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HYDRO ALUMINIUM SMELTER CAPPED WASTE STOCKPILE, 2020 ANNUAL GROUNDWATER MONITORING REPORT

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HYDRO ALUMINIUM SMELTER
2020 ANNUAL GROUNDWATER MONITORING REPORT

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Description	**2020 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-nine groundwater monitoring events have been completed between July 2013 and December 2020 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 elevated 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, an additional two pairs of shallow and 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 limit the movement of groundwater and cause groundwater discharge to the surface following rainfall events. Groundwater wells target 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 2020 GME data has identified the following:

- The leachate plume in shallow groundwater is delineated to the north, with a stable trend in soluble fluoride concentrations in well N9 at the leading edge of the plume
- The leachate plume in shallow groundwater is not expanding, with no increasing trends in pH or soluble fluoride concentrations in wells not impacted by leachate, aside from well N8 where pH and soluble fluoride concentrations remain low and are not indicative of leachate impact
- Consistent with previous monitoring, the leachate plume has impacted a deeper sand aquifer in a localised area close to the plume source, the CWS, as shown by elevated soluble fluoride concentrations and a high pH in well W2D. Concentrations at this well have been elevated over the monitoring period and there is no increasing trend observed, however there may be some expansion of impact to the east, towards W1D, with yellow coloured groundwater observed and an increasing pH trend identified although there is currently no trend in soluble fluoride concentrations, and pH remains low
- Consistent with previous monitoring, the leachate plume is not reaching the nearest surface water receptor of Swamp Creek, as indicated by low pH and low soluble fluoride concentrations in sentinel wells
- Installation of leachate interception trenches as an interim remedial measure has led to an improvement in down gradient surface water quality and vegetation health, with grasses now growing in both vegetation impact areas

Monitoring of groundwater and occasional pump out of passive leachate interception trenches is proposed to continue until remediation of the Capped Waste Stockpile is completed in 2022.

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 1 (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 GMEs completed between July 2013 and December 2019 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
- 'Hydro Aluminium Kurri Kurri Smelter, Capped Waste Stockpile, 2019 Annual Groundwater Monitoring Report', by Ramboll, dated February 2020

This report presents the results of four quarterly GMEs, completed in March, June, September and December of 2020, as well as a trend analysis of the results from the 29 monitoring events completed between 2013 and 2020.

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 2020 Groundwater Monitoring Report is to:

- Tabulate results for depth to groundwater, physico-chemical parameters and analytical data collected in 2020
- 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 plume migration
- 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, including two shallow wells and two 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 dissolved aluminium and total and free cyanide

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 kilometres (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
- '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 CWS. The proposal for remediation is the consolidation of all contaminated materials within one centralised containment cell located approximately 1 km 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 (Environ 2015).

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 decreased after 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**.

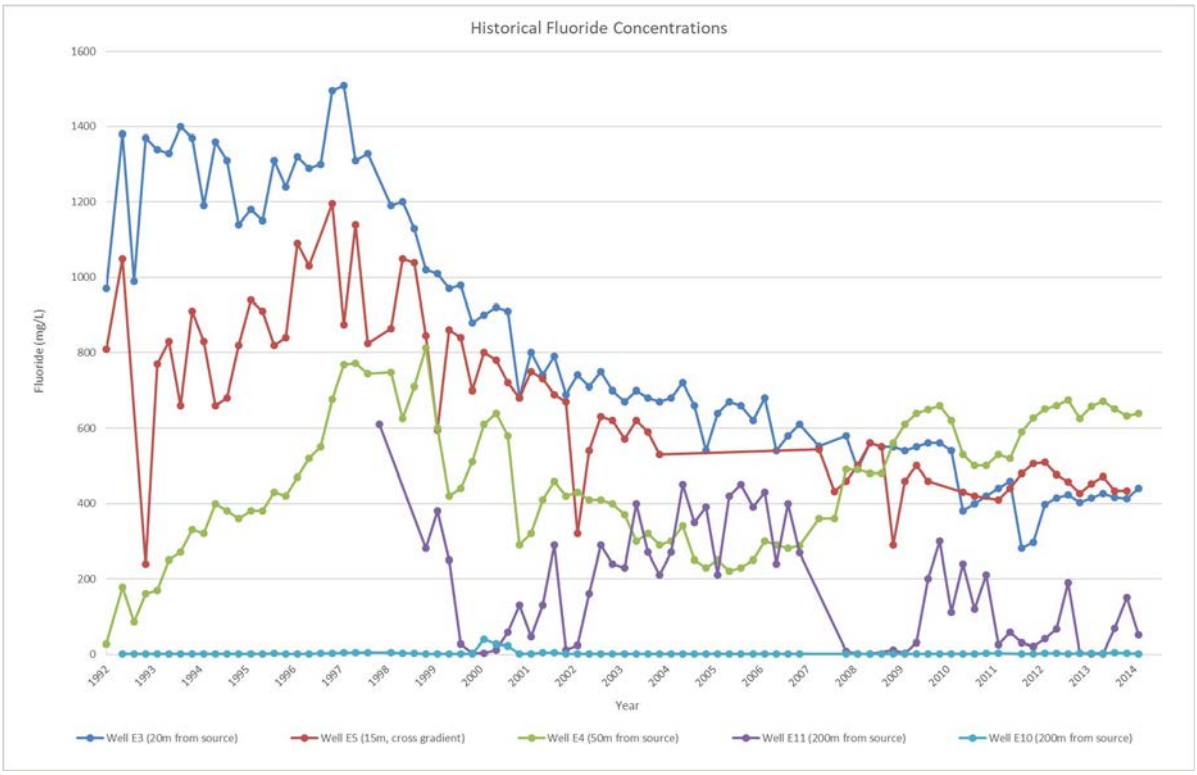


Figure 2-1: Historical Fluoride Concentrations Along the Plume 1992 - 2014

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 upstream of the smelter and 1.2 mg/L downstream. 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

The following leachate interception trenches were installed down gradient of the source of the leachate plume to capture leachate prior to daylighting to surface near the two vegetation impact areas:

- A passive interception trench was installed in early 2013 to the north of Section 2 to intercept leachate flowing into the southern vegetation impact area
- An active interception trench was installed at the toe of the CWS immediately upgradient of the wells on Section 1 in April 2014
- A second passive interception trench was installed north of Section 4 in October 2017 to capture leachate daylighting along the western edge of the northern vegetation impact area

The location of these interception trenches are shown in **Attachment 4**, **Appendix 2.** A conceptual cross section of the active interception trench on Section 1 is included in **Attachment 5**, **Appendix 2**.

These trenches were installed as an interim remedial measure to reduce daylighting and overland flow of leachate downgradient of the CWS. The active trench was in operation from May 2014 to March 2016 when the discharge rate dropped to 0 L/ minute. Operation of the active trench since

March 2016 has not been required as leachate is no longer collecting in the trench. The passive trenches are occasionally pumped out following heavy rainfall. The trenches have been effective as an interim remedial measure, with water quality improvements and regeneration of vegetation observed in the two vegetation impact areas.

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)
- 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. The CSM has been updated based on field observations and data to 2020.

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 a high pH.

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 surface water flow

Infiltration as a transport mechanism was stopped by the capping of the CWS with low permeability 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 chemical 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
- An 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	No	No	NR	No	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. Following the installation of the interception trenches, the daylighting of groundwater has reduced in frequency and impacted surface water has been observed on few occasions during heavy rainfall since 2014.
Incidental ingestion of impacted surface water	No	No	NR	No	No	No	
Uptake of impacted surface water	NR	NR	No	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 AND ANALYSIS QUALITY PLAN

3.1 Objective

The objective of each quarterly GME is to collect water quality data from the groundwater monitoring network to inform the behaviour of the leachate plume over time and provide data for annual reporting.

The groundwater monitoring network comprises groundwater wells located on five sections along the length of the leachate plume, as follows:

- 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~~[1], W4S, ~~W4D~~[2]
- Section 4: Wells E11, W5S, W5D, N2
- Section 5: Wells G2, N8, N9, W6S, W6D

Two pairs of shallow and deep wells adjacent to Swamp Creek (F5/G5 and F6/G6) were added to the groundwater monitoring network in 2016. These are sentinel wells that are unimpacted by leachate. The presence of leachate in these wells would indicate potential impact to Swamp Creek, the nearest surface water receptor.

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) from 29 groundwater wells in the groundwater monitoring network
- Laboratory analysis of groundwater samples for soluble fluoride, total and dissolved aluminium, and total and free cyanide. Dissolved aluminium was included as part of laboratory analysis from June 2018.

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.
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, water quality meter and flexible pump tubing was decontaminated by washing in a Decon®90 solution and rinsing with potable water between sampling locations.
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.

[1] This well was damaged in the April 2015 storm. As this well was dry for the majority of the 2013 and 2014 sampling events, it has not been replaced.

[2] This well was damaged in the April 2015 storm. It was able to be sampled until October 2016 but is now damaged beyond repair and has not been replaced.

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 Purpose	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 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. During the 2020 GMEs, 29 wells will be sampled unless found to be dry. This takes into consideration the two wells (W3SA and W4D) that were damaged in the April 2016 storm. 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 will be 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 GMEs were completed in March 2020, June 2020, September 2020 and December 2020. 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 2020 GMEs. Each section provides a cross section at different lengths along the known location of the leachate 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 sentinel wells located adjacent to Swamp Creek, the nearest surface water receptor.
Sampling Density	Twenty-nine groundwater wells were selected for sampling for the 2020 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 2020 quarterly GMEs.
Sample Collection Method	For the 2020 quarterly GMEs, groundwater samples were collected using low flow methods (peristaltic pump and dedicated LDPE tubing). Groundwater samples were collected directly into laboratory-supplied bottles with field filtration for dissolved aluminium (0.45 µm). 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 Decon®90 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.
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 approximately 10% and inter-laboratory duplicate samples were analysed at a rate of approximately 5% during the 2020 GMEs. At least one rinsate sample was collected per GME. A summary of the field quality control samples collected during the 2020 GMEs is outlined below: • March 2020: two intra-laboratory duplicates (D01, D02), one inter-laboratory duplicate (T01) and one rinsate (R01) • June 2020: two intra-laboratory duplicates (D01_170620, D02_180620), one inter-laboratory duplicate (T01_180620) and one rinsate (R01_180320) • September 2020: two intra-laboratory duplicates (DUP1, DUP2), one inter-laboratory duplicate (TRIP1) and one rinsate (R01_20200923) • December 2020: two intra-laboratory duplicates (D01_20201208, D02_091220), one inter-laboratory duplicate (T01_20201208) and one rinsate (R01_091220)
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. RPDs for most analytes were below the criterion (30%) except for: • March 2020: intra-laboratory duplicate pair F6/D01 RPD for total aluminium 40%, intra-laboratory duplicate pair G5/D02 RPD for fluoride 40% and total aluminium 32%, inter-laboratory duplicate pair G5/T01 RPD for fluoride 40% • June 2020: inter-laboratory duplicate pair F6/T01_180620 RPD for total aluminium 40% • September 2020: intra-laboratory duplicate pair G2/DUP1 RPD for fluoride 40%, inter-laboratory duplicate pair G5/TRIP1 RPD for dissolved aluminium 40% • December 2020: inter-laboratory duplicate pair W6D/T01_20201208 RPD for dissolved aluminium 67% and total aluminium 75% Higher RPDs are the result of low-level detections close to the practical quantitation limit (PQL) with the exception of inter-laboratory duplicate W6D/T01_20201208 RPD for total aluminium 75%. There is no criterion for total aluminium. Therefore, the higher RPD is not considered to affect the outcomes of this report. Rinsate sample results were all reported at less than the limit of reporting (<LOR) for the four 2020 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 except for cyanide (total and free) for the inter-laboratory duplicate sample collected during June 2020. The inter-laboratory duplicate sample for cyanide had to be extracted from the unpreserved bottle generally used for analysis of fluoride. Without the correct preservative the holding time for cyanide is one day.
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 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 2020 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 2020 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 2020 GMEs were completed by two samplers, Jordyn Kirsch and Jake Bourke, both Ramboll environmental scientists.
- 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
- 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
- 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
- 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[a]	No guideline	No guideline	5 - 9
Electrical Conductivity (µS/cm)	No guideline	4,500 – 7,700[b] >12,200[c]	No guideline	No guideline

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

6. RESULTS AND TREND ANALYSIS

A summary of groundwater elevation, pH and laboratory results for the past 29 GMEs, including the four quarterly GMEs from 2020 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.

The following parameters have been assessed in the following sections:

- Section 6.1: Shallow Aquifer
    - Section 6.1.1: Groundwater Elevation and Flow Direction
    - Section 6.1.2: Groundwater pH
    - Section 6.1.3: Soluble Fluoride
    - Section 6.1.4: Free Cyanide
- Section 6.2: Deep Aquifer
    - Section 6.2.1: Groundwater Elevation and Flow Direction
    - Section 6.2.2: Groundwater pH
    - Section 6.2.3: Soluble Fluoride
    - Section 6.2.4: Free Cyanide

6.1 Shallow Aquifer

6.1.1 Groundwater Elevation and Flow Direction

Figure 6-1 shows groundwater elevation within the shallow aquifer across the 29 monitoring events completed between July 2013 and December 2020. Monthly rainfall is presented for the same period.

Historical groundwater elevation within the shallow aquifer generally shows an increase in response to heavy rainfall and a downward trend in groundwater elevation during extended periods of low rainfall.

Overall, groundwater elevation in the shallow aquifer has decreased marginally between the start of monitoring in July 2013 and the most recent GME in December 2020. Decreasing groundwater elevations are consistent with a period of drought from 2017 to 2019, with groundwater elevations now recovering with an increase in rainfall in 2020.

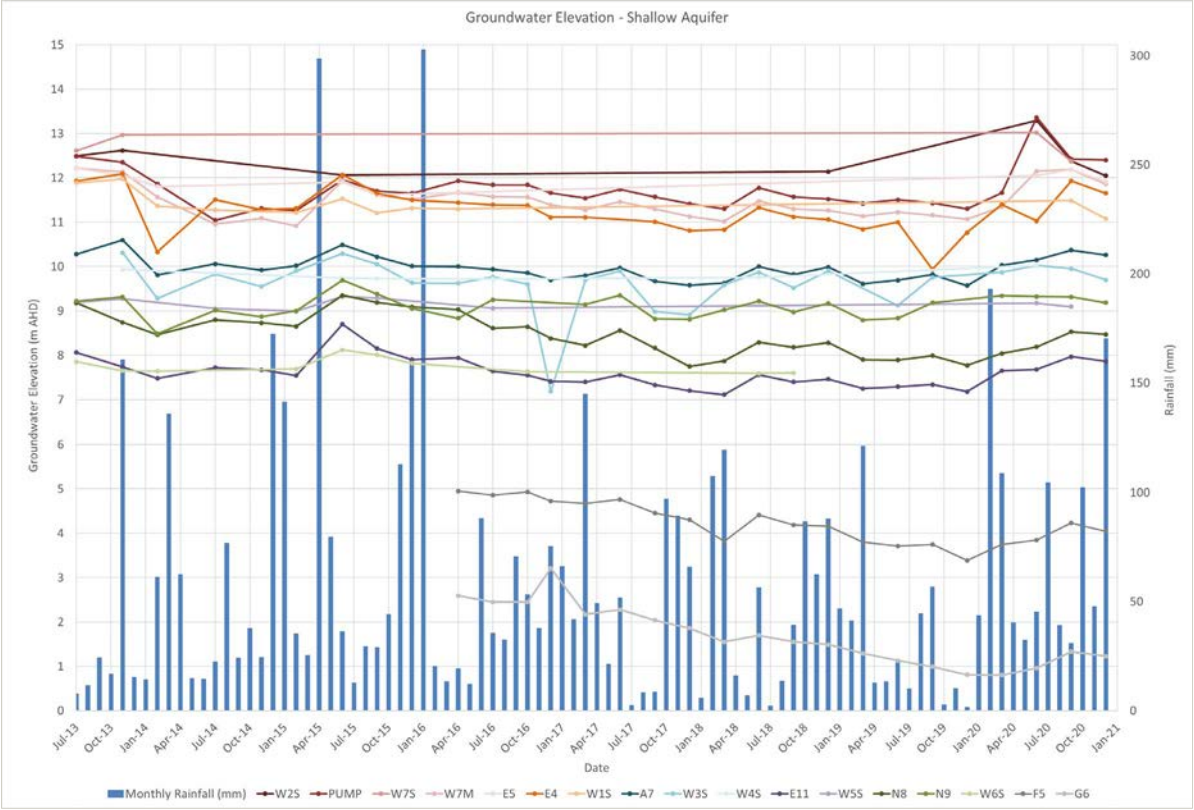


Figure 6-1: Groundwater Elevation – Shallow Aquifer, 2013 to 2020

Interpreted groundwater flow directions within the shallow aquifer for the four GMEs completed during 2020 is presented in **Figure 6-2**.

Between March 2020 and December 2020, groundwater flow within the shallow aquifer was generally to the north and north east. These observations are largely consistent with historical observations. Historical elevations and flow directions are attached in **Appendix 7**.

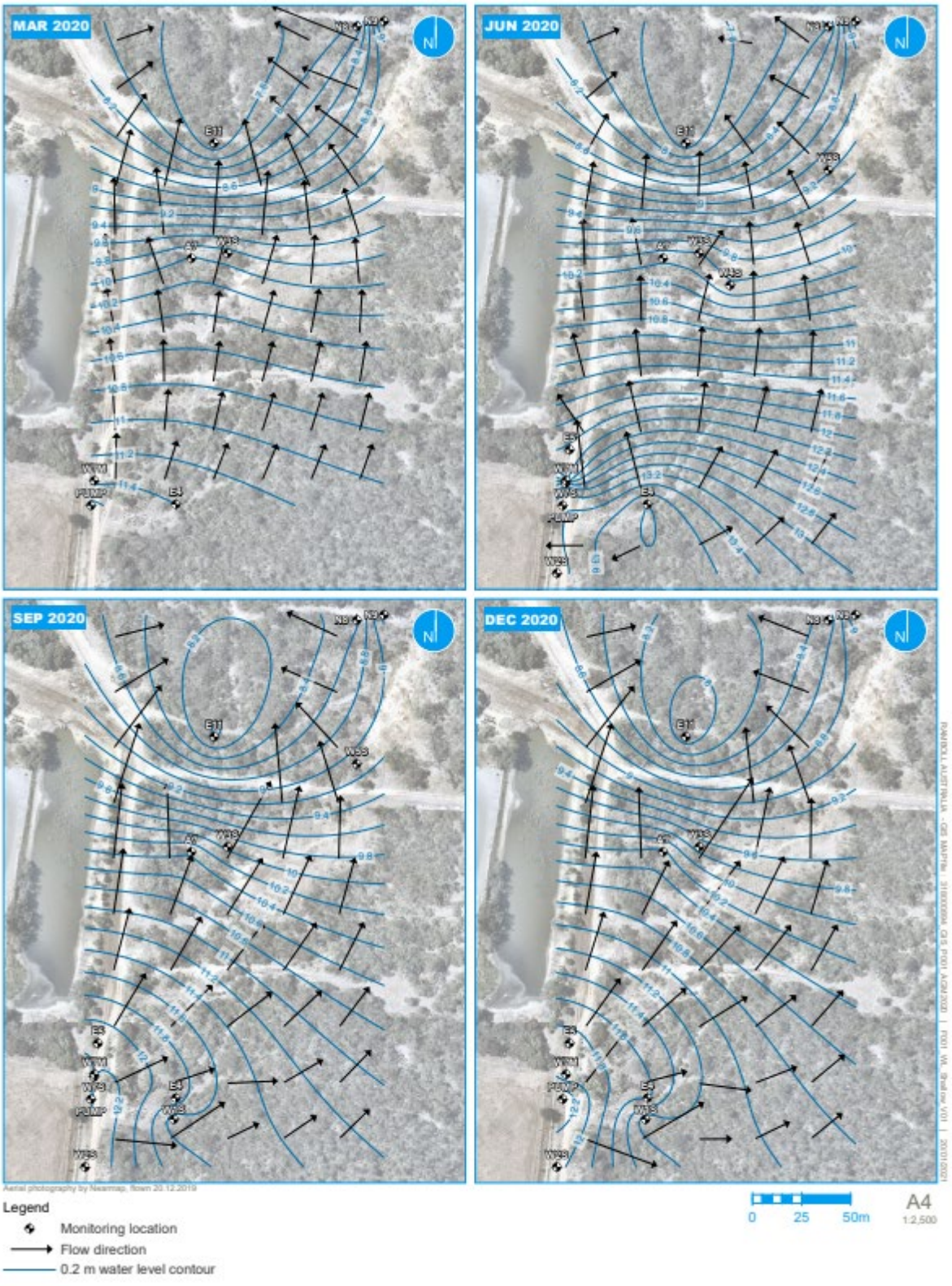


Figure 6-2: Interpolated Groundwater Elevation and Flow Direction – Shallow Aquifer 2020

6.1.2 Groundwater pH

Table 6-2 summarises field pH values reported within the shallow aquifer during 2020. Complete results are included in **Appendix 3.**

Table 6-1: Field pH Values - Shallow Aquifer

Contaminant of Concern	Date	No. of Samples	Minimum Value (pH Units)	Maximum Value (pH Units)	No. Results Exceeding Criteria
Field pH	March 2020	10	4.06	9.67	**5 (Recreational) 3 (95% Protection)**
	June 2020	15	4.59	9.73	**9 (Recreational) 3 (95% Protection)**
	September 2020	15	4.49	9.87	**6 (Recreational) 4 (95% Protection)**
	December 2020	13	4.19	10.64	**7 (Recreational) 5 (95% Protection)**

A pH greater than 9 exceeds both the ANZECC (2000) 95% protection for aquatic species criteria and the recreational criteria. Wells with a pH greater than 9, which is also characteristic of leachate impacted groundwater, include the following:

- Section 1: E5, W7M
- Section 2: E4
- Section 3: A7
- Section 4: E11
- Section 5: None

Section 1 well PUMP has a variable pH, with pH less than 9 in three of the four 2020 GMEs. Other shallow wells along the length of the leachate plume had pH values ranging between 6.7 and 8.7 during 2020.

The pH in the sentinel wells F5 and G6 near Swamp Creek were less than 5, which may be indicative of the natural pH of groundwater in this part of the Buffer Zone. Although this pH is outside the range for ANZECC (2000) 95% protection criteria, it is not considered to require further analysis as it is not indicative of leachate impact.

The lateral extent of high pH impacted groundwater in the shallow aquifer throughout 2020 is presented in **Figure 6-3.**

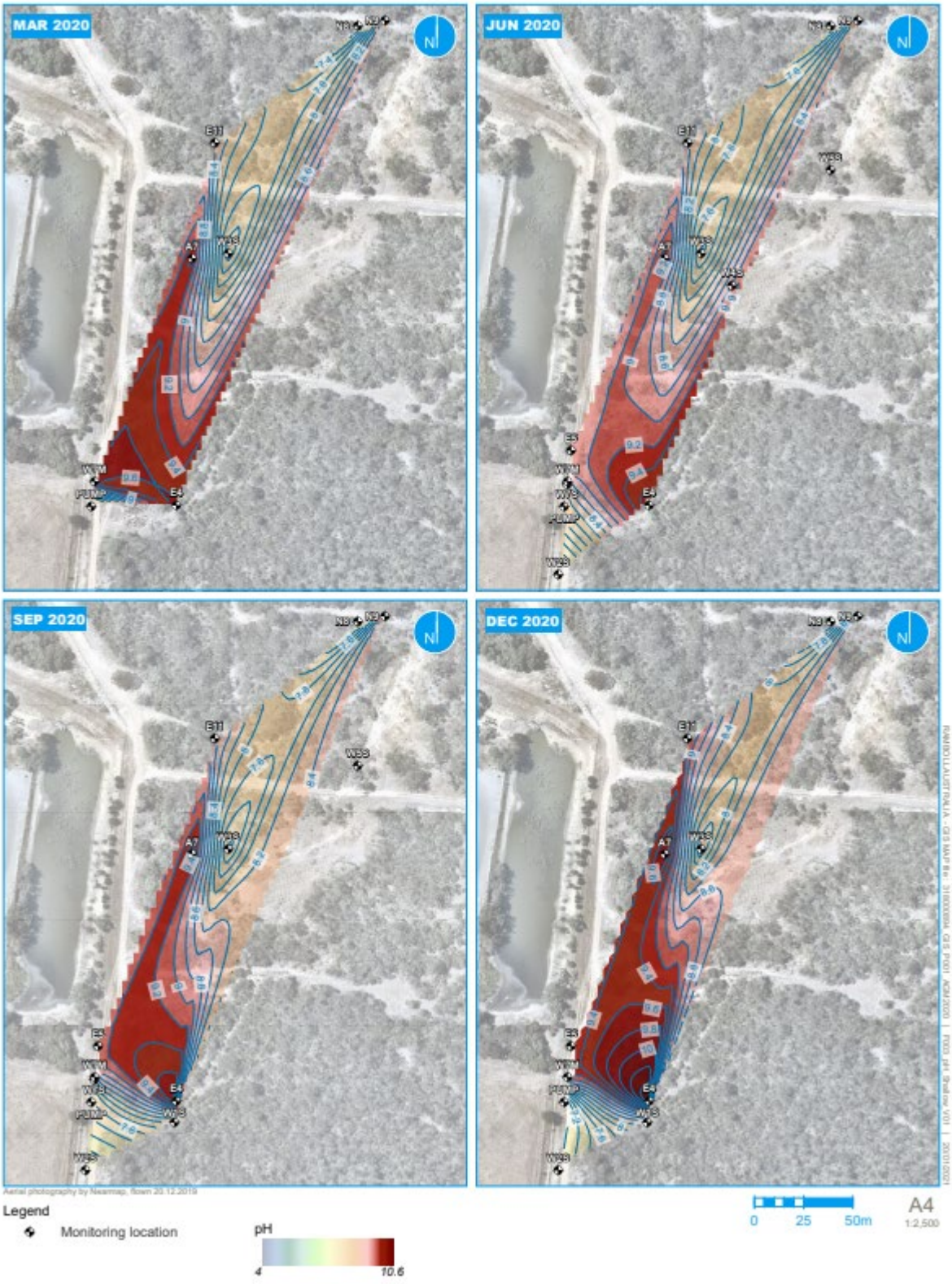


Figure 6-3: Interpolated Field pH – Shallow Aquifer 2020

6.1.2.1 Time Series Trends

Comparison of pH values for the 29 GMEs completed between July 2013 and December 2020 are shown in **Figure 6-4** to **Figure 6-6**. The blue dotted line shows pH 9, where pH above this is characteristic of leachate impact. The time series trends show the following:

- The consistent presence of groundwater with elevated pH at wells E4, E5, W7M, A7 and E11 along the length of the plume
- Variable pH in groundwater at wells PUMP on Section 1 and N9 on Section 5
- The low pH of groundwater in sentinel wells F5 and G6.

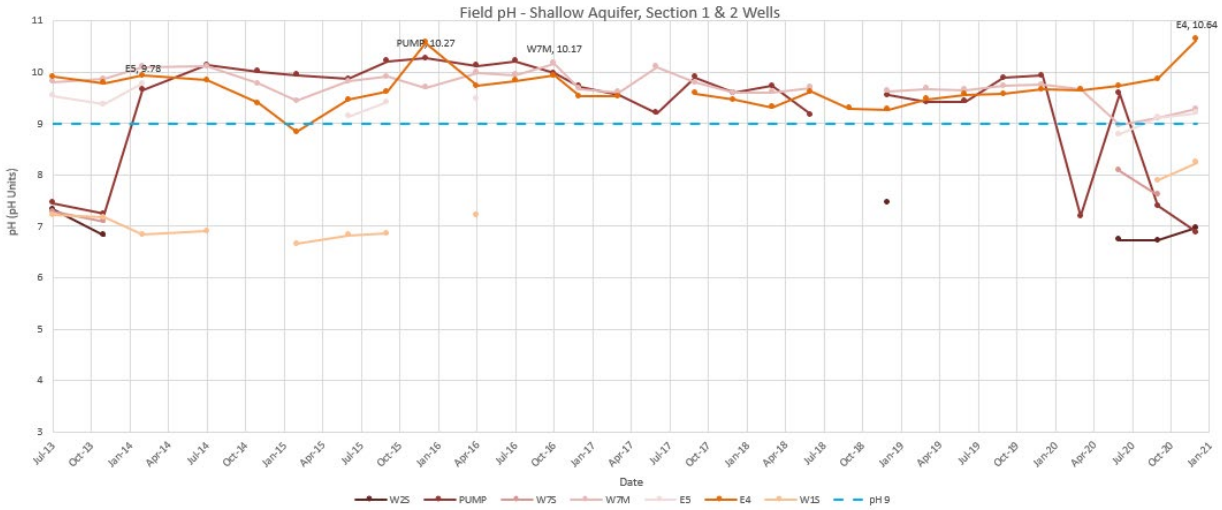


Figure 6-4: Field pH Values – Shallow Aquifer, Section 1 & 2 Wells

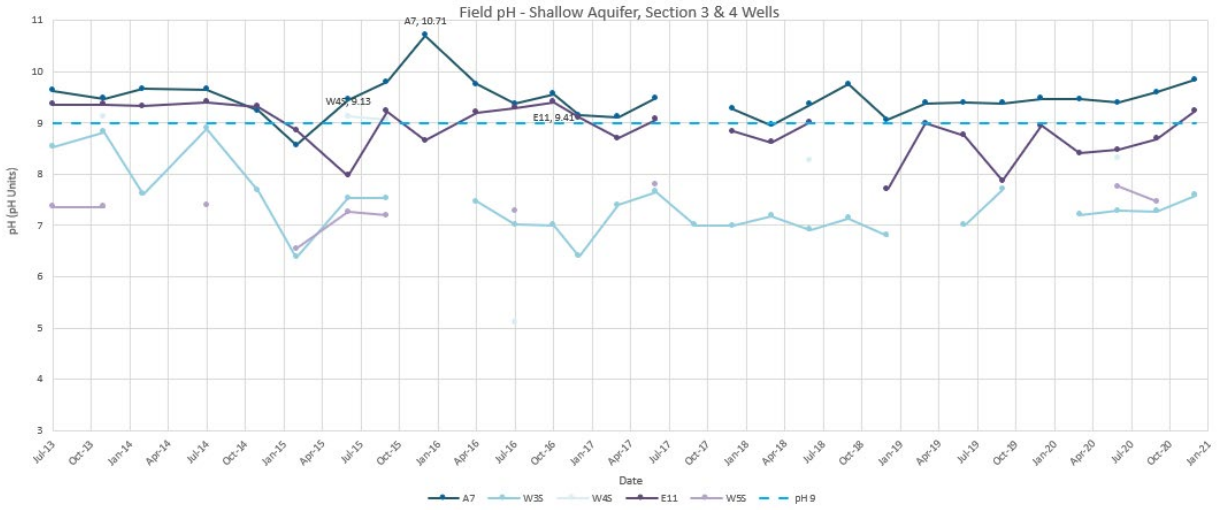


Figure 6-5: Field pH Values – Shallow Aquifer, Section 3 & 4 Wells



Figure 6-6: Field pH Values – Shallow Aquifer, Section 5 & Sentinel Wells

6.1.2.2 Mann-Kendall Trend Analysis

Mann-Kendall trend analysis was used to statistically assess each of the shallow monitoring locations to identify trends in pH. 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 2020 (29 sampling events) were included for the purpose of Mann-Kendall trend analysis of pH, a summary is provided in **Table 6-3**.

Mann-Kendall trend analysis of pH within the shallow aquifer indicates an increasing trend at two wells, N8 (located on Section 5) and sentinel well G6. Since the first GME in July 2013, pH values at N8 have increased from pH 6.36 to pH 6.95 in December 2020 (see **Figure 6-6**) and this increase is not indicative of leachate impact, nor is the increase considered a significant change. Groundwater pH values at G6 also remain low and not indicative of leachate impact, increasing from pH 3.6 in April 2016 to pH 4.19 in December 2020 (see **Figure 6-6**). There are no increasing trends in pH in wells impacted by leachate.

Table 6-2: Mann-Kendall pH Trends - Shallow Aquifer

Well	Previous Trend 2013 to 2019	Current Trend 2013 to 2020	pH >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
PUMP	Stable	**Decreasing**	**Yes**	**Yes**
W2S	I.D	Stable	No	No
W7M	**Decreasing**	**Decreasing**	**Yes**	**Yes**
W7S	I.D	No Trend	**Yes**	No
E5	Stable	Prob. Decreasing	**Yes**	**Yes**
Section 2				
E4	**Decreasing**	Stable	**Yes**	**Yes**
W1S	Stable	No Trend	**Yes**	No
Section 3				
W3S	**Decreasing**	**Decreasing**	No	No
W4S	Prob. Decreasing	Stable	**Yes**	No
A7	Stable	Stable	**Yes**	**Yes**

Well	Previous Trend 2013 to 2019	Current Trend 2013 to 2020	pH >Assessment Criteria[1]	Leachate Impacted[2]
Section 4				
E11	**Decreasing**	**Decreasing**	**Yes**	**Yes**
W5S	No Trend	No Trend	No	No
Section 5				
N8	**Increasing**	**Increasing**	No	No
N9	Stable	No Trend	**Yes**	No
W6S	Stable	-	-	No
Sentinel				
F5	Prob. Decreasing	Stable	No	No
G6	No Trend	**Increasing**	No	No

- Indicates no 2020 data available

I.D Insufficient data to perform trend analysis

[1]Field pH exceeded the assessment criteria for 95% Protection for Aquatic Ecosystems or Recreational criteria during any GME completed in 2020

[2]Groundwater generally characteristic of leachate impact i.e. pH >9, brown in colour

6.1.3 Soluble Fluoride

Table 6-4 summarises the laboratory results for soluble fluoride within the shallow aquifer during 2020. Complete results are included in **Appendix 3**.

Table 6-3: Soluble Fluoride Concentrations - Shallow Aquifer

Contaminant of Concern	Date	No. of Samples	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	No. Results Exceeding Criteria
Soluble Fluoride	March 2020	10	<0.4	810	**7 (Irrigation, Stock Watering and Recreational)**
	June 2020	15	<0.4	690	**12 (Irrigation, Stock Watering and Recreational)**
	September 2020	15	0.1	560	**12 (Irrigation, Stock Watering and Recreational)**
	December 2020	13	0.2	680	**10 (Irrigation, Stock Watering and Recreational)**

During the four GMEs completed in 2020, soluble fluoride concentrations in shallow groundwater exceeded the site assessment criteria for Irrigation, Stock Watering and Recreational use at 12 wells as follows:

- Section 1: Pump, W2S, W7M, W7S, E5
- Section 2: E4, W1S
- Section 3: W3S, A7
- Section 4: E11, W5S
- Section 5: N9

Variation in the number of results exceeding site criteria were the results of a number of wells being dry at the time of sampling.

All Section 1, Section 2 and Section 4 shallow wells exceeded the site assessment criteria for soluble fluoride during 2020, with concentrations generally decreasing away from the CWS. The highest concentrations were reported at Section 1 well W7M (maximum of 810 mg/L during March 2020) and Section 2 well E4 (maximum concentration of 690 mg/L during June 2020). The sentinel 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 lateral extent of soluble fluoride in the shallow aquifer throughout 2020 is presented in **Figure 6-7.**

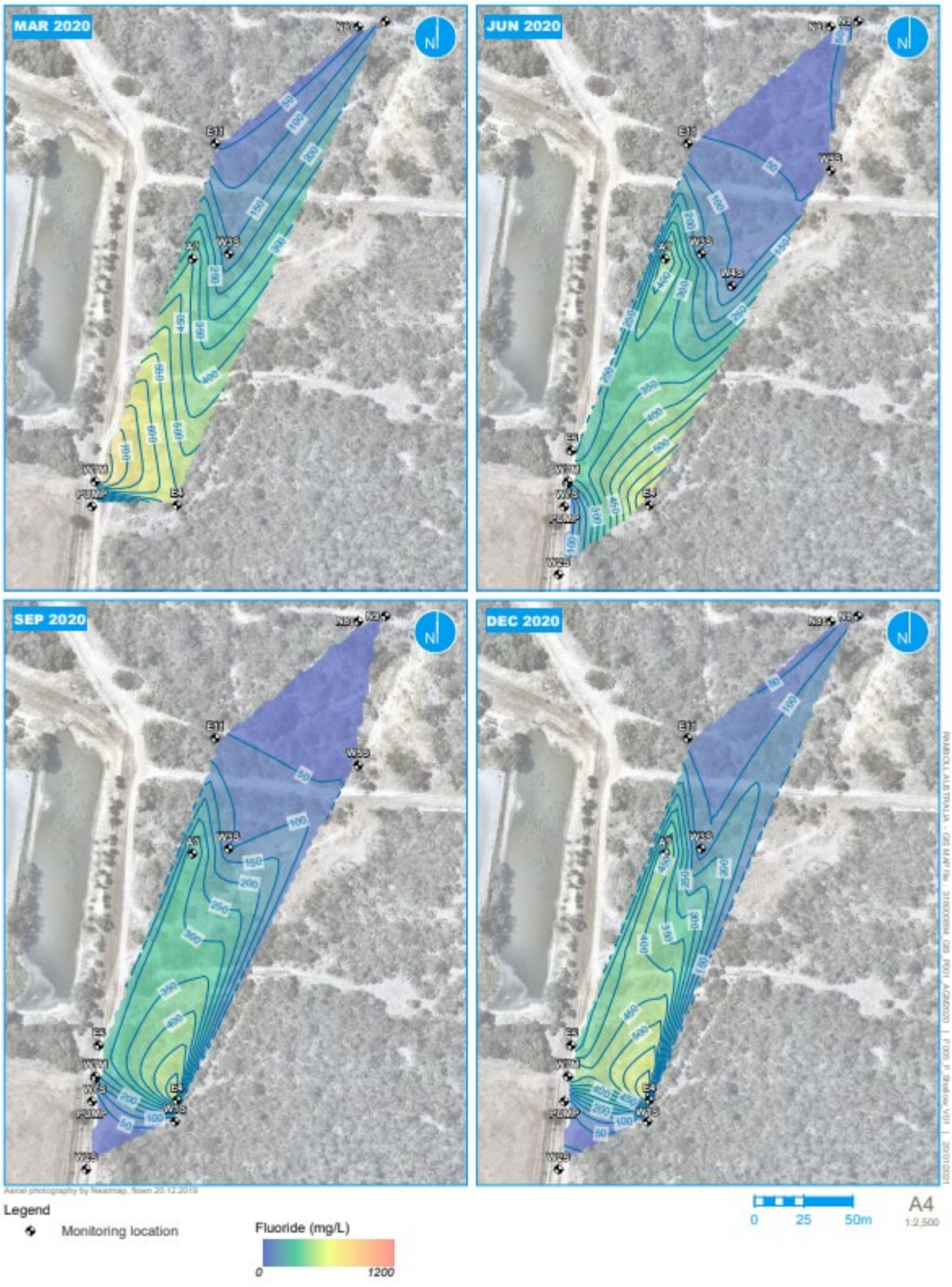


Figure 6-7: Interpolated Soluble Fluoride, Shallow Aquifer 2020

6.1.3.1 Time Series Trends

Comparison of soluble fluoride concentrations for the 29 GMEs completed between July 2013 and December 2020 are shown in **Figure 6-8** to **Figure 6-10**. The time series trends show the following:

- Fluctuating soluble fluoride concentrations in wells on Section 1 and Section 2, closest to the source of the leachate
- Consistently elevated soluble fluoride concentrations indicating leachate impact at wells A7, E11, W4S and W5S on Section 3 and Section 4
- Fluctuating soluble fluoride concentrations at well N9 on Section 5, the leading edge of the plume
- Consistently low soluble fluoride concentrations at the sentinel wells F5 and G6.

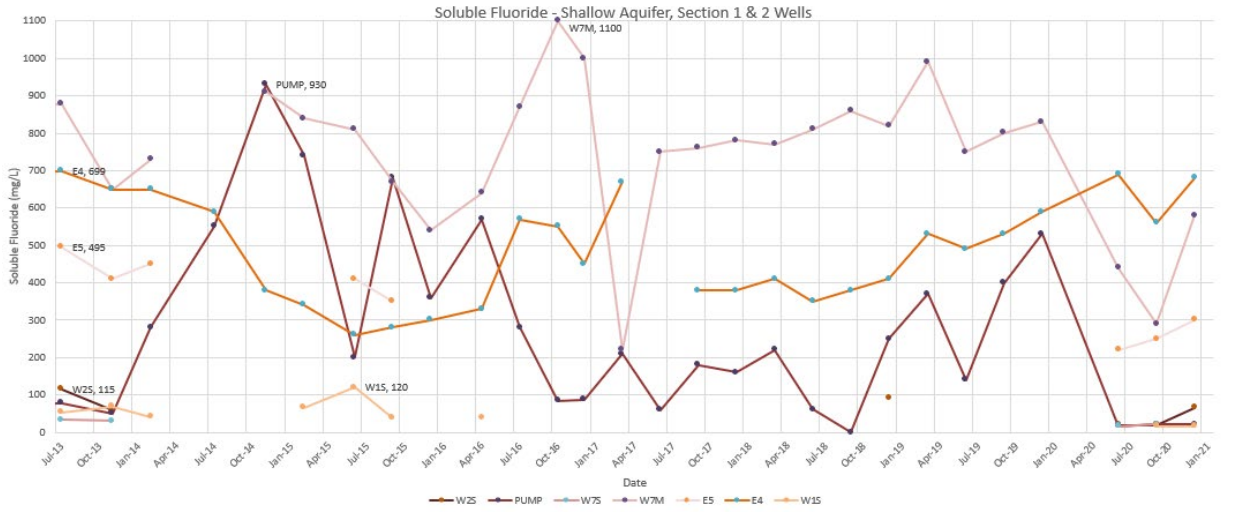


Figure 6-8: Soluble Fluoride Concentrations – Shallow Aquifer, Section 1 & 2 Wells

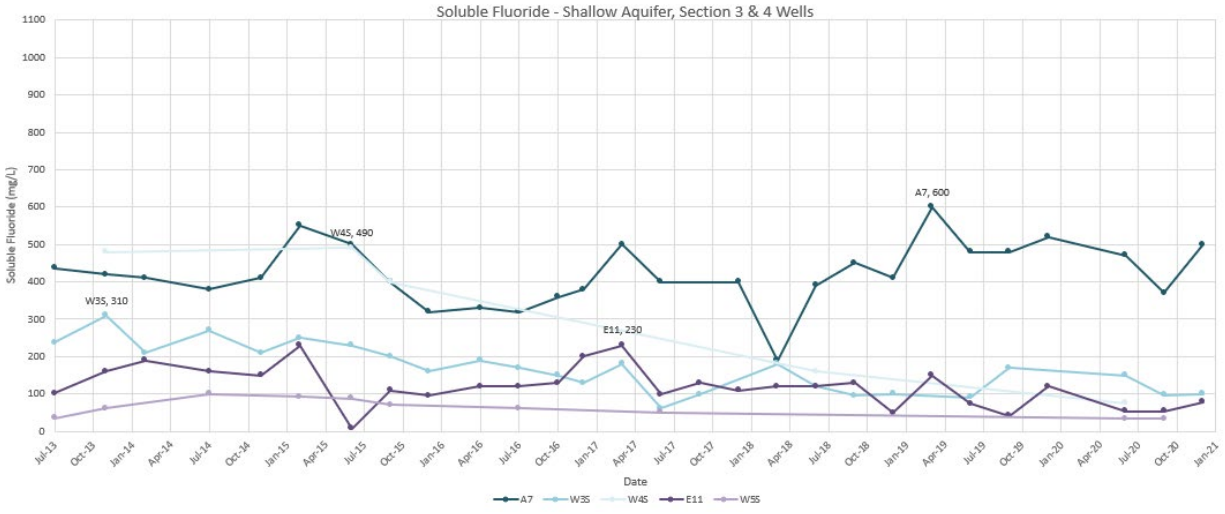


Figure 6-9: Soluble Fluoride Concentrations – Shallow Aquifer, Section 3 & 4 Wells

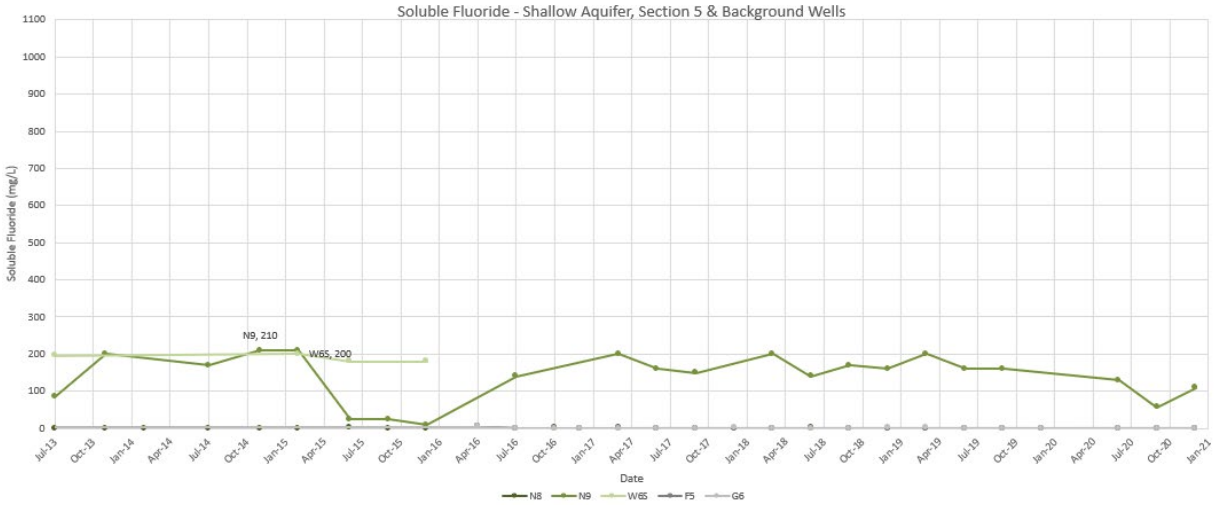


Figure 6-10: Soluble Fluoride Concentrations – Shallow Aquifer, Section 5 & Sentinel Wells

6.1.3.2 Mann-Kendall Trend Analysis

Data from July 2013 to December 2020 (29 sampling events) were included for the purpose of Mann-Kendall trend analysis of soluble fluoride, a summary is provided in **Table 6-5**.

Mann-Kendall trend analysis of soluble fluoride within the shallow aquifer 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 December 2020. Soluble fluoride concentrations at N8 are within natural fluctuations and pH at N8 is not characteristic of leachate impacted groundwater.

Mann-Kendall trend analysis of soluble fluoride at N9, the well at the leading edge of the plume, shows a stable trend indicating the plume is not expanding to the north.

Table 6-4: Mann-Kendall Trend Analysis of Soluble Fluoride – Shallow Aquifer

Well	Previous Trend 2013 to 2019	Current Trend 2013 to 2020	Soluble Fluoride >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
PUMP	Stable	**Decreasing**	**Yes**	**Yes**
W2S	I.D	Stable	**Yes**	No
W7M	No Trend	Stable	**Yes**	**Yes**
W7S	I.D	Stable	**Yes**	No
E5	**Decreasing**	**Decreasing**	**Yes**	**Yes**
Section 2				
E4	Stable	No Trend	**Yes**	**Yes**
W1S	Stable	**Decreasing**	**Yes**	No
Section 3				
W3S	**Decreasing**	**Decreasing**	**Yes**	No
W4S	Stable	**Decreasing**	**Yes**	No
A7	No Trend	No Trend	**Yes**	**Yes**
Section 4				

Well	Previous Trend 2013 to 2019	Current Trend 2013 to 2020	Soluble Fluoride >Assessment Criteria[1]	Leachate Impacted[2]
E11	Prob. Decreasing	**Decreasing**	**Yes**	**Yes**
W5S	I.D	I.D	**Yes**	No
Section 4				
N8	**Increasing**	**Increasing**	No	No
N9	No Trend	Stable	**Yes**	No
W6S	Stable	-	-	No
Sentinel				
F5	No Trend	No Trend	No	No
G6	No Trend	No Trend	No	No

- Indicates no 2020 data available

I.D Insufficient data to perform trend analysis

[1]Soluble fluoride exceeded the assessment criteria of either Irrigation, Stock Watering or Recreational during any GME completed in 2020

[2]Groundwater generally characteristic of leachate impact i.e. pH >9, brown in colour

6.1.4 Free Cyanide Shallow Wells

Both total and free cyanide were included for analysis in the 2020 GMEs. Free cyanide was introduced for analysis in 2015, as there are no Australian guidelines for total cyanide.

Laboratory results for free cyanide in shallow groundwater reported during 2020 are summarised in **Table 6-6**.

Table 6-5: Free Cyanide Concentrations - Shallow Aquifer

Contaminant of Concern	Date	No. of Samples	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	No. Results Exceeding Criteria
Free Cyanide	March 2020	10	<0.004	0.016	**1 (95% Protection for Aquatic Ecosystems)**
	June 2020	15	<0.004	0.007	0
	September 2020	15	<0.004	0.019	**3 (95% Protection for Aquatic Ecosystems)**
	December 2020	13	<0.004	0.010	**4 (95% Protection for Aquatic Ecosystems)**

Free cyanide concentrations were below the laboratory limit of reporting in the majority of wells along the leachate plume, aside from the following:

- Section 1: W2S, E5, W7M
- Section 3: W3S
- Section 5: N9

Free cyanide concentrations in these wells exceeded the ANZECC (2000) 95% protection for aquatic ecosystems criterion in the December 2020 GME. Free cyanide concentrations did not exceed the recreational criteria of 0.1 mg/L during 2020.

Sentinel wells F5 and G6 have consistently reported free cyanide concentrations below the laboratory limit of reporting since regular monitoring began in 2016.

6.1.4.1 Time Series Trends

Comparison of free cyanide concentrations for the 24 GMEs completed between February 2015 and December 2020 are shown in **Figure 6-11** to **Figure 6-13**. Overall, concentrations of free cyanide in groundwater have decreased between 2015 and 2020 with no detections above the recreational guideline value of 0.1 mg/L since December 2015.

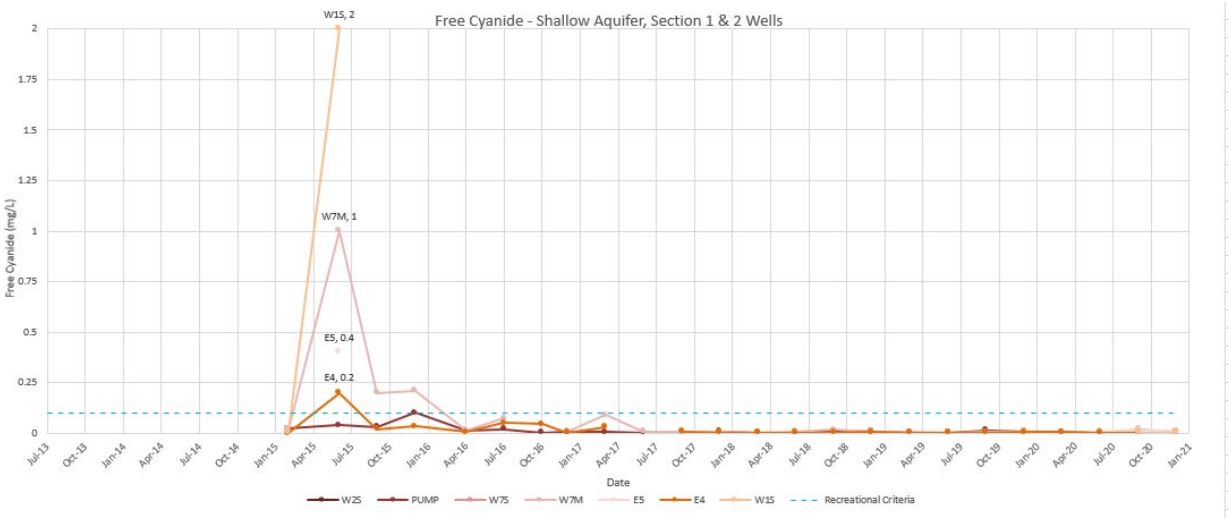


Figure 6-11: Free Cyanide Concentrations – Shallow Aquifer, Section 1 & 2 Wells

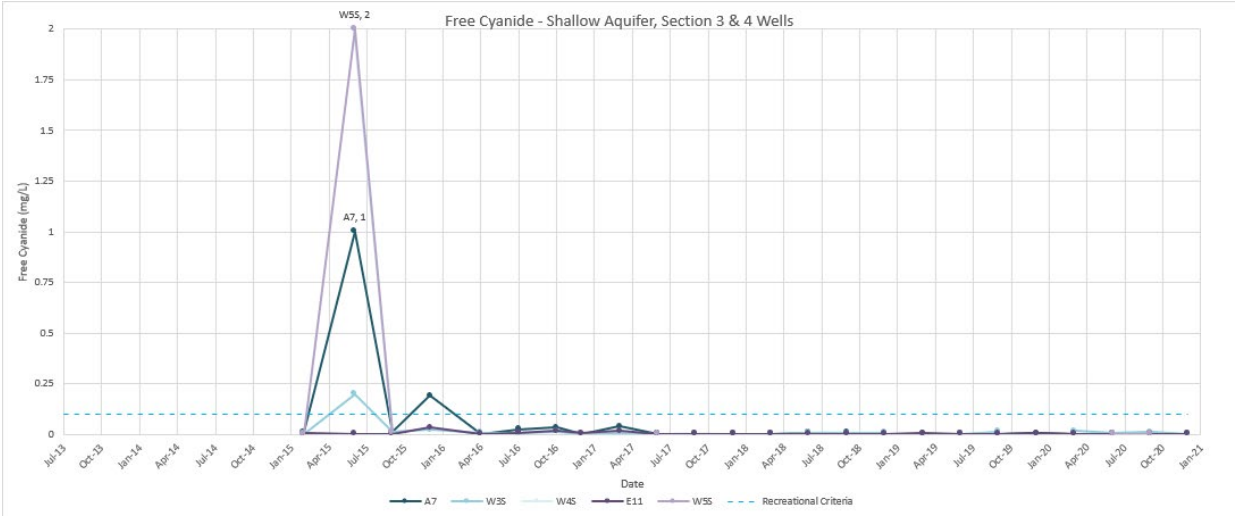


Figure 6-12: Free Cyanide Concentrations – Shallow Aquifer, Section 3 & 4 Shallow Wells

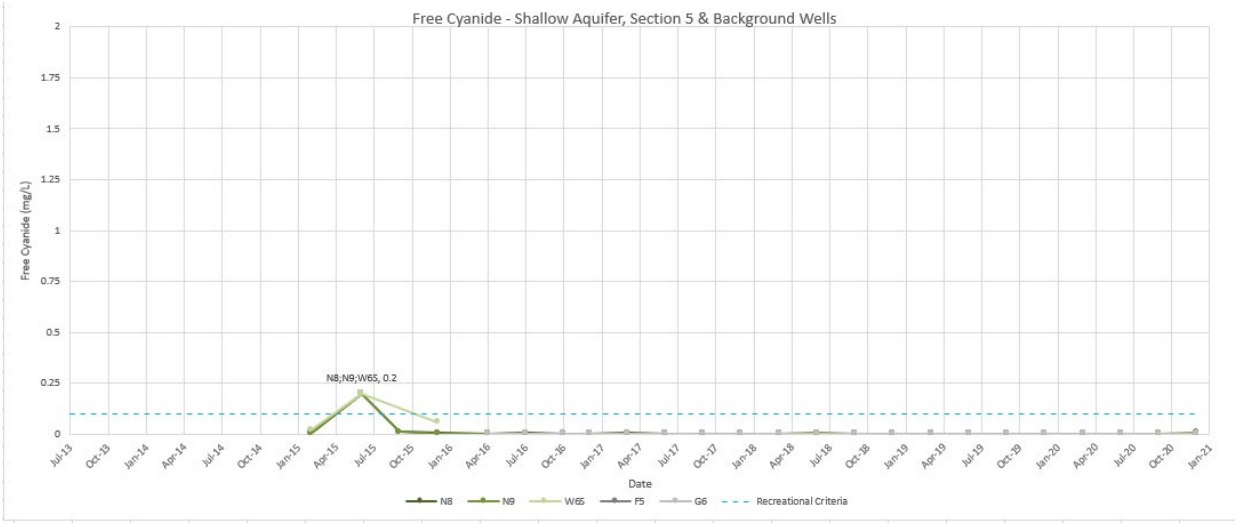


Figure 6-13: Free Cyanide Concentrations - Shallow Aquifer, Section 5 & Sentinel Shallow Wells

6.1.4.2 Mann-Kendall Trend Analysis

Data from February 2015 to December 2020 (24 sampling events) were included for the purpose of Mann-Kendall trend analysis of free cyanide in the shallow aquifer, a summary is provided in **Table 6-7**. Mann-Kendall trend analysis of free cyanide in shallow groundwater indicates no 'increasing' trends.

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

Well	Previous Trend 2013 to 2019	Current Trend 2013 to 2020	Free Cyanide >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
PUMP	**Decreasing**	**Decreasing**	No	**Yes**
W2S	I.D	Stable	**Yes**	No
W7M	**Decreasing**	**Decreasing**	**Yes**	**Yes**
W7S	I.D	I.D	No	No
E5	I.D	No Trend	**Yes**	**Yes**
Section 2				
E4	Prob. Decreasing	**Decreasing**	No	**Yes**
W1S	I.D	No Trend	No	No
Section 3				
W3S	Stable	No Trend	**Yes**	No
W4S	I.D	No Trend	No	No
A7	**Decreasing**	**Decreasing**	No	**Yes**
Section 4				
E11	No Trend	Prob. Decreasing	No	**Yes**
W5S	No Trend[1]	No Trend	No	No
Section 5				
N8	Stable	Stable	No	No
N9	No Trend	No Trend	**Yes**	No

Well	Previous Trend 2013 to 2019	Current Trend 2013 to 2020	Free Cyanide >Assessment Criteria[1]	Leachate Impacted[2]
W6S	I.D	I.D	No	No
Sentinel				
F5	Stable	Stable	No	No
G6	Stable	Stable	No	No

I.D Insufficient data to perform trend analysis

[1] Free cyanide exceeded the assessment criteria of either 95% Protection of Aquatic Ecosystems or Recreational during any GME completed in 2020

[2]Groundwater generally characteristic of leachate impact i.e. pH >9, brown in colour

6.2 Deep Aquifer

6.2.1 Groundwater Elevation and Flow Direction

Figure 6-14 shows groundwater elevation within the deep aquifer across the 29 monitoring events completed between July 2013 and December 2020. Monthly rainfall is presented for the same period.

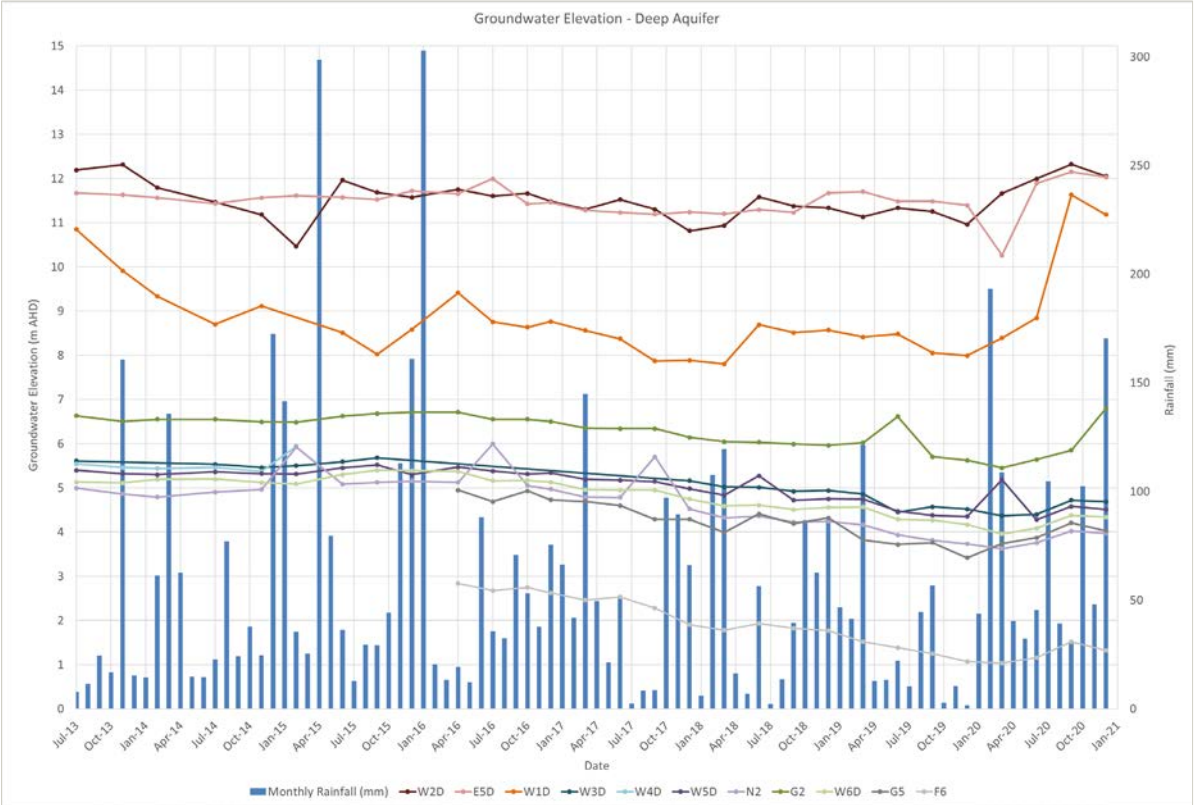


Figure 6-14: Groundwater Elevation – Deep Aquifer, 2013 to 2020

Groundwater levels within the deep aquifer decreased over the period of low rainfall between 2017 and 2019 and increased in 2020 in response to rainfall, with groundwater levels in the deep aquifer now similar to those observed during the first monitoring event in July 2013.

Interpreted groundwater flow directions within the deep aquifer for the four GMEs completed during 2020 is presented in **Figure 6-15**. Historical elevations and flow directions are attached in **Appendix 7**.

Groundwater flow direction in the deep aquifer is to the north and north east. The deep aquifer contours show little variation between June 2013 and December 2020. There is a consistent gradient

from approximately 11 m AHD near E5D to approximately 6 m AHD near W4D, then the gradient shallows through the northern vegetation impact area.

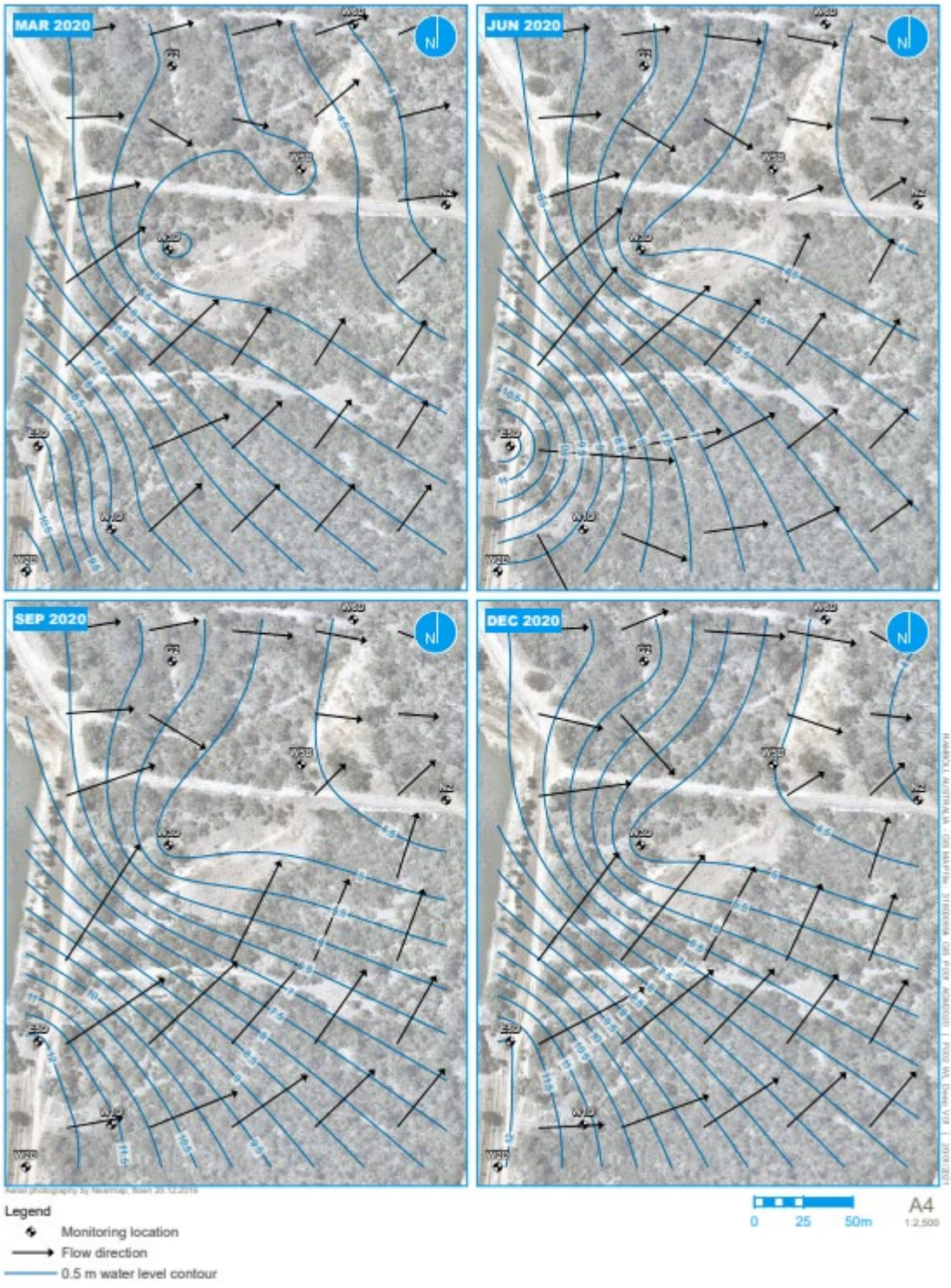


Figure 6-15: Interpolated Water Level Contours and Flow Direction – Deep Aquifer 2020

6.2.2 Groundwater pH

Table 6-8 summarises field pH values reported within the deep aquifer during 2020. Complete results are included in **Appendix 3.**

Table 6-7: Field pH Values – Deep Aquifer

Contaminant of Concern	Date	No. of Samples	Minimum Value (pH Units)	Maximum Value (pH Units)	No. Results Exceeding Criteria
Field pH	March 2020	10	4.09	10.12	**1 (95% Protection and Recreational)**
	June 2020	10	4.54	10.11	**1 (95% Protection and Recreational)**
	September 2020	10	3.88	10.18	**1 (95% Protection and Recreational)**
	December 2020	10	3.55	10.09	**2 (95% Protection)** **1 (Recreational)**

The deep aquifer has generally not been impacted by leachate with pH levels largely below pH 8, except for W2D located on Section 1. The pH at W2D has consistently been greater than 9 indicating leachate impact in groundwater at this well.

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).

The lateral extent of high pH impacted groundwater in the deep aquifer throughout 2020 is presented in **Figure 6-16**.

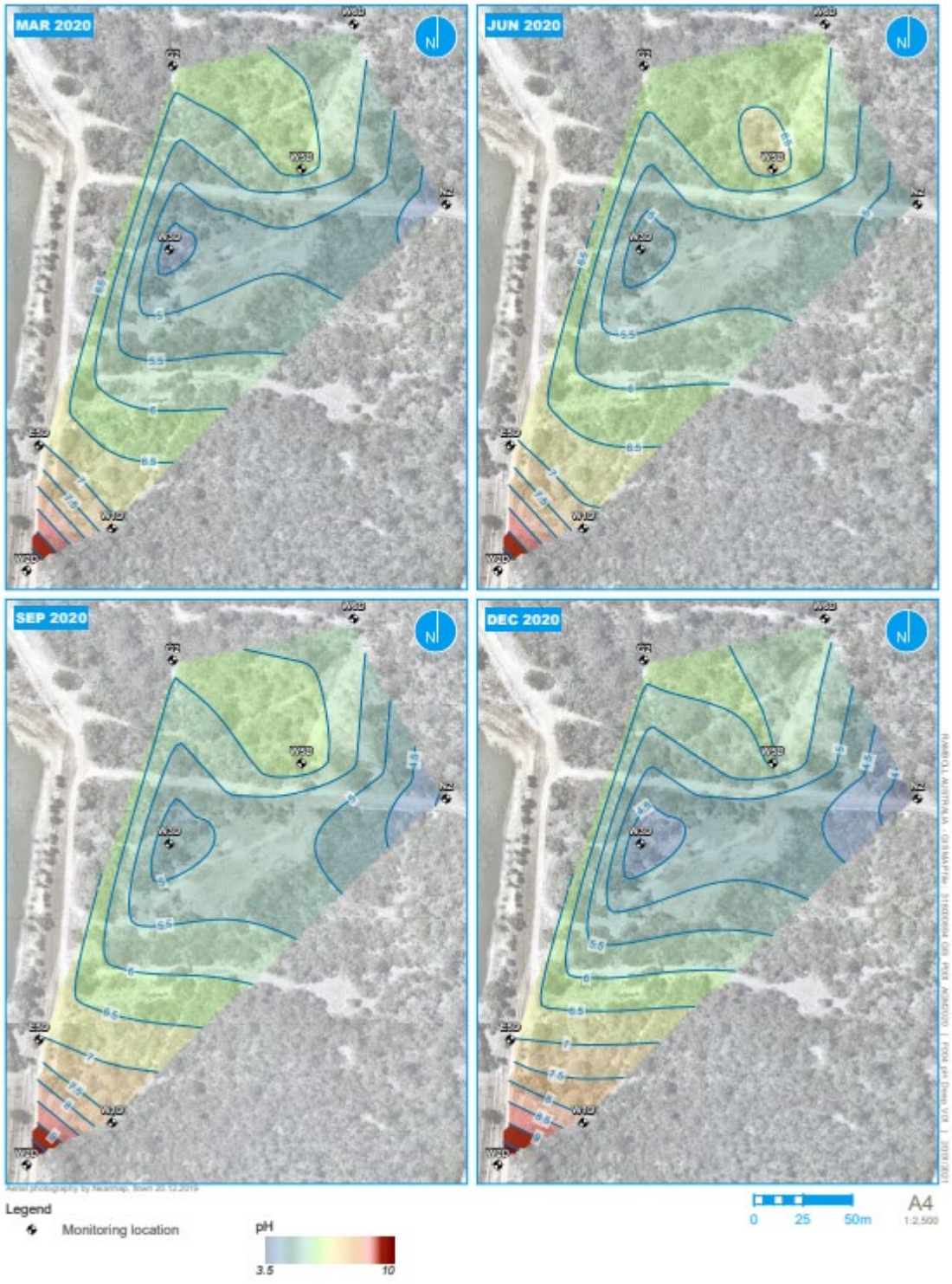


Figure 6-16: Interpolated pH – Deep Aquifer 2020

6.2.2.1 Time Series Trends

Comparison of pH values reported within the deep aquifer for the 29 GMEs completed between July 2013 and December 2020 are shown in **Figure 6-17** to **Figure 6-19**. The blue dotted line shows pH 9 which is indicative of leachate impact.

The time series trends show the following:

- Consistently elevated pH above 9 at well W2D on Section 1
- Some fluctuations in pH in wells on Section 1, Section 2 and Section 3, including an increase in pH at well W1D during the 2020 GMEs
- pH consistently below 8 in down gradient and sentinel wells.

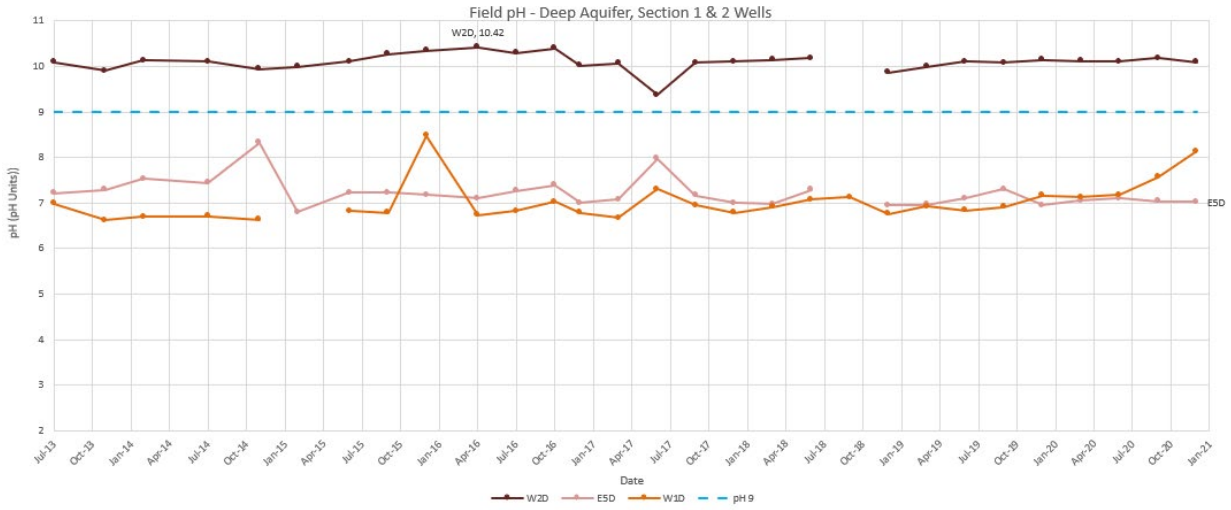


Figure 6-17: Field pH Values – Deep Aquifer, Section 1 & 2 Wells

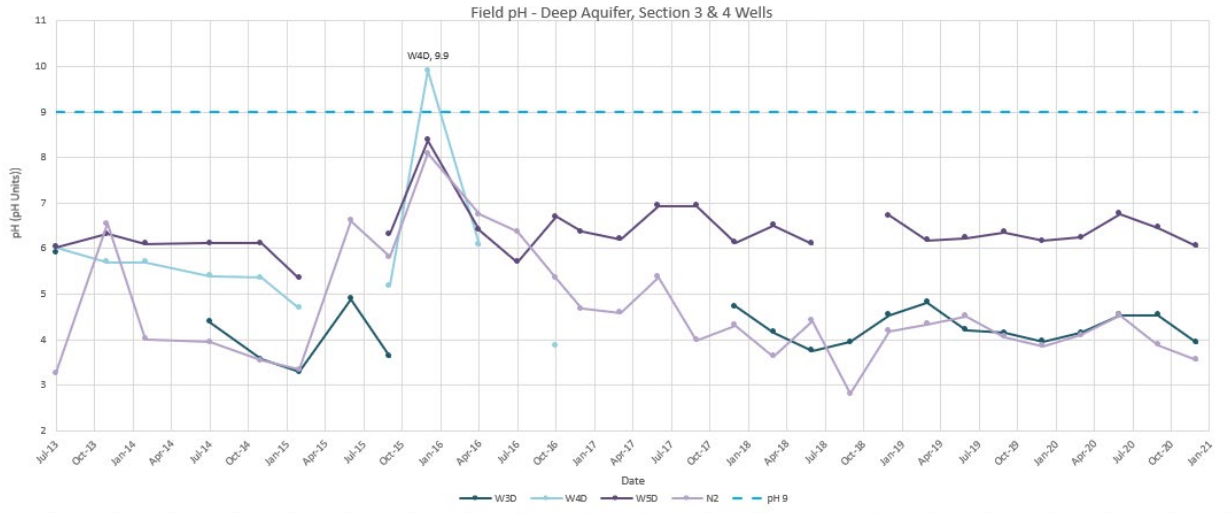


Figure 6-18: Field pH Values – Deep Aquifer, Section 3 & 4 Wells

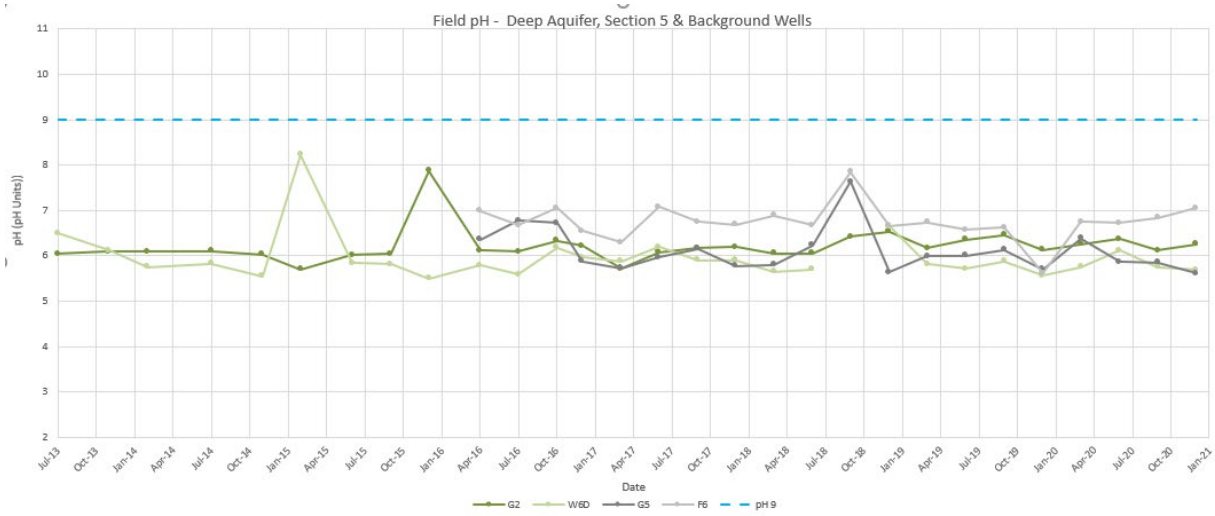


Figure 6-19: Field pH Values, Section 5 & Sentinel Deep Wells (pH Units)

6.2.2.2 Mann-Kendall Trend Analysis

Data from July 2013 to December 2020 (29 sampling events) were included for the purpose of Mann-Kendall trend analysis of pH, a summary is provided in **Table 6-9**.

Mann-Kendall trend analysis of pH within the deep aquifer indicates an increasing trend at W1D, located on Section 2 and G2, located on Section 5. As mentioned above, groundwater pH at deep well W1D increased consecutively from March 2020 and exceeded the assessment criteria for 95% protection of aquatic ecosystems during December 2020. Observations made during sampling indicate that groundwater at this location was consistently yellow during the 2020 GMEs. The increasing pH trend may be indicative of the leachate plume expanding to the east of well W2D, the most leachate-impacted well.

Groundwater pH at G2 does not exceed site assessment criteria, nor is it characteristic of leachate impacted groundwater. Further assessment of pH at G2 identified the increase to be marginal (0.22 pH units between July 2013 and December 2020).

Trend analysis of groundwater pH at W2D, located on Section 1 reported 'no trend'. W2D is located directly adjacent to the CWS and reports the highest pH values of wells within the deep aquifer.

Table 6-8: Mann-Kendall pH Trends - Deep Aquifer

Well	Previous Trend 2013 to 2019	Current Trend 2013 to 2020	pH >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
W2D	No Trend	No Trend	**Yes**	**Yes**
E5D	**Decreasing**	**Decreasing**	No	No
Section 2				
W1D	**Increasing**	**Increasing**	**Yes**	No
Section 3				
W3D	Stable	Stable	No	No
~~W4D~~	*Destroyed*	*Destroyed*	*Destroyed*	*Destroyed*
Section 4				
W5D	Prob. Increasing	Prob. Increasing	No	No
N2	Stable	Prob. Decreasing	No	No

Well	Previous Trend 2013 to 2019	Current Trend 2013 to 2020	pH >Assessment Criteria[1]	Leachate Impacted[2]
Section 5				
G2	**Increasing**	**Increasing**	No	No
W6D	Stable	Stable	No	No
Sentinel				
G5	Prob. Decreasing	**Decreasing**	No	No
F6	Prob. Decreasing	No Trend	No Trend	No

I.D Insufficient data to perform trend analysis
[1] Free cyanide exceeded the assessment criteria of either 95% Protection of Aquatic Ecosystems or Recreational during any GME completed in 2020
[2]Groundwater generally characteristic of leachate impact i.e. pH >9, brown in colour

6.2.3 Soluble Fluoride

Laboratory results for soluble fluoride in the deep aquifer reported during 2020 are summarised in **Table 6-10**.

Table 6-9: Soluble Fluoride Concentrations – Deep Aquifer

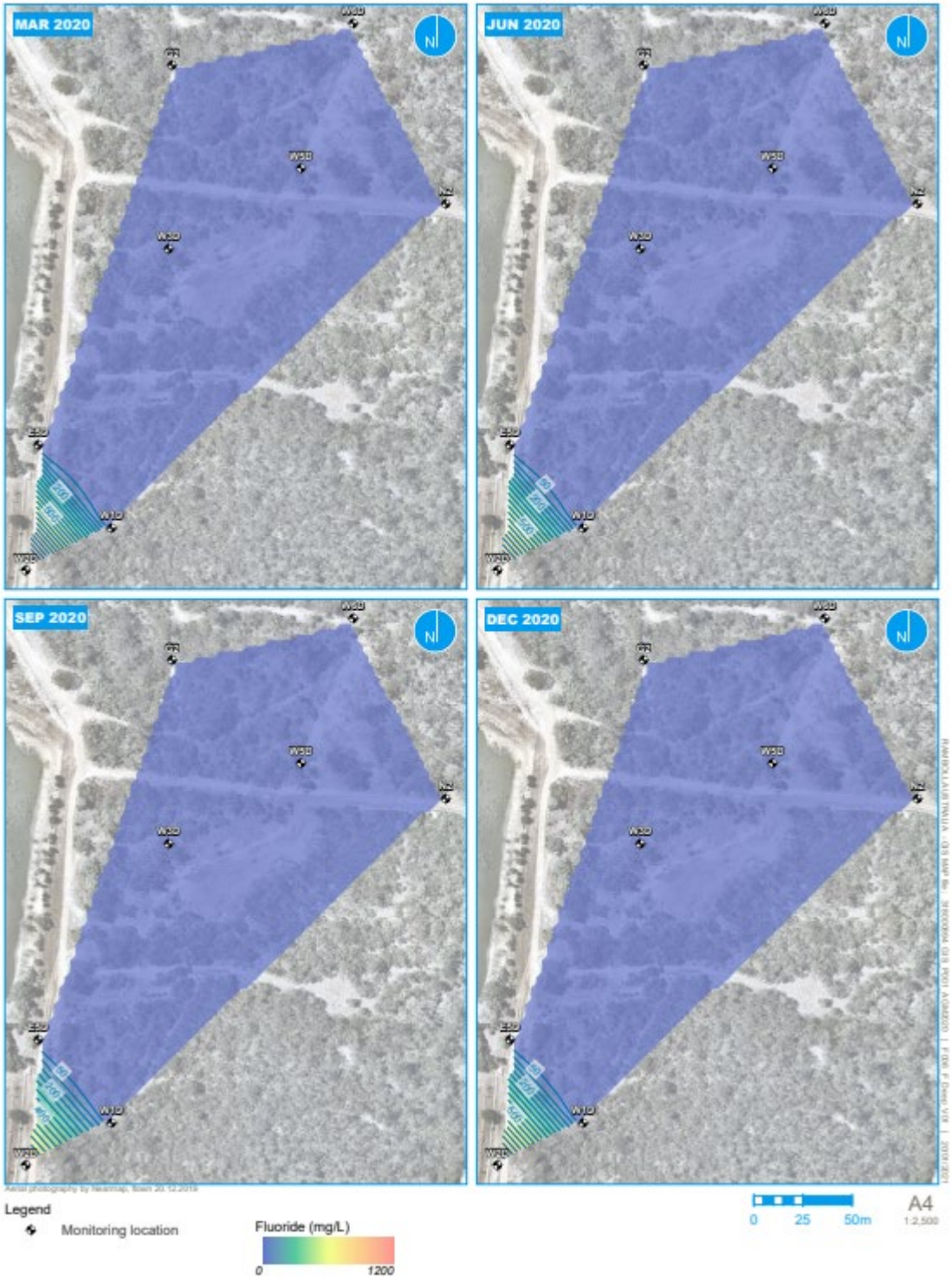
Contaminant of Concern	Date	No. of Samples	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	No. Results Exceeding Criteria
Soluble Fluoride	March 2020	10	<0.1	1300	**3 (Irrigation, Stock Watering & Recreational)**
	June 2020	10	<0.1	1100	**3 (Irrigation, Stock Watering & Recreational)**
	September 2020	10	<0.1	800	**3 (Irrigation, Stock Watering & Recreational)**
	December 2020	10	<0.1	1000	**3 (Irrigation, Stock Watering & Recreational)**

During the GMEs completed throughout 2020 soluble fluoride exceeded site assessment criteria at three wells as follows:

- Section 1: W2D and E5D
- Section 2: W1D

The highest soluble fluoride concentrations were consistently reported at Section 1 deep well W2D.

The lateral extent of soluble fluoride in the deep aquifer throughout 2020 is presented in **Figure 6-20**.


MAR 2020
JUN 2020
SEP 2020
DEC 2020
N
W20
W21
W30
W31
W32
W33
W34
W35
W36
W37
W38
W39
W40
W41
W42
W43
W44
W45
W46
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W54
W55
W56
W57
W58
W59
W60
W61
W62
W63
W64
W65
W66
W67
W68
W69

6.2.3.1 Time Series Trends

Comparison of soluble fluoride concentrations within the deep aquifer for the 29 GMEs completed between July 2013 and December 2020 are shown in **Figure 6-21** to **Figure 6-24** with concentrations for W2D only, shown in **Figure 6-21**.

The time series trends show the following:

- Consistently elevated soluble fluoride concentrations at well W2D on Section 1
- Some initial fluctuations in concentrations on Section 1 to Section 5 followed by consistently lower soluble fluoride concentrations from 2017 to 2020, aside from an increase at W1D in 2020
- Consistently low soluble fluoride concentrations in the sentinel wells

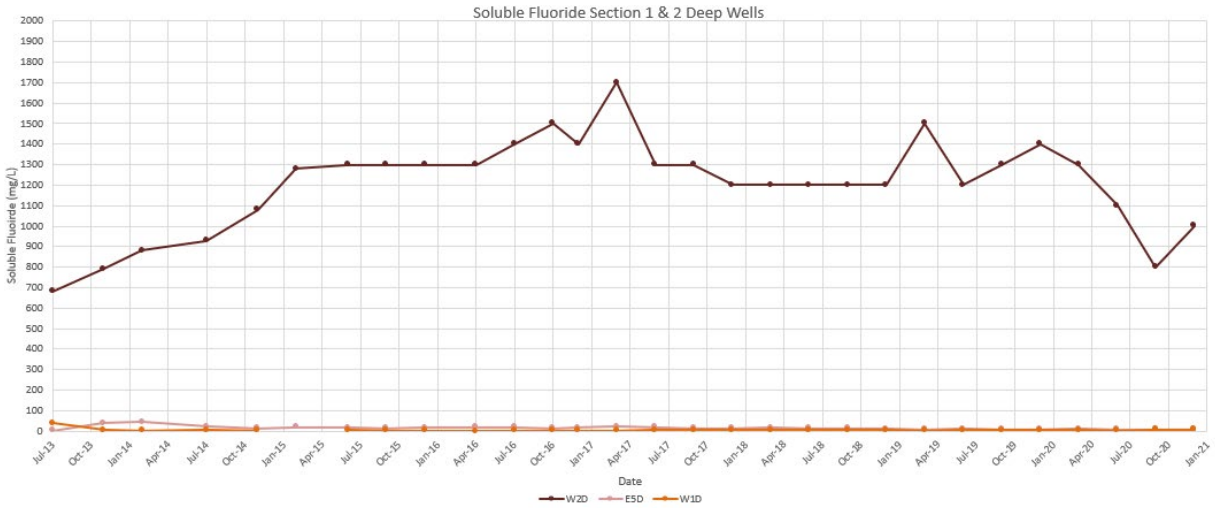


Figure 6-21: Soluble Fluoride Concentrations – Deep Aquifer, W2D

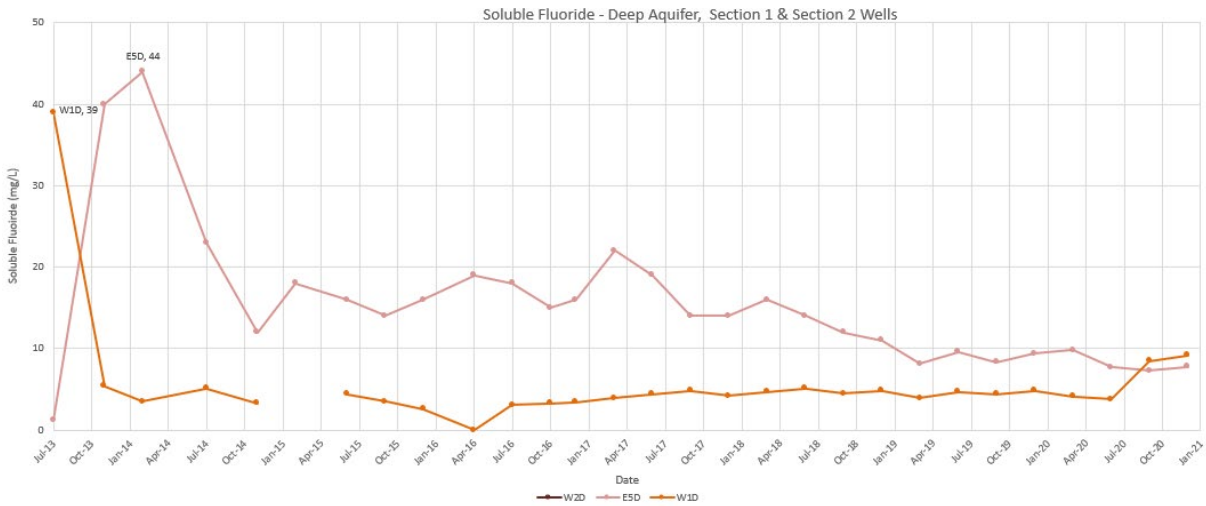


Figure 6-22: Soluble Fluoride Concentrations – Deep Aquifer, Section 1 & 2 Wells

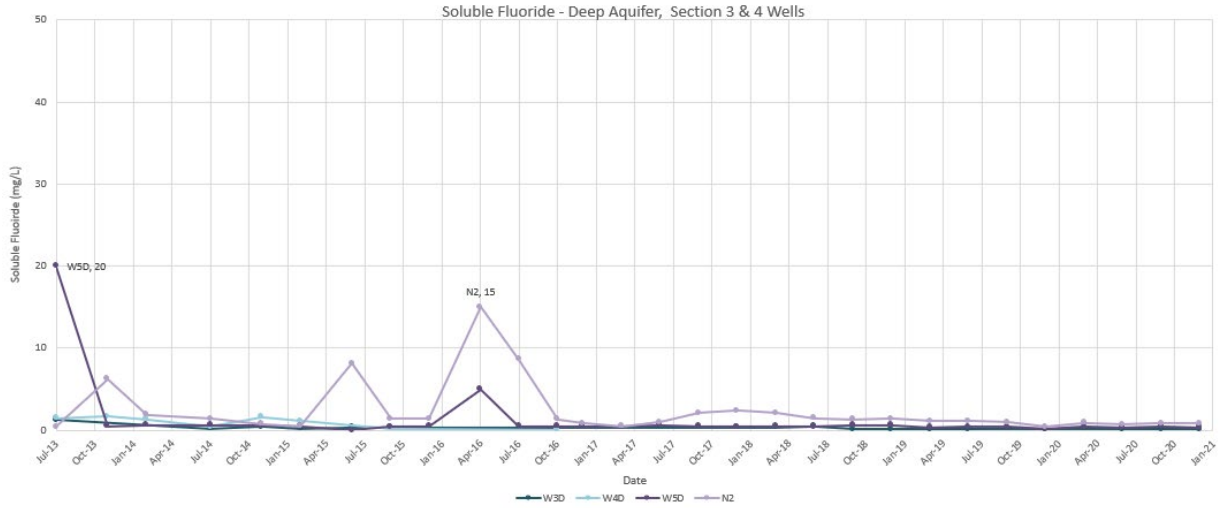


Figure 6-23: Soluble Fluoride Concentrations – Deep Aquifer, Section 3 & 4 Wells

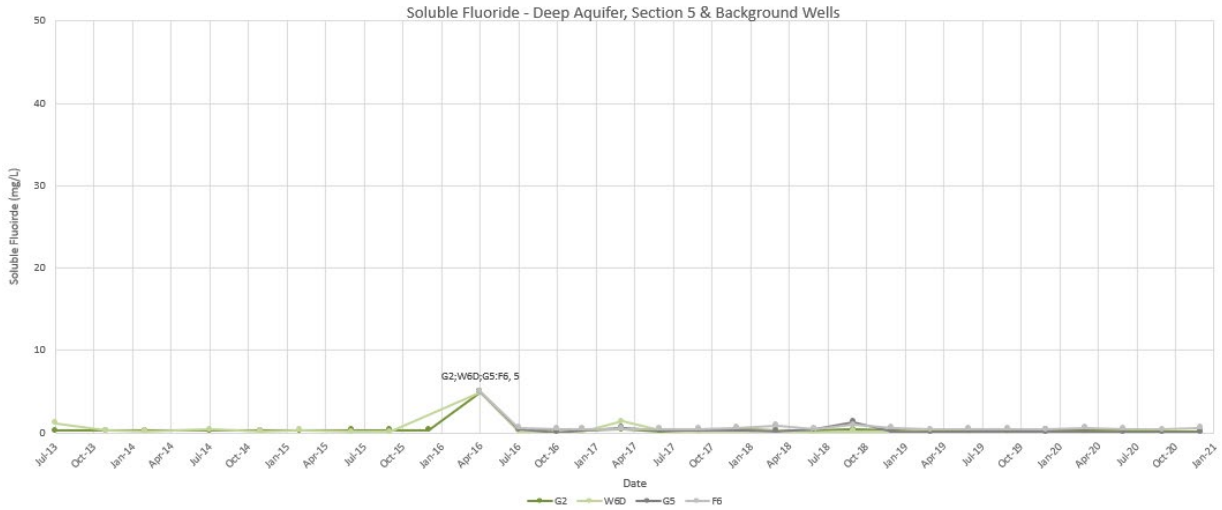


Figure 6-24: Soluble Fluoride Concentrations – Deep Aquifer, Section 5 & Sentinel Wells

6.2.3.2 Mann-Kendall Trend Analysis

Data from July 2013 to December 2020 (29 sampling events) were included for the purpose of Mann-Kendall trend analysis of soluble fluoride, a summary is provided in **Table 6-11**. Mann-Kendall trend analysis of soluble fluoride indicates 'decreasing' or 'no trend' in the deep wells. Increasing trends that were identified at wells W2D and G2 in the period 2013 to 2019 now show 'no trend'.

Table 6-10: Mann-Kendall Soluble Fluoride Trends - Deep Aquifer

Well	Previous Trend 2013 to 2019	Current Trend 2013 to 2020	Soluble Fluoride >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
W2D	**Increasing**	No Trend	**Yes**	**Yes**
E5D	**Decreasing**	**Decreasing**	**Yes**	No
Section 2				
W1D	No Trend	No Trend	**Yes**	No
Section 3				
W3D	**Decreasing**	**Decreasing**	No	No
~~W4D~~	~~Destroyed~~	~~N/A~~	~~Destroyed~~	~~Destroyed~~
Section 4				
W5D	**Decreasing**	**Decreasing**	No	No
N2	No trend	**Decreasing**	No	No
Section 5				
G2	**Increasing**	No Trend	No	No
W6D	**Decreasing**	**Decreasing**	No	No
Sentinel				
G5	**Decreasing**	**Decreasing**	No	No
F6	Prob. Decreasing	No Trend	No	No

I.D Insufficient data to perform trend analysis

[1]Soluble Fluoride exceeded the assessment criteria of either 95% Protection of Aquatic Ecosystems or Recreational during any GME completed in 2020

[2]Groundwater generally characteristic of leachate impact i.e. pH >9, brown in colour

6.2.4 Free Cyanide

Laboratory results for free cyanide in deep groundwater reported during 2020 are summarised in **Table 6-12**. Free cyanide concentrations exceeded the site assessment criteria for 95% protection for aquatic ecosystems at W2D during March 2020 and December 2020. All other wells targeting the deep aquifer reported free cyanide concentrations below the laboratory limit of reporting.

Table 6-11: Free Cyanide Concentrations – Deep Aquifer

Contaminant of Concern	Date	No. of Samples	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	No. Results Exceeding Criteria
Free Cyanide	March 2020	10	<0.004	0.009	**1 (95% Protection)**
	June 2020	10	<0.004	0.002	0
	September 2020	10	<0.004	0.008	**1 (95% Protection)**
	December 2020	10	<0.004	0.006	0

6.2.4.1 Time Series Trends

Comparison of free cyanide concentrations at W2D for twenty-four GMEs completed between February 2015 and December 2020 are shown in **Figure 6-25**. Only concentrations at W2D have been graphed because all other concentrations have historically fallen below the laboratory limit of reporting. Free cyanide concentrations at W2D fluctuated above and below the assessment criteria during 2020 but have decreased overall between June 2015 and December 2020.

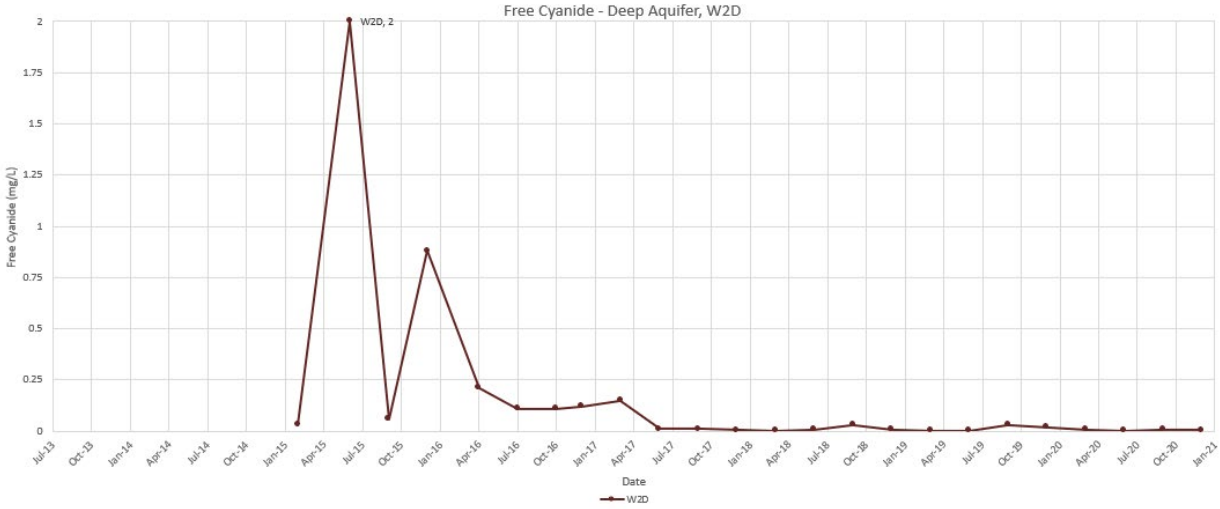


Figure 6-25: Free Cyanide Concentration – Deep Aquifer, W2D

6.2.4.2 Mann-Kendall Trend Analysis

Data from February 2015 to December 2020 (24 sampling events) were included for the purpose of Mann-Kendall trend analysis of free cyanide, a summary is provided in **Table 6-13**. Mann-Kendall trend analysis of free cyanide in the deep aquifer shows a 'stable' trend at all wells aside from the leachate impacted well W2D, which shows a 'decreasing' trend.

Table 6-12: Mann-Kendall Trend Analysis of Free Cyanide – Deep Aquifer

Well	Previous Trend 2013 to 2019	Current Trend 2013 to 2020	Free Cyanide >Assessment Criteria[1]	Leachate Impacted[2]
Section 1				
W2D	**Decreasing**	**Decreasing**	**Yes**	**Yes**
E5D	Stable	Stable	No	No
Section 2				
W1D	Stable	Stable	No	No
Section 3				
W3D	Stable	Stable	No	No
~~W4D~~	Destroyed	NA	Destroyed	Destroyed
Section 4				
W5D	Stable	Stable	No	No
N2	Stable	Stable	No	No
Section 5				
G2	Stable	Stable	No	No
W6D	Stable	Stable	No	No
Sentinel				
G5	Stable	Stable	No	No
F6	Stable	Stable	No	No

I.D Insufficient data to perform trend analysis

[1]Free cyanide exceeded the assessment criteria of either 95% Protection of Aquatic Ecosystems or Recreational during any GME completed in 2020

[2]Groundwater generally characteristic of leachate impact i.e. pH >9, brown in colour

7. HYDRO DATA

Hydro collect groundwater samples for analysis from the monitoring well network in between the Ramboll quarterly GMEs. Twenty-eight (28) sampling events have been completed by Hydro between May 2014 and December 2020. 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 **Table 7-1** 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 GMEs completed by Ramboll.

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

Date	W1S	W1D	W2D	W7S	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	-	-	-	-	-
March 2020	-	5.6	1,100	-	8.4	180	-	-	-	-

Date	W1S	W1D	W2D	W7S	E5D	W3S	W4S	W5S	W6S	W6D
June 2020	-	6.8	650	-	8.0	130	-	-	-	-
September 2020	-	12	910	-	17	33	-	-	-	-
December 2020	-	9.6	770	-	11	<0.5	-	-	-	-

- *Not sampled*

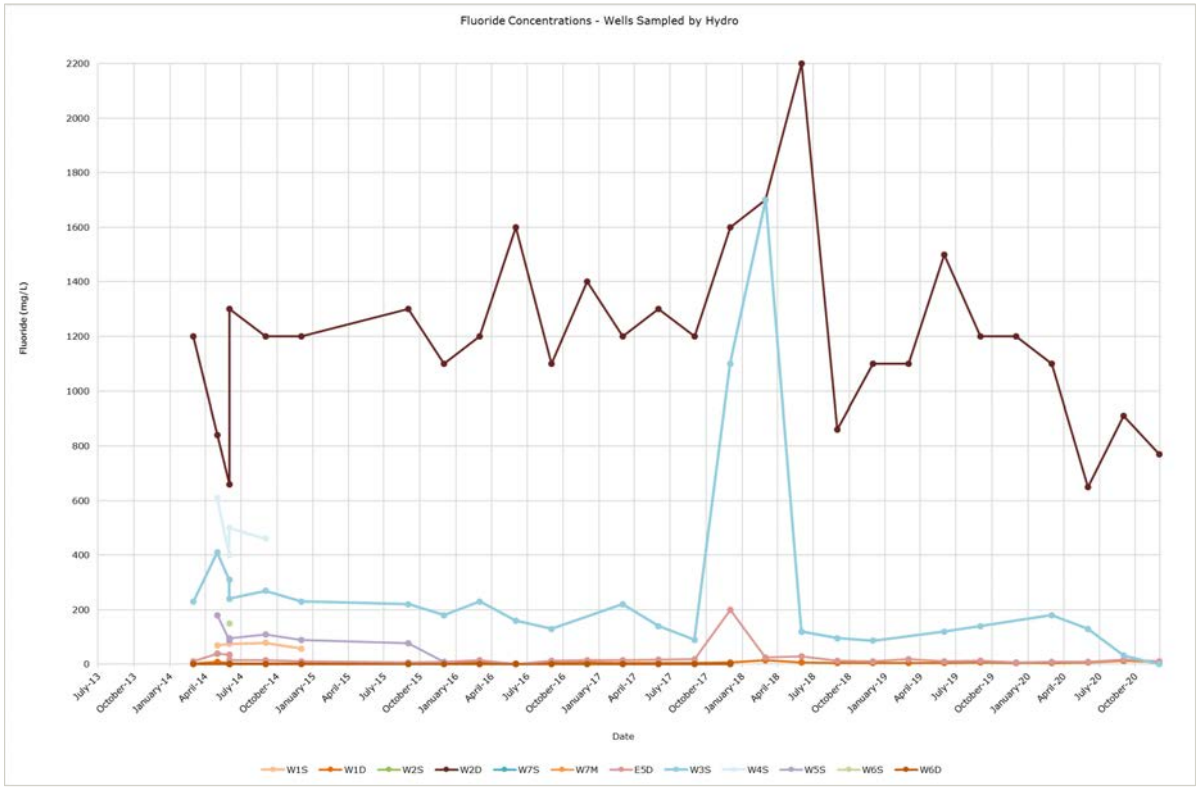


Figure 7-1: Fluoride Concentrations in Wells Sampled by Hydro

8. CONCLUSIONS AND RECOMMENDATIONS

Twenty-nine 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 2020.

Each GME included the sampling and analysis of groundwater from a network of 27 shallow and deep wells located on five sections along the length of the leachate plume down-gradient of the CWS. An additional pair of two shallow and deep wells were added to the network in 2016. 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 2020 GME data has identified the following:

- The leachate plume in shallow groundwater is delineated to the north, with a stable trend in soluble fluoride concentrations in well N9 at the leading edge of the plume
- The leachate plume in shallow groundwater is not expanding, with no increasing trends in pH or soluble fluoride concentrations in wells not impacted by leachate, aside from well N8 where pH and soluble fluoride concentrations remain low and are not indicative of leachate impact
- Consistent with previous monitoring, the leachate plume has impacted a deeper sand aquifer in a localised area close to the plume source, the CWS, as shown by elevated soluble fluoride concentrations and a high pH in well W2D. Concentrations at this well have been elevated over the monitoring period and there is no increasing trend observed, however there may be some expansion of impact to the east, towards W1D, with yellow coloured groundwater observed and an increasing pH trend identified although there is currently no trend in soluble fluoride concentrations, and pH remains low
- Consistent with previous monitoring, the leachate plume is not reaching the nearest surface water receptor of Swamp Creek, as indicated by low pH and low soluble fluoride concentrations in sentinel wells
- Installation of leachate interception trenches as an interim remedial measure has led to an improvement in down gradient surface water quality and vegetation health, with grasses now growing in both vegetation impact areas

Monitoring of groundwater and occasional pump out of the passive leachate interception trenches is proposed to continue until remediation of the Capped Waste Stockpile is completed in 2022.

9. REFERENCES

ANZG (2018) Guidelines for Fresh and Marine Water Quality

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

ENVIRON (February 2015) Groundwater Fate and Transport Modelling, Leachate Plume – Capped Waste Stockpile, Hydro Aluminium Smelter Kurri Kurri, NSW

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

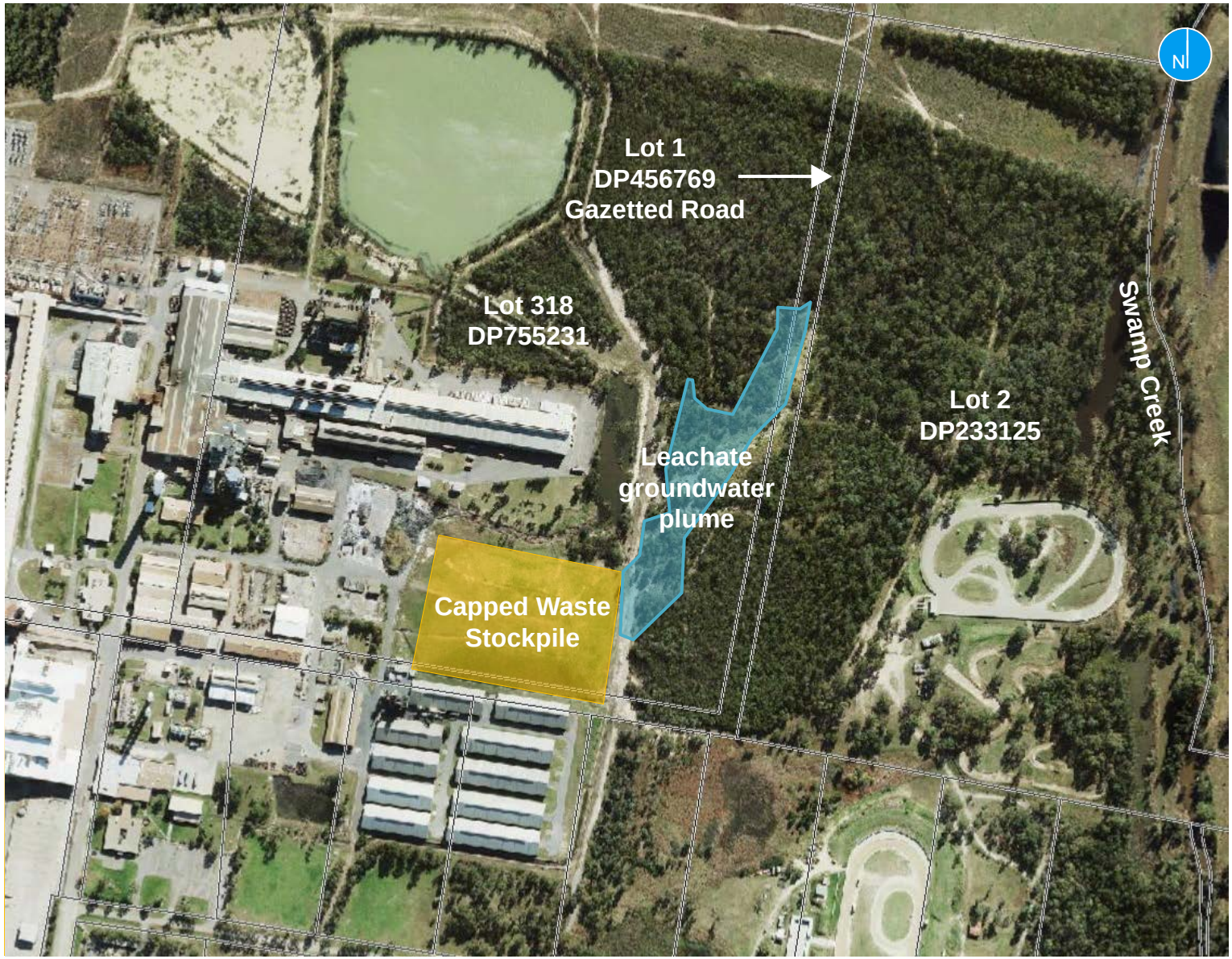
ENVIRON (September 2016) Plume Delineation Report, Capped Waste Stockpile

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



RAMBOLL/AUSTRALIA - GIS MAP file : 318000664 - 2019 Annual Groundwater Monitoring Report - Figure 1

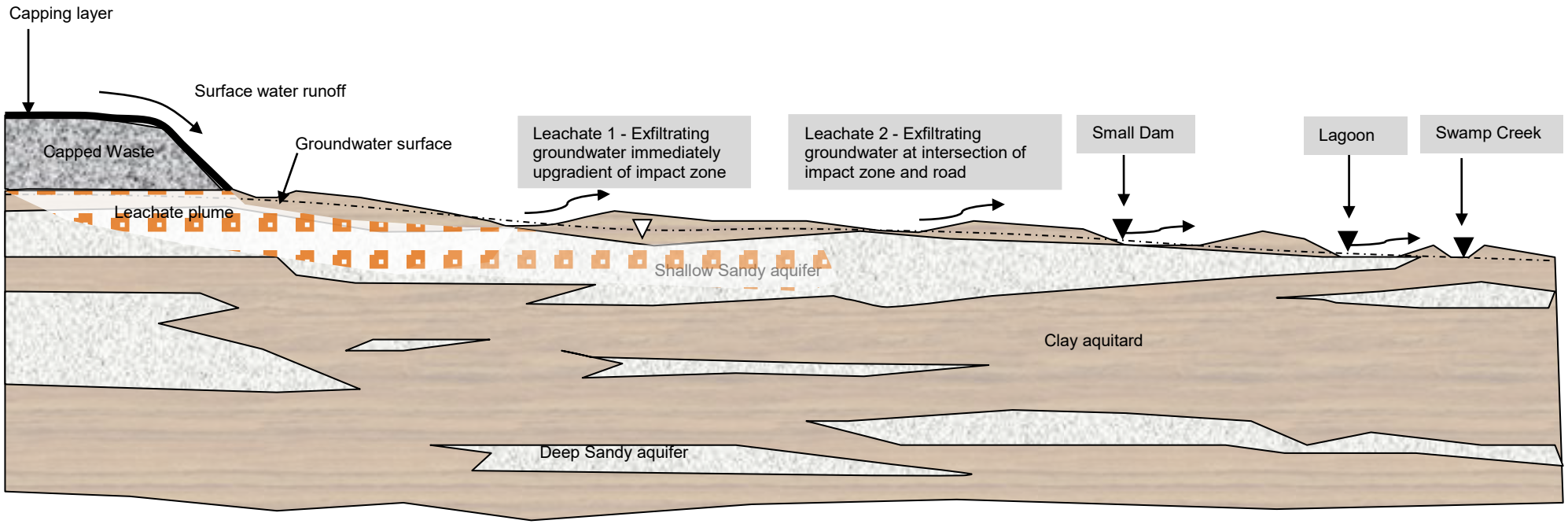
Figure 1 | AEC 1: Site Location Plan, 2020 Annual Groundwater Monitoring Report



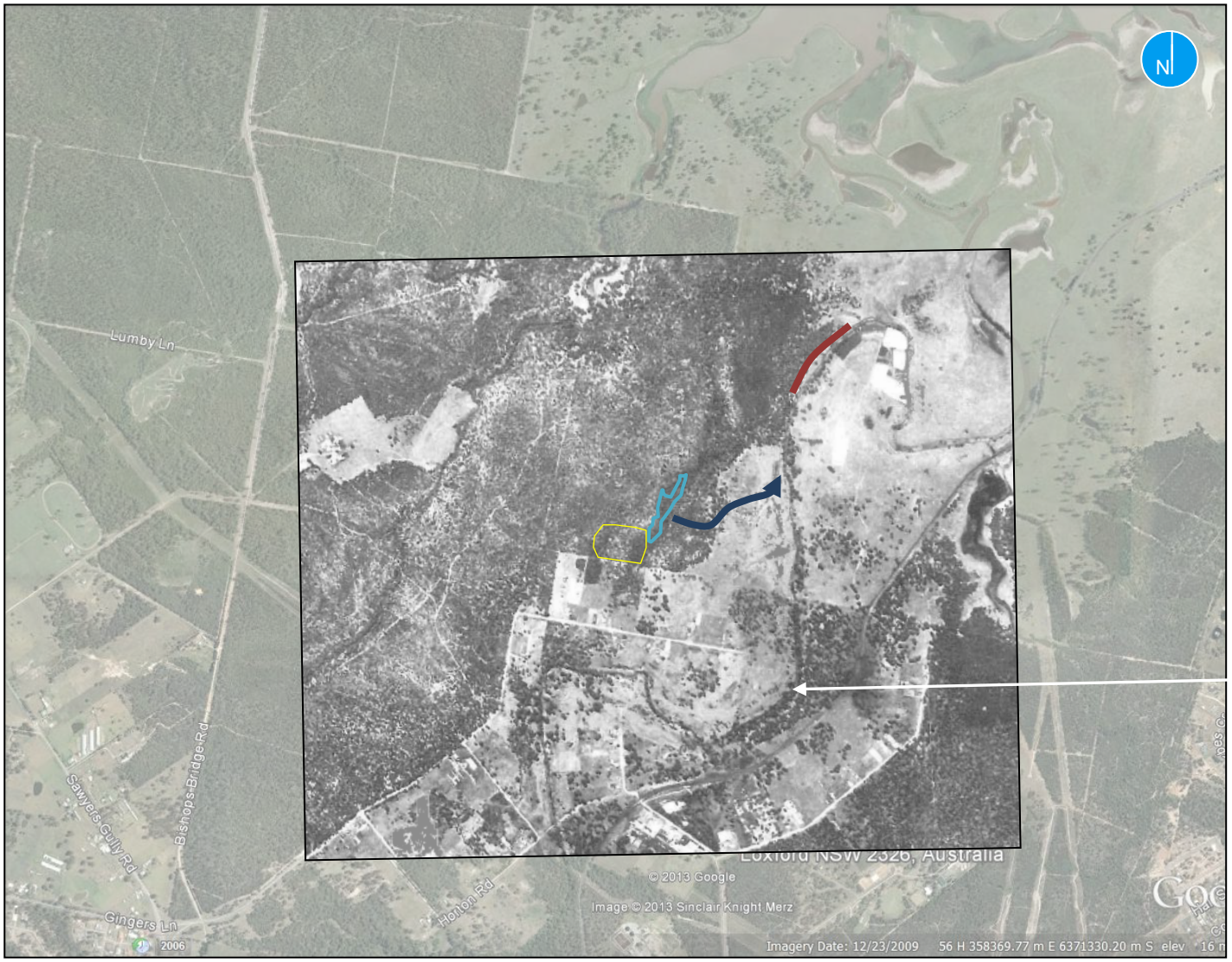
RAMBOLL AUSTRALIA - GIS MAP file : 318000664 - 2019 Annual Groundwater Monitoring Report - Figure 2

Figure 2 | Groundwater Monitoring Well Network, 2020 Annual Groundwater Monitoring Report

APPENDIX 2
ATTACHMENTS

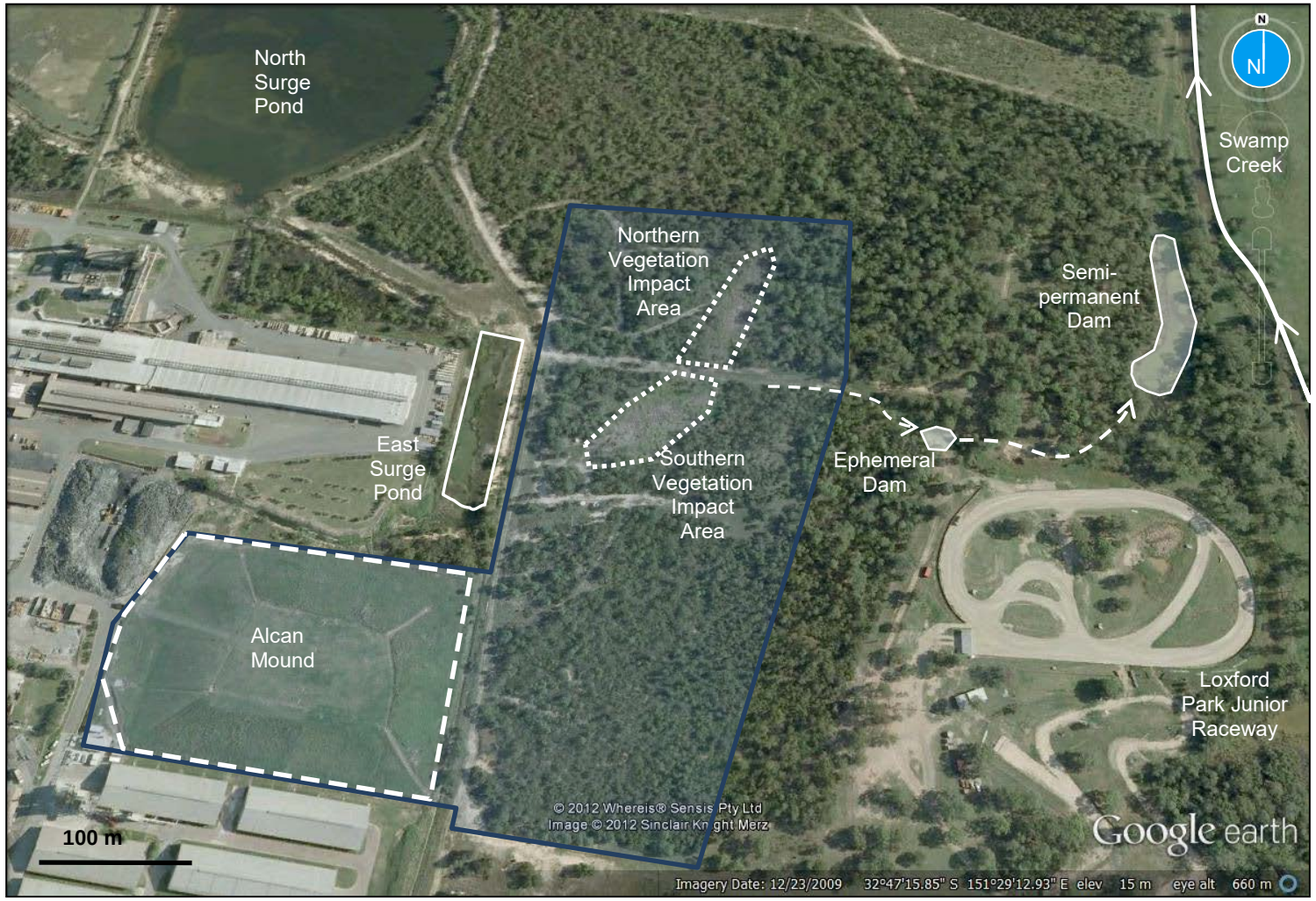


RAMBOLL AUSTRALIA - GIS MAP file : 318000664 - 2019 Annual Groundwater Monitoring Report - Attachment 1



RAMBOLL AUSTRALIA - GIS MAP file : 318000664 - 2019 Annual Groundwater Monitoring Report - Attachment 2

Attachment 2 | 1961 Aerial Photograph showing Plume Location, 2019 Annual Groundwater Monitoring Report



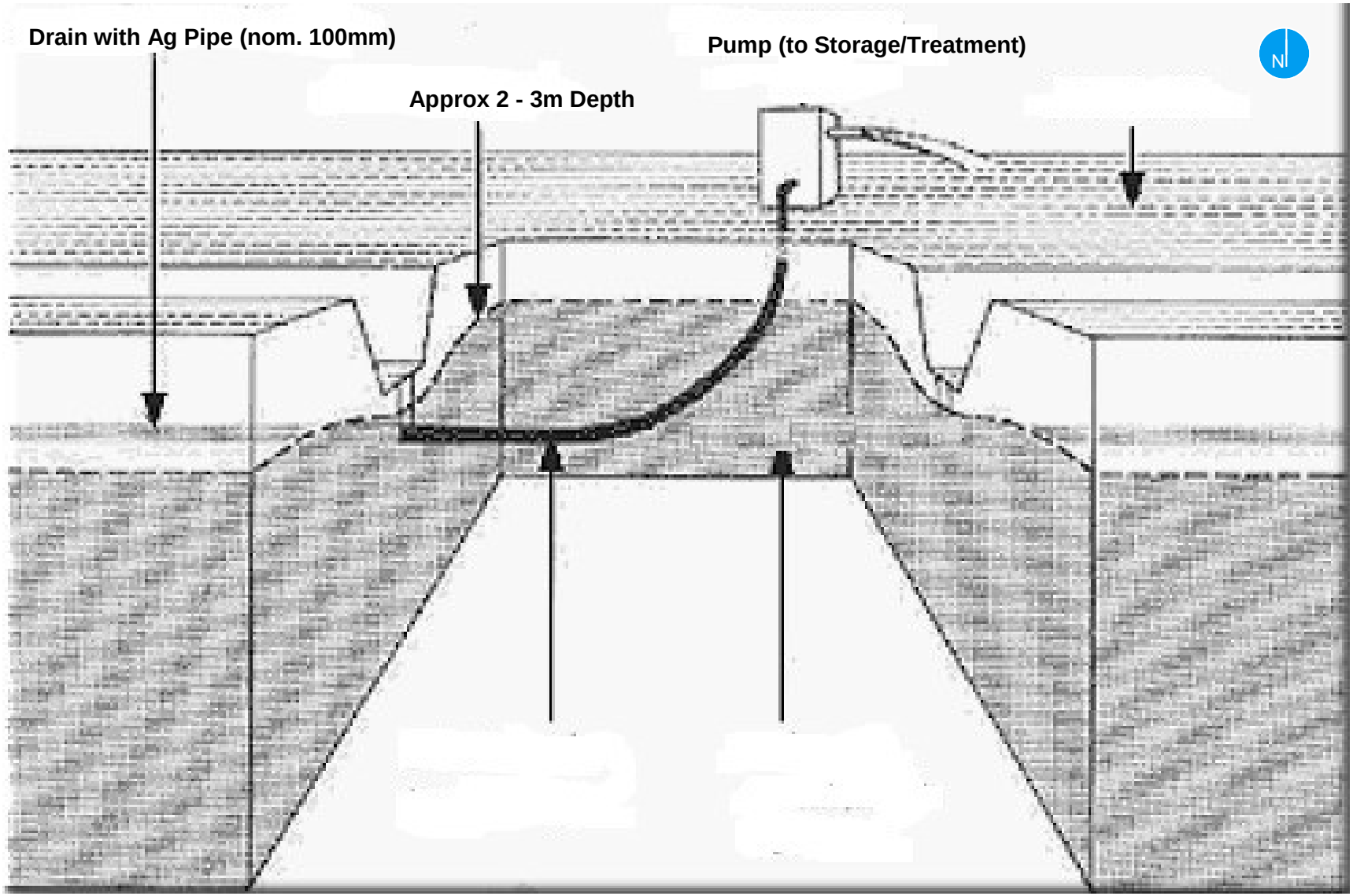
RAMBOLL AUSTRALIA - GIS MAP file : 318000864 - 2019 Annual Groundwater Monitoring Report - Attachment 3



13

Topographic Contours mAHD (based on 1m Lidar)

RAMBOLL AUSTRALIA - GIS MAP file : 318000864 - 2019 Annual Groundwater Monitoring Report - Attachment 4



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

APPENDIX 3
2013-2020 GME HISTORICAL DATA

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table i: Results
Shallow Aquifer, Section 1

RAMBOLL

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
					Sample ID:		W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		12.489	12.619	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
					Sample Description:		Light brown	Clear	Dry	Dry	Dry	Dry	Turbid, brown, purged dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	7.33	6.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	***115***	***58***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***91.5***	***33***	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table i: Results
Shallow Aquifer, Section 1

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14
Sample ID:							W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	W2S	E5	E5	E5	E5	E5
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							-			12.139						13.289	12.379	12.049	12.214	12.054	11.804	-	-
Sample Description:							Dry	Dry	Dry	Clear, no odour	Dry	Dry	Dry	Dry	Dry	Clear, turbid	Turbid, pale yellow, no odour	Turbid, light brown, no odour	Brown	Brown	Brown	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	-	-	-	7.47	-	-	-	-	-	6.74	6.73	6.97	*9.54*	*9.37*	*9.78*	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	-	-	-	***92***	-	-	-	-	-	***20***	***20***	***66***	***495***	***410***	***450***	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	0.01	-	-	-	-	-	<0.004	<0.004	0.008	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	3.9	-	-	-	-	-	0.17	0.48	1.8	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	-	-	-	***37***	-	-	-	-	-	***18***	***19***	***31***	0.33	0.52	2.5	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	***11***	-	-	-	-	-	***9.6***	***7.2***	***5.2***	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentrations below the LOR noted as <value

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table i: Results
Shallow Aquifer, Section 1

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	14-April-2017	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19
Sample ID:							E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5	E5
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							-	11.904	11.614	-	11.724	-	-	-	-	-	-	-	-	-	-	-	-
Sample Description:							Dry	Brown	Brown	Dry	Brown	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]				5 - 9	pH units	-	-	*9.14*	*9.42*	-	*9.48*	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Fluoride		1		2	1.5	mg/L	0.1	-	***410***	***350***	-	***330***	-	-	-	-	-	-	-	-	-	-	-	-
Free Cyanide	0.007				0.1	mg/L	0.004	-	*<0.8*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5		5	9	mg/L	0.01	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table i: Results
Shallow Aquifer, Section 1

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16
					Sample ID:		E5	E5	E5	E5	E5	E5	E5	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		-	-	-	-	12.054	12.184	11.914	12.487	12.352	11.862	11.042	11.312	11.262	11.952	11.702	11.652	11.932
					Sample Description:		Dry	Dry	Dry	Dry	Slightly red/brown	Clear, yellow/brown, no odour	Clear to slightly turbid, brown, no odour	Light brown	Light brown, cloudy	Brown, murky, light brown	Brown, no odour	Brown, turbid, some odour	Light brown, no odour	Light brown	Very turbid, brown	-	Brown, turbid
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	-	-	-	-	8.79	*9.11*	*9.2*	7.45	7.24	*9.65*	*10.14*	*10.01*	*9.95*	*9.87*	*10.22*	*10.27*	*10.13*
Soluble Fluoride		1	2	1.5		mg/L	0.1	-	-	-	-	***220***	***250***	***300***	***79***	***51***	***280***	***550***	***930***	***740***	***200***	***680***	***360***	***570***
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	0.007	0.011	0.01	-	-	-	-	-	0.021	<0.08	0.029	0.1	0.01
Total Cyanide						mg/L	0.004	-	-	-	-	62	57	79	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	-	-	-	-	0.9	1	3.6	***58.1***	***60***	***17***	-	***310***	***370***	***120***	***610***	***97***	***280***
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	0.08	0.07	0.12	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table i: Results
Shallow Aquifer, Section 1

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20
					Sample ID:		PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		11.842	11.842	11.662	11.542	11.742	11.572	11.412	11.302	11.772	11.572	11.522	11.422	11.502	11.432	11.302	11.662	13.362
					Sample Description:		Very turbid, brown	-	Milky	Brown	Brown	Milky brown	Brown	Turbid, brown	Light brown, no odour	Light brown/grey, hydrogen sulfide odour	Clear to slightly brown, no odour	Slightly brown, slight sulphidic odour	Slightly turbid, clear, no odour	Brown/grey, sulphidic odour	Turbid, slightly brown	Yellow/brown, turbid	Clear, no odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	*10.22*	*9.98*	*9.72*	*9.56*	*9.2*	*9.9*	*9.6*	*9.73*	*9.17*	*13.68*	*9.55*	*9.42*	*9.43*	*9.89*	*9.93*	7.2	*9.59*
Soluble Fluoride		1	2	1.5		mg/L	0.1	***280***	***85***	***88***	***210***	***60***	***180***	***160***	***220***	***62***		***250***	***370***	***140***	***400***	***530***	***30***	***17***
Free Cyanide	0.007			0.1		mg/L	0.004	0.018	<0.004	0.006	0.006	<0.004	<0.005	0.009	<0.004	<0.004	0.01	0.009	<0.004	<0.004	0.014	0.007	<0.004	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	20	4.1	44	14	21	9.8	35	57	0.31	0.009
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***93***	***90***	***120***	***740***	***39***	***160***	***45***	***82***	***46***	***23***	**5.4**	***9.3***	***38***	***93***	***77***	***49***	3.2
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	0.09	0.46	1.9	1.3	4.3	0.86	2.9	***17***	0.44

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

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Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table i: Results
Shallow Aquifer, Section 1

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17
					Sample ID:		PUMP	PUMP	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		12.422	12.402	12.614	12.969	-	-	-	-	-	-	-	-	-	-	-	-	-
					Sample Description:		Turbid, yellow, no odour	Slightly turbid, light brown, no odour	Cloudy/turbid	Light brown, cloudy sediment	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	7.4	6.88	7.29	7.1	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	***21***	***22***	***34***	***31***	-	-	-	-	-	-	-	-	-	-	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	0.077	0.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	**6.1**	***12***	***415***	***42***	-	***210***	-	-	-	-	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	0.76	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table i: Results
Shallow Aquifer, Section 1

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14
					Sample ID:		W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7S	W7M	W7M	W7M
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		-	-	-	-	-	-	-	-	-	-	-	13.019	12.369	-	12.218	12.138	11.568
					Sample Description:		Purge dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Clear, no odour	Turbid, yellow/brown, no odour	Dry	Light brown	Brown	Brown, dark, sulphur smell
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	-	-	-	-	-	-	-	-	-	-	-	8.08	7.61	-	*9.81*	*9.87*	*10.1*
Soluble Fluoride		1	2	1.5		mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	***17***	***22***	-	***878***	***650***	***730***
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	<0.004	<0.004	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	0.08	1.1	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	**5.9**	***65***	-	***11.4***	2.3	***45***
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	2.1	0.55	-	-	-	-

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Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table i: Results
Shallow Aquifer, Section 1

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:						Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:						Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:						Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18
Sample ID:						W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M
Project Name:						Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:						Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:						Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
Aquifer:						Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):						10.958	11.088	10.918	11.938	11.608	11.518	11.668	11.578	11.568	11.388	11.278	11.458	11.298	11.128	11.018	11.478	11.298
Sample Description:						Brown, no odour	Brown, turbid, some odour	Brown/copper, strong odour	Brown	Brown	-	Brown	-	Brown	-	Brown	Brown	Brown	Tea brown	Tea brown	Turbid, light brown, no odour	Turbid, brown, no odour
Analyte grouping / Analyte						**Units**	**LOR**															
pH (field)	6.5-8[a]			5 - 9		pH units	-	*10.12*	*9.78*	*9.44*	*9.82*	*9.91*	*9.7*	*9.99*	*9.95*	*10.17*	*9.68*	*9.61*	*10.1*	*9.8*	*9.6*	*9.61*	*9.7*	*13.24*
Soluble Fluoride		1	2	1.5		mg/L	0.1	-	***910***	***840***	***810***	***670***	***540***	***640***	***870***	***1100***	***1000***	***220***	***750***	***760***	***780***	***770***	***810***	***860***
Free Cyanide	0.007			0.1		mg/L	0.004	-		0.02	***<2***	***<0.4***	*0.21*	0.013	0.072	-	0.007	0.09	0.007	0.005	0.006	<0.004	0.008	0.017
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	140	190	160
Aluminium (total)	0.055	5	5	9		mg/L	0.01		***21***	0.99	***32***	**8.7**	**7.8**	4.4	0.08	**6.2**	***11***	3.4	1.3	1.2	3.6	***10***	0.76	**6.6**
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16	0.14

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Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table i: Results
Shallow Aquifer, Section 1

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational										
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20
					Sample ID:		W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M	W7M
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		11.268	11.138	11.228	11.158	11.068	11.348	12.148	12.188	11.858
					Sample Description:		Slightly brown, slight odour	Slightly brown	Brown, no odour	Brown/red, slightly sulphidic odour	Slightly brown	Slightly red/brown, no odour	Clear, no odour	Clear to slightly turbid, brown, no odour	Slightly turbid, brown, no odour
Analyte grouping / Analyte						**Units**	**LOR**								
pH (field)	6.5-8[a]			5 - 9		pH units	-	*9.63*	*9.68*	*9.65*	*9.73*	*9.75*	*9.67*	*8.97*	*9.1*	*9.28*
Soluble Fluoride		1	2	1.5		mg/L	0.1	***820***	***990***	***750***	***800***	***830***	***810***	***440***	***290***	***580***
Free Cyanide	0.007			0.1		mg/L	0.004	0.007	0.006	<0.004	0.006	0.009	0.006	<0.004	0.019	0.009
Total Cyanide						mg/L	0.004	130	150	130	160	160	130	34	28	30
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.31	**7.5**	1.5	2	***10***	0.74	2.8	***11***	***11***
Aluminium (dissolved)						mg/L	0.01	0.22	0.28	0.30	0.30	0.27	0.39	0.83	2.60	0.76

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table ii: Results
Shallow Aquifer, Section 2

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							11.887	11.977	11.367	11.277	-	11.217	11.527	11.207	11.317	11.297	-	-	-	-	-	-	-
Sample Description:							Brown	Brown	Brown, cloudy, sulphur odour	Dark brown	Dry	Brown, no odour	Dark brown, turbid	Brown		Brown	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	7.22	7.17	6.84	6.9	-	6.66	6.83	6.86	-	7.21	-	-	-	-	-	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	***53***	***69***	***42***	-	-	***66***	***120***	***38***	-	***39***	-	-	-	-	-	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	0.004	*<4*	-	-	-	-	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***121***	***130***	***27***	-	-	***120***	***1200***	-	-	***15***	-	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table ii: Results
Shallow Aquifer, Section 2

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14
Sample ID:							W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	W1S	E4	E4	E4	E4	E4
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							-	-	-	-	-	-	-	-	-	10.857	11.487	11.077	11.93	12.09	10.33	11.51	11.28
Sample Description:							Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Turbid, yellow, no odour	Red/brown, sulphidic odour	Brown	Brown, sulphur smell	Brown	Dark brown, no odour	Strong sulphur odour, dark brown
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9	pH units	-	-	-	-	-	-	-	-	-	-	-	7.89	8.24	*9.91*	*9.79*	*9.94*	*9.84*	*9.4*
Soluble Fluoride		1	2	1.5	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	***17***	***17***	***699***	***650***	***650***	***590***	***380***
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	-	-	-	-	-	<0.004	<0.004	-	-	-	-	-
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	0.71	0.7	-	-	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	3.2	**7**	0.379	0.89	0.4	3.2	***35***
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	0.3	0.14	-	-	-	-	-

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[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table ii: Results
Shallow Aquifer, Section 2

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19
Sample ID:							E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							11.31	12.07	11.65	11.5	11.44	11.39	11.38	11.11	11.11	-	11.01	10.81	10.83	11.33	11.12	11.06	10.84
Sample Description:							Brown/orange, no odour	Brown	Dark brown, turbid		Brown	Brown	Turbid, brown	Tea colour	Tea brown	Dry	Milky brown	Dark brown	Brown	Brown/orange, strong hydrogen sulfide odour	Turbid, slightly brown/yellow	Slightly brown, no odour	Slightly brown, slight sulphidic odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	8.84	*9.46*	*9.62*	*10.57*	*9.73*	*9.83*	*9.94*	*9.53*	*9.53*	-	*9.59*	*9.46*	*9.32*	*9.62*	*9.29*	*9.27*	*9.47*
Soluble Fluoride		1	2	1.5		mg/L	0.1	***340***	***260***	***280***	***300***	***330***	***570***	***550***	***450***	***670***	-	***380***	***380***	***410***	***350***	***380***	***410***	***530***
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.4	<0.04	0.032	0.004	0.049	0.045	<0.004	0.029	-	0.008	<0.004	<0.004	<0.004	<0.004	0.006	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	61	69	41	48	57
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***46***	***49***	***53***	***18***	***14***	***9.9***	2.6	***36***	***12***	-	***32***	***37***	***37***	***13***	***22***	1.7	**5.2**
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.42	0.8	1.1

Blank Cell indicates no criterion available
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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table ii: Results
Shallow Aquifer, Section 2

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20
					Sample ID:	E4	E4	E4	E4	E4	E4	E4
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
					Aquifer:	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):	11	9.94	10.77	11.4	11.03	11.93	11.65
					Sample Description:	Slightly yellow, sulphidic odour	Brown, sulphidic odour	Clear to slightly grey	Yellow/brown	Red/brown, no odour	Clear to slightly turbid, orange/brown, slight unknown	Brown/red, easy to filter

Analyte grouping / Analyte					**Units**	**LOR**							
pH (field)	6.5-8[¤]			5 - 9	pH units	-	*9.56*	*9.58*	*9.67*	*9.65*	*9.73*	*9.87*	*10.64*
Soluble Fluoride		1	2	1.5	mg/L	0.1	***490***	***530***	***590***	***560***	***690***	***560***	***680***
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	0.006	0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	74	130	130	110	160	190	1.8
Aluminium (total)	0.055	5	5	9	mg/L	0.01	1.3	0.98	1.8	***14***	0.5	0.55	0.44
Aluminium (dissolved)					mg/L	0.01	0.25	0.83	0.45	0.79	0.36	0.46	0.28

Blank Cell indicates no criterion available
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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
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Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table iii: Results
Shallow Aquifer, Section 3

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:						Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:						Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:						Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:						A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7
Project Name:						Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:						Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:						Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
Aquifer:						Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):						10.279	10.599	9.809	10.059	9.919	10.019	10.489	10.219	10.009	9.999	9.939	9.859	9.699	9.799	9.969	9.669	9.579
Sample Description:						Brown	Brown	Brown	Brown, strong organic material odour	Brown/orange, slightly turbid, slight odour	Dark orange/brown, no odour	Brown	Brown	-	Brown	Brown	Turbid, brown	Brown	Tea brown	Tea brown	Tea brown, foul smell	Tea brown, smelly
Analyte grouping / Analyte						**Units**	**LOR**															
pH (field)	6.5-8[a]			5 - 9		pH units	-	*9.63*	*9.47*	*9.67*	*9.66*	*9.24*	8.56	*9.45*	*9.8*	*10.71*	*9.75*	*9.37*	*9.57*	*9.15*	*9.12*	*9.49*	2.65	*9.27*
Soluble Fluoride		1	2	1.5		mg/L	0.1	***436***	***420***	***410***	***380***	***410***	***550***	***500***	***400***	***320***	***330***	***320***	***360***	***380***	***500***	***400***	***390***	***400***
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	*11*	*<2*	<0.020	*0.19*	<0.004	0.026	0.032	<0.004	0.039	<0.004	<0.005	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.208	4.7	0.7	0.26	0.71	1.7	2.7	0.61	0.72	***14***	2.9	2.1	3	***25***	3.7	**5.9**	4.1
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
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Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table iii: Results
Shallow Aquifer, Section 3

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:						Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:						Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:						Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14
Sample ID:						A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	A7	W3S	W3S	W3S	W3S	W3S
Project Name:						Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:						Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:						Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
Aquifer:						Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):						9.629	9.999	9.819	9.989	9.609	9.689	9.819	9.569	10.029	10.149	10.369	10.259	-	10.312	9.282	9.832	9.552
Sample Description:						Tea brown	Dark brown/orange, very strong hydrogen sulfide odour	Slightly brown/yellow, 'rotten egg' odour	Brown, sulphidic odour	Slightly brown, sulphidic odour	Slightly brown, sulphidic odour	Brown sulphidic odour	Slightly red/brown, sulphidic odour	Slightly red/brown, sulphidic odour	Slightly brown, sulphidic odour	Clear, brow, strong 'rotten eggs' odour	Red/brown, strong odour	Light brown	Brown	Light brown	Clear to brown, no odour	Brown/orange, no odour
Analyte grouping / Analyte						**Units**	**LOR**															
pH (field)	6.5-8[a]			5 - 9		pH units	-	8.96	*9.36*	*9.75*	*9.06*	*9.38*	*9.4*	*9.39*	*9.48*	*9.46*	*9.4*	*9.6*	*9.85*	8.53	8.82	7.61	8.89	7.68
Soluble Fluoride		1	2	1.5		mg/L	0.1	***190***	***390***	***450***	***410***	***600***	***480***	***480***	***520***	***410***	***470***	***370***	***500***	***237***	***310***	***210***	***270***	***210***
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	0.007	0.009	<0.004	<0.004	<0.004	<0.004	0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-
Total Cyanide						mg/L	0.004	15	87	80	54	100	82	88	90	64	86	81	1.8	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	**8.9**	***24***	4.4	1	0.44	0.5	0.4	0.33	0.46	0.37	0.4	0.87	***11.7***	2.6	***7.1***	***9.2***	***5.3***
Aluminium (dissolved)						mg/L	0.01	-	0.37	0.2	0.25	0.19	0.16	0.21	0.28	0.25	0.21	0.22	0.23	-	-	-	-	-

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table iii: Results
Shallow Aquifer, Section 3

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19
Sample ID:							W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W3S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							9.902	10.292	10.052	9.632	9.622	9.762	9.602	7.182	9.702	9.902	8.982	8.912	9.582	9.872	9.522	9.902	-
Sample Description:							Brown/orange, no odour	Brown	Light brown, slightly turbid	-	Brown	Turbid, brown	Turbid, brown	Brown	-	Tea brown	Brown	Purge dry	Milky brown	Turbid, brown	Turbid, brown, no odour	Slightly brown, no odour	Turbid, pale brown, silty
Analyte grouping/Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.38	7.53	7.53		7.46	7.02	7.01	6.4	7.4	7.66	7	6.99	7.19	6.91	7.14	6.8	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	***250***	***230***	***200***	***160***	***190***	***170***	***150***	***110***	***180***	***62***	***99***	-	***180***	***120***	***96***	***100***	-
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	*<0.4*	<0.02	0.023	0.007	0.005	0.014	<0.004	0.007	<0.004	<0.005	-	<0.004	0.007	0.004	0.008	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	20	24	14	15	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***34***	4.4	***24***	***92***	***15***	**6.9**	***21***	***90***	***48***	***15***	***110***	-	***80***	***16***	***23***	***21***	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	1.3	1.1	3.2	-

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table iii: Results
Shallow Aquifer, Section 3

RAMBOLL

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16
					Sample ID:	W3S	W3S	W3S	W3S	W3S	W3S	W3S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
					Aquifer:	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):	9.122	9.752	-	9.872	10.022	9.952	9.702	-	9.934	-	-	-	-	9.739	9.729	-	-
					Sample Description:	Clear to yellow, slightly turbid, cloudy	Slightly brown	Insufficient water for sampling	Slightly brown/red	Clear, slightly red/brown	Clear to slightly turbid, brown, no odour	Red/brown, no odour	Dry	Brown	Dry	Dry	Dry	Dry	Brown	Dark brown	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	7.01	7.7	-	7.21	7.29	7.28	7.59	-	*9.13*	-	-	-	-	*9.13*	*9.07*	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	***90***	***170***	-	***150***	***150***	***97***	***100***	-	***480***	-	-	-	-	***490***	***400***	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	0.013	-	0.016	0.005	0.011	<0.004	-	-	-	-	-	-	*<4*	*<40*	-	-
Total Cyanide						mg/L	0.004	15	20	-	26	18	9.3	14	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***33***	3.8	-	***26***	3.1	**8.2**	***29***	-	3.6	-	-	-	-	2.3	***13***	-	-
Aluminium (dissolved)						mg/L	0.01	3.3	0.79	-	4.1	1.2	4.4	3.5	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
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Concentrations below the LOR noted as <value
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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table iii: Results
Shallow Aquifer, Section 3

RAMBOLL

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20
Sample ID:							W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S	W4S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							9.719	-	-	-	-	-	-	-	9.759	-	-	-	-	-	-	9.599	10.029
Sample Description:							Slightly turbid, brown	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dark brown, orange odour	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Slightly red/brown
Analyte grouping / Analyte					**Units**	**LOR**																	
pH (field)	6.5-8[a]			5 - 9	pH units	-	5.11	-	-	-	-	-	-	-	8.26	-	-	-	-	-	-	-	8.32
Soluble Fluoride		1	2	1.5	mg/L	0.1	-	-	-	-	-	-	-	-	***160***	-	-	-	-	-	-	-	***76***
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	-	-	-	<0.004	-	-	-	-	-	-	-	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	2.1
Aluminium (total)	0.055	5	5	9	mg/L	0.01	-	-	-	-	-	-	-	-	***71***	-	-	-	-	-	-	-	***19***
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	0.38	-	-	-	-	-	-	-	5.4

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Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table iii: Results
Shallow Aquifer, Section 3

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational				
					Sample Type:		Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab
					Sample date:		Sep-20	Dec-20
					Sample ID:		W4S	W4S
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 3	Section 3
					Aquifer:		Shallow	Shallow
					SWL (m AHD):			10.629
					Sample Description:		Purge dry	Dry, mud at base of well
Analyte grouping / Analyte					**Units**	**LOR**		
pH (field)	6.5-8[a]			5 - 9	pH units	-	-	-
Soluble Fluoride		1	2	1.5	mg/L	0.1	-	-
Free Cyanide	0.007			0.1	mg/L	0.004	-	-
Total Cyanide					mg/L	0.004	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	-	-
Aluminium (dissolved)					mg/L	0.01	-	-

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table iv: Results
Shallow Aquifer, Section 4

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							8.06	7.735	7.48	7.72	7.67	7.54	8.7	8.15	7.9	7.94	7.64	7.55	7.41	7.4	7.56	7.33	7.2
Sample Description:							Clear/light brown	Cloudy, brown	Light brown	Brown, slightly turbid, sulphidic odour	Dark grey, turbid, no odour	Brown/orange, slight sulphidic odour	Brown	-	-	Clear to light brown, turbid	Turbid, brown	Turbid, brown	Grey	Brown	Brown	Milky	Brown
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	*9.36*	*9.36*	*9.33*	*9.41*	*9.32*	8.86	7.97	*9.23*	8.65	*9.2*	*9.29*	*9.41*	*9.1*	8.7	*9.07*	3.51	8.83
Soluble Fluoride		1	2	1.5		mg/L	0.1	*102*	*160*	*190*	*160*	*150*	*230*	*7.4*	*110*	*96*	*120*	*120*	*130*	*200*	*230*	*99*	*130*	*110*
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	0.005	<0.004	<0.004	0.033	<0.004	0.009	0.016	0.004	0.015	<0.004	<0.005	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***23***	***23***	4	**7.8**	3.6	5	2.5	***11***	2.7	**7.6**	***23***	***22***	***15***	***89***	**5.6**	***120***	***49***
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table iv: Results
Shallow Aquifer, Section 4

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14
Sample ID:							E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	E11	W5S	W5S	W5S	W5S	W5S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							7.11	7.56	7.4	7.46	7.25	7.29	7.34	7.18	7.65	7.68	7.97	7.86	9.188	9.273	-	9.053	-
Sample Description:							Yellow	Light brown, hydrogen sulfide odour	Slightly brown	Clear, no odour	-	Clear, sulphidic odour	Clear, slightly turbid	Clear, sulphidic odour	-	Clear, slight sulphidic odour	Clear, yellow/brown, no odour	Clear to slightly turbid, light brown, no odour	Light brown	Light brown, cloudy	Dry	Brown, turbid, no odour	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	8.62	*9.02*	*10.45*	7.7	8.99	8.76	7.87	8.95	8.41	8.48	8.69	*9.24*	7.37	7.37	-	7.39	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	*120*	*120*	*130*	*49*	*150*	*74*	*41*	*120*	*41*	*54*	*53*	*78*	*35*	*61*	-	*100*	-
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	0.004	<0.004	<0.004	0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-
Total Cyanide						mg/L	0.004	7.4	10	8	0.65	18	3.8	0.3	20	0.79	1.9	3.5	5.1	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	4.4	4.9	***9.3***	***6.4***	***11***	1.8	3.9	1.5	3.3	2.4	2.6	***5.3***	***13***	***13***	-	***15***	-
Aluminium (dissolved)						mg/L	0.01	-	0.03	0.02	0.1	0.06	0.04	0.03	0.03	0.07	0.06	0.12	0.08	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table iv: Results
Shallow Aquifer, Section 4

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19
Sample ID:							W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S	W5S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							8.993	9.323	9.293	-	-	9.063	-	-	-	-	-	-	-	-	-	-	-
Sample Description:							Brown/orange, no odour	Brown	Brown	Dry	Dry	-	Dry	Dry	Dry	Brown	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.55	7.26	7.2	-	-	7.29	-	-	-	7.79	-	-	-	-	-	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	*93*	*88*	*70*	-	-	*62*	-	-	-	*50*	-	-	-	-	-	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	*<4*	<0.02	-	-	-	-	-	-	<0.004	-	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***22***	**7**	***31***	-	-	***10***	-	-	-	**6.2**	-	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table iv: Results
Shallow Aquifer, Section 4

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational									
					Sample Type:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20
					Sample ID:	W5S	W5S	W5S	W5S	W5S	W5S	W5S
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
					Aquifer:	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):	-	-	-	8.843	9.173	9.093	-
					Sample Description:	Dry	Dry	Dry	Dry	Clear, yellow, no odour	Slightly turbid, yellow/orange / brown, no odour	Dry

Analyte grouping / Analyte					**Units**	**LOR**							
pH (field)	6.5-8[α]			5 - 9	pH units	-	-	-	-	-	7.76	7.47	-
Soluble Fluoride		1	2	1.5	mg/L	0.1	-	-	-	-	*34*	*34*	-
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	<0.004	<0.004	-
Total Cyanide					mg/L	0.004	-	-	-	-	2.6	2.2	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	-	-	-	-	**11**	**23**	-
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	**6.6**	2.6	-

Blank Cell indicates no criterion available

[α] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table v: Results
Shallow Aquifer, Section 5

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:						Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:						Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:						Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:						N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8
Project Name:						Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:						Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:						Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
Aquifer:						Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):						9.18	8.74	8.46	8.8	8.73	8.65	9.35	9.19	9.09	9.03	8.61	8.64	8.38	8.22	8.56	8.16	7.75
Sample Description:						Yellow	Clear, slightly cloudy	Light brown, sulphur odour	Clear/dark yellow, no odour	Dark grey, turbid, no odour	Orange/yellow, no odour	Brown	Slightly turbid, light brown	-	Brown, turbid	-	Turbid, brown	-	Light brown	Brown	Faint yellow	Faint brown
Analyte grouping / Analyte					**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9	pH units	-	6.36	6.38	6.48	6.53	6.39	6.11	6.49	6.69	6.74	6.59	6.63	6.92	6.4	6.54	6.78	6.76	6.67
Soluble Fluoride		1	2	1.5	mg/L	0.1	0.27	0.17	0.26	0.27	0.29	0.35	0.9	0.3	0.4	***<10***	0.4	0.6	0.4	1	0.4	0.4	0.4
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	<0.004	*<0.4*	<0.02	0.005	<0.004	0.004	<0.004	<0.004	0.006	<0.004	<0.005	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.102	***12***	0.11	0.3	***91***	1.8	***29***	**5.3**	3.4	***34***	0.47	1.6	1	***34***	3.9	***25***	4
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table v: Results
Shallow Aquifer, Section 5

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14
Sample ID:							N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N8	N9	N9	N9	N9	N9
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							7.87	8.29	8.18	8.28	7.9	7.89	7.99	7.77	8.04	8.19	8.53	8.47	9.222	9.312	8.482	9.012	8.872
Sample Description:							Brown	Light brown, some odour	Brown/yellow	Slightly brown, very slight sulphidic odour	Slightly brown/yellow, no odour	Clear to yellow	Turbid, brown/yellow, no odour	Slightly yellow, sulphidic odour	Clear, bright yellow, sulphidic odour	Slightly yellow/red, no odour	Turbid, yellow, no odour	Slightly turbid, brown, slight odour	Light brown	Cloudy brown	Dry	Dark yellow, slightly turbid, no odour	Dark grey, becoming yellow, turbid, no odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.45	6.71	*10.53*	6.51	6.81	6.68	6.6	6.67	6.76	6.77	6.77	6.95	*9.16*	8.9	-	*9.17*	8.91
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.2	0.4	0.4	0.4	0.4	***85***	***200***	-	***170***	***210***
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-
Total Cyanide						mg/L	0.004	0.54	0.67	0.56	0.6	0.61	0.55	0.47	0.63	0.35	0.49	0.66	0.44	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	**5.1**	4.3	0.22	0.35	0.9	0.76	1.1	1.7	0.3	0.63	4.5	1	***14.7***	***62***	-	***9***	***130***
Aluminium (dissolved)						mg/L	0.01	-	0.02	0.03	0.06	0.04	0.06	0.06	0.06	0.07	0.05	0.06	0.05	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table v: Results
Shallow Aquifer, Section 5

RAMBOLL

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19
Sample ID:							N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9	N9
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							9.002	9.692	9.382	9.052	8.832	9.252	-	-	9.142	9.352	8.822	8.812	9.022	9.222	8.972	9.172	8.792
Sample Description:							Brown/orange, sulphidic odour	Turbid, grey	Clear, strong sulphidic odour	-	Brown	Slightly brown	Brown	Dry	Brown	Light brown, smelly	-	Tea brown	Tea brown	Light brown, some odour	Brown, sediment, strong hydrogen sulfide odour	Clear, slightly brown, sulphidic odour	Light brown, sediments, strong sulphidic odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	8.46	7.22	7.34	7.7	6.61	8.11	8.54	-	8.61	*9.32*	-	8.6	8.65	8.72	*12.9*	8.72	8.33
Soluble Fluoride		1	2	1.5		mg/L	0.1	***210***	***24***	***25***	***9***	-	***140***	-	-	***200***	***160***	***150***		***200***	***140***	***170***	***160***	***200***
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	*<0.4*	<0.02	<0.004	-	<0.004	-	-	<0.004	<0.004	<0.005	<0.004	<0.004	0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	15	6.7	7.2	7.4	6.6
Aluminium (total)	0.055	5	5	9		mg/L	0.01	**8**	***14***	***22***	0.89	-	**5.5**	-	-		1.6	-	-	0.54	***17***	0.95	0.28	1.5
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.08	0.27

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table v: Results
Shallow Aquifer, Section 5

RAMBOLL

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16
Sample ID:							N9	N9	N9	N9	N9	N9	N9	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							8.832	9.182	-	9.342	9.322	9.312	9.182	7.85	7.65	7.64	-	-	7.69	8.12	8.01	7.82	-
Sample Description:							Clear, sediments	Clear to slightly brown, sulphidic odour	Insufficient water for sampling	Clear, sulphidic odour	Clear, sulphidic odour	Clear to slightly turbid, yellow, sulphidic odour	Turbid, light brown, slight odour	Light brown	Dry	Dry	Brown/yellow, turbid	Dry	Orange, no odour	Light brown, turbid	Light brown, slightly turbid	-	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	8.71	8.5	-	8.64	8.53	8.7	8.69	8.87	-	-	8.79	-	7.27	8.72	8.98	8.67	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	***160***	***160***	-	***140***	***130***	***57***	***110***	***195***	-	-	-	-	***200***	***180***	-	***180***	-
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	-	<0.004	<0.004	<0.004	0.008	-	-	-	-	-	0.019	*<0.4*	-	0.058	-
Total Cyanide						mg/L	0.004	9.2	8	-	5.4	3.7	2.9	5.3	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	2	0.64	-	4.9	1.6	1.3	1.6	***60.1***	-	-	-	-	3.5	***7.7***	-	***22***	-
Aluminium (dissolved)						mg/L	0.01	0.46	0.08	-	1.1	0.7	0.6	0.28	-	-	-	-	-	-	-	-		-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table v: Results
Shallow Aquifer, Section 5

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20
					Sample ID:		W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S	W6S
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
					Aquifer:		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		-	7.63	-	-	-	-	-	-	7.59	7.6	-	-	-	-	-	7.59	-
					Sample Description:		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soluble Fluoride		1	2	1.5		mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table v: Results
Shallow Aquifer, Section 5

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational				
					Sample Type:		Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab
					Sample date:		Sep-20	Dec-20
					Sample ID:		W6S	W6S
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 5	Section 5
					Aquifer:		Shallow	Shallow
					SWL (m AHD):		-	Dry
					Sample Description:		Dry	Dry
Analyte grouping / Analyte					**Units**	**LOR**		
pH (field)	6.5-8[a]			5 - 9	pH units	-	-	-
Soluble Fluoride		1	2	1.5	mg/L	0.1	-	-
Free Cyanide	0.007			0.1	mg/L	0.004	-	-
Total Cyanide					mg/L	0.004	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	-	-
Aluminium (dissolved)					mg/L	0.01	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																			
Sample Type:						Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:						Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:						Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20
Sample ID:						F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5	F5
Project Name:						Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:						Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:						Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
Aquifer:						Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):						4.95	4.86	4.93	4.73	4.67	4.76	4.46	4.3	3.82	4.41	4.19	4.16	3.8	3.71	3.75	3.39	3.75	3.85
Sample Description:						Clear to light brown	Clear	Clear	Colourless	Colourless with particles	Faint yellow	Colourless	Colourless with particles	Colourless with particles	Clear, hydrogen sulfide odour	Clear	Clear, very slight sulphidic odour	Clear, no odour	Clear, slight sulphidic odour	Clear, no odour	Clear, sulphidic odour	Clear, organic odour	Clear, slight sulphidic odour
Analyte grouping / Analyte					**Units**	**LOR**																	
pH (field)	6.5-8[¤]			5 - 9	pH units	-	7.38	5.58	5.25	4.46	4.11	5.08	4.21	4.57	4.3	4.46	4.35	5.02	4.96	4.71	4.6	4.54	5.38	4.75
Soluble Fluoride		1	2	1.5	mg/L	0.1	***<10***	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	<0.1	<0.4	<0.4
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	<0.004	0.013	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	0.055	5	5	9	mg/L	0.01	2.2	2.1	0.89	2.3	2.3	4.6	2.9	3.2	3	2.2	2.1	2	1.4	1.7	2.3	1.9	1.7	2.5
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	1.5	1.9	1.7	1.1	0.92	1.5	1.2	1.3	2.3

Blank Cell indicates no criterion available

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																			
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Sep-20	Dec-20	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19
Sample ID:							F5	F5	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6	G6
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
Aquifer:							Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
SWL (m AHD):							4.23	4.04	2.59	2.45	2.45	3.21	2.17	2.28	2.04	1.86	1.55	1.7	1.55	1.49	1.29	1.13	0.99	0.81
Sample Description:							Clear, no odour	Clear, sulphidic odour	-	Clear	Clear	Colourless with particles	Colourless with particles	Colourless	Colourless with particles	Colourless with particles	Colourless with particles	Clear, no odour	Clear, no odour	Clear, no odour	Clear, slight sulphidic odour	Clear, sulphidic odour	Slightly brown, strong sulphidic odour	Clear, sulphidic odour
Analyte grouping / Analyte						**Units**	**LOR**																	
pH (field)	6.5-8[¤]			5 - 9		pH units	-	4.71	5.01	3.6	3.82	4.04	3.79	3.66	4.55	4.21	3.86	3.66	3.6	3.88	3.81	4.14	3.88	4.14	3.93
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.1	0.2	*<10*	<0.1	0.2	<0.1	<0.1	0.4	0.4	0.5	0.4	0.4	0.4	0.7	0.6	0.3	0.2
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	<0.004	<0.004	-	-	-	-	-	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	0.055	5	5	9		mg/L	0.01	3.2	2.2	*28*	0.78	0.13	*29*	*25*	*23*	*21*	*27*	*27*	*25*	*23*	*25*	*16*	*17*	*9.8*	**9**
Aluminium (dissolved)						mg/L	0.01	2.7	1.9	-	-	-	-	-	-	-	-	-	*26*	*22*	*23*	*16*	*18*	*9.5*	**8.9**

Blank Cell indicates no criterion available

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Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table vi: Results
Shallow Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational						
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Mar-20	Jun-20	Sep-20	Dec-20
					Sample ID:		G6	G6	G6	G6
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Background	Background	Background	Background
					Aquifer:		Shallow	Shallow	Shallow	Shallow
					SWL (m AHD):		0.8	0.96	1.33	1.23
					Sample Description:		Clear, sulphidic odour	Clear, sulphidic odour, slightly turbid	Clear, no odour	Clear, sulphidic odour

Analyte grouping / Analyte					**Units**	**LOR**				
pH (field)	6.5-8[¤]			5 - 9	pH units	-	4.06	4.59	4.49	4.19
Soluble Fluoride		1	2	1.5	mg/L	0.1	0.2	0.2	0.2	0.2
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	0.055	5	5	9	mg/L	0.01	**6.9**	**7.3**	***9.3***	**6.9**
Aluminium (dissolved)					mg/L	0.01	**6.7**	**5.8**	**8.5**	**6.9**

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Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table vii: Results
Deep Aquifer, Section 1

RAMBOLL

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18
					Sample ID:	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					SWL (m AHD):	12.193	12.313	11.793	11.463	11.183	10.463	11.963	11.683	11.573	11.753	11.603	11.663	11.483	11.303	11.523	11.303	10.813	10.933
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					Sample Description:	Brown	Brown	Brown	Dark brown, slight sulphidic odour	Brown, turbid, strong odour	Copper/brown, strong sulphidic odour	Brown	Brown	-	Brown	Brown	Brown	Brown	Dark brown	Dark brown	Tea brown	Tea brown	Reddish/tea brown
Analyte grouping / Analyte					**Units**	**LOR**																	
pH (field)	6.5-8[¤]			5 - 9	pH units	-	*10.09*	*9.9*	*10.13*	*10.1*	9.94	*9.99*	*10.11*	*10.27*	*10.34*	*10.42*	*10.29*	*10.4*	*10.02*	*10.07*	*9.37*	*10.08*	*10.1*	*10.14*
Soluble Fluoride		1	2	1.5	mg/L	0.1	***682***	***790***	***880***	***930***	***1080***	***1279***	***1300***	***1300***	***1300***	***1300***	***1400***	***1500***	***1400***	***1700***	***1300***	***1300***	***1200***	***1200***
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	0.03	<4	*0.058*	*0.88*	*0.21*	*0.11*	*0.11*	*0.12*	*0.15*	0.012	0.01	0.006	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300
Aluminium (total)	0.055	5	5	9	mg/L	0.01	2.86	0.6	0.67	1.4	44	0.03	0.19	0.03	3.5	0.06	0.09	0.92	***31***	1	0.08	1.6	0.28	1.1
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

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For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table vii: Results
Deep Aquifer, Section 1

RAMBOLL

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																			
					Sample Type:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15
					Sample ID:	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	W2D	E5D	E5D	E5D	E5D	E5D	E5D	E5D
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					SWL (m AHD):	11.583	11.373	11.333	11.133	11.333	11.253	10.963	11.663	8.842	12.323	12.053	11.672	11.632	11.562	11.432	11.562	11.612	11.572
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					Sample Description:	Dark brown, odour	Dark brown	Brown, slight 'burnt' odour	Dark brown	Brown, very slight sulphidic odour	Brown/red, no odour	Slightly brown/red	Red/brown, sulphidic odour	Red/brown, sulphidic odour	Turbid, orange/brown, no odour	Clear to turbid, brown, slight odour	Cloudy, brown	-	Light brown/clear	Brown, no odour	Yellow/orange, no odour	Light brown/copper, no odour	-
Analyte grouping / Analyte					**Units**	**LOR**																	
pH (field)	6.5-8[a]			5 - 9	pH units	-	*10.18*	*13.74*	*9.87*	*9.99*	*10.1*	*10.08*	*10.14*	*10.12*	*10.11*	*10.18*	*10.09*	7.22	7.29	7.53	7.44	8.32	6.8	7.23
Soluble Fluoride		1	2	1.5	mg/L	0.1	***1200***	***1200***	***1200***	***1500***	***1200***	***1300***	***1400***	***1300***	***1100***	***800***	***1000***	1.21	***40***	***44***	***23***	***12***	***18***	***16***
Free Cyanide	0.007			0.1	mg/L	0.004	0.007	0.029	0.009	0.004	0.004	0.03	0.018	0.009	<0.004	0.008	0.006	-	-	-	-	-	<0.004	<0.4
Total Cyanide					mg/L	0.004	330	280	330	300	230	240	270	250	210	190	1.8	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.71	0.39	1	0.61	0.72	0.83	1.2	0.97	0.76	0.76	0.71	1.697	1.5	***110***	2.2	3.3	3.4	2.1
Aluminium (dissolved)					mg/L	0.01	0.77	0.52	0.69	0.51	0.7	0.73	0.7	0.76	0.78	0.69	0.58	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table vii: Results
Deep Aquifer, Section 1

RAMBOLL

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19
					Sample ID:	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D	E5D
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1	Section 1
					SWL (m AHD):	11.522	11.722	11.652	11.992	11.422	11.462	11.282	11.232	11.192	11.242	11.202	11.292	11.232	11.672	11.702	11.482	11.482	11.392
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					Sample Description:	Brown	-	Brown	Brown	Brown	Milky	Brown	Light brown	Milky brown	Light tea brown	Light yellow	Light brown, some odour	Brown	Slightly brown, no odour	Clear to slightly yellow, no odour	Slightly brown, no odour	Clear to slightly brown, no odour	Clear, no odour
Analyte grouping / Analyte					**Units**	**LOR**																	
pH (field)	6.5-8[a]			5 - 9	pH units	-	7.23	7.18	7.1	7.27	7.39	7	7.08	7.97	7.16	7	6.97	7.29	*12.79*	6.95	6.96	7.1	7.3	6.95
Soluble Fluoride		1	2	1.5	mg/L	0.1	***14***	***16***	***19***	***18***	***15***	***16***	***22***	***19***	***14***	***14***	***16***	***14***	***12***	***11***	***8.1***	***9.6***	***8.3***	***9.4***
Free Cyanide	0.007			0.1	mg/L	0.004	<0.02	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	0.6	1.6	1.2	0.81	1.1	0.92	0.68	1.1
Aluminium (total)	0.055	5	5	9	mg/L	0.01	2.1	4.3	3.6	2.7	1.9	4.2	***64***	2.8	5	2.2	3.4	4.1	2.2	0.72	1.3	1.2	1.2	2.5
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	<0.01	0.01	0.03	<0.01	0.01	<0.01	<0.01

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table vii: Results
Deep Aquifer, Section 1

RAMBOLL

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**		Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Mar-20	Jun-20	Sep-20	Dec-20
					Sample ID:		E5D	E5D	E5D	E5D
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 1	Section 1	Section 1	Section 1
					SWL (m AHD):		10.262	11.892	12.152	12.032
					Aquifer:		Deep	Deep	Deep	Deep
					Sample Description:		Bright yellow, sulphidic odour	Clear, no odour	Clear to slightly turbid, yelow, no odour	Slightly turbid, light brown, no odour
Analyte grouping / Analyte					**Units**	**LOR**				
pH (field)	6.5-8[a]			5 - 9	pH units	-	7.05	7.1	7.04	7.02
Soluble Fluoride		1	2	1.5	mg/L	0.1	***9.8***	***7.7***	***7.3***	***7.8***
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	2.3	0.84	0.7	0.63
Aluminium (total)	0.055	5	5	9	mg/L	0.01	1.2	1.3	1.6	1.3
Aluminium (dissolved)					mg/L	0.01	0.01	<0.01	0.02	0.01

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

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Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table viii: Results
Deep Aquifer, Section 2

RAMBOLL

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							10.852	9.912	9.332	8.702	9.112	-	8.512	8.022	8.582	9.412	8.752	8.632	8.762	8.562	8.372	7.872	7.882
Sample Description:							Brown	-	Light brown	Light brown, turbid	-	Dry	Light brown, turbid	Light brown, slightly turbid	-	Brown	Brown	Turbid, brown	Light brown	Tea brown	Tea brown	Tea brown	Tea brown
Analyte grouping / Analyte					**Units**	**LOR**																	
pH (field)	6.5-8[a]			5 - 9	pH units	-	6.98	6.62	6.7	6.71	6.63	-	6.82	6.79	8.48	6.73	6.82	7.02	6.78	6.67	7.3	6.95	6.78
Soluble Fluoride		1	2	1.5	mg/L	0.1	***39***	***5.4***	***3.5***	***5.1***	***3.3***	-	***4.4***	***3.5***	***2.6***	***<10***	***3.1***	***3.3***	***3.4***	***3.9***	***4.4***	***4.8***	***4.2***
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	-	<0.2	<0.02	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	***21.2***	0.9	2.4	2.4	0.26	0.26	4	0.95	0.4	1.5	0.66	0.87	18	89	120	4.1	1.4
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table viii: Results
Deep Aquifer, Section 2

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational													
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20
Sample ID:							W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D	W1D
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2	Section 2
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							7.802	8.692	8.512	8.572	8.412	8.482	8.052	7.992	8.392	8.842	11.632	11.182
Sample Description:							Brown	Yellow, hydrogen sulfide odour	Slight brown/yellow	Clear, slightly brown, slight sulphidic odour	Clear to slightly brown, slight sulphidic odour	Clear, slighly cloudy, sulphidic odour	Slightly brown/yellow, sulphidic odour	Slightly yellow, no odour	Bright yellow	Clear to slightly yellow	Clear, dark yellow no odour	Yellow, no odour
Analyte grouping / Analyte					**Units**	**LOR**												
pH (field)	6.5-8[a]			5 - 9	pH units	-	6.91	7.07	7.12	6.76	6.92	6.83	6.91	7.16	7.12	7.17	7.57	8.14
Soluble Fluoride		1	2	1.5	mg/L	0.1	***4.7***	***5.1***	***4.5***	***4.8***	***3.9***	***4.7***	***4.4***	***4.8***	***4.1***	***3.8***	***8.5***	***9.2***
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	0.34	0.69	0.59	0.67	0.64	0.47	0.046	0.67	0.25	0.5	1	1.1
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.46	0.88	0.38	0.43	0.48	0.69	0.71	0.23	0.98	2.1	1.2	0.53
Aluminium (dissolved)					mg/L	0.01	-	0.14	0.14	0.25	0.15	0.21	0.19	0.1	0.15	0.22	0.13	0.09

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table ix: Results
Deep Aquifer, Section 3

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							5.61	-	-	5.53	5.46	5.5	5.59	5.68	-	-	-	-	-	-	-	-	5.16
Sample Description:							Clear	Dry	Dry	Clear, no odour	Grey, slightly turbid, no odour	Clear, no odour	Clear	Sclear, sulphidic odour	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Turbid, suspended particles
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	5.91	-	-	4.38	3.56	3.29	4.89	3.62	-	-	-	-	-	-	-	-	4.72
Soluble Fluoride		1	2	1.5		mg/L	0.1	1.23	-	-	0.19	0.41	0.22	0.3	0.3	-	-	-	-	-	-	-	-	0.3
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	<0.004	<0.004	<0.004	-	-	-	-	-	-	-	-	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.7	-	-	0.58	0.72	0.76	0.81	0.04	-	-	-	-	-	-	-	-	1.4
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table ix: Results
Deep Aquifer, Section 3

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14
					Sample ID:	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W3D	W4D	W4D	W4D	W4D	W4D
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):	5.02	5.01	4.92	4.94	4.86	4.45	4.57	4.52	4.37	4.4	4.72	4.69	5.539	5.459	5.439	5.459	5.369
					Sample Description:	Slightly turbid, odourless	Clear, some odour	Light brown, some odour	Clear, no odour	Clear, no odour	Clear, slight sulphidic odour	-	Clear, no odour	Clear	Clear	Clear, no odour	Clear, no odour	Clear	Clear	Clear	Clear to pale yellow, no odour	Clear, no odour
Analyte grouping / Analyte					**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9	pH units	-	4.16	3.75	3.94	4.53	4.81	4.21	4.15	3.96	4.14	4.54	4.53	3.93	6.02	5.7	5.7	5.4	5.36
Soluble Fluoride		1	2	1.5	mg/L	0.1	0.3	0.5	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	1.48	*1.7*	1.3	0.41	*1.6*
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-
Total Cyanide					mg/L	0.004	<0.004	0.036	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	1.2	1.5	0.9	1	0.81	1	1	1.1	0.99	2.3	0.97	1.2	0.794	0.48	0.19	0.27	0.5
Aluminium (dissolved)					mg/L	0.01	-	1.3	0.91	1	0.74	0.87	0.94	0.94	0.89	0.69	0.72	1.1	-	-	-	-	-

Blank Cell indicates no criterion available

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Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table ix: Results
Deep Aquifer, Section 3

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational										
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16
					Sample ID:		W4D	W4D	W4D	W4D	W4D	W4D	W4D	W4D
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3	Section 3
					Aquifer:		Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):		5.939	-	-	-	-	-	-	-
					Sample Description:		Clear, no odour	Clear	Clear	-	Clear	-	-	Well destroyed

Analyte grouping / Analyte					**Units**	**LOR**								
pH (field)	6.5-8[¤]			5 - 9	pH units	-	4.69	-	5.18	9.9	6.08	-	3.87	-
Soluble Fluoride		1	2	1.5	mg/L	0.1	1.1	-	0.2	-	-	-	<0.1	-
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	-	-	-	-	-	-	-
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.35	-	-	-	-	-	-	-
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

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Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table x: Results
Deep Aquifer, Section 4

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
Sample ID:							W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							5.396	5.321	5.301	5.361	5.321	5.311	5.451	5.521	5.301	5.471	5.381	5.311	5.341	5.191	5.171	5.141	4.981
Sample Description:							Clear	Clear	Clear	Clear, no odour	Light brown, slightly turbid, no odour	Clear, no odour	Dry	Clear	-	Clear	Clear	Slighlty turbid	Colourless	Colourless	Clear, colourless	Colourless	Faint yellow with particles
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.02	6.32	6.1	6.11	6.11	5.34	-	6.32	8.37	6.4	5.7	6.7	6.37	6.21	6.94	6.93	6.13
Soluble Fluoride		1	2	1.5		mg/L	0.1	***20***	0.51	0.59	0.65	0.53	0.44	-	0.4	0.5	***<10***	0.5	0.5	0.5	0.4	0.6	0.5	0.4
Free Cyanide	0.007			0.1		mg/L	0.004	-	-	-	-	-	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.323	0.04	0.02	0.02	0.05	0.16	-	0.99	0.54	0.39	0.23	0.14	0.05	0.01	0.05	0.02	0.2
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

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Concentration in red font exceed Irrigation criteria value

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Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table x: Results
Deep Aquifer, Section 4

RAMBOLL

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14
					Sample ID:		W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	W5D	N2	N2	N2	N2	N2
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
					Aquifer:		Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):		4.831	5.271	4.721	4.751	4.741	4.471	4.381	4.351	5.181	4.281	4.581	4.511	4.993	4.863	4.793	4.903	4.963
					Sample Description:		Clear with few particles	Clear some particles, no odour	Clear, slightly brown	Clear, no odour	-	Clear, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Clear, sulphidic odour	Clear, no odour	Clear, no odour	Clear	Clear	Clear	Pale yellow/brown, slightly turbid, no odour	Light grey, slightly turbid, no odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.5	6.1	*10.2*	6.72	6.18	6.23	6.35	6.16	6.24	6.76	6.46	6.05	3.26	6.54	4.01	3.94	3.54
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.5	0.4	0.6	0.6	0.3	0.4	0.4	0.1	0.4	0.3	0.5	0.3	0.43	***6.2***	*1.9*	1.4	0.74
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-
Total Cyanide						mg/L	0.004	<0.004	0.004	0.01	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.03	0.16	0.09	0.04	0.44	0.04	0.24	0.28	0.04	0.52	0.24	0.09	**5.771**	3	4.6	4.5	**6.7**
Aluminium (dissolved)						mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	<0.01	-	-	-	-	-

Blank Cell indicates no criterion available

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Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table x: Results
Deep Aquifer, Section 4

RAMBOLL

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19
Sample ID:							N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2	N2
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							5.923	5.083	5.123	5.153	5.123	5.993	5.053	4.973	4.793	4.783	5.703	4.523	4.323	4.363	4.223	4.243	4.163
Sample Description:							Light brown, no odour	Brown/black	Clear, sulphidic odour	-	Turbid, black	Trubid, black	Turbid	Faint yellow	Brown	Brown	Milky	Faint yellow	-	Light brown, no odour	Clear, slightly brown	-	Clear, no odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	3.34	6.61	5.81	8.09	6.75	6.37	5.35	4.67	4.59	5.37	3.98	4.31	3.63	4.41	2.8	4.18	4.34
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.49	***8.1***	1.4	1.4	***15***	***8.6***	1.3	0.8	0.5	1	***2.1***	***2.4***	***2.1***	1.5	1.3	1.4	1.1
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	0.054	0.013	0.01	0.005	<0.004
Aluminium (total)	0.055	5	5	9		mg/L	0.01	***28***	3.4	2.4	***9.1***	***24***	3.2	3.7	**5.9**	***23***	***10***	***23***	5.7	5.2	**6.9**	4.7	5	4.2
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	3.1	3.8	3.9	4.2

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table x: Results
Deep Aquifer, Section 4

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20
					Sample ID:	N2	N2	N2	N2	N2	N2	N2
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4	Section 4
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):	3.933	3.813	3.733	3.623	3.753	4.023	3.973
					Sample Description:	Clear to grey, no odour	Clear, no odour. Purged dry	Clear, no odour	Clear to turbid, slightly brown	Clear, sulphidic odour	Clear to slightly turbid, no odour	Clear, no odour

Analyte grouping / Analyte					**Units**	**LOR**							
pH (field)	6.5-8[¤]			5 - 9	pH units	-	4.51	4.05	3.85	4.09	4.54	3.88	3.55
Soluble Fluoride		1	2	1.5	mg/L	0.1	1.1	1	0.4	0.9	0.7	0.8	0.8
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	0.005	0.007	<0.004	0.051	0.009	<0.004	<0.004
Aluminium (total)	0.055	5	5	9	mg/L	0.01	**6.2**	**8.4**	**7.7**	**8.5**	**6.7**	4.5	3.1
Aluminium (dissolved)					mg/L	0.01	3.2	3.2	3.5	2.6	2.6	3.1	2.8

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xi: Results
Deep Aquifer, Section 5

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17
					Sample ID:	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):	6.632	6.502	6.552	6.552	6.492	6.482	6.622	6.682	6.712	6.712	6.552	6.552	6.502	6.352	6.342	6.342	6.142
					Sample Description:	Clear	Clear	Clear	Pale brown, slightly turbid, no odour	Light brown/orange, slight odour, slightly turbid	Light brown, no odour	Clear, slightly cloudy	Turbid, brown	-	Light brown, turbid	Clear	Slightly turbid	Faint yellow	Faint yellow	Faint yellow	Faint yellow	Faint yellow
Analyte grouping / Analyte					**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9	pH units	-	6.04	6.09	6.09	6.1	6.03	5.7	6.01	6.04	7.87	6.11	6.09	6.33	6.22	5.71	6.08	6.16	6.19
Soluble Fluoride		1	2	1.5	mg/L	0.1	0.28	0.28	0.25	0.28	0.28	0.28	0.3	0.3	0.3	***<10***	0.3	0.3	0.3	0.4	0.2	0.3	0.4
Free Cyanide	0.007			0.1	mg/L	0.004	-	-	-	-	-	<0.004	<0.004	<0.02	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.115	0.1	0.04	1.2	2.1	2.9	2	4.1	1.8	***9.6***	1.2	1.6	1.2	1.2	**6.6**	1.8	1.7
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xi: Results
Deep Aquifer, Section 5

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																	
Sample Type:							Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Laboratory:							Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
Sample date:							Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14
Sample ID:							G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	G2	W6D	W6D	W6D	W6D	W6D
Project Name:							Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Site:							Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
Section:							Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
Aquifer:							Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
SWL (m AHD):							6.042	6.032	5.992	5.962	6.022	6.612	5.702	5.622	5.452	5.642	5.852	6.802	5.129	5.109	5.189	5.199	5.119
Sample Description:							Faint yellow	Clear, no odour	Light brown, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Clear, no odour	Slightly turbid, pale yellow, no odour	Slightly turbid, light brown, no odour	Clear	Clear	Clear	Pale brown, slightly turbid, no odour	Clear, no odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.05	6.05	6.42	6.53	6.16	6.35	6.46	6.13	6.26	6.37	6.12	6.26	6.49	6.11	5.75	5.83	5.54
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.3	0.3	0.4	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	1.19	0.25	0.21	0.4	0.19
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-
Total Cyanide						mg/L	0.004	<0.004	0.005	0.006	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	-	-
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.5	2.4	0.57	1.5	1	0.68	1.1	1.3	0.41	1	1.9	1.7	1.087	0.06	0.04	1.2	0.5
Aluminium (dissolved)						mg/L	0.01	-	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	-	-	-	-	-

Blank Cell indicates no criterion available

[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

For Limit of Reporting (LOR) refer to laboratory certificates of analysis

Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xi: Results
Deep Aquifer, Section 5

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19
					Sample ID:		W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D	W6D
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
					Aquifer:		Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):		5.089	5.299	5.399	5.389	5.369	5.159	5.169	5.129	4.959	4.949	4.949	4.749	4.589	4.609	4.509	4.559	4.569
					Sample Description:		Clear, no odour	Clear	Clear	-	Clear	Clear	Colourless, clear	Faint yellow	Clear	Clear, colourless	Light yellow	Clear, colourless	Colourless with particles	Turbid, light brown, no odour	Clear, slightly brown	Clear, no odour	Slightly yellow
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[¤]			5 - 9		pH units	-	8.22	5.84	5.81	5.5	5.79	5.58	6.18	5.96	5.88	6.19	5.9	5.9	5.65	5.7	***10.47***	6.65	5.81
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.3	0.1	0.1	-	***<10***	0.2	0.1	0.1	1.4	0.3	0.1	0.2	0.3	<0.1	0.2	0.2	<0.1
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	-	-	-	-	-	-	-	-	-	-	-	-	0.01	0.005	0.006	<0.004	<0.004
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.12	0.19	0.74	-	0.08	0.08	0.17	-	1.1	0.09	***25***	2.7	0.47	***19***	0.96	2.4	3.6
Aluminium (dissolved)						mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01	0.02	0.02

Blank Cell indicates no criterion available
[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
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For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in ***underline/italics*** exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xi: Results
Deep Aquifer, Section 5

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20
					Sample ID:	W6D	W6D	W6D	W6D	W6D	W6D	W6D
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5	Section 5
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):	4.289	4.269	4.169	3.959	4.089	4.379	4.339
					Sample Description:	Clear, slight odour	Turbid, slightly brown, no odour	Clear, slight sulphidic odour	Clear, no odour	Clear, no odour	-	Turbid, yellow/brown, no odour

Analyte grouping / Analyte					**Units**	**LOR**							
pH (field)	6.5-8[¤]			5 - 9	pH units	-	5.71	5.87	5.56	5.75	6.12	5.75	5.69
Soluble Fluoride		1	2	1.5	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.98	3.6	1.9	1.6	4.4	3.6	3.2
Aluminium (dissolved)					mg/L	0.01	0.02	0.02	0.02	0.04	0.03	0.04	0.02

Blank Cell indicates no criterion available

[¤] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

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Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value

Concentration in red font exceed Irrigation criteria value

Concentration in **bold** font exceed Stock Watering criteria value

Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xii: Results
Deep Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational																		
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20
					Sample ID:		G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5	G5
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
					Aquifer:		Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):		4.95	4.69	4.93	4.73	4.69	4.6	4.29	4.29	3.99	4.41	4.19	4.32	3.82	3.72	3.76	3.42	3.74
					Sample Description:		Clear	-	Colourless, clear	Colourless	Colourless with suspended solids	Turbid	Light brown with particles		Colourless with few particles	Clear, some particles, no odour	Clear	Clear, very slight sulphidic odour	Clear, slight sulphidic odour	Clear, sulphidic odour	Clear, black particulates, very slight sulphidic odour	Clear, no odour	Clear, very strong sulphidic odour
Analyte grouping / Analyte						**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9	pH units	-	6.36	6.77	6.72	5.88	5.73	5.96	6.15	5.77	5.8	6.23	7.63	5.64	5.99	6	6.13	5.7	6.38
Soluble Fluoride		1	2	1.5	mg/L	0.1	***<10***	0.4	<0.1	0.3	0.6	0.3	0.3	0.3	0.2	0.4	1.3	0.2	<0.1	0.2	0.2	0.1	0.2
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	0.006	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	-	-	-	-	-	-	-	-	<0.004	<0.004	0.01	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	0.055	5	5	9	mg/L	0.01	1.8	***24***	0.14	0.17	**6.2**	3.6	4.9	0.26	0.19	0.9	0.04	0.21	0.29	0.12	0.29	0.41	0.11
Aluminium (dissolved)					mg/L	0.01	-	-	-	-	-	-	-	-	-	<0.01	<0.01	0.03	0.03	<0.01	0.01	0.02	<0.01

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
Concentration in **bold** font exceed Stock Watering criteria value
Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xii: Results
Deep Aquifer, Background

	95% Protection of Aquatic Ecosystems	**Irrigation**	**Stock Watering**	**Recreational**	**Sample Type:**	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:	Jun-20	Sep-20	Dec-20	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19
					Sample ID:	G5	G5	G5	F6	F6	F6	F6	F6	F6	F6	F6	F6	F6	F6	F6	F6	F6
					Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
					Aquifer:	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):	3.87	4.21	4.03	2.84	2.68	2.75	2.62	2.46	2.53	2.28	1.9	1.78	1.93	1.82	1.77	1.52	1.38
					Sample Description:	Clear, sulphidic odour, black particulate	Clear, no odour	Clear, no odour	-	Clear	-	Colourless	Colourless with particles	Colourless	Colourless with particles	Light grey with particles	Clear, colourless	Clear, no odour	Clear, no odour	Clear	Clear, slight sulphidic odour	Clear, sulphidic odour

Analyte grouping / Analyte					**Units**	**LOR**																
pH (field)	6.5-8[a]			5 - 9	pH units	-	5.86	5.85	5.61	6.99	6.67	7.05	6.54	6.29	7.08	6.75	6.68	6.88	6.67	7.85	6.66	6.73	6.57
Soluble Fluoride		1	2	1.5	mg/L	0.1	<0.1	<0.1	<0.1	*<10*	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.9	0.5	1	0.6	0.4	0.5
Free Cyanide	0.007			0.1	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide					mg/L	0.004	<0.004	<0.004	<0.004	-	-	-	-	-	-	-	-	0.024	<0.004	0.032	0.005	<0.004	<0.004
Aluminium (total)	0.055	5	5	9	mg/L	0.01	0.08	0.07	0.06	0.57	0.7	0.15	0.12	0.33	0.08	0.11	**7.6**	0.16	0.06	0.03	0.05	0.06	0.05
Aluminium (dissolved)					mg/L	0.01	0.03	0.03	0.03	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
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Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xii: Results
Deep Aquifer, Background

	95% Protection of Aquatic Ecosystems	Irrigation	Stock Watering	Recreational								
					Sample Type:		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
					Laboratory:		Envirolab	Envirolab	Envirolab	Envirolab	Envirolab	Envirolab
					Sample date:		Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20
					Sample ID:		F6	F6	F6	F6	F6	F6
					Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
					Site:		Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri	Hydro Kurri Kurri
					Section:		Background	Background	Background	Background	Background	Background
					Aquifer:		Deep	Deep	Deep	Deep	Deep	Deep
					SWL (m AHD):		1.25	1.07	1.03	1.16	1.52	1.32
					Sample Description:		Clear, black particulate, sulphidic odour	Clear, sulphidic odour	Clear, sulphidic odour	Clear, sulphidic odour	Clear, no odour	Clear, no odour
Analyte grouping / Analyte						**Units**	**LOR**					
pH (field)	6.5-8[a]			5 - 9		pH units	-	6.62	5.61	6.75	6.72	6.83	7.05
Soluble Fluoride		1	2	1.5		mg/L	0.1	0.5	0.4	0.6	0.5	0.4	0.6
Free Cyanide	0.007			0.1		mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide						mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.008
Aluminium (total)	0.055	5	5	9		mg/L	0.01	0.12	0.07	0.03	0.04	0.27	0.03
Aluminium (dissolved)						mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Blank Cell indicates no criterion available
[a] Values for lowland rivers from Table 3.3.2 in ANZECC (2000)
LOR = Limit of Reporting
Concentrations below the LOR noted as <value
For Limit of Reporting (LOR) refer to laboratory certificates of analysis
Concentration in grey box exceed 95% Protection of Aquatic Ecosystems criteria value
Concentration in red font exceed Irrigation criteria value
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Concentration in *underline/italics* exceed Recreational criteria value

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiii: Results
QA / QC

	Duplicate Type:		Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplciate	RPD%	Primary	Intra-laboratory	RPD%	Primary	Intra-laboratory	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary
	Sample Type:		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater
	Sample date:		Feb-15	Feb-15		Feb-15	Feb-15		Feb-15	Feb-15		Jun-15	Jun-15		Jun-15	Jun-15		Jun-15	Jun-15		Sep-15	Sep-15		Sep-15
	Sample ID:		G2	QA1		G2	QA2		E11	QA3		PUMP	QA1 (QA100)		W7M	QA2 (QA101)		W7M	QA3 (QC200)		PUMP	QA100		W7M
	Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow
Analyte grouping / Analy		**Units**	**LOR**																					
Soluble Fluoride		mg/L	0.1	0.28	0.28	*0.0*	0.28	0.4	*35.3*	230	240	*4.3*	200	210	*4.9*	810	850	*4.8*	810	895	*10.0*	680	670	*1.5*	660
Free Cyanide		mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	0.005	0.005	*0.0*	<0.08	<0.08	*NC*	<2	<4	*NC*	<2	<0.040	*NC*	0.029	0.027	*7.1*	<0.04
Total Cyanide		mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	7.7	13	*51.2*	8.7	9.3	*6.7*	170	180	*5.7*	170	107	*45.5*	110	100	*9.5*	100
Aluminium (total)		mg/L	0.01	2.9	2.8	*3.5*	2.9	1.62	*56.6*	5	5.2	*3.9*	120	120	*0.0*	32	3.4	*161.6*	32	3.42	*161.4*	610	6,200	*164.2*	8700
Aluminium (dissolved)		mg/L	0.01	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-

LOR = Limit of Reporting
<value = Less than the laboratory Limit of Reporting (LOR)
Shaded cells exceed RPD >30%
NC = not calculated as one or more results are below the LOR.

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiii: Results
QA / QC

	Duplicate Type:		Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-Iboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate
	Sample Type:		Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater
	Sample date:		Sep-15		Sep-15	Sep-15		Dec-15	Dec-15		Dec-15	Dec-15		Apr-16	Apr-16		Apr-16	Apr-16		Apr-16	Apr-16		Jul-16	Jul-16
	Sample ID:		QA101		W7M	QA200		W2D	QA101		W2D	QA201		G2	QA101		G2	QA201		E11	QA102		G2	QC101
	Project Name:		Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow
Analyte grouping / Analy		**Units**	**LOR**																					
Soluble Fluoride		mg/L	0.1	13	*192.3*	660	648	*1.8*	1300	1200	*8.0*	1300	1300	*0.0*	0.2	0.2	*0.0*	0.2	0.3	*40.0*	120	120	*0.0*	0.3	0.3
Free Cyanide		mg/L	0.004	<0.004	*NC*	<0.04	<0.04	*NC*	0.88	0.67	*27.1*	0.88	0.7	*22.8*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004
Total Cyanide		mg/L	0.004	1.9	*192.5*	100	56.9	*54.9*	290	300	*3.4*	290	290	*0.0*	0.046	0.038	*19.0*	0.046	<0.004	*NC*	15	15	*0.0*	<0.004	<0.004
Aluminium (total)		mg/L	0.01	2100	*122.2*	8700	2270	*117.2*	3.5	3	*15.4*	3.5	2.8	*22.2*	9.6	8.9	*7.6*	9.6	10	*4.1*	7.6	9.4	*21.2*	1.2	1.2
Aluminium (dissolved)		mg/L	0.01	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-

LOR = Limit of Reporting
<value = Less than the laboratory Limit of Reporting (LOR
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Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiii: Results
QA / QC

	Duplicate Type:		RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%
	Sample Type:			Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater	
	Sample date:			Jul-16	Jul-16		Jul-16	Jul-16		Oct-16	Oct-16		Oct-16	Oct-16		Oct-16	Oct-16		Dec-16	Dec-16		Dec-16	Dec-16	
	Sample ID:			G2	QC102		W7M	QC100		W5D	QA100		W5D	QA200		A7	QA101		N2	2DUP		F5	5DUP	
	Project Name:			Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	
	Sampling Method:			Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow	
Analyte grouping / Analy	**Units**	**LOR**																						
Soluble Fluoride	mg/L	0.1	*0.0*	0.3	0.2	*40.0*	870	900	*3.4*	0.5	0.4	*22.2*	0.5	0.5	*0.0*	390	390	*0.0*	0.8	0.7	13.3	<0.1	<0.1	*NC*
Free Cyanide	mg/L	0.004	*NC*	<0.004	<0.004	*NC*	0.072	0.084	*15.4*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	0.03	0.03	*0.0*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*
Total Cyanide	mg/L	0.004	*NC*	<0.004	<0.004	*NC*	250	260	*3.9*	0.005	0.005	*0.0*	0.005	<0.003	*NC*	76	94	*21.2*	0.12	0.098	20.2	<0.004	<0.004	*NC*
Aluminium (total)	mg/L	0.01	*0.0*	1.2	0.79	*41.2*	0.08	0.08	*0.0*	0.14	0.1	*7.4*	0.14	0.14	*0.0*	2.1	2.2	*4.7*	5.9	5.6	5.2	2.3	2.2	4.4
Aluminium (dissolved)	mg/L	0.01	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*

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Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiii: Results
QA / QC

	Duplicate Type:		Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary
	Sample Type:		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater
	Sample date:		Mar-17	Mar-17		Mar-17	Mar-17		Mar-17	Mar-17		Jun-17	Jun-17		Jun-17	Jun-17		Jun-17	Jun-17		Sep-17	Sep-17		Sep-17
	Sample ID:		E5D	DUP1		E5D	TRIP1		W6D	DUP2		N8	DUP1		G2	TRIP1		G2	DUP2		G2	DUP1		G2
	Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow
Analyte grouping / Analy		**Units**	**LOR**																					
Soluble Fluoride		mg/L	0.1	22	19	14.6	22	21.9	0.5	1.4	0.5	94.7	0.4	0.4	0.0	0.2	0.3	40.0	0.2	0.3	40.0	0.3	0.3	0.0	0.3
Free Cyanide		mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
Total Cyanide		mg/L	0.004	5.5	2.3	82.1	5.5	3.04	57.6	0.043	0.043	0.0	<0.004	0.2	*NC*	<0.004	<0.004	*NC*	<0.004	0.004	*NC*	<0.004	<0.004	*NC*	<0.004
Aluminium (total)		mg/L	0.01	64	26	84.4	64	13.1	132.0	1.1	0.8	31.6	3.9	4.9	22.7	6.6	1.04	145.5	6.6	9.4	35.0	1.8	4.9	92.5	1.8
Aluminium (dissolved)		mg/L	0.01	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-

LOR = Limit of Reporting
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Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiii: Results
QA / QC

	Duplicate Type:	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate
	Sample Type:	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater
	Sample date:	Sep-17		Sep-17	Sep-17		Dec-17	Dec-17		Dec-17	Dec-17		Dec-17	Dec-17		Mar-18	Mar-18		Mar-18	Mar-18		Mar-18	Mar-18
	Sample ID:	TRIP1		N8	DUP2		W2D	DUP1		W2D	TRIP1		G2	DUP2		F6	DUP1		G5	TRIP1		G5	DUP2
	Project Name:	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
	Sampling Method:	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow
Analyte grouping / Analy	**Units**	**LOR**																					
Soluble Fluoride	mg/L	0.1	0.4	28.6	0.4	0.4	0.0	1200	1200	0.0	1200	1430	17.5	0.4	0.4	0.0	0.9	1	10.5	0.2	0.2	0.0	0.2	0.2
Free Cyanide	mg/L	0.004	<0.004	*NC*	<0.004	<0.004	*NC*	0.006	0.012	66.7	0.006	<1	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004
Total Cyanide	mg/L	0.004	<0.004	*NC*	0.41	0.027	175.3	200	230	14.0	200	268	29.1	<0.004	<0.004	*NC*	0.024	0.023	4.3	<0.004	<0.004	*NC*	<0.004	<0.004
Aluminium (total)	mg/L	0.01	0.82	74.8	25	26.0	3.9	0.28	0.25	11.3	0.28	<100	*NC*	1.7	1.4	19.4	0.16	0.13	20.7	0.19	0.17	11.1	0.19	0.15
Aluminium (dissolved)	mg/L	0.01	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-	*NC*	-	-

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Project No: 318000894
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Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiii: Results
QA / QC

	Duplicate Type:		RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%
	Sample Type:			Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater	
	Sample date:			Jun-18	Jun-18		Jun-18	Jun-18		Jun-18	Jun-18		Sep-18	Sep-18		Sep-18	Sep-18		Sep-18	Sep-18		Dec-18	Dec-18	
	Sample ID:			E5D	QA101		W1D	QA102		W1D	QA103		W3D	QA101		G2	QA102		G2	QA103		E5D	QA101	
	Project Name:			Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	
	Sampling Method:			Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow	
Analyte grouping / Analy	**Units**	**LOR**																						
Soluble Fluoride	mg/L	0.1	0.0	14	14	0.0	5.1	5.9	14.5	5.1	5.1	0.0	0.1	0.1	0.0	0.4	0.4	0.0	0.4	0.4	0.0	11	11	0.0
Free Cyanide	mg/L	0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.005	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*
Total Cyanide	mg/L	0.004	*NC*	1.6	1.7	6.1	0.69	0.532	25.9	0.7	0.7	4.3	<0.004	<0.004	*NC*	0.006	0.006	0.0	0.006	0.01	50.0	0.81	0.82	1.2
Aluminium (total)	mg/L	0.01	23.5	4.1	3.8	7.6	0.88	0.58	41.1	0.88	0.93	5.5	0.9	1.0	5.4	0.57	0.49	15.1	0.57	0.37	42.6	0.72	0.6	18.2
Aluminium (dissolved)	mg/L	0.01	*NC*	<0.01	<0.01	*NC*	0.14	0.1	33.3	0.1	0.1	0.0	0.9	1.0	9.4	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	0.03	0.02	40.0

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Project No: 318000894
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Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiii: Results
QA / QC

	Duplicate Type:		Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary
	Sample Type:		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater
	Sample date:		Dec-18	Dec-18		Dec-18	Dec-18		Mar-19	Mar-19		Mar-19	Mar-19		Mar-19	Mar-19		Jun-19	Jun-19		Jun-19	Jun-19		Jun-19
	Sample ID:		W1D	QA103		W1D	QA102		W5D	QA101		G5	QA103		W5D	QA102		G2	QA101		F6	QA102		F6
	Project Name:		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring
	Sampling Method:		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow
Analyte grouping / Analy		**Units**	**LOR**																					
Soluble Fluoride		mg/L	0.1	4.8	5.7	17.1	4.8	4.8	0.0	0.3	0.3	0.0	<0.1	0.1	*NC*	0.3	0.5	50.0	0.3	0.3	0.0	0.5	0.5	0.0	0.5
Free Cyanide		mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
Total Cyanide		mg/L	0.004	0.67	0.171	118.7	0.67	0.45	39.3	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004
Aluminium (total)		mg/L	0.01	0.43	0.76	55.5	0.43	0.51	17.0	0.44	0.38	14.6	0.3	0.3	12.9	0.44	0.36	20.0	0.7	0.7	0.0	0.05	0.04	22.2	0.05
Aluminium (dissolved)		mg/L	0.01	0.25	<0.01	*NC*	0.25	0.21	17.4	<0.01	<0.01	*NC*	30.0	30.0	0.0	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01

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Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiii: Results
QA / QC

	Duplicate Type:	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate
	Sample Type:	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater
	Sample date:	Jun-19		Sep-19	Sep-19		Sep-19	Sep-19		Sep-19	Sep-19		Dec-19	Dec-19		Dec-19	Dec-19		Dec-19	Dec-19		Mar-20	Mar-20
	Sample ID:	QA103		F6	QA101		G5	QA102		G5	QA103		G2	QA101		G5	QA102		G5	QA103		F6	D01
	Project Name:	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Groundwater M	Groundwater M		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
	Sampling Method:	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow
Analyte grouping / Analy	**Units**	**LOR**																					
Soluble Fluoride	mg/L	0.1	0.5	0.0	0.5	0.5	0.0	0.2	0.3	40.0	0.2	0.3	40.0	0.3	<0.1	*NC*	0.1	<0.1	*NC*	0.1	0.1	0.0	0.6	0.6
Free Cyanide	mg/L	0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004
Total Cyanide	mg/L	0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004
Aluminium (total)	mg/L	0.01	0.08	46.2	0.12	0.18	40.0	0.29	0.32	9.8	0.29	0.48	49.4	1.3	1.2	8.0	0.41	0.37	10.3	0.41	0.29	34.3	0.03	0.02
Aluminium (dissolved)	mg/L	0.01	<0.01	*NC*	<0.01	<0.01	*NC*	*0.01*	<0.01	*NC*	0.01	<0.01	*NC*	<0.01	<0.01	*NC*	0.02	0.02	0.0	0.02	0.02	0	<0.01	<0.01

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Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiii: Results
QA / QC

	Duplicate Type:		RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%
	Sample Type:			Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater	
	Sample date:			Mar-20	Mar-20		Mar-20	Mar-20		Jun-20	Jun-20		Jun-20	Jun-20		Jun-20	Jun-20		Sep-20	Sep-20		Sep-20	Sep-20	
	Sample ID:			G5	D02		G5	T01		G2	D01_170620		F6	D02_180620		F6	T01_180620		G2	DUP1		G5	DUP2	
	Project Name:			Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	
	Sampling Method:			Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow	
Analyte grouping / Analy	**Units**	**LOR**																						
Soluble Fluoride	mg/L	0.1	0.0	0.2	0.3	40.0	0.2	0.3	40.0	0.3	0.3	0.0	0.5	0.5	0.0	0.5	0.6	18.2	0.2	0.3	40.0	<0.1	0.1	*NC*
Free Cyanide	mg/L	0.004	*NC*	<0.004	<0.04	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*
Total Cyanide	mg/L	0.004	*NC*	<0.004	<0.04	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.008	*NC*
Aluminium (total)	mg/L	0.01	40.0	0.11	0.08	31.6	0.11	0.12	8.7	1	1	0.0	0.04	0.05	22.2	0.04	0.06	40.0	1.9	1.7	11.1	0.07	0.08	13.3
Aluminium (dissolved)	mg/L	0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	<0.01	<0.01	*NC*	0.03	0.03	0.0

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Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiii: Results
QA / QC

	Duplicate Type:	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%	Primary	Inter-laboratory Duplicate	RPD%	Primary	Intra-laboratory Duplicate	RPD%
	Sample Type:	Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater		Groundwater	Groundwater	
	Sample date:	Sep-20	Sep-20		Dec-20	Dec-20		Dec-20	Dec-20		Dec-20	Dec-20	
	Sample ID:	G5	TRIP1		W6D	D01_20201208		W6D	T01_20201208		F6	D02_091220	
	Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring		Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	
	Sampling Method:	Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow		Low-flow	Low-flow	
Analyte grouping / Analy	**Units**	**LOR**											
Soluble Fluoride	mg/L	0.1	<0.1	<0.1	*NC*	<0.1	<0.1	*NC*	<0.1	0.1	*NC*	0.6	0.7	*15.4*
Free Cyanide	mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*
Total Cyanide	mg/L	0.004	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	<0.004	<0.004	*NC*	0.008	0.007	*13.3*
Aluminium (total)	mg/L	0.01	0.07	0.07	0.0	3.2	2.6	20.7	3.2	1.46	74.7	0.03	0.03	0.0
Aluminium (dissolved)	mg/L	0.01	0.03	0.02	40.0	0.02	0.02	0.0	0.02	0.01	66.7	<0.01	<0.01	*NC*

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Project No: 318000894
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Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiv: Results
Rinsate

	Sample Type:	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank	Rinsate Blank
	Sample date:	Feb-15	Jun-15	Sep-15	Dec-15	Apr-16	Jul-16	Oct-16	Dec-16	Mar-17	Jun-17	Sep-17	Dec-17	Mar-18	Jun-18	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20
	Sample ID:	QB1	QA4 (QA300)	QA300	QA301	QA301	QA300	QA300	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	QC101	QC101	QC101	QC101	R01	QC101	QC101	R01	R01_180320
	Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring
Analyte grouping / Analy	**Units**	**LOR**																						
Soluble Fluoride	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Free Cyanide	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Total Cyanide	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Aluminium (total)	mg/L	0.01	*0.05*	<0.01	<0.01	*0.02*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aluminium (dissolved)	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

LOR = Limit of Reporting
<value = Less than the laboratory Limit of Reporting (LOR)
Shaded cells indicate when above the acceptance criteria for Trip Spikes/Blanks and Rinsates

Project No: 318000894
Client Name: Hydro Aluminium Kurri Kurri Pty Ltd
Project Name: 2020 Annual Groundwater Monitoring Report
Project Site: Kurri Kurri Smelter
21-01-21

Table xiv: Results
Rinsate

	Sample Type:	Rinsate Blank	Rinsate Blank
	Sample date:	Sep-20	Dec-20
	Sample ID:	R01_20200923	R01_091220
	Project Name:	Quarterly Groundwater Monitoring	Quarterly Groundwater Monitoring

Analyte grouping / Analy	**Units**	**LOR**		
Soluble Fluoride	mg/L	0.1	<0.1	<0.1
Free Cyanide	mg/L	0.004	<0.004	<0.004
Total Cyanide	mg/L	0.004	<0.004	<0.004
Aluminium (total)	mg/L	0.01	<0.01	<0.01
Aluminium (dissolved)	mg/L	0.01	<0.01	<0.01

LOR = Limit of Reporting
<value = Less than the laboratory Limit of Reporting (LOR
Shaded cells indicate when above the acceptance criteria for Trip Spikes/Blanks and Rinsates

APPENDIX 4
FIELD PARAMETER FORMS

RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID:	W2S
Project Name:	Ramboll Personnel:
Project No:	
Date: 17-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.39	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:

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

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

HUNTER
Suite 18, 50 Glebe Road
The Junction NSW 2291
Ph: 02 4962 5444

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W2D

Project Name:	Ramboll Personnel:
Project No: 318000894.	
Date: 17-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 2.37	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 ppm	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.31	22.0	10.10	40974	0.04	-291.5	26702	0.2	Red/brown, sulphidic
10.32	22.0	10.12	41323	0.02	-301.5	26884	0.3	odour
10.33	22.1	10.12	41443	0.01	-312.7	26968.5	0.4	" " " "
10.34	22.1	10.12	41560	0.00	-312.8	27040	0.5	" " " "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: cloudy.

Other:

PERTH
Level 2, 200 Adelaide Terrace
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Ph: 08 9225 5199

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North Sydney NSW 2060
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Low Flow Groundwater Sampling Field Parameter Form

Project Name:	Well ID: Pump
Project No: 3180008894	Ramboll Personnel:
Date: 17-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 2.64	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 3.36.	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: Yellow / brown, turbid

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.59	22.2	10.0	2944	3.49	-91.8	1641.5	0.2	slightly brown
11.00	22.1	9.92	1833	4.66	-94.0	1020	0.3	" "
11.01	22.1	9.72	1223	5.70	-96.6	741.0	0.4	" "
11.02	22.1	9.51	997	6.09	-96.2	611.0	0.5	" "
11.03	22.2	9.15	795	6.02	-79.5	481	0.6	" "
11.04	22.3	8.71	662	5.90	-56.2	409.5	0.7	" "
11.05	22.5	8.12	533	6.19	-31.5	351.0	0.8	" "
11.06	22.6	7.83	535	6.07	-23.7	344.5	0.9	" "
11.07	22.6	7.66	526	6.12	-15.8	338.0	1.0	" "
11.08	22.7	7.47	516.2	6.29	-5.0	334.7	1.1	" "
11.09	22.8	7.39	508.9	6.24	0.0	329.65	1.2	" "
11.10	22.8	7.31	503.7	6.18	4.2	326.95	1.3	" "
11.11	22.9	7.25	502.3	6.32	7.7	326.95	1.4	" "
11.12	22.9	7.20	509.5	5.92	11.5	332.8	1.5	" "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: cloudy.

Other: difficult to filter.

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID:	W7S
Project Name:	Ramboll Personnel:
Project No: 3180008894	
Date: 17-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 2.33	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)

Miscellaneous Field Comments: DRY.

Well Head Integrity:

Samples Filtered: ~~metals~~

Weather Conditions: cloudy

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	W7M
Project Name:	Hydro GME
Project No:	31800089 4
Date:	17-3-20.
Start time:	
Finish time:	
Ramboll Personnel:	J. Kirsch.
Subcontractors:	

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	3.73.	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)
11.36	23.2	9.70	24012	0.05	-130.8	15619.5	0.1	slightly red/brown
11.37	23.2	9.68	23991	0.02	-169.0	15580.5	0.2	no odour,
11.38	23.2	9.67	23975	0.01	-202.9	15593.5	0.3	" " " " "
11.39	23.2	9.67	24122	0.03	-222.3	15769.0	0.4	" " " "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: cloudy.

Other:

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SYDNEY
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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	ES
Project Name: Hydro GME	Ramboll Personnel: J. Kirsch
Project No: 318000894	
Date: 17-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 2.58	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)

Miscellaneous Field Comments DRY.

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: ESD.

Project Name: Hydro GME
Project No: 31800089 4
Date: 17-3-20.
Start time:
Finish time:

Ramboll Personnel:

Subcontractors:

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 5.43.	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: bright yellow.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
12.03	23.1	7.36	15566	0.60	-82.7	10127.0	0.1	Sulphidic odour
12.04	22.9	7.13	15574	0.79	-85.3	10127.0	0.2	" "
12.05	22.9	7.07	15583	0.69	-89.6	10127.0	0.3	" "
12.06	22.8	7.05	15587	0.60	-94.0	10127.0	0.4	" "

Miscellaneous Field Comments

Well Head Integrity:
Samples Filtered: metals
Weather Conditions: cloudy.
Other:

PERTH
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Project Name:	Hydro GME	Well ID:	42
Project No:	318000894	Ramboll Personnel:	
Date:	17-3-20		
Start time:		Subcontractors:	
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	8.89	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	13.41	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)
12:35	20.3	7.06	6355	0.78	-2.2	4127.5	0.1	clear, no odour
12:36	20.1	6.80	6354	0.59	-0.9	4134.0	0.2	" " "
12:37	20.0	6.61	6359	0.42	-0.1	4134.0	0.3	" " "
12:38	19.9	6.47	6357	0.37	-0.9	4134.0	0.4	" " "
12:39	19.9	6.38	6359	0.34	-1.6	4134.0	0.5	" " "
12:40	19.8	6.32	6358	0.32	-1.6	4134.0	0.6	" " "
12:41	19.8	6.26	6360	0.31	-2.3	4134.0	0.7	" " "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: cloudy.

Other:

PERTH
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North Sydney NSW 2060
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID:	N9

Project Name: Hydro GME	Ramboll Personnel:
Project No: 3180008894	
Date: 17-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.19	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: Yellow, difficult to filter.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
13.06	20.6	9.03	8932	1.83	-192.3	6474.0	0.1	Clear, sulphidic odour
13.07	20.7	8.67	10219	1.83	-204.3	6630.0	0.2	" " "
13.08	20.7	8.66	10259	1.39	-208.5	6688.5	0.3	" " "
13.09	20.7	8.64	10632	1.08	-223.6	6935.5	0.4	" " "

Miscellaneous Field Comments

Well Head Integrity: 2.40 pump at lowest capacity

Samples Filtered: metals

Weather Conditions: cloudy

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
Ph: 02 9954 8100

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID:	W65

Project Name: Hydro GME	Ramboll Personnel:
Project No: 318000894	
Date: 17-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 3.10	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: cloudy.

Other:

PERTH
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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W6D

Project Name: Hydro GME	Ramboll Personnel:
Project No: 318000894	
Date: 17-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.33	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	8.82	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)
13:31	20.0	7.61	1322	3.42	25.5	858.0	0.1	clear, no odour
13:32	19.7	6.81	1311	2.25	38.7	851.5	0.2	" " "
13:33	19.5	6.42	1313	1.95	42.6	851.5	0.3	" " "
13:34	19.5	6.20	1316	1.72	40.2	858.0	0.4	" " "
13:35	19.4	6.02	1318	1.86	33.7	858.0	0.5	" " "
13:36	19.4	5.89	1303	1.70	26.0	858.0	0.6	" " "
13:37	19.3	5.80	1314	1.83	21.8	851.5	0.7	" " "
13:38	19.3	5.75	1313	1.77	15.7	851.5	0.8	" " "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: cloudy.

Other:

PERTH
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID:	N8

Project Name: Hydro GME	Ramboll Personnel:
Project No: 3180008944	
Date: 17-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.11	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	5.29.	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: bright yellow

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
13:56	20.9	7.61	10226	1.20	-104.8	6734.0	0.1	clear, sulphidic odour
13:57	20.5	7.02	10988	0.55	-110.5	6825.0	0.2	" " "
13:58	20.5	6.88	10597	0.43	-113.3	6857.5	0.3	" " "
13:59	20.5	6.81	10571	0.33	-115.6	6870.5	0.4	" " "
14:00	20.5	6.76	10588	0.31	-118.5	6883.5	0.5	" " "

Miscellaneous Field Comments

Well Head Integrity: 4.52 pump at lowest capacity.

Samples Filtered: metals

Weather Conditions: cloudy.

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E11

Project Name: Hydro GME	Ramboll Personnel:
Project No: 318000894	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 3.19	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 4.84	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)
7.50	18.9	8.35	11709	1.09	-114.7	7637.5	0.1	
7.51	18.9	8.40	11754	0.54	-126.3	7631.0	0.2	
7.52	18.9	8.41	11738	0.45	-128.3	7624.5	0.3	
7.53	19.0	8.41	11708	0.37	-128.4	7605.0	0.4	

Miscellaneous Field Comments

Well Head Integrity: 3.19

Samples Filtered: metals

Weather Conditions:

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	WSS

Project Name: Hydro GME	Ramboll Personnel:
Project No: 318000894	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.65	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	1.69	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: metals.

Weather Conditions: sunny.

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	WSD
Project Name:	Hydro GME
Project No:	3180000894
Date:	18-3-20
Start time:	
Finish time:	
Ramboll Personnel:	
Subcontractors:	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 5.39	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 10.53	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)
8.17	17.7	7.59	6337	2.49	-19.0	4166.5	0.1	clear, no odour
8.18	18.3	7.11	6664	0.90	-19.6	4355.0	0.2	" " "
8.19	18.3	6.84	6786	0.67	-18.7	4420.0	0.3	" " "
8.20	18.4	6.62	6815	0.62	-17.9	4439.5	0.4	" " "
8.21	18.5	6.47	6834	0.51	-17.3	4452.5	0.5	" " "
8.22	18.5	6.36	6841	0.45	-16.1	4452.5	0.6	" " "
8.23	18.5	6.29	6844	0.41	-14.5	4452.5	0.7	" " "
8.24	18.5	6.24	6851	0.39	-14.2	4459.0	0.8	" " "

Miscellaneous Field Comments

Well Head Integrity: 7.95 pump at lowest capacity.

Samples Filtered: metals

Weather Conditions: sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: N2

Project Name: Hydro GME	Ramboll Personnel:
Project No: 318000894	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 5.23	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 5.62.	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)
8.44	17.8	5.41	7261	2.36	239.9	4719.0	0.1	slightly brown, turbid
8.45	17.7	4.99	7277	2.09	243.8	4719.0	0.2	" " "
8.46	18.2	4.27	7388	1.45	242.3	4816.5	0.3	" " "
8.47	18.2	4.14	7473	0.79	295.0	4862.0	0.4	" " "
8.48	18.2	4.09	7486	0.81	299.1	4862.0	0.5	clear " "

Miscellaneous Field Comments: difficult to filter.

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: sunny.

Other: sampled during stabilisation (cyanide)

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: F6

Project Name: Hydro GME
Project No: 318000894
Date: 18-3-20
Start time:
Finish time:

Ramboll Personnel:

Subcontractors:

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 5.65	m	YSI Pro Plus
Correction:	m	
Groundwater Elevation:	m	
Depth to Immiscible Layer	m	Measurement device:
Thickness to Immiscible layer:	m	Geopump.
Well Depth 15.46.	m	
Thickness to Groundwater Column:	m	Measurement device:

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)
9.14	18.2	8.08	9973	5.8	-32.8	6149	0.1	clear, sulphidic odour
9.15	18.3	7.27	9746	2.09	-53.0	6396	0.2	" " "
9.16	18.4	7.06	9927	1.06	-62.2	6461.0	0.3	" " "
9.17	18.4	6.94	10001	0.73	-67.9	6506.5	0.4	" " "
9.18	18.5	6.84	10054	0.62	-72.6	6539.0	0.5	" " "
9.19	18.5	6.78	10082	0.51	-76.5	6558.5	0.6	" " "
9.20	18.5	6.75	10097	0.45	-79.4	6565.0	0.7	" " "

Miscellaneous Field Comments DO1_180320.

Well Head Integrity: 6.42.
Samples Filtered: metals
Weather Conditions: Sunny.
Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	66

Project Name: Hydro GME	Ramboll Personnel:
Project No: 318000894	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.75	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.16	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)
9.45	18.8	5.89	7142	1.41	122.9	4654	0.1	clear, sulphidic
9.46	18.8	5.04	7199	0.73	116.6	4686.5	0.2	odour
9.47	18.8	4.59	7221	0.62	101.5	4693.5	0.3	" " "
9.48	18.8	4.33	7225	0.47	85.2	4693.0	0.4	" " "
9.49	18.8	4.16	7231	0.36	74.2	4699.5	0.5	" " "
9.50	18.8	4.11	7238	0.32	68.4	4706	0.6	" " "
9.51	18.8	4.06	7240	0.33	63.2	4706	0.7	" " "

Miscellaneous Field Comments

Well Head Integrity: 5.79

Samples Filtered: metals

Weather Conditions: sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	G5

Project Name: Hydro GME	Ramboll Personnel: J. Kirsch
Project No: 318000894	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.85	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)
10:22	19.7	6.64	8336	2.81	-204.9	5603	0.1	clear, very strong sulphuric odour
10:23	19.4	6.45	9022	1.88	-246.1	5908.5	0.2	" " " "
10:24	19.3	6.40	9176	1.70	-267.5	5973.5	0.3	" " " "
10:25	19.3	6.39	9233	1.17	-280.0	6012.5	0.4	" " " "
10:26	19.3	6.38	9268	0.86	-288.9	6032.0	0.5	" " " "

Miscellaneous Field Comments: DO2_~~0320~~ 180320
TOI_180320.

Well Head Integrity: 4.47.

Samples Filtered: metals

Weather Conditions: sunny.

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: F5

Project Name: Hydro GME	Ramboll Personnel: J. Kirsch
Project No: 31800089 4	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 3.88	m	YSI Pro Plus
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: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10.50	20.0	6.08	10832	1.44	-120.8	7059	0.1	clear, organic odour
10.51	19.8	5.87	10920	0.81	-118.6	7104.5	0.2	" " "
10.52	19.7	5.74	10980	0.47	-117.5	7143.5	0.3	" " "
10.53	19.6	5.55	10970	0.35	-110.7	7130.5	0.4	" " "
10.54	19.6	5.41	10977	0.31	-109.1	7137.0	0.5	" " "
10.55	19.7	5.42	10984	0.31	-110.9	7143.5	0.6	" " "
10.56	19.7	5.38	10987	0.29	-109.8	7143.5	0.7	" " "

Miscellaneous Field Comments

Well Head Integrity: 4.16.

Samples Filtered: metals

Weather Conditions: sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	A7

Project Name:	Ramboll Personnel: J. Kirsch
Project No: 318000894	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 2.29	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:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11.23	22.5	9.28	17566	0.23	-300.6	11946.5	0.1	slightly red/brown,
11.24	22.4	9.41	17629	0.11	-333.7	11953.0	0.2	sulphidic odour
11.25	22.2	9.45	17594	0.07	-350.8	11927	0.3	" " " " "
11.26	22.2	9.46	17591	0.05	-365.1	11355.5	0.4	" " " " "

Miscellaneous Field Comments

Well Head Integrity:	2.43
Samples Filtered:	metals
Weather Conditions:	sunny
Other:	

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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	W3D

Project Name:	Ramboll Personnel:
Project No:	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 6.92	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 10.08	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)
11.55								
~~11:49~~	26.7	4.66	2528	3.50	41.2	1670.5	0.1	Clear,
11.56	23.2	4.39	2801	3.35	51.1	1820	0.2	"
11.57	22.0	4.19	2780	1.95	60.3	1800.5	0.3	"
11.58	21.7	4.16	2759	0.89	63.9	1787.5	0.4	"
11:59	21.5	4.14	2742	0.70	71.1	1781.0	0.5	"

Miscellaneous Field Comments

Well Head Integrity: 7.75

Samples Filtered: metals

Weather Conditions: sunny.

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W35

Project Name:	Ramboll Personnel:
Project No: 318000894.	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 1.48	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)
12·17	23·3	7.10	8157	1·16	216.7	5309	0·1	slightly brown/red
12·18	23·0	7.42	8176	1·32	225·6	5336·0	0·2	" " "
sample 12·19	23·0	7.63	8264	1·82	230·9	5490·0	0·3	" " "
12·20	22·5	7.35	8744	0·95	209·3	5687·5	0·4	" " "
12·21	22.4	7·23	8773	0·33	211·0	5707·0	0·5	" " "
12·22	22·3	7.21	8792	0·31	217·3	5720·0	0·6	" " "

Miscellaneous Field Comments: Sampled during stabilisation.

Well Head Integrity: 1.78 pump at lowest capacity.

Samples Filtered: metals

Weather Conditions: sunny

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID:	W45

Project Name:	Ramboll Personnel:
Project No: 318000894.	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 1.03	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: Sunny.

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W15

Project Name:	Ramboll Personnel:
Project No: 318000894	
Date: 18-3-20	
Start time:	Subcontractors:
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

Well ID:	WID

Project Name:	Ramboll Personnel:
Project No:	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements			
Organic Vapours in Well:	ppm	Measurement device:	
Depth to Groundwater 4.72	m		
Correction:	m		
Groundwater Elevation:	m	Measurement device:	
Depth to Immiscible Layer	m		
Thickness to Immiscible layer:	m		
Well Depth 10.37	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)
12.52	21.0	7.15	10922	0.33	-77.9	7098.0	0.1	Bright yellow
12.53	20.8	7.13	10909	0.27	-79.0	7085.0	0.2	
12.54	20.9	7.12	10880	0.21	-80.1	7085.0	0.3	

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: Sunny.

Other:

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Ramboll Australia Pty Ltd
ACN 095 437 442
ABN 49 095 437 442
www.ramboll.com

RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID:	E4

Project Name:	Ramboll Personnel:
Project No: 318000894	
Date: 18-3-20	
Start time:	Subcontractors:
Finish time:	

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.41	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.39	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)
13:12	24.6	8.77	23616	0.89	-224.2	15236	0.1	Yellow/brown
13:13	23.4	9.55	23104	2.5	-246.4	14917.5	0.2	" "
13:14	22.9	9.61	23156	0.13	-256.5	15317	0.3	" "
13:15	22.2	9.64	23610	0.08	-288.0	15359.5	0.4	" "
13:16	22.0	9.65	23608	0.07	-295.6	15333.0	0.5	" "

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: sunny.

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
Ph: 02 9954 8100

HUNTER
Suite 18, 50 Glebe Road
The Junction NSW 2291
Ph: 02 4962 5444

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www.ramboll.com

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

GZ

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 8.7	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 13.42	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)
11:39	19.0	6.55	6206	0.69	-16.4	4036.5	0.1	clear, no odour.
11:40	19.0	6.47	6206	0.65	-16.0	4036.5	0.2	" " "
11:41	19.0	6.41	6208	0.69	-15.0	4036.5	0.3	" " "
11:42	19.0	6.37	6203	0.69	-14.4	4030.0	0.4	" " "

Miscellaneous Field Comments: well in good condition, monument rusted, hinge broken, DO1_170620.

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

ESD

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	1/6/19 17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 2.29	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 5.44	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: Yellow/red, non turbid

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11:08	19.3	7.31	14153	0.71	199.0	9204	0.1	clear, no odour
11:09	19.2	7.21	14160	0.65	195.1	9204	0.2	" " "
11:10	19.2	7.14	14162	0.57	190.3	9210.5	0.3	" " "
11:11	19.2	7.10	14164	0.49	185.4	9197.5	0.4	" " "

Miscellaneous Field Comments: well and monument in good condition

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

PUMP

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 859		
Date:	16/6/20 . 17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 . 0.94	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 . 3.45	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)
8:38	12.5	10.15	381.8	9.60	-83.9	241.15	0.1	clear, no odour
8:39	12.6	9.86	359.2	9.10	-67.8	230.75	0.2	" " "
8:40	12.6	9.66	342.9	9.37	-55.8	217.10	0.3	" " "
8:41	12.6	9.59	321.3	9.53	-97.7	209.10	0.4	" " "

Miscellaneous Field Comments

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

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

BH25 BH9

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.94	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.65 2.37	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)
7.53	12.1	7.02	548.1	13.07	119.2	353.6	0.1	clear, turbid
7.54	13.3	6.97	543.6	11.21	126.7	352.30	0.2	" "
7.55	13.7	6.86	537.0	10.65	121.6	347.75	0.3	" "
7.56	13.8	6.74	528.7	10.35	118.5	341.25	0.4	" "

Miscellaneous Field Comments: well in good condition
Sand difficult to filter

Well Head Integrity:

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

GW2D

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000		
Date:	17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.04	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	6.36	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)
8:13	14.9	10.11	31180	4.34	-281.7	20559.5	0.1	Red/brown, sulphuric
8:14	15.9	10.11	32750	4.08	-303.9	21560.3	0.2	odour.
8:15	16.2	10.11	33509	3.77	-311.7	21918.0	0.3	" " " "
8:16	16.3	10.11	33082	3.75	-318.6	22210.5	0.4	" " " "

Miscellaneous Field Comments: well in good condition.

Well Head Integrity: 2.25.

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:	318000 854		
Date:	12/19 17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 ~~3.10~~	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 3.10	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)

Miscellaneous Field Comments

DRY

Well Head Integrity:	
Samples Filtered:	
Weather Conditions:	
Other:	

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WTS

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000		
Date:	17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 ~~1.60~~	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 2.30	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)
8.57	13.5	9.09	346.5	8.10	-36.9	223.6	0.1	Clear, no odour
8.58	13.6	8.77	330.2	7.19	-27.9	211.90	0.2	" " "
8.59	13.6	8.57	322.7	6.74	-21.4	208.65	0.3	" " "
9.00	13.5	8.37	312.9	6.62	-13.0	201.5	0.4	" " "
9.01	13.5	8.20	308.1	6.39	-4.5	200.2	0.5	" " "
9.02	13.5	8.08	307.6	6.30	0.7	199.5	0.6	" " "

Miscellaneous Field Comments: well in good condition

Well Head Integrity:

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WTBM 119

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	12/19 . 17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 2.17	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 3.72	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: slightly red brown.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
9.17	15.8	8.98	10624	1.03	115.8	6903	0.1	clear, no odour
9.18	15.9	8.97	10615	1.25	119.2	6896.5	0.2	" " "
9.19	16.0	8.97	10592	1.02	121.9	6890	0.3	" " "

Miscellaneous Field Comments: well in good condition.

Well Head Integrity:

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N8 W7

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 874		
Date:	16/6/19 . 17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.78 3.96	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 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)
1.09	18.1	7.66	10296	3.58	-109.1	6708	0.1	slightly yellow/red,
1.10	18.1	7.13	10430	0.92	-105.3	6786	0.2	no odour
1.11	18.1	6.93	10476	0.69	-102.5	6812	0.3	" " " " "
1.12	18.1	6.83	10490	0.55	-101.0	6812	0.4	" " " " "
1.13	18.1	6.77	10489	0.48	-100.6	6818.5	0.5	" " " " "

Miscellaneous Field Comments: well in good condition, no casing.

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: overcast

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W6D 19.

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 894		
Date:	10/12/19 . 17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.78 6.20	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 8.80	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)
~~12:35~~	~~19.4~~	~~10.02~~	~~4.0~~	~~9.11~~	~~-45.1~~	~~260~~	~~0.1~~	
12:37	18.4	8.21	1292	2.73	-9.2	838.5	0.1	clear, no odour
12:38	18.4	7.12	1301	1.01	19.0	845.0	0.2	" " "
12:39	18.5	6.56	1305	0.64	27.3	851.5	0.3	" " "
12:40	18.5	6.26	1309	0.51	30.2	851.5	0.4	" " "
12:41	18.5	6.12	1308	0.49	33.0	851.5	0.5	" " "

Miscellaneous Field Comments: well and casing in good condition. Instaff...

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

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N9 · 419

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	16/6/20 17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2·28 2·21	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2·85 2·83	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)
12·10	17·7	8·82	5479	4·49	-189·4	5525	0·1	clear, sulphidic odour
12·11	17·4	8·54	8542	1·60	-213·7	5551.0	0·2	" " "
12·12	17·3	8·52	8503	1·41	-228·5	5531·5	0·3	" " "
12·13	17·2	8·53	8490	1·30	-230·1	5512.0	0·4	" " "

Miscellaneous Field Comments: well and casing in good condition. Secure.

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: overcast

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

ES

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	5/12/19 . 17/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.78 2.05	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 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)
~~17:8~~	17.8	8.8	18130	2.31	196.7	11809	0.1	slightly red/brown
10:48	17.9	8.79	18228	1.42	205.9	11862.5	0.2	" " "
10:49	17.9	8.79	18269	0.82	214.0	11882	0.3	" " "
								~~with black particulate~~

Miscellaneous Field Comments: well in good condition, monument rusted, hinge broken.

Well Head Integrity:

Samples Filtered: metals

Weather Conditions: sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

E4 MW

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 874		
Date:	18/6/20		
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 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)
13.20	17.5	9.73	28794	1.04	-318.8	18746	0.1	Red/brown, no odour
13.21	17.5	9.73	28861	0.22	-329.8	18765.5	0.2	" " " "
13.22	17.5	9.73	28887	0.08	-335.5	18772	0.3	" " " "

Miscellaneous Field Comments: well in good condition, groundwater level adjusted. NO I.D., no cap.

Well Head Integrity:

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WID

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 874		
Date:	17/6/20 - 18/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 4.27	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.45 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)
12:57	18.5	7.59	10559	1.40	-97.9	6903	0.1	clear to slightly
12:58	18.6	7.36	10713	2.70	-117.8	6961.5	0.2	yellow
12:59	18.6	7.28	10715	2.41	-119.2	6961.5	0.3	" " " "
13:00	18.6	7.22	10708	2.59	-118.3	6955.0	0.4	" " " "
13:01	18.6	7.17	10694	2.66	-115.8	6948.5	0.5	" " " "

Miscellaneous Field Comments: well and monument in good condition.

Well Head Integrity:

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WIS. MW

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 874		
Date:	12/19		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 2.32	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 2.91	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. good cond.

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W45 2019

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	12/19 18/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 0.60	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 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)
12·24	16·8	8.96	5885	5·07	28·2	3750.5	0·1	slightly red / brown
12·25	16·8	8.70	5365	5·35	57·0	3432	0·2	" " "
12·26	16·5	8·58	1868	5·42	65·9	3100·5	0·3	" " "
12·27	16·2	8·41	4409	5·32	72·7	2840	0·4	" " "
12·28	16·1	8·32	4287	4·79	80·9	2782	0·5	" " "

Miscellaneous Field Comments: well in good condition, no monument. pumped dry.

Well Head Integrity:

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

GW3

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	7/2/19 . 18/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 . 1.33	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 . 2.55	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: slightly red/ brown

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11:51	17.0	7.76	8281	0.81	171.1	5395	0.1	clear
11.52	16.7	7.57	8313	0.72	188.3	5395.5	0.2	"
11.53	16.4	7.43	8293	0.73	197.1	5395	0.3	"
11.54	16.4	7.31	8247	0.94	208.5	5369	0.4	"
11.55	16.3	7.29	8194	1.21	214.2	5317.0	0.5	"

Miscellaneous Field Comments: well in good condition, small monument. part of label missing.

Well Head Integrity:

Samples Filtered: metals.

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W3D 417

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 874		
Date:	17/6/20 18/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 6.89	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 10.08	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 mg/L	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11:26	18.3	7.36	2993	3.71	-21.2	1950	0.1	Clear
11:27	18.4	6.28	2989	1.44	-5.9	1943.5	0.2	"
11:28	18.4	5.66	2965	0.81	1.4	1924.0	0.3	"
11:29	18.4	5.19	2907	0.56	5.2	1878.5	0.4	"
11:30	18.4	4.93	2856	0.46	10.8	1846.0	0.5	"
11:31	18.3	4.75	2811	0.41	21.3	1820.	0.6	"
11:32	18.3	4.63	2724	0.37	34.9	1761.5	0.7	"
11:33	18.3	4.54	2677	0.36	47.9	1729	0.8	"

Miscellaneous Field Comments: well in good condition, [illegible] too shelves. no monument, half label missing.

Well Head Integrity:

Samples Filtered: metals

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:	318000 874		
Date:	11/6/19 . 18/6/20.		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 2.17	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 4.32	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
11:05	17.0	9.33	19251	4.72	-331.3	12577.5	0.1	Slightly brown, sulphidic
11:06	17.1	9.37	19564	0.94	-354.5	12796.5	0.2	odour
11:07	17.2	9.39	19676	0.32	-371.3	12792.0	0.3	" " " "
11:08	17.2	9.40	19722	0.13	-389.5	12824.5	0.4	" " " "

Miscellaneous Field Comments: well in good condition, no cap. Bush. [illegible]

Well Head Integrity:

Samples Filtered: metals.

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

F5

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	12/19 · 18/6/20 ·		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 3.78	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 7.37	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)
10·33	17·4	7·00	10982	5·07	6·2	7163	0·1	Clear, slight sulphidic
10·34	17·7	5·94	11180	1·96	14·9	7273·5	0·2	odour
10·35	17·9	5·96	11233	0·97	14·9	7306	0·3	" " " "
10·36	18·0	5·16	11251	0·55	17·6	7312·5	0·4	" " " "
10·37	18·0	5·01	11247	0·43	18·8	7312·5	0·5	" " " "
10·38	18·2	4·87	11236	0·33	20·9	7299·5	0·6	" " " "
10·39	18·2	4·80	11227	0·29	21·6	7299·5	0·7	" " " "
10·40	18·1	4·75	11227	0·26	21·9	7299·5	0·8	" " " "

Miscellaneous Field Comments: well in good condition since monument installed

Well Head Integrity:

Samples Filtered: metals

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:	318000 854		
Date:	17/6/20 18/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 3.72	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 11.31	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: black particulate.

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
10:10	17.4	7.60	5801	5.40	-103.0	3906	0.1	clear, sulphidic odour
10:11	17.6	6.97	6664	4.15	-61.0	4320	0.2	" " "
10:12	17.6	6.50	6868	2.83	-46.7	4978.5	0.3	" " "
10:13	17.6	6.14	6925	1.37	-42.6	4509.5	0.4	" " "
10:14	17.7	5.97	6949	0.80	-42.0	4511	0.5	" " "
10:15	17.8	5.86	6952	0.52	-41.5	4517.5	0.6	" " "

Miscellaneous Field Comments: well in good condition, monument rusted.

Well Head Integrity:

Samples Filtered: metals.

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

G6

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000		
Date:	18/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.78 5.59	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 7.19	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)
9.43	17.5	7.17	6891	6.35	19.4	4530.5	0.1	clear ~~to slightly brown~~,
9.44	17.8	5.92	7055	3.42	38.6	4589.0	0.2	sulphidic odour,
9.45	17.8	5.31	7062	1.71	41.9	4589	0.3	slightly turbid
9.46	17.9	5.06	7054	1.02	45.5	4582.5	0.4	" " " "
9.47	18.0	4.87	7055	0.68	45.6	4589.0	0.5	" " " " "
9.48	18.0	4.71	7063	0.47	46.2	4589.0	0.6	" " " " "
9.49	18.0	4.59	7060	0.37	44.9	4589.0	0.7	" " " " "

Miscellaneous Field Comments: well in good condition, no stickup - screened casing.

Well Head Integrity:

Samples Filtered: metals.

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

F6

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	18/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 5.52	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 15.98	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	17.1	6.92	9669	1.61	-68.0	6248.5	0.1	clear sulphidic
9.08	17.1	6.82	9729	1.23	-69.5	6331.0	0.2	odour
9.09	17.2	6.77	9756	1.13	-70.2	6349	0.3	" " "
9.10	17.3	6.72	9786	0.70	-71.2	6363.5	0.4	" " "

Miscellaneous Field Comments: well in good condition
D02_180620
T01_180620
Installed monument pulling away from concrete base.

Well Head Integrity:

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WSD 17

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	10/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 6.29	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 10.59	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)
8.08	15.5	8.23	5700	6.88	-56.1	3718	0.1	Clear, slightly sulphidic
8.09	16.0	7.67	5828	6.27	-37.9	3809	0.2	odour
8.10	16.0	7.28	5949	4.73	-29.0	3895.5	0.3	" " " "
8.11	16.3	7.06	6034	3.75	-27.7	3939	0.4	" " " "
8.12	16.3	6.88	6168	2.78	-26.0	4023.5	0.5	" " " "
8.13	16.4	6.76	6252	2.05	-24.9	4080.5	0.6	" " " "

Miscellaneous Field Comments: well in good condition
Sealed
no monument

Well Head Integrity:

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

NZ MP

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 874		
Date:	17/6/19 18/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 5.10	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 5.62	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: difficult to filter

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8:35	15.5	5.38	6891	5.33	163.5	4426	0.1	clear, sulphidic
8:36	16.3	5.07	7109	1.06	179.9	4628	0.2	odour
8:37	17.0	4.86	7249	3.06	178.8	4738.5	0.3	" " "
8:38	17.1	4.68	7258	1.75	172.8	4712.5	0.4	" " "
8:39	17.0	4.54	7209	1.23	174.1	4673.5	0.5	" " "

Miscellaneous Field Comments: well in good condition, no monument - shelf in well.

Well Head Integrity:

Samples Filtered: metals

Weather Conditions:

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WSS 17

Project Name:	Hydro GME	Ramboll Personnel:	J Kirsch
Project No:	318000 854		
Date:	17/6/19 . 18/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 1.32	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.45 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)
7:46	14.0	8.66	3188	7.29	-66.4	2073.5	0.1	clear, ~~to slightly~~ yellow,
7:47	14.0	8.30	3163	6.57	-61.2	2054.0	0.2	no odour
7:48	14.1	8.03	3078	5.76	-50.0	1989	0.3	" " " " "
7:49	14.1	7.87	3009	5.17	-41.3	1950.0	0.4	" " " " "
7:50	14.1	7.76	2950	4.66	-24.2	1911.0	0.5	" " " " "

Miscellaneous Field Comments

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:	318000		
Date:	14/6/19 - 15/6/20		
Start time:		Subcontractors:	0
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.28 3.16	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.85 4.82	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)
7:27	17.3	8.48	11930	3.80	-148.7	7741.5	0.1	clear, slight sulphidic
7:28	17.3	8.49	11807	2.70	-159.5	7663.0	0.2	odour
7:29	17.4	8.48	11703	2.17	-156.8	7579.0	0.3	" " " "

Miscellaneous Field Comments: well in good condition
missing: rusted, hinge broken.

Well Head Integrity:

Samples Filtered: metals.

Weather Conditions:

Other:

RAMBOLL

Daily Field Report

Project Name: Hydro GME	Ramboll Personel: J. Bourke, J. Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 6.30am	Subcontractors:
Finish time: 1.30pm	Subcontractor time on-site:
Travel time: 1hr	Visitors:
	Visitor time on-site:
Weather: Overcast in morning, then sunny	

BoM

Field Report:

Time	Activites and/or Observations
6.30am	JAB + JK arrive onsite to meet Glenn. Sampling gear loaded into Glenn's ute. Safety talk done and SWMS signed
7.00am	Groundwater sampling commences with wells W2S, W2D, PUMP, W7S, W7M, E5D, E5, G2, N9. W6S found to be dry. W6D, N8, E11, W5S, W5D, N2, F6, G6 sampled
1.15pm	Finished sampling for the day. Headed back to carpark to unload gear from Glenn's ute.
1.30pm	Left site to head home.

QA/QC

Primary sample: G2
Duplicate: DUP1

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North Sydney NSW 2060
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ABN 49 095 437 442
www.ramboll.com

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W25

Project Name: Hydro GME	Ramboll Personnel: J Bourke
Project No: 318000894	J Kirsch
Date: 22/09/20	
Start time: 7.05am	Subcontractors: N/A
Finish time: 7.37am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 1.85	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. (uS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
7.19	17.8	7.78	1682	2.99	-35.8	1092		~~Clear~~ no odour tinted, pale yellow
7.20	17.4	7.54	1647	1.03	-39.2	1059.5		" "
7.21	17.4	7.40	1630	0.94	-37.4	1053		" "
7.22	17.4	7.29	1582	0.93	-32.4	1007.5		" "
7.23	17.5	7.21	1494	1.02	-27.7	955.5		" "
7.24	17.5	7.10	1401	1.15	-20.4	903.5		" "
7.25	17.6	7.01	1319	1.31	-11.4	845		" "
7.26	17.6	6.92	1169	1.56	30.7	734.5		" "
7.27	17.6	6.81	966	1.86	52.9	598		" "
7.28	17.6	6.73	856	2.45	68.7	546		" "

Miscellaneous Field Comments

Well Head Integrity: 2.09m

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W2D

Project Name: Hydro GME	Ramboll Personnel: J Bourke J.Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 7.37am	Subcontractors: N/A
Finish time: 7.50am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 1.71	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. (µS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
7.41	18.6	10.20	30721	1.44	-90.3	20007		turbid, orange/brown, no odour
7.42	18.5	10.19	30800	1.18	-99.5	20026		" "
7.43	18.5	10.18	30836	1.09	-108	20046		" "
7.44	18.5	10.18	30875	0.98	-118.9	20072		" "

Miscellaneous Field Comments

Well Head Integrity: 2.5m
Samples Filtered: Metals
Weather Conditions: Overcast
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

PUMP

Project Name: Hydro GME	Ramboll Personnel: J Bourke J Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 7.54am	Subcontractors: N/A
Finish time: 8.17am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 1.88	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 3.46	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. (mS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
7:59	18.4	9.19	807	1.03	-93.4	520		turbid, yellow, no odour
8.00	18.1	8.54	769	0.43	-84.5	500		" "
8.01	18.0	8.37	760	0.35	-81.1	494		" "
8.02	17.9	8.19	749	0.33	-77.7	487.5		" "
8.03	17.8	8.01	737	0.29	-74.6	474.5		" "
8.04	17.9	7.87	727	0.29	-70.9	468		" "
8.05	17.9	7.69	711	0.25	-64.1	461.5		" "
8.06	17.9	7.62	703	0.24	-62.7	455		" "
8.07	17.9	7.56	696	0.23	-60.6	448.5		" "
8.08	18.0	7.48	686	0.21	-57.8	442		" "
8.09	17.8	7.43	677	0.21	-55.9	435.5		" "
8.10	17.9	7.40	672	0.19	-54.4	435.5		" "

Miscellaneous Field Comments

Well Head Integrity: 2.04m

Samples Filtered: Metals

Weather Conditions: Overcast

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WTS

Project Name: Hydro GME	Ramboll Personnel: J Bourke J Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 8.21am	Subcontractors: N/A
Finish time: 8.33am	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 1.93	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 2.31	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. (µS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
8.26	19.2	9.30	1763	1.81	-43.8	1137		Turbid, yellow/brown
8.27	18.5	8.70	1747	1.73	-27.5	1105		no odour "
8.28	18.7	8.05	1507	2.10	-16.3	1170		" "
8.29	18.8	7.84	1870	1.09	-71.9	1248		" "
8.30	18.4	7.75	2082	0.89	-77.2	1378		" "
8.31	18.4	7.67	2140	0.92	-71.5	1397		" "
8.32	18.3	7.61	1266	0.96	-59.1	1361		" "

Miscellaneous Field Comments - Sampled during stabilisation from flow cell
- Unable to filter for metals (too turbid)

Well Head Integrity: 2.31 - purge dry

Samples Filtered: ~~Metals~~

Weather Conditions: Overcast/Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WTM

Project Name: Hydro GME	Ramboll Personnel: J Bourke J Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 8.34am	Subcontractors: N/A
Finish time: 8.55am	

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 3.72	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

(uS/cm)

TIME	TEMP (°C)	pH	SPEC. COND.	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
8.44	19.7	9.11	8039	0.84	172.5	5193		~~Turbid~~, brown, no odour, ~~clear~~ slightly turbid
8.45	19.3	9.11	8200	0.70	170	5310		
8.46	18.9	9.11	8137	0.51	174.5	5284		
8.47	18.5	9.10	8167	0.51	177.3	5297		
8.48	18.4	9.10	8164	0.48	178	7133		
8.49	18.3	9.10	8193	0.47	176.7	7153		
8.50	18.3	9.10	8198	0.47	176.1	7143		

Miscellaneous Field Comments

Well Head Integrity: 2.64m
Samples Filtered: Metals
Weather Conditions: Sunny
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

E5D

Project Name: Hydro GME	Ramboll Personnel: J Bourke, J Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 9.00am	Subcontractors: N/A
Finish time: 9.18am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 2.03	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 4.43	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. (µS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
9.05	20.2	7.61	14458	0.71	11.8	9392		clear to slightly turbid, yellow, no odour
9.06	19.8	7.40	14452	0.61	8.3	9392		
9.07	19.9	7.27	14468	0.43	6.6	9405		" "
9.08	20.0	7.18	14466	0.35	6.5	9405		" "
9.09	19.9	7.12	14457	0.34	5.0	9399		" "
9.10	19.9	7.08	14457	0.46	-5.9	9399		" "
9.11	20.1	7.05	14460	0.63	-9.4	9399		" "
9.12	20.1	7.04	14460	0.80	-13.7	9399		" "

Miscellaneous Field Comments

Well Head Integrity: 2.27m
Samples Filtered: Metals
Weather Conditions: Sunny
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

E5

Project Name: Hydro GME	Ramboll Personnel: J Bourke, J Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 9.18am	Subcontractors: N/A
Finish time: 9.30am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 1.92	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. (µS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
9.24	19.2	9.22	20077	0.72	129.1	13045		clear, yellow/brown, no odour
9.25	18.9	9.16	20033	5.0	113.1	13026		" "
9.26	19.0	9.14	20054	4.8	111.0	13045		" "
9.27	18.9	9.11	20106	6.4	113.4	13071		" "
9.28	18.8	9.11	20099	4.7	116.0	13065		" "

Miscellaneous Field Comments: Sampled during stabilisation from flow cell

Well Head Integrity: 2.08m
Samples Filtered: Metals
Weather Conditions: Sunny
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

G2

Project Name: Hydro GME	Ramboll Personnel: J Bourke J. Kitsch
Project No: 318000894	
Date: 22/09/20	
Start time: 9.37am	Subcontractors: N/A
Finish time: 10.07am	

Field Measurements			
Organic Vapours in Well:	ppm	Measurement device:	
Depth to Groundwater 8.49	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. (us/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
9.43	20.6	7.62	6227	1.01	0.2	4056		Slightly turbid, pale
9.44	20.1	6.95	6243	0.96	6.9	4049		yellow, no odour
9.45	20.1	6.63	6256	0.71	9.7	4075		" "
9.46	19.9	6.53	6271	0.64	9.9	4075		" "
9.47	19.9	6.43	6265	0.60	4.9	4069		" "
9.48	20.0	6.37	6249	0.40	7.7	4056		" "
9.49	20.3	6.30	6242	0.39	8.1	4056		" "
9.50	20.4	6.25	6253	0.44	7.4	4062		" "
9.51	20.5	6.20	6272	0.56	8.3	4075		" "
9.52	20.5	6.17	6284	0.61	8.4	4088		" "
9.53	20.3	6.13	6308	0.74	9.9	4101		" "
9.54	20.3	6.12	6307	0.87	10.5	4101		" "

Miscellaneous Field Comments

Well Head Integrity: 8.49m

Samples Filtered: Metals

Weather Conditions: Sunny

Other: Duplicate taken - DUP1

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N9

Project Name: Hydro GME	Ramboll Personnel: J Bourke J Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 10:10am	Subcontractors: N/A
Finish time: 10:24am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 2.22	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. (µS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
10.17	17.1	9.16	6553	4.36	-181.4	4212		clear to slightly turbid, yellow, sulfuric odour
10.18	16.6	8.98	6375	4.65	-169.9	4160		
10.19	16.6	8.98	6575	4.74	-173.1	4251		" "
10.20	16.5	8.80	6514	5.11	-151	4231		" "
10.21	16.6	8.76	6406	5.25	-123.7	4147		" "
10.22	17.5	8.70	6522	6.73	-135	4264		" "

Miscellaneous Field Comments

Well Head Integrity: 2.55m

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WGS

Project Name: Hydro GME	Ramboll Personnel: J Bourke
Project No: 318000894	J Kirsch
Date: 22/09/20	
Start time: 10:26 am	Subcontractors: N/A
Finish time: 10:27am	

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 3.12	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 Purge dry

Well Head Integrity:

Samples Filtered: N/A

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

WGD

Project Name: Hydro GME	Ramboll Personnel: J Bourke J Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 10.27am	Subcontractors: N/A
Finish time: 10.47am	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 5.91	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 8.87	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. (uS/cm)	DO %	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
10:35	20.9	8.09	1226	11.4	10.3	799.5		
10:36	20.7	7.02	1248	11.6	38.5	812.5		
10:37	19.6	6.70	1268	10.0	72.4	825.5		
10:38	19.6	6.45	1267	16.6	80.4	819		
10:39	19.6	6.24	1262	16.3	77.4	819		
10:40	19.7	6.09	1258	14.6	55	819		
10:41	19.8	5.94	1258	13.8	50.3	819		
10:42	19.8	5.82	1255	13.0	46.0	812		
10:43	19.8	5.75	1250	12.8	43.4	812		

Miscellaneous Field Comments

Well Head Integrity: 6.26m

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N8

Project Name: Hydro GME	Ramboll Personnel: J Bourke, J Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 10:54am	Subcontractors: N/A
Finish time: 11:13am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 3.62	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
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: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND. (mS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
10:58	19.6	7.29	10834	3.47	-87.7	7013		Turbid, yellow, no odour
10:59	18.9	7.14	10733	2.83	-85.8	6981		" "
11:00	18.9	7.00	10746	2.30	-85.6	6987		" "
11:01	18.7	6.91	10707	2.36	-85.7	6968		" "
11:02	18.9	6.87	10684	2.54	-85.8	6968		" "
11:03	19.2	6.81	10704	2.75	-86.7	6961		" "
11:04	19.4	6.79	10702	2.80	-87.5	6948		" "
11:05	19.4	6.77	10728	2.78	-87.0	6974		" "

Miscellaneous Field Comments

Well Head Integrity: 4.14am

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

Project Name: Hydro GME	Ramboll Personnel: J Bourke
Project No: 318000894	E11
Date: 22/09/22	Subcontractors: N/A
Start time: 11.18am	
Finish time: 11:32am	

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 4.82	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. (µS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
11:23	18.9	8.72	11397	0.26	-142.8	7403		clear, yellow brown, no odour
11:24	18.3	8.70	11326	0.25	-158	7345		" "
11:25	18.2	8.69	11260	0.22	-160	7306		" "
11:26	18.1	8.69	11222	0.19	-161.6	7286		" "

Miscellaneous Field Comments

Well Head Integrity: 2.9m
Samples Filtered: Metals
Weather Conditions: Sunny
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W55

Project Name: Hydro GME	Ramboll Personnel: J Bourke J. Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 11:39am	Subcontractors: N/A
Finish time: 11:52am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 1.4	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 1.7	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. (uS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
11:43	21.1	8.85	3513	6.13	-33.3	2262		Slightly turbid, yellow/orange/brown, no odour
11:44	19.8	8.20	3380	4.21	-18.9	2145		" "
11:45	19.8	8.02	3060	4.50	9.1	1963		" "
11:46	19.7	7.85	2911	4.68	121.9	1865		" "
11:47	19.7	7.68	2531	4.66	209.3	1631		" "
11:48	20.3	7.52	2394	5.40	203.1	1592		" "
11:49	21.1	7.47	2541	5.89	198.5	1631		" "

Miscellaneous Field Comments: Sampled during stabilisation from flow cell

Well Head Integrity: 1.55m
Samples Filtered: Metals
Weather Conditions: Sunny
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W5D

Project Name: Hydro GME	Ramboll Personnel: J Bourke J Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 11:52am	Subcontractors: N/A
Finish time: 12.06pm	

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.99	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.53	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. (µS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
11:56	21.9	7.57	6326	1.28	-29.6	4121		clear, no odour
11:57	21.2	6.94	6348	0.60	-16.7	4121		" "
11:58	21.2	6.76	6321	0.57	-13.0	4101		" "
11:59	21.5	6.58	6273	0.44	-10.3	4069		" "
12.00	21.3	6.51	6241	0.41	-9.3	4043		" "
12.01	21.3	6.46	6203	0.39	-8.4	4030		" "

Miscellaneous Field Comments

Well Head Integrity: 6.87m

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

N2

Project Name: Hydro GME	Ramboll Personnel: J Bourke
Project No: 318000894	J Kirsch
Date: 22/09/20	
Start time: 12.08pm	Subcontractors: N/A
Finish time: 12:31pm	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 4.83	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. (µS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
12:17	20.4	5.43	7422	2.25	313.8	4849		clear to slightly turbid,
12:18	19.7	4.80	7432	2.26	348.0	4816		no odour "
12:19	19.5	4.58	7419	2.23	381.0	4836		" "
12:20	18.9	4.25	7462	2.08	422.8	4849		" "
12:21	18.8	4.07	7436	1.90	441	4816		" "
12:22	19.1	3.94	7418	1.98	445.1	4823		" "
12.23	19.1	3.88	7408	2.04	447.3	4816		" "

Miscellaneous Field Comments

Well Head Integrity: 5.54m

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

F6

Project Name: Hydro GME	Ramboll Personnel: J Bourke J Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 12.33pm	Subcontractors: N/A
Finish time: 12:51pm	

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.16	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	15.51	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. (µS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
12:42	21.6	7.83	10139	1.11	-92.7	6584		clear, no odour
12:43	21.1	7.32	10087	0.72	-82.5	6558		" "
12:44	21.4	7.01	10055	0.64	-73.9	6532		" "
12:45	21.5	6.93	10049	0.62	-73.0	6526		" "
12:46	21.6	6.87	10040	0.58	-72.5	6532		" "
12:47	21.5	6.83	10065	0.56	-72.2	6545		" "

Miscellaneous Field Comments

Well Head Integrity: 5.72m

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

G6

Project Name: Hydro GME	Ramboll Personnel: J Bourke J. Kirsch
Project No: 318000894	
Date: 22/09/20	
Start time: 12:51pm	Subcontractors: N/A
Finish time: 1.12pm	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 5.22	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 7.17	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. (µS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
12:57	20.8	6.41	8061	0.51	60.9	5232		clear no odour
12:58	20.9	5.78	8033	0.54	52.2	5219		" "
12:59	21.0	5.51	8031	0.53	48.3	5226		" "
1.00	20.9	5.17	8061	0.49	41.0	5245		" "
1.01	20.9	4.95	8071	0.56	32.8	5239		" "
1.02	21.1	4.80	8025	0.63	27.0	5219		" "
1.03	21.3	4.65	8032	0.76	11.8	5252		" "
1.04	21.1	4.53	8080	0.92	11.3	5253		" "
1.05	21.0	4.49	8088	0.98	9.5	5258		" "

Miscellaneous Field Comments

Well Head Integrity: 5.26m
Samples Filtered: Metals
Weather Conditions: Sunny
Other:

RAMBOLL

Daily Field Report

Project Name: Hydro GME	Ramboll Personel: J. Bourke
Project No: 318000894	
Date: 23/09/20	
Start time: 6.30am	Subcontractors:
Finish time:	Subcontractor time on-site:
Travel time: 1hr	Visitors:
	Visitor time on-site:
Weather: Fine/Sunny	BoM

Field Report:

Time	Activites and/or Observations
6.30am	JAB arrives onsite to meet Glenn
6.45am	Sampling gear loaded into Glenn's ute while Glenn fills water container
7.00am	Headed to first sampling location for the day
7.12am	Groundwater sampling commences for wells G5, F5, A7, W3D, W35, W45, W1S, W1D and E4.
10.32am	Finished sampling for the day. Rinsate done on flexi-tubing (R01-20200923). Headed back to carpark to unload Gear from Glenn's ute.
11.00am	Left site to head to office

QA/QC:

Primary sample: G5
Duplicate: DUP2
Triplicate: TRIP1
Rinsate: R01-20200923

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

G5

Project Name: Hydro GME	Ramboll Personnel: J Bourke
Project No: 318000894	
Date: ~~23/09/19~~ 23/09/20	
Start time: 7.12am	Subcontractors: N/A
Finish time: 7.49am	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 3.38	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:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
7:25	16.6	6.94	6707	1.42	-60.9	4452		clear no odour
7.26	16.9	6.38	7051	0.70	-38.5	4595		" "
7.27	17.1	6.10	7126	0.56	-31.2	4634		" "
7.28	17.2	5.96	7167	0.54	-31.3	4660		" "
7.29	17.2	5.91	7169	0.54	-31.7	4660		" "
7.30	17.3	5.85	7173	0.54	-32.8	4667		" "

Miscellaneous Field Comments

Well Head Integrity: 3.86m

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other: Duplicate (DUP2) and triplicate (TRIP1) taken

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

F5

Project Name: Hydro GME	Ramboll Personnel: J Bourke
Project No: 318000894	
Date: 23/09/20	
Start time: 7.49am	Subcontractors: N/A
Finish time: 8.09 am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 3.4	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 7.37	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)
7.56	17.4	5.72	11471	0.69	63.9	7462		water clear, no odour
7.57	17.4	5.31	11517	0.59	54.7	7486		" "
7.58	17.4	5.15	11526	0.48	53.2	7494		" "
7.59	17.4	5.02	11530	0.42	50.8	7494		" "
8.00	17.4	4.83	11537	0.45	47.5	7501		" "
8.01	17.4	4.77	11538	0.47	45.9	7501		" "
8.02	17.4	4.71	11538	0.50	45.3	7501		" "

Miscellaneous Field Comments

Well Head Integrity: 3.72m

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

A7

Project Name: Hydro GME	Ramboll Personnel: J Bourke
Project No: 318000894	
Date: 23/09/20	
Start time: 8.21am	Subcontractors: N/A
Finish time: 8.37am	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 1.95	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 4.32	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)
8.28	16.4	9.59	19064	0.36	-299.8	12421		clear, brown,
8.29	16.4	9.50	19152	0.21	-309.9	12454		strong 'rotten eggs'
8.30	16.3	9.60	19162	0.16	-317.9	12473		odour " "
8.31	16.3	9.60	19210	0.13	-326.1	12480		" "

Miscellaneous Field Comments

Well Head Integrity: 2.1m
Samples Filtered: Metals
Weather Conditions: Sunny
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W3D

Project Name: Hydro GME	Ramboll Personnel: J Bourke
Project No: 318000894	
Date: 23/09/20	
Start time: 8.38am	Subcontractors: N/A
Finish time: 9.09am	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 6.57	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: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	pH	SPEC. COND.	DO	REDOX (mV)	TDS	Litres Removed	Comments (Appearance, Odour, etc)
8.57	19.1	7.13	3518	2.16	40.9	2457		cleary no odour
8.58	18.9	6.16	4101	1.17	35.0	2678		" "
8.59	19.0	5.71	4135	1.00	-6.8	2678		" "
9.00	19.1	5.38	4093	0.70	-10.7	2626		" "
9.01	19.1	5.01	3960	0.54	-7.7	2567		" "
9.02	19.2	4.69	3875	0.61	13.6	2509		" "
9.03	19.2	4.60	3811	0.72	17.3	2476		" "
9.04	19.2	4.53	3775	0.82	40.5	2437		" "

Miscellaneous Field Comments

Well Head Integrity: 7.57m

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W35

Project Name:	Hydro GME	Ramboll Personnel:	J Bourke
Project No:	318000894		
Date:	23/09/20		
Start time:	9.09am	Subcontractors:	N/A
Finish time:	9.23am		

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.4	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.55	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. (mS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
9.12	18.1	7.77	7135	~~1.6~~ 0.86	219.5	4634		clear to slightly turbid, brown, no odour
9.13	18.1	7.52	7074	0.83	223.9	4682		
9.14	18.8	7.36	7043	0.61	226.6	4569		" "
9.15	18.9	7.30	6996	0.61	229.1	4537		" "
9.16	19.1	7.28	6947	0.60	229.7	4511		" "

Miscellaneous Field Comments

Well Head Integrity: 1.72m
Samples Filtered: Metals
Weather Conditions: Sunny
Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W45

Project Name: Hydro GME	Ramboll Personnel: J Bourke
Project No: 318000894	
Date: 23/09/20	
Start time: 9.34am	Subcontractors: N/A
Finish time: 9.35am	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 0.99	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: Not sampled. Purge dry

Well Head Integrity:

Samples Filtered: N/A

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W15

Project Name: Hydro GME	Ramboll Personnel: J Bourke
Project No: 318000894	
Date: 23/09/20	
Start time: 9.43am	Subcontractors: N/A
Finish time: 9.56am	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 1.69	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 2.41	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. (uS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
9.49	18.5	8.05	13244	0.43	-214.7	8580		turbid, yellow, no
9.50	18.1	7.94	13173	0.24	-218.1	8573		odour
9.51	18.0	7.89	13200	0.17	-218.5	8593		" "

Miscellaneous Field Comments

Well Head Integrity: 2.03m

Samples Filtered: Metals

Weather Conditions: Sunny

Other:

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

W1D

Project Name: Hydro GME	Ramboll Personnel: J Bourke
Project No: 318000894	
Date: 23/09/20	
Start time: 9.56am	Subcontractors: N/A
Finish time: 10.11am	

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.48	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.4	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. (mS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
10:02	19.7	8.01	14893	0.60	9.8	9685		clear, dark yellow,
10.03	19.4	7.82	14909	0.39	-0.5	9691		no odour "
10:04	19.4	7.71	14916	0.27	-5.3	9691		" "
10:05	19.4	7.61	14919	0.30	-8.0	9698		" "
10:06	19.3	7.57	14919	0.26	-11.8	9698		" "

Miscellaneous Field Comments

Well Head Integrity: 2.21m

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 Bourke
Project No: 318000894	
Date: 23/09/20	
Start time: 10.15am	Subcontractors: N/A
Finish time: 10.32am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 1.88	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 3.41	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. (uS/cm)	DO (ppm)	REDOX (mV)	TDS (mg/L)	Litres Removed	Comments (Appearance, Odour, etc)
10:23	19.4	9.78	29726	0.41	-262.9	19298		clear to slightly turbid, orange/brown, slight unknown odour
10:24	18.4	9.86	29658	0.15	-286.8	19272		" "
10:25	18.3	9.87	29651	0.11	-299.7	19272		" "
10:26	18.3	9.87	29665	0.09	-305.9	19279		" "
10:27	18.3	9.87	29707	0.07	-318	19311		" "

Miscellaneous Field Comments

Well Head Integrity: 2.06m
Samples Filtered: Metals
Weather Conditions: Sunny
Other:

RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W2S

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Bourke
Project No: 318000894	
Date: 8/12/20	
Start time: 7.45am	Subcontractors: N/A
Finish time: 8.01am	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 2.18	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: Turbid, light brown, no odour

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
7.47	0.2	8.2	0.1	21.3	7.04	3420	0.77	-89.7	2242.5	turbid, light brown, no odour
7.49	0.2		0.1	21.5	6.97	3522	1.09	-101.9	2294.5	" " "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments well purged dry - sampled from flow cell

Well Head Integrity: 2.38mbTOC

Samples Filtered: metals

Weather Conditions: Fine/Sunny/Windy

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
Ph: 02 9954 8100

HUNTER
Suite 18, 50 Glebe Road
The Junction NSW 2291
Ph: 02 4962 5444

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ABN 49 095 437 442
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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W2D

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Bourke
Project No: 318000894	
Date: 8/12/20	
Start time: 8.02am	Subcontractors: N/A
Finish time: 8.27am	

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.98	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	6.36	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☒ Peristalic ☐ Bailer

Start Sampling: 8.10am End Sampling: 8.25am

Sample Appearance: brown, clear, slight odour

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
8.12	0.2	0.2/2	0.1	20.2	10.05	28402	0.46	-305	8447	brown clear, slight odour
8.14	0.2	"	0.1	20.2	10.14	28465	0.21	-323	8518.5	" "
8.16	0.2	"	0.05	20.2	10.09	28500	0.22	-332	8590	" "
8.18	0.2	"	0.06	20.2	10.09	28486	0.29	-330	8642	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: 2.69mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny/Windy

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
Ph: 02 9954 8100

HUNTER
Suite 18, 50 Glebe Road
The Junction NSW 2291
Ph: 02 4962 5444

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: PUMP

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Bourke
Project No: 318000894	
Date: 8/12/20	
Start time: 8.29am	Subcontractors: N/A
Finish time: 8.55am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater ~~1.88~~ 1.90	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 3.43	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: 8.38am End Sampling:

Sample Appearance: light brown, no odour, slightly turbid

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
8.40	0.2	0.2/1	0.05	21.4	7.22	789	0.76	-152	516	no odour
8.42	0.2	"	0.04	21.4	7.14	775	0.74	-145.8	500.5	light brown, slightly turbid,
8.44	0.2	"	0.03	21.4	6.96	754	0.83	-128.9	487.5	" "
8.46	0.2	"	0.02	21.4	6.94	742	0.58	-118.9	481	" "
8.48	0.2	"	0.01	21.5	6.88	738	0.53	-109.9	481	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: 2.11mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny/Windy

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
Ph: 02 9954 8100

HUNTER
Suite 18, 50 Glebe Road
The Junction NSW 2291
Ph: 02 4962 5444

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ABN 49 095 437 442
www.ramboll.com

RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID:	W75
Project Name:	Quarterly Groundwater Monitoring
Project No:	318000894
Date:	8/12/20
Start time:	8.59am
Finish time:	
Ramboll Personnel:	J. Bourke
Subcontractors:	N/A

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:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: well dry – unable to sample

Well Head Integrity:

Samples Filtered: N/A

Weather Conditions: Fine/Sunny/Windy

Other:

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Low Flow Groundwater Sampling Field Parameter Form

Well ID: W7MD

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Bourke
Project No: 318000894	
Date: 8/12/20	
Start time: 9.04am	Subcontractors: N/A
Finish time: 9.31am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 2.46	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 ☑ Peristaltic ☐ Bailer

Start Sampling: 9.10am End Sampling: 9.25am

Sample Appearance: brown, slightly turbid, no odour

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
9.11	0.2	0.2/1.5	0.2	21.1	9.28	8742	8.28	104.7	5635	water brown, slightly
9.13	0.2	0.2/2	0.1	21.1	9.29	9241	8.16	154	6019	turbid, no odour
9.15	0.2	0.2/2	0.05	21.2	9.32	9263	8.11	163.4	6012.5	" "
9.17	0.2	"	0.05	21.1	9.28	9293	7.34	177.7	5986	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: 3.11 mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny/Windy

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E5D

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Bourke
Project No: 318000894	
Date: 8/12/20	
Start time: 9.35am	Subcontractors: N/A
Finish time: 9.58am	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 2.15	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: 9.40am End Sampling: 9.57am

Sample Appearance: slightly turbid, light brown, no odour

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
9.44	0.2	0.2/2	0.1	21.1	7.09	14432	0.9	-101.7	9379	slightly turbid, light
9.46	0.2	11	0.07	21.2	7.07	14403	0.7	-100.2	14394	brown, no odour
9.48	0.2	11	0.03	21.2	7.04	14430	0.38	-97.9	9386	11 11
9.50	0.2	11	0.01	21.3	7.02	14436	0.18	-98.6	9386	11 11

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: 2.38mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny/Windy

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E5

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Bourke
Project No: 318000894	
Date: 8/12/20	
Start time: 9.59am	Subcontractors: N/A
Finish time:	

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.19	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: 10.05am End Sampling:

Sample Appearance: brown, clear/slightly turbid, no odour

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
10.06	0.2	0.2/2	0.05	22.5	9.26	19490	3.82	162.6	2675	brown, clear/slightly
10.08	0.2	11	0.03	22.4	9.21	19516	2.27	168.2	2701	turbid, no odour
10.10	0.2	11	0.03	22.3	9.20	19530	1.69	173.6	2701	in 17

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: 2.35mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

PERTH
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: G2

Project Name: Quarterly Groundwater Monitoring
Project No: 318000894
Date: 8/12/20
Start time: 10.24am
Finish time:

Ramboll Personnel: J. Bourke
Subcontractors: N/A

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 7.54	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 13.44	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☒ Peristalic ☐ Bailer
Start Sampling: 10.31am
End Sampling:
Sample Appearance: light brown, slightly turbid, no odour

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
10.36	0.2	0.2/3	0.08	21.4	6.02	6097	0.97	-3.4	3952	light brown, slightly turbid,
10.39	0.2	11	0.0	21.6	6.23	6063	0.57	-2.1	3939	no odour
10.42	0.2	11	0.0	21.5	6.25	6070	0.36	-1.9	3945	" "
10.45	0.2	11	0.0	22.4	6.26	6091	0.31	0.5	3958	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: 7.54 mbTOC
Samples Filtered: Metals
Weather Conditions: Fine/Sunny
Other:

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East Perth WA 6004
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: N9

Project Name: Quarterly Groundwater Monitoring
Project No: 318000894
Date: 8/12/20
Start time: 11.12am
Finish time: 11.32am

Ramboll Personnel: J. Bourke
Subcontractors: N/A

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.35	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: 11.12am
End Sampling: 11.30am
Sample Appearance: light brown, turbid, no odour slight

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
11.14	0.2	0.2/2	0.1	20.3	8.71	7565	2.60	-218.1	4914	light brown, turbid,
11.16	0.2	"	0.05	20.1	8.68	7510	2.04	-226.7	4875	slight odour
11.18	0.2	"	0.05	20.1	8.73	7183	2.30	-195	4647	" "
11.20	0.2	"	0.03	20.1	8.71	7072	2.54	-191.2	4595	" "
11.22	0.2	"	0.04	20.0	8.69	7281	2.63	-184.7	4764.5	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: 2.73mbTOC
Samples Filtered: Metals
Weather Conditions: Fine / Sunny
Other:

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East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
Level 3, 100 Pacific Highway
North Sydney NSW 2060
Ph: 02 9954 8100

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W65

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Bourke
Project No: 318000894	
Date: 8/12/20	
Start time: 11.35am	Subcontractors: N/A
Finish time: 11.37am	

Field Measurements		
Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 3.11	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 3.12	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Not sampled - dry

Well Head Integrity:

Samples Filtered: N/A

Weather Conditions: Fine / Sunny

Other:

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East Perth WA 6004
Ph: 08 9225 5199

SYDNEY
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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W6D

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Bourke
Project No: 318000894	
Date: 6/12/20	
Start time: 11.39am	Subcontractors: N/A
Finish time: 12.16pm	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 5.95	m	
Correction:	m	
Groundwater Elevation:	m	Measurement device:
Depth to Immiscible Layer	m	
Thickness to Immiscible layer:	m	
Well Depth 8.8	m	Measurement device:
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: 11.42am End Sampling:

Sample Appearance: yellow brown, turbid, no odour

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
11.48	0.2	0.2/2	0.1	20.8	5.9	1279	1.62	129	824	yellow brown, turbid,
11.50	0.2	〃	0.1	20.9	5.78	1251	1.48	123	812.5	no odour
11.53	0.2	0.2/3	0.05	21.0	5.7	1247	1.19	118.5	812.5	〃 〃
11.56	0.2	〃	0.04	21.1	5.69	1253	1.10	119	812.5	〃 〃

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments DO1-20201208 and TO1-20201208 taken

Well Head Integrity: 6.38 mbTOC

Samples Filtered: metals

Weather Conditions: Fine/Sunny

Other:

PERTH
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East Perth WA 6004
Ph: 08 9225 5199

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: N8

Project Name: Quarterly Groundwater Monitoring
Project No: 318000894
Date: 8/12/20
Start time: 12.22pm
Finish time:

Ramboll Personnel: J. Bourke
Subcontractors: N/A

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 3.68	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 ☒ Peristaltic ☐ Bailer
Start Sampling:
End Sampling:
Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
12.30	0.2	0.2/2	0.05	23.6	6.97	10605	0.31	-111.9	6903	brown, slightly turbid, slight odour
12.32	0.2	11	0.05	23.4	6.93	10571	0.24	-113.2	6870	
12.34	0.2	11	0.03	23.6	6.96	10594	0.19	-119.2	6890	
12.36	0.2	11	0.03	23.7	6.95	10604	0.15	-121.5	6896	

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: 4.03 mbTOC
Samples Filtered: Metals
Weather Conditions: Fine/Sunny
Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: E11

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Bourke
Project No: 318000894	
Date: 8/12/20	
Start time: 12:57pm	Subcontractors: N/A
Finish time: 12.18pm	

Field Measurements

Organic Vapours in Well:	ppm	Measurement device:
Depth to Groundwater 2.98	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: light brown, clear to slightly turbid, no odour

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
1:01	0.2	0.2/2	0.05	20.9	9.38	12731	0.62	-193.3	8281	light brown, clear
1:03	0.2	"	0.03	21.0	9.47	12697	0.73	-193.5	8235	to slightly turbid, no odour
1:05	0.2	"	0.03	21.7	9.38	12450	0.48	-182.5	8079	" "
1:07	0.2	0.2/3	0.0	21.8	9.27	12314	0.14	-178.4	7995	" "
1:09	0.2	"	0.0	21.9	9.24	12353	0.11	-180.8	8014	" "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: 3.07mbTOC

Samples Filtered: Metals

Weather Conditions: Fine/Sunny

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: WSD

Project Name:	Quarterly Groundwater Monitoring
Project No:	318000894
Date:	9/12/20
Start time:	
Finish time:	
Ramboll Personnel:	J. Kirsch.
Subcontractors:	N/A

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.06	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.55	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (~~L~~) mL	flowrate (~~L~~/min) 100mL/m	Depth to water Drawdown (~~m~~)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
7.55	700	100mL/m	6.74	18.3	6.02	6475	0.94	-9.9	4212	clear, no odour
7.57	900	100mL/m	6.82	18.2	6.04	6498	0.92	-9.0	4225	clear, no odour
7.59	1100	100mL/m	6.86	18.5	6.05	6482	0.88	-8.2	4218.5	clear, no odour
8.01	1300	100mL/m	6.96	18.6	6.05	6492	0.81	-8.1	4225	clear, no odour
8.03	1500	100mL/m	7.01	18.6	6.05	4225	0.87	-7.3	4225	clear, no odour

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: pump at lowest capacity, water easy to filter.

Well Head Integrity: 7.18 after sampling.

Samples Filtered: metals

Weather Conditions: sunny.

Other:

PERTH
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East Perth WA 6004
Ph: 08 9225 5199

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: F5

Project Name:	Quarterly Groundwater Monitoring
Project No:	318000894
Date:	9/12/20
Start time:	
Finish time:	
Ramboll Personnel:	J. Kirsch.
Subcontractors:	N/A

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	7.39	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (mL)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
10:52	300	100mL/m	3.70	20.0	5.17	11451	1.34	-62.5	7492.5	clear, sulphidic odour
10:54	500	100mL/m	3.79	19.6	5.16	11457	0.94	-73.8	7442.5	" " "
10:56	700	100mL/m	3.83	19.6	5.07	11429	0.91	-80.6	7429.5	" " "
10:58	900	100mL/m	3.84	19.5	5.04	11430	0.85	-83.8	7429.5	" " "
11:00	1100	100mL/m	3.87.	19.6	5.01	11428	0.71	-88.6	7429.5	" " "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: pump at lowest capacity

Well Head Integrity: 3.86 at end of sampling.

Samples Filtered: metals

Weather Conditions: sunny.

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: G5

Project Name:	Quarterly Groundwater Monitoring
Project No:	318000894
Date:	9/12/20.
Start time:	
Finish time:	
Ramboll Personnel:	J. Kirsch
Subcontractors:	N/A

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	3.56	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:	11.35	m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (~~L~~) (mL)	flowrate (L/min)	SWL. Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
10.25	300mL	100mL/m	3.91	20.4	5.63	6875	1.86	-41.2	4478.5	Clear, no odour.
10.27	500mL	100mL/m	3.96	20.3	5.57	6921	1.04	-41.7	4491	" " "
10.29	700mL	100mL/m	4.01	20.6	5.59	6898	1.01	-47.6	4478	" " "
10.31	900mL	100mL/m	4.04	20.8	5.61	6905	0.74	-49.4	4491.5	" " "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: pump at lowest capacity 11ack suspended particulate.

Well Head Integrity: 4.01 at end of sampling.

Samples Filtered: metals

Weather Conditions: sunny.

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: G6

Project Name:	Quarterly Groundwater Monitoring
Project No:	318000894
Date:	9/12/20
Start time:	9.37
Finish time:	
Ramboll Personnel:	J. Kirsch.
Subcontractors:	N/A

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.32	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	7.10	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
9.44	200mL	100mL/m	5.37	19.1	4.30	7424	0.96	54.7	4829.5	clear, sulphidic odour
9.46	400mL	100mL/m	5.38	19.0	4.25	7439	1.07	38.3	4836	clear, sulphidic odour.
9.48	600mL	100mL/m	5.37	18.9	4.25	7430	0.78	26.1	4829.5	clear, sulphidic odour
9.50	800mL	100mL/m	5.38	19.2	4.21	7410	0.73	9.9	4816.5	" " "
9.52	1L	100mL/m	5.38	19.1	4.23	7433	0.37	1.3	4829.5	" " "
9.54	1.2L	100mL/m	5.38	19.1	4.24	7424	0.34	1.8	4823.0	" " "
9.56	1.4L	100mL/m	5.38	19.1	4.19	7425	0.35	-5.5	4829.5	" " "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments

Well Head Integrity: 5.38.

Samples Filtered: metals

Weather Conditions: sunny.

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W5S

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Kirsch
Project No: 318000894	
Date: 9/12/20	
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	1.70	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments Dry.

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: F6.

Project Name:	Quarterly Groundwater Monitoring
Project No:	318000894
Date:	9/12/20.
Start time:	
Finish time:	
Ramboll Personnel:	J. Kirsch.
Subcontractors:	N/A

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	5.36	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
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:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	~~Vol~~ Vol (mL)	flowrate ~~(L/min)~~ (mL/m)	Standing ~~Drawdown~~ (m) WL.	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
9.05	100	100mL/m	5.56	19.2	7.08	9604	1.73	-57.4	6246.5	Clear, no odour
9.07	300	100mL/m	5.65	19.2	7.06	9636	1.18	-59.6	6266	Clear, no odour
9.09	500	100mL/m	5.71	19.2	7.06	9639	0.57	-59.6	6266	Clear, no odour
9.11	700	100mL/m	5.77	19.2	7.05	9650	0.49	-59.3	6266	Clear, no odour

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Pump at lowest capacity. 002-091220. well monument rusted at base.

Well Head Integrity: 6.21

Samples Filtered: metals

Weather Conditions: sunny.

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: N2

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Kirsch
Project No: 318000894	
Date: 9/12/20	
Start time:	Subcontractors: N/A
Finish time:	

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	4.88	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
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: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L) mL	flowrate (L/min)	Standing ~~Drawdow n (m)~~ water level.	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
8.30	300	100mL/m	5.06	17.8	3.59	6981	0.72	418.8	4537	clear, no odour
8.32	500	100mL/m	5.10	17.7	3.59	6987	0.89	423.5	4543.5	" " "
8.34	700	100mL/m	5.15	17.7	3.58	6989	0.95	428.4	4543.5	" " "
8.36	900	100mL/m	5.20	17.8	3.55	6987	0.93	433.5	4593.5	" " "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: pump at lowest capacity. wrong bottle caps?

Well Head Integrity: 5.33 .

Samples Filtered: metals

Weather Conditions: sunny.

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: A7

Project Name: Quarterly Groundwater Monitoring	Ramboll Personnel: J. Kirsch.
Project No: 318000894	
Date: 9/12/20	
Start time:	Subcontractors: N/A
Finish time:	

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.06	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	4.32.	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol ~~(L)~~ (mL)	flowrate ~~(L/min)~~ (mL/m)	SWL ~~Drawdow~~ n (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
11.90	400mL	100	2.19.	21.7	10.23	19730	0.01	-419	2818	~~Slightly~~ Red brown, strong odour
11.92	600	100	2.15	21.9	9.95	19828	—	-424.7	2829.5	" " " "
11.94	800	100	2.16	22.0	10.01	19737	—	-428.6	2849	" " " "
11.96	1000	100	2.18	21.8	9.95	19784	—	-431.8	2857	" " " "
11.98	1200	100	2.20	21.7	9.85	19755	—	-434.2	2837.5	" " " "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: pump at lowest capacity.

Well Head Integrity: 2.28 at end of sampling.

Samples Filtered: metals

Weather Conditions: sunny.

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W35.

Project Name:	Quarterly Groundwater Monitoring	Ramboll Personnel:	J. Kirsch
Project No:	318000894		
Date:	9/12/20.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.65.	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.55.	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol ~~(L)~~ (mL)	flowrate ~~(L/min)~~ (mL/m)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
12.17	300	100	1.80	22.5	7.59	7304	2.34	-56.1	4725.5	Red/brown, no odour
12.19	500	100	1.86	21.9	7.54	7172	1.93	-28.2	4654.0	" " " "
12.21	700	100	1.92	21.8	7.55	7060	1.87	-4.5	4563.0	" " " "
12.23	900	100	1.98	22.0	7.58	6869	1.68	144.1	4439.5	" " " "
12.25	1100	100	2.03	22.2	7.59	6670	1.93	176.5	4329.0	" " " "
12.27	1300	100	2.04	22.2	7.59	6587	2.23	195.5	4283.0	" " " "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Pump at lowest capacity very difficult to filter.

Well Head Integrity: 2.23 at end of sampling.

Samples Filtered: metals

Weather Conditions: Sunny.

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID:	WAS

Project Name:	Quarterly Groundwater Monitoring	Ramboll Personnel:	J. Kirsch
Project No:	318000894		
Date:	9/12/20		
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	1.12	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (L/min)	Drawdown (m)	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: Dry, mud at base.

Well Head Integrity:

Samples Filtered:

Weather Conditions:

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W3D.

Project Name:	Quarterly Groundwater Monitoring	Ramboll Personnel:	J. Kirsch
Project No:	318000894		
Date:	9/12/20.		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	6.60	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.00	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol ~~(L)~~ (mL)	flowrate ~~(L/min)~~ mL/m	~~Drawdown~~ ~~(m)~~ SWL	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
12:53	200	100	6.89	22.3	4.21	3026	6.31	271.0	1963	clear, no odour.
12:55	400	100	6.97	21.3	4.19	2948	5.75	347.3	1904	" " "
12:57	600	100	7.09	21.3	4.02	2903	5.28	388.2	1885	" " "
12:59	800	100	7.20	21.2	3.91	2844	5.15	402.5	1839.5	" " "
13:01	1000	100	7.28	21.3	3.93	2773	4.95	410.3	1800.0	" " "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: pump at lowest capacity.

Well Head Integrity: 7.59 after sampling.

Samples Filtered: metals

Weather Conditions: Sunny.

Other:

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W1S.

Project Name:	Quarterly Groundwater Monitoring	Ramboll Personnel:	J. Kirsch
Project No:	318000894		
Date:	9/12/20		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.10	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	2.93 4+	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol (L)	flowrate (~~L/min~~) mL/min	~~Drawdow n~~ (m) SWL	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
13.40	300	100	2.10	22.2	8.38	13966	6.20	-177.2	9067.5	Red/brown, sulphidic odou
13.42	500	100	2.21	22.2	8.33	13974	5.99	-173.1	9048	" " " "
13.44	700	100	2.34	22.7	8.25	13980	5.35	-173.2	9158	" " " "
13.46	900	100		21.5	8.24	13769	4.52	-173.5	9061	" " " "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: pump at lowest capacity. well purged dry, sampled from container gathered during stabalisation.

Well Head Integrity: 2.42.

Samples Filtered: metals.

Weather Conditions:

Other: difficult to filter.

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RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Well ID: W1D.

Project Name:	Quarterly Groundwater Monitoring	Ramboll Personnel:	J. Kirsch.
Project No:	318000894		
Date:	9/12/20		
Start time:		Subcontractors:	N/A
Finish time:			

Field Measurements			
Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	1.93	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	10.40	m	Measurement device:
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristalic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

Stability Parameters			<0.1m	±0.1°C	±0.1 pH unit	±10%	±0.1mg/L	±10%	±10%	
TIME	Vol ~~(L)~~ mL	flowrate ~~(L/min)~~ mL/m	~~Drawdown~~ m(m) SWL	TEMP (°C)	pH	SPEC. COND. (µS/cm)	DO (mg/L)	Redox (mV)	TDS	Comments (Appearance, colour and odour)
14:03	300	100	2.12	21.7	8.22	14888	0.47	-151.7	9678.5	~~Clear to slightly~~ brownish yellow,
14:05	500	100	2.29	21.7	8.22	14892	0.28	-158.0	9678.5	" " , no odour
14:07	700	100	2.40	21.7	8.17	14880	0.54	-163.9	9678.0	" " " "
14:09	900	100	2.53	21.7	8.15	14884	0.59	-167.7	9665	" " " "
14:11	1100	100	2.68	21.7	8.14	14883	0.62	-170.5	9673	" " " "

IF Negative Redox and >2mg/L DO. RECALIBRATE and check again.

Miscellaneous Field Comments: pump at lowest capacity. bright yellow easy to filter

Well Head Integrity: 2.96 at end of sampling.

Samples Filtered: metals

Weather Conditions: sunny

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
Ph: 02 9954 8100

HUNTER
Suite 18, 50 Glebe Road
The Junction NSW 2291
Ph: 02 4962 5444

Ramboll Australia Pty Ltd
ACN 095 437 442
ABN 49 095 437 442
www.ramboll.com

RAMBOLL

Prepared by:
Reviewed by:

Low Flow Groundwater Sampling Field Parameter Form

E4

Project Name: Hydro 4mE	Ramboll Personnel: J. Kirsch.
Project No: 3180008994	
Date: 9/12/20	
Start time:	Subcontractors:
Finish time:	

Field Measurements

Organic Vapours in Well:		ppm	Measurement device:
Depth to Groundwater	2.16	m	
Correction:		m	
Groundwater Elevation:		m	Measurement device:
Depth to Immiscible Layer		m	
Thickness to Immiscible layer:		m	
Well Depth	3.42	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~~ mL Removed	Comments (Appearance, Odour, etc)
SWL 2.21	14:31	21.5	10.65	27923	1.14	-325.8	7771.0	200	Brown/red easy to filter
2.25	14:33	21.0	10.68	27288	0.49	-338.4	7764.5	400	
2.26	14:35	20.8	10.72	27255	0.48	-345.3	7719.0	600	
2.29.	14:37	21.0	10.64	27002	0.29	-341.0	7517.5	800	

Miscellaneous Field Comments

Well Head Integrity:	2.35 at end of sampling
Samples Filtered:	metals
Weather Conditions:	Sunny.
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 - 318000894
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		18/03/2020	WATER	X	X	X	X	X										
2	W6D		17/03/2020	WATER	X	X	X	X	X										
3	F5		18/03/2020	WATER	X	X	X	X	X										
4	G5		18/03/2020	WATER	X	X	X	X	X										
5	G2		17/03/2020	WATER	X	X	X	X	X										
6	N8		17/03/2020	WATER	X	X	X	X	X										
7	W5D		18/03/2020	WATER	X	X	X	X	X										
8	F6		18/03/2020	WATER	X	X	X	X	X										
9	G6		18/03/2020	WATER	X	X	X	X	X										
10	N2		18/03/2020	WATER	X	X	X	X	X										
11	W1D		18/03/2020	WATER	X	X	X	X	X										
12	E5D		17/03/2020	WATER	X	X	X	X	X										
13	E11		18/03/2020	WATER	X	X	X	X	X										
14	N9		17/03/2020	WATER	X	X	X	X	X										

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

Job No: 239201
Date Received: 19/03/20
Time Received: 1038
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:	18/03/2020	**Date & Time:**	19/03/20 1038
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 - 318000894	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	W3S		18/03/2020	WATER	X	X	X	X	X								
16	PUMP		17/03/2020	WATER	X	X	X	X	X								
17	A7		18/03/2020	WATER	X	X	X	X	X								
18	E4		18/03/2020	WATER	X	X	X	X	X								
19	W7M		17/03/2020	WATER	X	X	X	X	X								
20	W2D		17/03/2020	WATER	X	X	X	X	X								
21	D01_180320		10/12/2019	WATER	X	X	X	X	X								
22	D02_180320		11/12/2019	WATER	X	X	X	X	X								
-	T01_180320		11/12/2019	WATER	X	X	X	X	X								please send to ALS
23	R01_180320		11/12/2019	WATER	X	X	X	X	X								

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: 18/03/2020	Date & Time: 19/03/20 1038	Temperature Received at: (if applicable)
Signature:	Signature:	Transported by: Hand delivered / courier

239201

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 239201

Client Details

Client	Ramboll Australia Pty Ltd
Attention	Kirsty Greenfield
Address	PO Box 560, North Sydney, NSW, 2060

Sample Details

Your Reference	**Hydro Groundwater Plume Monitoring - 318000894**
Number of Samples	23 Water
Date samples received	19/03/2020
Date completed instructions received	19/03/2020

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

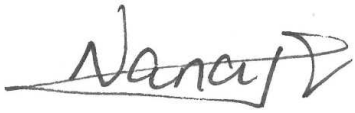
Date results requested by	26/03/2020
Date of Issue	26/03/2020

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Results Approved By
Loren Bardwell, Senior Chemist
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		239201-1	239201-2	239201-3	239201-4	239201-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		18/03/2020	17/03/2020	18/03/2020	18/03/2020	17/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Date analysed	-	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
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		239201-6	239201-7	239201-8	239201-9	239201-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		17/03/2020	18/03/2020	18/03/2020	18/03/2020	18/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Date analysed	-	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Fluoride, F	mg/L	0.4	0.4	0.6	0.2	0.9
Total Cyanide	mg/L	0.35	<0.004	<0.004	<0.004	0.051
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		239201-11	239201-12	239201-13	239201-14	239201-15
Your Reference	UNITS	W1D	E5D	E11	N9	W3S
Date Sampled		18/03/2020	17/03/2020	18/03/2020	17/03/2020	18/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Date analysed	-	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Fluoride, F	mg/L	4.1	9.8	41	140	150
Total Cyanide	mg/L	0.25	2.3	0.79	5.4	26
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	0.016

Miscellaneous Inorganics						
Our Reference		239201-16	239201-17	239201-18	239201-19	239201-20
Your Reference	UNITS	PUMP	A7	E4	W7M	W2D
Date Sampled		17/03/2020	18/03/2020	18/03/2020	17/03/2020	17/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Date analysed	-	19/03/2020	19/03/2020	19/03/2020	19/03/2020	19/03/2020
Fluoride, F	mg/L	30	410	560	810	1,300
Total Cyanide	mg/L	0.31	64	110	130	250
Free Cyanide in Water	mg/L	<0.004	<0.004	0.004	0.006	0.009

Miscellaneous Inorganics				
Our Reference		239201-21	239201-22	239201-23
Your Reference	UNITS	D01_180320	D02_180320	R01_180320
Date Sampled		11/12/2019	11/12/2019	11/12/2019
Type of sample		Water	Water	Water
Date prepared	-	19/03/2020	19/03/2020	19/03/2020
Date analysed	-	19/03/2020	19/03/2020	19/03/2020
Fluoride, F	mg/L	0.6	0.3	<0.1
Total Cyanide	mg/L	<0.004	<0.04	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.04	<0.004

HM in water - dissolved						
Our Reference		239201-1	239201-2	239201-3	239201-4	239201-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		18/03/2020	17/03/2020	18/03/2020	18/03/2020	17/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	20/03/2020	20/03/2020	20/03/2020	20/03/2020	20/03/2020
Date analysed	-	20/03/2020	20/03/2020	20/03/2020	20/03/2020	20/03/2020
Aluminium-Dissolved	µg/L	890	40	1,300	<10	<10

HM in water - dissolved						
Our Reference		239201-6	239201-7	239201-8	239201-9	239201-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		17/03/2020	18/03/2020	18/03/2020	18/03/2020	18/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	20/03/2020	20/03/2020	20/03/2020	20/03/2020	20/03/2020
Date analysed	-	20/03/2020	20/03/2020	20/03/2020	20/03/2020	20/03/2020
Aluminium-Dissolved	µg/L	70	<10	<10	6,700	2,600

HM in water - dissolved						
Our Reference		239201-11	239201-12	239201-13	239201-14	239201-15
Your Reference	UNITS	W1D	E5D	E11	N9	W3S
Date Sampled		18/03/2020	17/03/2020	18/03/2020	17/03/2020	18/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	20/03/2020	20/03/2020	20/03/2020	20/03/2020	20/03/2020
Date analysed	-	20/03/2020	20/03/2020	20/03/2020	20/03/2020	20/03/2020
Aluminium-Dissolved	µg/L	150	10	70	1,100	4,100

HM in water - dissolved						
Our Reference		239201-16	239201-17	239201-18	239201-19	239201-20
Your Reference	UNITS	PUMP	A7	E4	W7M	W2D
Date Sampled		17/03/2020	18/03/2020	18/03/2020	17/03/2020	17/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	20/03/2020	20/03/2020	20/03/2020	20/03/2020	20/03/2020
Date analysed	-	20/03/2020	20/03/2020	20/03/2020	20/03/2020	20/03/2020
Aluminium-Dissolved	µg/L	17,000	250	790	390	760

HM in water - dissolved				
Our Reference		239201-21	239201-22	239201-23
Your Reference	UNITS	D01_180320	D02_180320	R01_180320
Date Sampled		11/12/2019	11/12/2019	11/12/2019
Type of sample		Water	Water	Water
Date prepared	-	20/03/2020	20/03/2020	20/03/2020
Date analysed	-	20/03/2020	20/03/2020	20/03/2020
Aluminium-Dissolved	µg/L	<10	<10	<10

HM in water - total						
Our Reference		239201-1	239201-2	239201-3	239201-4	239201-5
Your Reference	UNITS	W3D	W6D	F5	G5	G2
Date Sampled		18/03/2020	17/03/2020	18/03/2020	18/03/2020	17/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	23/03/2020	23/03/2020	23/03/2020	23/03/2020	23/03/2020
Date analysed	-	23/03/2020	23/03/2020	23/03/2020	23/03/2020	23/03/2020
Aluminium-Total	µg/L	990	1,600	1,700	110	410

HM in water - total						
Our Reference		239201-6	239201-7	239201-8	239201-9	239201-10
Your Reference	UNITS	N8	W5D	F6	G6	N2
Date Sampled		17/03/2020	18/03/2020	18/03/2020	18/03/2020	18/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	23/03/2020	23/03/2020	23/03/2020	23/03/2020	23/03/2020
Date analysed	-	23/03/2020	23/03/2020	23/03/2020	23/03/2020	23/03/2020
Aluminium-Total	µg/L	300	40	30	6,900	8,500

HM in water - total						
Our Reference		239201-11	239201-12	239201-13	239201-14	239201-15
Your Reference	UNITS	W1D	E5D	E11	N9	W3S
Date Sampled		18/03/2020	17/03/2020	18/03/2020	17/03/2020	18/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	23/03/2020	23/03/2020	23/03/2020	23/03/2020	23/03/2020
Date analysed	-	23/03/2020	23/03/2020	23/03/2020	23/03/2020	23/03/2020
Aluminium-Total	µg/L	980	1,200	3,300	4,900	26,000

HM in water - total						
Our Reference		239201-16	239201-17	239201-18	239201-19	239201-20
Your Reference	UNITS	PUMP	A7	E4	W7M	W2D
Date Sampled		17/03/2020	18/03/2020	18/03/2020	17/03/2020	17/03/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	23/03/2020	23/03/2020	23/03/2020	23/03/2020	23/03/2020
Date analysed	-	23/03/2020	23/03/2020	23/03/2020	23/03/2020	23/03/2020
Aluminium-Total	µg/L	49,000	460	14,000	740	970

HM in water - total				
Our Reference		239201-21	239201-22	239201-23
Your Reference	UNITS	D01_180320	D02_180320	R01_180320
Date Sampled		11/12/2019	11/12/2019	11/12/2019
Type of sample		Water	Water	Water
Date prepared	-	23/03/2020	23/03/2020	23/03/2020
Date analysed	-	23/03/2020	23/03/2020	23/03/2020
Aluminium-Total	µg/L	20	80	<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	239201-2
Date prepared	-			19/03/2020	1	19/03/2020	19/03/2020		19/03/2020	19/03/2020
Date analysed	-			19/03/2020	1	19/03/2020	19/03/2020		19/03/2020	19/03/2020
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	0.2	0.2	0	100	99
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	96	77
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	100	96

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	239201-22
Date prepared	-			[NT]	10	19/03/2020	19/03/2020		19/03/2020	19/03/2020
Date analysed	-			[NT]	10	19/03/2020	19/03/2020		19/03/2020	19/03/2020
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	10	0.9	[NT]		104	98
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	10	0.051	[NT]		94	95
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	10	<0.004	[NT]		111	86

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	19/03/2020	19/03/2020		[NT]	[NT]
Date analysed	-			[NT]	11	19/03/2020	19/03/2020		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	11	4.1	4.2	2	[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	11	0.25	0.25	0	[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	11	<0.004	<0.004	0	[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	19/03/2020	19/03/2020		[NT]	[NT]
Date analysed	-			[NT]	21	19/03/2020	19/03/2020		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	21	0.6	0.6	0	[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	21	<0.004	<0.004	0	[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	21	<0.004	<0.004	0	[NT]	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	239201-2
Date prepared	-			20/03/2020	1	20/03/2020	20/03/2020		20/03/2020	20/03/2020
Date analysed	-			20/03/2020	1	20/03/2020	20/03/2020		20/03/2020	20/03/2020
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	890	860	3	106	97

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	239201-20
Date prepared	-			[NT]	11	20/03/2020	20/03/2020		20/03/2020	20/03/2020
Date analysed	-			[NT]	11	20/03/2020	20/03/2020		20/03/2020	20/03/2020
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	11	150	160	6	98	#

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	19	20/03/2020	20/03/2020		[NT]	[NT]
Date analysed	-			[NT]	19	20/03/2020	20/03/2020		[NT]	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	19	390	410	5	[NT]	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	239201-2
Date prepared	-			23/03/2020	1	23/03/2020	23/03/2020		23/03/2020	23/03/2020
Date analysed	-			23/03/2020	1	23/03/2020	23/03/2020		23/03/2020	23/03/2020
Aluminium-Total	µg/L	10	Metals-022	<10	1	990	990	0	106	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	239201-20
Date prepared	-			[NT]	11	23/03/2020	23/03/2020		23/03/2020	23/03/2020
Date analysed	-			[NT]	11	23/03/2020	23/03/2020		23/03/2020	23/03/2020
Aluminium-Total	µg/L	10	Metals-022	[NT]	11	980	880	11	104	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	19	23/03/2020	23/03/2020		[NT]	[NT]
Date analysed	-			[NT]	19	23/03/2020	23/03/2020		[NT]	[NT]
Aluminium-Total	µg/L	10	Metals-022	[NT]	19	740	830	11	[NT]	[NT]

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.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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

8 HM 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.

8 HM 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.

MISC_INORG: Total Cyanide PQL has been raised due to matrix interferences. Samples were diluted and reanalysed however same results were achieved.

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000894
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		18/03/2020	WATER	X	X	X	X	X				
2	W6D		17/03/2020	WATER	X	X	X	X	X				
3	F5		18/03/2020	WATER	X	X	X	X	X				
4	G5		18/03/2020	WATER	X	X	X	X	X				
5	G2		17/03/2020	WATER	X	X	X	X	X				
6	N8		17/03/2020	WATER	X	X	X	X	X				
7	W5D		18/03/2020	WATER	X	X	X	X	X				
8	F6		18/03/2020	WATER	X	X	X	X	X				
9	G6		18/03/2020	WATER	X	X	X	X	X				
10	N2		18/03/2020	WATER	X	X	X	X	X				
11	W1D		18/03/2020	WATER	X	X	X	X	X				
12	E5D		17/03/2020	WATER	X	X	X	X	X				
13	E11		18/03/2020	WATER	X	X	X	X	X				
14	N9		17/03/2020	WATER	X	X	X	X	X				

Environmental Division
Sydney
Work Order Reference
ES2009635

Telephone : +61-2-8784 8555

Relinquished by (company):	Ramboll	Received by (company):	ELS Syd.
Print Name:	Jordyn Kirsch	Print Name:	S. Bolton
Date & Time:	18/03/2020	Date & Time:	19/03/20 1038
Signature:		Signature:	

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

rec: TAD: 19/3/20 4:10p

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2009635**	Page	: 1 of 2
Amendment	: **1**		
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS KIRSTY GREENFIELD	Contact	: Loren Schiavon
Address	: EASTPOINT COMPLEX SUITE 19B, LEVEL 2 50 GLEBE ROAD THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 4934 4354	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000894	Date Samples Received	: 19-Mar-2020 16:10
Order number	: ----	Date Analysis Commenced	: 21-Mar-2020
C-O-C number	: ----	Issue Date	: 27-Jan-2021 11:38
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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

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

General Comments

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

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

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

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

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

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

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

- Amendment (27/01/2021): This report has been amended as a result of misinterpretation of sample date. All analysis results are as per the previous report

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Sample ID	**T01_180320**	----	----	----	----
				Sampling date / time	18-Mar-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES2009635-001**	--------	--------	--------	--------
					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		**0.12**	----	----	----	----
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	: **ES2009635**	Page	: 1 of 3
Amendment	: **1**		
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS KIRSTY GREENFIELD	Contact	: Loren Schiavon
Address	: EASTPOINT COMPLEX SUITE 19B, LEVEL 2 50 GLEBE ROAD THE JUNCTION NSW 2291	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 4934 4354	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000894	Date Samples Received	: 19-Mar-2020
Order number	: ----	Date Analysis Commenced	: 21-Mar-2020
C-O-C number	: ----	Issue Date	: 27-Jan-2021
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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

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

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2934142)									
ES2009689-002	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.08	0.07	0.00	No Limit
ES2009638-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.13	0.12	0.00	0% - 50%
EG020T: Total Metals by ICP-MS (QC Lot: 2933166)									
ES2009593-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit
ES2009860-009	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	18.5	20.1	8.53	0% - 20%
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 2934578)									
ES2009635-001	T01_180320	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.00	No Limit
ES2009860-009	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: 2934577)									
ES2009756-008	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.006	47.8	No Limit
ES2009635-001	T01_180320	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: 2929089)									
ES2009297-002	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.2	0.1	0.00	No Limit
ES2009805-003	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: 2934142)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	97.4	80.0	116
EG020T: Total Metals by ICP-MS (QCLot: 2933166)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	95.8	82.0	120
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2934578)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	100	88.0	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2934577)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	111	73.0	133
EK040P: Fluoride by PC Titrator (QCLot: 2929089)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	99.2	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	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 2934578)							
ES2009635-001	T01_180320	EK025SF: Free Cyanide	----	0.2 mg/L	110	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2934577)							
ES2009635-001	T01_180320	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	114	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 2929089)							
ES2009635-001	T01_180320	EK040P: Fluoride	16984-48-8	5 mg/L	96.2	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2009635**	Page	: 1 of 4
Amendment	: **1**		
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS KIRSTY GREENFIELD	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000894	Date Samples Received	: 19-Mar-2020
Site	: ----	Issue Date	: 27-Jan-2021
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	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
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	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*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
T01_180320	**18-Mar-2020**	**----**	----	----	**24-Mar-2020**	14-Sep-2020	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
T01_180320	**18-Mar-2020**	**24-Mar-2020**	14-Sep-2020	✓	**24-Mar-2020**	14-Sep-2020	✓
EK025SF: Free CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK025SF)							
T01_180320	**18-Mar-2020**	**----**	----	----	**25-Mar-2020**	01-Apr-2020	✓
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
T01_180320	**18-Mar-2020**	**----**	----	----	**25-Mar-2020**	01-Apr-2020	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
T01_180320	**18-Mar-2020**	**----**	----	----	**21-Mar-2020**	15-Apr-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	14	**14.29**	**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	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	14	**7.14**	**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	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	14	**7.14**	**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	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	14	**7.14**	**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, APHA 4500-CN-C&O and ISO 14403: 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 Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C&O / ASTM D7511 / ISO 14403. 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 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 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 Schedule B(3)

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318000894
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	W6D		17/06/2020	WATER	X	X	X	X	X								
2	G6		18/06/2020	WATER	X	X	X	X	X								
3	F5		18/06/2020	WATER	X	X	X	X	X								
4	W3D		18/06/2020	WATER	X	X	X	X	X								
5	G5		18/06/2020	WATER	X	X	X	X	X								
6	G2		17/06/2020	WATER	X	X	X	X	X								
7	W5D		18/06/2020	WATER	X	X	X	X	X								
8	N8		17/06/2020	WATER	X	X	X	X	X								
9	F6		18/06/2020	WATER	X	X	X	X	X								
10	N2		18/06/2020	WATER	X	X	X	X	X								
11	W1D		18/06/2020	WATER	X	X	X	X	X								
12	E5D		17/06/2020	WATER	X	X	X	X	X								
13	W7S		17/06/2020	WATER	X	X	X	X	X								
14	E11		18/06/2020	WATER	X	X	X	X	X								

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Phone: 02 9910 9200
Job No: 245220
Date Received: 19-06-2020
Time Received: 1105
Received By: ICG
Temp: Cool / Ambient
Cooling: Ice / Icepack 6.8°C
Security: Intact / Broken / None

Relinquished by (company):	Ramboll	**Received by (company):**	ES Syd
Print Name:	Jordyn Kirsch	**Print Name:**	IC-Core
Date & Time:	18/06/2020	**Date & Time:**	19.06.2020 11:05
Signature:		**Signature:**	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 6.8 (if applicable)
Transported by: Hand delivered / courier

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000894	**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	W5S		18/06/2020	WATER	X	X	X	X	X									
16	W2S		17/06/2020	WATER	X	X	X	X	X									
17	N9		17/06/2020	WATER	X	X	X	X	X									
18	W3S		18/06/2020	WATER	X	X	X	X	X									
19	W4S		18/06/2020	WATER	X	X	X	X	X									
NR ~~20~~	W6S		17/06/2020	WATER	X	X	X	X	X									
20	PUMP		17/06/2020	WATER	X	X	X	X	X									
21	E5		17/06/2020	WATER	X	X	X	X	X				—	—				
22	A7		18/06/2020	WATER	X	X	X	X	X									
23	E4		18/06/2020	WATER	X	X	X	X	X									
24	W7M		17/06/2020	WATER	X	X	X	X	X									
25	W2D		17/06/2020	WATER	X	X	X	X	X									
26	D01_170620		17/06/2020	WATER	X	X	X	X	X									
27	D02_180620		18/06/2020	WATER	X	X	X	X	X									
ALS	T01_180620		18/06/2020	WATER	X	X	X	X	X									please send to ALS
28	R01_180320		18/06/2020	WATER	X	X	X	X	X									

Relinquished by (company): Ramboll	Received by (company): ELS Syd	*Lab use only:*
Print Name: Jordyn Kirsch	Print Name: IC-Core	Samples Received: Cool or Ambient (circle one)
Date & Time: 18/06/2020	Date & Time: 19-06-20 11:05	Temperature Received at: 6.8 (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 245220

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 Groundwater Plume Monitoring - 318000894**
Number of Samples	28 Water
Date samples received	19/03/2020
Date completed instructions received	19/03/2020

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	26/06/2020
Date of Issue	26/06/2020

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Results Approved By
Loren Bardwell, Senior Chemist
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		245220-1	245220-2	245220-3	245220-4	245220-5
Your Reference	UNITS	W6D	G6	F5	W3D	G5
Date Sampled		17/06/2020	18/06/2020	18/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Fluoride, F	mg/L	<0.1	0.2	0.2	0.1	<0.1
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		245220-6	245220-7	245220-8	245220-9	245220-10
Your Reference	UNITS	G2	W5D	N8	F6	N2
Date Sampled		17/06/2020	18/06/2020	17/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Fluoride, F	mg/L	0.3	0.3	0.4	0.5	0.7
Total Cyanide	mg/L	<0.004	<0.004	0.49	<0.004	0.009
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		245220-11	245220-12	245220-13	245220-14	245220-15
Your Reference	UNITS	W1D	E5D	W7S	E11	W5S
Date Sampled		18/06/2020	17/06/2020	17/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Fluoride, F	mg/L	3.8	7.7	17	54	34
Total Cyanide	mg/L	0.50	0.84	0.080	1.9	2.6
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		245220-16	245220-17	245220-18	245220-19	245220-20
Your Reference	UNITS	W2S	N9	W3S	W4S	PUMP
Date Sampled		17/06/2020	17/06/2020	18/06/2020	18/06/2020	17/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Fluoride, F	mg/L	20	130	150	76	17
Total Cyanide	mg/L	0.17	3.7	18	2.1	0.009
Free Cyanide in Water	mg/L	<0.004	<0.004	0.005	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		245220-21	245220-22	245220-23	245220-24	245220-25
Your Reference	UNITS	E5	A7	E4	W7M	W2D
Date Sampled		17/06/2020	18/06/2020	18/06/2020	17/06/2020	17/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Fluoride, F	mg/L	220	470	690	440	1,100
Total Cyanide	mg/L	62	86	160	34	210
Free Cyanide in Water	mg/L	0.007	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics				
Our Reference		245220-26	245220-27	245220-28
Your Reference	UNITS	D01_170620	D02_180620	R01_180320
Date Sampled		17/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020
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

HM in water - dissolved						
Our Reference		245220-1	245220-2	245220-3	245220-4	245220-5
Your Reference	UNITS	W6D	G6	F5	W3D	G5
Date Sampled		17/06/2020	18/06/2020	18/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Aluminium-Dissolved	µg/L	30	5,800	2,300	690	30

HM in water - dissolved						
Our Reference		245220-6	245220-7	245220-8	245220-9	245220-10
Your Reference	UNITS	G2	W5D	N8	F6	N2
Date Sampled		17/06/2020	18/06/2020	17/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Aluminium-Dissolved	µg/L	<10	40	50	<10	2,600

HM in water - dissolved						
Our Reference		245220-11	245220-12	245220-13	245220-14	245220-15
Your Reference	UNITS	W1D	E5D	W7S	E11	W5S
Date Sampled		18/06/2020	17/06/2020	17/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Aluminium-Dissolved	µg/L	220	<10	2,100	60	6,600

HM in water - dissolved						
Our Reference		245220-16	245220-17	245220-18	245220-19	245220-20
Your Reference	UNITS	W2S	N9	W3S	W4S	PUMP
Date Sampled		17/06/2020	17/06/2020	18/06/2020	18/06/2020	17/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Aluminium-Dissolved	µg/L	9,600	700	1,200	5,400	440

HM in water - dissolved						
Our Reference		245220-21	245220-22	245220-23	245220-24	245220-25
Your Reference	UNITS	E5	A7	E4	W7M	W2D
Date Sampled		17/06/2020	18/06/2020	18/06/2020	17/06/2020	17/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Aluminium-Dissolved	µg/L	80	210	360	830	780

HM in water - dissolved				
Our Reference		245220-26	245220-27	245220-28
Your Reference	UNITS	D01_170620	D02_180620	R01_180320
Date Sampled		17/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020
Aluminium-Dissolved	µg/L	<10	<10	<10

HM in water - total						
Our Reference		245220-1	245220-2	245220-3	245220-4	245220-5
Your Reference	UNITS	W6D	G6	F5	W3D	G5
Date Sampled		17/06/2020	18/06/2020	18/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Aluminium-Total	µg/L	4,400	7,300	2,500	2,300	80

HM in water - total						
Our Reference		245220-6	245220-7	245220-8	245220-9	245220-10
Your Reference	UNITS	G2	W5D	N8	F6	N2
Date Sampled		17/06/2020	18/06/2020	17/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Aluminium-Total	µg/L	1,000	520	630	40	6,700

HM in water - total						
Our Reference		245220-11	245220-12	245220-13	245220-14	245220-15
Your Reference	UNITS	W1D	E5D	W7S	E11	W5S
Date Sampled		18/06/2020	17/06/2020	17/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Aluminium-Total	µg/L	2,100	1,300	5,900	2,400	11,000

HM in water - total						
Our Reference		245220-16	245220-17	245220-18	245220-19	245220-20
Your Reference	UNITS	W2S	N9	W3S	W4S	PUMP
Date Sampled		17/06/2020	17/06/2020	18/06/2020	18/06/2020	17/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Aluminium-Total	µg/L	18,000	1,600	3,100	19,000	3,200

HM in water - total						
Our Reference		245220-21	245220-22	245220-23	245220-24	245220-25
Your Reference	UNITS	E5	A7	E4	W7M	W2D
Date Sampled		17/06/2020	18/06/2020	18/06/2020	17/06/2020	17/06/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020	22/06/2020	22/06/2020
Aluminium-Total	µg/L	900	370	500	2,800	760

HM in water - total				
Our Reference		245220-26	245220-27	245220-28
Your Reference	UNITS	D01_170620	D02_180620	R01_180320
Date Sampled		17/06/2020	18/06/2020	18/06/2020
Type of sample		Water	Water	Water
Date prepared	-	22/06/2020	22/06/2020	22/06/2020
Date analysed	-	22/06/2020	22/06/2020	22/06/2020
Aluminium-Total	µg/L	1,000	50	<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	245220-2
Date prepared	-			22/06/2020	1	22/06/2020	22/06/2020		22/06/2020	22/06/2020
Date analysed	-			22/06/2020	1	22/06/2020	22/06/2020		22/06/2020	22/06/2020
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	<0.1	<0.1	0	94	70
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	104	101
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	105	102

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	245220-22
Date prepared	-			[NT]	10	22/06/2020	22/06/2020		22/06/2020	22/06/2020
Date analysed	-			[NT]	10	22/06/2020	22/06/2020		22/06/2020	22/06/2020
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	10	0.7	[NT]		105	#
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	10	0.009	0.009	0	104	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	10	<0.004	<0.004	0	105	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	245220-26
Date prepared	-			[NT]	11	22/06/2020	22/06/2020		[NT]	22/06/2020
Date analysed	-			[NT]	11	22/06/2020	22/06/2020		[NT]	22/06/2020
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	11	3.8	3.8	0	[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	11	0.50	[NT]		[NT]	94
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	11	<0.004	[NT]		[NT]	100

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	20	22/06/2020	22/06/2020		[NT]	[NT]
Date analysed	-			[NT]	20	22/06/2020	22/06/2020		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	20	17	[NT]		[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	20	0.009	0.009	0	[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	20	<0.004	<0.004	0	[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	22/06/2020	22/06/2020		[NT]	[NT]
Date analysed	-			[NT]	21	22/06/2020	22/06/2020		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	21	220	220	0	[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	21	62	[NT]		[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	21	0.007	[NT]		[NT]	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	245220-2
Date prepared	-			22/06/2020	1	22/06/2020	22/06/2020		22/06/2020	22/06/2020
Date analysed	-			22/06/2020	1	22/06/2020	22/06/2020		22/06/2020	22/06/2020
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	30	20	40	111	#

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	245220-22
Date prepared	-			[NT]	11	22/06/2020	22/06/2020		22/06/2020	22/06/2020
Date analysed	-			[NT]	11	22/06/2020	22/06/2020		22/06/2020	22/06/2020
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	11	220	210	5	110	#

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	22/06/2020	22/06/2020		[NT]	[NT]
Date analysed	-			[NT]	21	22/06/2020	22/06/2020		[NT]	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	21	80	80	0	[NT]	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	245220-11
Date prepared	-			22/06/2020	1	22/06/2020	22/06/2020		22/06/2020	22/06/2020
Date analysed	-			22/06/2020	1	22/06/2020	22/06/2020		22/06/2020	22/06/2020
Aluminium-Total	µg/L	10	Metals-022	<10	1	4400	3500	23	108	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			[NT]	12	22/06/2020	22/06/2020		22/06/2020	[NT]
Date analysed	-			[NT]	12	22/06/2020	22/06/2020		22/06/2020	[NT]
Aluminium-Total	µg/L	10	Metals-022	[NT]	12	1300	1400	7	111	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	20	22/06/2020	22/06/2020		[NT]	[NT]
Date analysed	-			[NT]	20	22/06/2020	22/06/2020		[NT]	[NT]
Aluminium-Total	µg/L	10	Metals-022	[NT]	20	3200	3400	6	[NT]	[NT]

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.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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

8 HM 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.

8 HM 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.

Fluoride
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

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000894
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: Slightly 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	W5S		18/06/2020	WATER	X	X	X	X	X								
16	W2S		17/06/2020	WATER	X	X	X	X	X								
17	N9		17/06/2020	WATER	X	X	X	X	X								
18	W3S		18/06/2020	WATER	X	X	X	X	X								
19	W4S		18/06/2020	WATER	X	X	X	X	X								
NR ~~20~~	W6S		17/06/2020	WATER	X	X	X	X	X								
20	PUMP		17/06/2020	WATER	X	X	X	X	X								
21	E5		17/06/2020	WATER	X	X	X	X	X								
22	A7		18/06/2020	WATER	X	X	X	X	X								
23	E4		18/06/2020	WATER	X	X	X	X	X								
24	W7M		17/06/2020	WATER	X	X	X	X	X								
25	W2D		17/06/2020	WATER	X	X	X	X	X								
26	D01_170620		17/06/2020	WATER	X	X	X	X	X								
27	D02_180620		18/06/2020	WATER	X	X	X	X	X								
AMS	T01_180620		18/06/2020	WATER	X	X	X	X	X								please send to ALS
28	R01_180320		18/06/2020	WATER	X	X	X	X	X								

vironmental Division
dney
Work Order Reference
ES2021396

phone : + 61-2-8784 8555

Relinquished by (company):	Ramboll	Received by (company):	ELS Syd
Print Name:	Jordyn Kirsch	Print Name:	K-Coore
Date & Time:	18/06/2020	Date & Time:	19-06-20 11:05
Signature:		Signature:	

ELS Syd
K-Coore
19-06-20 12:30

Lab use only:
Samples Received: Cool / or Ambient (circle one)
Temperature Received at: 6.8 (if applicable)
Transported by: Hand delivered / courier

Rec. Soffitto 19/6/20 1620 6.8°C

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2021396**	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 - 318000894	Date Samples Received	: 19-Jun-2020 16:20
Order number	: ----	Date Analysis Commenced	: 22-Jun-2020
C-O-C number	: ----	Issue Date	: 24-Jun-2020 18:34
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*
Dian Dao		Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**T01_180620**	----	----	----	----
				Client sampling date / time	18-Jun-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES2021396-001**	--------	--------	--------	--------
					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		**60**	----	----	----	----
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		**0.6**	----	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2021396**	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 - 318000894	Date Samples Received	: 19-Jun-2020
Order number	: ----	Date Analysis Commenced	: 22-Jun-2020
C-O-C number	: ----	Issue Date	: 24-Jun-2020
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 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*
Dian Dao		Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				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: 3094261)									
ES2021390-005	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.17	0.17	0.00	0% - 50%
ES2021390-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.19	0.20	0.00	0% - 50%
EG020T: Total Metals by ICP-MS (QC Lot: 3095006)									
ES2021247-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit
ES2021371-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	60 µg/L	0.06	0.00	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 3092643)									
ES2021309-001	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: 3092645)									
ES2021322-005	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.004	0.00	No Limit
ES2021416-006	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	0.079	0.079	0.00	0% - 50%
EK040P: Fluoride by PC Titrator (QC Lot: 3096541)									
ES2021303-003	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.00	No Limit
ES2021303-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	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: 3094261)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	91.2	80.0	116
EG020T: Total Metals by ICP-MS (QCLot: 3095006)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	96.9	82.0	120
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 3092643)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	113	88.0	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3092645)								
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: 3096541)								
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: 3092643)							
ES2021309-001	Anonymous	EK025SF: Free Cyanide	----	0.4 mg/L	114	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3092645)							
ES2021322-005	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	106	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 3096541)							
ES2021294-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	101	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2021396**	Page	: 1 of 5
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Telephone	: +61-2-8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000894	Date Samples Received	: 19-Jun-2020
Site	: ----	Issue Date	: 24-Jun-2020
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

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

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

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EK025SF: Free CN by Segmented Flow Analyser						
Clear Plastic Bottle - Natural						
T01_180620	----	----	----	22-Jun-2020	19-Jun-2020	**3**
EK026SF: Total CN by Segmented Flow Analyser						
Clear Plastic Bottle - Natural						
T01_180620	----	----	----	22-Jun-2020	19-Jun-2020	**3**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
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	13	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			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
T01_180620	**18-Jun-2020**	**----**	----	----	**22-Jun-2020**	15-Dec-2020	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
T01_180620	**18-Jun-2020**	**23-Jun-2020**	15-Dec-2020	✓	**23-Jun-2020**	15-Dec-2020	✓
EK025SF: Free CN by Segmented Flow Analyser							
Clear Plastic Bottle - Natural (EK025SF)							
T01_180620	**18-Jun-2020**	**----**	----	----	**22-Jun-2020**	19-Jun-2020	×
EK026SF: Total CN by Segmented Flow Analyser							
Clear Plastic Bottle - Natural (EK026SF)							
T01_180620	**18-Jun-2020**	**----**	----	----	**22-Jun-2020**	19-Jun-2020	×

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
T01_180620	**18-Jun-2020**	**----**	----	----	**23-Jun-2020**	16-Jul-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	8	**25.00**	**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	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	13	**15.38**	**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	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	13	**7.69**	**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	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	13	**7.69**	**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	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	0	13	**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 - 318000894	**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: 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	W6D		22/09/2020	WATER	X	X	X	X	X								
2	G6		22/09/2020	WATER	X	X	X	X	X								
3	F5		23/09/2020	WATER	X	X	X	X	X								
4	W3D		23/09/2020	WATER	X	X	X	X	X								
5	G5		23/09/2020	WATER	X	X	X	X	X								
6	G2		22/09/2020	WATER	X	X	X	X	X								
7	W5D		22/09/2020	WATER	X	X	X	X	X								
8	N8		22/09/2020	WATER	X	X	X	X	X								
9	F6		22/09/2020	WATER	X	X	X	X	X								
10	N2		22/09/2020	WATER	X	X	X	X	X								
11	W1D		23/09/2020	WATER	X	X	X	X	X								
12	E5D		22/09/2020	WATER	X	X	X	X	X								
13	W7S		22/09/2020	WATER	X	X	X	X	X								unable to field filter. Please filter unpreserved sample for dissolved aluminium analysis (0.45 µm)
14	E11		22/09/2020	WATER	X	X	X	X	X								

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

Job No: 252111

Date Received: 25/09/2020

Time Received: 10.30

Received By: RL

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:	R. Chazeen
Date & Time:	24/09/2020	Date & Time:	25/09/2020 10.30
Signature:		Signature:	

Lab use only:

Samples Received: Cool or Ambient (circle one)

Temperature Received at: 8.4 (if applicable)

Transported by: Hand delivered / courier

#252111.

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000894	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: 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	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	W1S		23/09/2020	WATER	X	X	X	X	X									
16	W5S		22/09/2020	WATER	X	X	X	X	X									
17	W2S		22/09/2020	WATER	X	X	X	X	X									
18	N9		22/09/2020	WATER	X	X	X	X	X									
19	W3S		23/09/2020	WATER	X	X	X	X	X									
20	PUMP		22/09/2020	WATER	X	X	X	X	X									
21	E5		22/09/2020	WATER	X	X	X	X	X									
22	A7		23/09/2020	WATER	X	X	X	X	X									
23	E4		23/09/2020	WATER	X	X	X	X	X									
24	W7M		22/09/2020	WATER	X	X	X	X	X									
25	W2D		22/09/2020	WATER	X	X	X	X	X									
26	DUP1		22/09/2020	WATER	X	X	X	X	X									
27	DUP2		23/09/2020	WATER	X	X	X	X	X									
sendout	TRIP1		23/09/2020	WATER	X	X	X	X	X									please send to ALS
28	R01_20200923		23/09/2020	WATER	X	X	X	X	X									
					X	X	X	X	X									

Relinquished by (company):	Ramboll	Received by (company):	GLS Syd
Print Name:	Jordyn Kirsch	Print Name:	R. Lhazeon
Date & Time:	24/09/2020	Date & Time:	25/09/2020. 10.30
Signature:		Signature:	

Lab use only:
Samples Received Cool or Ambient (circle one)
Temperature Received at: 9.4 (if applicable)
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 252111

Client Details

Client	Ramboll Australia Pty Ltd
Attention	Kirsty Greenfield
Address	PO Box 560, North Sydney, NSW, 2060

Sample Details

Your Reference	**Hydro Groundwater Plume Monitoring - 318000894**
Number of Samples	28 Water
Date samples received	25/09/2020
Date completed instructions received	25/09/2020

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

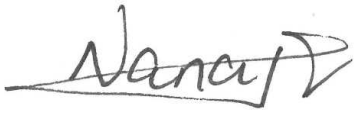
Date results requested by	02/10/2020
Date of Issue	01/10/2020

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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
Hannah Nguyen, Senior Chemist
Loren Bardwell, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		252111-1	252111-2	252111-3	252111-4	252111-5
Your Reference	UNITS	W6D	G6	F5	W3D	G5
Date Sampled		22/09/2020	22/09/2020	23/09/2020	23/09/2020	23/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Fluoride, F	mg/L	<0.1	0.2	0.1	0.1	<0.1
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		252111-6	252111-7	252111-8	252111-9	252111-10
Your Reference	UNITS	G2	W5D	N8	F6	N2
Date Sampled		22/09/2020	22/09/2020	22/09/2020	22/09/2020	22/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Fluoride, F	mg/L	0.2	0.5	0.4	0.4	0.8
Total Cyanide	mg/L	<0.004	<0.004	0.66	<0.004	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		252111-11	252111-12	252111-13	252111-14	252111-15
Your Reference	UNITS	W1D	E5D	W7S	E11	W1S
Date Sampled		23/09/2020	22/09/2020	22/09/2020	22/09/2020	23/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Fluoride, F	mg/L	8.5	7.3	22	53	17
Total Cyanide	mg/L	1.0	0.70	1.1	3.5	0.71
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		252111-16	252111-17	252111-18	252111-19	252111-20
Your Reference	UNITS	W5S	W2S	N9	W3S	PUMP
Date Sampled		22/09/2020	22/09/2020	22/09/2020	23/09/2020	22/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Fluoride, F	mg/L	34	20	57	97	21
Total Cyanide	mg/L	2.2	0.48	2.9	9.3	0.077
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	0.011	<0.004

Miscellaneous Inorganics						
Our Reference		252111-21	252111-22	252111-23	252111-24	252111-25
Your Reference	UNITS	E5	A7	E4	W7M	W2D
Date Sampled		22/09/2020	23/09/2020	23/09/2020	22/09/2020	22/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Fluoride, F	mg/L	250	370	560	290	800
Total Cyanide	mg/L	57	81	190	28	190
Free Cyanide in Water	mg/L	0.011	<0.004	<0.004	0.019	0.008

Miscellaneous Inorganics				
Our Reference		252111-26	252111-27	252111-28
Your Reference	UNITS	DUP1	DUP2	R01_20200923
Date Sampled		22/09/2020	23/09/2020	23/09/2020
Type of sample		Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020
Fluoride, F	mg/L	0.3	0.1	<0.1
Total Cyanide	mg/L	<0.004	<0.008	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004

HM in water - dissolved						
Our Reference		252111-1	252111-2	252111-3	252111-4	252111-5
Your Reference	UNITS	W6D	G6	F5	W3D	G5
Date Sampled		22/09/2020	22/09/2020	23/09/2020	23/09/2020	23/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Aluminium-Dissolved	µg/L	40	8,500	2,700	720	30

HM in water - dissolved						
Our Reference		252111-6	252111-7	252111-8	252111-9	252111-10
Your Reference	UNITS	G2	W5D	N8	F6	N2
Date Sampled		22/09/2020	22/09/2020	22/09/2020	22/09/2020	22/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Aluminium-Dissolved	µg/L	<10	<10	60	<10	3,100

HM in water - dissolved						
Our Reference		252111-11	252111-12	252111-13	252111-14	252111-15
Your Reference	UNITS	W1D	E5D	W7S	E11	W1S
Date Sampled		23/09/2020	22/09/2020	22/09/2020	22/09/2020	23/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Aluminium-Dissolved	µg/L	130	20	550	120	300

HM in water - dissolved						
Our Reference		252111-16	252111-17	252111-18	252111-19	252111-20
Your Reference	UNITS	W5S	W2S	N9	W3S	PUMP
Date Sampled		22/09/2020	22/09/2020	22/09/2020	23/09/2020	22/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Aluminium-Dissolved	µg/L	2,600	7,200	600	4,400	760

HM in water - dissolved						
Our Reference		252111-21	252111-22	252111-23	252111-24	252111-25
Your Reference	UNITS	E5	A7	E4	W7M	W2D
Date Sampled		22/09/2020	23/09/2020	23/09/2020	22/09/2020	22/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Aluminium-Dissolved	µg/L	70	220	460	2,600	690

HM in water - dissolved				
Our Reference		252111-26	252111-27	252111-28
Your Reference	UNITS	DUP1	DUP2	R01_20200923
Date Sampled		22/09/2020	23/09/2020	23/09/2020
Type of sample		Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020
Aluminium-Dissolved	µg/L	<10	30	<10

HM in water - total						
Our Reference		252111-1	252111-2	252111-3	252111-4	252111-5
Your Reference	UNITS	W6D	G6	F5	W3D	G5
Date Sampled		22/09/2020	22/09/2020	23/09/2020	23/09/2020	23/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Aluminium-Total	µg/L	3,600	9,300	3,200	970	70

HM in water - total						
Our Reference		252111-6	252111-7	252111-8	252111-9	252111-10
Your Reference	UNITS	G2	W5D	N8	F6	N2
Date Sampled		22/09/2020	22/09/2020	22/09/2020	22/09/2020	22/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Aluminium-Total	µg/L	1,900	240	4,500	270	4,500

HM in water - total						
Our Reference		252111-11	252111-12	252111-13	252111-14	252111-15
Your Reference	UNITS	W1D	E5D	W7S	E11	W1S
Date Sampled		23/09/2020	22/09/2020	22/09/2020	22/09/2020	23/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Aluminium-Total	µg/L	1,200	1,600	65,000	2,600	3,200

HM in water - total						
Our Reference		252111-16	252111-17	252111-18	252111-19	252111-20
Your Reference	UNITS	W5S	W2S	N9	W3S	PUMP
Date Sampled		22/09/2020	22/09/2020	22/09/2020	23/09/2020	22/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Aluminium-Total	µg/L	23,000	19,000	1,300	8,200	6,100

HM in water - total						
Our Reference		252111-21	252111-22	252111-23	252111-24	252111-25
Your Reference	UNITS	E5	A7	E4	W7M	W2D
Date Sampled		22/09/2020	23/09/2020	23/09/2020	22/09/2020	22/09/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020	28/09/2020	28/09/2020
Aluminium-Total	µg/L	1,000	400	550	11,000	760

HM in water - total				
Our Reference		252111-26	252111-27	252111-28
Your Reference	UNITS	DUP1	DUP2	R01_20200923
Date Sampled		22/09/2020	23/09/2020	23/09/2020
Type of sample		Water	Water	Water
Date prepared	-	28/09/2020	28/09/2020	28/09/2020
Date analysed	-	28/09/2020	28/09/2020	28/09/2020
Aluminium-Total	µg/L	1,700	80	<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 adjusted 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	252111-2
Date prepared	-			28/09/2020	1	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Date analysed	-			28/09/2020	1	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	<0.1	<0.1	0	83	60
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	96	76
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	100	99

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	252111-22
Date prepared	-			[NT]	10	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Date analysed	-			[NT]	10	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	10	0.8	[NT]		84	73
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	10	<0.004	<0.004	0	98	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	10	<0.004	<0.004	0	99	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	252111-27
Date prepared	-			[NT]	26	28/09/2020	28/09/2020		[NT]	28/09/2020
Date analysed	-			[NT]	26	28/09/2020	28/09/2020		[NT]	28/09/2020
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	26	0.3	[NT]		[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	26	<0.004	<0.004	0	[NT]	78
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	26	<0.004	<0.004	0	[NT]	88

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	252111-2
Date prepared	-			28/09/2020	1	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Date analysed	-			28/09/2020	1	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	40	30	29	100	#

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	252111-22
Date prepared	-			[NT]	11	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Date analysed	-			[NT]	11	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	11	130	140	7	98	#

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	28/09/2020	28/09/2020		[NT]	[NT]
Date analysed	-			[NT]	21	28/09/2020	28/09/2020		[NT]	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	21	70	80	13	[NT]	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	252111-2
Date prepared	-			28/09/2020	1	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Date analysed	-			28/09/2020	1	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Aluminium-Total	µg/L	10	Metals-022	<10	1	3600	4200	15	114	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	252111-22
Date prepared	-			[NT]	11	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Date analysed	-			[NT]	11	28/09/2020	28/09/2020		28/09/2020	28/09/2020
Aluminium-Total	µg/L	10	Metals-022	[NT]	11	1200	1200	0	114	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	28/09/2020	28/09/2020		[NT]	[NT]
Date analysed	-			[NT]	21	28/09/2020	28/09/2020		[NT]	[NT]
Aluminium-Total	µg/L	10	Metals-022	[NT]	21	1000	1100	10	[NT]	[NT]

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.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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

8 HM 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 filtered, preserved sample was received for sample #13, therefore the unpreserved sample was filtered through 0.45µm filter at the lab. Note: there is a possibility some elements may be underestimated.

8 HM 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.

MISC_INORG: Total Cyanide PQL has been raised due to interferences from analytes (other than those being tested) in the sample/s. Samples were diluted and reanalysed however same results were achieved.

#252111.

ENVIROLAB GROUP

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000894
Contact person: JK	PO No.:
Project Mgr: Kirsty Greenfield	Envirolab Quote No. :
Sampler: 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

HT

Environmental Division Sydney
Work Order Reference
ES2034111

Telephone : + 61-2-8784 8555

Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium	dissolved aluminium	Comments
15	W1S		23/09/2020	WATER	X	X	X	X	X	Provide as much information about the sample as you can
16	W5S		22/09/2020	WATER	X	X	X	X	X	
17	W2S		22/09/2020	WATER	X	X	X	X	X	
18	N9		22/09/2020	WATER	X	X	X	X	X	
19	W3S		23/09/2020	WATER	X	X	X	X	X	
20	PUMP		22/09/2020	WATER	X	X	X	X	X	
21	E5		22/09/2020	WATER	X	X	X	X	X	
22	A7		23/09/2020	WATER	X	X	X	X	X	
23	E4		23/09/2020	WATER	X	X	X	X	X	
24	W7M		22/09/2020	WATER	X	X	X	X	X	
25	W2D		22/09/2020	WATER	X	X	X	X	X	
26	DUP1		22/09/2020	WATER	X	X	X	X	X	
27	DUP2		23/09/2020	WATER	X	X	X	X	X	
sendout	TRIP1	(1)	23/09/2020	WATER	X	X	X	X	X	
28	R01_20200923		23/09/2020	WATER	X	X	X	X	X	please send to ALS
					X	X	X	X	X	

Relinquished by (company):	Ramboll	ELS Syd
Print Name:	Jordyn Kirsch	Ray
Date & Time:	24/09/2020	24/9/2020 1418
Signature:		

Received by (company):	ELS Syd
Print Name:	R. Ghazeon
Date & Time:	25/09/2020. 10.30
Signature:	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 9.4 (if applicable)
Transported by: Hand delivered / courier

Rec-soffice Yes 28/9/20 1730

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2034111**	Page	: 1 of 2
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS KRISTY GREENFIELD	Contact	: Loren Schiavon
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	: 02 4962 5444	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000894	Date Samples Received	: 28-Sep-2020 17:30
Order number	: ----	Date Analysis Commenced	: 29-Sep-2020
C-O-C number	: ----	Issue Date	: 02-Oct-2020 16:34
Sampler	: 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 ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

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

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Client sample ID	**TRIP1**	----	----	----	----
			Client sampling date / time	23-Sep-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2034111-001**	--------	--------	--------	--------
				Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.02**	----	----	----	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.07**	----	----	----	----
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	: **ES2034111**	Page	: 1 of 3
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS KRISTY GREENFIELD	Contact	: Loren Schiavon
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	: 02 4962 5444	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000894	Date Samples Received	: 28-Sep-2020
Order number	: ----	Date Analysis Commenced	: 29-Sep-2020
C-O-C number	: ----	Issue Date	: 02-Oct-2020
Sampler	: 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 ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				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: 3284770)									
ES2034131-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.02	0.02	0.00	No Limit
EW2004362-001	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: 3283825)									
ES2034088-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.10	<0.10	0.00	No Limit
ES2034169-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.01	0.02	0.00	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 3283806)									
ES2033893-001	Anonymous	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.00	No Limit
ES2033893-010	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: 3283807)									
ES2034076-005	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
ES2034154-002	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	2.43	2.47	1.48	0% - 20%
EK040P: Fluoride by PC Titrator (QC Lot: 3282719)									
ES2034095-003	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.7	0.7	0.00	No Limit
ME2001519-002	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.9	0.9	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: 3284770)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	91.2	80.0	116
EG020T: Total Metals by ICP-MS (QCLot: 3283825)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	96.9	82.0	120
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 3283806)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	94.3	88.0	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3283807)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	113	73.0	133
EK040P: Fluoride by PC Titrator (QCLot: 3282719)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	102	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: 3283806)							
ES2033893-001	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	126	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3283807)							
ES2034076-005	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	106	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 3282719)							
ES2034095-003	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	99.6	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2034111**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS KRISTY GREENFIELD	Telephone	: +61 2 8784 8555
Project	: Hydro Groundwater Plume Monitoring - 318000894	Date Samples Received	: 28-Sep-2020
Site	: ----	Issue Date	: 02-Oct-2020
Sampler	: 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	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS)					
Dissolved Metals by ICP-MS - Suite A	0	15	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	0	15	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*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
TRIP1	**23-Sep-2020**	**----**	----	----	**30-Sep-2020**	22-Mar-2021	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
TRIP1	**23-Sep-2020**	**30-Sep-2020**	22-Mar-2021	✓	**30-Sep-2020**	22-Mar-2021	✓
EK025SF: Free CN by Segmented Flow Analyser							
White Plastic Bottle-NaOH (EK025SF)							
TRIP1	**23-Sep-2020**	**----**	----	----	**30-Sep-2020**	07-Oct-2020	✓
EK026SF: Total CN by Segmented Flow Analyser							
White Plastic Bottle-NaOH (EK026SF)							
TRIP1	**23-Sep-2020**	**----**	----	----	**30-Sep-2020**	07-Oct-2020	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
TRIP1	**23-Sep-2020**	**----**	----	----	**29-Sep-2020**	21-Oct-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	15	**13.33**	**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	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**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	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**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	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	0	15	**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	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	0	15	**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, APHA 4500-CN-C&O and ISO 14403: 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 Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C&O / ASTM D7511 / ISO 14403. 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 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 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 Schedule B(3)

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - 318000894	**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: Jordyn Kirsch	**Envirolab Quote No. :**		
Sampler: JB + 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:** 0421330255	**Lab comments:** Highly contaminated		
Fax:			
Email: jkirsch@ramboll.com; jbourke@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	W6D		08/12/2020	WATER	X	X	X	X	X									
2	G6		09/12/2020	WATER	X	X	X	X	X									
3	F5		09/12/2020	WATER	X	X	X	X	X									
4	W3D		09/12/2020	WATER	X	X	X	X	X									
5	G5		09/12/2020	WATER	X	X	X	X	X									
6	G2		08/12/2020	WATER	X	X	X	X	X									
7	W5D		09/12/2020	WATER	X	X	X	X	X									
8	N8		08/12/2020	WATER	X	X	X	X	X									
9	F6		09/12/2020	WATER	X	X	X	X	X									
10	N2		09/12/2020	WATER	X	X	X	X	X									
11	W1D		09/12/2020	WATER	X	X	X	X	X									
12	E5D		08/12/2020	WATER	X	X	X	X	X									
13	E11		08/12/2020	WATER	X	X	X	X	X									
14	W1S		09/12/2020	WATER	X	X	X	X	X									

ENVIROLAB GROUP

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

Job No: 258134

Date Received: 14/12/20
Time Received: 1105
Received By: Helen
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company): Ramboll	**Received by (company):** ES	***Lab use only:***	
Print Name: Jordyn Kirsch	**Print Name:** Helen W	**Samples Received:** Cool or Ambient (circle one)	
Date & Time: 10/12/2020	**Date & Time:** 14/12/20 1105	**Temperature Received at:** 22.2 (if applicable)	
Signature:	**Signature:**	**Transported by:** Hand delivered / courier	

258134

ENVIROLAB GROUP

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000894	**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: Jordyn Kirsch	Envirolab Quote No. :	
Sampler: JB + 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 *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; jbourke@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	W2S		08/12/2020	WATER	X	X	X	X	X								
16	N9		08/12/2020	WATER	X	X	X	X	X								
17	W3S		09/12/2020	WATER	X	X	X	X	X								
18	PUMP		08/12/2020	WATER	X	X	X	X	X								
19	E5		08/12/2020	WATER	X	X	X	X	X								
20	A7		09/12/2020	WATER	X	X	X	X	X								
21	E4		09/12/2020	WATER	X	X	X	X	X								
22	W7M		08/12/2020	WATER	X	X	X	X	X								
23	W2D		08/12/2020	WATER	X	X	X	X	X								
24	D01_20201208		08/12/2020	WATER	X	X	X	X	X								
25	D02_091220		09/12/2020	WATER	X	X	X	X	X								
~~26~~	T01_20201208		08/12/2020	WATER	X	X	X	X	X								Please send to ALS
26 ~~27~~	R01_091220		09/12/2020	WATER	X	X	X	X	X								

Relinquished by (company):	Ramboll	Received by (company):	ELS
Print Name:	Jordyn Kirsch	Print Name:	Helen
Date & Time:	10/12/2020	Date & Time:	14-12-20
Signature:		Signature:	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: (if applicable)
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 258134

Client Details

Client	Ramboll Australia Pty Ltd
Attention	J Kirsch
Address	PO Box 560, North Sydney, NSW, 2060

Sample Details

Your Reference	**Hydro Groundwater Plume Monitoring - 318000894**
Number of Samples	26 Water
Date samples received	14/12/2020
Date completed instructions received	14/12/2020

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

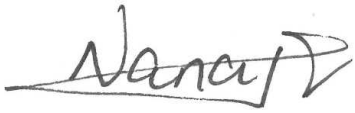
Date results requested by	21/12/2020
Date of Issue	21/12/2020

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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
Hannah Nguyen, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Miscellaneous Inorganics						
Our Reference		258134-1	258134-2	258134-3	258134-4	258134-5
Your Reference	UNITS	W6D	G6	F5	W3D	G5
Date Sampled		08/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Fluoride, F	mg/L	<0.1	0.2	0.2	0.1	<0.1
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		258134-6	258134-7	258134-8	258134-9	258134-10
Your Reference	UNITS	G2	W5D	N8	F6	N2
Date Sampled		08/12/2020	09/12/2020	08/12/2020	09/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Fluoride, F	mg/L	0.2	0.3	0.4	0.6	0.8
Total Cyanide	mg/L	<0.004	<0.004	0.44	0.008	<0.004
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		258134-11	258134-12	258134-13	258134-14	258134-15
Your Reference	UNITS	W1D	E5D	E11	W1S	W2S
Date Sampled		09/12/2020	08/12/2020	08/12/2020	09/12/2020	08/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Fluoride, F	mg/L	9.2	7.8	78	17	66
Total Cyanide	mg/L	1.1	0.63	5.1	0.70	1.8
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	0.008

Miscellaneous Inorganics						
Our Reference		258134-16	258134-17	258134-18	258134-19	258134-20
Your Reference	UNITS	N9	W3S	PUMP	E5	A7
Date Sampled		08/12/2020	09/12/2020	08/12/2020	08/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Fluoride, F	mg/L	110	100	22	300	500
Total Cyanide	mg/L	5.3	14	0.23	79	1.8
Free Cyanide in Water	mg/L	0.008	<0.004	<0.004	0.01	<0.004

Miscellaneous Inorganics						
Our Reference		258134-21	258134-22	258134-23	258134-24	258134-25
Your Reference	UNITS	E4	W7M	W2D	D01_20201208	D02_091220
Date Sampled		09/12/2020	08/12/2020	08/12/2020	08/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Fluoride, F	mg/L	680	580	1,000	<0.1	0.7
Total Cyanide	mg/L	1.8	30	1.8	<0.004	0.007
Free Cyanide in Water	mg/L	<0.004	0.009	0.006	<0.004	<0.004

Miscellaneous Inorganics		
Our Reference		258134-26
Your Reference	UNITS	R01_091220
Date Sampled		09/12/2020
Type of sample		Water
Date prepared	-	15/12/2020
Date analysed	-	15/12/2020
Fluoride, F	mg/L	<0.1
Total Cyanide	mg/L	<0.004
Free Cyanide in Water	mg/L	<0.004

HM in water - dissolved						
Our Reference		258134-1	258134-2	258134-3	258134-4	258134-5
Your Reference	UNITS	W6D	G6	F5	W3D	G5
Date Sampled		08/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Aluminium-Dissolved	µg/L	20	6,900	1,900	1,100	30

HM in water - dissolved						
Our Reference		258134-6	258134-7	258134-8	258134-9	258134-10
Your Reference	UNITS	G2	W5D	N8	F6	N2
Date Sampled		08/12/2020	09/12/2020	08/12/2020	09/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Aluminium-Dissolved	µg/L	20	<10	50	<10	2,800

HM in water - dissolved						
Our Reference		258134-11	258134-12	258134-13	258134-14	258134-15
Your Reference	UNITS	W1D	E5D	E11	W1S	W2S
Date Sampled		09/12/2020	08/12/2020	08/12/2020	09/12/2020	08/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Aluminium-Dissolved	µg/L	90	10	80	140	5,200

HM in water - dissolved						
Our Reference		258134-16	258134-17	258134-18	258134-19	258134-20
Your Reference	UNITS	N9	W3S	PUMP	E5	A7
Date Sampled		08/12/2020	09/12/2020	08/12/2020	08/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Aluminium-Dissolved	µg/L	280	3,500	1,900	120	230

HM in water - dissolved						
Our Reference		258134-21	258134-22	258134-23	258134-24	258134-25
Your Reference	UNITS	E4	W7M	W2D	D01_20201208	D02_091220
Date Sampled		09/12/2020	08/12/2020	08/12/2020	08/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Aluminium-Dissolved	µg/L	280	760	580	20	<10

HM in water - dissolved		
Our Reference		258134-26
Your Reference	UNITS	R01_091220
Date Sampled		09/12/2020
Type of sample		Water
Date prepared	-	15/12/2020
Date analysed	-	15/12/2020
Aluminium-Dissolved	µg/L	<10

HM in water - total						
Our Reference		258134-1	258134-2	258134-3	258134-4	258134-5
Your Reference	UNITS	W6D	G6	F5	W3D	G5
Date Sampled		08/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Aluminium-Total	µg/L	3,200	6,900	2,200	1,200	60

HM in water - total						
Our Reference		258134-6	258134-7	258134-8	258134-9	258134-10
Your Reference	UNITS	G2	W5D	N8	F6	N2
Date Sampled		08/12/2020	09/12/2020	08/12/2020	09/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Aluminium-Total	µg/L	1,700	90	1,000	30	3,100

HM in water - total						
Our Reference		258134-11	258134-12	258134-13	258134-14	258134-15
Your Reference	UNITS	W1D	E5D	E11	W1S	W2S
Date Sampled		09/12/2020	08/12/2020	08/12/2020	09/12/2020	08/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Aluminium-Total	µg/L	530	1,300	5,300	7,000	31,000

HM in water - total						
Our Reference		258134-16	258134-17	258134-18	258134-19	258134-20
Your Reference	UNITS	N9	W3S	PUMP	E5	A7
Date Sampled		08/12/2020	09/12/2020	08/12/2020	08/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Aluminium-Total	µg/L	1,600	29,000	12,000	3,600	870

HM in water - total						
Our Reference		258134-21	258134-22	258134-23	258134-24	258134-25
Your Reference	UNITS	E4	W7M	W2D	D01_20201208	D02_091220
Date Sampled		09/12/2020	08/12/2020	08/12/2020	08/12/2020	09/12/2020
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Date analysed	-	15/12/2020	15/12/2020	15/12/2020	15/12/2020	15/12/2020
Aluminium-Total	µg/L	440	11,000	710	2,600	30

HM in water - total		
Our Reference		258134-26
Your Reference	UNITS	R01_091220
Date Sampled		09/12/2020
Type of sample		Water
Date prepared	-	15/12/2020
Date analysed	-	15/12/2020
Aluminium-Total	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 adjusted 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	258134-2
Date prepared	-			15/12/2020	1	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Date analysed	-			15/12/2020	1	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	<0.1	<0.1	0	88	80
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	100	92
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	101	100

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	258134-22
Date prepared	-			[NT]	11	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Date analysed	-			[NT]	11	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	11	9.2	9.2	0	100	87
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	11	1.1	1.1	0	107	96
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	11	<0.004	<0.004	0	101	#

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	15/12/2020	15/12/2020		[NT]	[NT]
Date analysed	-			[NT]	21	15/12/2020	15/12/2020		[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	21	680	660	3	[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	21	1.8	1.8	0	[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	21	<0.004	<0.004	0	[NT]	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	258134-2
Date prepared	-			15/12/2020	1	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Date analysed	-			15/12/2020	1	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	20	20	0	95	#

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	258134-22
Date prepared	-			[NT]	11	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Date analysed	-			[NT]	11	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	11	90	90	0	95	#

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	15/12/2020	15/12/2020		[NT]	[NT]
Date analysed	-			[NT]	21	15/12/2020	15/12/2020		[NT]	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	21	280	280	0	[NT]	[NT]

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	258134-2
Date prepared	-			15/12/2020	1	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Date analysed	-			15/12/2020	1	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Aluminium-Total	µg/L	10	Metals-022	<10	1	3200	3200	0	98	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	258134-22
Date prepared	-			[NT]	11	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Date analysed	-			[NT]	11	15/12/2020	15/12/2020		15/12/2020	15/12/2020
Aluminium-Total	µg/L	10	Metals-022	[NT]	11	530	500	6	90	#

QUALITY CONTROL: HM in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	15/12/2020	15/12/2020		[NT]	[NT]
Date analysed	-			[NT]	21	15/12/2020	15/12/2020		[NT]	[NT]
Aluminium-Total	µg/L	10	Metals-022	[NT]	21	440	450	2	[NT]	[NT]

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.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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

MISC_INORG:Free Cyanide in Water # Low spike recovery was obtained for this sample. This is due to matrix interferences. However, an acceptable recovery was obtained for the LCS.

8 HM 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.

8 HM 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

Client: Ramboll	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - 318000894
Contact person: JK	PO No.:
Project Mgr: Jordyn Kirsch	Envirolab Quote No. :
Sampler: JB + 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; jbourke@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	W2S		08/12/2020	WATER	X	X	X	X	X											
16	N9		08/12/2020	WATER	X	X	X	X	X											
17	W3S		09/12/2020	WATER	X	X	X	X	X											
18	PUMP		08/12/2020	WATER	X	X	X	X	X											
19	E5		08/12/2020	WATER	X	X	X	X	X											
20	A7		09/12/2020	WATER	X	X	X	X	X											
21	E4		09/12/2020	WATER	X	X	X	X	X											
22	W7M		08/12/2020	WATER	X	X	X	X	X											
23	W2D		08/12/2020	WATER	X	X	X	X	X											
24	D01_20201208		08/12/2020	WATER	X	X	X	X	X											
25	D02_091220		09/12/2020	WATER	X	X	X	X	X											
~~26~~	T01_20201208		08/12/2020	WATER	X	X	X	X	X											
26 ~~27~~	R01_091220		09/12/2020	WATER	X	X	X	X	X											Please send to ALS

Environmental Division
Sydney
Work Order Reference
ES2044416

Telephone : +61-2-8784 8555

A NORTON 14/12/20
4:30pm

Relinquished by (company):	Ramboll	ELS Syd	
Print Name:	Jordyn Kirsch	k-lore	
Date & Time:	10/12/2020	14/12/2020 1230.	
Signature:			

Received by (company):	ELS
Print Name:	Helen
Date & Time:	14-12-20
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	: **ES2044416**	Page	: 1 of 2
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: J KIRSCH	Contact	: Loren Schiavon
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 - 318000894	Date Samples Received	: 14-Dec-2020 16:30
Order number	: ----	Date Analysis Commenced	: 16-Dec-2020
C-O-C number	: ----	Issue Date	: 21-Dec-2020 21:51
Sampler	: JB + 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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			*Sample ID*	**T01_20201208**	**----**	**----**	**----**	**----**
			Sampling date / time	08-Dec-2020 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2044416-001**	**--------**	**--------**	**--------**	**--------**
				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	**1.46**	**----**	**----**	**----**	**----**
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	: **ES2044416**	Page	: 1 of 3
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: J KIRSCH	Contact	: Loren Schiavon
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 - 318000894	Date Samples Received	: 14-Dec-2020
Order number	: ----	Date Analysis Commenced	: 16-Dec-2020
C-O-C number	: ----	Issue Date	: 21-Dec-2020
Sampler	: JB + 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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3425631)									
ES2044316-002	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.09	0.09	0.00	No Limit
ES2044316-011	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	2.02	2.00	0.840	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 3424029)									
ES2044499-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.17	0.20	13.9	0% - 50%
ME2001947-008	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.05	0.05	0.00	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 3422742)									
ES2044143-001	Anonymous	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.00	No Limit
ES2044149-006	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: 3422743)									
ES2044164-010	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
ES2044165-008	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: 3427967)									
ES2044488-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit
ES2044513-008	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.7	0.7	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: 3425631)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	88.9	80.0	116
EG020T: Total Metals by ICP-MS (QCLot: 3424029)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	91.3	82.0	120
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 3422742)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	127	88.0	128
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3422743)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	107	73.0	133
EK040P: Fluoride by PC Titrator (QCLot: 3427967)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	115	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	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 3422742)							
ES2044143-001	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	94.1	70.0	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3422743)							
ES2044164-010	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	96.1	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2044416**	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 - 318000894	Date Samples Received	: 14-Dec-2020
Site	: ----	Issue Date	: 21-Dec-2020
Sampler	: JB + 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	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS)					
Dissolved Metals by ICP-MS - Suite A	0	15	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	0	19	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	0	13	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*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
T01_20201208	**08-Dec-2020**	**----**	----	----	**17-Dec-2020**	06-Jun-2021	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
T01_20201208	**08-Dec-2020**	**16-Dec-2020**	06-Jun-2021	✓	**16-Dec-2020**	06-Jun-2021	✓
EK025SF: Free CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK025SF)							
T01_20201208	**08-Dec-2020**	**----**	----	----	**16-Dec-2020**	22-Dec-2020	✓
EK026SF: Total CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK026SF)							
T01_20201208	**08-Dec-2020**	**----**	----	----	**16-Dec-2020**	22-Dec-2020	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
T01_20201208	**08-Dec-2020**	**----**	----	----	**17-Dec-2020**	05-Jan-2021	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	15	**13.33**	**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	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**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	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**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	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	0	15	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	0	19	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	0	13	**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, APHA 4500-CN-C&O and ISO 14403: 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 Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	WATER	In house: Referenced to APHA 4500-CN C&O / ASTM D7511 / ISO 14403. 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 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 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 Schedule B(3)

APPENDIX 6
CALIBRATION CERTIFICATES

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: Eloise Carroll

Calibration date: 13/03/2020

Next calibration due: 12/05/2020

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 18J104309

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		349209	pH 9.87
2. pH 7.00		pH 7.00		330737	pH 7.02
3. pH 4.00		pH 4.00		330734	pH 3.99
4. mV		229.6mV		337308/338782	229.4mV
5. EC		2.76mS		333787	2.77mS
6. D.O		0.00ppm		329994	0.00ppm
7. Temp		22.4°C		MultiTherm	21.7°C

Calibrated by: Darcy Keogh

Calibration date: 13/03/2020

Next calibration due: 12/04/2020

Oil / Water Interface Meter

Instrument Geotech Interface Meter (30M)
Serial No. 4063

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: **Eloise Carroll**

Calibration date: **12/06/2020**

Next calibration due: **11/08/2020**

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 17B100729

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 7.00		pH 7.00		330737	pH 7.05
2. pH 4.00		pH 4.00		330734	pH 4.06
3. pH 10.00		pH 10.00		352607	pH 9.75
3. mV		229.6mV		346052/342074	229.8mV
4. EC		2.76mS		333787	2.75mS
5. D.O		0.00ppm		1904288592	0.03ppm
6. Temp		22.2°C		MultiTherm	20.8°C

Calibrated by: Eloise Carroll

Calibration date: 12/06/2020

Next calibration due: 12/07/2020

Oil / Water Interface Meter

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Instrument Geotech Interface Meter (30M)
Serial No. 3913

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check Connectors	Cleaned	✓	
	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

LESLEY NEARN-CAVANAGH Darcy Keogh

Calibration date: 10/09/2020

Next calibration due: 9/11/2020

Multi Parameter Water Meter

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Instrument YSI Quatro Pro Plus
Serial No. 18J104309

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		352607	pH 9.80
2. pH 7.00		pH 7.00		330737	pH 7.11
3. pH 4.00		pH 4.00		347027	pH 4.04
4. mV		229.6mV		346052/342074	229.3mV
5. EC		2.76mS		343511	2.74mS
6. D.O		0.00ppm		1904288592	0.01ppm
7. Temp		21.7°C		MultiTherm	21.9°C

Calibrated by: Darcy Keogh

Calibration date: 17/09/2020

Next calibration due: 17/10/2020

Oil / Water Interface Meter

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Instrument **Interface Meter (30M)**
Serial No. **313375**

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
	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: **Jay Marosa**

Calibration date: **2/12/2020**

Next calibration due: **31/01/2021**

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 18L102021

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 7.00		pH 7.00		355072	pH 6.98
2. pH 4.00		pH 4.00		351412	pH 4.12
3. pH 10.00		pH 10.00		355386	pH 9.72
3. mV		229.6mV		357172/357173	228.9mV
4. EC		2.76mS		350510	2.74mS
5. D.O		0.00ppm		10959	0.00ppm
6. Temp		21.7°C		MultiTherm	21.8°C

Calibrated by: Lauren Tompkins

Calibration date: 2/12/2020

Next calibration due: 1/01/2021

RAMBOLL

Water Quality Meter Calibration Sheet

Project Name: Quarterly Groundwater Monitoring
Project No: 31800894
Ramboll Personnel: J. Bourke

Water Quality Meter Type: 451 Professional Plus
Serial Number: 18L102021
Certificate ID:

Date	Time	pH (ph Units)						Electrical Conductivity (µS/cm)					Dissolved Oxygen (ppm)					Redox (mV)				
		Solution	Accebtable Range	Pre-Calibration Reading	Acceptable Range	Calibration Required (Y/N)	Post-Calibration Reading	Temp. (°C)	Pre-Calibration Reading	Acceptable Range	Calibration Required (Y/N)	Post-Calibration Reading	Solution	Pre-Calibration Reading	Acceptable Range	Calibration Required (Y/N)	Post-Calibration Reading	Temp. (°C)	Pre-Calibration Reading	Acceptable Range	Calibration Required (Y/N)	Post-Calibration Reading
7/12/20	7.05pm	4	3.9 - 4.1	4.20	3.9 - 4.1	Y	4.00			± 5%			0% Saturation		± 0.1 ppm					± 10 mV		
		7	6.9 - 7.1	7.02	6.9 - 7.1	—	7.00						Ambient Air		± 0.5 ppm of value on Table A							
		10	9.9 – 10.1	—	9.9 – 10.1	—	—															
		4	3.9 - 4.1		3.9 - 4.1					± 5%			0% Saturation		± 0.1 ppm					± 10 mV		
		7	6.9 - 7.1		6.9 - 7.1								Ambient Air		± 0.5 ppm of value on Table A							
		10	9.9 – 10.1		9.9 – 10.1																	
		4	3.9 - 4.1		3.9 - 4.1					± 5%			0% Saturation		± 0.1 ppm					± 10 mV		
		7	6.9 - 7.1		6.9 - 7.1								Ambient Air		± 0.5 ppm of value on Table A							
		10	9.9 – 10.1		9.9 – 10.1																	
		4	3.9 - 4.1		3.9 - 4.1					± 5%			0% Saturation		± 0.1 ppm					± 10 mV		
		7	6.9 - 7.1		6.9 - 7.1								Ambient Air		± 0.5 ppm of value on Table A							
		10	9.9 – 10.1		9.9 – 10.1																	
		4	3.9 - 4.1		3.9 - 4.1					± 5%			0% Saturation		± 0.1 ppm					± 10 mV		
		7	6.9 - 7.1		6.9 - 7.1								Ambient Air		± 0.5 ppm of value on Table A							
		10	9.9 – 10.1		9.9 – 10.1																	
		4	3.9 - 4.1		3.9 - 4.1					± 5%			0% Saturation		± 0.1 ppm					± 10 mV		
		7	6.9 - 7.1		6.9 - 7.1								Ambient Air		± 0.5 ppm of value on Table A							
		10	9.9 – 10.1		9.9 – 10.1																	
		4	3.9 - 4.1		3.9 - 4.1					± 5%			0% Saturation		± 0.1 ppm					± 10 mV		
		7	6.9 - 7.1		6.9 - 7.1								Ambient Air		± 0.5 ppm of value on Table A							
		10	9.9 – 10.1		9.9 – 10.1																	

APPENDIX 7
HISTORICAL GROUNDWATER CONTOURS

Groundwater Contours - Shallow Aquifer 2013 -2018







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



Shallow Aquifer December 2017



Shallow Aquifer March 2018



Shallow Aquifer June 2018



Shallow Aquifer September 2018



Shallow Aquifer December 2018

Groundwater Contours – Deep Aquifer 2013 -2018



Deep Aquifer July 2013



Deep Aquifer November 2013



Deep Aquifer February 2014



Deep Aquifer June 2014



Deep Aquifer November 2014



Deep Aquifer February 2015



Deep Aquifer June 2015



Deep Aquifer September 2015



Deep Aquifer December 2015



Deep Aquifer April 2016



Deep Aquifer July 2016



Deep Aquifer October 2016



Deep Aquifer December 2016



Deep Aquifer March 2017



Deep Aquifer June 2017



Deep Aquifer September 2017



Deep Aquifer December 2017


W6D
G2
W5D
N2
E3D
W1D
Deep Aquifer March 2018


W6D
G2
W5D
N2
E3D
W1D
Deep Aquifer June 2018


W6D
G2
W5D
N2
E3D
W1D
Deep Aquifer September 2018


W6D
G2
W5D
N2
E3D
W1D
Deep Aquifer December 2018

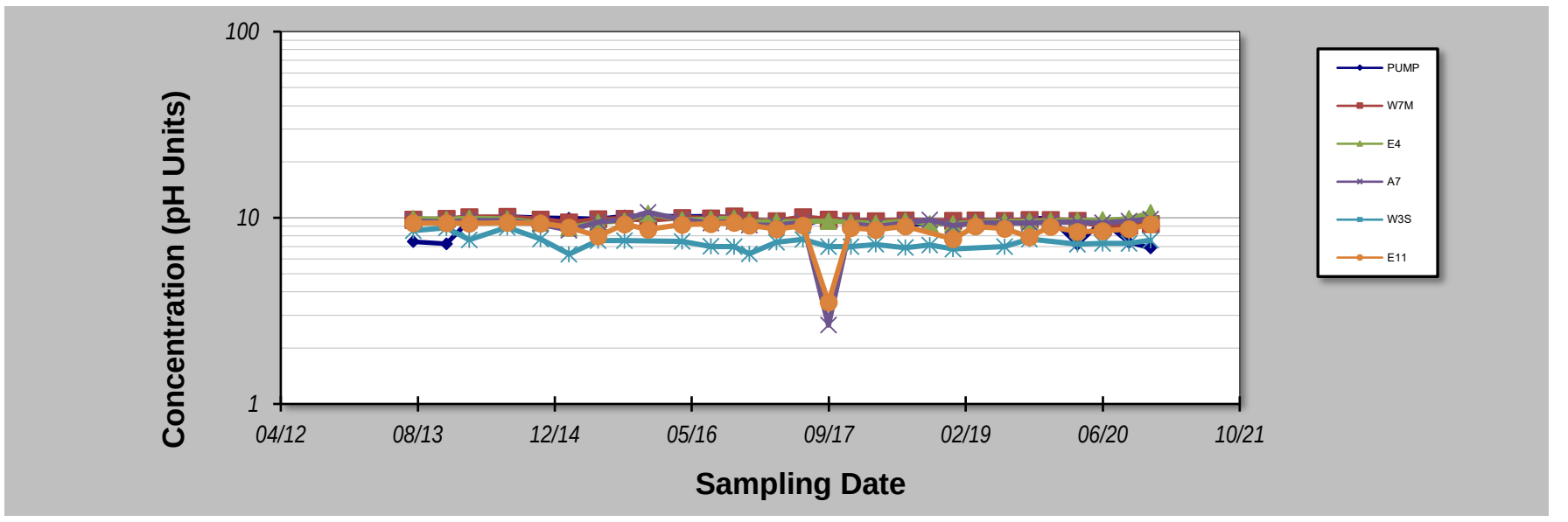
APPENDIX 8
MANN-KENDALL TREND ANALYSIS

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **14-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
Constituent: **pH**
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	17-Mar-20	7.2	9.67	9.65	9.46	7.21	8.41	
27	17-Jun-20	9.59	8.97	9.73	9.4	7.29	8.48	
28	22-Sep-20	7.4	9.1	9.87	9.6	7.28	8.69	
29	9-Dec-20	6.88	9.28	10.64	9.85	7.59	9.24	
30								
Coefficient of Variation:		0.11	0.03	0.04	0.14	0.08	0.13	
Mann-Kendall Statistic (S):		-123	-154	-7	-10	-79	-156	
Confidence Factor:		99.3%	99.9%	54.7%	56.6%	95.7%	99.9%	
Concentration Trend:		Decreasing	Decreasing	Stable	Stable	Decreasing	Decreasing	



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.
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.

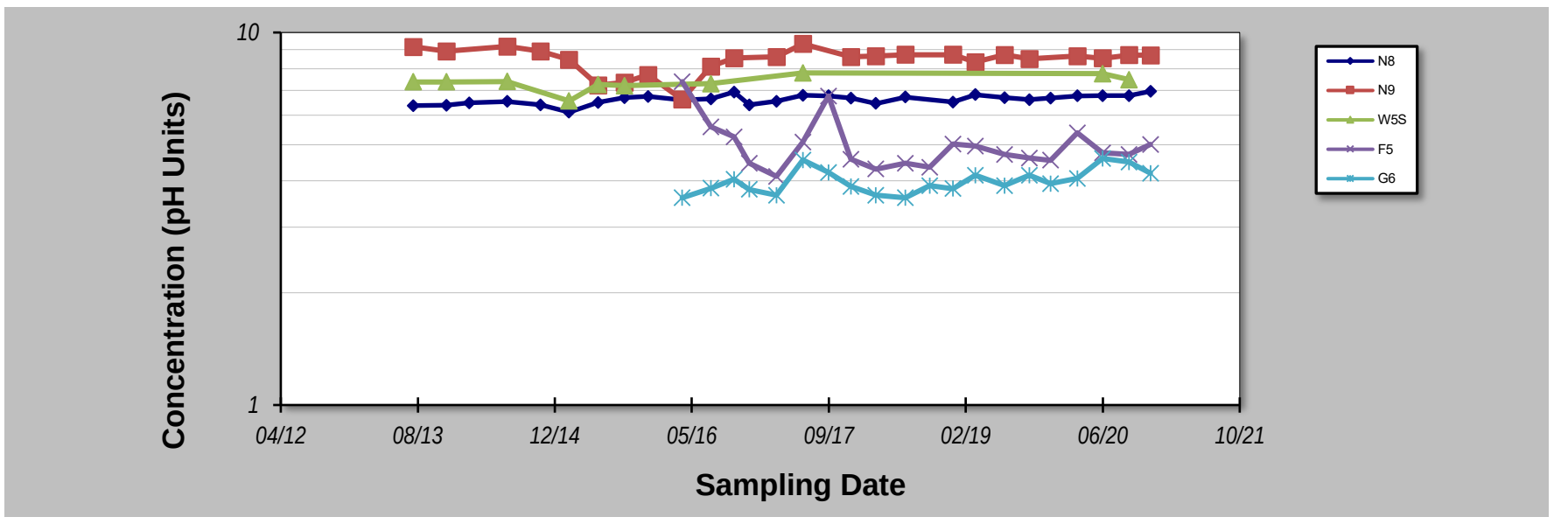
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **14-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
Constituent: **pH**
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	7.37				
2	26-Nov-13	6.38	8.9	7.37				
3	18-Feb-14	6.48						
4	7-Jul-14	6.53	9.17	7.39				
5	4-Nov-14	6.39	8.91					
6	17-Feb-15	6.11	8.46	6.55				
7	3-Jun-15	6.49	7.22	7.26				
8	7-Sep-15	6.69	7.34	7.2				
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	7.29	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	17-Mar-20	6.76	8.64		5.38	4.06		
27	17-Jun-20	6.77	8.53	7.76	4.75	4.59		
28	22-Sep-20	6.77	8.7	7.47	4.71	4.49		
29	9-Dec-20	6.95	8.69		5.01	4.19		
30								
Coefficient of Variation:		0.03	0.08	0.05	0.16	0.08		
Mann-Kendall Statistic (S):		185	7	12	-18	76		
Confidence Factor:		>99.9%	55.9%	83.2%	70.7%	99.3%		
Concentration Trend:		Increasing	No Trend	No Trend	Stable	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.
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.

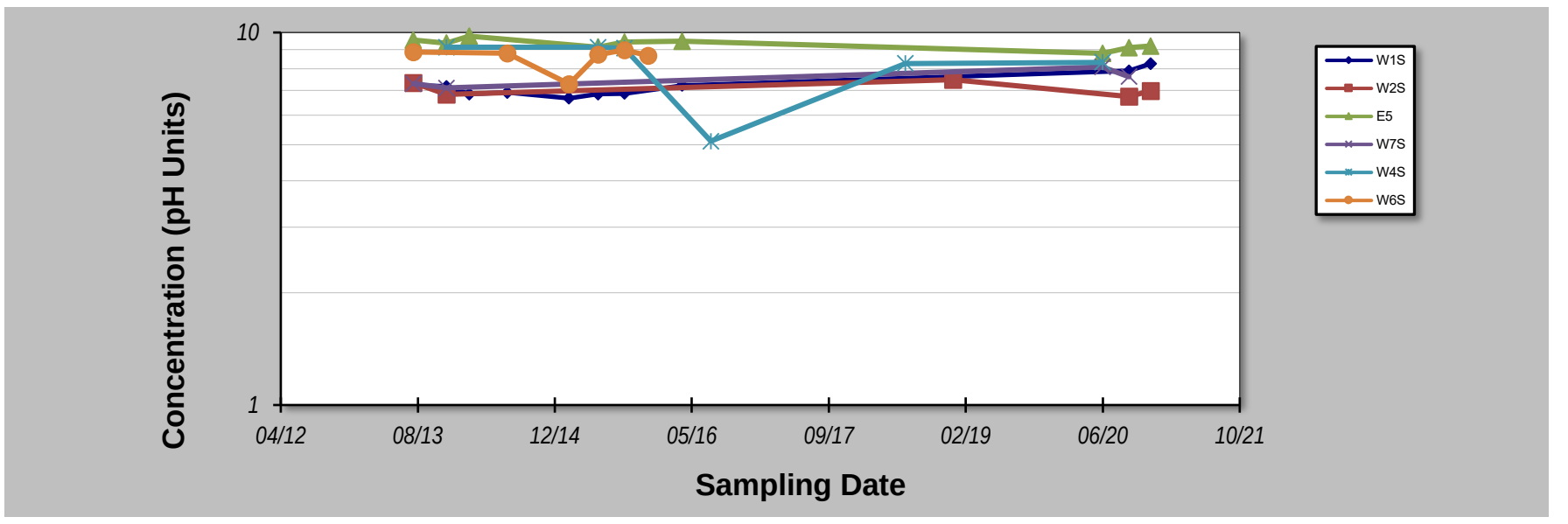
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **14-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
Constituent: **pH**
Concentration Units: **pH Units**

Sampling Point ID:	W1S	W2S	E5	W7S	W4S	W6S	
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)						
1	29-Jul-13	7.22	7.33	9.54	7.29		8.87	
2	26-Nov-13	7.17	6.82	9.37	7.1	9.13		
3	18-Feb-14	6.84		9.78				
4	7-Jul-14	6.9					8.79	
5	4-Nov-14							
6	17-Feb-15	6.66					7.27	
7	3-Jun-15	6.83		9.14		9.13	8.72	
8	7-Sep-15	6.86		9.42		9.07	8.98	
9	2-Dec-15						8.67	
10	5-Apr-16	7.21		9.48				
11	19-Jul-16					5.11		
12	12-Oct-16							
13	6-Dec-16							
14	15-Mar-17							
15	20-Jun-17							
16	21-Sep-17							
17	12-Dec-17							
18	13-Mar-18							
19	28-Jun-18					8.26		
20	26-Sep-18							
21	19-Dec-18		7.47					
22	11-Mar-19							
23	26-Jun-19							
24	24-Sep-19							
25	11-Dec-19							
26	17-Mar-20							
27	17-Jun-20			8.79	8.08	8.32		
28	22-Sep-20	7.89	6.73	9.11	7.61			
29	9-Dec-20	8.24	6.97	9.2				
30								
Coefficient of Variation:		0.07	0.05	0.03	0.06	0.19	0.07	
Mann-Kendall Statistic (S):		11	-2	-14	2	-8	-3	
Confidence Factor:		81.0%	59.2%	91.0%	62.5%	89.8%	64.0%	
Concentration Trend:		No Trend	Stable	Prob. Decreasing	No Trend	Stable	Stable	



Notes:

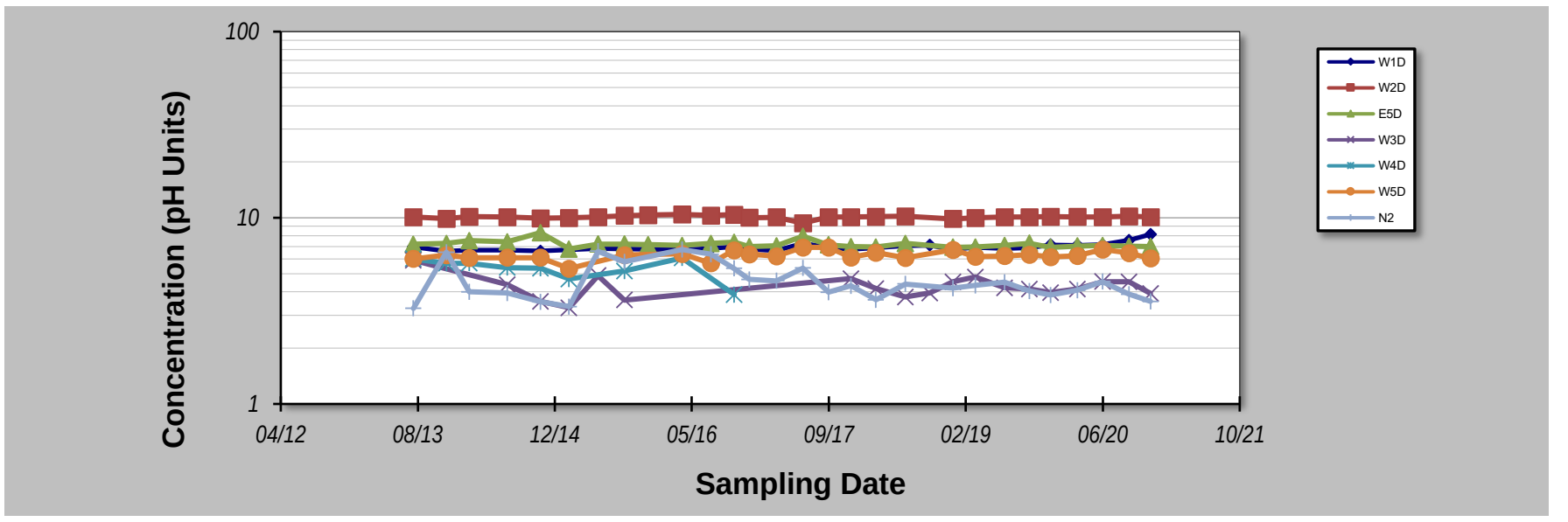
1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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:	14-Dec-20	Job ID:	318000894
Facility Name:	Hydro Kurri Kurri	Constituent:	pH
Conducted By:	Jake Bourke	Concentration Units:	pH Units

Sampling Point ID:	W1D	W2D	E5D	W3D	W4D	W5D	N2
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)						
1	29-Jul-13	6.98	10.09	7.22	5.91	6.02	6.02	3.26
2	26-Nov-13	6.62	9.9	7.29		5.7	6.32	6.54
3	18-Feb-14	6.7	10.13	7.53		5.7	6.1	4.01
4	7-Jul-14	6.71	10.1	7.44	4.38	5.4	6.11	3.94
5	4-Nov-14	6.63	9.94	8.32	3.56	5.36	6.11	3.54
6	17-Feb-15		9.99	6.8	3.29	4.69	5.34	3.34
7	3-Jun-15	6.82	10.11	7.23	4.89			6.61
8	7-Sep-15	6.79	10.27	7.23	3.62	5.18	6.32	5.81
9	2-Dec-15		10.34	7.18				
10	5-Apr-16	6.73	10.42	7.1		6.08	6.4	6.75
11	19-Jul-16	6.82	10.29	7.27			5.7	6.37
12	12-Oct-16	7.02	10.4	7.39		3.87	6.7	5.35
13	6-Dec-16	6.78	10.02	7			6.37	4.67
14	15-Mar-17	6.67	10.07	7.08			6.21	4.59
15	20-Jun-17	7.3	9.37	7.97			6.94	5.37
16	21-Sep-17	6.95	10.08	7.16			6.93	3.98
17	12-Dec-17	6.78	10.1	7	4.72		6.13	4.31
18	13-Mar-18	6.91	10.14	6.97	4.16		6.5	3.63
19	28-Jun-18	7.07	10.18	7.29	3.75		6.1	4.41
20	26-Sep-18	7.12			3.94			
21	19-Dec-18	6.76	9.87	6.95	4.53		6.72	4.18
22	11-Mar-19	6.92	9.99	6.96	4.81		6.18	4.34
23	26-Jun-19	6.83	10.1	7.1	4.21		6.23	4.51
24	24-Sep-19	6.91	10.08	7.3	4.15		6.35	4.05
25	11-Dec-19	7.16	10.14	6.95	3.96		6.16	3.85
26	17-Mar-20	7.12	10.12	7.05	4.14		6.24	4.09
27	17-Jun-20	7.17	10.11	7.1	4.54		6.76	4.54
28	22-Sep-20	7.57	10.18	7.04	4.53		6.46	3.88
29	9-Dec-20	8.14	10.09	7.02	3.93		6.05	3.55
30								
Coefficient of Variation:		0.05	0.02	0.04	0.14	0.13	0.06	0.23
Mann-Kendall Statistic (S):		187	27	-129	-2	-19	68	-63
Confidence Factor:		>99.9%	69.5%	99.5%	51.4%	97.0%	93.0%	90.1%
Concentration Trend:		Increasing	No Trend	Decreasing	Stable	Decreasing	Prob. Increasing	Prob. Decreasing



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.
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.

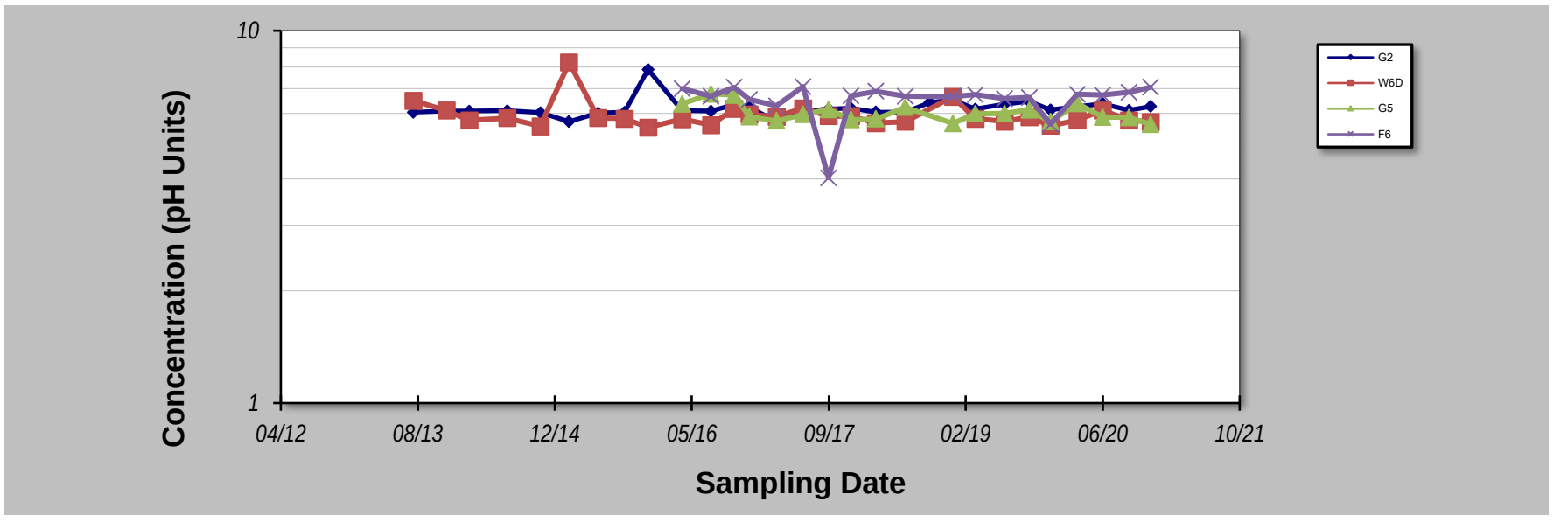
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **14-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
Constituent: **pH**
Concentration Units: **pH Units**

Sampling Point ID:	G2	W6D	G5	F6			
Sampling Event	Sampling Date	PH CONCENTRATION (pH Units)						
1	29-Jul-13	6.04	6.49					
2	26-Nov-13	6.09	6.11					
3	18-Feb-14	6.09	5.75					
4	7-Jul-14	6.1	5.83					
5	4-Nov-14	6.03	5.54					
6	17-Feb-15	5.7	8.22					
7	3-Jun-15	6.01	5.84					
8	7-Sep-15	6.04	5.81					
9	2-Dec-15	7.87	5.5					
10	5-Apr-16	6.11	5.79	6.36	6.99			
11	19-Jul-16	6.09	5.58	6.77	6.67			
12	12-Oct-16	6.33	6.17	6.72	7.05			
13	6-Dec-16	6.22	5.96	5.88	6.54			
14	15-Mar-17	5.71	5.88	5.73	6.29			
15	20-Jun-17	6.08	6.19	5.96	7.08			
16	21-Sep-17	6.16	5.9	6.15	4.03			
17	12-Dec-17	6.19	5.9	5.77	6.68			
18	13-Mar-18	6.05	5.65	5.8	6.88			
19	28-Jun-18	6.05	5.7	6.23	6.67			
20	26-Sep-18	6.42						
21	19-Dec-18	6.53	6.65	5.64	6.66			
22	11-Mar-19	6.16	5.81	5.99	6.73			
23	26-Jun-19	6.35	5.71	6	6.57			
24	24-Sep-19	6.46	5.87	6.13	6.62			
25	11-Dec-19	6.13	5.56	5.7	5.61			
26	17-Mar-20	6.26	5.75	6.38	6.75			
27	17-Jun-20	6.37	6.12	5.86	6.72			
28	22-Sep-20	6.12	5.75	5.85	6.83			
29	9-Dec-20	6.26	5.69	5.61	7.05			
30								
Coefficient of Variation:		0.06	0.09	0.06	0.11			
Mann-Kendall Statistic (S):		149	-51	-49	5			
Confidence Factor:		99.8%	83.7%	95.3%	55.5%			
Concentration Trend:		Increasing	Stable	Decreasing	No Trend			



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.
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.

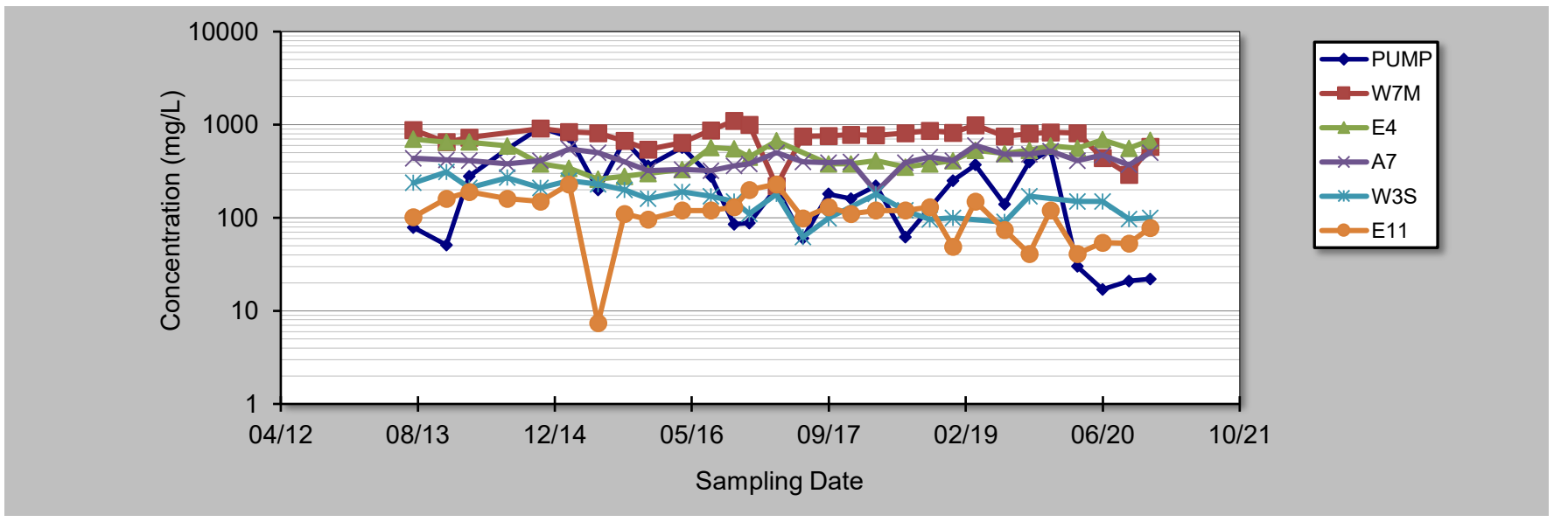
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **23-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
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	17-Mar-20	30	810	560	410	150	41	
27	17-Jun-20	17	440	690	470	150	54	
28	22-Sep-20	21	290	560	370	97	53	
29	8-Dec-20	22	580	680	500	100	78	
30								
Coefficient of Variation:		0.91	0.26	0.28	0.19	0.38	0.47	
Mann-Kendall Statistic (S):		-107	-36	65	56	-198	-132	
Confidence Factor:		98.2%	75.4%	89.6%	84.7%	>99.9%	99.3%	
Concentration Trend:		Decreasing	Stable	No Trend	No Trend	Decreasing	Decreasing	



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.
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.

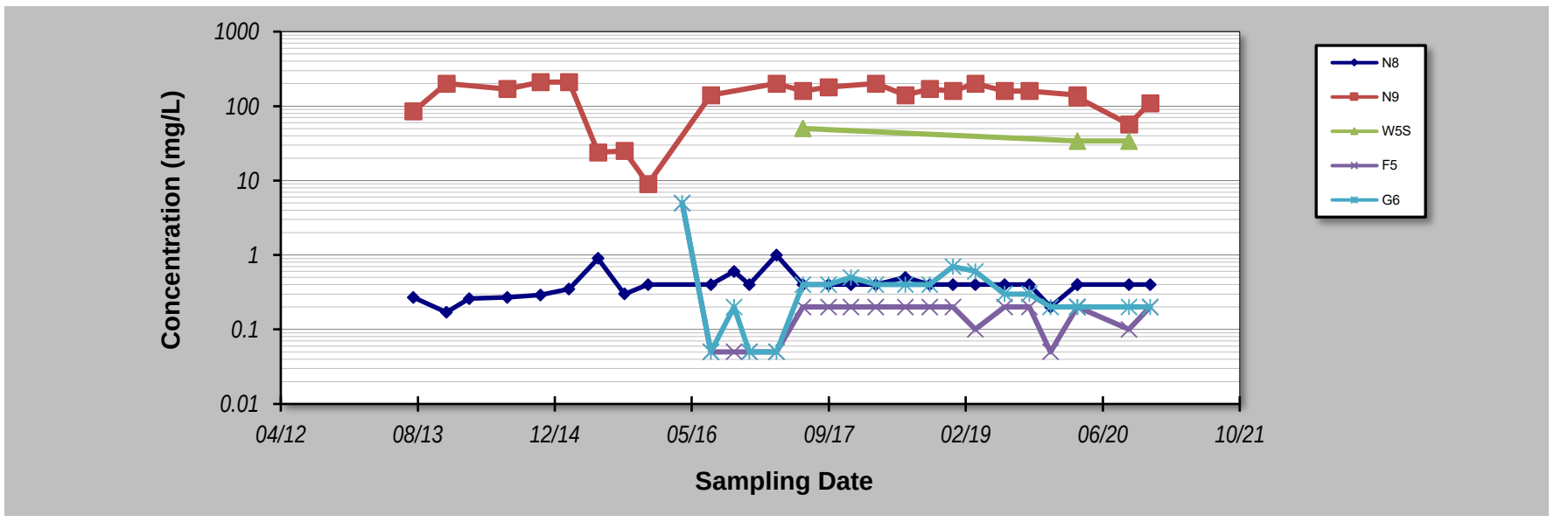
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **23-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
Constituent: **Soluble Fluoride**
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	17-Mar-20	0.4	140		0.2	0.2		
27	17-Mar-20	0.4	130	34	0.2	0.2		
28	22-Sep-20	0.4	57	34	0.1	0.2		
29	8-Dec-20	0.4	110		0.2	0.2		
30								
Coefficient of Variation:		0.43	0.44	0.23	2.77	1.98		
Mann-Kendall Statistic (S):		93	-46	-2	19	-21		
Confidence Factor:		96.6%	88.1%		71.8%	74.0%		
Concentration Trend:		Increasing	Stable		No Trend	No Trend		



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.
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.

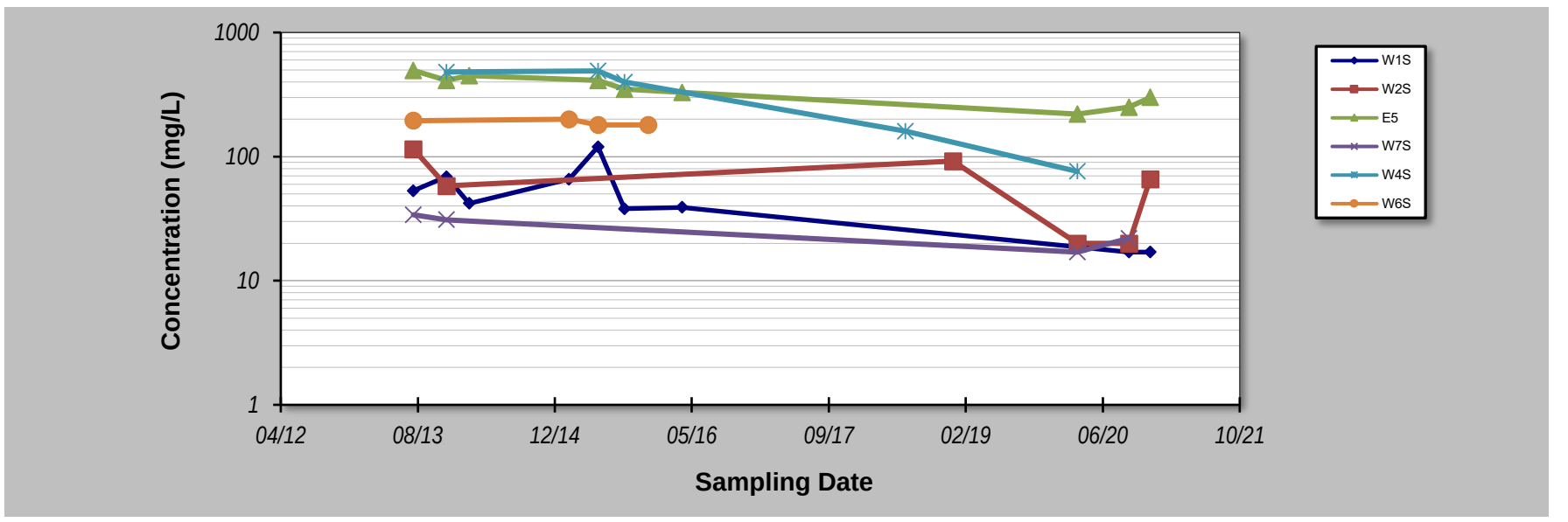
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **23-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
Constituent: **Soluble Fluoride**
Concentration Units: **mg/L**

Sampling Point ID:	W1S	W2S	E5	W7S	W4S	W6S	
Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)						
1	29-Jul-13	53	115	495	34		195	
2	26-Nov-13	69	58	410	31	480		
3	18-Feb-14	42		450				
4	7-Jul-14							
5	4-Nov-14							
6	17-Feb-15	66					200	
7	3-Jun-15	120		410		490	180	
8	7-Sep-15	38		350		400		
9	2-Dec-15						180	
10	5-Apr-16	39		330				
11	19-Jul-16							
12	12-Oct-16							
13	6-Dec-16							
14	15-Mar-17							
15	20-Jun-17							
16	21-Sep-17							
17	12-Dec-17							
18	13-Mar-18							
19	28-Jun-18					160		
20	26-Sep-18							
21	19-Dec-18		92					
22	11-Mar-19							
23	26-Jun-19							
24	24-Sep-19							
25	11-Dec-19							
26	17-Mar-20							
27	17-Mar-20		20	220	17	76		
28	22-Sep-20	17	20	250	22			
29	8-Dec-20	17	66	300				
30								
Coefficient of Variation:		0.62	0.62	0.26	0.30	0.59	0.05	
Mann-Kendall Statistic (S):		-19	-6	-27	-4	-8	-3	
Confidence Factor:		97.0%	81.5%	99.8%	83.3%	95.8%	72.9%	
Concentration Trend:		Decreasing	Stable	Decreasing	Stable	Decreasing	Stable	



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.
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.

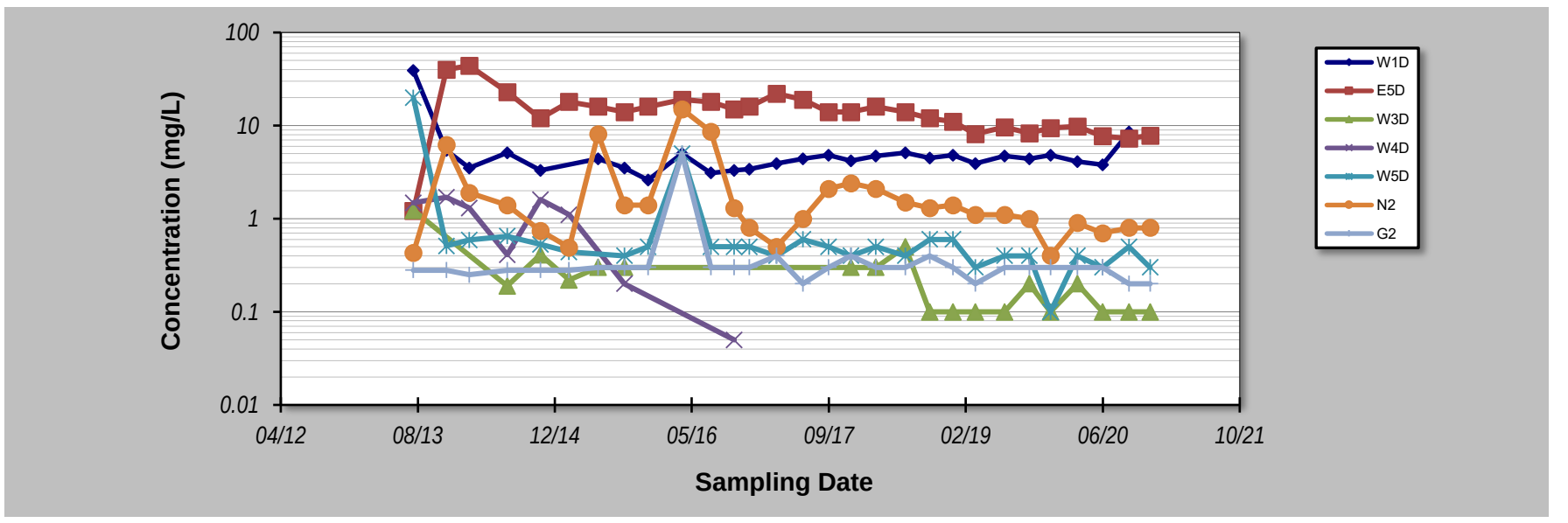
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **23-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
Constituent: **Soluble Fluoride**
Concentration Units: **mg/L**

Sampling Point ID:	W1D	E5D	W3D	W4D	W5D	N2	G2
Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)						
1	29-Jul-13	39	1.21	1.23	1.48	20	0.43	0.28
2	26-Nov-13	5.4	40		1.7	0.51	6.2	0.28
3	18-Feb-14	3.5	44		1.3	0.59	1.9	0.25
4	7-Jul-14	5.1	23	0.19	0.41	0.65	1.4	0.28
5	4-Nov-14	3.3	12	0.41	1.6	0.53	0.74	0.28
6	17-Feb-15		18	0.22	1.1	0.44	0.49	0.28
7	3-Jun-15	4.4	16	0.3			8.1	0.3
8	7-Sep-15	3.5	14	0.3	0.2	0.4	1.4	0.3
9	2-Dec-15	2.6	16			0.5	1.4	0.3
10	5-Apr-16	5	19			5	15	5
11	19-Jul-16	3.1	18			0.5	8.6	0.3
12	12-Oct-16	3.3	15		0.05	0.5	1.3	0.3
13	6-Dec-16	3.4	16			0.5	0.8	0.3
14	15-Mar-17	3.9	22			0.4	0.5	0.4
15	20-Jun-17	4.4	19			0.6	1	0.2
16	21-Sep-17	4.8	14			0.5	2.1	0.3
17	12-Dec-17	4.2	14	0.3		0.4	2.4	0.4
18	13-Mar-18	4.7	16	0.3		0.5	2.1	0.3
19	28-Jun-18	5.1	14	0.5		0.4	1.5	0.3
20	26-Sep-18	4.5	12	0.1		0.6	1.3	0.4
21	19-Dec-18	4.8	11	0.1		0.6	1.4	0.3
22	11-Mar-19	3.9	8.1	0.1		0.3	1.1	0.2
23	26-Jun-19	4.7	9.6	0.1		0.4	1.1	0.3
24	24-Sep-19	4.4	8.3	0.2		0.4	1	0.3
25	11-Dec-19	4.8	9.4	0.1		0.1	0.4	0.3
26	17-Mar-20	4.1	9.8	0.2		0.4	0.9	0.3
27	17-Jun-20	3.8	7.7	0.1		0.3	0.7	0.3
28	22-Sep-20	8.5	7.3	0.1		0.5	0.8	0.2
29	8-Dec-20		7.8	0.1		0.3	0.8	0.2
30								
Coefficient of Variation:		1.20	0.58	1.01	0.68	2.86	1.39	1.93
Mann-Kendall Statistic (S):		30	-225	-80	-18	-168	-103	34
Confidence Factor:		72.6%	>99.9%	99.8%	98.4%	>99.9%	97.3%	73.0%
Concentration Trend:		No Trend	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	No Trend



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.
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.

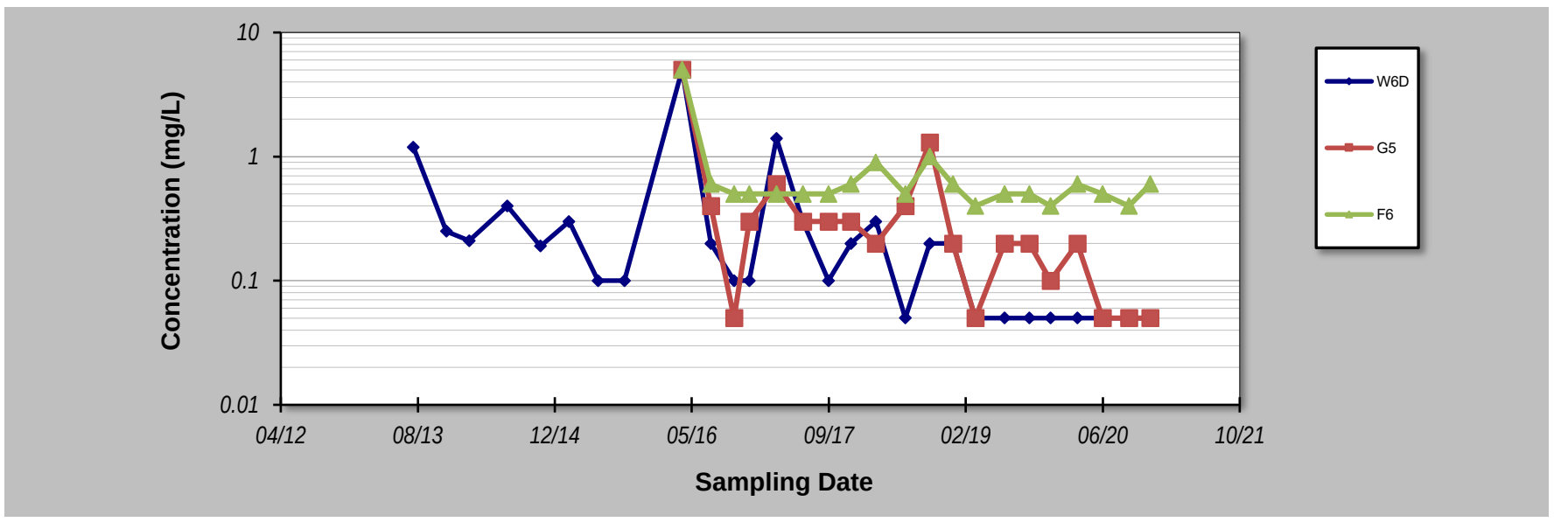
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **23-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
Constituent: **Soluble Fluoride**
Concentration Units: **mg/L**

Sampling Point ID:	W6D	G5	F6				
Sampling Event	Sampling Date	SOLUBLE FLUORIDE CONCENTRATION (mg/L)						
1	29-Jul-13	1.19						
2	26-Nov-13	0.25						
3	18-Feb-14	0.21						
4	7-Jul-14	0.4						
5	4-Nov-14	0.19						
6	17-Feb-15	0.3						
7	3-Jun-15	0.1						
8	7-Sep-15	0.1						
9	2-Dec-15							
10	5-Apr-16	5	5	5				
11	19-Jul-16	0.2	0.4	0.6				
12	12-Oct-16	0.1	0.05	0.5				
13	6-Dec-16	0.1	0.3	0.5				
14	15-Mar-17	1.4	0.6	0.5				
15	20-Jun-17	0.3	0.3	0.5				
16	21-Sep-17	0.1	0.3	0.5				
17	12-Dec-17	0.2	0.3	0.6				
18	13-Mar-18	0.3	0.2	0.9				
19	28-Jun-18	0.05	0.4	0.5				
20	26-Sep-18	0.2	1.3	1				
21	19-Dec-18	0.2	0.2	0.6				
22	11-Mar-19	0.05	0.05	0.4				
23	26-Jun-19	0.05	0.2	0.5				
24	24-Sep-19	0.05	0.2	0.5				
25	11-Dec-19	0.05	0.1	0.4				
26	17-Mar-20	0.05	0.2	0.6				
27	17-Jun-20	0.05	0.05	0.5				
28	22-Sep-20	0.05	0.05	0.4				
29	8-Dec-20	0.05	0.05	0.6				
30								
Coefficient of Variation:		2.37	2.13	1.29				
Mann-Kendall Statistic (S):		-193	-97	-35				
Confidence Factor:		>99.9%	99.9%	86.3%				
Concentration Trend:		Decreasing	Decreasing	No Trend				



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.
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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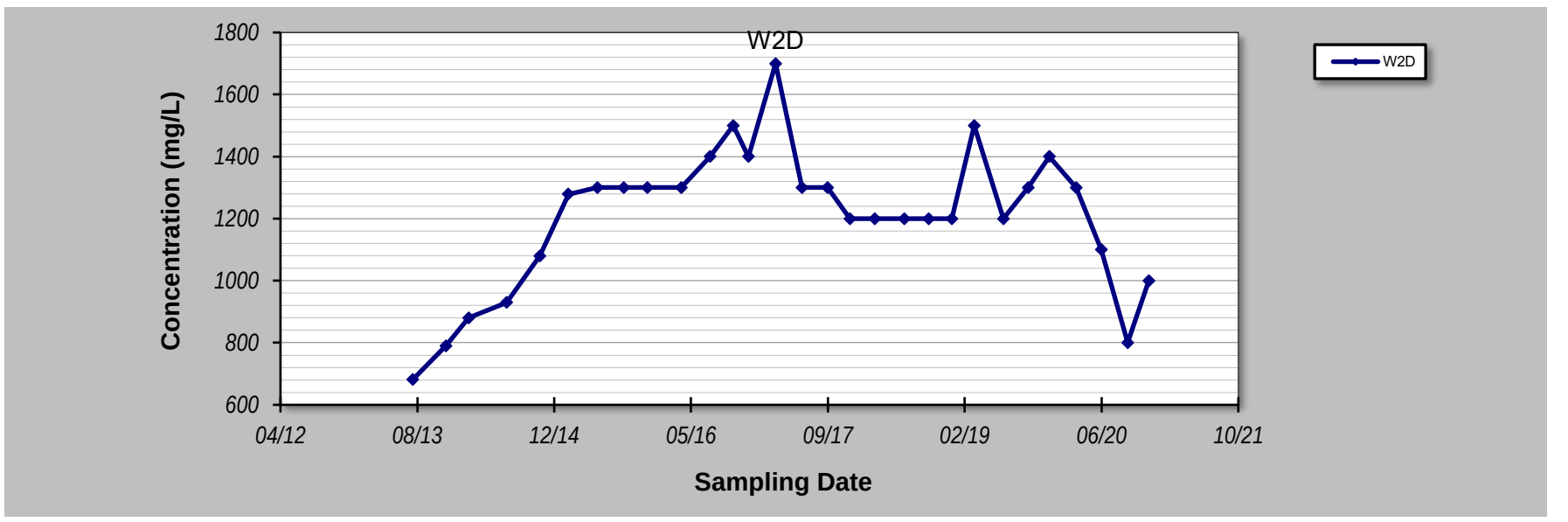
GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **23-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
Constituent: **Soluble Fluoride**
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	17-Mar-20	1300						
27	17-Jun-20	1100						
28	22-Sep-20	800						
29	8-Dec-20	1000						
30								
Coefficient of Variation:		0.19						
Mann-Kendall Statistic (S):		39						
Confidence Factor:		76.0%						
Concentration Trend:		No Trend						



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.
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.

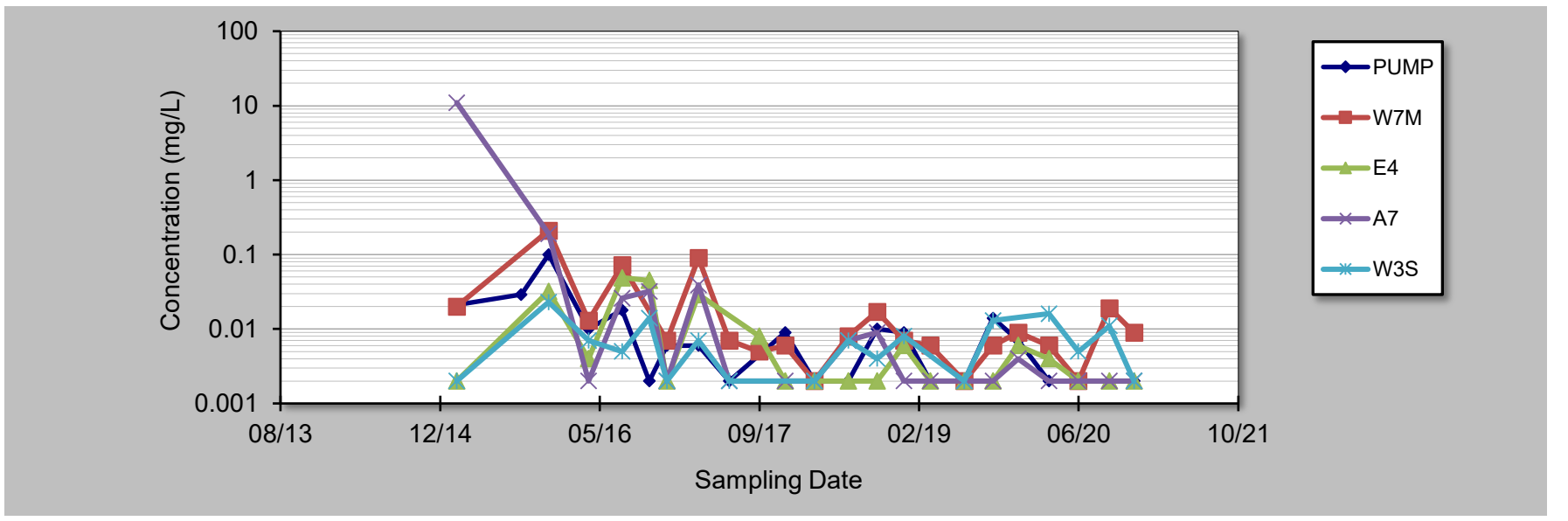
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **23-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
Constituent: **Free Cyanide**
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	17-Mar-20	0.002	0.006	0.004	0.002	0.016		
22	17-Jun-20	0.002	0.002	0.002	0.002	0.005		
23	22-Sep-20	0.002	0.019	0.002	0.002	0.011		
24	8-Dec-20	0.002	0.009	0.002	0.002	0.002		
25								
Coefficient of Variation:		1.79	1.93	1.52	4.44	0.81		
Mann-Kendall Statistic (S):		-97	-61	-62	-78	4		
Confidence Factor:		99.7%	96.6%	96.8%	99.1%	54.5%		
Concentration Trend:		Decreasing	Decreasing	Decreasing	Decreasing	No Trend		



Notes:

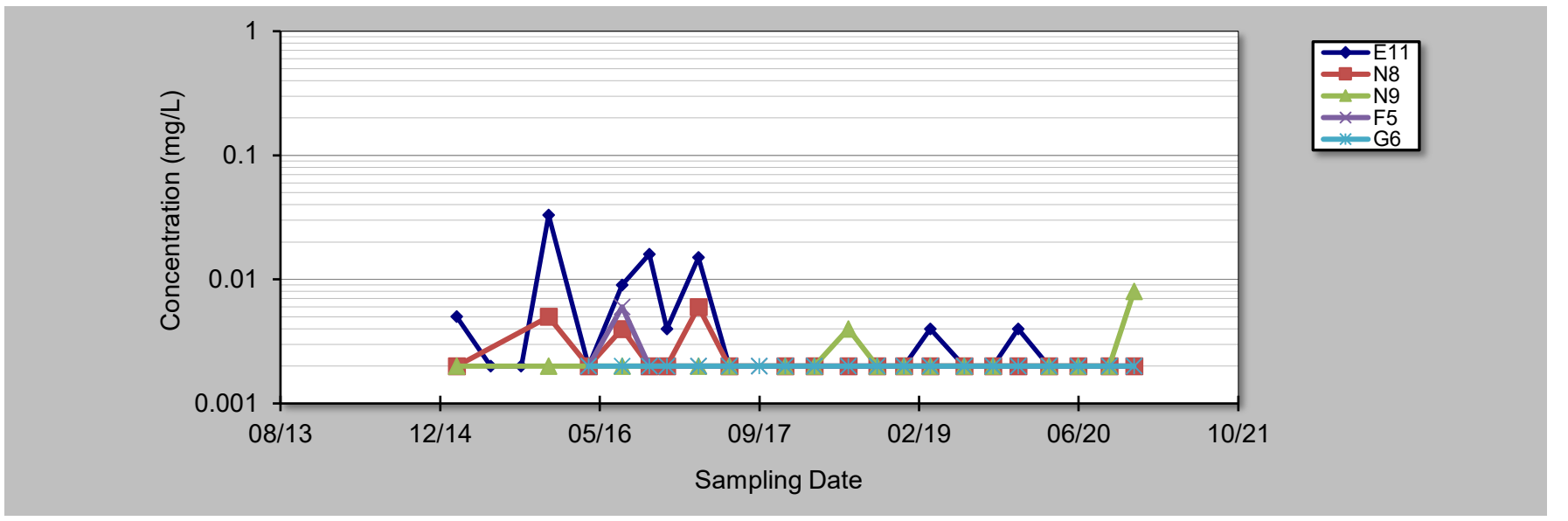
1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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:	23-Dec-20	Job ID:	318000894
Facility Name:	Hydro Kurri Kurri	Constituent:	Free Cyanide
Conducted By:	Jake Bourke	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	17-Mar-20	0.002	0.002	0.002	0.002	0.002		
22	17-Jun-20	0.002	0.002	0.002	0.002	0.002		
23	22-Sep-20	0.002	0.002	0.002	0.002	0.002		
24	8-Dec-20	0.002	0.002	0.008	0.002	0.002		
25								
Coefficient of Variation:		1.39	0.46	0.61	0.41	0.00		
Mann-Kendall Statistic (S):		-63	-39	15	-17	0		
Confidence Factor:		94.9%	87.3%	71.5%	69.6%	48.7%		
Concentration Trend:		Prob. Decreasing	Stable	No Trend	Stable	Stable		



Notes:

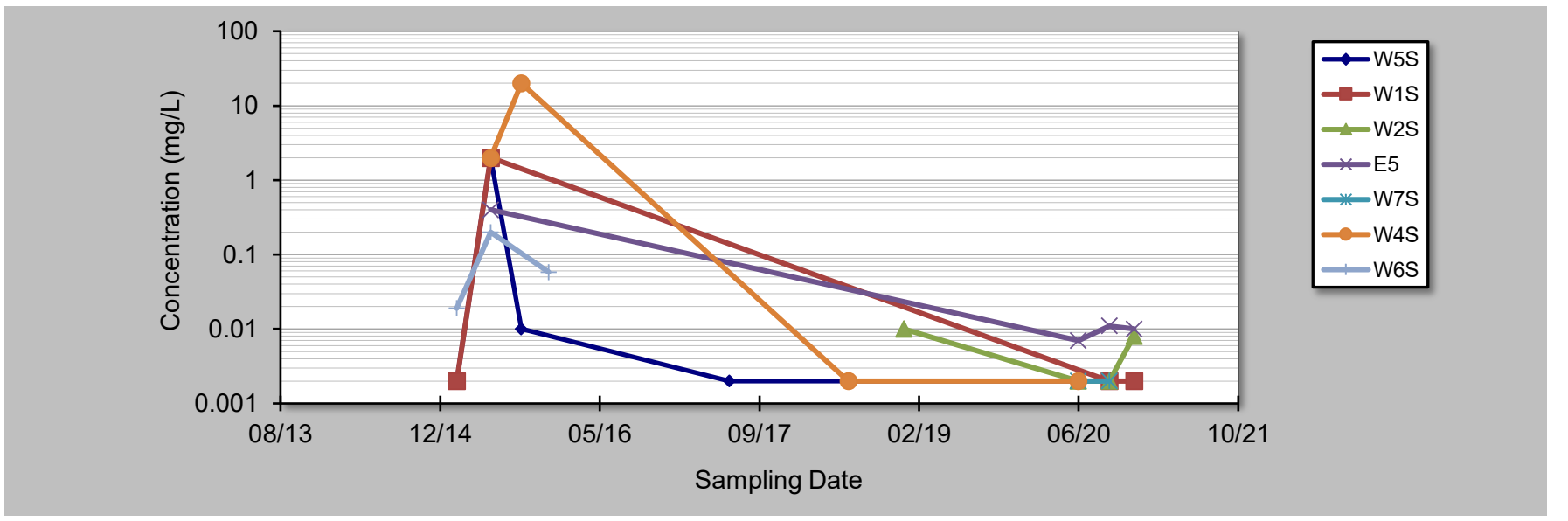
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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	**23-Dec-20**	Job ID:	**318000894**
Facility Name:	**Hydro Kurri Kurri**	Constituent:	**Free Cyanide**
Conducted By:	**Jake Bourke**	Concentration Units:	**mg/L**

Sampling Point ID:	W5S	W1S	W2S	E5	W7S	W4S	W6S
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15	0.002	0.002					0.019
2	3-Jun-15	2	2		0.4		2	0.2
3	7-Sep-15	0.01					20	
4	2-Dec-15							0.058
5	5-Apr-16							
6	19-Jul-16							
7	12-Oct-16							
8	6-Dec-16							
9	15-Mar-17							
10	20-Jun-17	0.002						
11	21-Sep-17							
12	12-Dec-17							
13	13-Mar-18							
14	28-Jun-18						0.002	
15	26-Sep-18							
16	19-Dec-18			0.01				
17	11-Mar-19							
18	26-Jun-19							
19	24-Sep-19							
20	11-Dec-19							
21	17-Mar-20							
22	17-Jun-20	0.002		0.002	0.007	0.002	0.002	
23	22-Sep-20	0.002	0.002	0.002	0.011	0.002		
24	8-Dec-20		0.002	0.008	0.01			
25								
Coefficient of Variation:		2.42	1.99	0.75	1.83	0.00	1.77	1.03
Mann-Kendall Statistic (S):		-5	-1	-1	-2	0	-3	1
Confidence Factor:		76.5%	50.0%	50.0%	62.5%		72.9%	
Concentration Trend:		No Trend	No Trend	Stable	No Trend		No Trend	



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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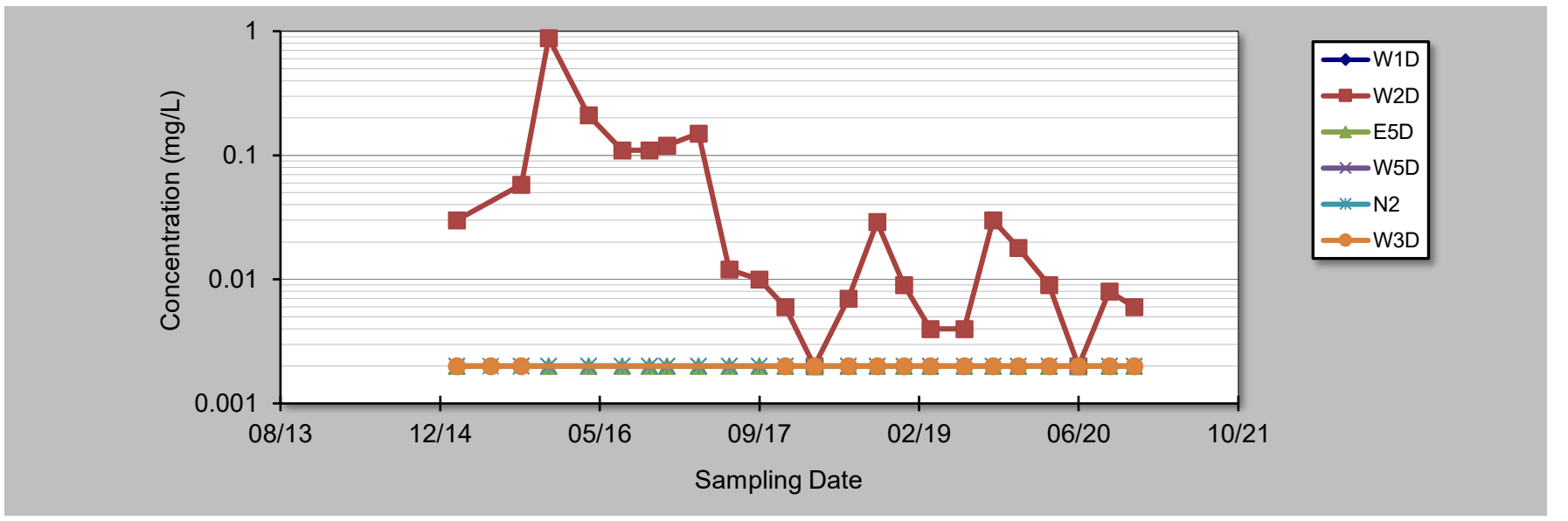
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date: **23-Dec-20**
Facility Name: **Hydro Kurri Kurri**
Conducted By: **Jake Bourke**

Job ID: **318000894**
Constituent: **Free Cyanide**
Concentration Units: **mg/L**

Sampling Point ID:	W1D	W2D	E5D	W5D	N2	W3D	
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15		0.03	0.002	0.002	0.002	0.002	
2	3-Jun-15					0.002	0.002	
3	7-Sep-15		0.058		0.002	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	0.002	
13	13-Mar-18	0.002	0.002	0.002	0.002	0.002	0.002	
14	28-Jun-18	0.002	0.007	0.002	0.002	0.002	0.002	
15	26-Sep-18	0.002	0.029	0.002	0.002	0.002	0.002	
16	19-Dec-18	0.002	0.009	0.002	0.002	0.002	0.002	
17	11-Mar-19	0.002	0.004	0.002	0.002	0.002	0.002	
18	26-Jun-19	0.002	0.004	0.002	0.002	0.002	0.002	
19	24-Sep-19	0.002	0.03	0.002	0.002	0.002	0.002	
20	11-Dec-19	0.002	0.018	0.002	0.002	0.002	0.002	
21	17-Mar-20	0.002	0.009	0.002	0.002	0.002	0.002	
22	17-Jun-20	0.002	0.002	0.002	0.002	0.002	0.002	
23	22-Sep-20	0.002	0.008	0.002	0.002	0.002	0.002	
24	8-Dec-20	0.002	0.006	0.002	0.002	0.002	0.002	
25								
Coefficient of Variation:		0.00	2.32	0.00	0.00	0.00	0.00	
Mann-Kendall Statistic (S):		0	-123	0	0	0	0	
Confidence Factor:		48.6%	>99.9%	48.9%	48.9%	49.0%	48.2%	
Concentration Trend:		Stable	Decreasing	Stable	Stable	Stable	Stable	



Notes:

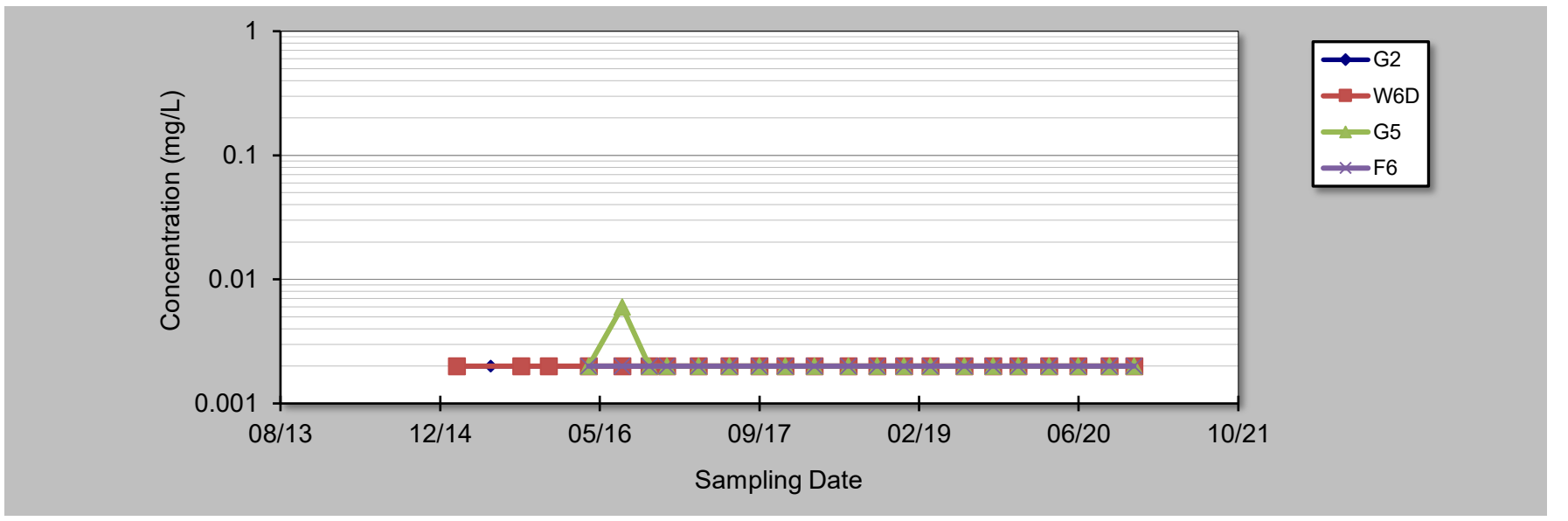
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GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	23-Dec-20	Job ID:	318000894
Facility Name:	Hydro Kurri Kurri	Constituent:	Free Cyanide
Conducted By:	Jake Bourke	Concentration Units:	mg/L

Sampling Point ID:	G2	W6D	G5	F6	W4D		
Sampling Event	Sampling Date	FREE CYANIDE CONCENTRATION (mg/L)						
1	17-Feb-15	0.002	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	17-Mar-20	0.002	0.002	0.002	0.002			
22	17-Jun-20	0.002	0.002	0.002	0.002			
23	22-Sep-20	0.002	0.002	0.002	0.002			
24	8-Dec-20	0.002	0.002	0.002	0.002			
25								
Coefficient of Variation:		0.00	0.00	0.41	0.00			
Mann-Kendall Statistic (S):		0	0	-17	0			
Confidence Factor:		48.9%	48.9%	69.6%	48.7%			
Concentration Trend:		Stable	Stable	Stable	Stable			



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.
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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