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HYDRO ALUMINIUM SMELTER
CAPPED WASTE STOCKPILE, 2015 ANNUAL GROUNDWATER MONITORING REPORT

RAMBOLL ENVIRON

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ACRONYMS AND ABBREVIATIONS

AHD	Australian Height Datum
ALS	Australian Laboratory Services
ANZECC	Australian and New Zealand Environment and Conservation Council
BGL	Below Ground Level
CN	Cyanide (total or free)
DP	Deposited Plan
DQO	Data Quality Objective
DQI	Data Quality Indicator
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
ESA	Environmental Site Assessment
Ha	Hectare
km	Kilometres
LOR	Limit of Reporting
m	Metres
Metals	Al: Aluminium
mg/L	Milligrams per Litre
m BGL	Metres below ground level
mg/L	Micrograms per Litre
NATA	National Association of Testing Authorities
NC	Not Calculated
ND	Not Detected
NEHF	National Environmental Health Forum
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
n	Number of Samples
OH&S	Occupational Health & Safety
PQL	Practical Quantitation Limit
pH	a measure of acidity, hydrogen ion activity
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
SPL	Spent Pot Lining
UCL	Upper Confidence Limit
µg/L	Micrograms per Litre
-	On tables is "not calculated", "no criteria" or "not applicable"

EXECUTIVE SUMMARY

Nine groundwater monitoring events (GMEs) have been completed leachate impacted groundwater plume associated with the Capped Waste Stockpile (AEC 1) at the former Hydro Aluminium Kurri Kurri Smelter. The nine events were undertaken in July 2013, November 2013, February 2014, June 2014, November 2014, February 2015, June 2015, September 2015 and December 2015. Each GME included the sampling and analysis of groundwater from 25 wells located on 5 sections along the length of the leachate plume down-gradient of the Capped Waste Stockpile. Physico-chemical parameters were recorded and groundwater samples were analysed for soluble fluoride, total and free cyanide and total aluminium.

Monitoring of the groundwater downgradient of the Capped Waste Stockpile was initiated to assess the impacts to groundwater from leachate and to provide a temporal and spatial evaluation of the plume.

A leachate interception trench was installed immediately down-gradient of the toe of the Capped Waste Stockpile, between the Capped Waste Stockpile and the wells on Section 1 in April 2014. The impact of the leachate interception trench on impacts to groundwater was assessed as part of this annual report.

The groundwater monitoring completed to date has found:

- Groundwater flow is interpreted to be north to north-east in both the shallow and deeper parts of the aquifer. This is consistent with historical observations;
- Groundwater is drawn down within the shallow groundwater wells around the interception trench since the commissioning of the trench in May 2014 providing evidence that the trench is operating as designed;
    - Decreasing concentrations of key analytes are generally observed since installation of the trench. Specifically groundwater concentrations of key analytes have decreased at the leading edge of the plume;
- Fluoride concentrations in the deep aquifer remain low and this aquifer appears unimpacted by leachate, with the exception of E5D. The concentrations of fluoride in E5D are elevated, however have decreased from February 2014 to December 2015. The absence of impacts in the deeper aquifer continues to show that the connection between the a shallow and deeper aquifer is semi-continuous;
- The groundwater table in the deep aquifer shows a lack of response to the leachate interception trench.

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

1. INTRODUCTION

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

The portion of the Smelter Site subject to the quarterly groundwater monitoring comprises the former smelter waste storage area known as the 'Capped Waste Stockpile' and an associated area of leachate impacted groundwater. The Capped Waste Stockpile and associated leachate impacted groundwater were identified as Area of Concern (AEC) 1 in the Phase 2 Environmental Site Assessment completed by Ramboll Environ in 2012. The location of AEC1 is shown in **Figure 1**. The results of five quarterly groundwater monitoring events, completed in July 2013, November 2013, February 2014, June 2014 and November 2014, were reported in 'Hydro Aluminium Kurri Kurri Smelter, Capped Waste Stockpile, 12 Month Groundwater Monitoring Report', by Ramboll Environ dated February 2015.

This report is the second annual report and presents the results of four quarterly groundwater monitoring events, completed in February 2015, June 2015, September 2015, and December 2015, as well as a trend analysis of the results from the nine monitoring events completed between 2013 and 2015.

1.1 Objective and Scope of Work

The objective of each quarterly Groundwater Monitoring Event (GME) was to:

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

The objective of this 12 Month Summary Report is to:

- Tabulate results for depth to water, physico-chemical parameters and analytical data;
- Complete trend analysis of monitored parameters in key wells incorporating data collected since July 2013;
- Assess the impact of the leachate interception trench on groundwater quality;
- Provide conclusions and recommendations.

The scope of work for each quarterly groundwater monitoring event included:

- Gauging, purging and sampling of 25 groundwater monitoring wells on five sections through the plume;
- Measurement of groundwater physico-chemical properties during purging, including pH, temperature, electrical conductivity (EC), redox (mV) and dissolved oxygen;
- Laboratory analysis of groundwater samples for soluble fluoride, total and free cyanide and aluminium.

1.2 Limitations

The scope of the quarterly monitoring was included in the Plume Delineation Assessment proposal dated 14 January 2015. Specific assumptions and limitations identified by Ramboll Environ as being relevant are set out in the report. The methodology and sources of information used by Ramboll Environ are outlined in our scope of work. Ramboll Environ has made no independent verification of this information beyond the agreed scope of works and assumes no responsibility for any inaccuracies or omissions made by others.

2. BACKGROUND

2.1 Site Background

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

The Capped Waste Stockpile is a repository of waste arising during the operations of the aluminium smelter and includes Spent Pot Liner (SPL), anodes, scrubber bags, concrete, brick, bulky waste, fines and other smelter wastes. The Capped Waste Stockpile is located near the eastern boundary of the smelter footprint and adjacent to the surrounding Hydro owned buffer land.

The Capped Waste Stockpile was maintained as an uncapped bunded waste repository prior to being capped with clay under development consent in the mid 1990's. At this time, impacts to vegetation in the buffer zone downgradient of the Capped Waste Stockpile were observed. Leachate from the Capped Waste Stockpile was also known to have impacted on groundwater and investigations commenced to investigate the extent of groundwater impact. These investigations identified that leachate impacted groundwater likely originated from the north-east corner of the Capped Waste Stockpile and extended approximately 250m north-east. The Capped Waste Stockpile and associated leachate impacted groundwater were identified as Area of Concern (AEC) 1 in the Phase 2 Environmental Site Assessment completed by Ramboll Environ in 2012. The location of AEC1 is shown in **Figure 1** in **Appendix 1**. Ramboll Environ 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

A summary of the Plume Delineation Report was included in Section 2.2 of the 2014 12 Month Groundwater Monitoring Report.

Following these investigations, a Groundwater Monitoring Program was developed that included the monitoring of 25 wells on 5 sections along the length of the plume. Further information regarding the development of the Program is presented in Section 2.4 of the 12 Month Groundwater Monitoring Report, 2014.

2.2 Conceptual Site Model

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

The site generally comprises flat, low lying swampy ground that is at an elevation of between 12mAHD and 15mAHD. The Capped Waste Stockpile is located within the smelter portion of the site and is approximately 170m in length by 130m in width and is up to 11m 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 fenceline. 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 Capped Waste Stockpile comprises stockpiled spent pot lining wastes and other wastes including cryolite, alumina, floor sweepings, shot blast dust, cement and potlining mix.

The uncapped storage of waste and subsequent infiltration of rain water 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 Capped Waste Stockpile.

The Capped Waste Stockpile was capped in 1995 to prevent infiltration. The suspected burial of leachate during capping and the ongoing contact between waste material and shallow groundwater beneath the Capped Waste Stockpile may continue to further contribute to leachate generation.

Major contaminants in the leachate are sodium (4,800mg/L to 15,300mg/L), fluoride (1,100mg/L to 3,420mg/L), sulphate (4,000mg/L to 6,740mg/L) and cyanide (70mg/L to 200mg/L) based on data obtained from leachate ponded within the bunded area of the Capped Waste Stockpile 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 Capped Waste Stockpile 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 50m wide and 250m in length extending to the north east of the Capped Waste Stockpile. 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 in **Figure 2** in **Appendix 1**.

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 complexly 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 (**Figure 3** in **Appendix 1**). 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 750m to 1000m north-east of the plume, as shown in **Figure 3** in **Appendix 1**. 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 15,000µs/cm) exceeds the limit (12,200µs/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 (>9), elevated electrical conductivity (>5000µS/cm), elevated fluoride (>200mg/L) and total cyanide (>6mg/L) concentrations and is brown in colour. Historical data indicates fluoride concentrations within the leachate plume have been decreasing since the Capped Waste Stockpile was capped in 1995. Fluoride concentrations near the Capped Waste Stockpile, 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 4** below.

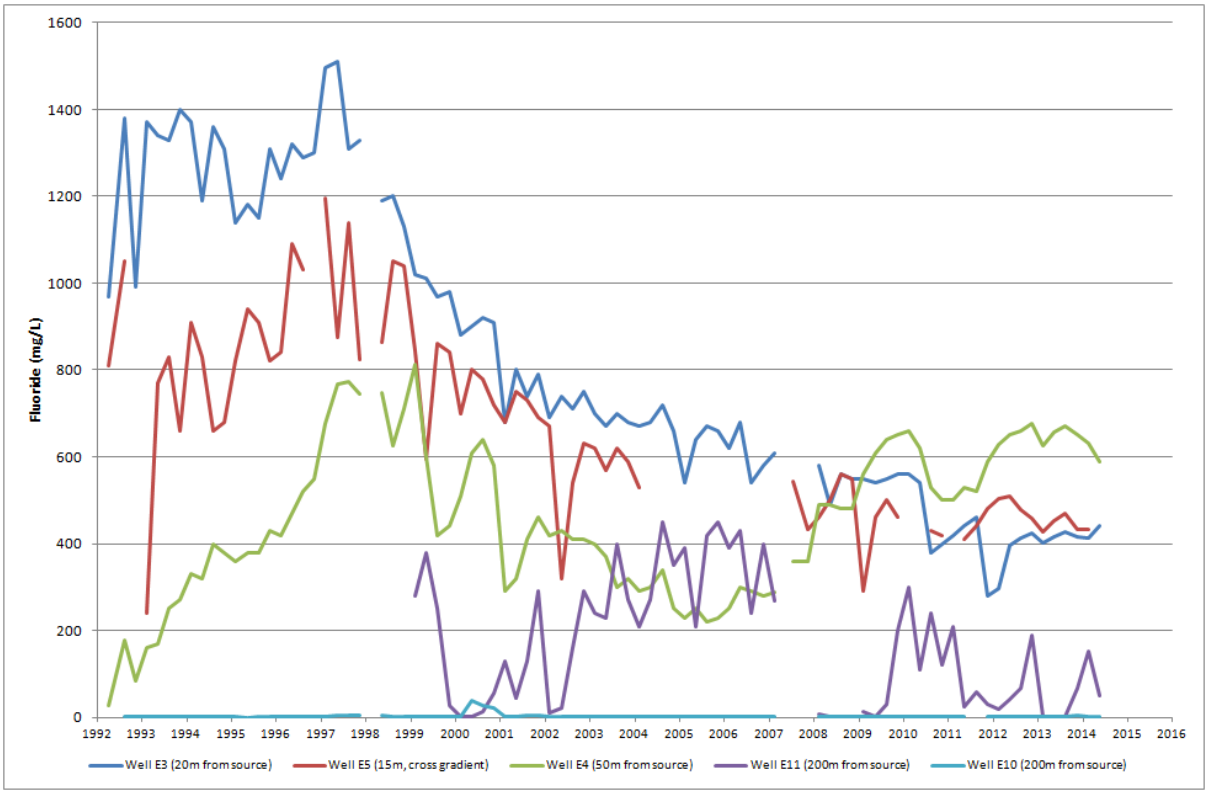


Figure 4: Historical Fluoride Concentrations along the Plume

Ex-filtrated leachate impacted groundwater is observed to become overland flow discharging along a surface water flowpath to a small dam. During periods of high rain 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 **Figure 5** in **Appendix 1**.

Fluoride concentrations at the semi-permanent dam, located between the leachate impacted groundwater plume and Swamp Creek, typically vary between 15mg/L and 25mg/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 0.49mg/L up stream of the smelter and 1.2mg/L down-stream. Adjacent to the semi-permanent dam discharge to Swamp Creek, fluoride concentrations were 1.6mg/L. The Stage 2 Aquatic Assessment - Ecological Risk Assessment completed by ENVIRON in June 2013 indicated there is no discernable 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 shallow aquifer within the buffer zone of the Hydro Aluminium Smelter has been impacted by leachate from the Capped Waste Stockpile. The characteristics of this shallow aquifer and the underlying deep aquifer, which has not been impacted, are important critical to the understanding of the site CSM. Aquifer characteristics have been identified as outlined in **Table 2.1**.

Table 2.1: Aquifer Characteristics	
Aquifer Type	Unconsolidated sediment (estuarine)
Aquifer Depth	Shallow: Approximately 0.3m bgs to 2.5m bgs
	Deep: Approximately 3.5m bgs to 7m 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 aquifer type, 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 no porosity identified within the unconsolidated estuarine sediments. The leachate from the Capped Waste Stockpile moves through the sediments with mid to high porosity but is retarded by high plasticity clays.

2.4 Leachate Interception trench

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

The leachate interception trench was installed at the toe of the Capped Waste Stockpile immediately upgradient of the wells on Section 1 in April 2014, refer to **Figure 6** in **Appendix 1**. The leachate interception trench was designed to intercept and collect shallow, perched leachate impacted groundwater through a slotted pipe under vacuum. The pipe was installed using horizontal trenching equipment (ditch witch trencher) to a depth of 3m in order to remain above any confining layers. The location of the interception trench is shown in **Figure 6** in **Appendix 1** and a conceptual cross section of the trench is included in **Figure 7** in **Appendix 1**.

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

The leachate interception trench has been in operation since May 2014 and is expected to have an impact on the leachate plume by lowering the groundwater table and removing leachate at the location of the trench.

2.5 Fate and transport modelling

Ramboll 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 Capped Waste Stockpile, the model estimated a fluoride concentration of 4.3 mg/L at the receptor distance (1000m), 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 (SPL), anodes, scrubber bags, concrete, brick, bulky waste, fines and other smelter wastes stockpiled within the Capped Waste Stockpile);
- 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.

3. SAMPLING, ANALYSIS AND QUALITY PLAN

3.1 Objective

The objective of the quarterly groundwater monitoring is to collect water quality data to inform the behaviour of the plume. The groundwater monitoring network is shown in **Figure 6** in **Appendix 1**.

3.2 Scope of Works

The scope of works included the following:

- The collection of groundwater samples and measurement of water level in wells on the following five sections:
  - Section 1: Wells E5, E5D, W7S, W7M, PUMP, W2S, W2D;
  - Section 2: Wells E5, E5D, E4, W1S, W1D;
  - Section 3: Wells A7, W3S, W3D, ~~W3SA~~, W4S, W4D;
  - Section 4: Wells E11, W5S, W5D, N2;
  - Section 5: Wells G2, N8, N9, W6S, W6D.
- Field analysis for physico-chemical parameters including pH, temperature, EC, redox and dissolved oxygen; and
- Laboratory analysis of groundwater samples for soluble fluoride, total and free cyanide, and total aluminium.

It is noted that well W3SA was destroyed in the April 2015 storm and has not been replaced as this shallow well was dry for the majority of the 2013/2014 sampling events.

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 Monitor

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, including pH, temperature, EC, redox and dissolved oxygen, stabilised to within 10% of the previous reading. Readings were recorded on field sheets. Generally, 1 to 2L were purged from each well.
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, was decontaminated by washing in a Decon90 solution and rinsing with water between samples.
Sample Collection and Storage	Groundwater samples were collected into laboratory-supplied bottles with the appropriate preservative for the analysis undertaken. The bottles were stored in an ice-filled esky in the field and in transit to the laboratory.
Chain of Custody	Groundwater samples were dispatched to the laboratory under chain of custody conditions.

3.4 Data Quality Objectives

Data quality objectives for the Stage 2 investigations and future groundwater monitoring are outlined in **Table 3.2**.

Table 3.2: Data Quality Objectives	
DQO	**Outcome**
State the Problem	To collect baseline and 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	1) collect physico-chemical properties and samples from the groundwater monitoring well network (see **Figure 6**) over five groundwater monitoring events, 2) complete analysis of collected groundwater samples for soluble fluoride, total cyanide and total aluminium and 3) analysis of the data.
Define the Study Boundaries	AEC 1 identified in **Figure 1**, plus the surface water receptors identified down gradient of AEC 1, including a semi-permanent dam and Swamp Creek. The investigation relates to groundwater.
Develop a Decision Rule	The statistical parameters of interest are the concentrations of the fluoride, cyanide, aluminium, pH and EC identified historically and in the current investigations. The action levels are 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 and surface water 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. 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 groundwater monitoring events to monitor the state of a groundwater leachate plume, decision errors relate to the comparability of data between monitoring events. As such, all 25 wells should be sampled during each monitoring event, unless wells are found to be dry. Standard operating procedures, including consistent use of low flow techniques, should be implemented to ensure comparability of data between events. The same primary and secondary laboratories should be used for analysis and laboratory QA/QC should be assessed to ensure comparability between events.
Optimise the Design for Obtaining Data	Low flow sampling techniques will be used to collect groundwater samples to optimise the quality of the samples. Field samples for each round were collected using the same sampling procedures to ensure comparability between sampling events.

3.5 Data Quality Indicators

Project data quality indicators 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	Acceptability Limits
Completeness	All critical locations sampled All samples collected Experienced sampler Documentation correct	All critical samples analysed All analysis completed Appropriate methods	As per NEPM (2013)
Comparability	Experienced sampler Climatic conditions appropriate for the type of analyte. Climatic conditions noted during sampling. Same types of samples collected	Same analytical methods used Same sample PQLs Same laboratories (NATA accredited) Same units	As per NEPM (2013)
Representativeness	Appropriate media sampled	All samples analysed according	As per NEPM (2013)
Precision	Collection of blind and split duplicate samples	Blind duplicates analysed 1 in 10 samples Split duplicates analysed 1 in 10 samples Laboratory duplicates analysed Laboratory prepared trip spikes	As per NEPM (2013)
Accuracy	Collection of rinsate blanks	Analysis of: Field/ trip blanks Rinsate blanks Method blanks Matrix spikes Surrogate spikes Laboratory control samples Reagent blanks	As per NEPM (2013)

4. ASSESSMENT CRITERIA

4.1 Groundwater Assessment Criteria

The assessment criteria proposed 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; and
- ENVIRON (March 2013) Tier 2 Ecological Risk Assessment, Kurri Kurri Aluminium Smelter.

4.2 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 1.5km 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 15km north-east of the site near Maitland.

Surface water within Swamp Creek is described generally neutral, ranging between pH 7.0 and 7.8 and conductivity was generally fresh, ranging from 626µS/cm to 1520µS/cm. This surface water body is considered to be a fresh water receptor.

Groundwater is expected to follow the topography and flow north-east towards the dam and 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 2km 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.

It is noted that 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 Waste Water Treatment Works is located up gradient of the site. The works has a licensed discharge point into Swamp Creek.

4.3 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 ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality are considered applicable for the protection of aquatic ecosystems of receiving waters. ANZECC (2000) 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 Table 3.4.1 of ANZECC (2000) 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 fresh water 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 are provided in **Table 4.1**.

Table 4.1: Groundwater Assessment Criteria (mg/L)

Contaminant	95% Protection for Aquatic Ecosystems	Irrigation	Stock Watering	Recreational
Aluminium	0.055	5	5	9
Fluoride	No guideline	1	2	1.5
Free Cyanide	0.007	No guideline	No guideline	0.1
pH	6.5 - 8**	No guideline	No guideline	5 - 9
Electrical Conductivity (µS/cm)	No guideline	4500 - 7700***	No guideline	No guideline

** Values for lowland rivers from Table 3.3.2 in ANZECC (2000)

*** Values for tolerant crops from Table 4.2.4 in ANZECC (2000)

**** Value from Table 4.2.4 in ANZECC (2000) for where electrical conductivity is 'generally too saline' for plant growth

5. QUALITY ASSURANCE / QUALITY CONTROL

Four groundwater monitoring events were completed in February 2015, June 2015, September 2015 and December 2015. An evaluation of quality assurance and quality control for the four events is included in **Appendix 3**. Quality assurance and quality control has been assessed against the DQIs outlined in **Section 3.5**, including completeness, comparability, representativeness, precision and accuracy.

Ramboll Environ makes the following conclusions regarding the DQIs:

- Completeness: The data for the 2015 GMEs is considered to be complete. One well, W3SA, was destroyed during the April 2015 storm and has not been replaced. As this well was dry for four of the five previous sampling events, the loss of this well is not considered to affect the completeness of the data.
- Comparability: The groundwater data collected during the four 2015 GMEs is considered to be comparable. This data is also comparable to data from the 2013/2014 GMEs.
- 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 deep aquifer.
- Precision: In the field, Ramboll Environ achieved precision by using standard operating procedures for the collection of groundwater samples and by collecting duplicate and triplicate samples for analysis. RPD results for duplicate samples were acceptable aside from aluminium results in the September 2015 GME, which should be considered approximate only. Laboratory quality control results indicate precision was achieved at the laboratory.
- Accuracy: In the field, Ramboll Environ achieved accuracy by using standard operating procedures for the collection of groundwater samples. It is noted that the water quality meter appears to have been damaged in the December 2015 GME and elevated pH levels in wells W1D, W4D, W5D, N2 and G2 in December 2015 are considered unreliable. Laboratory quality control results indicate accuracy was achieved at the laboratory.

6. TREND ANALYSIS JULY 2013 TO DECEMBER 2015

Nine groundwater monitoring events have been assessed as part of this trend analysis, with GMEs completed at the following times:

- First GME: July 2013;
- Second GME: November 2013;
- Third GME: February 2014;
- Fourth GME: June 2014;
- Fifth GME: November 2014;
- Sixth GME: February 2015;
- Seventh GME: June 2015;
- Eighth GME: September 2015; and
- Ninth GME: December 2015.

The following parameters have been assessed in the following sections:

- Section 6.1: Shallow aquifer – depth to groundwater and flow direction;
- Section 6.2: Shallow aquifer – pH concentrations;
- Section 6.3: Shallow aquifer – leachate concentrations;
- Section 6.4: Deep aquifer – depth to groundwater and flow direction;
- Section 6.5: Deep aquifer – pH concentrations.
- Section 6.6: Deep aquifer – leachate concentrations.

A summary of laboratory results for the four GMEs from 2015 are included in **Appendix 4**. Groundwater field parameter forms are included in **Appendix 5** and laboratory reports 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 and cyanide was not considered appropriate due to its potential for degradation.

6.1 Shallow Aquifer – Depth to Groundwater and Flow Direction

Comparison of depth to water in the shallow wells between the five GMEs is included in **Table 6.1**.

Comparison of water levels between July 2013 and December 2015 indicate they generally increased, likely associated with rainfall throughout this period. There was no rainfall between November 2013 and February 2014 and water levels were observed to decrease over this period.

Between the February and June 2014 GMEs, a leachate interception trench was installed between the toe of the Capped Waste Stockpile and Section 1 wells. The leachate interception trench was designed to intercept and remove groundwater impacted by leachate in the very shallow part of the aquifer. Since July 2014, some of the six shallow wells on Section 1 have been dry or pumped dry during purging. The lack of water in these wells is considered to be due to the drawdown in the shallow aquifer caused by the leachate interception trench immediately upgradient of these wells. The water levels in wells further down gradient from the leachate interception trench were also generally observed to have decreased.

Table 6.1: Comparison of Depth to Water in Shallow Wells (mAHD)									
Well ID	**Jul-13**	**Nov-13**	**Feb-14**	**Jun-14**	**Nov-14**	**Feb-15**	**Jun-15**	**Sep-15**	**Dec-15**
W1S	11.89	11.98	11.37	11.28*	-	11.22	11.53	11.21	11.32*
W2S	12.49	12.62	-	-	-	-	12.06*	11.80*	-
E5	12.21	12.05	11.80	-	11.53*	-	11.90	11.61	-
PUMP	12.49	12.35	11.86	11.04	11.31	11.26	11.95	11.70	11.65
W7S	12.61	12.97	-	12.06*	11.96*	-	-	-	-
W7M	12.22	12.14	11.57	10.60*	11.09	10.92	11.94	11.61	11.52
E4	11.93	12.09	10.53	11.51	11.28	11.31	12.07	11.65	11.73
A7	10.28	10.60	9.81	10.06	9.92	10.02	10.49	10.22	10.0
W3S	9.97	10.31	9.28	9.83	9.55	9.90	10.29	10.05	9.64
W3SA	9.65	10.05	-	9.65*	9.63*	9.66	**	**	**
W4S	9.52	9.86	-	9.51*	9.51*	-	9.74	9.73	-
E11	8.06	7.74	7.48	7.72	7.76	7.54	8.7	8.15	9.89
W5S	9.19	9.27	-	9.05	8.79*	8.99	9.32	9.29	-
N8	9.18	8.74	8.46	8.80	8.73	8.65	9.35	9.19	9.09
N9	9.22	9.31	8.48*	9.01	8.87	9.00	9.69	9.38	9.06
W6S	7.85	7.65*	7.64*	7.65*	7.65*	7.69	8.12	8.01*	7.82

*Well pumped dry during purging, no sample collected;

** Well destroyed during April 2015 storms

- Well dry

Interpreted groundwater flow directions are shown in **Figures 8** to **16.** Groundwater flow directions in the shallow aquifer are predicted to be generally to the north to north east.

Figure 8: July 2013 Shallow Groundwater Flow Direction

Figure 9: November 2013 Shallow Groundwater Flow Direction

Figure 10: February 2014 Shallow Groundwater Flow Direction

Figure 11: June 2014 Shallow Groundwater Flow Direction

Figure 12: November 2014 Shallow Groundwater Flow Direction

Figure 13: February 2015 Shallow Groundwater Flow Direction

Figure 14: June 2015 Shallow Groundwater Flow Direction

Figure 15: September 2015 Shallow Groundwater Flow Direction

Figure 16: December 2015 Shallow Groundwater Flow Direction

As shown in the groundwater flow plots, a decline in the phreatic surface (top of the groundwater table) is evident in the area between the Capped Waste Stockpile and the start of the southern vegetation impact area between the February 2014 GME and the November 2014 GME. This is the result of the commissioning of the leachate interception trench in May 2014. Wells close to the north-eastern corner of the Capped Waste Stockpile, including W1S, W2S, W7S and W7M were dry in the June 2014 GME and November 2014 GME, indicating a drawdown of water at the interception trench.

6.2 Shallow Aquifer – pH Levels

The leachate plume has an elevated pH, with the pH of leachate impacted groundwater generally exceeding 9. Shallow aquifer pH levels for the nine GMEs completed between July 2013 and December 2015 are summarised in **Figure 17**. Well W3SA was destroyed in the April 2015 storm. As well W3SA had only one data point, and it has been removed from the results.

The pH levels within the shallow groundwater monitoring wells within Section 1 and Section 2 remained generally stable from November 2014 to December 2015 at levels greater than 8.5. There has been an increase in pH at well E4, located approximately 50m east of the interception trench on the eastern edge of the plume, from 8.84 in February 2015 to 10.57 in December 2015.

The pH levels in wells W1S, W3S, W5S and N9 were consistently below 9 in the four 2015 GMEs although groundwater in these wells is impacted with leachate.

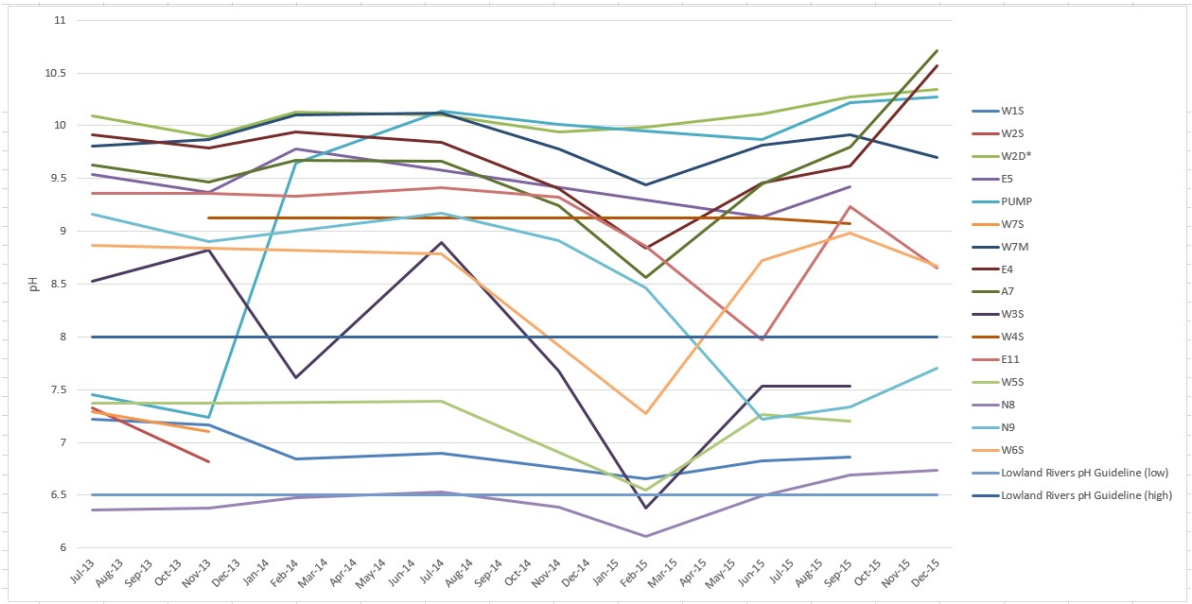


Figure 17: pH Levels in Shallow Wells

6.3 Shallow Aquifer – Key Chemical Concentrations

6.3.1 Fluoride

Comparison of fluoride concentrations between the five GMEs completed between July 2013 and December 2015 is summarised in **Figure 18**. Well W3SA was destroyed in the April 2015 storm. As well W3SA had only one data point, and it has been removed from the results.

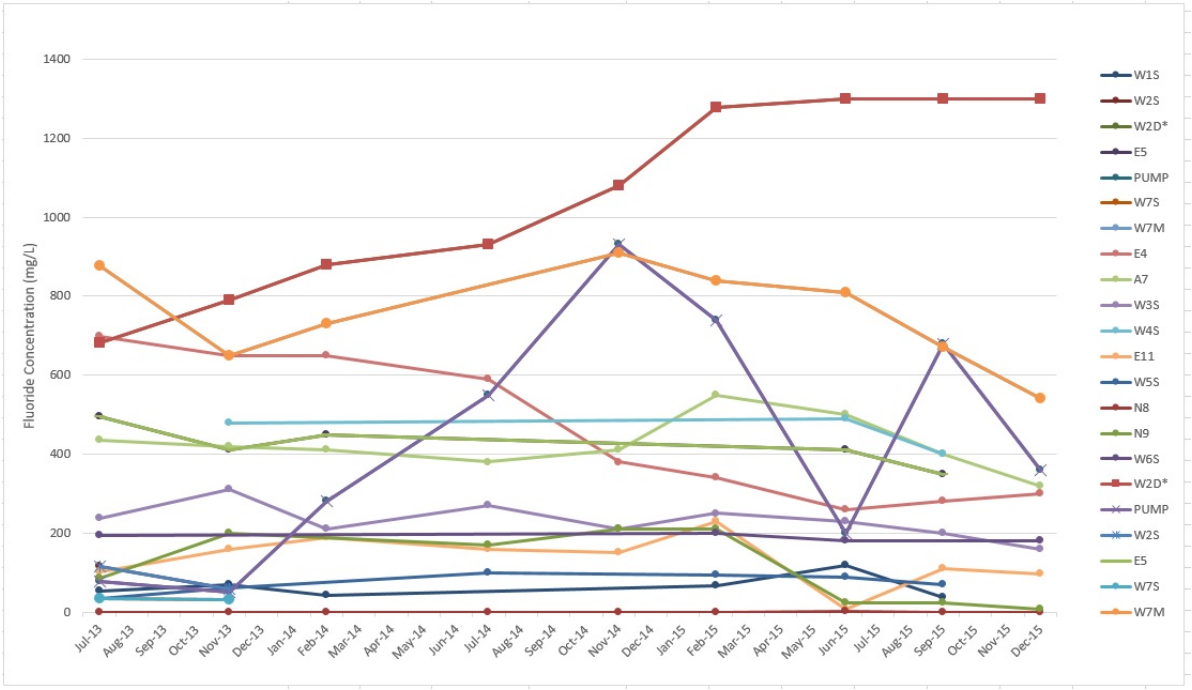


Figure 18: Fluoride Concentrations in Shallow Wells

Between November 2014 and December 2015, fluoride concentrations in wells along Section 1 that were not dry (W2D, W7M and Pump) generally stabilised or decreased (see **Figure 19**). In 2015, the fluoride concentration in W2D had stabilised at 1300mg/L, while fluoride concentrations in wells W7M and E5 (when well was not dry) have decreased. Since November 2014, the fluoride concentration in the well Pump has fluctuated between 200mg/L and 680mg/L, as shown below in **Figure 19**.

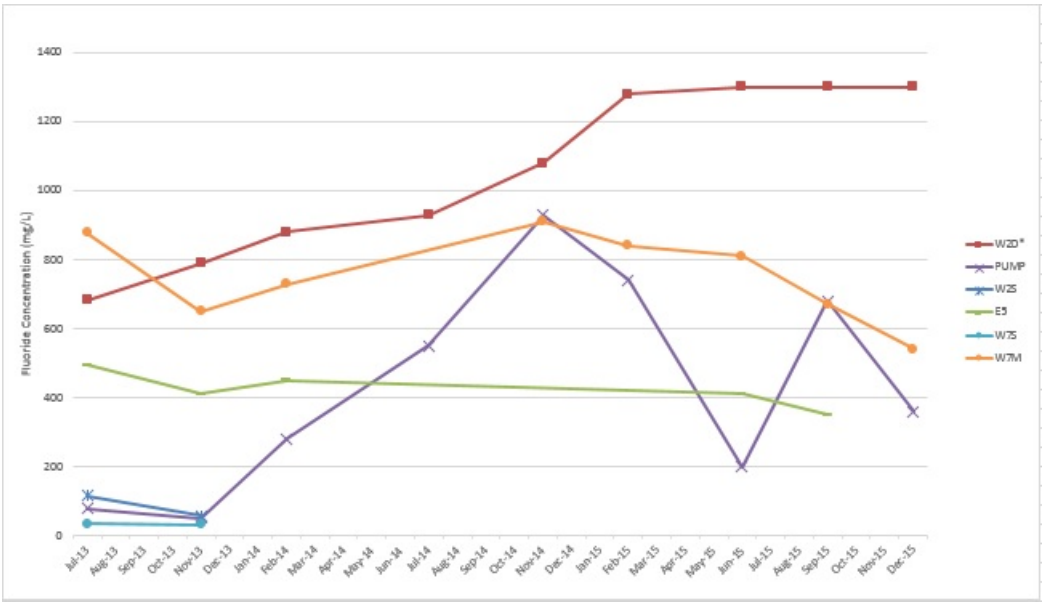


Figure 19: Fluoride Concentrations in Section 1

Fluoride concentrations further from the source generally decreased in 2015, as shown in **Figure 20**. The largest decrease in fluoride concentrations was observed in well E4, located approximately 50m east of the interception trench. A decrease in fluoride concentrations was also observed in wells A7, W3S, W4S on Section 3 located approximately 150m down gradient of the source. Fluoride concentrations in leading edge wells further from the plume source, E11 and N9,

have decreased since February 2015, indicating the leachate trench is now reducing fluoride concentrations at the plume's leading edge.

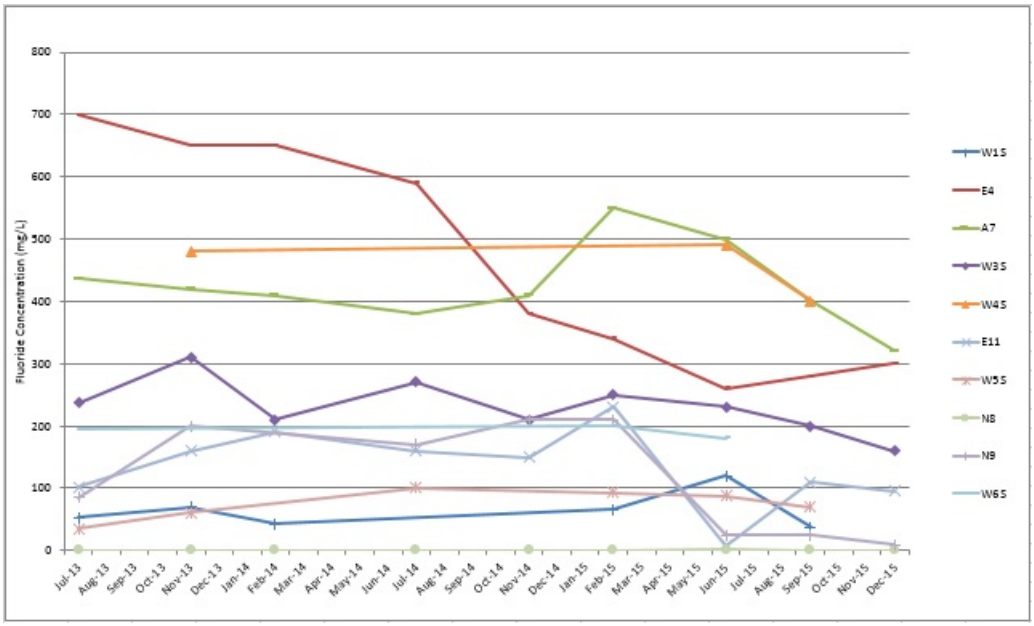


Figure 20: Fluoride Concentrations in Shallow Wells Down-Gradient of the Interception Trench

6.3.2 Cyanide

6.3.2.1 Total Cyanide

A summary of the Total Cyanide concentrations in the Shallow groundwater monitoring wells is provided in **Table 6.4** below.

Table 6.4: Comparison of Total Cyanide Concentrations in Shallow Wells (mg/L)

Well ID	Jul-13	Nov-13	Feb-14	Jun-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1S	1.7	0.98	0.87	-	-	15	1.1	-	-
W2S	0.41	0.49	-	-	-	-	-	-	-
W2D*	170	160	170	240	260	200	270	290	290
E5	42	43	43	-	-	-	69	-	-
PUMP	17.1	0.76	6.2	-	120	58	9.3	110	48
W7S	0.096	0.45	-	37	-	-	-	-	-
W7M	63	78	86	-	200	130	180	100	83
E4	130	140	130	160	65	41	25	99	35
A7	96	88	90	89	110	78	100	66	62
W3S	34	38	36	53	41	25	24	28	19
W3SA	-	16	-	-	-	-	-	-	-
W4S	-	41	-	-	-	-	330	34	7.4
E11	17	17	21	32	17	7.7	0.49	9.4	-
W5S	1.7	1.7	-	2	-	9.3	2.3	3	0.63
N8	4	0.34	0.44	0.54	0.53	6.6	0.69	0.6	1.2
N9	4.5	12	-	13	21	13	1.2	0.95	-
W6S	19	-	-	-	-	12	14	-	19

- Well dry at time of sampling

There are no applicable guidelines for Total Cyanide

Total Cyanide concentrations within the samples collected from W2D increased from 170 mg/L in February 2014 to 290 mg/L in December 2015. Total Cyanide concentrations within the samples collected from W7M fluctuated from 63 mg/L in July 2013 to 200 mg/L in November 2014. The concentrations then decreased to 83 mg/L in December 2015. Total Cyanide concentrations in wells on the edge of the plume have decreased. Fluoride concentrations in well E4, located approximately 50m east of the interception trench, decreased from 160mg/L in July 2014 to 35mg/L in December 2015. This indicates the removal of groundwater impacted by leachate via the interception trench has reduced Total Cyanide concentrations at a short distance from the source.

Total Cyanide concentrations in the leading edge well further from the plume source, N9, has decreased from 21 mg/L in November 2014 to 0.95 mg/L in December 2015. This decrease indicates the interception trench is now reducing Total Cyanide concentrations at the plume's leading edge.

6.3.2.2 Free Cyanide

A summary of the Free Cyanide concentrations in the Shallow groundwater monitoring wells is provided in **Table 6.5** below.

Table 6.5: Comparison of Free Cyanide Concentrations in Shallow Wells (mg/L)

Well ID	Feb-15	June-15	Sep-15	Dec-15
W1S	0.004	<0.4	-	-
W2S	-	-	-	-
W2D*	0.030	<4	0.058	**0.88**
E5	-	**<0.8**	-	-
PUMP	0.021	<0.08	0.029	**0.10**
W7S	-	-	-	-
W7M	0.020	*<2*	<0.04	**0.21**
E4	<0.004	*<0.4*	<0.04	0.032
A7	0.011	*<2*	<0.02	**0.19**
W3S	<0.004	*<0.4*	<0.02	0.023
W3SA	-	-	-	-
W4S	-	*<4*	<0.04	-
E11	0.005	<0.004	<0.004	0.033
W5S	<0.004	*<0.4*	<0.02	-
N8	<0.004	*<0.4*	<0.02	0.005
N9	<0.004	*<0.4*	<0.02	<0.004
W6S	0.019	*<0.4*	-	0.058

- Well dry at time of sampling

The majority of Free Cyanide samples collected from the shallow groundwater monitoring wells were below the limit of reporting (LOR). However, it is noted that the Practical Quantitation Limits (PQLs) for free cyanide were raised in the July and September 2015 GMEs due to the high dilution required for total cyanide results to be reportable within the calibration range.

Concentrations of Free Cyanide are significantly lower than concentrations of Total Cyanide in the shallow aquifer, indicating that the majority of the cyanide within the leachate is in a complex form. The form of cyanide may be a Weak Acid Dissociable (WAD) complex or a strongly complexed form that has no environmental impact.

6.3.3 Aluminium

A summary of the Aluminium (Total) concentrations in the Shallow groundwater monitoring wells is provided in **Table 6.6** below.

Table 6.6: Comparison of Total Aluminium Concentrations in Shallow Wells (mg/L)

Well ID	Jul-13	Nov-13	Feb-14	Jun-14	Nov-14	Feb-15	June-15	Sep-15	Dec-15
W1S	121	130	27	-	-	120	1200	-	-
W2S	91.5	33	-	-	-	-	-	-	-
W2D*	2.86	0.6	0.67	1.4	44	0.03	0.19	0.03	3.5
E5	0.33	0.52	2.5	-	-	-	3	-	-
PUMP	58.1	60	17	-	310	370	120	610	97
W7S	415	42	-	210	-	-	-	-	-
W7M	11.4	2.3	45	-	21	0.99	32	8.7	7.8
E4	0.379	0.89	0.4	3.2	35	46	49	53	-
A7	0.208	4.7	0.7	0.26	0.71	1.7	2.7	0.61	0.72
W3S	11.7	2.6	7.1	9.2	5.3	34	4.4	24	92
W3SA	-	4.3	-	-	-	-	-	-	-
W4S	-	3.6	-	-	-	-	2.3	13	-
E11	23	23	4	7.8	3.6	5	2.5	11	2.7
W5S	13	13	-	15	-	22	7	31	-
N8	0.102	12	0.11	0.3	91	1.8	29	5.3	3.4
N9	14.7	62	-	9	130	8	14	22	0.89
W6S	60.1	-	-	-	-	3.5	7.7	-	22

- Well dry at time of sampling

The concentrations of total Aluminium within the shallow groundwater wells have generally fluctuated between November 2014 and December 2015. The majority of concentrations in the groundwater wells were <100mg/L, with the exception of PUMP. Concentrations of total Aluminium of 610 mg/L was detected in the sample from PUMP in September 2015.

6.4 Deep Aquifer – Depth to Groundwater and Flow Direction

Comparison of depth to water between the nine GMEs completed between July 2013 GME and December 2015 is included in **Table 6.7**. Comparison of depth to groundwater between the GMEs indicates groundwater levels have remained stable in the deep aquifer between the nine monitoring events. Well W1D is an exception to this, with water levels decreasing over 2m between the July 2013 GME and the June 2014 GME, with a slight rebound in November 2014.

Table 6.7: Comparison of Depth to Water in Deep Wells (mAHD)

Well ID	Jul-13	Nov-13	Feb-14	Jun-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1D	10.85	10.91	9.33	8.70	9.11	-	8.51	8.02	8.58
W2D	12.19	12.31	11.79	11.46	11.18	10.46	11.96	11.68	11.57
E5D	11.69	11.63	11.56	11.61	11.56	11.61	11.57	11.52	11.72
W3D	5.61	-	-	5.53	5.46	5.5	5.59	5.68	-
W4D	5.54	5.46	5.44	5.46	5.37	5.94	-	-	-
W5D	5.39	5.32	5.30	5.36	5.32	5.31	5.45	5.52	5.30
N2	4.99	4.86	4.79	4.90	4.96	5.92	5.08	5.12	5.15
G2	5.63	6.50	6.55	6.55	6.49	6.48	6.62	6.68	5.71
W6D	5.13	5.11	5.19	5.20	5.12	5.09	5.30	5.40	5.39

- Well dry at time of sampling

Groundwater flow direction plots are provided below in **Figures 21** to **29** and show groundwater flow direction in the deep aquifer is consistently to the north-east. The deep aquifer contours show little variation between June 2013 and December 2015. There is a consistent gradient from 11m bgs near E5D to 6m bgs near W4D, then the gradient shallows through the northern vegetation impact area.

Figure 21: July 2013 Deep Groundwater Flow Direction

Figure 22: November 2013 Deep Groundwater Flow Direction

Figure 23: February 2014 Deep Groundwater Flow Direction

Figure 24: June 2014 Deep Groundwater Flow Direction

Figure 25: November 2014 Deep Groundwater Flow Direction

Figure 26: February 2015 Deep Groundwater Flow Direction

Figure 27: June 2015 Deep Groundwater Flow Direction

Figure 28: September 2015 Deep Groundwater Flow Direction

Figure 29: December 2015 Deep Groundwater Flow Direction

6.5 Deep Aquifer – pH Levels

The deep aquifer has generally not been impacted by leachate and the pH levels should reflect this, with pH levels below 9 anticipated. Deep aquifer pH levels for the nine GMEs between July 2013 and December 2015 are summarised in **Table 6.8**.

The pH levels in the deep groundwater wells have remained generally stable from July 2013 to December 2015, with pH levels less than 9. Elevated pH levels in wells W1D, W4D, W5D, N2 and G2 in December 2015 are considered to be due to damage incurred to the pH probe during the sampling event and are considered unreliable.

The pH levels in the deep wells are considered to be indicative of the natural conditions at the site. The natural pH conditions are slightly acidic to neutral, with pH conditions generally below the trigger values for lowland rivers of 6.5 to 8 (ANZECC 2000).

Table 6.8: Comparison of pH Levels in Deep Wells

Well ID	Jul-13	Nov-13	Feb-14	Jun-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1D	6.98	6.62	6.7	6.71	6.63	-	6.82	6.79	8.48*
E5D	7.22	7.29	7.53	7.44	8.32	6.8	7.23	7.23	7.18
W3D	5.91	-	-	4.38	3.56	3.29	4.89	3.62	-
W4D	6.02	5.7	5.7	5.4	5.36	4.69	-	5.18	9.9*
W5D	6.02	6.32	6.1	6.11	6.11	5.34	-	6.32	8.37*
N2	3.26	6.54	4.01	3.94	3.54	3.34	6.61	5.81	8.09*
G2	6.04	6.09	6.09	6.1	6.03	5.7	6.01	6.04	7.87*
W6D	6.49	6.11	5.75	5.83	5.54	8.22	5.84	5.81	5.5

*Elevated pH for December 2015 is considered to be a result of damage incurred to the pH probe during fieldworks.

- Well dry at time of sampling

6.6 Deep Aquifer – Key Chemical Concentrations

6.6.1 Fluoride

Comparison of fluoride concentrations in the nine GMEs completed between July 2013 and December 2015 is included in **Table 6.9**.

Soluble Fluoride concentrations in wells W1D, E5D and N2 exceed the site guidelines for Soluble Fluoride.

Table 6.9: Comparison of Soluble Fluoride Concentrations in Deep Wells (mg/L)

Well ID	Jul-13	Nov-13	Feb-14	Jun-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1D	39	5.4	3.5	5.1	3.3	-	4.4	3.5	2.6
E5D	1.21	40	44	23	12	18	16	14	16
W3D	1.23	-	-	0.19	0.41	0.22	0.3	0.3	-
W4D	1.48	1.7	1.3	0.41	1.6	1.1	-	0.2	-
W5D	20	0.51	0.59	0.65	0.53	0.44	-	0.4	0.5
N2	0.43	6.2	1.9	1.4	0.74	0.49	8.1	1.4	1.4
G2	0.28	0.28	0.25	0.28	0.28	0.28	0.3	0.3	0.3
W6D	1.19	0.25	0.21	0.4	0.19	0.3	0.1	0.1	-

- Well dry, no sample taken

Between the initial GME in July 2013 and the second GME in November 2013, the fluoride concentration in wells W1D and W5D decreased from 39mg/L and 20mg/L respectively to around 5mg/L and 0.5mg/L respectively. The fluoride concentrations in these wells have remained stable at the lower concentrations in subsequent GMEs, as shown below in **Figure 30**.

During the same period, the fluoride concentration in E5D increased from 1.21mg/L to 40mg/L. This well is located on Section 1 close to the source. Following the installation of the leachate interception trench, fluoride concentrations in E5D decreased from 44mg/L in February 2014 to 12mg/L in November 2014 and has remained stable at the lower concentration in subsequent GMEs, as shown below in **Figure 30**.

Fluoride concentrations in other deep wells have generally been stable, with only minor fluctuations in concentrations.

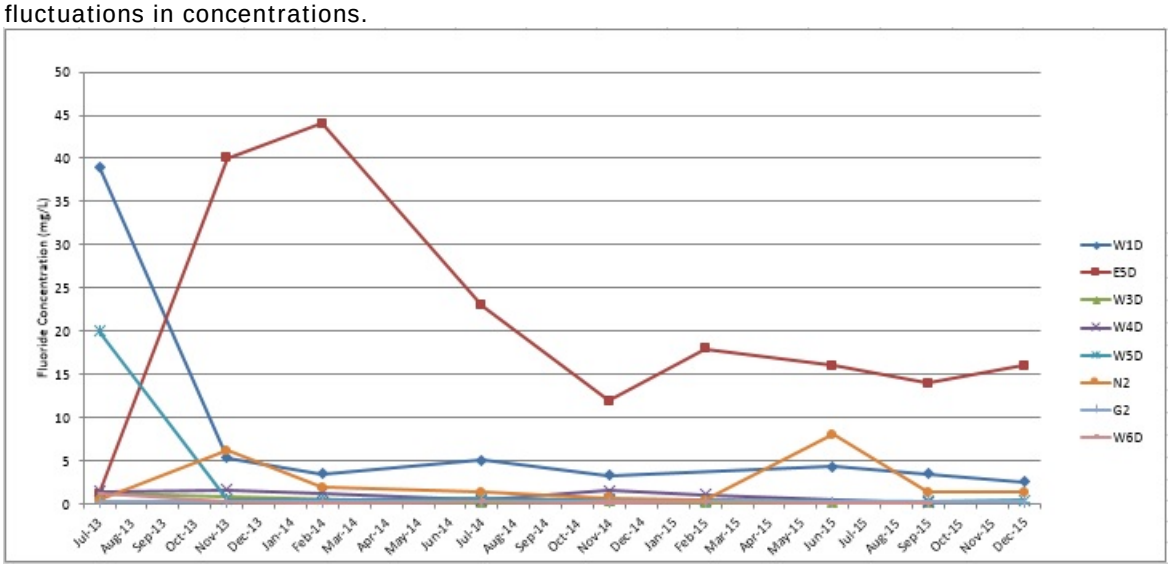


Figure 30: Fluoride Concentrations in Deep Wells

6.6.2 Total Cyanide

Total Cyanide concentrations have generally remained stable (<2 mg/L), with the exception of E5D. Total Cyanide concentrations in E5D decreased from 17 mg/L in February 2014 to 3 mg/L in December 2015.

Table 6.10: Comparison of Total Cyanide Concentrations in Deep Wells (mg/L)

Well ID	Jul-13	Nov-13	Feb-14	Jun-14	Nov-14	Feb-15	June-15	Sep-15	Dec-15
W1D	1.3	0.67	0.54	0.57	1.3	1.3	0.77	0.77	0.71
E5D	4.4	14	17	8.8	4.4	6.8	2.9	1.2	3
W3D	0.038	-	-	0.005	<0.04	0.08	0.013	0.008	-
W4D	0.16	0.13	0.011	<0.004	<0.04	0.007	-	-	-
W5D	0.025	0.039	0.069	0.016	<0.04	0.005	-	0.005	0.008
N2	<0.004	0.077	0.005	0.004	<0.04	0.009	0.021	0.05	0.032
G2	<0.004	0.028	<0.004	<0.004	<0.04	<0.004	<0.004	<0.004	<0.004
W6D	0.013	0.016	0.01	0.017	<0.04	0.008	<0.004	<0.004	-

- Well dry, no sample taken

Free Cyanide from all deep groundwater well samples analysed between February 2015 and December 2015 were below the LOR.

Table 6.11: Comparison of Free Cyanide Concentrations in Deep Wells (mg/L)

Well ID	Feb-15	June-15	Sep-15	Dec-15
W1D	-	<0.2	<0.2	<0.2
E5D	<0.004	<0.4	<0.4	<0.4
W3D	<0.004	<0.004	<0.004	<0.004
W4D	<0.004	-	-	-
W5D	<0.004	-	-	-
N2	<0.004	<0.004	<0.004	<0.004
G2	<0.004	<0.004	<0.004	<0.004
W6D	<0.004	<0.004	<0.004	<0.004

- Well dry, no sample taken

6.6.3 Total Aluminium

Total Aluminium concentrations have generally remained stable (<10 mg/L), with the exception of N2. Total Aluminium concentrations in N2 increased from 6.7 mg/L in November 2014 to 28 mg/L in February 2015. These concentrations then decreased to 3.4 mg/L in June 2015. These concentrations have then remained generally stable until December 2015.

The majority of Total Aluminium concentrations detected from July 2013 to December 2015 exceed the 95% Protection site guideline. The Total Aluminium concentrations detected in well N2 exceeded the Irrigation, Stock Watering and Recreational site guidelines in February and December 2015.

Table 6.12: Comparison of Total Aluminium Concentrations (mg/L) in Deep Wells

Well ID	Jul-13	Nov-13	Feb-14	Jun-14	Nov-14	Feb-15	June-15	Sep-15	Dec-15
W1D	21.2	0.9	2.4	2.4	0.26	0.26	4	0.95	0.4
E5D	1.697	1.5	110	2.2	3.3	3.4	2.1	2.1	4.3
W3D	0.7	-	-	0.58	0.72	0.76	0.81	0.04	-
W4D	0.794	0.48	0.19	0.27	0.5	0.35	-	-	-
W5D	0.323	0.04	0.02	0.02	0.05	0.16	-	0.99	0.54
N2	5.771	3	4.6	4.5	6.7	28	3.4	2.4	9.1

G2	0.115	0.1	0.04	1.2	2.1	2.9	2	4.1	1.8
W6D	1.087	0.06	0.04	1.2	0.5	0.12	0.19	0.74	-

- Well dry at time of sampling

7. PERFORMANCE OF LEACHATE INTERCEPTION TRENCH

Six rounds of GMEs have been completed following the installation of the leachate trench in April 2014, with 3 rounds completed prior to the installation of the trench. The leachate interception trench was installed at the toe of the Capped Waste Stockpile immediately upgradient of the wells on Section 1 in April 2014. The leachate interception trench was designed to intercept and collect shallow, perched groundwater impacted by leachate through a slotted pipe under vacuum, refer to **Figure 6** in **Appendix 1**. This leachate impacted groundwater is pumped directly to the East Surge Pond, for disposal of via irrigation following pumping to the North Dam.

The e leachate interception trench was immediately effective at reducing groundwater levels in the immediate vicinity of the toe of the Capped Waste Stockpile. This was evident from monitoring in wells along Section 1, where shallow wells W2S, E5 and W7S were observed to be dry or to pump dry since the June 2014 GME. This indicated that the leachate interception trench is operating as designed and that a reduction in the volume of leachate flowing into groundwater down-gradient of the Capped Waste Stockpile has be achieved.

Following the installation of the leachate interception trench, fluoride concentrations in the most impacted well on Section 1, W2D, initially increased and have now stabilised at 1300mg/L. Fluoride concentrations at other wells on Section 1 that continue to have groundwater have either fluctuated (PUMP) or reduced (W7M) since the installation. The increase and fluctuations in fluoride concentrations on Section 1 wells indicates that the leachate is concentrating in the area around Section 1, likely due to the vacuum created around the leachate interception trench.

Well E4 is located on the eastern edge of the plume approximately 50m east of the interception trench. Fluoride concentrations in this well started to reduce in June 2014 and have reduced from 699mg/L in July 2013 to 300mg/L in December 2015, indicating that the leachate interception trench has reduced fluoride concentrations in groundwater on the eastern edge of the plume.

There are two leading edge wells, E11 and N9, see **Figure 5** in **Appendix 1**. Since the installation of the leachate interception trench, the fluoride concentration in well E11 has fluctuated from 160mg/L in June 2014 to 96mg/L in December 2015 with a maximum of 230mg/L in February 2015. In contrast, fluoride concentrations in well N9 have reduced from a 200mg/L in November 2013 to 9mg/L in December 2015. The largest decline in fluoride concentrations occurred between February 2015 (210mg/L) and June 2015 (24mg/L).

The leachate interception trench has shown no impact to the deep aquifer, with the depth to groundwater and groundwater flow direction showing no variation from prior to the installation to after. The leachate interception trench was designed to intercept the shallow groundwater system only.

Whilst results generally appear to show that the installation of the leachate interception trench is reducing the mass of leachate entering the aquifer, it is also noted that the migration of leachate to groundwater is highly rainfall dependent as is the movement of groundwater within the shallow aquifer. Further monitoring is required to assess the temporal behaviour of the leachate impacted groundwater and the true effects of the interception trench.

8. CONCLUSION

Monitoring of groundwater down-gradient of the Capped Waste Stockpile was initiated to assess the impacts to groundwater from leachate and to provide a temporal and spatial evaluation of these impacts.

Nine groundwater monitoring events (GMEs) were completed in July 2013, November 2013, February 2014, June 2014, November 2014, February 2015, June 2015, September 2015 and December 2015. Each GME included the sampling and analysis of groundwater from 25 wells located on five sections along the length of the leachate impacted groundwater plume down gradient of the Capped Waste Stockpile. Physico-chemical parameters were recorded and groundwater samples were analysed for soluble fluoride, total cyanide, free cyanide and total aluminium. In May 2014, a leachate interception trench was constructed to intercept and remove shallow groundwater and leachate. Evaluation of trench performance formed part of the evaluation.

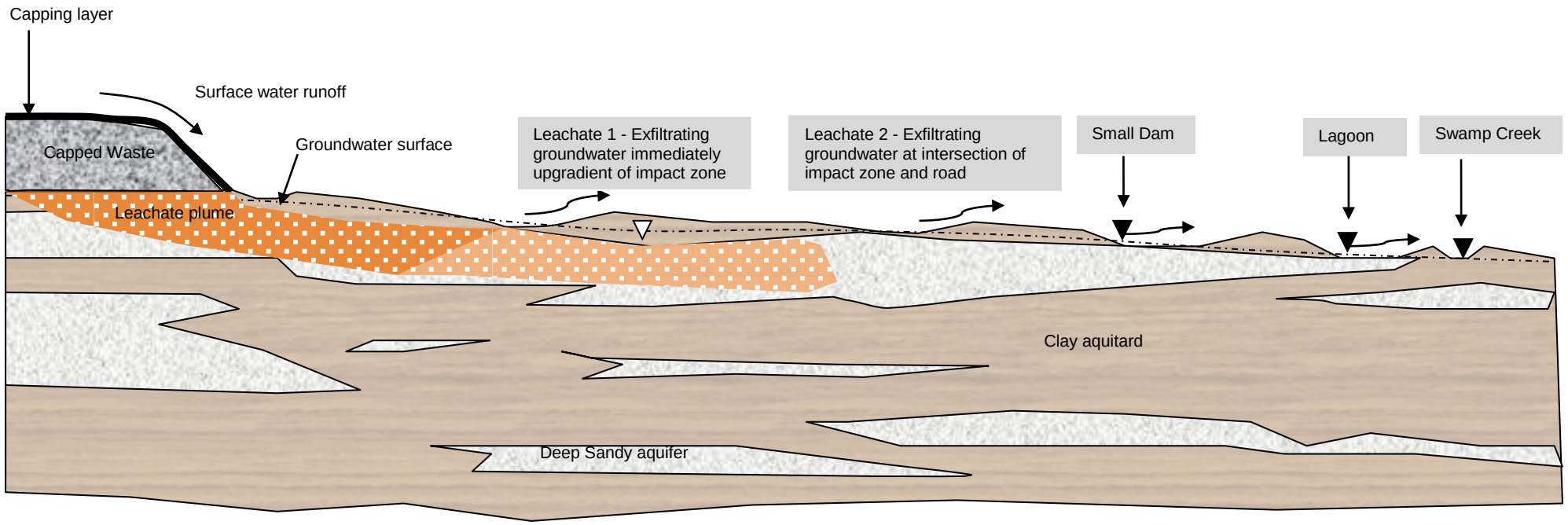
The groundwater monitoring completed to date has found:

- Groundwater flow is interpreted to be north to north-east in both the shallow and deeper parts of the aquifer. This is consistent with historical observations;
- Groundwater is drawn down within the shallow groundwater wells around the interception trench since the commissioning of the trench in May 2014 providing evidence that the trench is operating as designed;
    - Decreasing concentrations of key analytes are generally observed since installation of the trench. Specifically groundwater concentrations of key analytes have decreased at the leading edge of the plume;
- Fluoride concentrations in the deep aquifer remain low and this aquifer appears unimpacted by leachate, with the exception of E5D. The concentrations of fluoride in E5D are elevated, however have decreased from February 2014 to December 2015. The absence of impacts in the deeper aquifer continues to show that the connection between the a shallow and deeper aquifer is semi-continuous;
- The groundwater table in the deep aquifer shows a lack of response to the leachate interception trench.

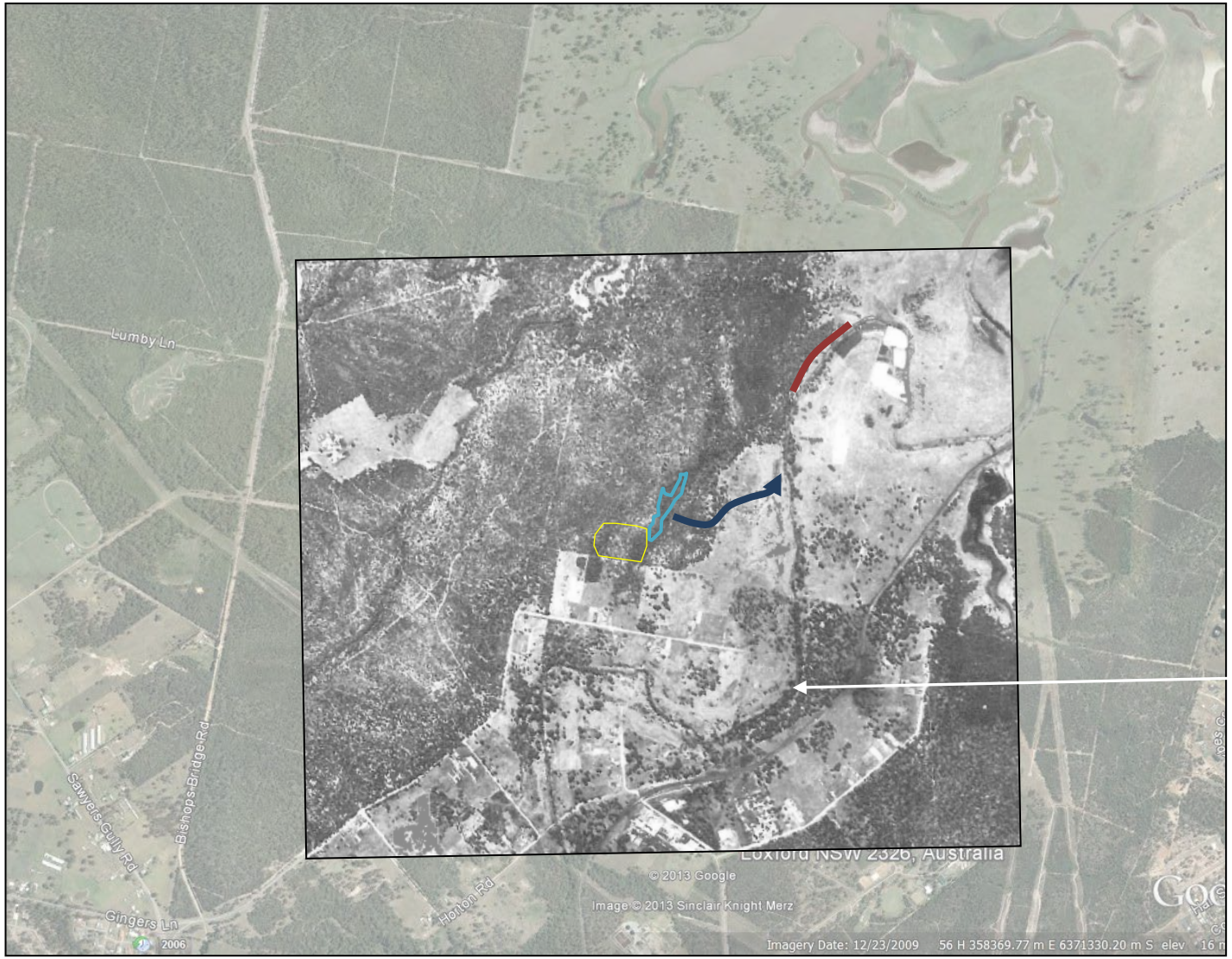
Monitoring of groundwater and operation of the toe leachate interception trench is proposed to continue until remediation of the Capped Waste Stockpile is completed. A further annual report will be prepared in 2017, following an additional four GMEs.

APPENDIX 1
FIGURES

HYDRO AUSTRALIA	12 MONTH GME SUMMARY	Site Location Plan AEC 1
RAMBOLL ENVIRON	JOB NO: AS130420	DATE: 24/02/2016 FIGURE 1



HYDRO AUSTRALIA	12 MONTH GME SUMMARY	Conceptual Plume Cross Section
RAMBOLL ENVIRON	JOB NO: AS130420	DATE: 24/02/2016	FIGURE 2



HYDRO AUSTRALIA 12 MONTH SUMMARY REPORT

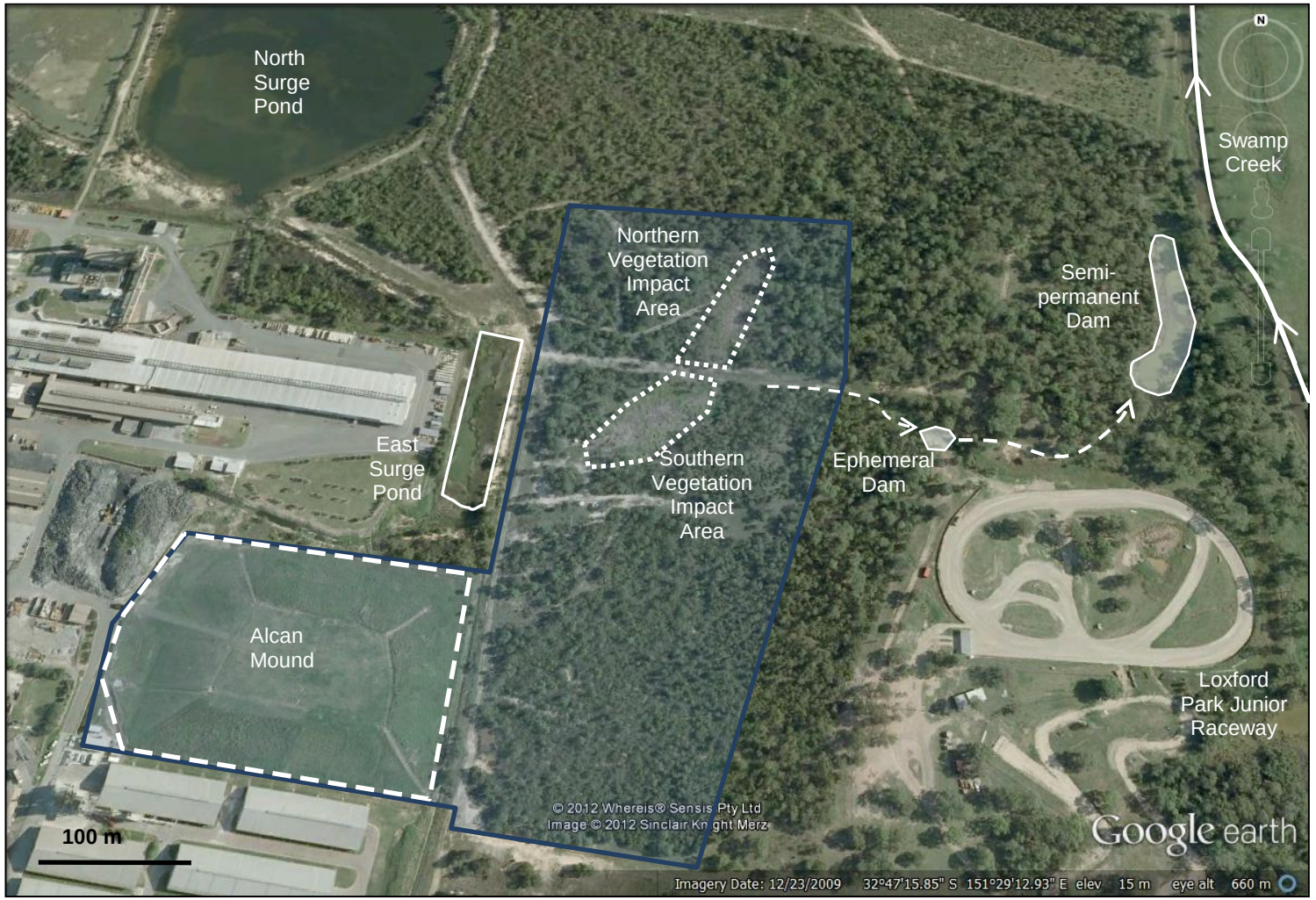
1961 Aerial Photograph showing Plume Location

RAMBOLL ENVIRON

JOB NO: AS130420

DATE: 24/02/2016

FIGURE 3



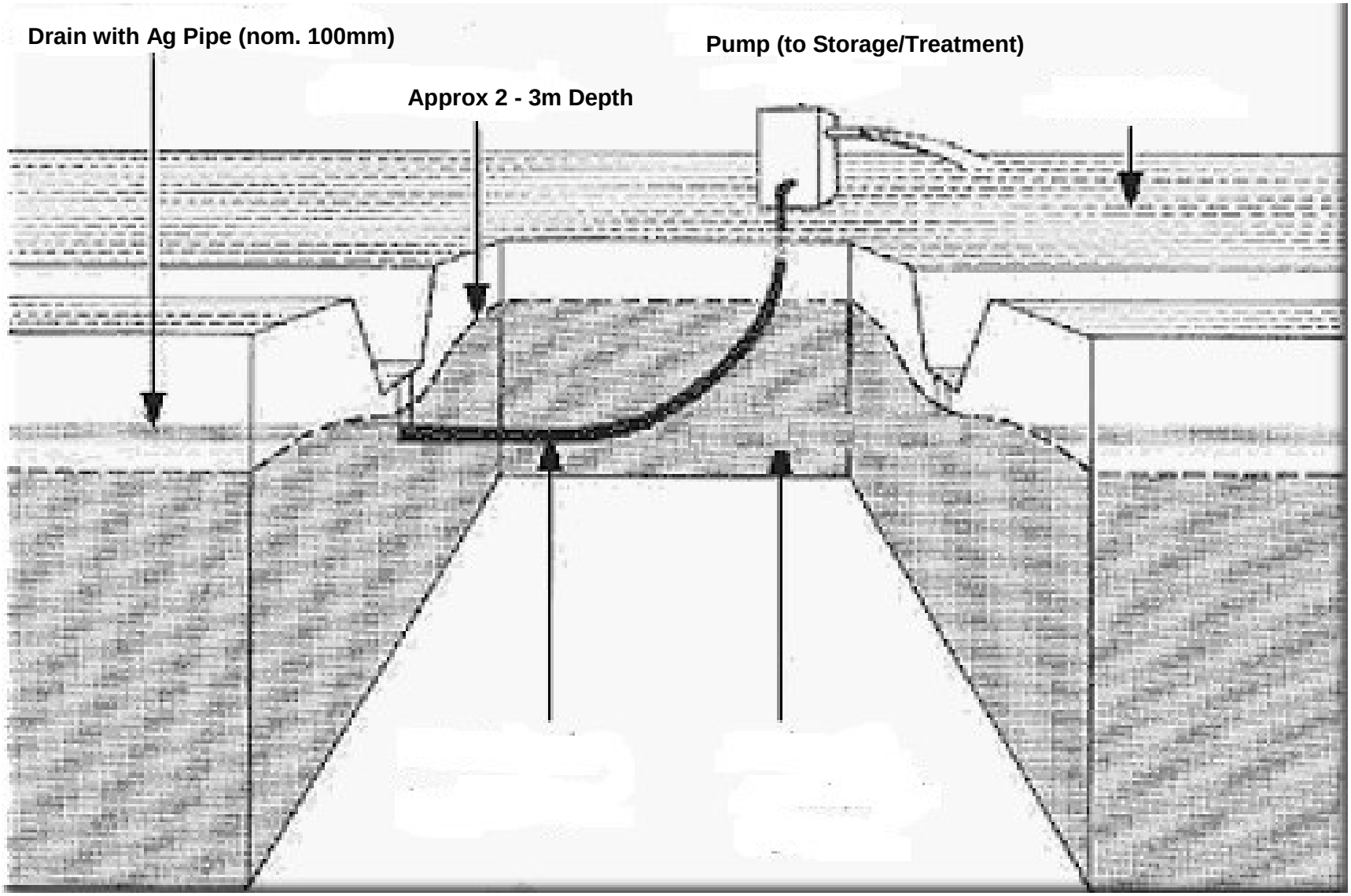
HYDRO AUSTRALIA	12 MONTH GME SUMMARY	Overland Flow Path of Leachate
RAMBOLL ENVIRON	JOB NO: AS130420	DATE: 24/02/2016	FIGURE 5

HYDRO AUSTRALIA

12 MONTH GME SUMMARY

Groundwater Monitoring Well Network

RAMBOLL ENVIRON JOB NO: AS130420 DATE: 24/02/2016 FIGURE 6



N

HYDRO AUSTRALIA	12 MONTH GME SUMMARY	Conceptual Cross Section of Leachate Interception Trench
RAMBOLL ENVIRON	JOB NO: AS130420	DATE: 24/02/2016 FIGURE 7

APPENDIX 2
QUALITY ASSURANCE / QUALITY CONTROL ASSESSMENT

A quality assurance assessment for the 2015 reporting period is presented in Table A and B below and covers the four Groundwater Monitoring Events (GMEs) completed in February 2015, June 2015, September 2015 and December 2015.

Table A: QA/QC – Sampling and Analysis Methodology Assessment

Sampling Methodology	Ramboll Environ Assessment
Sampling Pattern and Locations	Prior to the commencement of the GMEs, the leachate plume originating from the Capped Waste Stockpile was delineated through staged fieldwork and reported in ENVIRON (2013) 'Plume Delineation Report, Alcan Mound'. From the delineation work, 19 new groundwater wells were installed on five sections along the length of the plume to assist with groundwater monitoring. The five sections are approximately 60m apart and extend from the toe of the Capped Waste Stockpile 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 2015 GMEs. Each section provides a cross section of the leachate plume at different length along the known location of the plume. One of the wells, W3SA, was destroyed in the April 2015 storm and has not been replaced.
Sampling Density	Twenty five groundwater wells were selected for sampling for the 2015 GMEs on five sections along the length of the leachate plume. As the leachate plume is approximately 300m in length, there is one section per 60m.
Sample depths	Both shallow groundwater (leachate plume) and the deep aquifer were sampled as part of the 2015 GMEs.
Sample Collection Method	For the 2015 GMEs, groundwater samples were collected using low flow methods. Groundwater samples were collected directly into laboratory-supplied bottles. Disposable gloves were worn during sample collection.
Decontamination Procedures	Dedicated disposable tubing was used to collect the groundwater samples. A short piece of silicone tubing was retained in the peristaltic pump and used for all wells. This tubing was decontaminated between sampling locations by washing with a solution of Decon90 and potable water.
Sample handling and containers	All groundwater samples were placed into laboratory-supplied bottles that were prepared with the required preservatives by the laboratory. Groundwater samples were placed on ice following collection and during transportation to the laboratory.
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.
Detailed description of field screening protocols	A water quality meter was used to collect field data, including temperature, pH, electrical conductivity, reduction/ oxidation potential and dissolved oxygen. These parameters were recorded during purging until they stabilised, with subsequent readings within 10% of each other.
Calibration of field equipment	The water quality meter was hired from a rental company who calibrated the equipment prior to hire.

Table A: QA / QC – Sampling and Analysis Methodology Assessment	
Sampling Methodology	**Ramboll Environ Assessment**
	It is noted that the water quality meter appears to have been damaged in the December 2015 GME and elevated pH levels in wells W1D, W4D, W5D, N2 and G2 in December 2015 are considered unreliable.
Sampling Logs	Field parameter sheets for the 2015 GMEs are included in Appendix 5.

Table B: QA / QC – Field and Lab Quality Assurance and Quality Control

Field and Lab QA / QC	Ramboll Environ Comments
Field quality control samples	In general, intra-laboratory duplicate groundwater samples were analysed at a rate of 10% and inter-laboratory duplicate groundwater samples were analysed at a rate of 5% during the five GMEs. No rinsate blank samples were collected. A summary of the field quality control samples collected during each GME is outlined below.

GME	Intra-lab Dups	Inter-lab Dups	Rinsate Blanks
Feb 2015	G2/QA1, E11/QA3	G2/QA2	QB1
June 2015	PUMP/QA100, W7M/QA101	W7M/QA200	QA300
Sept 2015	PUMP/QA100, W7M/QA101,	W7M/QA200	QA300
Dec 2015	W2D/QA101	W2D/QA201	QA301

Field quality control results	Intra- and inter-laboratory duplicate results for each GME are presented in Table C. February 2015: Relative Percent Differences (RPDs) for fluoride total cyanide and free cyanide and aluminium were less than 50%, aside from total cyanide in one intra-laboratory duplicate pair and aluminium in the inter-laboratory duplicate pair. Both RPD results marginally exceeded 50%. June 2015: Relative Percent Differences (RPDs) for fluoride, total cyanide, free cyanide and aluminium were less than 50%, aside from aluminium in the intra- and inter-laboratory duplicate pairs. Both duplicate results were similar at 3.4mg/L, indicating that the primary result may be incorrect and should be considered approximate only. September 2015: Relative Percent Differences (RPDs) for the primary and intra-laboratory duplicate pair of W7M/QA101 exceeded 50%. RPDs for the inter-laboratory duplicate pair were less than 50% aside from aluminium. Aluminium RPDs for all primary/ duplicate pairs exceeded 50%. The high RPDs are likely due to sediment within the samples and the aluminium results for this sampling round should be considered approximate.

Table B: QA/QC – Field and Lab Quality Assurance and Quality Control	
Field and Lab QA/QC	**Ramboll Environ Comments**
	December 2015: Relative Percent Differences (RPDs) for fluoride, total cyanide, free cyanide and aluminium are less than 50%. Rinsate blank results were all less than the limits of reporting for all 2015 sampling rounds.
NATA registered laboratory and NATA endorsed methods	Envirolab was used as the primary laboratory and ALS was used as the secondary laboratory. The laboratory certificates are NATA stamped.
Analytical methods	Summary analytical methods were included in the laboratory test certificates.
Holding times	Review of the COCs and laboratory certificates indicate that holding times were met.
Practical Quantitation Limits (PQLs)	PQLs for all groundwater analytes were below the site assessment criteria, except for free cyanide in the July 2015 and September 2015 GMEs. Envirolab indicates that the PQL was raised for free cyanide due to the high dilution required for total cyanide results to be reportable within the calibration range.
Laboratory quality control samples	Laboratory quality control samples including duplicates, laboratory control samples, matrix spikes, surrogate spikes and blanks were undertaken by the laboratories at appropriate frequencies.
Laboratory quality control results	The results for laboratory soil duplicates, laboratory control samples, matrix spikes and surrogates were acceptable and no detections were made in blank samples.

Table C: QA/QC – Duplicate Analysis Results February 2015

	G2	QA1	RPD %	G2	QA2	RPD %	E11	QA3	RPD %
Fluoride	0.28	0.28	0.0	0.28	0.4	35.3	230	240	4.3
Cyanide	<0.004	<0.004	0.0	<0.004	<0.004	0.0	7.7	13	**51.2**
Free Cyanide	<0.004	<0.004	0.0	<0.004	<0.004	0.0	0.005	0.005	0.0
Aluminium	2.9	2.8	3.5	2.9	1.62	**56.6**	5	5.2	3.9

Table C: QA/QC – Duplicate Analysis Results June 2015

	PUMP	QA100	RPD %	W7M	QA101	RPD %	W7M	QC200	RPD %

Fluoride	200	210	4.88	810	850	4.82	810	895	10
Cyanide	8.7	9.3	6.67	170	180	5.71	170	107	46
Free Cyanide	<0.08	<0.08	0.0	<2	<4	0.0	<2	<0.04	0.0
Aluminium	120	120	0.0	32	3.4	**162**	32	3.4	**162**

Table C: QA/QC – Duplicate Analysis Results September 2015

	PUMP	**QA100**	**RPD %**	**W7M**	**QA101**	**RPD %**	**W7M**	**QA200**	**RPD %**
Fluoride	680	670	1.5	660	13	**192**	660	648	1.8
Cyanide	110	100	9.5	100	1.9	**193**	100	56.9	**55**
Free Cyanide	0.029	0.027	7.2	<0.04	<0.004	0.0	<0.04	<0.004	0.0
Aluminium	610	6200	**164**	8700	2100	**122**	8700	2270	**117**

Table C: QA/QC – Duplicate Analysis Results December 2015

	W2D	**QA101**	**RPD %**	**W2D**	**QA201**	**RPD %**			
Fluoride	1300	1200	8	1300	1300	0.0			
Cyanide	290	300	3.5	290	290	0.0			
Free Cyanide	0.88	0.67	27	0.88	0.7	23			
Aluminium	3.5	3	15	3.5	2.8	22			

An assessment was made of data completeness, comparability, representativeness, precision and accuracy based on field and laboratory considerations, as outlined in NSW DEC (2006) and NSW EPA (2007) guidelines. This assessment for the 2015 GMEs is outlined is made in Table D.

Table D: QA/QC – Assessment of DQIs

DQI	Ramboll Environ Comments
Completeness	Completeness is a measure of whether all the data necessary to meet the project objectives was collected. As noted in Table A above, sampling locations were developed following staged fieldwork to delineate the leachate plume. Twenty-five groundwater wells on five sections along the length of the leachate plume were selected to provide data for monitoring of the leachate plume. One well, W3SA, was destroyed during the April 2015 storm and has not been

Table D: QA/QC – Assessment of DQIs	
DQI	**Ramboll Environ Comments**
	replaced. As this well was dry for four of the five previous sampling events, the loss of this well is not considered to affect the completeness of the data. Ramboll Environ considers the 2015 GMEs to be complete.
Comparability	Comparability is a measure of confidence that the data may be considered to be equivalent for each sampling and analysis event. The field investigations were completed by experienced personnel from Ramboll Environ using standard operating procedures. The four GMEs in 2015 were completed by Mark Tiedeman under the supervision of Kirsty Greenfield. The laboratory analysis was undertaken by NATA registered laboratories using accredited analytical methods. Envirolab Services was the primary laboratory and ALS was the secondary laboratory for the four 2015 GMEs. Ramboll Environ considers the groundwater data collected during the four 2015 GMEs to be comparable. This data is also comparable to data from the 2013/2014 GMEs.
Representativeness	Representativeness is the confidence that the data is representative of each media present at the site. In the field, representativeness is achieved by completing an adequate number of sampling points to characterise and monitor the leachate plume. As outlined in Table A, twenty-five wells were selected on five sections along the length of the leachate plume. Both the shallow (leachate plume) and deep aquifer were sampled. 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 deep aquifer.
Precision	Precision is a measure of the reproducibility of the data. In the field, Ramboll Environ achieved precision by using standard operating procedures for the collection of groundwater samples and by collecting duplicate and triplicate samples for analysis. As outlined in Table C, RPD results for duplicate samples were acceptable aside from aluminium results in the September 2015 GME, which should be considered approximate only. At the laboratory, precision is assessed using blind replicate samples and split samples. As outlined in Table B, all results for laboratory groundwater duplicates were acceptable and no detections were made in blank samples.
Accuracy	Accuracy is a measure of the closeness of a measurement to the true parameter value. In the field, Ramboll Environ achieved accuracy by using standard operating procedures for the collection of groundwater samples. It is noted that the water quality meter appears to have been damaged in the December 2015 GME and elevated pH levels in wells W1D, W4D, W5D, N2 and G2 in December 2015 are considered unreliable.

Table D: QA/QC – Assessment of DQIs	
DQI	**Ramboll Environ Comments**
	At the laboratory, accuracy is assessed using blind replicate samples and split samples. As outlined in Table B, all results for laboratory control samples, matrix spikes and surrogates were acceptable and no detections were made in blank samples.

APPENDIX 3
SUMMARY OF LABORATORY RESULTS FOR 2015 GMES

Shallow

Well ID	Soluble Fluoride								
95% Fresh[A]	-								
Irrigation	1								
Stock	2								
	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1S	53	69	42	-	-	66	120	38	-
W2S	115	58	-	-	-	-	-	-	-
W2D*	682	790	880	930	1080	1279	1300	1300	1300
E5	495	410	450	-	-	-	410	350	-
PUMP	79	51	280	550	930	740	200	680	360
W7S	34	31	-	-	-	-	-	-	-
W7M	878	650	730	-	910	840	810	670	540
E4	699	650	650	590	380	340	260	280	300
A7	436	420	410	380	410	550	500	400	320
W3S	237	310	210	270	210	250	230	200	160
W3SA	-	300	-	-	-	-	-	-	-
W4S	-	480	-	-	-	-	490	400	96
E11	102	160	190	160	150	230	7.4	110	-
W5S	35	61	-	100	-	93	88	70	0.4
N8	0.27	0.17	0.26	0.27	0.29	0.35	0.9	0.3	9
N9	85	200	-	170	210	210	24	25	-
W6S	195	-	-	-	-	200	180	-	180

Well ID	Total Cyanide								
95% Fresh[A]	0.007**								
	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1S	1.7	0.98	0.87	-	-	15	1.1	-	-
W2S	0.41	0.49	-	-	-	-	-	-	-
W2D*	170	160	170	240	260	200	270	290	290
E5	42	43	43	-	-	-	69	-	-
PUMP	17.1	0.76	6.2	-	120	58	9.3	110	48
W7S	0.096	0.45	-	37	-	-	-	-	-
W7M	63	78	86	-	200	130	180	100	83
E4	130	140	130	160	65	41	25	99	35
A7	96	88	90	89	110	78	100	66	62
W3S	34	38	36	53	41	25	24	28	19
W3SA	-	16	-	-	-	-	-	-	-
W4S	-	41	-	-	-	-	330	34	7.4
E11	17	17	21	32	17	7.7	0.49	9.4	-
W5S	1.7	1.7	-	2	-	9.3	2.3	3	0.63
N8	4	0.34	0.44	0.54	0.53	6.6	0.69	0.6	1.2
N9	4.5	12	-	13	21	13	1.2	0.95	-
W6S	19	-	-	-	-	12	14	-	19

Well ID	pH								
95% Fresh[A]	6.5-8								
	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1S	7.22	7.17	6.84	6.9	-	6.66	6.83	6.86	-
W2S	7.33	6.82	-	-	-	-	-	-	-
W2D*	10.09	9.9	10.13	10.1	9.94	9.99	10.11	10.27	10.34
E5	9.54	9.37	9.78	-	-	-	9.14	9.42	-
PUMP	7.45	7.24	9.65	10.14	10.01	9.95	9.87	10.22	10.27
W7S	7.29	7.1	-	-	-	-	-	-	-
W7M	9.81	9.87	10.1	10.12	9.78	9.44	9.82	9.91	9.7
E4	9.91	9.79	9.94	9.84	9.4	8.84	9.46	9.62	10.57
A7	9.63	9.47	9.67	9.66	9.24	8.56	9.45	9.8	10.71
W3S	8.53	8.82	7.61	8.89	7.68	6.38	7.53	7.53	-
W3SA	-	8.99	-	-	-	-	-	-	-
W4S	-	9.13	-	-	-	-	9.13	9.07	-
E11	9.36	9.36	9.33	9.41	9.32	8.86	7.97	9.23	8.65
W5S	7.37	7.37	-	7.39	-	6.55	7.26	7.2	-
N8	6.36	6.38	6.48	6.53	6.39	6.11	6.49	6.69	6.74
N9	9.16	8.9	-	9.17	8.91	8.46	7.22	7.34	7.7
W6S	8.87	-	-	8.79	-	7.27	8.72	8.98	8.67

Well ID	Total Aluminium								
95% Fresh[A]	0.055								
Irrigation	5								
Stock	5								
	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1S	121	130	27	-	-	120	1200	-	-
W2S	91.5	33	-	-	-	-	-	-	-
W2D*	2.86	0.6	0.67	1.4	44	0.03	0.19	0.03	3.5
E5	0.33	0.52	2.5	-	-	-	3	-	-
PUMP	58.1	60	17	-	310	370	120	610	97
W7S	415	42	-	210	-	-	-	-	-
W7M	11.4	2.3	45	-	21	0.99	32	8.7	7.8
E4	0.379	0.89	0.4	3.2	35	46	49	53	-
A7	0.208	4.7	0.7	0.26	0.71	1.7	2.7	0.61	0.72
W3S	11.7	2.6	7.1	9.2	5.3	34	4.4	24	92
W3SA	-	4.3	-	-	-	-	-	-	-
W4S	-	3.6	-	-	-	2.3	13	-	
E11	23	23	4	7.8	3.6	5	2.5	11	2.7
W5S	13	13	-	15	-	22	7	31	-
N8	0.102	12	0.11	0.3	91	1.8	29	5.3	3.4
N9	14.7	62	-	9	130	8	14	22	0.89
W6S	60.1	-	-	-	-	3.5	7.7	-	22

Deep

Well ID	Soluble Fluoride								
95% Fresh[A]	-								
Irrigation	1								
Stock	2								
	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1D	39	5.4	3.5	5.1	3.3	-	4.4	3.5	2.6
E5D	1.21	40	44	23	12	18	16	14	16
W3D	1.23	-	-	0.19	0.41	0.22	0.3	0.3	-
W4D	1.48	1.7	1.3	0.41	1.6	1.1	-	0.2	-
W5D	20	0.51	0.59	0.65	0.53	0.44	-	0.4	0.5
N2	0.43	6.2	1.9	1.4	0.74	0.49	8.1	1.4	1.4
G2	0.28	0.28	0.25	0.28	0.28	0.28	0.3	0.3	0.3
W6D	1.19	0.25	0.21	0.4	0.19	0.3	0.1	0.1	-

Well ID	Total Cyanide								
95% Fresh[A]	0.007**								
	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1D	1.3	0.67	0.54	0.57	1.3	1.3	0.77	0.77	0.71
E5D	4.4	14	17	8.8	4.4	6.8	2.9	1.2	3
W3D	0.038	-	-	0.005	<0.04	0.08	0.013	0.008	-
W4D	0.16	0.13	0.011	<0.004	<0.04	0.007	-	-	-
W5D	0.025	0.039	0.069	0.016	<0.04	0.005	-	0.005	0.008
N2	<0.004	0.077	0.005	0.004	<0.04	0.009	0.021	0.05	0.032
G2	<0.004	0.028	<0.004	<0.004	<0.04	<0.004	<0.004	<0.004	<0.004
W6D	0.013	0.016	0.01	0.017	<0.04	0.008	<0.004	<0.004	-2.6

Well ID	pH								
95% Fresh[A]	6.5-8								
	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1D	6.98	6.62	6.7	6.71	6.63	-	6.82	6.79	8.48
E5D	7.22	7.29	7.53	7.44	8.32	6.8	7.23	7.23	7.18
W3D	5.91	-	-	4.38	3.56	3.29	4.89	3.62	
W4D	6.02	5.7	5.7	5.4	5.36	4.69	-	5.18	9.9
W5D	6.02	6.32	6.1	6.11	6.11	5.34	-	6.32	8.37
N2	3.26	6.54	4.01	3.94	3.54	3.34	6.61	5.81	8.09
G2	6.04	6.09	6.09	6.1	6.03	5.7	6.01	6.04	7.87
W6D	6.49	6.11	5.75	5.83	5.54	8.22	5.84	5.81	5.5

Well ID	Total Aluminium								
95% Fresh[A]	0.055								
Irrigation	5								
Stock	5								
	Jul-13	Nov-13	Feb-14	Jul-14	Nov-14	Feb-15	Jun-15	Sep-15	Dec-15
W1D	21.2	0.9	2.4	2.4	0.26	0.26	4	0.95	0.4
E5D	1.697	1.5	110	2.2	3.3	3.4	2.1	2.1	4.3
W3D	0.7	-	-	0.58	0.72	0.76	0.81	0.04	
W4D	0.794	0.48	0.19	0.27	0.5	0.35	-		
W5D	0.323	0.04	0.02	0.02	0.05	0.16	-	0.99	0.54
N2	5.771	3	4.6	4.5	6.7	28	3.4	2.4	9.1
G2	0.115	0.1	0.04	1.2	2.1	2.9	2	4.1	1.8
W6D	1.087	0.06	0.04	1.2	0.5	0.12	0.19	0.74	

All results in mg/L, with the exception of pH
A ANZECC 2000 95% Protection Level for Receiving Water Type
Guidelines in italics are low level reliability guidelines
**Criteria for Free Cyanide
Results shaded grey are in excess of the primary acceptance criteria

APPENDIX 4
GROUNDWATER FIELD PARAMETERS

ENVIRON

Daily Field Log

Project No AS80420	**Report No**
Project Name GW monitoring	**Date** 17/2/15
Location Hydro	**Weather** Sunny.

Contractors	**Visitors**
	Glen

Equipment on Site

Vehicle
pump
water quality meter.

Activities and Observations

6-7 - drive to site
7-7.30 - sign in & undertake inductions
7.30-2.45 - groundwater sampling
2.45-3.30 - drive home.

Signed _____ Date 17/2/15

ENVIRON

Daily Field Log

Project No AS130420	**Report No**
Project Name GW Monitoring	**Date** 18/2/15
Location Hydro	**Weather** Sunny

Contractors	**Visitors**
	Glen. W

Equipment on Site

Vehicle
pump
water quality meter

Activities and Observations

6-7 - drive to site.
7-7:15 - safety field check.
7:15-12 - groundwater sampling
12-1 - drive to office

Page 1 of __ Signed _____ Date 18/2/15

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** W3D
Location: Hydro	**Sampler(s):** NG.

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	5.79	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	7.00	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
13:47	32.6	11.40 S	3.96	5.67	43mV	136 ppm	clear no odour
13:48	29.1	15.09 mS	3.55	1.77	62mV	905 ppm	"
13:49	26.8	15.05 mS	3.40	1.27	86mV	1283 ppm	"
13:49	25.1	2.04 mS	3.37	1.06	101mV	1.24 ppk	"
13:50	23.6	2.08 mS	3.29	0.88	124mV	1.27 ppk	"

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:

Sample Appearance:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** MW7
Location: Hydro	**Sampler(s):** NG.

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	3.40m	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	3.73m	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
8:35	22.6	371uS	9.39	5.02	-185mV	100.7ppm	brown/copper strong odour
8:37	22.8	224uS	9.48	2.70	-248mV	39.1ppm	"
8:38	12.7	487uS	9.44	3.76	-267mV	9.04ppt	"

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:

Sample Appearance:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 7/2/15
Project: Groundwater Plume Delineation	**Well Number:** ~~W20~~ W20
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	3.57m	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	6.32m	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
8:01	20.8	24.2mS	10.04	9.27	-449mV	52.8	brown / ~~black~~ copper
8:05	21.5	39.1mS	9.99	0.21	-485mV	16.7ppk	rotten egg odour.
8:08	21.5	39.1mS	9.99	0.18	-403mV	27.1ppk	copper/brown strong odour.

Well Sampling

Sampling Method:

Material:

Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/13
Project: Groundwater Plume Delineation	**Well Number:** DGMP
Location: Hydro	**Sampler(s):** NG.

Field Measurements

Organic vapours in well:	3.04m ppm	Measurement device:	
Depth to Groundwater:	~~0.32m~~ m	Measurement Device:	
Correction:	m		
Groundwater Elevation :	m		
Depth to Immiscible Layer:	m	Measurement Device:	
Thickness to Immiscible Layer:	m		
Well Depth: 3.52m	m	Source:	
Thickness to Groundwater Column:	m		

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
948	26.6	10.6mS	9.88	0.92	-422mV	10.24g	light brown no odour
9.49	26.4	17.15mS	9.93	0.27	-448mV	9.04g	" "
9.50	26.2	22.6mS	9.95	0.20	-451mV	15.61g	" "

Well Sampling

Sampling Method:

Material:

Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** ES1
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:	ppm	Measurement device:	
Depth to Groundwater: Bottom 2.57	m	Measurement Device:	
Correction:	m		
Groundwater Elevation :	m		
Depth to Immiscible Layer:	m	Measurement Device:	
Thickness to Immiscible Layer:	m		
Well Depth: 5.44m	m	Source:	
Thickness to Groundwater Column:	m		

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
8:54	22.3	13.1mS	6.75	0.92	-98mV	6.73ppk	light brown / copper no odour
8:56	22.4	10.22mS	6.78	0.51	-125mV	6.54ppk	" " "
8:57	22.5	11.26mS	6.79	0.41	-129mV	-129mV	" " "
8:58	22.6	10.41mS	6.80	0.33	-129mV	6.77ppk	" " "

Well Sampling

Sampling Method:

Material:

Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** WSD
Location: Hydro	**Sampler(s):** VG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	5.26	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	6.03	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
12:52	31.0	2.84mS	5.27	5.75	88mV	15.3ppm	clear no odour
12:53	27.5	2.91mS	5.34	1.84	91mV	2.37ppk	" "
12:54	25.2	4.48mS	5.34	1.43	92mV	2.79ppk	" "

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:

Sample Appearance:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** WS5
Location: Hydro	**Sampler(s):** NG.

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	1.50m	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	1.70m	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
13:03	27.4	38.6 uS	6.46	3.29	140mV	1361 ppm	brown/orange no odour
13:04	26.5	2298 uS	6.53	2.72	161mV	1374 ppm	" "
13:05	25.8	2.85 mS	6.55	2.54	174mV	1.78 ppk	" "

Well Sampling

Sampling Method:

Material:

Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 7/2/15
Project: Groundwater Plume Delineation	**Well Number:** WGS
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	3.00	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	3.12m	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
10:19	28.3	38.9	7.20	4.64	170mV	3.67	orange no odour
10:20	26.9	5.91mS	7.25	3.04	189mV	3.74	orange no odour
10:21	26.8	5.92mS	7.27	3.14	194mV	3.76	L orange no odour

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:

Sample Appearance:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 7/2/15
Project: Groundwater Plume Delineation	**Well Number:** W6D
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	5.20	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	5.91m	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
~~10:31~~	~~26.8~~		~~4.22~~	~~2.12~~			
10:32	24.3	730.0S	8.96	1.21	82mV	424.ppm	clear no odour
10:34	22.4	1139.uS	6.57	1.39	74mV	674ppm	" "
10:35	22.2	~~6741139uS~~	7.00	1.46	79mV	674ppm	" "
10:36	21.9	1140uS	8.22	1.47	77mV	599ppm	" "

Well Sampling

Sampling Method:

Material:

Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other: pH would not stabilise ranging from pH 4 - pH 10. the majority @ 7 - 8 pH.

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/14
Project: Groundwater Plume Delineation	**Well Number:** G2
Location: Hydro	**Sampler(s):** NG.

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	7.86	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	13.55m.	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
11:38	25.8	3.12mS	5.55	1.75	-39mV	1.92ppk	light brown no odour
11:39	24.2	4.67mS	5.60	1.40	-35mV	2.73ppk	" "
11:40	23.6	4.66mS	5.70	1.20	-32mV	2.92ppk	" "

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:

Sample Appearance:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered: Triplicate. QA1 & QA2.

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** NB
Location: Hydro	**Sampler(s):** NC

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	3.50	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	4.17m.	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
11:16	27.6	4.92mS	6.17	1.05	-174mV	3.13ppt	light brown turbid no odour
11:17	26.4	4.93mS	6.10	0.68	-177mV	5.05ppt	" " "
11:18	25.1	7.93mS	6.07	0.54	-181	5.07ppt	" " "
11:18	24.7	7.72mS	6.07	0.45	-183mV	5.05ppt	" " "
11:21	23.8	5.31mS	6.11	0.32	-182mV	3.35ppt	" " "

Well Sampling

Sampling Method:			
Material:			
Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** 19
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	2.53	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	3.18m.	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
10:52	26.7	6.12mS	8.49	2.64	-295mV	3.26ppk	brown/orange rotten egg odour
10:53	24.9	6.40mS	8.47	1.61	-285mV	6.46ppk	brown/orange, sulphur odour
10:54	24.0	10.31mS	8.46	1.34	-282mV	6.65ppk	brown/ orange sulphur odour

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:

Sample Appearance:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** E11
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	3.30	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	5.04	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
1202	26.0	7.39mS	8.91	0.63	-303mV	4.71ppk	~~brown~~ / ~~orange~~
12.03	24.3	8.20mS	8.92	0.39	-308mV	7.56ppk	"
12.04	23.5	11.26mS	8.86	0.34	-309mV	7.51ppk	"

5-light sulphur odour

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:

Sample Appearance:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered — Duplicate QAS.

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** N2
Location: Hydro	**Sampler(s):** NG.

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	2.93 m	m	Measurement Device:
Correction:	+0.06m.	m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	4.62m	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
12.26	24.5	3.84mS	3.30	1.99	118mV	2.44ppk	light brown no odour
12.27	23.3	6.00mS	3.33	1.53	126mV	3.23ppk	" "
12.28	22.3	5.90mS	3.34	1.33	137mV	3.77ppk	" "

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:

Sample Appearance:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other: top casing broken off well. Removed and sampled from base. measured from +0.0cm.

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** A7
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	2.30	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	4.30 m	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
13:32	29.9	14.65mS	8.62	1.41	-325mV	5.94ppK	dark orange/brown no odour
13:33	27.0	14.86mS	8.58	0.39	-337mV	9.96ppK	" "
13:34	25.8	15.20mS	8.56	0.28	-345mV	7.95ppK	" "

Well Sampling

Sampling Method:			
Material:			
Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15.
Project: Groundwater Plume Delineation	**Well Number:** W35
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	1.45	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	2.53	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
13.56	24.6	9.88mS	6.31	0.92	-181mV	4.01ppk	brown/orange no odour
13.57	24.3	10.01mS	6.36	0.64	-186mV	6.56ppk	" "
13.58	24.1	10.18mS	6.38	0.54	-188mV	6.61ppk	" "

Well Sampling

Sampling Method:			
Material:			
Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 18/2/15
Project: Groundwater Plume Delineation	**Well Number:** W15
Location: Hydro	**Sampler(s):** NG.

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	1.96	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	2.40m.	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
7.51	21.2	0.605	6.60	3.41	-9mV	1.8ppm	light brown no odour
7.52	21.4	3.74mS	6.63	2.54	-18mV	2.35ppk	" "
7.53	21.5	3.74mS	6.66	2.60	-24mV	2.32ppk	" "

Well Sampling

Sampling Method:

Material:

Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 18/2/15
Project: Groundwater Plume Delineation	**Well Number:** E4
Location: Hydro	**Sampler(s):** NG.

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	2.50	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	3.40	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
8:10	20.5	6.29mS	8.68	2.87	-358mV	23.3ppk	brown / orange no odour
8:11	20.3	6.24mS	8.86	1.39	-368mV	3.99ppk	" "
8:12	20.3	10.06mS	8.82	0.86	-372mV	6.51ppk	" "
8:12	20.2	10.10mS	8.84	0.55	-382mV	6.61ppk	" "

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:

Sample Appearance:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 18/2/15
Project: Groundwater Plume Delineation	**Well Number:** W40
Location: Hydro	**Sampler(s):** NG.

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	4.9	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	>8m.	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
8:54	23.2	129.40 S	4.62	3.28	34mV	31.7ppm	clear no odour
8:55	22.4	4.28mS	4.73	1.52	53mV	2.64ppk	" "
8:56	21.9	6.24mS	4.78	1.35	54mV	4.04ppk	" "
8:56	21.7	6.15mS	4.69	1.16	55mV	3.71ppk	" "

Well Sampling

Sampling Method:

Material:

Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 18/2/15
Project: Groundwater Plume Delineation	**Well Number:** W1D
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	DRY	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	10.36	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:

Sample Appearance:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** W25
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	DRY	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	2.45m	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:

Sample Appearance:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** W75
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	DRY.	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	2.36m	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:	
Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)

Well Sampling

Sampling Method:			
Material:			
Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 17/2/15
Project: Groundwater Plume Delineation	**Well Number:** ES
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	DRY.	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	2.57m	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)

Well Sampling

Sampling Method:

Material:

Start Sampling:	Finish Sampling:
Sample Appearance:	

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 18/2/15
Project: Groundwater Plume Delineation	**Well Number:** W45
Location: Hydro	**Sampler(s):** NG.

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	DRY	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	1.12	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:	
Volume in Casing: N/A. L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)

Well Sampling

Sampling Method:			
Material:			
Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 18/2/15
Project: Groundwater Plume Delineation	**Well Number:** W359
Location: Hydro	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	1.13	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	1.15	m	Source:
Thickness to Groundwater Column:		m	

Well Purging

Purge Method:

Volume in Casing: N/A L	Purge Volume: L
Start Purge:	End Purge:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)

Well Sampling

Sampling Method:			
Material:			
Start Sampling:		Finish Sampling:	
Sample Appearance:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Pre-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

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RENTALS

Equipment Report – Geo Pump 2 PERISTALTIC PUMP

This pump has been cleaned and checked:

☑ Clean and check all components	Ops check ✓

Date: 13/02/2015 Checked by: SERGIO R.

Signed: Sergio R.

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☑	☐	☐	Peristaltic Model (GP2) Pump, Alligator clips
☑	☐	☐	Instruction Sheet
☑	☐	☐	3/8" Medical Grade Silicone Tubing (pump head) 40cm
☑	☐	☐	2 metal Hose Clips
☑	☐	☐	Transport Case
☑	☐	☐	2 Batterys
☑	☐	☐	chargen
☐	☐	☐	
Processors Signature/ Initials			SH

Quote Reference	CS002138	Condition on return
Customer Ref		
Equipment ID	GP2SD	
Equipment serial no.		
Return Date	/ /	
Return Time		

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

NOWRA 4/15 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com

PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

SYDNEY 277-279 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT:	ENVIRON	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☑ Standard TAT (List due date):
OFFICE:	HUNTER		☐ Non Standard or urgent TAT (List due date):
PROJECT:	AS130420 PROJECT NO.:	ALS QUOTE NO.:	
ORDER NUMBER:	PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	
PROJECT MANAGER:	K. Greenfield	CONTACT PH:	
SAMPLER:	N. Gilbert	SAMPLER MOBILE:	
COC Emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to (will default to PM if no other addresses are listed):	ngilbert@environcorp.com		
Email Invoice to (will default to PM if no other addresses are listed):	KGreenfield@environcorp.com		

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:		°C 19.2	
Other comment:			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
N Gilbert	Marli Spencer		
DATE/TIME: 18/2/15 10:25am	DATE/TIME: 18/02/15 10:28AM	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED Including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Soluble fluoride	Total cyanide	Free cyanide	Total Aluminium					Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	QA2	17/2/15	W		1	X	X	X	X					
	QA3		W											
	QA2		W											

Environmental Division
Sydney
Work Order
ES1503709

Telephone : +61-2-8784 8555

TOTAL

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

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RENTALS

Equipment Certification Report – TPS 90FLMV Water Quality Meter

This Water Quality Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Span 1	Span 2	Traceability Lot #	Pass?
pH	7.00H / pH 4.00	7,00 pH	4,00 pH	1	☑
Conductivity	12.88mS/cm	0,00 mS/cm	12,88 mS/cm		☑
TDS	36 ppk	0,0 ppk	36,0 ppk		☑
Dissolved Oxygen	Sodium Sulphite / Air	0,00 ppm in Sodium Sulphite	8,64 ppm Saturation in Air		☑

Check only

Redox (ORP) *	Electrode operability test	~~240mV~~ 236mV +/- 10%	240 mV		☑

* This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading.

☑ Battery Status 7,62 (min 7.2V)
☑ Electrical Safety Tag attached (AS/NZS 3760)

☑ Temperature 22,3 °C
☑ Electrodes Cleaned and checked

Tag No: TFNK072

Valid to: 05/03/2015

Date: 13/02/2015

Signed: Sujo N.

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	90FLMV Unit. Ops check/Battery status: 8,11
☑	☐	pH sensor with wetting cap, 5m
☑	☐	Conductivity/TDS/Temperature K=10 sensor, 5m
☑	☐	Dissolved oxygen YSI5739 sensor with wetting cap, 5m
☑	☐	Redox (ORP) sensor with wetting cap, 5m
☑	☐	Power supply 240V to 12V DC 200mA
☑	☐	Instruction Manual
☑	☐	Quick Guide
☑	☐	Syringe with storage solution for pH and ORP sensors
☑	☐	Carry Case
☐	☐	Check to confirm electrical safety (tag must be valid)

Date: 13/02/2015

Signed: Sujo N.

TFS Reference	CS002132	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	90FLMV sn	Condition on return:	
Equipment Serial No.	T5120		

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W7S

Field Measurements

Depth to water: (from top of casing) 2.36	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 2.36	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC	LITRES REMOVED	Colour
		DRY				

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:** W7M
Location: Hydro Kurri Kurri	**Location:** W7M

Field Measurements

Depth to water: (from top of casing) 2.38	Measurement device: iP
Stickup:	Measurement Device:
Well Depth (from TOC): 3.73	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 08:55	End Purge: 09:15

pH	TEMP (°C)	D.O.	REDOX mV	EC µS	LITRES REMOVED	Colour
9.71	16.7	10.95	-100	64.2	2	'Tea tree brown'
9.78	16.7	10.93	-232	64.5	4	" "
9.82	16.9	10.83	-238	66.1	6	
						TDS 33.5 ppM

Sampling

Sampling Method: Low-flow peristaltic pump

Type: Groundwater

Start Sampling: 09:20	Finish Sampling: 09:20

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / (N) Ease of filtering?

Weather Condition: Cold

Duplicate Taken? (Y) / N Duplicate Number: QA101

Triplicate Taken? (Y) / N Triplicate Number: QA220

QA/QC Taken? (Y) / N QA/QC Number: ~~QA101~~ ~~QA200~~

Dup Trip

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:** N2
Location: Hydro Kurri Kurri	**Location:** N2.

Field Measurements

Depth to water: (from top of casing) 3.77	Measurement device: IP.
Stickup:	Measurement Device:
Well Depth (from TOC): 5.66	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 13:30	End Purge: 13:45.

pH	TEMP (°C)	D.O.	REDOX	EC µS	LITRES REMOVED	Colour
6.49	17.5	0.60	-139	1601	2	Tinted brown/black.
6.58	17.8	0.44	-153	1377	4	" "
6.61	18.0	0.41	-156	1304	6	" "
						TDS 740 ppm

Sampling

Sampling Method: Low-flow peristaltic pump.

Type: Groundwater

Start Sampling: 13:40	Finish Sampling: 14:20

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition: Clear Sunny.

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** ~~WZD~~ WSD

Field Measurements

Depth to water: (from top of casing) 5.12	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 6.15	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC mS	LITRES REMOVED	Colour
6.14	17.8	2.64	109	4.03	2	
	Pumped DRY – No Sample collected.					

Sampling

Sampling Method:			
Type: Groundwater			
Start Sampling:		Finish Sampling:	
Sample Appearance, eg colour, sediment:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Field Filtered ? Y / N Ease of filtering?
Weather Condition:
Duplicate Taken? Y / N Duplicate Number:
Triplicate Taken? Y / N Triplicate Number:
QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** ~~W2S~~ W5S

Field Measurements

Depth to water: (from top of casing) 1.17	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 1.70	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC mS	LITRES REMOVED	Colour
7.25	15.1	1.42	-105	4.32	1.5	"Tea-tree brown"
7.25	14.9	1.62	-104	3.96	2.0	
7.26	14.3	1.70	-98	3.86	2.5	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/14
Project: Plume Delineation	**Sample Number:** 3
Location: Hydro Kurri Kurri	**Location:** E4

Field Measurements	
Depth to water: (from top of casing) 1.74	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 3.40	

Well Purging						
Purge Method:						
Volume in Casing: L				Purge Volume: L		
Start Purge:				End Purge:		
pH	TEMP (°C)	D.O.	REDOX	EC mS	LITRES REMOVED	Colour
9.49	17.3	0.74	-255	10.59	2	Tea tree brown.
9.50	17.4	0.60	-257	10.04	4	
9.46	17.5	0.43	-243	9.73	6	

Sampling			
Sampling Method:			
Type: Groundwater			
Start Sampling:		Finish Sampling:	
Sample Appearance, eg colour, sediment:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments
Well Head Integrity:
Field Filtered ? Y / N Ease of filtering?
Weather Condition:
Duplicate Taken? Y / N Duplicate Number:
Triplicate Taken? Y / N Triplicate Number:
QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** E5

Field Measurements

Depth to water: (from top of casing) 2.20	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 2.58	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 09:30	End Purge: 09:46

pH	TEMP (°C)	D.O.	REDOX	EC µS	LITRES REMOVED	Colour
9.11	14.8	6.80	285	42.8	1	'Tea tree brown'
9.13	16.3	6.22	287	38.4	2	" "
9.14	16.5	6.12	278	37.2	3	" "

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** ESD.

Field Measurements

Depth to water: (from top of casing) 2.61	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 5.44	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 09.55	End Purge:

pH	TEMP (°C)	D.O. ppm	REDOX mV	EC mS	LITRES REMOVED	Colour
7.07	17.8	1.24	-94	166.5	2	Light brown turbid
7.14	18.8	0.99	-86	62.9	4	TDS 96.6 ppm.
7.22	18.9	0.81	-66	46.4	5	Tea tree brown.
7.23	19.0	0.73	-60	42.7	6	TDS 20.7 ppm.

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W6D

Field Measurements

Depth to water: (from top of casing) 4.99	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 5.91	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX ~V	EC µS	LITRES REMOVED	Colour
5.72	17.7	2.07	87	10.7	2	Clear.
5.92	17.0	9.64	49	7.7	4	TDS 3.3 ppm.
5.84	17.1	9.62	51	7.8	6	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W65.

Field Measurements

Depth to water: (from top of casing) 2.57	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 3.09	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC µS	LITRES REMOVED	Colour
[redacted] 8.69	16.5	3[redacted].64	244	23.1	2	Tea tree b.wun.
8.67	16.7	2[redacted].25	284	28.1	4	light b.wun/turbid
8.72	16.8	3.21.	290	28.3	6	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** N9

Field Measurements

Depth to water: (from top of casing) 1.84	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 3.16	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 11:10	End Purge: 11:20

pH	TEMP (°C)	D.O.	REDOX mV	EC mS	LITRES REMOVED	Colour
~~7.26~~ 7.26	15.6	0.97	-258	675.	2	Turbid - grey
7.22	15.6	0.60	-263	679	3	TDS 374 ppm
7.22	15.7	0.65	-255	677	4	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** N8

Field Measurements

Depth to water: (from top of casing) 2.80	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 4.57	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC mS	LITRES REMOVED	Colour
6.35	17.6	0.68	≈107	52.4	2	'Tea tree brown'
6.43	17.6	0.51	-121	71.7	4	" "
6.46	17.7	0.38	-134	63.1	5	" "
6.49	17.6	0.40	-143	56.4	6	" "

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** GW G2

Field Measurements

Depth to water: (from top of casing) 7.72	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 13.40	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC mS	LITRES REMOVED	Colour
6.23	17.8	0.62	-100	6.24	2	Clear - slightly cloudy
6.01	17.7	0.53	-95	6.25	4	" "
6.01	17.7	0.53	-97	6.25	6	" "

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** E11

Field Measurements

Depth to water: (from top of casing) 2.14	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 4.88	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 13:05	End Purge:

pH	TEMP (°C)	D.O. ppm	REDOX mV	EC mS	LITRES REMOVED	Colour
8.32	17.2	1.50	-180	7.50	2	'Tea tree brown'
8.33	17.3	0.96	-173	6.06	4	TDS - 3.58 ppk
8.24	17.3	0.75	-162	5.40	5	
8.11	17.2	0.65	-149	4.31	6	
7.97	17.1	0.65	-131	3.94	8	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W25

Field Measurements

Depth to water: (from top of casing) 2.17	Measurement device:
Stickup: 0.75	Measurement Device:
Well Depth (from TOC): 2.44	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°c)	D.O.	REDOX	EC	LITRES REMOVED	Colour
6.96	14.7	3.35	13.5 TDS ppm.	256		Turbid, brown.
	Purged Dry - Not sampled.					

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W20

Field Measurements

Depth to water: (from top of casing) 2.07	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 4.75	

Well Purging

Purge Method: Peristaltic pump

Volume in Casing: L | Purge Volume: L

Start Purge: 08:00 | End Purge: 08:15

pH	TEMP (°c)	D.O. ppm	REDOX mV	EC mS	LITRES REMOVED	Colour
10.17	18.2	1.52	-449	22.46	2	'Tea tree brown'
10.12	18.7	1.28	-464	23.05	4	" "
10.10	18.9	1.15	-476	23.67	6	" "
10.11	18.9	1.09	-479	23.90	8	" "
						TDS 15.7ppk

Sampling

Sampling Method:

Type: Groundwater

Start Sampling: | Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** PUMP

Field Measurements

Depth to water: (from top of casing) 2.35	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 3.47	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 08:30	End Purge: 08:45

pH	TEMP (°C)	D.O. ppm	REDOX mV	EC µS	LITRES REMOVED	Colour
9.85	13.0	1.03	59	55.3	2	light brown.
9.84	15.1	0.71	164	59.9	4	light brown.
9.88	15.6	0.74	157	46.6	5	" "
9.87	15.8	0.78	161	47.0	6	" "

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? (Y) / N QA/QC Number: Q4100 (Duplicate).

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W45

Field Measurements

Depth to water: (from top of casing) 0.89	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 1.11	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC	LITRES REMOVED	Colour
9.02	8.6	4.81	275	24.4	1	tea tree brown.
~~9.13~~	9.0	5.40	262	25.1	1.5	
9.13	8.9	5.51	262	25.0	2.0	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W4D

Field Measurements

Depth to water: (from top of casing) Blocked	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): Blocked.	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC mV	LITRES REMOVED	Colour
5.26	12.6	2.27	87	6.22	1	Clear.
					2	
		Pumped dry - No sample collected.				

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Unable to get interface probe down well - tubing on B't
No sample collected.

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W3D

Field Measurements

Depth to water: (from top of casing) 5.70	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): [redacted] 9.99	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC µS	LITRES REMOVED	Colour
4.21	15.3	1.69	231	1525	2	Clear.
4.99	16.7	1.61	202	1553	4	" "
4.89	16.8	1.69	172	1535	5	" "
						TDS 883ppm

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W3S

Field Measurements

Depth to water: (from top of casing) 1.06	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 2.55	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC mS	LITRES REMOVED	Colour
7.46	15.1	1.76	202	9.33	1.5	Tea tree brown.
7.51	15.2	1.30	203	9.45	2.2	
7.52	15.2	1.09	202	9.44	2.7	
7.53	15.2	1.17	199	9.29	3.5	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** A7

Field Measurements

Depth to water: (from top of casing) 1.83	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 4.28	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC mS	LITRES REMOVED	Colour
9.43	15.1	1.70	-254	21.47	2	Tea-tree brown.
9.45	16.0	0.66	-287	21.28	3	
9.45	16.1	0.63	-291	21.18	4	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W15

Field Measurements

Depth to water: (from top of casing) 1.65	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 2.42	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O. ppm	REDOX mV	EC mS	LITRES REMOVED	Colour
6.76	15.4	1.33	-90	5.32	2	Dark brown, turbid.
6.79	15.6	0.60	-94	5.29	3	" "
6.83	16.0	0.55	-107	5.24	4	" "

Sampling

Sampling Method:			
Type: Groundwater			
Start Sampling:		Finish Sampling:	
Sample Appearance, eg colour, sediment:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Field Filtered ? Y / N Ease of filtering?
Weather Condition:
Duplicate Taken? Y / N Duplicate Number:
Triplicate Taken? Y / N Triplicate Number:
QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W10

Field Measurements

Depth to water: (from top of casing) 4.6m	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 10.40	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC mS	LITRES REMOVED	Colour
6.83	18.0	0.68	-100	10.10	0.5	Light brown, turbid
6.82	18.1	0.50	-107	10.18	0.8	" "
6.82	18.1	0.45	-112	10.22	1.2	" "
		Purged Dry -		only ¼ of	preserved	green
					collected.	

Sampling

Sampling Method:			
Type: Groundwater			
Start Sampling:		Finish Sampling:	
Sample Appearance, eg colour, sediment:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Field Filtered ? Y / N Ease of filtering?
Weather Condition:
Duplicate Taken? Y / N Duplicate Number:
Triplicate Taken? Y / N Triplicate Number:
QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W7S

Field Measurements

Depth to water: (from top of casing) 2.36	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 2.36	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC	LITRES REMOVED	Colour
		DRY				

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:** W7M
Location: Hydro Kurri Kurri	**Location:** W7M

Field Measurements

Depth to water: (from top of casing) 2.38	Measurement device: iP
Stickup:	Measurement Device:
Well Depth (from TOC): 3.73	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 08:55	End Purge: 09:15

pH	TEMP (°C)	D.O.	REDOX mV	EC µS	LITRES REMOVED	Colour
9.71	16.7	10.95	-100	64.2	2	'Tea tree brown'
9.78	16.7	10.93	-232	64.5	4	" "
9.82	16.9	10.83	-238	66.1	6	
						TDS 33.5 ppM

Sampling

Sampling Method: Low-flow peristaltic pump

Type: Groundwater

Start Sampling: 09:20	Finish Sampling: 09:20

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / (N) Ease of filtering?

Weather Condition: Cold

Duplicate Taken? (Y) / N Duplicate Number: QA101

Triplicate Taken? (Y) / N Triplicate Number: QA220

QA/QC Taken? (Y) / N QA/QC Number: ~~QA101~~ ~~QA200~~

Dup Trip

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:** N2
Location: Hydro Kurri Kurri	**Location:** N2.

Field Measurements

Depth to water: (from top of casing) 3.77	Measurement device: IP.
Stickup:	Measurement Device:
Well Depth (from TOC): 5.66	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 13:30	End Purge: 13:45.

pH	TEMP (°C)	D.O.	REDOX	EC µS	LITRES REMOVED	Colour
6.49	17.5	0.60	-139	1601	2	Tinted brown/black.
6.58	17.8	0.44	-153	1377	4	" "
6.61	18.0	0.41	-156	1304	6	" "
						TDS 740 ppm

Sampling

Sampling Method: Low-flow peristaltic pump.

Type: Groundwater

Start Sampling: 13:40	Finish Sampling: 14:20

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition: Clear Sunny.

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** ~~WZD~~ WSD

Field Measurements

Depth to water: (from top of casing) 5.12	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 6.15	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC mS	LITRES REMOVED	Colour
6.14	17.8	2.64	109	4.03	2	
	Pumped DRY – No Sample collected.					

Sampling

Sampling Method:			
Type: Groundwater			
Start Sampling:		Finish Sampling:	
Sample Appearance, eg colour, sediment:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Field Filtered ? Y / N Ease of filtering?
Weather Condition:
Duplicate Taken? Y / N Duplicate Number:
Triplicate Taken? Y / N Triplicate Number:
QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** ~~W2S~~ W5S

Field Measurements

Depth to water: (from top of casing) 1.17	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 1.70	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC mS	LITRES REMOVED	Colour
7.25	15.1	1.42	-105	4.32	1.5	"Tea-tree brown"
7.25	14.9	1.62	-104	3.96	2.0	
7.26	14.3	1.70	-98	3.86	2.5	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/14
Project: Plume Delineation	**Sample Number:** 3
Location: Hydro Kurri Kurri	**Location:** E4

Field Measurements	
Depth to water: (from top of casing) 1.74	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 3.40	

Well Purging						
Purge Method:						
Volume in Casing: L				Purge Volume: L		
Start Purge:				End Purge:		
pH	TEMP (°C)	D.O.	REDOX	EC mS	LITRES REMOVED	Colour
9.49	17.3	0.74	-255	10.59	2	Tea tree brown.
9.50	17.4	0.60	-257	10.04	4	
9.46	17.5	0.43	-243	9.73	6	

Sampling			
Sampling Method:			
Type: Groundwater			
Start Sampling:		Finish Sampling:	
Sample Appearance, eg colour, sediment:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments
Well Head Integrity:
Field Filtered ? Y / N Ease of filtering?
Weather Condition:
Duplicate Taken? Y / N Duplicate Number:
Triplicate Taken? Y / N Triplicate Number:
QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** E5

Field Measurements

Depth to water: (from top of casing) 2.20	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 2.58	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 09:30	End Purge: 09:46

pH	TEMP (°C)	D.O.	REDOX	EC µS	LITRES REMOVED	Colour
9.11	14.8	6.80	285	42.8	1	'Tea tree brown'
9.13	16.3	6.22	287	38.4	2	" "
9.14	16.5	6.12	278	37.2	3	" "

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** ESD.

Field Measurements

Depth to water: (from top of casing) 2.61	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 5.44	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 09.55	End Purge:

pH	TEMP (°C)	D.O. ppm	REDOX mV	EC mS	LITRES REMOVED	Colour
7.07	17.8	1.24	-94	166.5	2	Light brown turbid
7.14	18.8	0.99	-86	62.9	4	TDS 96.6 ppm.
7.22	18.9	0.81	-66	46.4	5	Tea tree brown.
7.23	19.0	0.73	-60	42.7	6	TDS 20.7 ppm.

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W6D

Field Measurements

Depth to water: (from top of casing) 4.99	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 5.91	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX ~V	EC µS	LITRES REMOVED	Colour
5.72	17.7	2.07	87	10.7	2	Clear.
5.92	17.0	9.64	49	7.7	4	TDS 3.3 ppm.
5.84	17.1	9.62	51	7.8	6	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W65.

Field Measurements

Depth to water: (from top of casing) 2.57	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 3.09	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC µS	LITRES REMOVED	Colour
[redacted] 8.69	16.5	3[redacted].64	244	23.1	2	Tea tree b.wun.
8.67	16.7	2[redacted].25	284	28.1	4	light b.wun/turbid
8.72	16.8	3.21.	290	28.3	6	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** N9

Field Measurements

Depth to water: (from top of casing) 1.84	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 3.16	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 11:10	End Purge: 11:20

pH	TEMP (°C)	D.O.	REDOX mV	EC mS	LITRES REMOVED	Colour
~~7.26~~ 7.26	15.6	0.97	-258	675.	2	Turbid - grey
7.22	15.6	0.60	-263	679	3	TDS 374 ppm
7.22	15.7	0.65	-255	677	4	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** N8

Field Measurements

Depth to water: (from top of casing) 2.80	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 4.57	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC mS	LITRES REMOVED	Colour
6.35	17.6	0.68	≈107	52.4	2	'Tea tree brown'
6.43	17.6	0.51	-121	71.7	4	" "
6.46	17.7	0.38	-134	63.1	5	" "
6.49	17.6	0.40	-143	56.4	6	" "

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** GW G2

Field Measurements

Depth to water: (from top of casing) 7.72	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 13.40	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC mS	LITRES REMOVED	Colour
6.23	17.8	0.62	-100	6.24	2	Clear - slightly cloudy
6.01	17.7	0.53	-95	6.25	4	" "
6.01	17.7	0.53	-97	6.25	6	" "

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** E11

Field Measurements

Depth to water: (from top of casing) 2.14	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 4.88	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 13:05	End Purge:

pH	TEMP (°C)	D.O. ppm	REDOX mV	EC mS	LITRES REMOVED	Colour
8.32	17.2	1.50	-180	7.50	2	'Tea tree brown'
8.33	17.3	0.96	-173	6.06	4	TDS - 3.58 ppk
8.24	17.3	0.75	-162	5.40	5	
8.11	17.2	0.65	-149	4.31	6	
7.97	17.1	0.65	-131	3.94	8	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W25

Field Measurements

Depth to water: (from top of casing) 2.17	Measurement device:
Stickup: 0.75	Measurement Device:
Well Depth (from TOC): 2.44	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°c)	D.O.	REDOX	EC	LITRES REMOVED	Colour
6.96	14.7	3.35	13.5 TDS ppm.	256		Turbid, brown.
	Purged Dry - Not sampled.					

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W20

Field Measurements

Depth to water: (from top of casing) 2.07	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 4.75	

Well Purging

Purge Method: Peristaltic pump

Volume in Casing: L | Purge Volume: L

Start Purge: 08:00 | End Purge: 08:15

pH	TEMP (°c)	D.O. ppm	REDOX mV	EC mS	LITRES REMOVED	Colour
10.17	18.2	1.52	-449	22.46	2	'Tea tree brown'
10.12	18.7	1.28	-464	23.05	4	" "
10.10	18.9	1.15	-476	23.67	6	" "
10.11	18.9	1.09	-479	23.90	8	" "
						TDS 15.7ppk

Sampling

Sampling Method:

Type: Groundwater

Start Sampling: | Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 3/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** PUMP

Field Measurements

Depth to water: (from top of casing) 2.35	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 3.47	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge: 08:30	End Purge: 08:45

pH	TEMP (°C)	D.O. ppm	REDOX mV	EC µS	LITRES REMOVED	Colour
9.85	13.0	1.03	59	55.3	2	light brown.
9.84	15.1	0.71	164	59.9	4	light brown.
9.88	15.6	0.74	157	46.6	5	" "
9.87	15.8	0.78	161	47.0	6	" "

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? (Y) / N QA/QC Number: Q4100 (Duplicate).

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W45

Field Measurements

Depth to water: (from top of casing) 0.89	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 1.11	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC	LITRES REMOVED	Colour
9.02	8.6	4.81	275	24.4	1	tea tree brown.
~~9.13~~	9.0	5.40	262	25.1	1.5	
9.13	8.9	5.51	262	25.0	2.0	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W4D

Field Measurements

Depth to water: (from top of casing) Blocked	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): Blocked.	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC mV	LITRES REMOVED	Colour
5.26	12.6	2.27	87	6.22	1	Clear.
					2	
		Pumped dry - No sample collected.				

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Unable to get interface probe down well - tubing on B't
No sample collected.

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W3D

Field Measurements

Depth to water: (from top of casing) 5.70	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): [redacted] 9.99	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC µS	LITRES REMOVED	Colour
4.21	15.3	1.69	231	1525	2	Clear.
4.99	16.7	1.61	202	1553	4	" "
4.89	16.8	1.69	172	1535	5	" "
						TDS 883ppm

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W3S

Field Measurements

Depth to water: (from top of casing) 1.06	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 2.55	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC mS	LITRES REMOVED	Colour
7.46	15.1	1.76	202	9.33	1.5	Tea tree brown.
7.51	15.2	1.30	203	9.45	2.2	
7.52	15.2	1.09	202	9.44	2.7	
7.53	15.2	1.17	199	9.29	3.5	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** A7

Field Measurements

Depth to water: (from top of casing) 1.83	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 4.28	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX	EC mS	LITRES REMOVED	Colour
9.43	15.1	1.70	-254	21.47	2	Tea-tree brown.
9.45	16.0	0.66	-287	21.28	3	
9.45	16.1	0.63	-291	21.18	4	

Sampling

Sampling Method:

Type: Groundwater

Start Sampling:	Finish Sampling:

Sample Appearance, eg colour, sediment:

Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:

Field Filtered ? Y / N Ease of filtering?

Weather Condition:

Duplicate Taken? Y / N Duplicate Number:

Triplicate Taken? Y / N Triplicate Number:

QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W15

Field Measurements

Depth to water: (from top of casing) 1.65	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 2.42	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O. ppm	REDOX mV	EC mS	LITRES REMOVED	Colour
6.76	15.4	1.33	-90	5.32	2	Dark brown, turbid.
6.79	15.6	0.60	-94	5.29	3	" "
6.83	16.0	0.55	-107	5.24	4	" "

Sampling

Sampling Method:			
Type: Groundwater			
Start Sampling:		Finish Sampling:	
Sample Appearance, eg colour, sediment:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Field Filtered ? Y / N Ease of filtering?
Weather Condition:
Duplicate Taken? Y / N Duplicate Number:
Triplicate Taken? Y / N Triplicate Number:
QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130335	**Date:** 4/6/15
Project: Plume Delineation	**Sample Number:**
Location: Hydro Kurri Kurri	**Location:** W10

Field Measurements

Depth to water: (from top of casing) 4.6m	Measurement device:
Stickup:	Measurement Device:
Well Depth (from TOC): 10.40	

Well Purging

Purge Method:

Volume in Casing: L	Purge Volume: L
Start Purge:	End Purge:

pH	TEMP (°C)	D.O.	REDOX mV	EC mS	LITRES REMOVED	Colour
6.83	18.0	0.68	-100	10.10	0.5	Light brown, turbid
6.82	18.1	0.50	-107	10.18	0.8	" "
6.82	18.1	0.45	-112	10.22	1.2	" "
		Purged Dry -		only ¼ of	preserved	green
					collected.	

Sampling

Sampling Method:			
Type: Groundwater			
Start Sampling:		Finish Sampling:	
Sample Appearance, eg colour, sediment:			
Pre-Sampling:	pH:	Spec.Cond:	Temp:
Post-Sampling:	pH:	Spec.Cond:	Temp:

Miscellaneous Field Comments

Well Head Integrity:
Field Filtered ? Y / N Ease of filtering?
Weather Condition:
Duplicate Taken? Y / N Duplicate Number:
Triplicate Taken? Y / N Triplicate Number:
QA/QC Taken? Y / N QA/QC Number:

Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 1/12/15
Project:	**Well Number:** W55
Location:	**Sampler(s):** MT

Field Measurements		
Organic vapours in well:	ppm	Measurement Device:
Depth to Groundwater:	1.67 m	Measurement Device:
Correction:	m	
Groundwater Elevation :	m	
Depth to Immiscible Layer:	m	Measurement Device:
Thickness to Immiscible Layer:	m	
Well Depth:	1.71 m	
Thickness to Groundwater Column:	m	
Well Diameter:	mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
			DRY				

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 2/12/15
Project:	**Well Number:** WL4S
Location:	**Sampler(s):** MT

Field Measurements		
Organic vapours in well:	ppm	Measurement Device:
Depth to Groundwater:	m	Measurement Device:
Correction:	m	
Groundwater Elevation :	m	
Depth to Immiscible Layer:	m	Measurement Device:
Thickness to Immiscible Layer:	m	
Well Depth:	m	
Thickness to Groundwater Column:	m	
Well Diameter:	mm	

Well Purging		
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.		
Volume in 50mm dia well is approximately 2L per metre:		
If purging: 3 volumes to be purged: SWL x 5.9 =	L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth:	m	Purge Method: Bailer / Pump
# Well Volumes to be purged:		Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):		

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
			DRY				

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 2/12/15
Project:	**Well Number:** W2D
Location:	**Sampler(s):** MS

Field Measurements			
Organic vapours in well:		ppm	Measurement Device:
Depth to Groundwater:	—	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	4.68	m	
Thickness to Groundwater Column:		m	
Well Diameter:		mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: | End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
				DRY			

Miscellaneous Field Comments
Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 2/12/15
Project:	**Well Number:** EC4
Location:	**Sampler(s):** MS

Field Measurements			
Organic vapours in well:		ppm	Measurement Device:
Depth to Groundwater:	2.31	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	3.40	m	
Thickness to Groundwater Column:		m	
Well Diameter:		mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: mS/cm

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
09:55	20.40	10.58	10.46	0.0	-176.8	6,852	128 NTU
09:59	20.50	10.58	10.57	0.0	-177.1	6,543	93
10:01	20.50	10.57	10.56	0.0	-173.2	6,366	89.7

Miscellaneous Field Comments
Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 1/12/15.
Project:	**Well Number:** W5D
Location:	**Sampler(s):** MS

Field Measurements		
Organic vapours in well:	ppm	Measurement Device:
Depth to Groundwater: 5.27.	m	Measurement Device:
Correction:	m	
Groundwater Elevation :	m	
Depth to Immiscible Layer:	m	Measurement Device:
Thickness to Immiscible Layer:	m	
Well Depth: 10.53 .	m	
Thickness to Groundwater Column:	m	
Well Diameter:	mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND. µS/cm	pH	DO	Redox mV	TDS	Comments (appearance, odour, etc)
14:23	20.80	5,665	8.46	0.34	-115.2	3,684	82.1
14:25	21.00	5,671	8.43	0.29	-107.1	3,686	79.6
14:27	21.00	5,661	8.37	0.26	-101.7	3,669	74.0

Miscellaneous Field Comments
Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 2/12/15
Project:	**Well Number:** W48
Location:	**Sampler(s):** MT

Field Measurements		
Organic vapours in well:	ppm	Measurement Device:
Depth to Groundwater:	m	Measurement Device:
Correction:	Unable to dip well - blockage.	
Groundwater Elevation :	m	
Depth to Immiscible Layer:	m	Measurement Device:
Thickness to Immiscible Layer:	m	
Well Depth:	m	
Thickness to Groundwater Column:	m	
Well Diameter:	30 mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: mS/cm

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS mg/L	Comments (appearance, odour, etc)
08:11	20.40	7,301	9.98	0.57	-50.5	4,744	43.1 NTU
08:13	20.10	7,132	9.90	0.54	-44.9	4,620	24.7
		Approx 500mL			purged - well		purged dry.

Miscellaneous Field Comments
Well Head Integrity:
Samples Filtered
Weather Condition:
Other: Unable to dip well.

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 2/12/2015
Project: GW Plume monitoring.	**Well Number:** A7
Location: Hydro	**Sampler(s):** MT

Field Measurements			
Organic vapours in well:	–	ppm	Measurement Device: –
Depth to Groundwater:	2.31	m	Measurement Device: IP
Correction:	–	m	
Groundwater Elevation :	–	m	
Depth to Immiscible Layer:	–	m	Measurement Device: IP
Thickness to Immiscible Layer:	–	m	
Well Depth:	4.33	m	
Thickness to Groundwater Column:	–	m	
Well Diameter:	50	mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND. mS/cm	pH	DO mg/L	Redox	TDS mg/L	Comments (appearance, odour, etc)
7:05	21.88	14.37	10.63	2.45	-140.9	9,300	2.7 NTU. Leachate brown
7:07	19.30	14.74	10.69	0.35	-147.7	9,584	7.8
7:11	19.00	14.82	10.71	0.06	-153.1	9,635	7.84

Miscellaneous Field Comments
Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 1/12/15
Project: GW Plume Monitoring -	**Well Number:** ESD
Location:	**Sampler(s):** MS

Field Measurements			
Organic vapours in well:	— ppm	Measurement Device:	—
Depth to Groundwater:	2.46 m	Measurement Device:	IP
Correction:	= m		
Groundwater Elevation :	= m		
Depth to Immiscible Layer:	— m	Measurement Device:	IP
Thickness to Immiscible Layer:	m		
Well Depth:	5.43. m		
Thickness to Groundwater Column:	— m		
Well Diameter:	50 mm		

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND. µs/cm	pH	DO mg/L	Redox mV	TDS g/L	Comments (appearance, odour, etc)
09:20	25.63	24.75	7.24	0.52	4.0	15.87	8921 NTU light brown.
09:23	24.18	24.16	7.18	21.6	0.47	15.43	733.
09:26	23.85	24.03	7.18	21.1	0.44	15.64	674

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130456	**Date:** 2/12/15
Project: Gw Plume Monitoring	**Well Number:** W15
Location: Nyngan	**Sampler(s):** MT

Field Measurements			
Organic vapours in well:	—	ppm	Measurement Device: —
Depth to Groundwater:	1.86	m	Measurement Device: IP
Correction:	—	m	
Groundwater Elevation :	—	m	
Depth to Immiscible Layer:	—	m	Measurement Device: IP
Thickness to Immiscible Layer:	—	m	
Well Depth:	2.44	m	
Thickness to Groundwater Column:	—	m	
Well Diameter:	50	mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
		Purged	Dry	after	~2	hr.	

Miscellaneous Field Comments
Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 2/12/15
Project: GW Plume monitoring	**Well Number:** W1D
Location: Hydro.	**Sampler(s):** MT

Field Measurements

Organic vapours in well:	–	ppm	Measurement Device: –
Depth to Groundwater:	4.53	m	Measurement Device: IP
Correction:	–	m	
Groundwater Elevation :	–	m	
Depth to Immiscible Layer:	–	m	Measurement Device: IP
Thickness to Immiscible Layer:	–	m	
Well Depth:	10.44	m	
Thickness to Groundwater Column:	–	m	
Well Diameter:	50	mm	

Well Purging

Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.

Volume in 50mm dia well is approximately 2L per metre:

If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L

Observations during purging (turbidity, colour, sheen, odour):

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: Slam

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
09:35	20.10	9,275	8.52	0.0	53.9	6,028	76.8
09:37	20.10	9,275	8.50	0.0	55.5	6,038	77.7
09:41	20.20	9,303	8.48	0.0	57.1	6,040	78.7.

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS30420	**Date:** 1/12/15
Project:	**Well Number:** W2S
Location:	**Sampler(s):** MT.

Field Measurements			
Organic vapours in well:		ppm	Measurement Device:
Depth to Groundwater:	—	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	2.45	m	
Thickness to Groundwater Column:		m	
Well Diameter:		mm	

Well Purging			
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.			
Volume in 50mm dia well is approximately 2L per metre:			
If purging: 3 volumes to be purged: SWL x 5.9 =		L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth:		m	Purge Method: Bailer / Pump
# Well Volumes to be purged:			Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):			

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
				DRY.			

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 1/12/15
Project: GW Plume monitoring	**Well Number:** W2D
Location:	**Sampler(s):** MT

Field Measurements			
Organic vapours in well:	—	ppm	Measurement Device: —
Depth to Groundwater:	2.46	m	Measurement Device: IP
Correction:	—	m	
Groundwater Elevation :	—	m	
Depth to Immiscible Layer:	—	m	Measurement Device: IP
Thickness to Immiscible Layer:	—	m	
Well Depth:	6.34	m	
Thickness to Groundwater Column:	—	m	
Well Diameter:	50	mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND. mS/cm	pH	DO mg/L	Redox	TDS g/L	Comments (appearance, odour, etc)
07:29	20.70	67.77	10.38	3.83	-191.3	44.12	Turbidity 1609 NTU
07:36	20.70	70.80	10.36	5.19	-169.9	46.03	1763
07:39	20.70	71.84	10.34	5.66	-162.7	46.66	1825.
							Leachate brown.

Miscellaneous Field Comments

Well Head Integrity:
Samples Filtered
Weather Condition:
Other: ← QA101 (intra-dup) and QA201 (inter-dup).

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 1/12/15.
Project: GW Plume monitoring.	**Well Number:** ES.
Location: Hydro	**Sampler(s):** MT

Field Measurements			
Organic vapours in well:		ppm	Measurement Device:
Depth to Groundwater:	2.54	m	Measurement Device:
Correction:		m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	2.58.	m	
Thickness to Groundwater Column:		m	
Well Diameter:		mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
		DRY					

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 1/12/15
Project: GW Plume monitoring	**Well Number:** PUMP
Location: Buffer Zone.	**Sampler(s):** MT

Field Measurements

Organic vapours in well:	–	ppm	Measurement Device: –
Depth to Groundwater:	2.65	m	Measurement Device: IP.
Correction:	–	m	
Groundwater Elevation :	–	m	
Depth to Immiscible Layer:	–	m	Measurement Device: IP
Thickness to Immiscible Layer:	–	m	
Well Depth:	3.51.	m	
Thickness to Groundwater Column:	–	m	
Well Diameter:	100	mm	

Well Purging

Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.

Volume in 50mm dia well is approximately 2L per metre:

If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L

Observations during purging (turbidity, colour, sheen, odour):

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: Brown, turbid.

TIME	TEMP (°C)	SPEC. COND. µS/cm	pH	DO mg/L	Redox	TDS g/L	Comments (appearance, odour, etc)
08:22	23.10	33.03	10.24	0.81	-184.4	20.83	TURB - 2,981 NTU. Brown, Turbid.
08:25	23.65.	29.98	10.27	0.33	-224.4	19.42	3,616.
08:28	24.00	22.61	10.27	0.27	-237.1	15.94	3,342.

Miscellaneous Field Comments

Well Head Integrity:	✓
Samples Filtered	–
Weather Condition:	Hot, sunny.
Other:	–

Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 1/12/15
Project:	**Well Number:** [redacted] W7M
Location:	**Sampler(s):** MT

Field Measurements

Organic vapours in well:	—	ppm	Measurement Device: —
Depth to Groundwater:	2.80	m	Measurement Device: IP
Correction:	—	m	
Groundwater Elevation :	—	m	
Depth to Immiscible Layer:	—	m	Measurement Device: IP
Thickness to Immiscible Layer:	—	m	
Well Depth:	3.73	m	
Thickness to Groundwater Column:	—	m	
Well Diameter:	50	mm	

Well Purging

Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.

Volume in 50mm dia well is approximately 2L per metre:

If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L

Observations during purging (turbidity, colour, sheen, odour):

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: mS/cm.

TIME	TEMP (°C)	SPEC. COND.	pH	DO mg/L	Redox mV	TDS g/L	Comments (appearance, odour, etc)
08:50	24.08	34.40.	9.62	0.84	-81.2	23.18	814 NTU - Brown / [illegible]
08:53	23.10	28.05	9.70	0.88	-179.6	18.07	766
08:55	23.10	27.10.	9.70	1.12	-177.9	17.53	748

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 1/12/15.
Project:	**Well Number:** W6S
Location:	**Sampler(s):** MT

Field Measurements			
Organic vapours in well:		ppm	Measurement Device:
Depth to Groundwater:		m	Measurement Device:
Correction:		m	
Groundwater Elevation :	2.87	m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	3.10.	m	
Thickness to Groundwater Column:		m	
Well Diameter:		mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. CONDUCT.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
10:11	30.28.	22.16	8.63	6.47	332.9	14.26	Turb6 — 2600
10:13	30.65	21.56	8.67	6.75	331.2	Ld-OL	2,668
10:15	29.90	21.69	8.67	ORP	328.2	Ld.08	2,905.

Miscellaneous Field Comments

Well Head Integrity:
Samples Filtered
Weather Condition:
Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130456	**Date:** 1/12/15
Project: GW plume monitoring.	**Well Number:** MW9
Location: Hydro	**Sampler(s):** MT

Field Measurements			
Organic vapours in well:	—	ppm	Measurement Device: —
Depth to Groundwater:	2.48	m	Measurement Device: IP
Correction:	—	m	
Groundwater Elevation :	—	m	
Depth to Immiscible Layer:	—	m	Measurement Device: IP
Thickness to Immiscible Layer:	—	m	
Well Depth:	3.13	m	
Thickness to Groundwater Column:	—	m	
Well Diameter:	50	mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND.	pH	DO mg/L	Redox mV	TDS mg/L	Comments (appearance, odour, etc)
11:40	32.4	4,968	7.73	4.88	-168.3	3,229	Turbid - strong sulphur odour
11:42	32.2	4,618	7.69	4.36	-163.1	2,983	283 NTU
11:44	32.1	4,117	7.70	4.74	-152.6	2,657	266

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 1/12/15
Project: GW Plume monitoring	**Well Number:** N8
Location:	**Sampler(s):** MT

Field Measurements			
Organic vapours in well:	–	ppm	Measurement Device: –
Depth to Groundwater:	3.06	m	Measurement Device: IP
Correction:	–	m	
Groundwater Elevation :	–	m	
Depth to Immiscible Layer:	–	m	Measurement Device: IP
Thickness to Immiscible Layer:	–	m	
Well Depth:	4.57	m	
Thickness to Groundwater Column:	–	m	
Well Diameter:	50	mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: ms/cm

TIME	TEMP (°C)	SPEC. COND.	pH	DO mg/L	Redox mV	TDS g/L	Comments (appearance, odour, etc)
12:15	27.1	17.52	6.73	0.94	10.3	11.38	1,083 NTU.
12:17	26.7	17.30	6.71	0.76	16.3	11.24	670
12:19	26.3	17.31	6.74	0.68	20.3	11.25	

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS/304456	**Date:** 1/12/15
Project: Gw Plume Monitoring	**Well Number:** E11
Location: Kingsbridge.	**Sampler(s):** MT

Field Measurements

Organic vapours in well:	–	ppm	Measurement Device: –
Depth to Groundwater:	2.94	m	Measurement Device: IP
Correction:	–	m	
Groundwater Elevation :	–	m	
Depth to Immiscible Layer:	–	m	Measurement Device: IP
Thickness to Immiscible Layer:	–	m	
Well Depth:	4.90	m	
Thickness to Groundwater Column:	–	m	
Well Diameter:	50	mm	

Well Purging

Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.

Volume in 50mm dia well is approximately 2L per metre:

If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L

Observations during purging (turbidity, colour, sheen, odour):

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
13:27	21.80	10.72	8.37	0.02	-102.9	6,894	513 TBU - leachate brown.
13:29	20.70	9.2	8.68	0.01	-115.5	5,897	468
13:32	20.25	8.484	8.65	0.01	-119.9	5,539	584

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 1/12/15.
Project:	**Well Number:** G2
Location:	**Sampler(s):**

Field Measurements			
Organic vapours in well:	–	ppm	Measurement Device: –
Depth to Groundwater:	7.63	m	Measurement Device: IP
Correction:	–	m	
Groundwater Elevation :	–	m	
Depth to Immiscible Layer:	–	m	Measurement Device: IP
Thickness to Immiscible Layer:	–	m	
Well Depth:	13.58	m	
Thickness to Groundwater Column:	–	m	
Well Diameter:	50	mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND.	pH	DO mg/L	Redox	TDS	Comments (appearance, odour, etc)
12:49	24.43	14.51	7.86	0.49	14.2	9,480	382 TBU
12:51	24.30	14.73	7.86	0.35	20.1	9,575	361
12:54	24.30	14.68	7.87	0.32	21.9	9,541	385

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 1/12/15
Project:	**Well Number:** W75
Location:	**Sampler(s):** MAT

Field Measurements		
Organic vapours in well:	ppm	Measurement Device:
Depth to Groundwater:	m	Measurement Device:
Correction:	m	
Groundwater Elevation :	m	
Depth to Immiscible Layer:	m	Measurement Device:
Thickness to Immiscible Layer:	m	
Well Depth: 2-36	m	
Thickness to Groundwater Column:	m	
Well Diameter:	mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND.	pH	DO	Redox	TDS	Comments (appearance, odour, etc)
			DRY				

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130420	**Date:** 2/12/15
Project: GW Plume monitoring	**Well Number:** W2S
Location: Hydro	**Sampler(s):** MF

Field Measurements			
Organic vapours in well:	– ppm	Measurement Device:	–
Depth to Groundwater:	1.72 m	Measurement Device:	IP
Correction:	– m		
Groundwater Elevation :	– m		
Depth to Immiscible Layer:	– m	Measurement Device:	IP
Thickness to Immiscible Layer:	– m		
Well Depth:	2.54 m		
Thickness to Groundwater Column:	– m		
Well Diameter:	50 mm		

Well Purging

Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.

Volume in 50mm dia well is approximately 2L per metre:

If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L

Observations during purging (turbidity, colour, sheen, odour):

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. ~~COND.~~	pH	DO	Redox	TDS mg/L	Comments (appearance, odour, etc)
7:41	21.20	7,544	10.31	2.28	-146.4	4,899	94.8 NTU Brown/turbid
7:45	20.50	7,437	10.29	0.72	-144.5	4,842	39.6
7:47	20.50	7,295	10.37	0.70	-144.1	4,740	35.6
7:49	20.50	7,326	10.44	0.66	-142.3	4,764	34.8

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 6/12/15
Project:	**Well Number:** N2
Location:	**Sampler(s):** MT

Field Measurements			
Organic vapours in well:	—	ppm	Measurement Device: —
Depth to Groundwater:	3.70	m	Measurement Device: IP
Correction:	—	m	
Groundwater Elevation :	—	m	
Depth to Immiscible Layer:	—	m	Measurement Device: IP
Thickness to Immiscible Layer:	—	m	
Well Depth:	5.69	m	
Thickness to Groundwater Column:	—	m	
Well Diameter:	50	mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND. µS/cm	pH	DO mg/L	Redox	TDS	Comments (appearance, odour, etc)
13:50	22.95	5,659	8.25	0.25	-118.4	3,684	132 NTU Turbid - dark grey.
13:52	21.43	5,670	8.20	0.11	-124.8	3,693	121
13:55	20.80	5,676	8.14	0.08	-131.9	3,686	73.7
13:57	20.80	5,706	8.09	0.07	-134.3	3,708	69.3

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

Groundwater Sampling Field Parameter Form

Ref. Number: AS130458	**Date:** 1/12/15.
Project: Gw. Plume Monitoring	**Well Number:** W6D
Location: Hydro	**Sampler(s):** MT

Field Measurements			
Organic vapours in well:	—	ppm	Measurement Device: —
Depth to Groundwater:	4.90	m	Measurement Device: IP
Correction:	—	m	
Groundwater Elevation :	—	m	
Depth to Immiscible Layer:	—	m	Measurement Device: IP
Thickness to Immiscible Layer:	—	m	
Well Depth:	5.91	m	
Thickness to Groundwater Column:	—	m	
Well Diameter:	50.	mm	

Well Purging	
Volume to be purged = (TD-WL)/SWL x 1.9625 x # volumes to be purged.	
Volume in 50mm dia well is approximately 2L per metre:	
If purging: 3 volumes to be purged: SWL x 5.9 = L	If developing: 10 volumes to be purged: SWL x 19.6 = L
Water Level Depth: m	Purge Method: Bailer / Pump
# Well Volumes to be purged:	Well Volume to be purged: L
Observations during purging (turbidity, colour, sheen, odour):	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°C)	SPEC. COND. (µS/cm)	pH	DO mg/L	Redox mV	TDS mg/L	Comments (appearance, odour, etc)
09:56	24.00	2,489	5.53	2.30	195.6	1624	~~2,574~~ NTU Clear.
09:59	22.6	2,509	5.51	2.29	197.7	1,629	2,576
10:02	22.3	2,500	5.50	2.18	198.9	1,623	2,473.

Miscellaneous Field Comments

Well Head Integrity:

Samples Filtered

Weather Condition:

Other:

APPENDIX 5
LABORATORY REPORTS FOR 2015 GMES

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
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CERTIFICATE OF ANALYSIS 123828

Client:
Environ
PO Box 560
North Sydney
NSW 2060

Attention: N Gilbert, K Greenfield

Sample log in details:

Your Reference:	**Hydro GW Plume Monitoring AS130420**		
No. of samples:	22 waters		
Date samples received / completed instructions received	19/02/15	/	19/02/15

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: / Issue Date:	26/02/15	/	26/02/15
Date of Preliminary Report:	Not Issued		

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

Results Approved By:

Jacinta Hurst
Laboratory Manager

Miscellaneous Inorganics						
Our Reference:	UNITS	123828-1	123828-2	123828-3	123828-4	123828-5
Your Reference	----------	W3D	E4	W1S	W3S	A7
Date Sampled	----------	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/02/2015	19/02/2015	19/02/2015	19/02/2015	19/02/2015
Date analysed	-	19/02/2015	19/02/2015	19/02/2015	19/02/2015	19/02/2015
Fluoride, F	mg/L	0.22	340	66	250	550
Total Cyanide	mg/L	0.008	41	15	25	78
Free Cyanide in Water	mg/L	<0.004	<0.004	0.004	<0.004	0.011

Miscellaneous Inorganics						
Our Reference:	UNITS	123828-6	123828-7	123828-8	123828-9	123828-10
Your Reference	----------	N2	E11	N9	N8	G2
Date Sampled	----------	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/02/2015	19/02/2015	19/02/2015	19/02/2015	19/02/2015
Date analysed	-	19/02/2015	19/02/2015	19/02/2015	19/02/2015	19/02/2015
Fluoride, F	mg/L	0.49	230	220	0.35	0.28
Total Cyanide	mg/L	0.009	7.7	13	6.6	<0.004
Free Cyanide in Water	mg/L	<0.004	0.005	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference:	UNITS	123828-11	123828-12	123828-13	123828-14	123828-15
Your Reference	----------	W6D	W6S	W5S	W5D	E5D
Date Sampled	----------	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/02/2015	19/02/2015	19/02/2015	19/02/2015	19/02/2015
Date analysed	-	19/02/2015	19/02/2015	19/02/2015	19/02/2015	19/02/2015
Fluoride, F	mg/L	0.30	200	93	0.44	18
Total Cyanide	mg/L	0.008	12	9.3	0.005	6.8
Free Cyanide in Water	mg/L	<0.004	0.019	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference:	UNITS	123828-16	123828-17	123828-18	123828-19	123828-20
Your Reference	----------	PUMP	W2D	W7M	W4D	QA1
Date Sampled	----------	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	19/02/2015	19/02/2015	19/02/2015	19/02/2015	19/02/2015
Date analysed	-	19/02/2015	19/02/2015	19/02/2015	19/02/2015	19/02/2015
Fluoride, F	mg/L	740	1,279	840	1.1	0.28
Total Cyanide	mg/L	58	200	130	0.007	<0.004
Free Cyanide in Water	mg/L	0.021	0.030	0.020	<0.004	<0.004

Miscellaneous Inorganics			
Our Reference:	UNITS	123828-21	123828-22
Your Reference	----------	QA3	QB1
Date Sampled	----------	17/02/2015	17/02/2015
Type of sample		Water	Water
Date prepared	-	19/02/2015	19/02/2015
Date analysed	-	19/02/2015	19/02/2015
Fluoride, F	mg/L	240	<0.1
Total Cyanide	mg/L	13	<0.004
Free Cyanide in Water	mg/L	0.005	<0.004

All metals in water - total						
Our Reference:	UNITS	123828-1	123828-2	123828-3	123828-4	123828-5
Your Reference	----------	W3D	E4	W1S	W3S	A7
Date Sampled	----------	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	20/02/2015	20/02/2015	20/02/2015	20/02/2015	20/02/2015
Date analysed	-	20/02/2015	20/02/2015	20/02/2015	20/02/2015	20/02/2015
Aluminium-Total	µg/L	760	46,000	120,000	34,000	1,700

All metals in water - total						
Our Reference:	UNITS	123828-6	123828-7	123828-8	123828-9	123828-10
Your Reference	----------	N2	E11	N9	N8	G2
Date Sampled	----------	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	20/02/2015	20/02/2015	20/02/2015	20/02/2015	20/02/2015
Date analysed	-	20/02/2015	20/02/2015	20/02/2015	20/02/2015	20/02/2015
Aluminium-Total	µg/L	28,000	5,000	8,000	1,800	2,900

All metals in water - total						
Our Reference:	UNITS	123828-11	123828-12	123828-13	123828-14	123828-15
Your Reference	----------	W6D	W6S	W5S	W5D	E5D
Date Sampled	----------	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	20/02/2015	20/02/2015	20/02/2015	20/02/2015	20/02/2015
Date analysed	-	20/02/2015	20/02/2015	20/02/2015	20/02/2015	20/02/2015
Aluminium-Total	µg/L	120	3,500	22,000	160	3,400

All metals in water - total						
Our Reference:	UNITS	123828-16	123828-17	123828-18	123828-19	123828-20
Your Reference	----------	PUMP	W2D	W7M	W4D	QA1
Date Sampled	----------	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	20/02/2015	20/02/2015	20/02/2015	20/02/2015	20/02/2015
Date analysed	-	20/02/2015	20/02/2015	20/02/2015	20/02/2015	20/02/2015
Aluminium-Total	µg/L	370,000	30	990	350	2,800

All metals in water - total			
Our Reference:	UNITS	123828-21	123828-22
Your Reference	----------	QA3	QB1
Date Sampled	----------	17/02/2015	17/02/2015
Type of sample		Water	Water
Date prepared	-	20/02/2015	20/02/2015
Date analysed	-	20/02/2015	20/02/2015
Aluminium-Total	µg/L	5,200	50

Method ID	Methodology Summary
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			19/02/2015	123828-1	19/02/2015 || 19/02/2015	LCS-W1	19/02/2015
Date analysed	-			20/02/2015	123828-1	19/02/2015 || 19/02/2015	LCS-W1	20/02/2015
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	123828-1	0.22 || 0.21 || RPD: 5	LCS-W1	111%
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	123828-1	0.008 || 0.008 || RPD: 0	LCS-W1	89%
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	123828-1	<0.004 || <0.004	LCS-W1	99%
QUALITY CONTROL All metals in water - total	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			20/02/2015	123828-7	20/02/2015 || 20/02/2015	LCS-W2	20/02/2015
Date analysed	-			20/02/2015	123828-7	20/02/2015 || 20/02/2015	LCS-W2	20/02/2015
Aluminium-Total	µg/L	10	Metals-022 ICP-MS	<10	123828-7	5000 || 5200 || RPD: 4	LCS-W2	96%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	123828-11	19/02/2015 || 19/02/2015	LCS-W2	19/02/2015
Date analysed	-	123828-11	19/02/2015 || 19/02/2015	LCS-W2	20/02/2015
Fluoride, F	mg/L	123828-11	0.30 || 0.34 || RPD: 13	LCS-W2	111%
Total Cyanide	mg/L	123828-11	0.008 || 0.009 || RPD: 12	LCS-W2	96%
Free Cyanide in Water	mg/L	123828-11	<0.004 || <0.004	LCS-W2	99%
QUALITY CONTROL All metals in water - total	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	123828-17	20/02/2015 || 20/02/2015	LCS-W3	20/02/2015
Date analysed	-	123828-17	20/02/2015 || 20/02/2015	LCS-W3	20/02/2015
Aluminium-Total	µg/L	123828-17	30 || 30 || RPD: 0	LCS-W3	100%
QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	123828-21	19/02/2015 || 19/02/2015	123828-2	19/02/2015
Date analysed	-	123828-21	19/02/2015 || 19/02/2015	123828-2	20/02/2015
Fluoride, F	mg/L	123828-21	240 || 230 || RPD: 4	123828-2	#
Total Cyanide	mg/L	123828-21	13 || 15 || RPD: 14	123828-2	95%
Free Cyanide in Water	mg/L	123828-21	0.005 || 0.005 || RPD: 0	123828-2	82%
QUALITY CONTROL All metals in water - total	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	123828-21	20/02/2015 || 20/02/2015	123828-8	20/02/2015
Date analysed	-	123828-21	20/02/2015 || 20/02/2015	123828-8	20/02/2015
Aluminium-Total	µg/L	123828-21	5200 || 5400 || RPD: 4	123828-8	#

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	123828-22	19/02/2015
Date analysed	-	[NT]	[NT]	123828-22	20/02/2015
Fluoride, F	mg/L	[NT]	[NT]	123828-22	112%
Total Cyanide	mg/L	[NT]	[NT]	[NR]	[NR]
Free Cyanide in Water	mg/L	[NT]	[NT]	123828-22	97%
QUALITY CONTROL All metals in water - total	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	123828-22	20/02/2015
Date analysed	-	[NT]	[NT]	123828-22	20/02/2015
Aluminium-Total	µg/L	[NT]	[NT]	123828-22	100%

Report Comments:

METALS_WLL_ALL_T: # 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:# 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.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

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.

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: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC 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.

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: ENVIRON	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - AS130420
Contact person: Natalie Gilbert	**PO No.:**
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**
Sampler: N.Gilbert	**Date results required:**
Address: Level 2 Suite 19B, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: 0249625444 **Mob:** ~~4.32E+08~~ 0432843901	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: ngilbert@environcorp.com; kgreenfield@environcorp.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										Provide as much information about the sample as you can
1	W3D		17-18/2/15	WATER	X	X	X	X										
2	E4		17-18/2/15	WATER	X	X	X	X										
3	W1S		17-18/2/15	WATER	X	X	X	X										
4	W3S		17-18/2/15	WATER	X	X	X	X										
5	A7		17-18/2/15	WATER	X	X	X	X										
6	N2		17-18/2/15	WATER	X	X	X	X										
7	E11		17-18/2/15	WATER	X	X	X	X										
8	N9		17-18/2/15	WATER	X	X	X	X										
9	N8		17-18/2/15	WATER	X	X	X	X										
10	G2		17-18/2/15	WATER	X	X	X	X										
11	W6D		17-18/2/15	WATER	X	X	X	X										
12	W6S		17-18/2/15	WATER	X	X	X	X										
13	W5S		17-18/2/15	WATER	X	X	X	X										

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

Job No: 123828
Date Received: 19/2/15
Time Received: 10:30
Received by: PT
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company):	ENVIRON	**Received by (company):** ELS	*Lab use only:*
Print Name:	N. GILBERT	**Print Name:** PT	**Samples Received:** Cool or Ambient (circle one)
Date & Time:	18/2/15 12.30PM	**Date & Time:** 19/2/15 10:30	**Temperature Received at:** (if applicable)
Signature:		**Signature:** PT	**Transported by:** Hand delivered / courier

White - Lab copy / Blue - Client copy / Pink - Retain in Book

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: ENVIRON	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - AS130420
Contact person: Natalie Gilbert	**PO No.:**
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**
Sampler: N.Gilbert	**Date results required:**
Address: Level 2 Suite 19B, 50 Glebe Road, The Junction	Or choose: standard / same day / 1 day / 2 day / 3 day
Phone: 0249625444 **Mob:** ~~4.322+08~~ 0432184301	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: ngilbert@environcorp.com; kgreenfield@environcorp.com	

Envirolab Services
12 Ashley St, Chatsw
Phone: 02 9910 620
E-mail: ahie@enviro
Contact: Aileen Hie

Envirolab Services
16-18 Hayden Crt, M
Phone: 08 9317 250
E-mail: lab@mpl.cor
Contact: Joshua Lim

Sample information					Tests Required													
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluble Fluoride	Total Cyanide	Free Cyanide	Total Aluminium										
14	W5D		17-18/2/15	WATER	X	X	X	X										
15	E5D		17-18/2/15	WATER	X	X	X	X										
16	PUMP		17-18/2/15	WATER	X	X	X	X										
17	W2D		17-18/2/15	WATER	X	X	X	X										
18	W7M		17-18/2/15	WATER	X	X	X	X										
19	W4D		17-18/2/15	WATER	X	X	X	X										
20	QA1		17-18/2/15	WATER	X	X	X	X										
21	QA3 (PT)		17-18/2/15	WATER	X	X	X	X										
22	QB1		17-18/2/15	WATER	X	X	X	X										

123828

Envirolab Services Pty Ltd
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ph 02 9910 6200 fax 02 9910 6201
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www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 129177

Client:
Environ
PO Box 560
North Sydney
NSW 2060

Attention: Fiona Robinson, Mark Tiedeman

Sample log in details:

Your Reference:	**AS130420**		
No. of samples:	23 Waters		
Date samples received / completed instructions received	05/06/2015	/	05/06/2015

This report replaces the previous R00 due to the addition of Free Cyanide

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: / Issue Date:	15/06/15	/	16/06/15
Date of Preliminary Report:	None Issued		

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Results Approved By:

Jacinta Hurst
Laboratory Manager

Miscellaneous Inorganics						
Our Reference:	UNITS	129177-1	129177-2	129177-3	129177-4	129177-5
Your Reference	----------	N2	W5S	E4	W4S	W3D
Date Sampled	----------	3/06/2015	3/06/2015	3/06/2015	4/06/2015	4/06/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/06/2015	10/06/2015	10/06/2015	10/06/2015	10/06/2015
Date analysed	-	10/06/2015	10/06/2015	10/06/2015	10/06/2015	10/06/2015
Fluoride, F	mg/L	7.9	88	260	490	0.3
Total Cyanide	mg/L	0.021	2.3	25	330	0.013
Free Cyanide in Water	mg/L	<0.004	<0.4	<0.4	<4	<0.004

Miscellaneous Inorganics						
Our Reference:	UNITS	129177-6	129177-7	129177-8	129177-9	129177-10
Your Reference	----------	W3S	A7	W1S	W1D	W7M
Date Sampled	----------	4/06/2015	4/06/2015	4/06/2015	4/06/2015	3/06/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/06/2015	10/06/2015	10/06/2015	10/06/2015	10/06/2015
Date analysed	-	10/06/2015	10/06/2015	10/06/2015	10/06/2015	10/06/2015
Fluoride, F	mg/L	230	500	120	4.4	810
Total Cyanide	mg/L	24	100	1.1	0.77	170
Free Cyanide in Water	mg/L	<0.4	<2	<0.4	<0.2	<2

Miscellaneous Inorganics						
Our Reference:	UNITS	129177-11	129177-12	129177-13	129177-14	129177-15
Your Reference	----------	E5	E5D	W6D	W6S	N9
Date Sampled	----------	3/06/2015	3/06/2015	3/06/2015	3/06/2015	3/06/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/06/2015	10/06/2015	10/06/2015	10/06/2015	10/06/2015
Date analysed	-	10/06/2015	10/06/2015	10/06/2015	10/06/2015	10/06/2015
Fluoride, F	mg/L	410	16	0.1	180	24
Total Cyanide	mg/L	69	2.9	<0.004	14	1.2
Free Cyanide in Water	mg/L	<0.8	<0.4	<0.004	<0.4	<0.4

Miscellaneous Inorganics						
Our Reference:	UNITS	129177-16	129177-17	129177-18	129177-19	129177-20
Your Reference	----------	N8	G2	E11	W2D	PUMP
Date Sampled	----------	3/06/2015	3/06/2015	3/06/2015	3/06/2015	3/06/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/06/2015	10/06/2015	10/06/2015	10/06/2015	10/06/2015
Date analysed	-	10/06/2015	10/06/2015	10/06/2015	10/06/2015	10/06/2015
Fluoride, F	mg/L	0.9	0.3	7.4	1,300	200
Total Cyanide	mg/L	0.69	<0.004	0.49	270	8.7
Free Cyanide in Water	mg/L	<0.4	<0.004	<0.004	<4	<0.08

Miscellaneous Inorganics				
Our Reference:	UNITS	129177-21	129177-22	129177-23
Your Reference	----------	QA100	QA101	QA300
Date Sampled	----------	3/06/2015	3/06/2015	4/06/2015
Type of sample		Water	Water	Water
Date prepared	-	10/06/2015	10/06/2015	10/06/2015
Date analysed	-	10/06/2015	10/06/2015	10/06/2015
Fluoride, F	mg/L	210	850	<0.1
Total Cyanide	mg/L	9.3	180	<0.004
Free Cyanide in Water	mg/L	<0.08	<4	<0.004

All metals in water - total						
Our Reference:	UNITS	129177-1	129177-2	129177-3	129177-4	129177-5
Your Reference	----------	N2	W5S	E4	W4S	W3D
Date Sampled	----------	3/06/2015	3/06/2015	3/06/2015	4/06/2015	4/06/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/06/2015	09/06/2015	09/06/2015	09/06/2015	09/06/2015
Date analysed	-	09/06/2015	09/06/2015	09/06/2015	09/06/2015	09/06/2015
Aluminium-Total	µg/L	3,400	7,000	49,000	2,200	810

All metals in water - total						
Our Reference:	UNITS	129177-6	129177-7	129177-8	129177-9	129177-10
Your Reference	----------	W3S	A7	W1S	W1D	W7M
Date Sampled	----------	4/06/2015	4/06/2015	4/06/2015	4/06/2015	3/06/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/06/2015	09/06/2015	09/06/2015	09/06/2015	09/06/2015
Date analysed	-	09/06/2015	09/06/2015	09/06/2015	09/06/2015	09/06/2015
Aluminium-Total	µg/L	4,400	2,700	1,200,000	4,000	32,000

All metals in water - total						
Our Reference:	UNITS	129177-11	129177-12	129177-13	129177-14	129177-15
Your Reference	----------	E5	E5D	W6D	W6S	N9
Date Sampled	----------	3/06/2015	3/06/2015	3/06/2015	3/06/2015	3/06/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/06/2015	09/06/2015	09/06/2015	09/06/2015	09/06/2015
Date analysed	-	09/06/2015	09/06/2015	09/06/2015	09/06/2015	09/06/2015
Aluminium-Total	µg/L	3,000	2,100	190	7,700	14,000

All metals in water - total						
Our Reference:	UNITS	129177-16	129177-17	129177-18	129177-19	129177-20
Your Reference	----------	N8	G2	E11	W2D	PUMP
Date Sampled	----------	3/06/2015	3/06/2015	3/06/2015	3/06/2015	3/06/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/06/2015	09/06/2015	09/06/2015	09/06/2015	09/06/2015
Date analysed	-	09/06/2015	09/06/2015	09/06/2015	09/06/2015	09/06/2015
Aluminium-Total	µg/L	23,000	2,000	2,500	190	120,000

All metals in water - total				
Our Reference:	UNITS	129177-21	129177-22	129177-23
Your Reference	----------	QA100	QA101	QA300
Date Sampled	----------	3/06/2015	3/06/2015	4/06/2015
Type of sample		Water	Water	Water
Date prepared	-	09/06/2015	09/06/2015	09/06/2015
Date analysed	-	09/06/2015	09/06/2015	09/06/2015
Aluminium-Total	µg/L	120,000	3,400	<10

Method ID	Methodology Summary
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			09/06/2015	129177-1	10/06/2015 || 10/06/2015	LCS-W1	10/06/2015
Date analysed	-			11/06/2015	129177-1	10/06/2015 || 10/06/2015	LCS-W1	11/06/2015
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	129177-1	7.9 || 8.1 || RPD: 2	LCS-W1	111%
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	129177-1	0.021 || 0.020 || RPD: 5	LCS-W1	91%
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	129177-1	<0.004 || <0.004	LCS-W1	104%
QUALITY CONTROL All metals in water - total	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			09/06/2015	129177-4	09/06/2015 || 09/06/2015	LCS-W1	09/06/2015
Date analysed	-			09/06/2015	129177-4	09/06/2015 || 09/06/2015	LCS-W1	09/06/2015
Aluminium-Total	µg/L	10	Metals-022 ICP-MS	<10	129177-4	2200 || 2300 || RPD: 4	LCS-W1	102%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	129177-11	10/06/2015 || 10/06/2015	129177-2	10/06/2015
Date analysed	-	129177-11	10/06/2015 || 10/06/2015	129177-2	11/06/2015
Fluoride, F	mg/L	129177-11	410 || 410 || RPD: 0	129177-2	#
Total Cyanide	mg/L	129177-11	69 || 70 || RPD: 1	129177-2	97%
Free Cyanide in Water	mg/L	129177-11	<0.8 || <0.8	129177-2	75%
QUALITY CONTROL All metals in water - total	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	129177-16	09/06/2015 || 09/06/2015	LCS-W2	09/06/2015
Date analysed	-	129177-16	09/06/2015 || 09/06/2015	LCS-W2	09/06/2015
Aluminium-Total	µg/L	129177-16	23000 || 29000 || RPD: 23	LCS-W2	97%
QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	129177-21	10/06/2015 || 10/06/2015	129177-22	10/06/2015
Date analysed	-	129177-21	10/06/2015 || 10/06/2015	129177-22	11/06/2015
Fluoride, F	mg/L	129177-21	210 || 210 || RPD: 0	129177-22	#
Total Cyanide	mg/L	129177-21	9.3 || 9.1 || RPD: 2	129177-22	114%
Free Cyanide in Water	mg/L	129177-21	<0.08 || <0.08	129177-22	103%
QUALITY CONTROL All metals in water - total	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	129177-17	09/06/2015
Date analysed	-	[NT]	[NT]	129177-17	09/06/2015
Aluminium-Total	µg/L	[NT]	[NT]	129177-17	110%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	LCS-W2	10/06/2015
Date analysed	-	[NT]	[NT]	LCS-W2	11/06/2015
Fluoride, F	mg/L	[NT]	[NT]	LCS-W2	111%
Total Cyanide	mg/L	[NT]	[NT]	LCS-W2	114%
Free Cyanide in Water	mg/L	[NT]	[NT]	LCS-W2	102%

Report Comments:

Fluoride's in water: # Percent recovery is not possible to report as the high concentration of analytes in the sample/s have caused interference.

Free Cyanide: PQL raised due to high dilution performed for total Cyanide result to be reportable within calibration range.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

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.

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: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

CHAIN OF CUSTODY - Client

ENVIROLAB SERVICES

Client: ENVIRON	**Client Project Name and Number:** AS130335
Project Mgr: Fiona Robinson	**PO No.:**
Sampler: Mark Tiedeman	**Envirolab Services Quote No. :**
Address: Level 2, Suite 19B 50 Glebe Road, The Junction NSW 2291	**Date results required:**
Email: mtiedeman@environcorp.com	**Or choose:** standard / 1 day / 2 day / 3 day
Phone: 02 4962 5444 **Fax:**	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*

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

Sample Information				Tests Required				Comments
Envirolab Sample ID	Client Sample ID	Date sampled	Type of sample	Soluble Fluoride	Free and Total Cyanide	Total Aluminium		Provide as much information about the sample as you can
1	N2	3/6/15	W	X	X	X		
2	W2S W5S	3/6/15		X	X	X		
3	E4	3/6/15		X	X	X		
4	W4S	4/6/15		X	X	X		
5	W3D	4/6/15		X	X	X		
6	W3S	4/6/15		X	X	X		
7	A7	4/6/15		X	X	X		
8	W1S	4/6/15		X	X	X		
9	W1D	4/6/15						Hold
10	W7M	3/6/15		X	X	X		
11	E5	3/6/15		X	X	X		
12	E5D	3/6/15		X	X	X		
13	W6D	3/6/15		X	X	X		
14	W6S	3/6/15		X	X	X		
15	N9	3/6/15		X	X	X		

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

Job No: 129177
Date Received: 5/6/15
Time Received: 12:00
Received by: PT
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company): ENVIRON	**Received by (company):** ES
Print Name: MARK TIEDEMAN	**Print Name:** 5/6/15 12:00
Date & Time: 4/6/15 14:15	**Date & Time:** PT
Signature:	**Signature:**

Samples Received: Cool or Ambient (circle one)
Temperature Recieved at: (if applicable)
Transported by: Hand delivered / courier
Page No: 1 of 2

CHAIN OF CUSTODY - Client

ENVIROLAB SERVICES

Client: ENVIRON	**Client Project Name and Number:** AS130355
Project Mgr: Fiona Robinson	**PO No.:**
Sampler: Mark Tiedeman	**Envirolab Services Quote No. :**
Address: Level 2, suite 19B 50 Glebe Road, The Junction NSW 2291	**Date results required:**
Email: mtiedeman@environcorp.com	**Or choose** standard / 1 day / 2 day / 3 day
Phone: 02 49 62 5449 **Fax:**	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*

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

Sample Information				Tests Required				Comments
Envirolab Sample ID 129177	Client Sample ID	Date sampled	Type of sample	Soluble Fluoride	Free and Total Cyanide	Total Aluminium		Provide as much information about the sample as you can
16	N8	3/6/15	W	X	X	X		
17	G2	3/6/15		X	X	X		
18	E11	3/6/15		X	X	X		
19	W2D	3/6/15		X	X	X		
20	Pump	3/6/15		X	X	X		
21	QA100	3/6/15		X	X	X		
22	QA101	3/6/15		X	X	X		
[illegible]	QA200	3/6/15		X	X	X		--- Forward to ALS
23	QA300 PT (QA301 in jars)	4/6/15		X	X	X		

Relinquished by (company): ENVIRON	**Received by (company):** ELS	**Samples Received:** Cool or Ambient (circle one)
Print Name: Mark Tiedeman	**Print Name:**	**Temperature Recieved at:** (if applicable)
Date & Time: 4/6/15 14:15	**Date & Time:** 8/6/15 PT	**Transported by:** Hand delivered / courier
Signature:	**Signature:**	**Page No:** 2 of 2

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

CERTIFICATE OF ANALYSIS 134015

Client:

Ramboll Environ Australia Pty Ltd
PO Box 560
North Sydney
NSW 2060

Attention: Natalie Gilbert, Kirsty Greenfield

Sample log in details:

Your Reference:	**AS130420**
No. of samples:	24 Waters
Date samples received / completed instructions received	09/09/15 / 09/09/15

This report supercedes (R00) due to the amendment to results Pump, W1D, QA100, QA101.
Initial results were reported in ug\L not as stated in the report as mg\L.

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: / Issue Date:	16/09/15 / 17/09/15
Date of Preliminary Report:	None Issued

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

Results Approved By:

Jacinta Hurst
Laboratory Manager

Miscellaneous Inorganics						
Our Reference:	UNITS	134015-1	134015-2	134015-3	134015-4	134015-5
Your Reference	----------	E5D	E5	W7M	PUMP	W2D
Date Sampled	----------	07/09/2015	07/09/2015	07/09/2015	07/09/2015	07/09/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/09/2015	09/09/2015	09/09/2015	09/09/2015	09/09/2015
Date analysed	-	09/09/2015	09/09/2015	09/09/2015	09/09/2015	09/09/2015
Fluoride, F	mg/L	14	350	660	680	1,300
Total Cyanide	mg/L	1.2	[NA]	100	110	290
Free Cyanide in Water	mg/L	<0.02	[NA]	<0.04	0.029	0.058

Miscellaneous Inorganics						
Our Reference:	UNITS	134015-6	134015-7	134015-8	134015-9	134015-10
Your Reference	----------	E4	W1S	W1D	W6D	N9
Date Sampled	----------	08/09/2015	08/09/2015	08/09/2015	07/09/2015	07/09/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/09/2015	09/09/2015	09/09/2015	09/09/2015	09/09/2015
Date analysed	-	09/09/2015	09/09/2015	09/09/2015	09/09/2015	09/09/2015
Fluoride, F	mg/L	280	38	3.5	0.1	25
Total Cyanide	mg/L	99	[NA]	0.77	<0.004	0.95
Free Cyanide in Water	mg/L	<0.04	[NA]	<0.02	<0.004	<0.02

Miscellaneous Inorganics						
Our Reference:	UNITS	134015-11	134015-12	134015-13	134015-14	134015-15
Your Reference	----------	N8	G2	E11	W5S	W5D
Date Sampled	----------	07/09/2015	07/09/2015	07/09/2015	07/09/2015	07/09/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/09/2015	09/09/2015	09/09/2015	09/09/2015	09/09/2015
Date analysed	-	09/09/2015	09/09/2015	09/09/2015	09/09/2015	09/09/2015
Fluoride, F	mg/L	0.3	0.3	110	70	0.4
Total Cyanide	mg/L	0.60	<0.004	9.4	3.0	0.005
Free Cyanide in Water	mg/L	<0.02	<0.004	<0.004	<0.02	<0.004

Miscellaneous Inorganics						
Our Reference:	UNITS	134015-16	134015-17	134015-18	134015-19	134015-20
Your Reference	----------	N2	A7	W3S	W3D	W4S
Date Sampled	----------	07/09/2015	08/09/2015	08/09/2015	08/09/2015	08/09/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	09/09/2015	09/09/2015	09/09/2015	09/09/2015	09/09/2015
Date analysed	-	09/09/2015	09/09/2015	09/09/2015	09/09/2015	09/09/2015
Fluoride, F	mg/L	1.4	400	200	0.3	400
Total Cyanide	mg/L	0.050	66	28	0.008	34
Free Cyanide in Water	mg/L	<0.004	<0.02	<0.02	<0.004	<0.04

Miscellaneous Inorganics					
Our Reference:	UNITS	134015-21	134015-22	134015-23	134015-24
Your Reference	----------	W4D	QA100	QA101	QA300
Date Sampled	----------	08/09/2015	08/09/2015	08/09/2015	08/09/2015
Type of sample		Water	Water	Water	Water
Date prepared	-	09/09/2015	09/09/2015	09/09/2015	09/09/2015
Date analysed	-	09/09/2015	09/09/2015	09/09/2015	09/09/2015
Fluoride, F	mg/L	0.2	670	13	<0.1
Total Cyanide	mg/L	[NA]	100	1.9	<0.004
Free Cyanide in Water	mg/L	[NA]	0.027	<0.004	<0.004

All metals in water - total						
Our Reference:	UNITS	134015-1	134015-3	134015-4	134015-5	134015-6
Your Reference	----------	E5D	W7M	PUMP	W2D	E4
Date Sampled	----------	07/09/2015	07/09/2015	07/09/2015	07/09/2015	08/09/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Date analysed	-	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Aluminium-Total	µg/L	2,100	8,700	610,000	30	53,000

All metals in water - total						
Our Reference:	UNITS	134015-8	134015-9	134015-10	134015-11	134015-12
Your Reference	----------	W1D	W6D	N9	N8	G2
Date Sampled	----------	08/09/2015	07/09/2015	07/09/2015	07/09/2015	07/09/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Date analysed	-	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Aluminium-Total	µg/L	950	740	22,000	5,300	4,100

All metals in water - total						
Our Reference:	UNITS	134015-13	134015-14	134015-15	134015-16	134015-17
Your Reference	----------	E11	W5S	W5D	N2	A7
Date Sampled	----------	07/09/2015	07/09/2015	07/09/2015	07/09/2015	08/09/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Date analysed	-	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Aluminium-Total	µg/L	11,000	31,000	990	2,400	610

All metals in water - total						
Our Reference:	UNITS	134015-18	134015-19	134015-20	134015-22	134015-23
Your Reference	----------	W3S	W3D	W4S	QA100	QA101
Date Sampled	----------	08/09/2015	08/09/2015	08/09/2015	08/09/2015	08/09/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Date analysed	-	10/09/2015	10/09/2015	10/09/2015	10/09/2015	10/09/2015
Aluminium-Total	µg/L	24,000	40	13,000	6,200	2,100

All metals in water - total		
Our Reference:	UNITS	134015-24
Your Reference	----------	QA300
Date Sampled	----------	08/09/2015
Type of sample		Water
Date prepared	-	10/09/2015
Date analysed	-	10/09/2015
Aluminium-Total	µg/L	<10

Method ID	Methodology Summary
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			09/09/2015	134015-1	09/09/2015 || 09/09/2015	LCS-W1	09/09/2015
Date analysed	-			09/09/2015	134015-1	09/09/2015 || 09/09/2015	LCS-W1	09/09/2015
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	134015-1	14 || 13 || RPD: 7	LCS-W1	97%
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	134015-1	1.2 || 1.1 || RPD: 9	LCS-W1	115%
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	134015-1	<0.02 || <0.02	LCS-W1	98%
QUALITY CONTROL All metals in water - total	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			10/09/2015	134015-1	10/09/2015 || 10/09/2015	LCS-W2	10/09/2015
Date analysed	-			10/09/2015	134015-1	10/09/2015 || 10/09/2015	LCS-W2	10/09/2015
Aluminium-Total	µg/L	10	Metals-022 ICP-MS	<10	134015-1	2100 || 2200 || RPD: 5	LCS-W2	107%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	134015-11	09/09/2015 || 09/09/2015	LCS-W2	09/09/2015
Date analysed	-	134015-11	09/09/2015 || 09/09/2015	LCS-W2	09/09/2015
Fluoride, F	mg/L	134015-11	0.3 || 0.3 || RPD: 0	LCS-W2	103%
Total Cyanide	mg/L	134015-11	0.60 || 0.57 || RPD: 5	LCS-W2	113%
Free Cyanide in Water	mg/L	134015-11	<0.02 || <0.02	LCS-W2	101%
QUALITY CONTROL All metals in water - total	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	134015-13	10/09/2015 || 10/09/2015	134015-3	10/09/2015
Date analysed	-	134015-13	10/09/2015 || 10/09/2015	134015-3	10/09/2015
Aluminium-Total	µg/L	134015-13	11000 || 11000 || RPD: 0	134015-3	#
QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	134015-21	09/09/2015 || 09/09/2015	134015-2	09/09/2015
Date analysed	-	134015-21	09/09/2015 || 09/09/2015	134015-2	09/09/2015
Fluoride, F	mg/L	134015-21	0.2 || 0.2 || RPD: 0	134015-2	#
Total Cyanide	mg/L	[NT]	[NT]	[NR]	[NR]
Free Cyanide in Water	mg/L	[NT]	[NT]	[NR]	[NR]
QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	134015-22	09/09/2015
Date analysed	-	[NT]	[NT]	134015-22	09/09/2015
Fluoride, F	mg/L	[NT]	[NT]	134015-22	#
Total Cyanide	mg/L	[NT]	[NT]	134015-22	#
Free Cyanide in Water	mg/L	[NT]	[NT]	134015-22	84%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	134015-3	09/09/2015
Date analysed	-	[NT]	[NT]	134015-3	09/09/2015
Fluoride, F	mg/L	[NT]	[NT]	[NR]	[NR]
Total Cyanide	mg/L	[NT]	[NT]	134015-3	#
Free Cyanide in Water	mg/L	[NT]	[NT]	134015-3	96%

Report Comments:

METALS_WLL_ALL_T: # 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.

Free Cyanide:The PQL has been raised due to the sample matrix requiring dilution.

Total Cyanide:# 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.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

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.

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: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

ENVIROLAB GROUP

Client: Ramboll Environ
Contact person: Natalie Gilbert
Project Mgr: Kirsty Greenfield
Sampler: Mark Tiedeman
Address: Level 2 Suite 19B, 50 Glebe Road,
The Junction
Phone: (02) 49625444 **Mob:** 0410 822 410
Fax:
Email: mtiedeman@environcorp.com; kgreenfield@environcorp.com

Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - AS130420
PO No.:
Envirolab Quote No. :
Date results required:
Or choose: standard / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharge applies
Lab comments: Highly contaminated

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	Comments
1	E5D		7/9/15	WATER	X	X	X	X	
2	E5		7/9/15	WATER	X				
	~~W7S~~		/9/15	WATER					
3	W7M		7/9/15	WATER	X	X	X	X	
4	PUMP		7/9/15	WATER	X	X	X	X	
5	W2D		7/9/15	WATER	X	X	X	X	
	~~W2S~~		/9/15	WATER					
6	E4		8/9/15	WATER	X	X	X	X	
7	W1S		8/9/15	WATER	X				
8	W1D		8/9/15	WATER	X	X	X	X	
	~~W6S~~		/9/15	WATER					
9	W6D		7/9/15	WATER	X	X	X	X	
10	N9		7/9/15	WATER	X	X	X	X	

Provide as much information about the sample as you can

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

Job No: 134015
Date Received: 9/9/15
Time Received: 10:00
Received by: PT
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company): Ramboll Environ
Print Name: M. Tiedeman
Date & Time:
Signature:

Received by (company): EL
Print Name: PT
Date & Time: ~~3/9~~ 9/9/15 10:00
Signature: PT

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

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll Environ	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - AS130420
Contact person: Mark Tiedeman	**PO No.:**
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**
Sampler: Mark Tiedeman	**Date results required:**
Address: Level 2 Suite 19B, 50 Glebe Road, The Junction	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: (02) 49625444 **Mob:** 0410 822 410	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:** Highly contaminated
Email: mtiedeman@environcorp.com; kgreenfield@environcorp.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											Provide as much information about the sample as you can
11	N8		7/9/15	WATER	X	X	X	X											
12	G2		7/9/15	WATER	X	X	X	X											
13	E11		7/9/15	WATER	X	X	X	X											
14	W5S		7/9/15	WATER	X	X	X	X											
15	W5D		7/9/15	WATER	X	X	X	X											
16	N2		7/9/15	WATER	X	X	X	X											
17	A7		8/9/15	WATER	X	X	X	X											
18	W3S		8/9/15	WATER	X	X	X	X											
19	W3D		8/9/15	WATER	X	X	X	X											
~~-~~	~~W3SA~~		/9/15	WATER															
20	W4S		8/9/15	WATER	X	X	X	X											
21	W4D		8/9/15	WATER	X														
22	QA101		8/9/15	WATER	X	X	X	X											134015

Relinquished by (company):	Ramboll Environ	**Received by (company):** EL	
Print Name:	M. Tiedeman	**Print Name:** PT	
Date & Time:	/9/15	**Date & Time:** 9/9/15 10:00	
Signature:		**Signature:** PT	

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

White - Lab copy / Blue - Client copy / Pink - Retain in Book

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll Environ	**Client Project Name / Number / Site etc (ie report title):** Hydro Groundwater Plume Monitoring - AS130420
Contact person: Mark Tiedeman	**PO No.:**
Project Mgr: Kirsty Greenfield	**Envirolab Quote No. :**
Sampler: Mark Tiedeman	**Date results required:**
Address: Level 2 Suite 19B, 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:** 0410 822 410	**Lab comments:** Highly contaminated
Fax:	
Email: mtiedeman@environcorp.com; kgreenfield@environcorp.com	

Envirolab Services
12 Ashley St, Chatswood, NSW 2067
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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										Provide as much information about the sample as you can
23	QA101		8/9/15	WATER	X	X	X	X										
24	~~QA200 QB1~~		8/9/15	WATER	X	X	X	X										
—	QA200		8/9/15	WATER	X	X	X	X										Forward to ALS
																		134015

Relinquished by (company):	Ramboll Environ	**Received by (company):** ELS
Print Name:	M. Tiedeman	**Print Name:** PT
Date & Time:	/9/15	**Date & Time:** 9/9/15 10:00
Signature:		**Signature:** PT

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

White - Lab copy / Blue - Client copy / Pink - Retain in Book

12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS 138581

Client:

Ramboll Environ Australia Pty Ltd
PO Box 560
North Sydney
NSW 2060

Attention: Kirsty Greenfield

Sample log in details:

Your Reference:	**AS130420**		
No. of samples:	20 waters		
Date samples received / completed instructions received	04/12/15	/	04/12/15

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: / Issue Date:	11/12/15	/	11/12/15
Date of Preliminary Report:	Not Issued		

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

Results Approved By:

Jacinta Hurst
Laboratory Manager

ACCREDITED FOR TECHNICAL COMPETENCE

Miscellaneous Inorganics						
Our Reference:	UNITS	138581-1	138581-2	138581-3	138581-4	138581-5
Your Reference	----------	A7	W3S	W2D	PUMP	W7M
Date Sampled	----------	01/12/2015	01/12/2015	01/12/2015	01/12/2015	01/12/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Date analysed	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Total Cyanide	mg/L	62	19	290	48	83
Free Cyanide in Water	mg/L	0.19	0.023	0.88	0.10	0.21
Fluoride, F	mg/L	320	160	1,300	360	540

Miscellaneous Inorganics						
Our Reference:	UNITS	138581-6	138581-7	138581-8	138581-9	138581-10
Your Reference	----------	E5D	W6D	W6S	N9	N8
Date Sampled	----------	01/12/2015	01/12/2015	01/12/2015	01/12/2015	01/12/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Date analysed	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Total Cyanide	mg/L	3.0	0.009	19	1.2	0.63
Free Cyanide in Water	mg/L	<0.004	<0.004	0.058	<0.004	0.005
Fluoride, F	mg/L	16	0.2	180	9.0	0.4

Miscellaneous Inorganics						
Our Reference:	UNITS	138581-11	138581-12	138581-13	138581-14	138581-15
Your Reference	----------	G2	E11	N2	W5D	W1D
Date Sampled	----------	01/12/2015	01/12/2015	01/12/2015	01/12/2015	01/12/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Date analysed	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Total Cyanide	mg/L	<0.004	7.4	0.032	0.008	0.71
Free Cyanide in Water	mg/L	<0.004	0.033	<0.004	<0.004	<0.004
Fluoride, F	mg/L	0.3	96	1.4	0.5	2.6

Miscellaneous Inorganics					
Our Reference:	UNITS	138581-16	138581-17	138581-18	138581-19
Your Reference	----------	E4	QA101	QA201	QA301
Date Sampled	----------	01/12/2015	01/12/2015	01/12/2015	02/12/2015
Type of sample		Water	Water	Water	Water
Date prepared	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Date analysed	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Total Cyanide	mg/L	35	300	290	<0.004
Free Cyanide in Water	mg/L	0.032	0.67	0.70	<0.004
Fluoride, F	mg/L	300	1,200	1,300	<0.1

HM in water - total						
Our Reference:	UNITS	138581-1	138581-2	138581-3	138581-4	138581-5
Your Reference	----------	A7	W3S	W2D	PUMP	W7M
Date Sampled	----------	01/12/2015	01/12/2015	01/12/2015	01/12/2015	01/12/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Date analysed	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Aluminium-Total	µg/L	720	93,000	3,500	97,000	7,800

HM in water - total						
Our Reference:	UNITS	138581-6	138581-7	138581-8	138581-9	138581-10
Your Reference	----------	E5D	W6D	W6S	N9	N8
Date Sampled	----------	01/12/2015	01/12/2015	01/12/2015	01/12/2015	01/12/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Date analysed	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Aluminium-Total	µg/L	4,300	720	22,000	890	3,400

HM in water - total						
Our Reference:	UNITS	138581-11	138581-12	138581-13	138581-14	138581-15
Your Reference	----------	G2	E11	N2	W5D	W1D
Date Sampled	----------	01/12/2015	01/12/2015	01/12/2015	01/12/2015	01/12/2015
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Date analysed	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Aluminium-Total	µg/L	1,800	2,700	9,100	540	400

HM in water - total					
Our Reference:	UNITS	138581-16	138581-17	138581-18	138581-19
Your Reference	----------	E4	QA101	QA201	QA301
Date Sampled	----------	01/12/2015	01/12/2015	01/12/2015	02/12/2015
Type of sample		Water	Water	Water	Water
Date prepared	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Date analysed	-	07/12/2015	07/12/2015	07/12/2015	07/12/2015
Aluminium-Total	µg/L	18,000	3,000	2,800	20

Method ID	Methodology Summary
Inorg-014	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA latest edition, 4500-F-C.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.

Client Reference: AS130420

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			07/12/2015	138581-1	07/12/2015 || 07/12/2015	LCS-W1	07/12/2015
Date analysed	-			07/12/2015	138581-1	07/12/2015 || 07/12/2015	LCS-W1	07/12/2015
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	138581-1	62 || 62 || RPD: 0	LCS-W1	108%
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	138581-1	0.19 || 0.19 || RPD: 0	LCS-W1	114%
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	138581-1	320 || 320 || RPD: 0	LCS-W1	101%
QUALITY CONTROL HM in water - total	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			07/12/2015	138581-7	07/12/2015 || 07/12/2015	LCS-W1	07/12/2015
Date analysed	-			07/12/2015	138581-7	07/12/2015 || 07/12/2015	LCS-W1	07/12/2015
Aluminium-Total	µg/L	10	Metals-022 ICP-MS	<10	138581-7	720 || 690 || RPD: 4	LCS-W1	103%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	138581-11	07/12/2015 || 07/12/2015	138581-2	07/12/2015
Date analysed	-	138581-11	07/12/2015 || 07/12/2015	138581-2	07/12/2015
Total Cyanide	mg/L	138581-11	<0.004 || <0.004	138581-2	#
Free Cyanide in Water	mg/L	138581-11	<0.004 || <0.004	138581-2	#
Fluoride, F	mg/L	138581-11	0.3 || 0.3 || RPD: 0	138581-2	108%
QUALITY CONTROL HM in water - total	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	138581-14	07/12/2015 || 07/12/2015	LCS-W2	07/12/2015
Date analysed	-	138581-14	07/12/2015 || 07/12/2015	LCS-W2	07/12/2015
Aluminium-Total	µg/L	138581-14	540 || 590 || RPD: 9	LCS-W2	108%
QUALITY CONTROL HM in water - total	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	138581-16	07/12/2015
Date analysed	-	[NT]	[NT]	138581-16	07/12/2015
Aluminium-Total	µg/L	[NT]	[NT]	138581-16	103%

Report Comments:

Total\Free Cyanide:# 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.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NR: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

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.

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: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: Ramboll Environ	**Client Project Name / Number / Site etc (ie report title):**
Contact person: Kirsty Greenfield	
Project Mgr: Mark Tiedeman	**PO No.:** AS130420
Sampler: Mark Tiedeman	**Envirolab Quote No. :**
Address: Level 2, Suite 19B	**Date results required:**
50 Glebe Road, The Junction NSW 2291	**Or choose:** standard / same day / 1 day / 2 day / 3 day
Phone: 02 49625444 **Mob:**	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*
Fax:	**Lab comments:**
Email: 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	Soluable Fluoride	Total Cyanide	Free Cyanide	Total Aluminium											Provide as much information about the sample as you can
1	A7		######		X	X	X	X											
2	W3S		######		X	X	X	X											
	~~W2S~~		######		X	X	X	X											As from Email.
3	W2D		######		X	X	X	X											
4	PUMP		######		X	X	X	X											
5	W7M		######		X	X	X	X											
6	E5D		######		X	X	X	X											
7	W6D		######		X	X	X	X											
8	W6S		######		X	X	X	X											
9	N9		######		X	X	X	X											
10	N8		######		X	X	X	X											
11	G2		######		X	X	X	X											
12	E11		######		X	X	X	X											

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

Job No: 138581
Date Received: 1300 · 4·12·15·
Time Received:
Received by: CB.
Temp: ~~Cool~~/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company):	**Received by (company):** ELS.
Print Name:	**Print Name:** CALUM BONSER.
Date & Time:	**Date & Time:** 1300 4·12·15.
Signature:	**Signature:** CB.

Lab use only:
Samples Received: (Cool) or Ambient (circle one)
Temperature Received at: 16.9 (if applicable)
Transported by: Hand delivered / courier

White - Lab copy / Blue - Client copy / Pink - Retain in Book

Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Soluable Fluoride	Total Cyanide	Free Cyanide	Total Aluminium					
~~13~~ 12	E11		01/12/2015		x	x	x	x					
~~14~~ 13	N2		01/12/2015		x	x	x	x					
~~15~~ 14	W5D		01/12/2015		x	x	x	x					
~~16~~ 15	W1D		02/12/2015		x	x	x	x					
~~17~~ 16	E4		02/12/2015		x	x	x	x					
~~18~~ ~~18~~	~~QA100~~		01/12/2015		x	x	x	x					As from email
~~18~~ ~~18~~ 17	QA101		01/12/2015		x	x	x	x					
~~19~~ ~~19~~ 18	QA201		01/12/2015		x	x	x	x					
20 19	QA300		02/12/2015		x	x	x	x					

CHAIN OF CUSTODY - Client

ENVIROLAB SERVICES

Envirolab

Client: ENVIRON	**Client Project Name and Number:** AS130355
Project Mgr: Fiona Robinson	**PO No.:**
Sampler: Mark Tiedeman	**Envirolab Services Quote No. :**
Address: Level 2, suite 19B 50 Glebe Road, The Junction NSW 2291	**Date results required:**
Email: mtiedeman@environcorp.com	**Or choose:** standard / 1 day / 2 day / 3 day
Phone: 02 49 62 5449 **Fax:**	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*

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 Sample ID	Client Sample ID	Date sampled	Type of sample	Soluble Fluoride	Free and Total Cyanide	Total Aluminium	Comments
16	N8	3/6/15	W	X	X	X	
17	G2	3/6/15		X	X	X	
18	E11	3/6/15		X	X	X	
19	W2D	3/6/15		X	X	X	
20	PUMP	3/6/15		X	X	X	
21	QA100	3/6/15		X	X	X	
22	QA101	3/6/15		X	X	X	
[redacted]	QA200	3/6/15		X	X	X	Forward to ALS
23	QA300 PT (QA301 in jars)	4/6/15		X	X	X	

Tests Required

Provide as much information about the sample as you can

Environmental Division
Sydney
Work Order Reference
ES1523553
Telephone : +61-2-8784 8555

Relinquished by (company): ENVIRON	ELS	**Received by (company):** ELS
Print Name: Mark Tiedeman	Pralistha	**Print Name:**
Date & Time: 4/6/15 14:15	9/6/15 11:50	**Date & Time:** 8/6/15 PT
Signature:	PT	**Signature:**

Samples Received: Cool or Ambient (circle one)
Temperature Recieved at: (if applicable)
Transported by: Hand delivered / courier
Page No: 2 of 2

Frank ALS 9/6/15 1530

CERTIFICATE OF ANALYSIS

Work Order	: **ES1503709**	Page	: 1 of 3
Client	: **ENVIRON AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Contact	: Client Services
Address	: PO BOX 564 MAITLAND NSW, AUSTRALIA 2320	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: kgreenfield@environcorp.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 49344354	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 49344359	Facsimile	: +61-2-8784 8500
Project	: AS130420	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 18-FEB-2015
Sampler	: NE	Issue Date	: 25-FEB-2015
Site	: ----		
		No. of samples received	: 1
Quote number	: EN/072/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics

General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	QA2	----	----	----	----
			Client sampling date / time	17-FEB-2015 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1503709-001	----	----	----	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	10	µg/L	**1620**	----	----	----	----
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	**0.4**	----	----	----	----

QUALITY CONTROL REPORT

Work Order	: **ES1503709**	Page	: 1 of 5
Client	: **ENVIRON AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Contact	: Client Services
Address	: PO BOX 564 MAITLAND NSW, AUSTRALIA 2320	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: kgreenfield@environcorp.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 49344354	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 49344359	Facsimile	: +61-2-8784 8500
Project	: AS130420	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-FEB-2015
Sampler	: NE	Issue Date	: 25-FEB-2015
Order number	: ----		
		No. of samples received	: 1
Quote number	: EN/072/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics

General Comments

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

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

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

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

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 (%)*
EG020T: Total Metals by ICP-MS (QC Lot: 3829910)									
ES1503461-074	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES1503720-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.24	0.24	0.0	0% - 20%
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 3830496)									
ES1503710-001	Anonymous	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 3830497)									
ES1503710-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 3830613)									
EW1500614-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.4	0.2	55.7	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
EG020T: Total Metals by ICP-MS (QCLot: 3829910)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	102	81	121
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 3830496)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	108	82	120
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3830497)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	----	0.2 mg/L	89.0	79	125
				<0.004	0.2 mg/L	101	70	124
EK040P: Fluoride by PC Titrator (QCLot: 3830613)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5.0 mg/L	95.4	75	119

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: 3830496)							
ES1503710-001	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	112	70	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3830497)							
ES1503710-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	104	70	130
EK040P: Fluoride by PC Titrator (QCLot: 3830613)							
ES1503696-001	Anonymous	EK040P: Fluoride	16984-48-8	5.0 mg/L	101	70	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are 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) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 3830496)										
ES1503710-001	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	112	----	70	130	----	----

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 3830497)										
ES1503710-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	104	----	70	130	----	----
EK040P: Fluoride by PC Titrator (QCLot: 3830613)										
ES1503696-001	Anonymous	EK040P: Fluoride	16984-48-8	5.0 mg/L	101	----	70	130	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1503709**	Page	: 1 of 5
Client	: ENVIRON AUSTRALIA PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Contact	: Client Services
Address	: PO BOX 564 MAITLAND NSW, AUSTRALIA 2320	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: kgreenfield@environcorp.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 49344354	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 49344359	Facsimile	: +61-2-8784 8500
Project	: AS130420	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-FEB-2015
Sampler	: NE	Issue Date	: 25-FEB-2015
Order number	: ----		
		No. of samples received	: 1
Quote number	: EN/072/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with recommended holding times (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
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
QA2	**17-FEB-2015**	**19-FEB-2015**	16-AUG-2015	✓	**19-FEB-2015**	16-AUG-2015	✓
EK025SF: Free CN by Segmented Flow Analyser							
White Plastic Bottle-NaOH (EK025SF)							
QA2	**17-FEB-2015**	**---**	03-MAR-2015	----	**19-FEB-2015**	03-MAR-2015	✓
EK026SF: Total CN by Segmented Flow Analyser							
White Plastic Bottle-NaOH (EK026SF)							
QA2	**17-FEB-2015**	**---**	03-MAR-2015	----	**19-FEB-2015**	03-MAR-2015	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
QA2	**17-FEB-2015**	**---**	17-MAR-2015	----	**19-FEB-2015**	17-MAR-2015	✓

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)							
Fluoride by PC Titrator	EK040P	1	5	**20.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	3	**33.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	1	5	**20.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Fluoride by PC Titrator	EK040P	1	5	**20.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	3	**33.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	2	5	**40.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Fluoride by PC Titrator	EK040P	1	5	**20.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	3	**33.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	1	5	**20.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Fluoride by PC Titrator	EK040P	1	5	**20.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	3	**33.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	1	5	**20.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

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
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 21st ed., 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 O. 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 21st ed., 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	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)

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW 846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

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

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

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

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com

PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townesville.environmental@alsglobal.com

WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: ENVIRON	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☑ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE: HUNTER		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes (No) N/A
PROJECT: AS13C420 PROJECT NO.:	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes (No) N/A
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C 19.2
PROJECT MANAGER: K. Greenfield	CONTACT PH:	OF: 1 2 3 4 5 6 7	Other comment:
SAMPLER: N. Gilbert	SAMPLER MOBILE:		
COC Emailed to ALS? (YES / (NO)	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed): ngilbert@environcorp.com			
Email Invoice to (will default to PM if no other addresses are listed): kgreenfield@environcorp.com			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
N Gilbert	Marli Spencer		Rany
DATE/TIME: 10.25am 18/2/15	DATE/TIME: 18/02/15 10:28AM	DATE/TIME:	DATE/TIME: 18/2 19:15

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Soluble fluoride	Total cyanide	Free cyanide	total Aluminium					Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	QA2	17/2/15	W		1	X	X	X	X					
	QA3		W		1									
	QA4		W		1									

TOTAL

Environmental Division
Sydney
Work Order
ES1503709

Telephone : +61-2-8784 8555

E-MAILED

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

CERTIFICATE OF ANALYSIS

Work Order	: **ES1523553**	Page	: 1 of 2
Client	: **ENVIRON AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: FIONA ROBINSON	Contact	:
Address	: PO BOX 560 NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: frobinson@environcorp.com.au	E-mail	:
Telephone	: +61 02 49344354	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 49344359	Facsimile	: +61-2-8784 8500
Project	: AS130355	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 09-Jun-2015 15:30
C-O-C number	: ----	Date Analysis Commenced	: 09-Jun-2015
Sampler	: ----	Issue Date	: 16-Jun-2015 12:25
Site	: ----		
		No. of samples received	: 1
Quote number	: ----	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics

General Comments

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

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

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

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

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

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.

- Poor spike recovery for (TEST NAME) due to matrix interferences(confirmed by re-analysis).
- Metals LOR for particular sample(s) raised due to high TDS content.
- EK025SF:LOR raised for Free Cyanide analysis on sample ID(QA200) due to sample matrix.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**QA200**	----	----	----	----
				Client sampling date / time	[03-Jun-2015]	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES1523553-001**	--------	--------	--------	--------
					Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**3.42**	----	----	----	----
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.040	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		**107**	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**895**	----	----	----	----

QUALITY CONTROL REPORT

Work Order	: **ES1523553**	Page	: 1 of 4
Client	: **ENVIRON AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: FIONA ROBINSON	Contact	:
Address	: PO BOX 560 NORTH SYDNEY NSW, AUSTRALIA 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: frobinson@environcorp.com.au	E-mail	:
Telephone	: +61 02 49344354	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 49344359	Facsimile	: +61-2-8784 8500
Project	: AS130355	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 09-Jun-2015
C-O-C number	: ----	Date Analysis Commenced	: 09-Jun-2015
Sampler	: ----	Issue Date	: 16-Jun-2015
Site	: ----	No. of samples received	: 1
Quote number	: ----	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

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

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020T: Total Metals by ICP-MS (QC Lot: 122706)									
ES1523500-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	65.0	65.4	0.706	0% - 20%
ES1523500-011	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	1.11	1.17	5.44	0% - 20%
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 126200)									
ES1523553-001	QA200	EK025SF: Free Cyanide	----	0.004	mg/L	<0.040	<0.040	0.00	No Limit
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 126199)									
ES1523560-008	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	0.021	0.022	5.13	No Limit
ES1523504-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	233	234	0.428	0% - 20%
EK040P: Fluoride by PC Titrator (QC Lot: 121244)									
ES1523553-001	QA200	EK040P: Fluoride	16984-48-8	0.1	mg/L	895	920	2.75	0% - 50%

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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				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
EG020T: Total Metals by ICP-MS (QCLot: 122706)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	99.0	81	121
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 126200)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	104	70	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 126199)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	112	70	130
EK040P: Fluoride by PC Titrator (QCLot: 121244)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	111	75	119

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: 126200)							
ES1523553-001	QA200	EK025SF: Free Cyanide	----	0.2 mg/L	87.0	70	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 126199)							
ES1523504-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	# Not Determined	70	130
EK040P: Fluoride by PC Titrator (QCLot: 121244)							
ES1523553-001	QA200	EK040P: Fluoride	16984-48-8	5 mg/L	# Not Determined	70	130

QA/QC Compliance Assessment for DQO Reporting

Work Order	: **ES1523553**	Page	: 1 of 4
Client	: **ENVIRON AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: FIONA ROBINSON	Telephone	: +61-2-8784 8555
Project	: AS130355	Date Samples Received	: 09-Jun-2015
Site	: ----	Issue Date	: 16-Jun-2015
Sampler	: ----	No. of samples received	: 1
Order number	: ----	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK026SF: Total CN by Segmented Flow Analyser	ES1523504--001	Anonymous	**Total Cyanide**	57-12-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EK040P: Fluoride by PC Titrator	ES1523553--001	QA200	**Fluoride**	16984-48-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Analysis Holding Time Compliance

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
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T) QA200	**03-Jun-2015**	**11-Jun-2015**	30-Nov-2015	✓	**11-Jun-2015**	30-Nov-2015	✓
EK025SF: Free CN by Segmented Flow Analyser							
White Plastic Bottle-NaOH (EK025SF) QA200	**03-Jun-2015**	**----**	----	----	**15-Jun-2015**	17-Jun-2015	✓
EK026SF: Total CN by Segmented Flow Analyser							
White Plastic Bottle-NaOH (EK026SF) QA200	**03-Jun-2015**	**----**	----	----	**15-Jun-2015**	17-Jun-2015	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P) QA200	**03-Jun-2015**	**----**	----	----	**09-Jun-2015**	01-Jul-2015	✓

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)							
Fluoride by PC Titrator	EK040P	1	5	**20.00**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	2	12	**16.67**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	2	19	**10.53**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Fluoride by PC Titrator	EK040P	1	5	**20.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	2	12	**16.67**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	19	**5.26**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Fluoride by PC Titrator	EK040P	1	5	**20.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	1	12	**8.33**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	19	**5.26**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Fluoride by PC Titrator	EK040P	1	5	**20.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	1	12	**8.33**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	19	**5.26**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

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
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 O. 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	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)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1530839**	Page	: 1 of 2
Client	: **RAMBOLL ENVIRON**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Contact	:
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
E-mail	: kgreenfield@environcorp.com.au	E-mail	:
Telephone	: +61 02 49344354	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 49344359	Facsimile	: +61-2-8784 8500
Project	: AS130420-HYDRO GROUNDWATER PLUME MONITORING	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	:	Date Samples Received	: 10-Sep-2015 15:30
C-O-C number	: ----	Date Analysis Commenced	: 14-Sep-2015
Sampler	: MARK TIEDEMAN	Issue Date	: 17-Sep-2015 13:30
Site	: ----		
		No. of samples received	: 1
Quote number	: ----	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Raymond Commodore	Instrument Chemist	Sydney Inorganics

General Comments

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

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

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

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

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

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.

- EG020/ED093: LOR's have been raised due to matrix interference. (High Total Dissolved Solids)
- EK025SF: LOR raised for Free Cyanide due to sample matrix.

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**QA200**	----	----	----	----
				Client sampling date / time	[08-Sep-2015]	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES1530839-001**	--------	--------	--------	--------
					Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**2.27**	----	----	----	----
EK025SF: Free CN by Segmented Flow Analyser									
Free Cyanide	----	0.004	mg/L		<0.040	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		**56.9**	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**648**	----	----	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1530839**	Page	: 1 of 4
Client	: **RAMBOLL ENVIRON**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Contact	:
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
E-mail	: kgreenfield@environcorp.com.au	E-mail	:
Telephone	: +61 02 49344354	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 49344359	Facsimile	: +61-2-8784 8500
Project	: AS130420-HYDRO GROUNDWATER PLUME MONITORING	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	:	Date Samples Received	: 10-Sep-2015
C-O-C number	: ----	Date Analysis Commenced	: 14-Sep-2015
Sampler	: MARK TIEDEMAN	Issue Date	: 17-Sep-2015
Site	: ----	No. of samples received	: 1
Quote number	: ----	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

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

NATA WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Raymond Commodore	Instrument Chemist	Sydney Inorganics

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020T: Total Metals by ICP-MS (QC Lot: 213420)									
ES1530672-001	Anonymous	EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.10	<0.10	0.00	No Limit
EK025SF: Free CN by Segmented Flow Analyser (QC Lot: 212859)									
ES1530955-001	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: 212860)									
ES1530955-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 213262)									
ES1530713-003	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	1.2	1.8	41.1	0% - 50%
ES1530865-003	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.4	0.4	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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				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
EG020T: Total Metals by ICP-MS (QCLot: 213420)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	95.8	81	121
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 212859)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	120	70	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 212860)								
EK026SF: Total Cyanide	57-12-5	0.004	mg/L	<0.004	0.2 mg/L	111	70	130
EK040P: Fluoride by PC Titrator (QCLot: 213262)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	80.4	75	119

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: 212859)							
ES1530955-001	Anonymous	EK025SF: Free Cyanide	----	0.2 mg/L	80.0	70	130
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 212860)							
ES1530955-001	Anonymous	EK026SF: Total Cyanide	57-12-5	0.2 mg/L	80.4	70	130
EK040P: Fluoride by PC Titrator (QCLot: 213262)							
ES1530713-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	85.6	70	130

ALS Environmental

QA/QC Compliance Assessment for DQO Reporting

Work Order	: **ES1530839**	Page	: 1 of 4
Client	: **RAMBOLL ENVIRON**	Laboratory	: Environmental Division Sydney
Contact	: KIRSTY GREENFIELD	Telephone	: +61-2-8784 8555
Project	: AS130420-HYDRO GROUNDWATER PLUME MONITORING	Date Samples Received	: 10-Sep-2015
Site	: ----	Issue Date	: 17-Sep-2015
Sampler	: MARK TIEDEMAN	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)					
Total Metals by ICP-MS - Suite A	0	7	0.00	5.00	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Analysis Holding Time Compliance

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
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)							
QA200	**08-Sep-2015**	**15-Sep-2015**	06-Mar-2016	✓	**16-Sep-2015**	06-Mar-2016	✓
EK025SF: Free CN by Segmented Flow Analyser							
White Plastic Bottle-NaOH (EK025SF)							
QA200	**08-Sep-2015**	**----**	----	----	**14-Sep-2015**	22-Sep-2015	✓
EK026SF: Total CN by Segmented Flow Analyser							
White Plastic Bottle-NaOH (EK026SF)							
QA200	**08-Sep-2015**	**----**	----	----	**14-Sep-2015**	22-Sep-2015	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
QA200	**08-Sep-2015**	**----**	----	----	**14-Sep-2015**	06-Oct-2015	✓

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)							
Fluoride by PC Titrator	EK040P	2	11	**18.18**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	8	**12.50**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	1	8	**12.50**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	7	**14.29**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Fluoride by PC Titrator	EK040P	1	11	**9.09**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	8	**12.50**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	2	8	**25.00**	**10.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	7	**14.29**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Fluoride by PC Titrator	EK040P	1	11	**9.09**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	8	**12.50**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	1	8	**12.50**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	7	**14.29**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Fluoride by PC Titrator	EK040P	1	11	**9.09**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Free CN by Segmented Flow Analyser	EK025SF	1	8	**12.50**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Cyanide by Segmented Flow Analyser	EK026SF	1	8	**12.50**	**5.00**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	0	7	**0.00**	**5.00**	×	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

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
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 O. 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	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 Environ	Client Project Name / Number / Site etc (ie report title): Hydro Groundwater Plume Monitoring - AS130420	**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: Mark Tiedeman	PO No.:	
Project Mgr: Kirsty Greenfield	Envirolab Quote No. :	
Sampler: Mark Tiedeman	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 19B, 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: 0410 822 410	Lab comments: Highly contaminated	
Fax:		
Email: mtiedeman@environcorp.com; kgreenfield@environcorp.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		Provide as much information about the sample as you can
23	QA101		8/9/15	WATER	X	X	X	X		
24	~~QA200 QB1~~		8/9/15	WATER	X	X	X	X		
(1) —	QA200		8/9/15	WATER	X	X	X	X		Forward to ALS
										134015

Environmental Division
Sydney
Work Order Reference
ES1530839

Telephone : + 61-2-8784 8555

Relinquished by (company):	Ramboll Environ	ELS	Received by (company): ELS	*Lab use only:*
Print Name:	M. Tiedeman	Sydney	Print Name: PT	Samples Received: Cool or Ambient (circle one)
Date & Time:	/9/15	PTr	Date & Time: 9/9/15 10:00	Temperature Received at: (if applicable)
Signature:		10/9/15 12:00	Signature: PT	Transported by: Hand delivered / courier

White - Lab copy / Blue - Client copy / Pink - Retain in Book

Soy Hop No. 10/9/15 15:30 10-3C