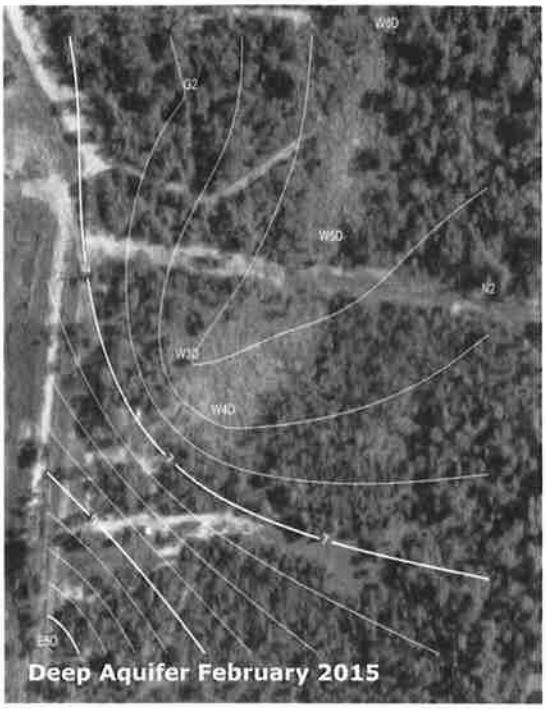
W5D
N2
W3D
W4D
E5D
W1D
Deep Aquifer November 2014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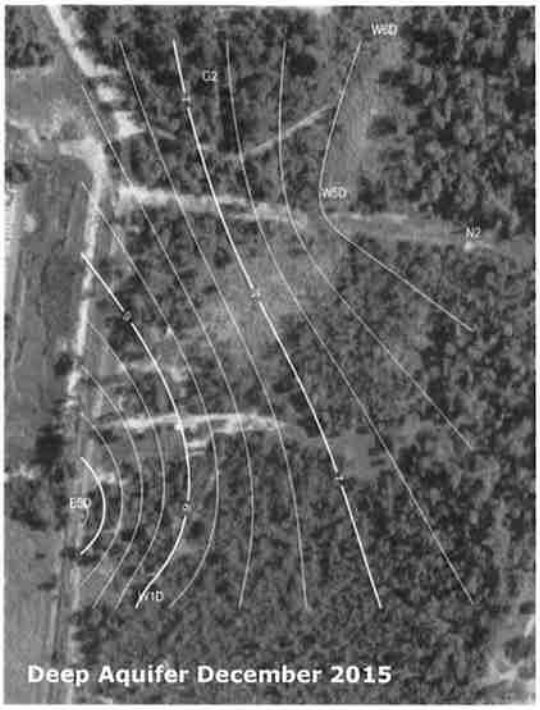
G2
W5D
N2
W3D
W4D
E5D
Deep Aquifer February 2015

W6D
G2
W5D
N2
W3D
E5D
W1D
Deep Aquifer June 2015

W6D
G2
W5D
N2
W3D
E5D
W1D
Deep Aquifer September 2015



Deep Aquifer December 2015

Deep Aquifer April 2016

Deep Aquifer July 2016

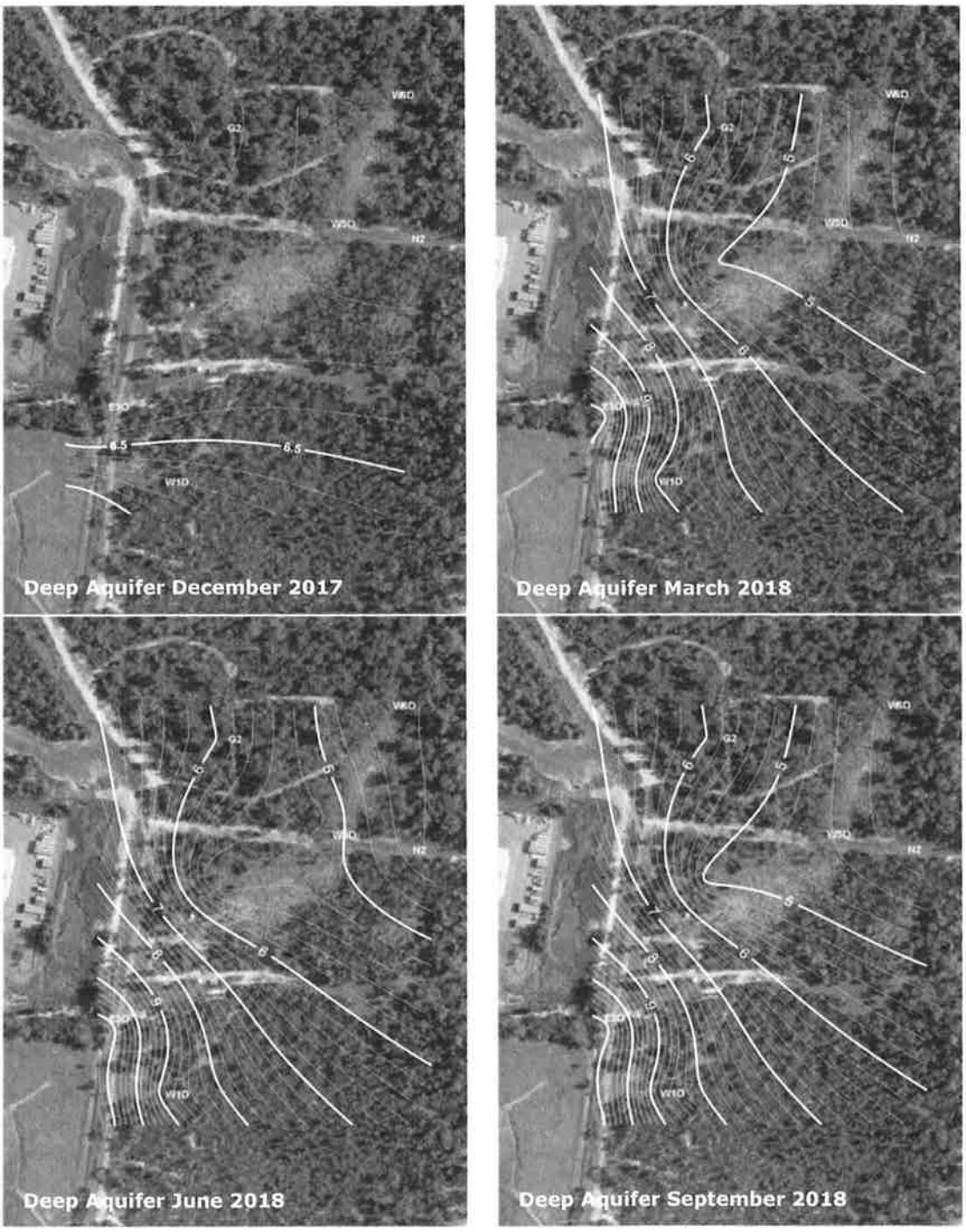
Deep Aquifer October 2016

W6D
G2
W5D
N2
E5D
W1D
Deep Aquifer December 2016

W6D
G2
W5D
N2
E5D
W1D
Deep Aquifer March 2017

W6D
G2
W5D
N2
E5D
W1D
Deep Aquifer June 2017

W6D
G2
W5D
N2
E5D
W1D
Deep Aquifer September 2017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E3D
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W1D
Deep Aquifer December 2017
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G2
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W5D
N2
5
7
8
8
E3D
9
W1D
Deep Aquifer March 2018
W6D
G2
6
6
W5D
N2
7
8
8
8
E3D
9
W1D
Deep Aquifer June 2018
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N2
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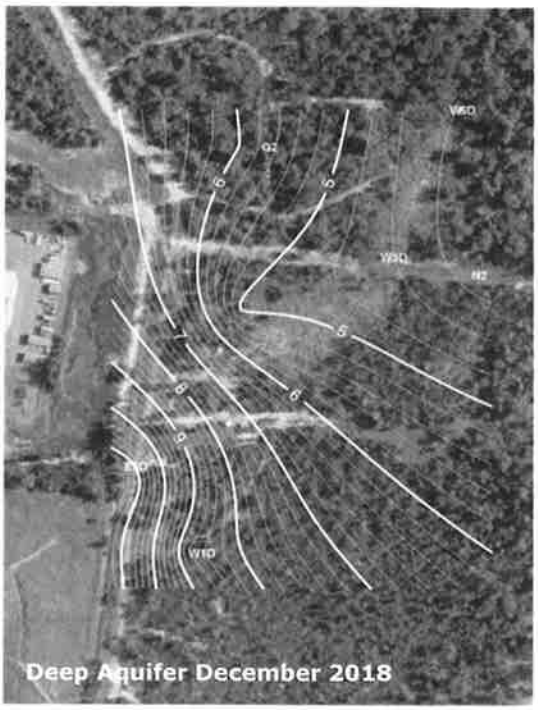
E3D
9
W1D
Deep Aquifer September 2018

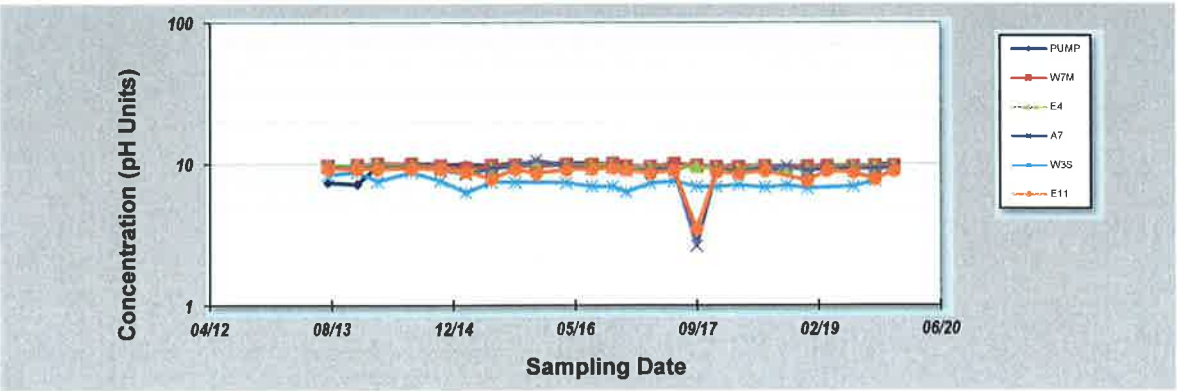

Deep Aquifer December 2018

APPENDIX 8
MANN-KENDALL TREND ANALYSIS

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	07-Jan-20	Job ID:	318000664
Facility Name:	Hydro Kurri Kurri	Constituent:	pH
Conducted By:	J.Kirsch	Concentration Units:	pH Units

Sampling Point ID:	PUMP	W7M	E4	A7	W3S	E11
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)					
1	29-Jul-13	7.45	9.81	9.91	9.63	8.53	9.36
2	26-Nov-13	7.24	9.87	9.79	9.47	8.82	9.36
3	18-Feb-14	9.65	10.1	9.94	9.67	7.61	9.33
4	7-Jul-14	10.14	10.12	9.84	9.66	8.89	9.41
5	4-Nov-14	10.01	9.78	9.4	9.24	7.68	9.32
6	17-Feb-15	9.95	9.44	8.84	8.56	6.38	8.86
7	3-Jun-15	9.87	9.82	9.46	9.45	7.53	7.97
8	7-Sep-15	10.22	9.91	9.62	9.8	7.53	9.23
9	2-Dec-15	10.27	9.7	10.57	10.71		8.65
10	5-Apr-16	10.13	9.99	9.73	9.75	7.46	9.2
11	19-Jul-16	10.22	9.95	9.83	9.37	7.02	9.29
12	12-Oct-16	9.98	10.17	9.94	9.57	7.01	9.41
13	6-Dec-16	9.72	9.68	9.53	9.15	6.4	9.1
14	15-Mar-17	9.56	9.61	9.53	9.12	7.4	8.7
15	20-Jun-17	9.2	10.1		9.49	7.66	9.07
16	21-Sep-17	9.9	9.8	9.59	2.65	7	3.51
17	12-Dec-17	9.6	9.6	9.46	9.27	6.99	8.83
18	13-Mar-18	9.73	9.61	9.32	8.96	7.19	8.62
19	28-Jun-18	9.17	9.7	9.62	9.36	6.91	9.02
20	26-Sep-18			9.29	9.75	7.14	
21	19-Dec-18	9.55	9.63	9.27	9.06	6.8	7.7
22	11-Mar-19	9.42	9.68	9.47	9.38		8.99
23	26-Jun-19	9.43	9.65	9.56	9.4	7.01	8.76
24	24-Sep-19	9.89	9.73	9.58	9.39	7.7	7.87
25	11-Dec-19	9.93	9.75	9.67	9.48		8.95
26							
27							
28							
29							
30							
Coefficient of Variation:		0.08	0.02	0.03	0.15	0.09	0.14
Mann-Kendall Statistic (S):		-43	-70	-68	-51	-91	-128
Confidence Factor:		85.0%	95.6%	95.2%	87.7%	99.5%	99.9%
Concentration Trend:		Stable	Decreasing	Decreasing	Stable	Decreasing	Decreasing



Notes:

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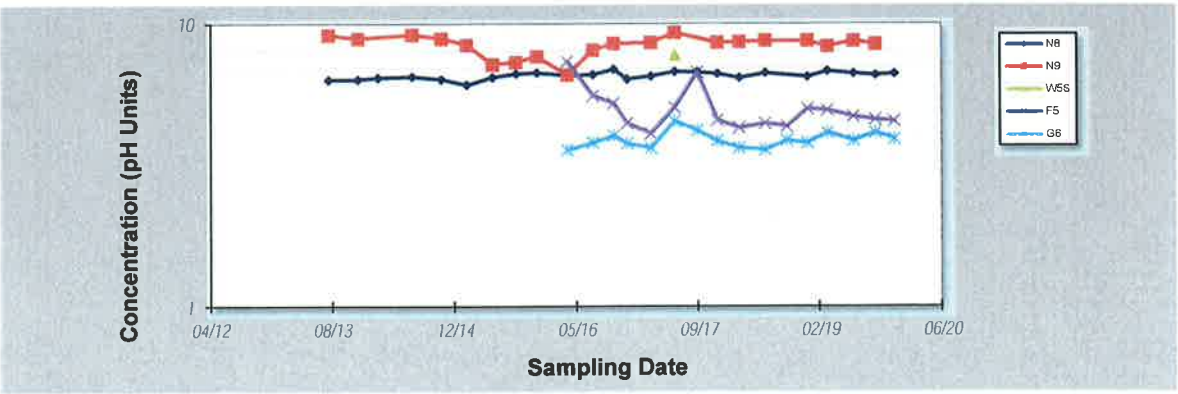
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	07-Jan-20	Job ID:	318000664
Facility Name:	Hydro Kurri Kurri	Constituent:	pH
Conducted By:	Jordyn Kirsch	Concentration Units:	pH Units

Sampling Point ID:	N8	N9	W5S	F5	G6		
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)						
1	29-Jul-13	6.36	9.16					
2	26-Nov-13	6.38	8.9					
3	18-Feb-14	6.48						
4	7-Jul-14	6.53	9.17					
5	4-Nov-14	6.39	8.91					
6	17-Feb-15	6.11	8.46					
7	3-Jun-15	6.49	7.22					
8	7-Sep-15	6.69	7.34					
9	2-Dec-15	6.74	7.7					
10	5-Apr-16	6.59	6.61		7.38	3.6		
11	19-Jul-16	6.63	8.11		5.58	3.82		
12	12-Oct-16	6.92	8.54		5.25	4.04		
13	6-Dec-16	6.4			4.46	3.79		
14	15-Mar-17	6.54	8.61		4.11	3.66		
15	20-Jun-17	6.78	9.32	7.79	5.08	4.55		
16	21-Sep-17	6.76			6.75	4.21		
17	12-Dec-17	6.67	8.6		4.57	3.86		
18	13-Mar-18	6.45	8.65		4.3	3.66		
19	28-Jun-18	6.71	8.72		4.46	3.6		
20	26-Sep-18				4.35	3.88		
21	19-Dec-18	6.51	8.72		5.02	3.81		
22	11-Mar-19	6.81	8.33		4.96	4.14		
23	26-Jun-19	6.68	8.71		4.71	3.88		
24	24-Sep-19	6.6	8.5		4.6	4.14		
25	11-Dec-19	6.67			4.54	3.93		
26								
27								
28								
29								
30								
Coefficient of Variation:		0.03	0.08		0.18	0.07		
Mann-Kendall Statistic (S):		103	-1		-33	26		
Confidence Factor:		99.5%	50.0%		92.4%	86.7%		
Concentration Trend:		Increasing	Stable		Prob. Decreasing	No Trend		



Notes:

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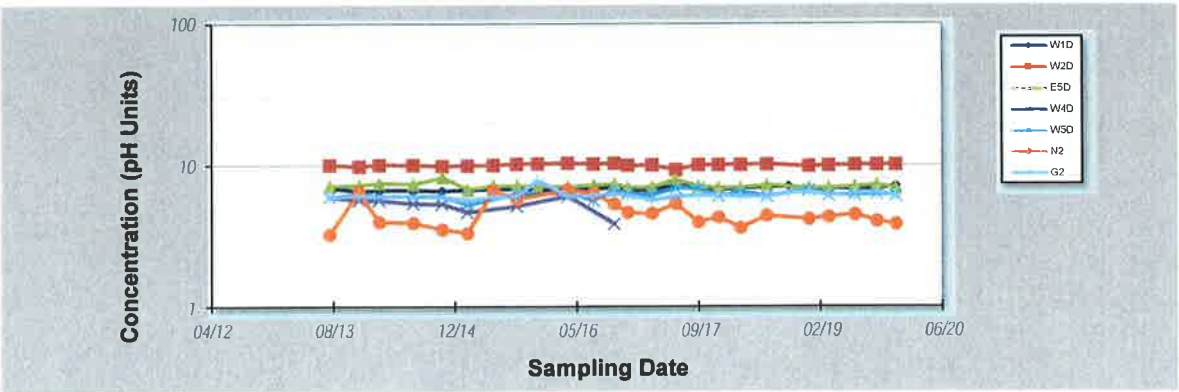
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 07-Jan-20
Facility Name: Hydro Kurri Kurri
Conducted By: J. Kirsch

Job ID: 318000664
Constituent: pH
Concentration Units: pH Units

Sampling Point ID:	W1D	W2D	E5D	W4D	W5D	N2	G2
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)						
1	29-Jul-13	6.98	10.09	7.22	6.02	6.02	3.26	6.04
2	26-Nov-13	6.62	9.9	7.29	5.7	6.32	6.54	6.09
3	18-Feb-14	6.7	10.13	7.53	5.7	6.1	4.01	6.09
4	7-Jul-14	6.71	10.1	7.44	5.4	6.11	3.94	6.1
5	4-Nov-14	6.63	9.94	8.32	5.36	6.11	3.54	6.03
6	17-Feb-15		9.99	6.8	4.69	5.34	3.34	5.7
7	3-Jun-15	6.82	10.11	7.23			6.61	6.01
8	7-Sep-15	6.79	10.27	7.23	5.18	6.32	5.81	6.04
9	2-Dec-15		10.34	7.18				7.87
10	5-Apr-16	6.73	10.42	7.1	6.08	6.4	6.75	6.11
11	19-Jul-16	6.82	10.29	7.27		5.7	6.37	6.09
12	12-Oct-16	7.02	10.4	7.39	3.87	6.7	5.35	6.33
13	6-Dec-16	6.78	10.02	7		6.37	4.67	6.22
14	15-Mar-17	6.67	10.07	7.08		6.21	4.59	5.71
15	20-Jun-17	7.3	9.37	7.97		6.94	5.37	6.08
16	21-Sep-17	6.95	10.08	7.16		6.93	3.98	6.16
17	12-Dec-17	6.78	10.1	7		6.13	4.31	6.19
18	13-Mar-18	6.91	10.14	6.97		6.5	3.63	6.05
19	28-Jun-18	7.07	10.18	7.29		6.1	4.41	6.05
20	26-Sep-18	7.12						6.42
21	19-Dec-18	6.76	9.87	6.95		6.72	4.18	6.53
22	11-Mar-19	6.92	9.99	6.96		6.18	4.34	6.16
23	26-Jun-19	6.83	10.1	7.1		6.23	4.51	6.35
24	24-Sep-19	6.91	10.08	7.3		6.35	4.05	6.46
25	11-Dec-19	7.16	10.14	6.95		6.16	3.85	6.13
26								
27								
28								
29								
30								
Coefficient of Variation:		0.03	0.02	0.05	0.13	0.06	0.23	0.06
Mann-Kendall Statistic (S):		96	8	-89	-19	54	-29	104
Confidence Factor:		99.5%	56.8%	98.6%	97.0%	93.2%	76.8%	99.2%
Concentration Trend:		Increasing	No Trend	Decreasing	Decreasing	Prob. Increasing	Stable	Increasing



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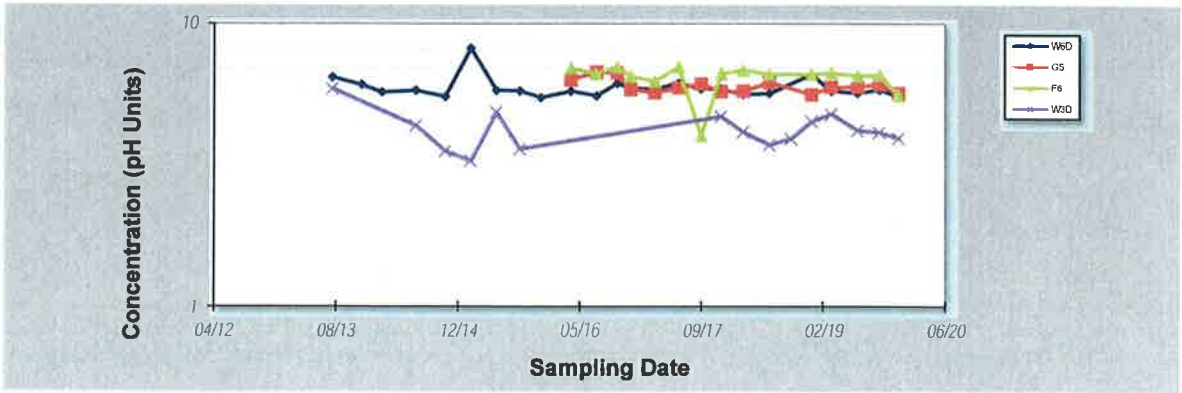
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	07-Jan-20	Job ID:	318000664
Facility Name:	Hydro Kurri Kurri	Constituent:	pH
Conducted By:	J.Kirsch	Concentration Units:	pH Units

Sampling Point ID:	W6D	G5	F6	W3D			
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)						
1	29-Jul-13	6.49			5.91			
2	26-Nov-13	6.11						
3	18-Feb-14	5.75						
4	7-Jul-14	5.83			4.38			
5	4-Nov-14	5.54			3.56			
6	17-Feb-15	8.22			3.29			
7	3-Jun-15	5.84			4.89			
8	7-Sep-15	5.81			3.62			
9	2-Dec-15	5.5						
10	5-Apr-16	5.79	6.36	6.99				
11	19-Jul-16	5.58	6.77	6.67				
12	12-Oct-16	6.17	6.72	7.05				
13	6-Dec-16	5.96	5.88	6.54				
14	15-Mar-17	5.88	5.73	6.29				
15	20-Jun-17	6.19	5.96	7.08				
16	21-Sep-17	5.9	6.15	4.03				
17	12-Dec-17	5.9	5.77	6.68	4.72			
18	13-Mar-18	5.65	5.8	6.88	4.16			
19	28-Jun-18	5.7	6.23	6.67	3.75			
20	26-Sep-18				3.94			
21	19-Dec-18	6.65	5.64	6.66	4.53			
22	11-Mar-19	5.81	5.99	6.73	4.81			
23	26-Jun-19	5.71	6	6.57	4.21			
24	24-Sep-19	5.87	6.13	6.62	4.15			
25	11-Dec-19	5.56	5.7	5.61	3.96			
26								
27								
28								
29								
30								
Coefficient of Variation:		0.09	0.06	0.12	0.15			
Mann-Kendall Statistic (S):		-30	-29	-30	-3			
Confidence Factor:		76.2%	91.6%	92.3%	53.9%			
Concentration Trend:		Stable	Prob. Decreasing	Prob. Decreasing	Stable			



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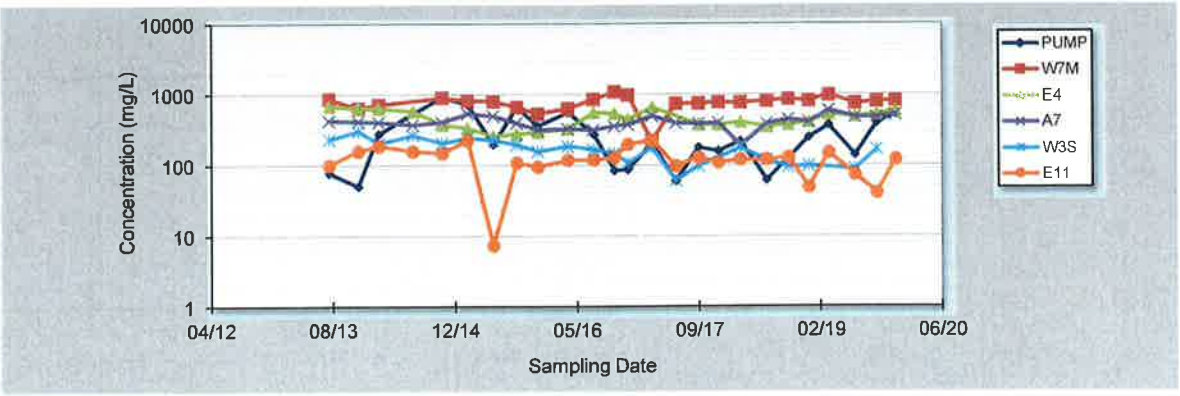
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 07-Jan-20
Facility Name: Hydro Kurri Kurri
Conducted By: J. Kirsch

Job ID: 318000664
Constituent: Soluble Fluoride
Concentration Units: mg/L

Sampling Point ID:	PUMP	W7M	E4	A7	W3S	E11
Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)					
1	29-Jul-13	79	878	699	436	237	102
2	26-Nov-13	51	650	650	420	310	160
3	18-Feb-14	280	730	650	410	210	190
4	7-Jul-14	550		590	380	270	160
5	4-Nov-14	930	910	380	410	210	150
6	17-Feb-15	740	840	340	550	250	230
7	3-Jun-15	200	810	260	500	230	7.4
8	7-Sep-15	680	670	280	400	200	110
9	2-Dec-15	360	540	300	320	160	96
10	5-Apr-16	570	640	330	330	190	120
11	19-Jul-16	280	870	570	320	170	120
12	12-Oct-16	85	1100	550	360	150	130
13	6-Dec-16	88	1000	450	380	110	200
14	15-Mar-17	210	220	670	500	180	230
15	20-Jun-17	60	750		400	62	99
16	21-Sep-17	180	760	380	390	99	130
17	12-Dec-17	160	780	380	400		110
18	13-Mar-18	220	770	410	190	180	120
19	28-Jun-18	62	810	350	390	120	120
20	26-Sep-18		860	380	450	96	130
21	19-Dec-18	250	820	410	410	100	49
22	11-Mar-19	370	990	530	600		150
23	26-Jun-19	140	750	490	480	90	74
24	24-Sep-19	400	800	530	480	170	41
25	11-Dec-19	530	830	590	520		120
26							
27							
28							
29							
30							
Coefficient of Variation:		0.78	0.22	0.29	0.20	0.38	0.42
Mann-Kendall Statistic (S):		-11	28	0	39	-152	-59
Confidence Factor:		59.7%	74.6%	49.0%	81.1%	>99.9%	91.1%
Concentration Trend:		Stable	No Trend	Stable	No Trend	Decreasing	Prob. Decreasing



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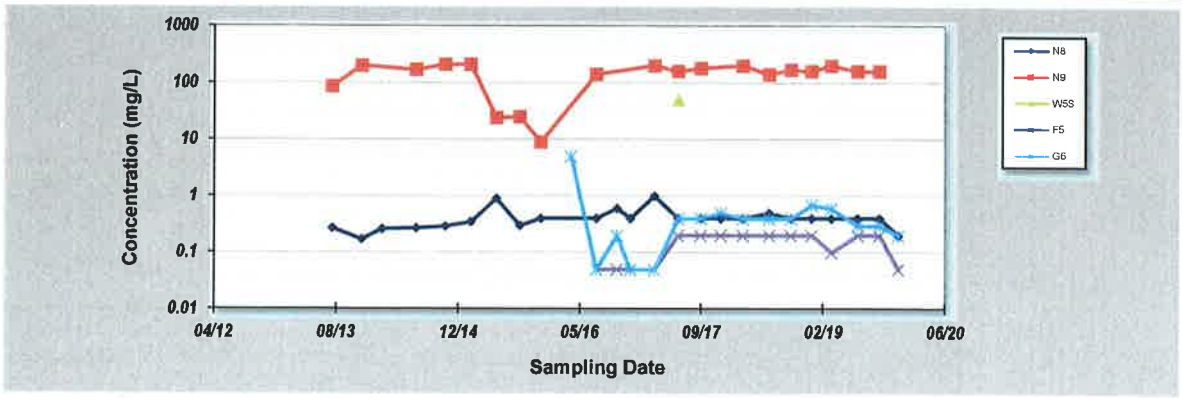
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	07-Jan-20	Job ID:	318000664
Facility Name:	Hydro Kurri Kurri	Constituent:	Soluble Fluoride
Conducted By:	J. Kirsch	Concentration Units:	mg/L

Sampling Point ID:	N8	N9	W5S	F5	G6		
Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)						
1	29-Jul-13	0.27	85					
2	26-Nov-13	0.17	200					
3	18-Feb-14	0.26						
4	7-Jul-14	0.27	170					
5	4-Nov-14	0.29	210					
6	17-Feb-15	0.35	210					
7	3-Jun-15	0.9	24					
8	7-Sep-15	0.3	25					
9	2-Dec-15	0.4	9					
10	5-Apr-16				5	5		
11	19-Jul-16	0.4	140		0.05	0.05		
12	12-Oct-16	0.6			0.05	0.2		
13	6-Dec-16	0.4			0.05	0.05		
14	15-Mar-17	1	200		0.05	0.05		
15	20-Jun-17	0.4	160	50	0.2	0.4		
16	21-Sep-17	0.4	180		0.2	0.4		
17	12-Dec-17	0.4			0.2	0.5		
18	13-Mar-18	0.4	200		0.2	0.4		
19	28-Jun-18	0.5	140		0.2	0.4		
20	26-Sep-18	0.4	170		0.2	0.4		
21	19-Dec-18	0.4	160		0.2	0.7		
22	11-Mar-19	0.4	200		0.1	0.6		
23	26-Jun-19	0.4	160		0.2	0.3		
24	24-Sep-19	0.4	160		0.2	0.3		
25	11-Dec-19	0.2			0.05	0.2		
26								
27								
28								
29								
30								
Coefficient of Variation:		0.46	0.44		2.72	1.90		
Mann-Kendall Statistic (S):		77	2		10	11		
Confidence Factor:		97.1%	51.4%		65.5%	67.1%		
Concentration Trend:		Increasing	No Trend		No Trend	No Trend		



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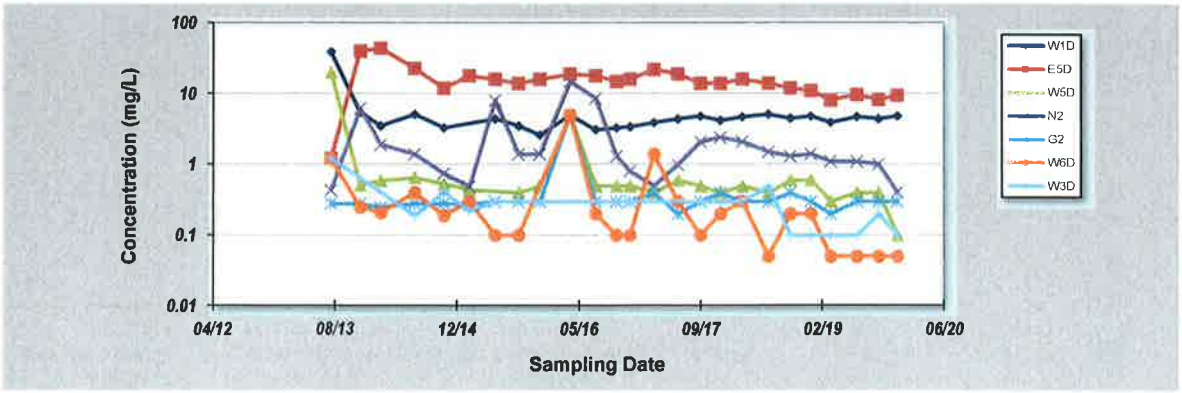
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	07-Jan-20	Job ID:	318000664
Facility Name:	Hydro Kurri Kurri	Constituent:	Soluble Fluoride
Conducted By:	J.Kirsch	Concentration Units:	mg/L

Sampling Point ID:		W1D	E5D	W5D	N2	G2	W6D	W3D
Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)						
1	29-Jul-13	39	1.21	20	0.43	0.28	1.19	1.23
2	26-Nov-13	5.4	40	0.51	6.2	0.28	0.25	
3	18-Feb-14	3.5	44	0.59	1.9	0.25	0.21	
4	7-Jul-14	5.1	23	0.65	1.4	0.28	0.4	0.19
5	4-Nov-14	3.3	12	0.53	0.74	0.28	0.19	0.41
6	17-Feb-15		18	0.44	0.49	0.28	0.3	0.22
7	3-Jun-15	4.4	16		8.1	0.3	0.1	0.3
8	7-Sep-15	3.5	14	0.4	1.4	0.3	0.1	0.3
9	2-Dec-15	2.6	16	0.5	1.4	0.3		
10	5-Apr-16	5	19	5	15	5	5	
11	19-Jul-16	3.1	18	0.5	8.6	0.3	0.2	
12	12-Oct-16	3.3	15	0.5	1.3	0.3	0.1	
13	6-Dec-16	3.4	16	0.5	0.8	0.3	0.1	
14	15-Mar-17	3.9	22	0.4	0.5	0.4	1.4	
15	20-Jun-17	4.4	19	0.6	1	0.2	0.3	
16	21-Sep-17	4.8	14	0.5	2.1	0.3	0.1	
17	12-Dec-17	4.2	14	0.4	2.4	0.4	0.2	0.3
18	13-Mar-18	4.7	16	0.5	2.1	0.3	0.3	0.3
19	28-Jun-18	5.1	14	0.4	1.5	0.3	0.05	0.5
20	26-Sep-18	4.5	12	0.6	1.3	0.4	0.2	0.1
21	19-Dec-18	4.8	11	0.6	1.4	0.3	0.2	0.1
22	11-Mar-19	3.9	8.1	0.3	1.1	0.2	0.05	0.1
23	26-Jun-19	4.7	9.6	0.4	1.1	0.3	0.05	0.1
24	24-Sep-19	4.4	8.3	0.4	1	0.3	0.05	0.2
25	11-Dec-19	4.8	9.4	0.1	0.4	0.3	0.05	0.1
26								
27								
28								
29								
30								
Coefficient of Variation:		1.26	0.55	2.76	1.34	1.94	2.21	0.96
Mann-Kendall Statistic (S):		23	-139	-111	-44	76	-117	-45
Confidence Factor:		70.6%	>99.9%	99.7%	84.1%	96.0%	99.9%	98.6%
Concentration Trend:		No Trend	Decreasing	Decreasing	No Trend	Increasing	Decreasing	Decreasing



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3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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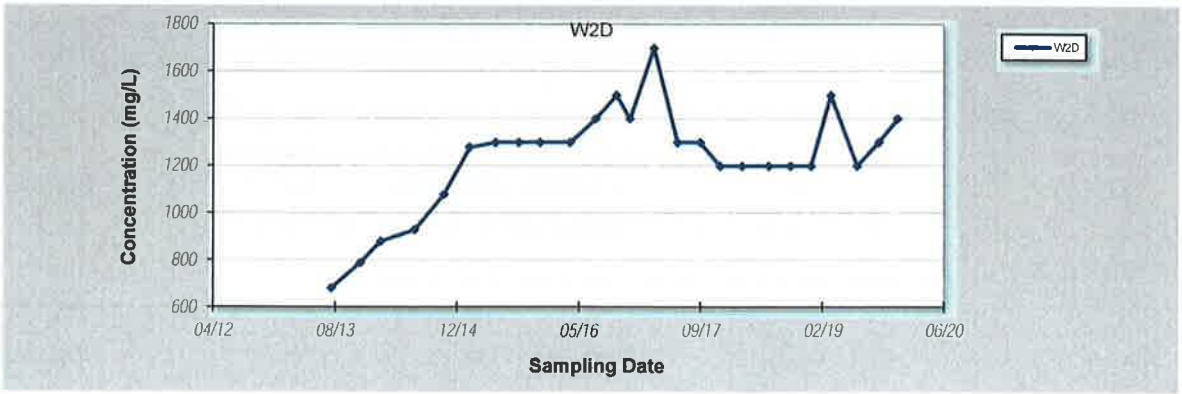
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	07-Jan-20	Job ID:	318000664
Facility Name:	Hydro Kurri Kurri	Constituent:	Soluble Fluoride
Conducted By:	J.Kirsch	Concentration Units:	mg/L

Sampling Point ID: **W2D**

Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)
1	29-Jul-13	682
2	26-Nov-13	790
3	18-Feb-14	880
4	7-Jul-14	930
5	4-Nov-14	1080
6	17-Feb-15	1279
7	3-Jun-15	1300
8	7-Sep-15	1300
9	2-Dec-15	1300
10	5-Apr-16	1300
11	19-Jul-16	1400
12	12-Oct-16	1500
13	6-Dec-16	1400
14	15-Mar-17	1700
15	20-Jun-17	1300
16	21-Sep-17	1300
17	12-Dec-17	1200
18	13-Mar-18	1200
19	28-Jun-18	1200
20	26-Sep-18	1200
21	19-Dec-18	1200
22	11-Mar-19	1500
23	26-Jun-19	1200
24	24-Sep-19	1300
25	11-Dec-19	1400
26		
27		
28		
29		
30		
Coefficient of Variation:		0.18
Mann-Kendall Statistic (S):		90
Confidence Factor:		98.2%
Concentration Trend:		Increasing



Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend, < 90% and COV < 1 = Stable.
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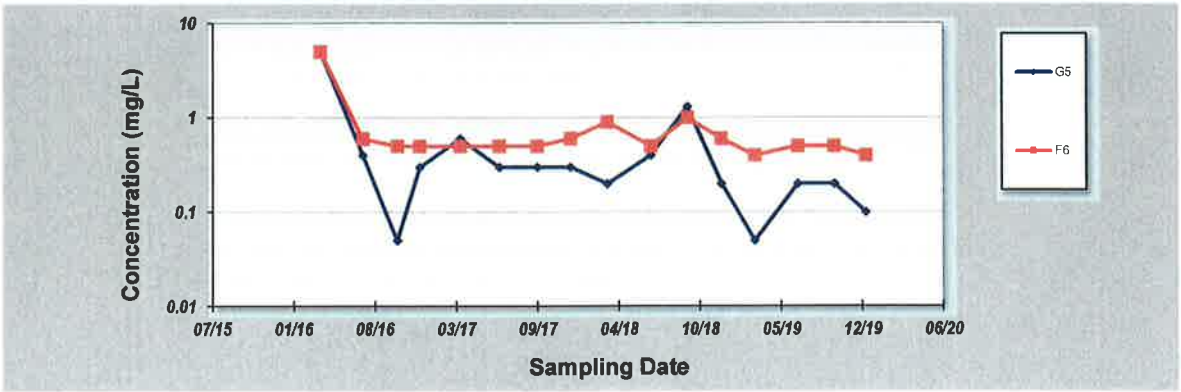
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	07-Jan-20	Job ID:	318000664
Facility Name:	Hydro Kurri Kurri	Constituent:	Soluble Fluoride
Conducted By:	J.Kirsch	Concentration Units:	mg/L

Sampling Point ID:	G5	F6					
Sampling Event	**Sampling Date**	**SOLUBLE FLUORIDE CONCENTRATION (mg/L)**					
1	5-Apr-16	5	5				
2	19-Jul-16	0.4	0.6				
3	12-Oct-16	0.05	0.5				
4	6-Dec-16	0.3	0.5				
5	15-Mar-17	0.6	0.5				
6	20-Jun-17	0.3	0.5				
7	21-Sep-17	0.3	0.5				
8	12-Dec-17	0.3	0.6				
9	13-Mar-18	0.2	0.9				
10	28-Jun-18	0.4	0.5				
11	26-Sep-18	1.3	1				
12	19-Dec-18	0.2	0.6				
13	11-Mar-19	0.05	0.4				
14	26-Jun-19	0.2	0.5				
15	24-Sep-19	0.2	0.5				
16	11-Dec-19	0.1	0.4				
17							
18							
19							
20							
Coefficient of Variation:		1.95	1.33				
Mann-Kendall Statistic (S):		-48	-30				
Confidence Factor:		97.9%	90.3%				
Concentration Trend:		Decreasing	Prob. Decreasing				



Notes:

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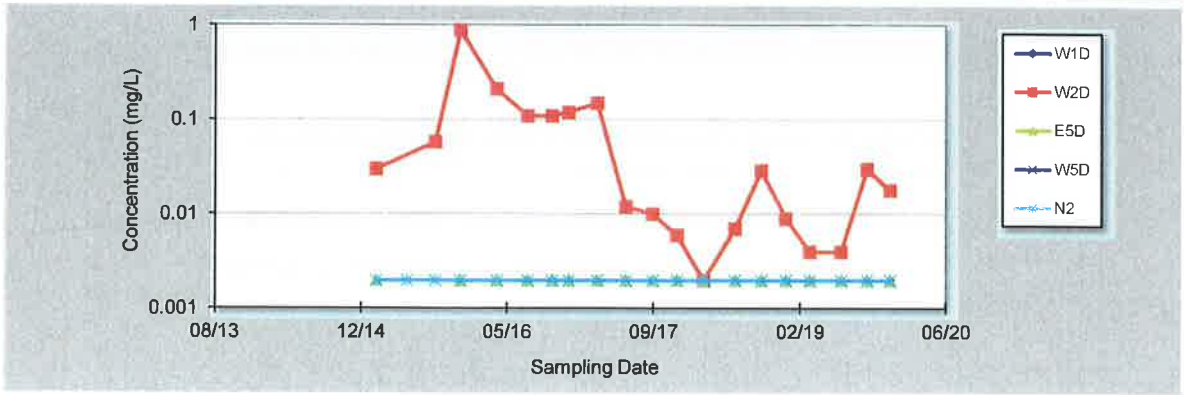
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: 07-Jan-20
Facility Name: Hydro Kurri Kurri
Conducted By: J Kirsch

Job ID: 318000644
Constituent: Free Cyanide
Concentration Units: mg/L

Sampling Point ID:	W1D	W2D	E5D	W5D	N2		
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15		0.03	0.002	0.002	0.002		
2	3-Jun-15					0.002		
3	7-Sep-15		0.058		0.002	0.002		
4	2-Dec-15		0.88	0.002	0.002	0.002		
5	5-Apr-16	0.002	0.21	0.002	0.002	0.002		
6	19-Jul-16	0.002	0.11	0.002	0.002	0.002		
7	12-Oct-16	0.002	0.11	0.002	0.002	0.002		
8	6-Dec-16	0.002	0.12	0.002	0.002	0.002		
9	15-Mar-17	0.002	0.15	0.002	0.002	0.002		
10	20-Jun-17	0.002	0.012	0.002	0.002	0.002		
11	21-Sep-17		0.01	0.002	0.002	0.002		
12	12-Dec-17	0.002	0.006	0.002	0.002	0.002		
13	13-Mar-18	0.002	0.002	0.002	0.002	0.002		
14	28-Jun-18	0.002	0.007	0.002	0.002	0.002		
15	26-Sep-18	0.002	0.029	0.002	0.002	0.002		
16	19-Dec-18	0.002	0.009	0.002	0.002	0.002		
17	11-Mar-19	0.002	0.004	0.002	0.002	0.002		
18	26-Jun-19	0.002	0.004	0.002	0.002	0.002		
19	24-Sep-19	0.002	0.03	0.002	0.002	0.002		
20	11-Dec-19	0.002	0.018	0.002	0.002	0.002		
21								
22								
23								
24								
25								
Coefficient of Variation:		0.00	2.11	0.00	0.00	0.00		
Mann-Kendall Statistic (S):		0	-74	0	0	0		
Confidence Factor:		48.0%	99.6%	48.5%	48.6%	48.7%		
Concentration Trend:		Stable	Decreasing	Stable	Stable	Stable		



Notes:

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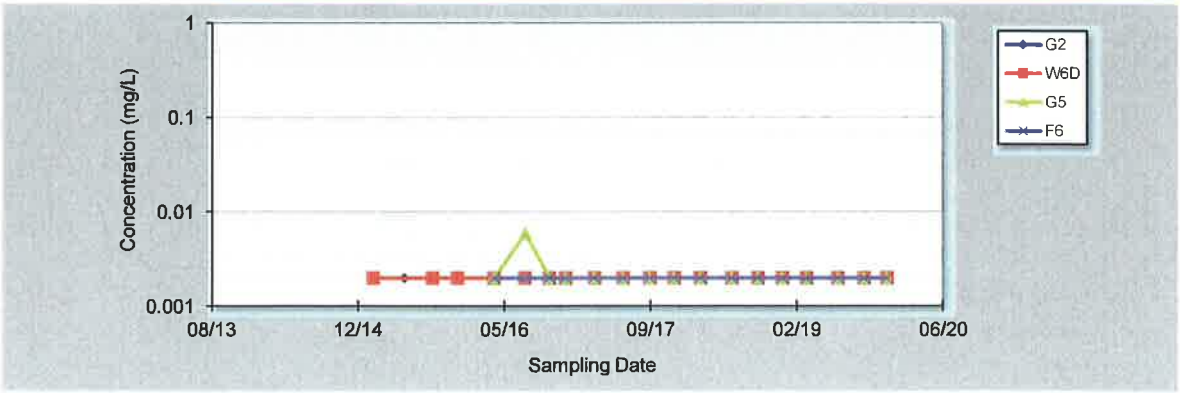
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	07-Jan-20	Job ID:	318000644
Facility Name:	Hydro Kurri Kurri	Constituent:	Free Cyanide
Conducted By:	J Kirsch	Concentration Units:	mg/L

Sampling Point ID:	G2	W6D	G5	F6			
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15	0.002	0.002					
2	3-Jun-15	0.002						
3	7-Sep-15		0.002					
4	2-Dec-15	0.002	0.002					
5	5-Apr-16	0.002	0.002	0.002	0.002			
6	19-Jul-16	0.002	0.002	0.006	0.002			
7	12-Oct-16	0.002	0.002	0.002	0.002			
8	6-Dec-16	0.002	0.002	0.002	0.002			
9	15-Mar-17	0.002	0.002	0.002	0.002			
10	20-Jun-17	0.002	0.002	0.002	0.002			
11	21-Sep-17	0.002	0.002	0.002	0.002			
12	12-Dec-17	0.002	0.002	0.002	0.002			
13	13-Mar-18	0.002	0.002	0.002	0.002			
14	28-Jun-18	0.002	0.002	0.002	0.002			
15	26-Sep-18	0.002	0.002	0.002	0.002			
16	19-Dec-18	0.002	0.002	0.002	0.002			
17	11-Mar-19	0.002	0.002	0.002	0.002			
18	26-Jun-19	0.002	0.002	0.002	0.002			
19	24-Sep-19	0.002	0.002	0.002	0.002			
20	11-Dec-19	0.002	0.002	0.002	0.002			
21								
22								
23								
24								
25								
Coefficient of Variation:		0.00	0.00	0.44	0.00			
Mann-Kendall Statistic (S):		0	0	-13	0			
Confidence Factor:		48.6%	48.6%	70.3%	48.2%			
Concentration Trend:		Stable	Stable	Stable	Stable			



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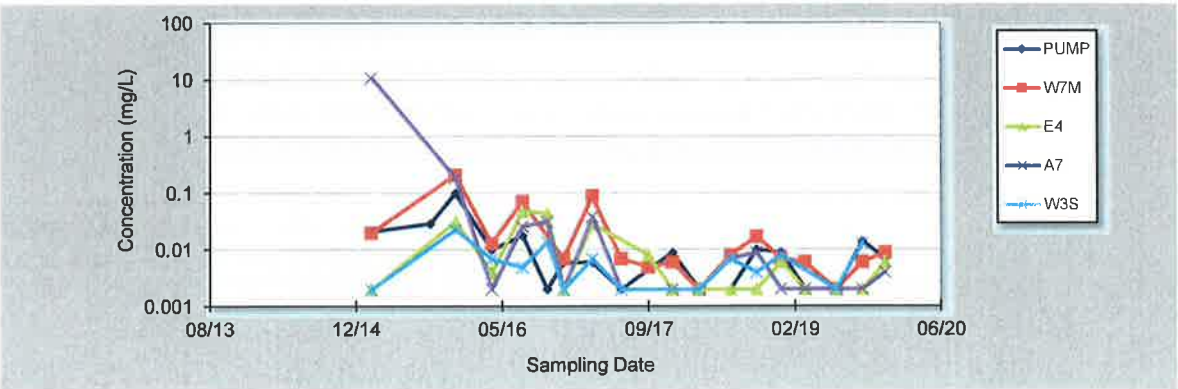
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	07-Jan-20	Job ID:	318000664
Facility Name:	Hydro Kurri Kurri	Constituent:	Free Cyanide
Conducted By:	Joshua Blackwell	Concentration Units:	mg/L

Sampling Point ID:		PUMP	W7M	E4	A7	W3S		
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15	0.021	0.02	0.002	11	0.002		
2	3-Jun-15							
3	7-Sep-15	0.029						
4	2-Dec-15	0.1	0.21	0.032	0.19	0.023		
5	5-Apr-16	0.01	0.013	0.004	0.002	0.007		
6	19-Jul-16	0.018	0.072	0.049	0.026	0.005		
7	12-Oct-16	0.002		0.045	0.032	0.014		
8	6-Dec-16	0.006	0.007	0.002	0.002	0.002		
9	15-Mar-17	0.006	0.09	0.029	0.039	0.007		
10	20-Jun-17	0.002	0.007		0.002	0.002		
11	21-Sep-17		0.005	0.008				
12	12-Dec-17	0.009	0.006	0.002	0.002			
13	13-Mar-18	0.002	0.002	0.002	0.002	0.002		
14	28-Jun-18	0.002	0.008	0.002	0.007	0.007		
15	26-Sep-18	0.01	0.017	0.002	0.009	0.004		
16	19-Dec-18	0.009	0.007	0.006	0.002	0.008		
17	11-Mar-19	0.002	0.006	0.002	0.002			
18	26-Jun-19	0.002	0.002	0.002	0.002	0.002		
19	24-Sep-19	0.014	0.006	0.002	0.002	0.013		
20	11-Dec-19	0.007	0.009	0.006	0.004			
21								
22								
23								
24								
25								
Coefficient of Variation:		1.63	1.86	1.40	4.00	0.87		
Mann-Kendall Statistic (S):		-49	-53	-37	-46	-2		
Confidence Factor:		96.6%	98.5%	93.0%	96.8%	52.2%		
Concentration Trend:		Decreasing	Decreasing	Prob. Decreasing	Decreasing	Stable		



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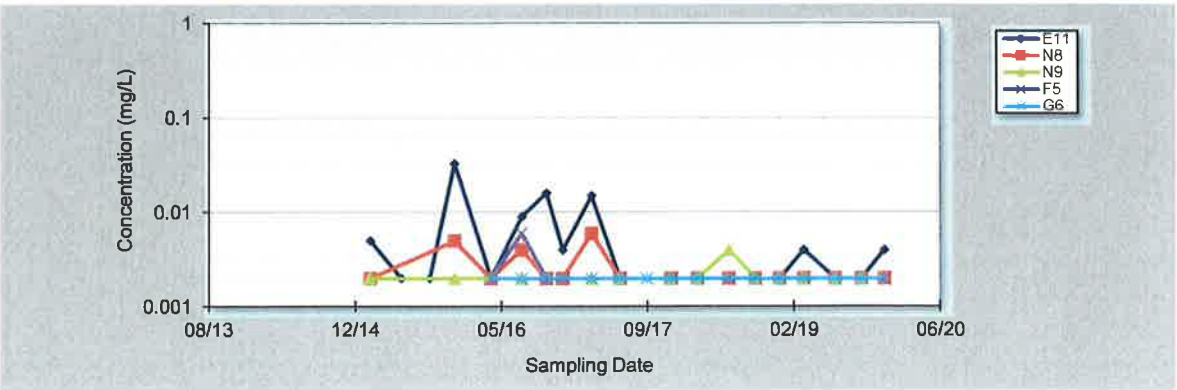
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	07-Jan-20	Job ID:	318000664
Facility Name:	Hydro Kurri Kurri	Constituent:	Free Cyanide
Conducted By:	J. Kirsch	Concentration Units:	mg/L

Sampling Point ID:	E11	N8	N9	F5	G6		
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15	0.005	0.002	0.002				
2	3-Jun-15	0.002						
3	7-Sep-15	0.002						
4	2-Dec-15	0.033	0.005	0.002				
5	5-Apr-16	0.002	0.002		0.002	0.002		
6	19-Jul-16	0.009	0.004	0.002	0.006	0.002		
7	12-Oct-16	0.016	0.002		0.002	0.002		
8	6-Dec-16	0.004	0.002		0.002	0.002		
9	15-Mar-17	0.015	0.006	0.002	0.002	0.002		
10	20-Jun-17	0.002	0.002	0.002	0.002	0.002		
11	21-Sep-17				0.002	0.002		
12	12-Dec-17	0.002	0.002	0.002	0.002	0.002		
13	13-Mar-18	0.002	0.002	0.002	0.002	0.002		
14	28-Jun-18	0.002	0.002	0.004	0.002	0.002		
15	26-Sep-18	0.002	0.002	0.002	0.002	0.002		
16	19-Dec-18	0.002	0.002	0.002	0.002	0.002		
17	11-Mar-19	0.004	0.002	0.002	0.002	0.002		
18	26-Jun-19	0.002	0.002	0.002	0.002	0.002		
19	24-Sep-19	0.002	0.002	0.002	0.002	0.002		
20	11-Dec-19	0.004	0.002		0.002	0.002		
21								
22								
23								
24								
25								
Coefficient of Variation:		1.33	0.49	0.26	0.44	0.00		
Mann-Kendall Statistic (S):		-31	-27	2	-13	0		
Confidence Factor:		85.1%	85.6%	52.4%	70.3%	48.2%		
Concentration Trend:		No Trend	Stable	No Trend	Stable	Stable		



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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0). >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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APPENDIX 4
FIELD PARAMETER FORMS

RAMBOLL

Daily Field Report

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J. Blackwell
Project No:	318000664		
Date:	~~12/03/19~~ 11/03/19		
Start time:	06:00	Subcontractors:	N/A
Finish time:	15:00		
Weather:			

Field Report: BoM

- JK & JB on site 06:00
- transfer equipment to GWs car.
- Start of Sampling - wells in section 1. 07:00

10:00 well N9 unable to be sampled due to insufficient water

11:45 lunch.

@ 14:45 - offload equipment to Ramboll ~~vehicle~~ vehicle, JK + JB to municiple landfill for inspection.

15:00 - off-site.

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HUNTER
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The Junction NSW 2291
Ph: 02 4962 5444

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Daily Field Report

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J. Blackwell
Project No:	318000664		
Date:	~~11/03/19~~ 12/03/19		
Start time:	8:45	Subcontractors:	N/A
Finish time:	2:00		
Weather:			

Field Report: BoM

08:45 JB+SK on site

09:00 load gear from Ramboll car to ~~GW's~~ GW's vehicle

12:45 unload gear from ~~GW's~~ GW's vehicle to Ramboll vehicle

~~13:00~~ 13:00 lunch

13:45 visit municipal landfill, excavation works have ~~exceeded~~ approx. 50m from last sample point. Total excavation appears to be just short of halfway, however, excavation appears to be widening.

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No.	Well ID	Well Depth (m)	Historical Comments	Notes March 2019
1	A7	5		Sampled 13-3-19
2	E11	4.8		Sampled 12-3-19
3	E4	3.4		Sampled 13-3-19
4	E5	2	DRY	Dry.
5	E5D	5.44		Sampled 12-3-19.
6	F5	7.4		Sampled 13-3-19
7	F6	15.6		Sampled 12-3-19
8	G2	13.46		Sampled 12-3-19
9	G5	11.37		Sampled 13-3-19
10	G6	7.15		Sampled 12-3-19
11	N2	5.6		Sampled 12-3-19
12	N8	5.34		Sampled 12-3-19
13	N9	2.8		Insufficient water.
14	PUMP	3.46		Sampled 12-3-19
15	W1D	11.5		Sampled 13-3-19
16	W1S	2	DRY	Dry.
17	W2D	8.5		Sampled 12-3-19
18	W2S	2.38	DRY	DRY
19	W3D	11		Sampled 13-3-19
20	W3S	2.5		Insufficient water
21	W3SA	0.5	DESTROYED	Destroyed
22	W4D	10	DESTROYED	Destroyed
23	W4S	0.4		Dry
24	W5D	10.5		Sampled 12-3-19
25	W5S	0.65	DRY?	DRY
26	W6D	9.5		Sampled 12-3-19
27	W6S	2	DRY	Dry.
28	W7M	3.72		Sampled 12-3-19
29	W7S	1.8	DRY	DRY

RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

F6

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:	1·47	Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5·16	m	YSI Quatro Pro Plus
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	Oil/water Interface Meter
Thickness to Immiscible layer:		m	
Well Depth	15·64	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☒ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
1·54	24·1	6·86	9·91	0.94	-128·9	6428·5	0.1	Clear, slight sulphidic
1·55	23·9	6.75	9·84	0.74	-130.4	6396.0	0.1	odour
1·56	23·8	6.74	9·81	0.71	-132.3	6383.0	0.1	" " "
1·57	23·7	6.73	9·82	0.60	-133.6	6376.5	0·1	" " "

Miscellaneous Field Comments

Well Head Integrity: S·83

Samples Filtered:

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

G6

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.26	m	YSI Quatro P/O Plus
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	Oil/water Interface Meter
Thickness to Immiscible layer:		m	
Well Depth	7.15	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 2.19 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
2.23	25.4	4.70	9.16	0.92	51.2	5967.0	0.1	Clear, slight sulphidic
2.24	24.8	4.41	9.08	0.69	41.1	5882.5	0.1	odour.
2.25	24.6	4.33	9.06	0.67	35.9	5876.0	0.1	" " "
2.26	24.5	4.21	9.02	0.55	28.6	5882.5	0.1	" " "
2.27	24.4	4.14	9.01	0.52	25.6	5856.5	0.1	" " "

Miscellaneous Field Comments

Well Head Integrity: 5.31

Samples Filtered: metals

Weather Conditions: Sunny

Other:

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SYDNEY
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Low Flow Groundwater Sampling Field Parameter Form

N2

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:	1.22	Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device: YSI Pro Plus
Depth to Groundwater	4.69	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device: IP Oil/Water Interface Meter
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.63	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 1.25 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
1.29	24.3	4.70	7.74	0.84	226.9	5005.0	0.1	clear, no odour
1.30	23.5	4.58	7.64	0.78	240.3	1959.5	0.1	" " "
1.31	23.1	4.47	7.64	0.68	282.5	4953.0	0.1	" " "
1.32	23.0	4.34	7.61	0.59	294.2	4953.0	0.1	" " "

Miscellaneous Field Comments

Well Head Integrity: S.23 pump at lowest capacity.

Samples Filtered: metals

Weather Conditions: Sunny. light breeze

Other:

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Low Flow Groundwater Sampling Field Parameter Form

WSD

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.83	m	YSI Quatro Pro Plus
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	Oil/water interface meter
Thickness to Immiscible layer:		m	
Well Depth	10.68	m	Measurement device:
Thickness to Groundwater Column:	'	m	

Well Sampling ~~Method~~:

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 12:52 End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
~~12:52~~	26.1	6.31	6.65	0.68	-19.8	4329	0	
12:53	25.7	6.24	671	0.66	-16.7	4361	0.1	
12:54	25.1	6.20	6.76	0.67	-13.4	4342	0.1	
12:55	25.0	6.18	6.69	0.63	-10.6	4348	0.1	

Miscellaneous Field Comments

Well Head Integrity: 7.1 pump at lowest capacity

Samples Filtered:

Weather Conditions:

Other: QA101, QA102

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Low Flow Groundwater Sampling Field Parameter Form

WS5

Project Name:	Quarterly GME 2019	Ramboll Personnel:	J.Kirsch J.Blackwell
Project No:	318000664		
Date:	12-3-19		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.70	m	Oil/water Interface Meter
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth		m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
DRY								

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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