Intended for

Hydro Aluminium Kurri Kurri Pty Ltd

Document type

Report

Date

December, 2020

KURRI KURRI ALUMINIUM SMELTER DECOMMISSIONING, DEMOLITION AND REMEDIATION

CONTAMINATED SOILS MANAGEMENT PLAN

KURRI KURRI ALUMINIUM SMELTER DECOMMISSIONING, DEMOLITION AND REMEDIATION
CONTAMINATED SOILS MANAGEMENT PLAN

Revision	**Final**
Date	**23/12/2020**
Made by	**C Whitehill**
Checked by	**S Taylor**
Approved by	**F Robinson**
Description	**Ramboll was engaged by Hydro Aluminium Kurri Kurri Pty Ltd to prepare an Environmental Management Plan (EMP) to describe how environmental management would be undertaken at the former Hydro Aluminium Kurri Kurri aluminium smelter at Hart Road Loxford, NSW and the surrounding land owned by Hydro. This Contaminated Soils Management Plan (CSMP) forms a component of the Soil and Water Management Plan (SWMP).**

Ref	318000533
Document ID	Hydro Kurri Kurri SWMP_Appendix 2_FINAL Contaminated Soils Management Plan_20201223

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ACRONYMS AND ABBREVIATIONS

BaP TEQ	Benzo(a)Pyrene Toxicity Equivalence Quotient
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes (Monocyclic aromatic Hydrocarbons)
CSMP	Contaminated Soils Management Plan
EMP	Environmental Management Plan
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	Environment Protection Authority
ESA	Environmental Site Assessment
Hydro	Hydro Aluminium Kurri Kurri Pty Ltd
PAHs	Polycyclic Aromatic Hydrocarbons
RAP	Remedial Action Plan
SSD	State Significant Development
SWMP	Soil and Water Management Plan
WHS	Work Health and Safety

GLOSSARY

Council	Cessnock City Council
The Department	Department of Planning, Industry and Environment
Hydro	Hydro Aluminium Kurri Kurri Pty Ltd
Hydro Land	The land owned by Hydro Aluminium Kurri Kurri Pty Ltd which includes the Smelter and surrounding land.
Remediation	Remediation of contaminated land and soils at the Smelter and on Hydro Land, including the construction of a Containment Cell as addressed in the State Significant Development application to the Department of Planning and Environment SSD 6666.
Stage 1 Demolition	Demolition of Smelter buildings addressed in the development application to Cessnock City Council 8/2015/399/1.
Stage 2 Demolition	Demolition of Smelter buildings, three concrete stacks, one water tower, subsurface structures to 1.5m below ground surface and operation of a concrete crushing plant addressed in the development application to Cessnock City Council 8/2018/46/1.
The Smelter	The former Hydro Aluminium Kurri Kurri Pty Ltd aluminium smelter at Hart Road, Loxford.

1. INTRODUCTION

1.1 Background

This Contaminated Soils Management Plan (CSMP) has been prepared by Ramboll Australia Pty Ltd on behalf of Hydro Aluminium Kurri Kurri Pty Ltd (Hydro). It has been prepared as part of the Soil and Water Management Plan (SWMP) to support the Environmental Management Plan (EMP) for the decommissioning, demolition and remediation activities at the former Hydro Aluminium Kurri Kurri Smelter (the Smelter) at Hart Road Loxford and the management of the surrounding land owned by Hydro (the Hydro Land).

1.2 Objectives

The objectives of this CSMP are to:

- Detail the controls to be implemented to manage known and uncovered contaminated soils.
- Establish the roles and responsibilities of all parties involved in soil contamination management.
- Establish supervision, monitoring and reporting framework for the CSMP.

1.3 Purpose and Scope

The purpose of the CSMP is to support the SWMP and detail the appropriate management of remediation areas in accordance with the Remedial Action Plans (RAPs) and Site Auditor requirements within the Smelter and the Dickson Road Landfill. The relevant RAPs are:

- Smelter RAP (Ramboll, 2018a)
- Dickson Road South RAP (Ramboll, 2018c)

1.4 Regulatory Framework and Guidelines

The management plan aims to comply with the requirements of the following legislation:

- *Contaminated Land Management Act 1997*
- *Protection of the Environment Operations Act 1997* (POEO Act)
- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *State Environmental Planning Policy No0. 55 (Remediation of Land)* (SEPP 55)

1.4.1 Environmental Protection Licence

The POEO Act requires any person carrying out scheduled work (as described in Schedule 1 of the POEO Act) to obtain an environment protection licence (EPL) that authorises that work to be carried out at the premises.

Hydro holds Environment Protection Licence (EPL) No. 1548 related to the following scheduled activities:

- Chemical storage >100 tonnes annual volume of waste generated or stored

1.4.2 SSD 6666 Development Consent Conditions

The Department of Planning, Industry and Environment (DPIE) issued the development consent for State Significant Development (SSD) 6666. While the development consent does not include any conditions related to contaminated soil management, it does require the remediation to be completed in accordance with the commitments in the Environmental Impact Statement (EIS), the Response to Submissions (RtS) and other project documents that form part of the development consent.

2. EXISTING CONTAMINATION AND POTENTIAL IMPACTS

2.1 Smelter Site Contamination

The Areas of Concern (AEC) and Potential Areas of Concern (PAEC) as identified within the Smelter RAP (Ramboll, 2018a) are shown in **Figure 2-1**. The location of the Dickson Road South is shown in **Figure 2-2**.

2.1.1 Known Contamination

The main AEC is the Capped Waste Stockpile, used to stockpile spent pot lining and other wastes associated with aluminium smelting, including cryolite, alumina, floor sweepings (alumina, cryolite and carbon), shot blast dust (carbon, steel shot), cement, potlining mix and small amounts of materials including plastics, wood, bonded and friable asbestos and steel. The spent pot lining has leached fluoride and cyanide into shallow groundwater beneath the Stockpile and a leachate plume has been identified (refer to the Leachate Management Plan). The contaminants of concern at the Capped Waste Stockpile include the following:

- Fluoride
- Cyanide
- Other potential contaminants include:
    - Polycyclic Aromatic Hydrocarbons (PAHs)
    - Total Recoverable Hydrocarbons (TRH)
    - Benzene, Toluene, Ethylbenzene and Xylenes (Monocyclic aromatic Hydrocarbons) (BTEX)
    - Heavy metals
    - Asbestos

Soil impacts identified at the Smelter Site are primarily associated with PAH impacts, in particular carcinogenic PAHs (Benzo(a)Pyrene Toxicity Equivalence Quotient (BaP TEQ)). PAH impacts to soil were observed to be shallow, within the fill material and generally less than 0.6m below ground surface (bgs). PAH contamination is limited in vertical extent and has not impacted underlying natural soils.

Seven AECs have been identified as requiring remediation due to PAH impacts in shallow surface soils. One AEC, Area East of the Playing Fields, included aesthetic issues with fill material and buried wastes to a depth of 1.0m bgs.

2.1.2 Extent of Remediation Required

The approximate fill volume estimates resulting from current site investigations are presented in **Table 2-1.** Additional volumes of contaminated material may be identified at the PAECs yet to be assessed due to access limitations, including the Transformer Yard and Substations, Area to the East of the Clay Borrow Pit and West Surge Pond.

Table 2-1 Smelter Site Fill Quantity Estimates

Type	Volume Estimate (m^3)			Bulk Density (T/m^3)	Mass Estimates	
		Range[1]			Range	
	Estimate	Low	High		Low	High
Capped Waste Stockpile (AEC1) including potentially impacted soils beneath the stockpile	159000	145000	206700	2	290000	413400
Anode Waste Pile (AEC 2)	1500	1370	1950	1.8	2470	3510
Area East of Playing Fields (PAEC 29)	7500	6820	9750	0.3-1.8	6820	9750
Carbon Plant (AEC 8)	940	860	1230	1.8	1548	2220
Bake Furnace Scrubber (PAEC 26)	510	470	670	1.8	850	1210

Type	Volume Estimate (m^3)			Bulk Density (T/m^3)	Mass Estimates	
		Range[1]			Range	
	Estimate	Low	High		Low	High
Diesel Spray Area (AEC 4)[2]	450	395	730	1.8	720	1320
Drainage Lines (AEC 5)	220	200	290	1.8	360	530
East Surge Pond (AEC 6)	2300	2100	2990	1.8	3780	5390
West surge pond (AEC 15)	2700	2460	3510	1.8	4430	6320
Area East of Clay Borrow Pit (PAEC 30)	2600	2370	3380	1.8	4270	6090
Transformer yard (PAEC 27)	15500	14100	20150	1.8	25380	36270

1. Low/high -10%, +30%
2. Low/high based on field observations

Migration of contaminants vertically through the soil profile is not anticipated however validation of the natural materials within the exposed excavations will be required. **Table 2-1** provides a preliminary guide to the extent of remediation required within the Smelter site. Final remediation will be undertaken in accordance with the Validation Plan within the Smelter RAP and therefore total fill quantities remain as estimates.

2.2 Dickson Road South

2.2.1 Known Contamination

Based on the results of the Phase 2 Environmental Site Assessment (ESA), contaminants of concern associated with the burial of smelter-derived wastes are considered to include the following:

- Fluoride
- PAHs
- Petroleum Hydrocarbons.

2.2.2 Potential Impacts

The site's sensitivity with respect to surface water and groundwater is considered to be moderate based on the following:

- Surface water and groundwater discharge into Swamp Creek, which is located 3.5km from Wentworth Swamp and 15km from the Hunter River within the Fishery Creek Catchment;
- Declining stream water quality and a reduction in diversity of native plants and animals has occurred within the Fishery Creek Catchment and water quality down gradient of the site has been impacted by historical coal mining;
- The Hunter River Groundwater Management Unit is used for irrigation, urban supply, drought supply, stock, domestic and commercial/ industrial use but it is not the main drinking water supply in the region.

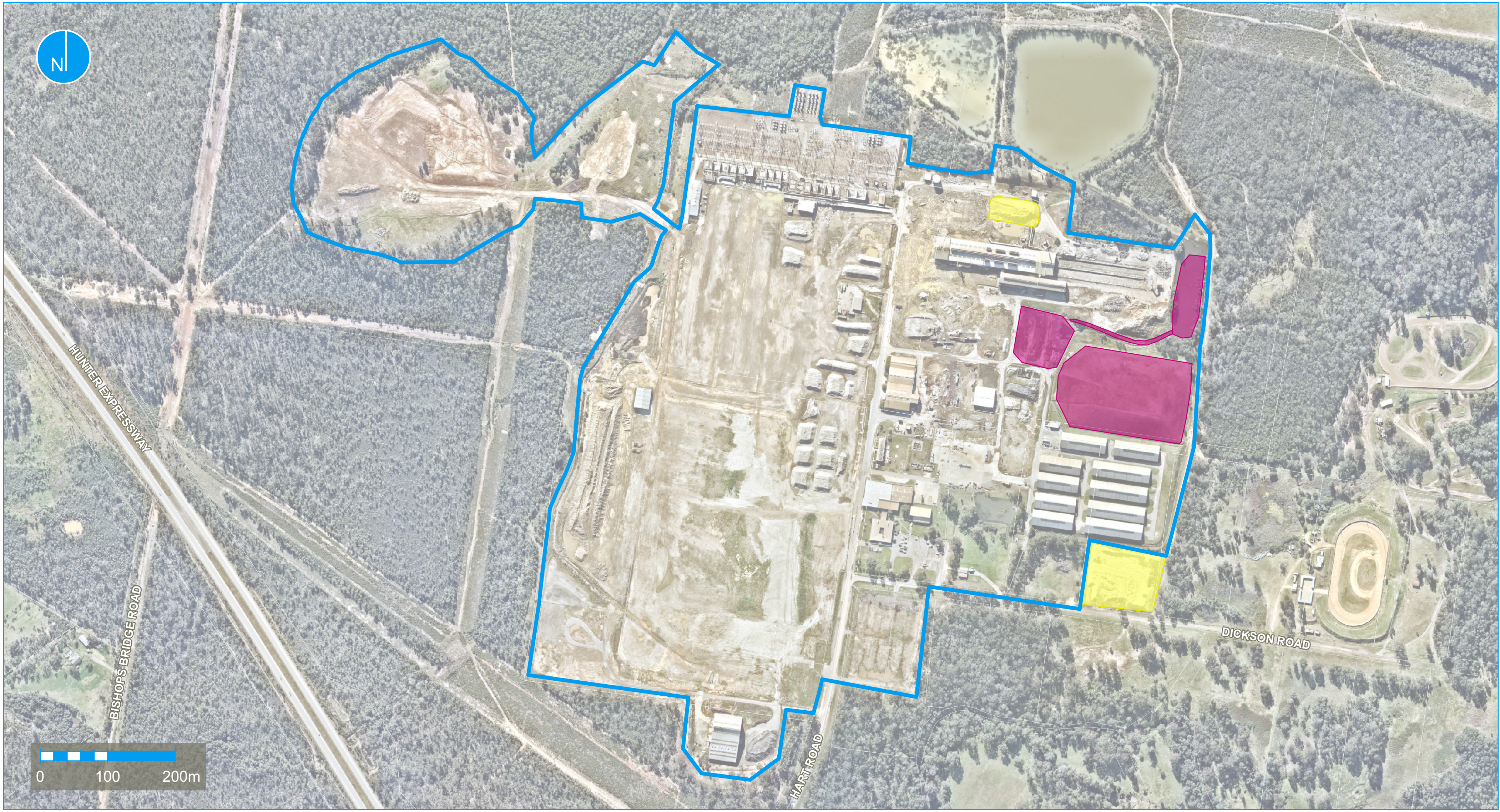
2.2.3 Extent of Remediation Required

The contaminant profile identified comprises an embankment that has been progressively filled with smelter-derived wastes and then capped with a thin sand layer. Sub-surface contamination including buried wastes in a soil matrix requires remediation across the area identified as Dickson Road South as shown in **Figure 2-2**.

The approximate fill volume estimates are presented in **Table 2-2**. The volume calculations were determined from an estimation of the lateral and vertical extent determined during site investigations. Tonnages were calculated from the anticipated bulk density as shown for each material present. There is inherent uncertainty in the volume estimates.

Table 2-2 Dickson Road South Fill Quantity Estimates

Type	Volume estimates (m^3)			Bulk Density (T/m^3)	Mass estimates (T)	
		Range			Range	
	Estimate	Low	High		Low	High
Smelter derived wastes	8,490	8,490	16,980	1.5	12,735	25,470
Contaminated soils	5,660	5,660	11,320	1.8	10,188	20,376



Aerial photography by Nearmap, flown 15.06.2020

RAMBOLL AUSTRALIA - GIS MAP file : 318000533_GIS_P001_RemediationEMP | F013_ContamSites_V02 | 4/11/2020

Legend

▭ Project site

🟪 AEC (Area of Ecological Concern)

🟨 Stockpiled contaminated soil

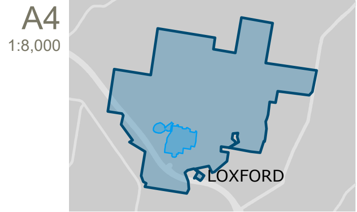
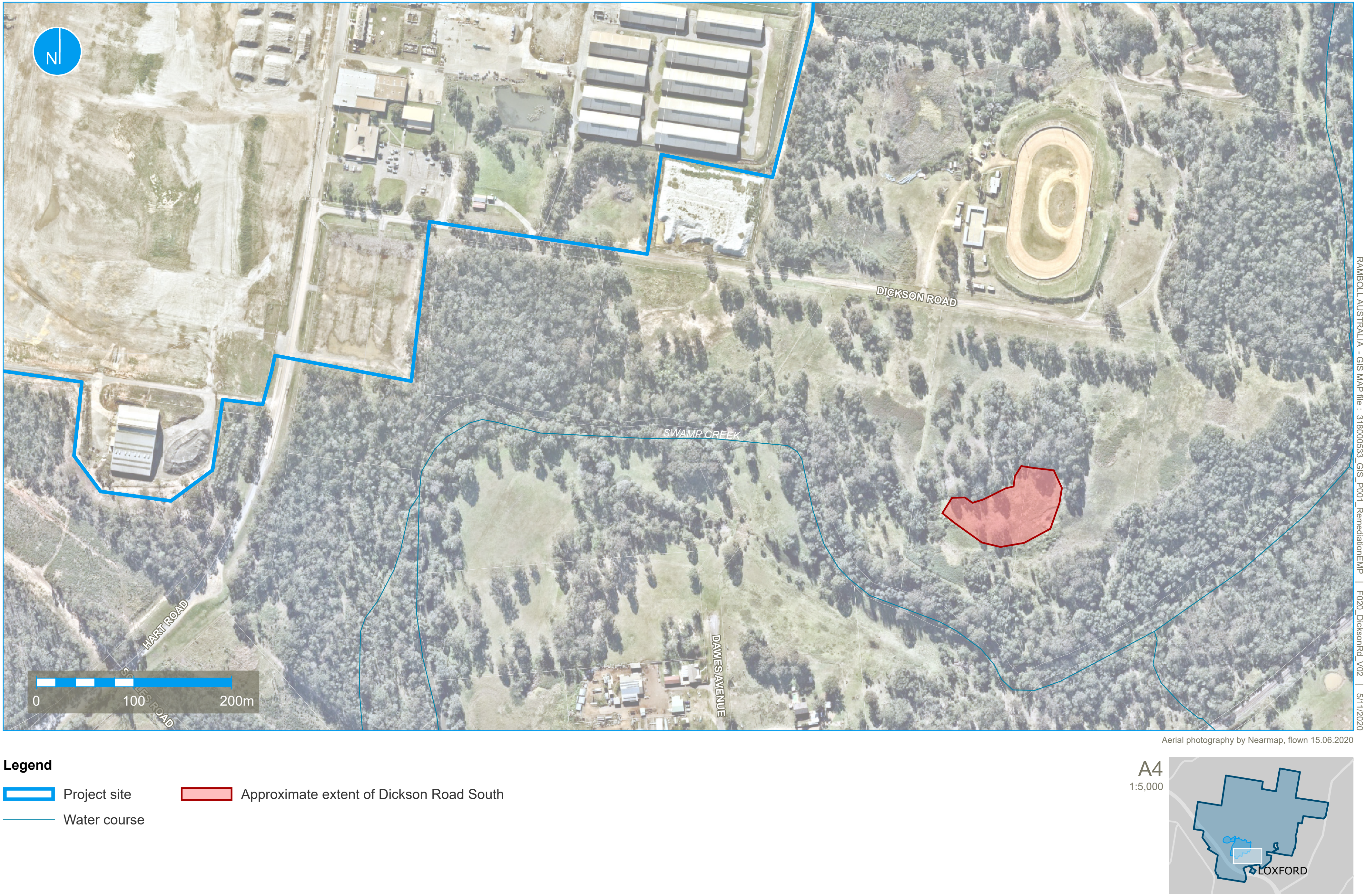


Figure 2-1 | Smelter Contaminated Soil Locations



RAMBOLL AUSTRALIA - GIS MAP file : 318000533_GIS_P001_RemediationEMP | F020_DicksonRd_V02 | 5/11/2020

Aerial photography by Nearmap, flown 15.06.2020

Figure 2-2 | Dickson Road South

3. IMPLEMENTATION

3.1 Roles and Responsibilities

Key personnel responsible for implementation of this CSMP are in **Table 3-1** and consistent with the overall EMP.

Table 3-1: Hydro Personnel and Environmental Management Responsibilities

Position	Responsibilities
OVERALL SITE MANAGEMENT	
Managing Director	Make certain that the Hydro Team and contractors are implementing this CSMP. Provide adequate resources and funding for the implementation of this CSMP. Provide adequate resources and funding for the monitoring and auditing of the implementation of this CSMP. Review and approve EMP (including this CSMP).
Principal Environmental Consultant	Provide advice on and assistance in implementation, monitoring and auditing of environmental management and performance. Review and modify the CSMP as directed by the Managing Director and/or Project Manager.
Principal Communications Consultant	Manage the mechanisms available for the community to receive information and to make enquiries or complaints about activities
SMELTER DECOMISSIONING, DEMOLITION AND REMEDIATION ACTIVITIES	
Project Manager	Make certain that any proposed works or changes to existing activities, that may have an impact on the environment or the community (including contaminated soils), have the necessary legislative approval prior to the commencement of works. Make certain that the environmental aspects and issues, associated with proposed works or changes to existing activities, are adequately addressed in the CSMP. Review and approve the CSMP on an annual basis or when changes to activities at the Smelter occur. Facilitate implementation of the CSMP.
Construction Manager	Verify that the work of contractors and Hydro personnel on the Project are undertaken in accordance with this CSMP, relevant environmental management plans, procedures and standards. Provide appropriate training to contractors and Hydro personnel on the Project regarding environment and community requirements and responsibilities. Review and approve the contractors' environmental management documentation prior to commencement of activities and inform contractors of changes to the CSMP.
Contract Administrator	Provide relevant environmental legislative, regulatory and management requirements in tender documentation. Verify that the work of contractors is undertaken in accordance with this CSMP and other relevant environmental procedures and standards.
Workplace Health and Safety (WHS) Manager	Provide Hydro personnel with the necessary tools and training to enable effective implementation of the EMP. Implement and maintain an induction package to be provided to all personnel working at the Smelter and Hydro Land, which will include information relevant to the environmental and community management (including soil and water quality). Undertake a weekly inspection of the Project activities at the Smelter, for the duration of the Project. Maintain a record of personnel induction and training records.

Position	Responsibilities
Environmental Site Auditor	Verify and sign-off on remediation activities.
Demolition Contractor	Comply with the requirements of the CSMP as it applies to Smelter demolition activities. Implement the environmental measures and actions as described in the CSMP through a Demolition EMP, sub-plans and specific procedures that comply with this CSMP. Develop and implement procedures for self-checking environmental management compliance with the Demolition Contractor's procedures and this CSMP. Report potential or actual environmental incidents associated with demolition activities at the Smelter, and assist as required in the investigation, implementation of corrective actions and recording of the incident.
Remediation Contractor	Comply with the requirements of the CSMP as it applies to Smelter and relevant Hydro Land remediation activities. Implement the environmental measures and actions as described in the CSMP through a Remediation EMP, sub-plans and specific procedures that comply with this CSMP. Develop and implement procedures for self-checking management compliance with the Remediation Contractor's procedures and this CSMP. Report potential or actual environmental incidents associated with remediation activities at the Smelter and relevant Hydro Land, and assist as required in the investigation, implementation of corrective actions and recording of the incident.
CARE, MAINTENANCE AND HYDRO LAND MANAGEMENT ACTIVITIES	
Environmental Officer/ Hydro Land Manager	Coordinate and implement the environmental monitoring program Verify that the work of contractors and Hydro personnel on Hydro Land are undertaken in accordance with this CSMP and relevant environmental procedures and standards. Undertake a weekly inspection of activities on the Hydro Land that would occur for two weeks or more.
ALL AREAS AND ACTIVITIES	
Contractors	Comply with the requirements of the CSMP as it applies to site environmental management and control. Implement the environmental measures and actions as described in the CSMP through procedures and management plans that comply with this CSMP. Develop and implement procedures for self-checking management compliance with Contractor's procedures and this CSMP.
All Personnel	Implementation of the relevant environmental measures described in this CSMP applicable to their activities.

3.2 Management Measures

Hydro will implement a number of controls to manage impacts association with the removal, transportation and remediation of soil contamination at the Smelter and the Dickson Road Landfill. The management measures to be implemented are outlined in **Table 3-2**.

The contaminated soil management measures described in **Table 3-2** complement the erosion and sediment control measures described in the SWMP, of which this CSMP forms an appendix. Where applicable it refers to the relevant control measures described in the SWMP.

Table 3-2: Contaminated Soil Management Measures

Management Measures	Action	Timing / Frequency	Responsibility	Further Detail
All personnel will be informed during the site induction of their obligations regarding contaminated soil management.	Contaminated soil management obligations and control measures to be communicated to personnel during site induction.	Prior to and during demolition and remediation activities	WHS Manager	Section 3.3.2 of the EMP (inductions and training)
Erosion and sediment controls will be installed prior to the commencement of activities.	An Erosion and Sediment Control Plan is to be developed and implemented prior to any activities associated with the demolition and remediation activities at the Smelter that would disturb contaminated soils and potentially cause erosion and sediment loss.	Prior to and during activities	Project Manager Remediation Contractor	Remediation IPMP: Appendix 3 of REMP
	An Erosion and Sediment Control Plan is to be developed and implemented prior to any remediation activities at the Dickson Road Landfill. The plan is to address the remediation area and any associated stockpile locations.	Prior to and during remediation activities	Project Manager Remediation Contractor	Remediation IPMP: Appendix 3 of REMP
	Prior to commencing the construction of the Containment Cell, erosion, drainage and sediment controls will be installed as shown in the Containment Cell Erosion and Sediment Control Plan in Appendix 7 of the SWMP.	Prior to remediation	Project Manager Remediation Contractor	Appendix 7 of the SWMP
Erosion and sediment controls are to be inspected and maintained.	Erosion and sediment controls will be inspected and maintained as described in Table 3-2 of the SWMP.	During activities Fortnightly and after a rain event	WHS Manager Remediation Contractor	Table 3-2 of the SWMP Remediation IPMP: Appendix 3 of REMP
Record the removal, transportation, temporary stockpiling and disposal of contaminated soils.	The type, source location and estimated quantity of each truckload of removed contaminated soils would be recorded at the removal location.	During remediation and construction of the Containment Cell	Remediation Contractor	Remediation IPMP: Materials Management Plan
	The type, source location and estimated quantity of each truckload of deposited stockpiled contaminated soils would be recorded.	During remediation	Remediation Contractor	Remediation IPMP: Materials Management Plan
	The type, source location and estimated quantity of each truckload of each truckload of contaminated soils would be provided at the Containment Cell prior to deposition.	During remediation and construction of the Containment Cell	Remediation Contractor	Remediation IPMP: Materials Management Plan
	The type, placement location and estimated quantity would be recorded for each truckload of contaminated soils deposited within the Containment Cell.	During remediation and construction of the Containment Cell	Remediation Contractor	Remediation IPMP: Materials Management Plan

Management Measures	Action	Timing / Frequency	Responsibility	Further Detail
The tracking of soils and other contaminated materials from contaminated areas subject to remediation onto remediated areas will be avoided to stop cross-contamination.	Remediated areas and contaminated areas will be clearly segregated through the use of flagging or temporary fencing. The access restriction represented by the flagging or fencing will be communicated to personnel during site inductions.	During activities	Remediation Contractor Project Manager	Remediation IPMP: Traffic Management Plan
	Trucks transporting material from the Capped Waste Stockpile will only travel on the designated Containment Cell Haul Road.	During activities	Remediation Contractor	Remediation IPMP: Traffic Management Plan
	Vehicle operators will be provided a copy of the Site Access Plan (Appendix B of the EMP) identifying the designated routes for the transportation of contaminated soils from the Capped Waste Stockpile and other remediation sites to the Containment Cell or a temporary stockpile location.	During activities	Remediation Contractor	Site Access Plan
	The Containment Cell Haul Road and other roads designated for the transportation of contaminated soils from remediation areas and stockpiles would be inspected as part of the daily inspections and Weekly Environmental Inspections. Any soils and materials spilled or tracked onto these roads would be removed.	During activities	Remediation Contractor	Section 5.2 of the EMP (inspections)
Use of chemicals and fuels will be managed to avoid spills and contamination of soil.	Vehicle refueling will be undertaken using mobile refueling vehicles equipped with spill containment equipment and a spill kit.	During activities	Remediation Contractors Demolition Contractors	Remediation IPMP: Appendix 3 of REMP
	All chemicals and fuels on site will be stored in accordance with the applicable Safety Data Sheet.	During activities	Remediation Contractors Demolition Contractors	Remediation IPMP: Appendix 3 of REMP
	An appropriate spill kit is always to be on site. Any spillage is to be immediately cleaned up. In the event of a large or hazardous spill, the fire brigade, police, ambulance and EPA would be contacted as appropriate, in accordance with Emergency Services Cooperation Agreement.	During activities	Remediation Contractors Demolition Contractors	Remediation IPMP: Appendix 3 of REMP

Management Measures	Action	Timing / Frequency	Responsibility	Further Detail
Record any incidents that cause soil contamination impacts, either on or off site, and the action taken to resolve the situation.	Record incidents in the incident register, undertake the required investigations and implement corrective actions	During activities As required	WHS Manager Remediation Contractors Demolition Contractors	Section 3.5.4 of the EMP (incidents) Section 5.4 of the EMP (corrective action)
	Determine the requirement to report the incident to the EPA and/ or the Department and complete the reporting requirements described in Section 3.5.4 of the EMP.	As required by EPL 1548 and/ or SSD 6666	Environmental Officer	Section 3.5.4 of the EMP
	Review corrective actions	During activities As required	WHS Manager Remediation Contractors Demolition Contractors	Section 5.4 of the EMP (corrective action)
Gypsum and materials imported for construction of the Containment Cell will be appropriately certified and managed to avoid contamination.	Only VENM, ENM, or other material approved in writing by the EPA or the Site Auditor is to be brought onto the site.	During construction of the containment cell	Remediation Contractor Project Manager	Remediation IPMP: Materials Management Plan
	Records will be kept of the volume and type of fill used on site. These records will be made available to the Planning Secretary if requested.	As required	Remediation Contractor Project Manager	Remediation IPMP: Materials Management Plan

4. MONITORING AND REVIEW

4.1 Monitoring

4.1.1 Surface Water

Hydro will continue to monitor surface water quality to confirm demolition and remediation activities are not causing harm to the environment or community and to maintain compliance with relevant approvals and licences.

Surface water monitoring will be undertaken as described in Section 4.1 of the SWMP.

4.1.2 Groundwater Monitoring

Hydro undertakes quarterly groundwater monitoring of selected groundwater wells at the Smelter. The program involves the collection of groundwater samples from 28 groundwater monitoring wells.

Groundwater monitoring will be undertaken as described in Section 4.1 of the SWMP.

4.1.3 Visual Inspections

Inspection of the environmental management of contaminated soils and stockpiles, including erosion and sediment controls, will be included as part of the regular inspection program described in Section 5.2 of the EMP and Section 4.1 of the SWMP.

Where an issue is identified during an inspection, the controls will be maintained or repaired or as required.

Records are to be taken during these inspections. These inspection records are to be filed and made available for review upon request of the EPA, the Department and Cessnock City Council.

4.2 Reporting

All internal and external environmental reporting requirements will be undertaken in accordance with Section 3.5 of the EMP.

4.3 Non-conformances

The need for preventative or corrective action arises from the identification of non-conformance with environmental legal requirements, Hydro environmental requirements or the potential for non-conformances to occur.

Non-conformances will be resolved and recorded in accordance with Section 3.5.5 of the EMP.

4.4 Complaints

Community Complaints are considered environmental incidents and are investigated and documented accordingly. This will include any complaints relating to Smelter-related soil and water quality issues.

Handling of complaints will be undertaken in accordance with Section 3.5.6 of the EMP.

4.5 Review and Improvement

Continual improvement of the SWMP will be achieved by the continual evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The Environmental Officer is responsible for ensuring that a regular review of the EMP and specialist management plans is undertaken.

The EMP and specialist management plans will be reviewed annually by an independent consultant in conjunction with preparation of the Annual Environmental Management Report (AEMR), or if changes to existing operations occur.

Reviews will be recorded in the document control section of this plan.

5. REFERENCES

Ramboll. 2018a. “Remedial Action Plan – Hydro Aluminium Smelter Kurri Kurri”.

Ramboll. 2018b. “Remedial Action Plan – Lots 435, 436 and 437 DP755231, Kurri Kurri, NSW”.

Ramboll. 2018c. “Remediation Action Plan – Dickson Road South, Kurri”.

Ramboll. 2018d. “Remedial Action Plan – Buffer Zone Asbestos, Kurri Kurri, NSW”.

Ramboll Australia. 2020. “Response to Submissions Report Former Hydro Aluminium Kurri Kurri Smelter Remediation”.

Ramboll. 2016. “Environmental Impact Statement – Former Hydro Aluminium Kurri Kurri Smelter Demolition and Remediation”.

6. LIMITATIONS

Ramboll Australia Pty Ltd prepared this report in accordance with the scope of work as outlined in our proposal to Hydro Aluminium Pty Ltd dated 20 July 2018 and in accordance with our understanding and interpretation of current regulatory standards.

Site conditions may change over time. This report is based on conditions encountered at the site at the time of the report and Ramboll Australia Pty Ltd disclaims responsibility for any changes that may have occurred after this time.

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

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

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

6.1 User Reliance

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

APPENDIX 1
SMELTER REMEDIATION ACTION PLAN

Intended for
Hydro Aluminium Kurri Kurri Pty Ltd

Document type
Remedial Action Plan

Date
July 2018

Hydro Smelter Kurri Kurri

REMEDIAL ACTION PLAN
HYDRO ALUMINIUM SMELTER KURRI KURRI

REMEDIAL ACTION PLAN
HYDRO ALUMINIUM SMELTER KURRI KURRI

Revision	**FINAL V4**
Date	**02/07/2018**
Made by	**Kirsty Greenfield**
Checked by	**Fiona Robinson**
Approved by	**Fiona Robinson**
Description	**Ramboll has prepared a remediation strategy for contaminated soils at the former Hydro Aluminium Kurri Kurri Smelter. The strategy is presented in this Remedial Action Plan.**

Ref AS130349
AS130349_Remedial_Action Plan_F1.docxVersion FINAL V4

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ACRONYMS AND ABBREVIATIONS

ACM	Asbestos Containing Materials
AEC	Area of Environmental Concern
AHD	Australian Height Datum
ALS	Australian Laboratory Services
ASET	Australian Safer Environment and Technology Pty Ltd. (Laboratory)
ANZECC	Australian and New Zealand Environment and Conservation Council
B(a)P	Benzo(a)pyrene
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes (Monocyclic aromatic Hydrocarbons)
CN	Cyanide (total or free)
CT	Certificate of Title
DP	Deposited Plan
DQO	Data Quality Objective
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
ESA	Environmental Site Assessment
Ha	Hectare
km	Kilometres
LOR	Limit of Reporting
m	Metres
MAH	Monocyclic Aromatic Hydrocarbons
Mercury	Inorganic mercury unless noted otherwise
Metals	As: Arsenic, Cd: Cadmium, Cr: Chromium, Cu: Copper, Fe: Iron, Ni: Nickel, Pb: Lead, Zn: Zinc, Hg: Mercury
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
m BGL	Metres below ground level
mg/L	Micrograms per Litre
MW	Monitoring well
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
OCPs	Organochlorine Pesticides
OH&S	Occupational Health & Safety
OPPs	Organophosphorus Pesticides
PAEC	Potential Area of Environmental Concern
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PQL	Practical Quantitation Limit
pH	a measure of acidity, hydrogen ion activity
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
SILs	Soil Investigation Levels
SVOCs	Semi Volatile Organic Compounds

TPHs	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
VENM	Virgin Excavated Natural Material
VOCs	Volatile Organic Compounds
µg/L	Micrograms per Litre
-	On tables is "not calculated", "no criteria" or "not applicable”

1. EXECUTIVE SUMMARY

Ramboll was engaged by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to prepare a Remedial Action Plan (RAP) for the remediation of 180 ha comprised of the Hydro Kurri Kurri Aluminium Smelter (the Smelter) and an area known as the Clay Borrow Pit.

The Smelter and the Clay Borrow Pit form the location of the proposed demolition, remediation and waste management project proposed by Hydro (the Project). The Smelter Site is located at Hart Road, Loxford, New South Wales (NSW).

A Masterplan has been developed that identifies land proposed for General Industrial (IN1), Heavy Industrial (IN3) and Environmental Conservation (E2) landuse at the Smelter Site. A Development Application for approval of a State Significant Development (supported by an Environmental Impact Statement) has been prepared for: the demolition of remaining redundant Smelter buildings; remediation of the Smelter Site; and design, construction and operation of a Containment Cell. The Environmental Impact Statement (EIS) must address the Secretary’s Environmental Assessment Requirements (SEARs).

The SEARs require preparation of a RAP. The SEARs also require an independent audit of the RAP and preparation of a Site Audit Report and Site Audit Statement indicating that the site can be made suitable for its future landuse.

Previous investigations at the Smelter Site have identified contamination associated with waste stockpiling at the Capped Waste Stockpile and the Anode Waste Pile; with fill importation at the Diesel Spray Area; with site operations at the Carbon Plant and Bake Furnace Scrubber; with burial of wastes at the Area East of the Playing Fields; and with drainage at the Drainage Lines and at the East Surge Pond. Groundwater impacts (leachate plume) have also been identified down gradient of the Capped Waste Stockpile.

Additional investigations are required to delineate the extent of soil contamination at the Anode Waste Pile. Investigations are also required at areas that have not been previously accessible, including investigation of sediments in the West Surge Pond and investigation of soil at the substations, the Area East of the Clay Borrow Pit and the Pot Rebuild Area. The additional investigation areas are not expected to present material contamination issues.

The RAP was commissioned by Hydro to detail the preferred methodology to remediate the impacted soils at each Area of Concern, which involves excavation and on-site containment; the requirement for the treatment of groundwater at the Capped Waste Stockpile; and to detail the required validation.

Ramboll considers that following implementation of the remedial measures and associated validation activities documented in the RAP and provision of a Validation Report, the Smelter Site can be made suitable for the proposed landuse outlined in the Masterplan.

2. INTRODUCTION

Ramboll Australia Pty Ltd (Ramboll) was engaged by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to prepare a Remedial Action Plan (RAP) for the remediation of 180 ha comprised of the Hydro Kurri Kurri Aluminium Smelter and an area known as the Clay Borrow Pit (herein after referred to as the “Smelter Site”).

The Smelter Site forms the location of the proposed demolition, remediation and waste management project proposed by Hydro. The Smelter Site is located at Hart Road, Loxford, New South Wales (NSW) as shown in **Figure 1.**

The RAP details site conditions and requirements for remediation of the Smelter Site. The Smelter Site is shown on **Figure 2**.

2.1 Background

The Kurri Kurri Aluminium Smelter produced 180,000 tonnes of aluminium metal per annum. The Smelter commenced production in 1969 with a single pot line. A second pot line was commissioned in 1979, and a third added in 1985. In 2002, Hydro undertook an upgrade program, which increased production capacity to 180,000 tonnes. The Smelter is surrounded by a 2,000ha buffer zone (Hydro Land), part of which is used for agricultural purposes.

Hydro suspended operations at the Kurri Kurri Smelter in 2012 and following a two year period of care and maintenance, closure was announced in May 2014.

Two Phase 2 Environmental Assessments have been completed (ENVIRON 2012 and 2015). These investigations identified seven Areas of Environmental Concern (AECs) within the Smelter Site that require surface soil and sediment remediation. These AECs have been delineated vertically and in the majority of cases laterally, however some require additional lateral investigation in areas of contamination prior to remediation. In addition, three AECs or potential AECs (PAECs) were not investigated due to access issues from existing buildings or services during 2014 Phase 2 ESA and will require further investigation to determine the potential risk of harm to human health or the environment.

A Masterplan has been developed that identifies land proposed for General Industrial (IN1), Heavy Industrial (IN3) and Environmental Conservation (E2) landuse at the Smelter Site.

A Development Application for approval of a State Significant Development (supported by an Environmental Impact Statement) has been prepared for: the demolition of remaining redundant Smelter buildings; remediation of the Smelter Site; and design, construction and operation of a Containment Cell. The Environmental Impact Statement (EIS) must address the Secretary’s Environmental Assessment Requirements (SEARs).

The SEARs require preparation of a RAP. The SEARs also require an independent audit of the RAP and preparation of a Site Audit Report and Site Audit Statement indicating that the site can be made suitable for its future land use.

2.2 Objective

The objective of the RAP is to provide a detailed plan of the works required to remediate the Smelter Site to a level suitable for the proposed commercial and industrial land uses. Additional objectives of the remediation works are:

- To ensure the remediation of the Smelter Site is protective of the human health and environment;
- Facilitate the completion of remedial works relevant to National and State regulatory requirements.

This RAP identifies the nature and extent of identified surface soil and sediment contamination, outlines the options for the remediation required, and provides detail of the required remediation and validation works. In addition, demolition of the Smelter infrastructure will be undertaken concurrently with remediation, and in some instances is required to facilitate remediation. Smelter demolition will result in the generation of demolition materials and smelter wastes that are not able to be recycled or reuse on the site, or off site. The necessity to manage these materials will be incorporated in the remediation evaluation.

2.3 Scope of Work

To meet the objective, Ramboll has completed the following scope of work:

- Review all previous reports prepared for the Smelter Site including:
  - ENVIRON (October 2013) Phase 1 Environmental Site Assessment, Hydro Kurri Kurri Aluminium Smelter
  - ENVIRON (November 2012) Phase 2 Environmental Site Assessment, Kurri Kurri Aluminium Smelter
  - ENVIRON (December 2012) Environmental Site Assessment, Capped Waste Stockpile, Kurri Kurri Aluminium Smelter
  - ENVIRON (March 2013) Tier 2 Ecological Risk Assessment, Kurri Kurri Aluminium Smelter
  - ENVIRON (April 2013) Preliminary Screening Level, Health Risk Assessment for Fluoride and Aluminium, Part of the Kurri Kurri Aluminium Smelter, Hart Road, Loxford
  - ENVIRON (June 2013) Stage 2 Aquatic Assessment – Ecological Risk Assessment, Kurri Kurri Aluminium Smelter
  - ENVIRON (October 213) Plume Delineation Report, Capped Waste Stockpile
  - ENVIRON (January 2015) Phase 2 Environmental Site Assessment, Smelter Site, Additional Investigations
  - ENVIRON (February 2015) Hydro Aluminium Smelter, Capped Waste Stockpile, 12 Month Groundwater Monitoring Report
- Outline a Sampling Plan for the three AEC/PAECs that have been identified requiring further investigation or any other AEC that requires lateral delineation of contamination;
- Identify and evaluate possible remedial options for each AEC including consultation with Hydro personnel in order to determine the most appropriate remedial option;
- Identify and evaluate possible remedial options for the leachate plume associated with the Capped Waste Stockpile;
- Consultation with regulatory guidelines;
- Outline how the remedial options will be undertaken to meet the remediation objective;
- Establish Data Quality Objectives (DQOs) for the development of the validation plan;
- Develop a validation plan to validate completion of the site remediation and confirm the suitability of the site for the proposed use.

2.4 Regulatory Framework and Guidelines

This document has been prepared in reference to the following regulations:

- *Contaminated Land Management Act 1997*.
- *Protection of the Environment Operations Act 1997*.
- *Environmental Planning and Assessment Act 1979*.

The SEARs issued by the Department of Planning and Environment to be addressed in preparation of the EIS for the Project included requirements regarding the RAP. **Table 2-1** lists the SEARs and where they are addressed in this RAP.

Table 2-1: SEARs for the RAP and Where Addressed

SEARS Condition	Where Addressed in the RAP
A Remediation Action Plan (RAP) accompanied by a Site Audit Statement from an Environment Protection Authority (EPA) accredited site auditor prepared in accordance with the contaminated land planning guidelines under the EP&A Act and relevant guidelines produced or approved under the ***Contaminated Land Management Act 1997***. The RAP must also:	
• characterise the nature and extent of contaminated material and any contaminated groundwater plumes	**Section 5**
• detail the proposed remediation process, including treatment methodologies and processes	**Section 8**
• justify the proposed treatment and remediation criteria based on the conclusions of a Human Health Risk Assessment prepared in accordance with the Environmental Health Risk Assessment - Guidelines for Assessing Human Health Risk from Environmental Hazards	Refer to the Human Health Risk Assessment, Appendix 11 of the EIS
• detail the proposed remediation management measures including the management of excavated material, stockpiles and wastewater	**Section 8**
• include a site validation plan	**Section 9**
• detail the final landform/use following remediation and the suitability of any fill material	**Section 8.6.10**
• identify any on-going management of the site following remediation works	**Section 17**

3. SITE IDENTIFICATION

3.1 Site Location

The Smelter Site is located approximately 30 km west of the town of Newcastle and 150 km north of Sydney in New South Wales, Australia.

For the purpose of the RAP, the Smelter Site comprises the whole of the lots that cover the smelter footprint. This Smelter Site was identified as a Land Parcel in the Masterplan completed in 2013.

Table 3-1 presents Smelter Site identification and location details.

Table 3-1: Site Identification

Item	Description
Site Owner	Hydro Aluminium Kurri Kurri Pty Limited (subject to Deed of Company Arrangement)
Street Address	Hart Road, Loxford, New South Wales, Australia , 2326
Local Government Area	Cessnock City Council
Parish	Heddon
County	Northumberland
Distance from Nearest CBD	Approximately 3.5 km northwest of Kurri Kurri, and 30km northwest of Newcastle
Geographical Coordinates	Latitude 32 78 53 S, Longitude 151 4735 E
Lot and DP Numbers	Lots 318, 319, 411, 412, 413, 414, 769 in DP 755231, Lots 1, 2, 3 in DP 456769 and part Lot 16 in DP 1082775
Site Area	180 ha.
Zoning (current)	RU2 – Rural Landscape
Site Elevation	RL 20 to 30 m in the centre and north of the lot to RL 10 m AHD to 15 m AHD in the south and south east
Site Map	Site location is shown in **Figure 1**. Site plan is shown in **Figure 2**. The study boundary within the Smelter Site is shown in **Figure 3**.

3.2 Site Boundaries

The Smelter Site is located within the following boundaries:

- East: Bushland within the Buffer Zone owned by Hydro (herewith described as the Hydro Land);
- North: Bushland within the Hydro Land;
- West: The former Bishops Bridge Road (now an internal access road only due to the construction of the new Hunter Expressway) and bushland within the Hydro Land; and
- South: The Hunter Expressway then bushland within the Hydro Land.

The boundary of the Smelter Site is shown on **Figure 2**. The layout of the Smelter is shown in **Figure 4**.

3.3 Proposed Landuse

A Rezoning Masterplan has been prepared for the Smelter Site, which identifies future land use zonings for different land parcels. The Smelter Site has been designated as one Land Parcel within the Master Plan and planned land use zonings within the Smelter Site include:

- Heavy Industrial (IN3): Clay Borrow Pit, which is the planned location of the Containment Cell, and portion of the smelter footprint directly east of the Clay Borrow Pit;
- General Industrial (IN1): Southern portion of the smelter footprint;
- Environmental Conservation (E2): Undeveloped bushland to the west, south and north of the smelter footprint.

4. SITE HISTORY

4.1 General Operations History

The Smelter Site encompasses a three pot-line aluminium smelter (the Smelter) with 360 pots and a capacity of up to 180,000 tonnes of aluminium per annum. The Smelter was built on previously undeveloped agricultural land. A buffer zone (the Hydro Land) of predominately rural land was progressively purchased around the planned facility as required in the planning approval for the Smelter.

The Smelter was developed in 1969 by Alcan Australia Ltd., later Capral Aluminium, with pot-lines commissioned in 1969. Line 1 was initially commissioned and comprised 120 cells and producing 50,000 tonnes per annum by 1973. Line 2 was commissioned in 1979 and comprised of 120 cells. Line 3 was commissioned in 1985 comprising 120 cells and reaching a final capacity for the plant of 180,000 tonnes per annum.

The Smelter and Hydro Land were purchased by VAW Aluminium in 2000, and became Hydro Aluminium Kurri Kurri Pty Ltd with the Norsk Hydro purchase of VAW Aluminium in 2002.

Pot Line 1 was taken out of active production in January 2012 reducing the capacity by 120 pots. The remaining two pot lines were taken out of active production in September 2012 and the closure of the Smelter was announced in May 2014. The Smelter and Hydro Land are currently maintained by a team of Hydro employees.

4.2 Overview of Former Site Operations

The Smelter layout is shown in **Figure 4**. The overall operational process at the Smelter was comprised of four main operational areas:

- Pot Lines, where alumina was reduced to molten aluminium in three pot-lines. Pot Lines 1, 2 and 3 are located on the western portion of the Smelter. Alumina and cryolite were placed within pots and an electrical current applied. Molten aluminium was siphoned from each pot and taken to the Cast House;
- Casthouse, where molten metal was cast into ingots and billets. The Cast House is located immediately east of Pot Line 1 near the main entrance. The Cast House produced cast aluminium products to product specifications often including the addition of alloys. The Cast Houses utilised chlorine gas to avoid oxidation during the casting process. The gas was captured when the casting chamber was filled. Wastes from the Cast House included dross and swarf, which have a high aluminium content and were sent for recycling off-site;
- Carbon Plant, where a ring furnace was used to bake anodes. The Carbon Plant is located near the northern Smelter boundary to the east of the potlines. The Carbon Plant produced anodes from a mixture of coke, pitch and recycled anode butts to produce a green anode. This green anode was then baked within a bake furnace prior to the addition of a cast iron rod, and dispatched to the Pot Lines. The bake furnace was gas fired however it was previously oil heated. Ancillary facilities associated with the Carbon Plant included a liquid pitch tank, petroleum coke storage, the bake furnace scrubber, the rodding building, rodding mix storage building, baked anode storage. The Anode Plant was included in the Carbon Plant; and
- Anode Plant, where carbon anodes were manufactured. The anode plant included the Greenmix Plant, the Baking Furnace and the Rodding Plant.

Infrastructure and ancillary structures at the Smelter Site include:

- A transformer yard and substation are located in the north western corner of the Smelter Site;
- Stormwater on the Smelter's paved areas is directed via conduits to either the West Surge Pond, which is located on the western boundary of the Smelter or the East Surge Pond, which is located on the eastern boundary of the Smelter. Surface water runoff from the car park and administration areas is directed to the South Surge Pond. All ponds flow to the North Dam, located to the north of the Carbon Plant;

- Smelter wastes including spent pot lining was initially stockpiled on a low lying area of the Smelter near the eastern plant boundary between 1969 and the early 1990s. The Smelter waste mound (known as the Capped Waste Stockpile) was capped with clay in 1995. Since this time smelter wastes have been stockpiled separately or recycled. Spent pot lining is now stored in purpose-built sheds, of which there are ten located to the south of the Capped Waste Stockpile. Eight of these sheds contain spent pot lining, the remaining two sheds contain other aluminium smelter wastes;
- A maintenance compound is located in the centre of the Smelter, south of the Carbon Plant. The compound is used for maintenance activities as well as storage of equipment and spare parts;
- A diesel refuelling area is located in the centre of the Smelter. The diesel refuelling area contains one above ground storage tank (AST) and a wash bay;
- A diesel spray area is located at the rear of the Carbon Plant on the northern Smelter boundary, which was used to treat rust coatings from cathode rods prior to reuse;
- Offices, a security gate house, canteen, two playing fields and a former gym building are located within the Smelter Site;
- Storage area west of the Pot Lines;
- A pot reconditioning area was located to the south of Pot Line 1. The pot reconditioning area contains one large building where pots were reconditioned for re-use.
- The Clay Borrow Pit, an area to the west of the Smelter from which clay material was won to cap the Capped Waste Stockpile. This excavation was subsequently backfilled with inert smelter wastes including refractory brick, concrete and bitumen. This material was removed in 2015 and is currently stockpiled in the Storage area west of the Pot Lines.
- Storage area west of the Pot Lines, which currently stores soils from buffer zone remediation works. Soil stockpiles are on hardstand, have erosion and sediment controls and stockpiles containing asbestos are covered with HDPE liners. During smelter operations, this area stored excess materials, which were recycled following closure of the smelter. The south west corner was used as a fire training area.
- Small areas of native vegetation are located within the boundaries of the Smelter Site, which adjoin larger areas of native vegetation outside the Smelter Site.

5. PREVIOUS INVESTIGATIONS

Ramboll has completed a number of investigations at the Smelter Site since operations were suspended in 2012. These investigations included a historical review of the Smelter Site, identification of Potential Areas of Concern (PAECs) and Areas of Concern (AECs), intrusive investigations for soil and groundwater and delineation of contaminated AECs.

Investigations completed by Ramboll that are relevant to this RAP are outlined below.

- ‘Stage 1 Phase 2 Environmental Site Assessment, Hydro Kurri Kurri Aluminium Smelter’, November 2012, ENVIRON
- ‘Tier 2 Ecological Risk Assessment Hydro Kurri Kurri Aluminium Smelter’, March 2013, ENVIRON
- ‘Preliminary Screening Level for Human Health Risk Assessment Hydro Kurri Kurri Aluminium Smelter’, April 2013, ENVIRON
- ‘Phase 1 Environmental Site Assessment, Hydro Kurri Kurri Aluminium Smelter’, October 2013, ENVIRON
- Hazardous Materials Audit – Six Stages, completed 2014
- ‘Stage 2 Phase 2 Environmental Site Assessment, Hydro Kurri Kurri Aluminium Smelter’, January 2015, ENVIRON
- ‘Environmental Site Assessment, Diesel Spray Area, Hydro Aluminium Smelter’, March 2018, Ramboll
- Capped Waste Stockpile Assessment
- ‘Hydro Aluminium Kurri Kurri Substations Assessment Trial – 3CC’, dated November 2017, Ramboll Environ

In addition, a Remedial Action Works Plan for the Clay Borrow Pit has also been completed and a summary of all reports are provided below for general context.

- ‘Remedial Action Works Plan Clay Borrow Pit Area, Hydro Kurri Kurri Aluminium Smelter’, July 2014, (ENVIRON, 2014b) ENVIRON.

5.1 Stage 1 of the Phase 2 ESA

Ramboll completed Stage 1 of the staged Phase 2 ESA in 2012. Stage 1 included the following documents:

- ‘Sampling, Analysis and Quality Plan, Kurri Kurri Aluminium Smelter’, March 2012, ENVIRON
- ‘Phase 2 Environmental Site Assessment, Kurri Kurri Aluminium Smelter’, 1 November 2012, ENVIRON

Stage 1 involved the following tasks:

- A desktop study, including a review of historical information and background data and a site walkover;
- The identification of 20 PAECs and five potential contaminants of concern relating to the production of aluminium and the ancillary operations (fluoride, aluminium, cyanide, PAHs, TPH);
- The development of an sampling and analytical quality plan (SAQP) to assess the PAECs and chemicals of concern;
- Field investigations, including the drilling of 31 boreholes, installation of 21 groundwater monitoring wells, collection of 45 surface soil samples, 14 sediment samples and 28 groundwater samples;
- Analysis of soil, groundwater and sediment samples for a range of potential contaminants of concern;

- The development of a conceptual site model including sources of contamination, receptors and pathways between the sources and receptors; and
- Recommendations for further investigations.

These results are compared against the most relevant guidelines available in 2012, as follows:

- NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme* (Third Edition);
- NSW EPA (1994) *Guidelines for Assessing Service Station Sites*; and
- NEPC (1999) *National Environmental Protection (Assessment of Site Contamination) Measure* (NEPM).

As the NEPM (1999) guidelines were updated in 2013, the 2012 soil results were re-assessed using the NEPM (2013) guidelines as part of Stage 2 Phase 2 investigation. Soil results from the 2012 investigation for all AECs compared against NEPM (2013) are included in **Appendix 1**.

The Phase 2 ESA identified ten areas of concern that require further evaluation, as follows:

- AEC 1: Capped Waste Stockpile – soil and groundwater.
- AEC 2: Anode Waste Pile – soil.
- AEC 3: Refuelling Area – groundwater.
- AEC 4: Diesel Spray Area – soil.
- AEC 6: East Surge Pond and associated drainage line - sediments.
- AEC 8: Carbon Plant (western end only) – soil.
- AEC 11: Washdown Bay – soil.
- AEC 12: Pot Lines – soil.
- AEC 15: West Surge Pond – sediments.
- Groundwater beneath the Smelter Site.

5.2 Capped Waste Stockpile

Following the Phase 2 ESA, the Capped Waste Stockpile was notified as potentially contaminated land to the NSW EPA under Section 60 of the *Contaminated Land Management Act 1997*. In response, the EPA requested further information regarding the contamination status of the notified area. Ramboll completed an Environmental Site Assessment on the notified area in 2013, which included the following tasks:

- Review and collation of relevant historical information pertaining to the Capped Waste Stockpile and the surrounding leachate impact area;
- Field sampling of 14 groundwater monitoring wells;
- Completion of a pumping test to assess aquifer behaviour;
- Water quality sampling of 14 wells following pumping to assess variations in response to changes in the aquifer; and
- Completion of a report identifying known information, data gaps and recommendations for further investigations to address the data gaps.

The recommended further investigations were undertaken, including a Preliminary Screening Level human health risk assessment to identify guidelines for fluoride in soil and water at the site for human health; a Tier 2 ecological risk assessment to assess impact from leachate migration on the local ecology; delineation of the plume using a combination of existing data and further field investigations and commencement of a quarterly monitoring regime to monitor the leachate plume.

The following documents were prepared for the Capped Waste Stockpile, noting the groundwater monitoring is currently on-going:

- *Section 60 Notification Supporting Information*, 12 August 2012, ENVIRON;
- *Environmental Site Assessment, Alcan Mound, Kurri Kurri Aluminium Smelter*, 13 December 2012, ENVIRON;
- *Tier 2 Ecological Risk Assessment, Kurri Kurri Aluminium Smelter*, March 2013a, ENVIRON;

- *Preliminary Screening Level, Health Risk Assessment for Fluoride and Aluminium, Part of the Kurri Kurri Aluminium Smelter, Hart Road, Loxfor*d, 2 April 2013b, ENVIRON; and
- *Plume Delineation Report, Alcan Mound*, 11 October 2013c, ENVIRON.

Following submission of these reports to NSW EPA, the EPA advised that the notified area could be managed through Hydro's Environmental Protection Licence. A copy of the correspondence from NSW EPA is included in **Appendix 2**.

5.3 Ecological Risk Assessment

A Tier 2 Ecological Risk Assessment was completed in March 2013 (2013a) as there are no ecological assessment guidelines in Australia for fluoride and aluminium. The ecological risk assessment assessed surface water quality down gradient of the Capped Waste Stockpile and was to assess if impacts to the downgradient ecological receptors were occurring as a result of leachate migration. The ecological risk assessment included an assessment of surface water quality at locations upstream and downstream of the Smelter Site in relation to fluoride and aluminium. The ecological risk assessment identified that the fluoride and aluminium concentrations present at the Capped Waste Stockpile have not impacted on the aquatic species at the receptor point at Swamp Creek.

5.4 Health Risk Assessment

A Health Risk Assessment was completed in April 2013 (ENVIRON, 2013b) as there are no human health assessment guidelines in Australia for fluoride and aluminium. The human health risk assessment allowed for the development of site-specific preliminary guidelines for fluoride and aluminium concentrations in soils, groundwater and surface water at the Smelter Site.

5.5 Phase 1 ESA

A Phase 1 ESA was completed in October 2013 (ENVIRON, 2013c) to identify any potential areas of concern that were not identified in the high level review completed as part of the Stage 1 Phase 2 ESA. The Phase 1 ESA included the following tasks:

- A review of historical reports relating to land use and operations at the Smelter Site and Hydro Land to assess the potential for soil and groundwater or surface water contamination arising from historical and current uses;
- A review of published geological, hydrogeological and hydrological data associated with the Smelter Site and Hydro Land to establish the environmental setting and sensitivity;
- Detailed review of historical aerial photographs from 1951 (earliest available aerial photo), 1957, 1961, 1966, 1975, 1978, 1987, 1994, 2001, 2006 and 2013;
- Detailed site walkover;
- Interview with Hydro Environmental Manager Mr Kerry McNaughton; and
- Review of previous investigations undertaken by Ramboll and others.

An Environmental Issues Register was developed for both the Smelter Site and Hydro Land, detailing the development on each deposited plan and potential environmental issues relating to the development.

The Phase 1 ESA did not complete a Dangerous Goods Database search. Hydro have maintained current records of all dangerous goods retained on site including those retained prior to ownership of the site by Hydro. In 2013 a review of these records, service plans, building plans and a detailed site inspection was completed. This information was documented in a Hazardous Materials Audit and Register, which is a live document maintained by Hydro. The register includes information on lead based paints; asbestos containing materials; synthetic mineral fibre; sumps; liquid wastes; dusts; transformers; fluorescent lighting and chemicals. The register will be used as a guide during demolition and remediation and will inform the validation program.

5.6 Hazardous Materials Audit

Ramboll was engaged by Hydro to undertake a Hazardous Materials Audit (HMA) in 2014 (Ramboll Environ 2014c-h).

The purpose of the HMA was to provide sufficient information to assist contractors to scope and undertake the hazardous materials removal works. To undertake the HMA, the Site was divided into six stages/areas:

- Stage 1 - Maintenance Workshops and Storage Sheds
- Stage 2 - Administration, Personal Training Centre, Gatehouse, Medical Centre and Personnel, Bathhouse and EOHS

- Stage 3 - Cast House and Associated Buildings
- Stage 4 - Pot Rooms and Associated Structures
- Stage 5 – Carbon Plant and Associated Structures
- Stage 6 - Transformer Yard, Substations And Miscellaneous Areas

The audit of each area comprised site inspections and recording of fixed plant and infrastructure that may contain hazardous materials, hazardous materials storage area, building structures and pits which could be readily accessed, and the status or condition in relation to potential contamination/ decontamination issues. This information was documented in a register including the following potential hazards:

- Asbestos containing materials
- Polychlorinated biphenyls (PCBs), mercury and sodium in lighting and transformers
- Synthetic mineral fibres (SMF)
- Ozone depleting substances and greenhouse gases
- Lead-based paints
- Contents of pits, tanks and bunds
- Miscellaneous: other potentially hazardous materials including impregnated materials, liquid and solid residues, dusts, anodes, cathodes and wastes. Dangerous goods have also been included in this section.

The register included the location, description, quantity, analysis results, observations from site visits including photos and environmental health and safety requirements as part of the demolition works.

5.7 Stage 2 of the Phase 2 ESA

Stage 2 of the Phase 2 ESA was completed in January 2015. The objective of the Stage 2 investigations was to build upon the results of the Stage 1 investigations in understanding the potential for soil and groundwater contamination to impact on the Smelter Site for commercial/ industrial landuse.

Stage 2 comprised the following documents:

- *Sampling, Analysis and Quality Plan, Kurri Kurri Aluminium Smelter*, June 2014, ENVIRON
- *Phase 2 Environmental Site Assessment, Kurri Kurri Aluminium Smelter*, January 2015, ENVIRON

The scope of work for the Stage 2 investigations included the following:

- Review of previous investigations and identification of data gaps;
- Development of a Sampling, Analysis and Quality plan (SAQP);
- Soil sampling at five AECs identified from the Stage 1 investigations and five new PAECs;
- The installation of seven new groundwater wells at three of the AECs;
- Groundwater sampling of the seven new and seventeen existing wells;
- Laboratory analysis for soil and groundwater samples;
- Assessment of laboratory results against site criteria;
- Refinement of the conceptual site model (CSM);
- Identification of additional site investigation works to refine the CSM; and
- Assessment of areas requiring remediation.

The CSM assumed a future commercial/industrial landuse at the Smelter Site, and considered off-site receptors in the down-hydraulic gradient area. The following complete source-pathway-receptor linkages were identified in the CSM:

- Inhalation of dust generated from surface soil impacts by current and future on-site commercial/industrial adult employees;
- Direct contact with impacted soil and groundwater by current and future on-site intrusive maintenance workers;

- Direct contact with impacted sediment by current and future on-site commercial/industrial employees.

In order to further refine the CSM, a number of targeted investigations are required to be performed at the West Surge Pond, the Transformer Yard and Sub-Stations and a filled area East of the Clay Borrow Pit.

Based upon the source-pathway-receptor linkages identified in the refined CSM, remediation of surface soil and sediment at the following AECs is required:

- AEC 1: Capped Waste Stockpile: Whilst not identified to represent a risk to downgradient ecology, the ongoing migration of leachate from the stockpile and impacted soils beneath the stockpile may present an unacceptable risk to future development of the site for industrial land use. Remediation to reduce this risk is considered necessary;
- AEC 2: Anode Waste Pile: PAH contamination in surface soils to 0.2m bgs. Delineation and remediation of PAH hot spot at MW103;
- AEC 4: Diesel Spray Area: PAH contamination of fill material at 0.4m to 0.6m bgs. Delineation and remediation required;
- AEC 6: East Surge Pond and associated drainage line: PAH contamination of sediments;
- AEC 8: Carbon Plant: PAH contamination of shallow soils to 0.4m bgs in grassed areas and gardens beds at the western end of the Carbon Plant;
- AEC 26: Bake Furnace Scrubber: PAH contamination in shallow soils to 0.3m bgs in grassed areas below the scrubber duct work. Delineation of remediation of PAH hot spot at HA115; and
- AEC 28: Area east of the Playing Fields: Buried wastes to be remediated for aesthetic reasons. Delineation and remediation of PAH hot spot identified in south east corner at TP117.

The following AECs identified in the 2012 Stage 1 Phase 2 ESA were not considered to require remediation following further assessment in the 2014 Stage 2 Phase 2 ESA:

- AEC 3: Refuelling Area - Installation of additional groundwater wells and sampling of the new and existing wells did not identify contaminants in groundwater at concentrations requiring remediation or further assessment.
- AEC 11: Washdown Bay – Re-assessment of soil samples against site-specific criteria for fluoride identified one shallow soil sample (total fluoride) that exceeded the criteria. Additional investigations did not identify soluble fluoride impacts in shallow soil.
- AEC 12: Pot Lines – Re-assessment of soil samples against site-specific criteria for fluoride identified shallow soil samples (total fluoride) that exceeded the criteria. Additional investigations did not identify soluble fluoride impacts in shallow soil.

Vertical delineation of the soil contamination at each AEC was completed as part of the Stage 2 Phase 2 investigations. The soil contamination identified was PAH (primarily benzo(a)pyrene) contamination in fill, which has not extended into the underlying alluvial sands and has not impacted groundwater. Lateral delineation of soil contamination has been completed to the extent practicable at this time given buildings, stockpiles, roads and services limit potential sampling locations. Lateral delineation of soil contamination and hotspots will be required at some AECs prior to remediation. Preliminary vertical delineation beneath the Capped Waste Stockpile indicates minor impacts to residual soils beneath the stockpile.

Soil results for each AEC are included in **Appendix 3**.

5.8 Remedial Action Work Plan for Clay Borrow Pit

The Clay Borrow Pit was assessed as an AEC in the Stage 1 Phase 2 ESA. Historical records indicate the Clay Borrow Pit was the source of clay materials for capping of the Capped Waste Stockpile located on the eastern side of the Smelter Site and undertaken in the 1990’s. The resultant void was later filled with inert materials from the Smelter primarily comprising bake furnace refractory, concrete and asphalt. Filling reinstated the excavation to ground level. Subsequent filling resulted in above ground stockpiling of these smelter materials in this area. Soil and groundwater samples were analysed for total petroleum hydrocarbons, pesticides, heavy metals, fluoride, and a range of semi-volatile hydrocarbons including PAHs, and chlorinated hydrocarbons.

Sampling of the soil matrix identified potential contaminants either below detectable limits or below guideline concentrations. However, the presence of fill represents an impact on visual amenity and safety risk to the proposed future commercial and industrial landuses of the Smelter Site.

Evaluation of groundwater quality from within the in-filled borrow pit (MW05) found concentrations of fluoride (15,000 µg/L). The fluoride concentration, compared to a background concentration of 1000 µg/L in MW06, is considered to be elevated.

A Remedial Action Works Plan (RAWP) was completed by Ramboll during December 2014 (2014b) in order to describe the works necessary to render the site suitable for the future commercial/industrial land use.

Remediation options were considered in terms of cost, risk of failure, long term legacy and onsite management, corporate responsibility and sustainability. The preferred strategy was excavation of the filled materials to remove all contaminant management requirements from The Clay Borrow Pit and reshaping of the resultant land surface. Excavated materials were proposed to be coarsely sorted and stockpiled in a designated area of the Smelter. Materials relocated to the Smelter will be stockpiled separately for later beneficial reuse where permissible, or incorporated within a whole-of-site remediation strategy.

The RAWP outlined the remedial plan to be implemented at the site to achieve the remediation objective. The RAWP included a detailed works methodology including validation requirements and environmental controls to be implemented during the works. Remediation was undertaken between March and August 2015. A Remediation and Validation Report has been completed for the Clay Borrow Pit and presents the successful remediation of the area.

5.9 Environmental Site Assessment – Diesel Spray Area

An Environmental Site Assessment was performed by Ramboll at the Diesel Spray Area to laterally delineate the extent of PAH impacted fill material and to estimate the quantity of fill that is impacted (Ramboll Environ 2018b).

Eight test pits were excavated at and in areas immediately surrounding the Diesel Spray Area to assess the lateral extent of the previously identified PAH impacted shallow fill material. The test pits were excavated using a backhoe and were extended into natural estuarine sands. Two to three soil samples were collected from each test pit, with soil samples analysed for PAHs.

Table 5-1: PAH Impact from Current and Previous Investigations

Sample Location	Depth	BaP TEQ (mg/kg)	Soil Description
MW19	0.3-0.4	32*	FILL: clayey gravelly sand, orange
MW19, FILL 1	0.3-0.4	**150.2**	FILL: gravelly sand, dark brown
FILL 2	0.2-0.3	19.2*	FILL: gravelly sand, dark brown
SB18	0.5-0.6	**70**	FILL: clayey sand, grey
SB112	0.4-0.5	**55**	FILL: gravelly sand, dark brown
TP202	0.2-0.3	**66**	FILL: gravelly sand, dark brown

*below the guideline but still elevated concentration.

The lateral extent of the PAH impacted fill material was assessed based on information from the 2016 field investigation and from two Phase 2 investigations (2012a and 2015a). The volume of PAH impacted fill material that requires remediation is estimated to be approximately 450 m^3, with a low estimate of 395 m^3 and a high estimate of 730 m^3. The depth of the PAH impacted fill material used in the volume estimates is 0.8 m bgs.

The low estimate is based on the PAH impacted fill material being confined to the western side of the fire system pump house (Building 12A) and water tank, approximate area of 14 m wide by 35 m long. The high estimate is based on the PAH impacted fill material extending to the eastern side of the water tank, approximate area of 14 m wide by 65 m long. PAH concentrations in fill beneath the fire system pump house and the water tank remain a data gap as intrusive investigations could not be completed beneath these buildings and the intention is to retain these buildings. Refer to **Figure 7.**

5.10 Capped Waste Stockpile Assessment

An assessment of the Capped Waste Stockpile was completed by Ramboll to provide a preliminary assessment of the composition of the stockpile and soil and groundwater conditions beneath the stockpile (Ramboll Environ 2016a).

The scope of work included the following:

- Review of available borehole logs for previously drilled bores adjacent to the Capped Waste Stockpile.
- Development of a health and safety methodology to safely drill within the stockpile.
- Drilling of six boreholes via sonic drilling and conversion of these boreholes to groundwater monitoring wells.
- Log and photograph material encountered within the Capped Waste Stockpile.
- Sampling and analysis of materials within the waste profile for the purpose of waste classification.
- Soil sampling and analysis of natural soils beneath the Capped Waste Stockpile.
- Survey of the groundwater wells to Australian Height Datum.
- Development of the new wells, groundwater sampling and analysis.
- Preparation of a factual report.

The following key findings were made from the assessment:

- The depth of the fill material in the six boreholes ranged between approximately 10.5 m and 12 mbgs.
- The natural soils underlying the wastes generally comprised a mixture of clays and sands. Clays encountered during the works were considered to be firm to very stiff. A band of coarse grained sands (>5.4 m in thickness) was identified in MW206. This sand was identified to contain leachate impacted groundwater.
- Elevated gas concentrations of carbon monoxide, ammonia and methane were detected within the Capped Waste Stockpile. Oxygen deficient concentrations as low as 3.2 % were also detected.
- The fill material encountered during the drilling works was generally dry, indicating that the cap over the stockpile is effective at reducing infiltration through the wastes. Leachate impacted groundwater was encountered within the underlying natural soils in four of the six groundwater wells installed.
- Soil sampling found asbestos fibres in three of the six boreholes. Chemical analysis of the waste materials for contaminants of concern classified the materials as hazardous waste and special waste on the basis of elevated total and leachable fluoride concentrations, total PAH concentrations and asbestos fibre content.
- Impacts to the underlying natural soils was limited to shallow PAH impacts extending to less than 1 m into underlying soils.

5.11 Substation Trial Assessment

The Smelter Site includes a transformer yard and 19 smaller substations. It is understood that the transformer yard will be retained on site and does not require remediation. The substations are a potential source of soil contamination due to the leaking of transformer oil that contains petroleum hydrocarbons and may contain Polychlorinated Biphenyls (PCBs). A remediation and validation trial was completed at one of the substations, 3CC, known to have previously contained PCBs in transformer oil (Ramboll Environ 2017).

The trial was completed to develop a methodology for the removal and segregation of potential PCB and hydrocarbon impacted materials (concrete, ballast and soil). The trial methodology included the separation of visually stained concrete, ballast and soil from material with no staining. Visually stained materials were stockpiled separately and samples were collected for analysis of the following materials:

- Stained concrete;
- Stained ballast and soil;
- Unstained concrete;
- Unstained ballast and soil;
- Soil within the substation footprint following removal of stained soil (validation samples);
- Soil within the substation footprint below areas without staining (validation samples).
- Soil analytical results were compared against NEPM (2013) commercial/ industrial criteria and NSW EPA waste classification criteria.

Based on the results of the trial, the following recommendations were made for the demolition, remediation and validation of substations at the Smelter Site:

- Stained soil and ballast was found to contain concentrations of petroleum hydrocarbons and PCBs exceeding NEPM HIL D criteria. It is therefore recommended that stained soil and ballast be excavated for off-site disposal.
- Based on the results of the trial it is recommended that stained soil and ballast are excavated to a nominal depth of 100 mm below areas where staining is evident to account for PCB/TRH contamination that is not visual.
- It is recommended that excavated substation footprints are preserved to allow for validation sampling of natural soils at the excavation base, prior to backfilling. Validation sampling of underlying soils should be completed by collecting one sample per excavation footprint.
- It is understood that unstained soil and ballast will be removed to facilitate the removal of the earth grid. Unstained soil and ballast was found to contain concentrations of petroleum hydrocarbons and PCBs below NEPM HIL D criteria and below the NSW EPA Chemical Control Order PCB waste guidelines. Unstained soil and ballast can be reused on site to fill voids following sampling to verify PCB concentrations are below the NSW EPA Chemical Control Order PCB waste guidelines (2 mg/kg). Unstained soil and ballast from all substations should be consolidated into one stockpile and sampled to confirm site suitability prior to reuse. In the event that PCB concentrations in the consolidated unstained soil and ballast stockpile are above the NSW EPA Chemical Control Order PCB waste guidelines, this material will need to be disposed off-site to landfill.
- Concrete pads for transformers and isolators where staining is evident should be broken up (as best can be achieved) such that stained concrete can be effectively separated from unstained concrete. Stained concrete from substations can be stockpiled with stained soil and ballast material for offsite disposal. Unstained concrete should be stockpiled separately and can be reused on-site for filling voids following sampling to verify PCB concentrations are below the NSW EPA Chemical Control Order PCB waste guidelines (2 mg/kg).

- Stained soil, ballast and concrete from substations where PCB containing oils were known to have been used should be consolidated into one stockpile for assessment for waste classification in accordance with the NSW EPA (2014) Waste Classification Guidelines – Part 1: Classifying waste, in order to inform disposal options. Stained soil, ballast and concrete with PCB concentrations less than 50 mg/kg may classify as General Solid Waste, depending on the petroleum hydrocarbon concentrations. Stained soil, ballast and concrete with PCB concentrations greater than 50 mg/kg will classify as Hazardous Waste.
- Stained soil, ballast and concrete from substations where PCB oils were not used should be consolidated into one stockpile for assessment for waste classification in accordance with the NSW EPA (2014) Waste Classification Guidelines – Part 1: Classifying waste, in order to inform disposal options. This material will likely classify as Restricted Solid Waste based on petroleum hydrocarbon concentrations.

5.12 Emerging Contaminants

Emerging contaminants of concern that have been considered at the Smelter Site include the use of aqueous film forming foams (AFFF) for fire-fighting that contain per- and poly-fluoroalkyl substances (PFAS). Ramboll requested by email dated 20 October 2015 information on the fire-fighting systems at Hydro. Mr Andrew Walker responded by email dated 22 October 2015 that the following types of fire-fighting systems were used:

- Water-based, dry powder and carbon dioxide fire extinguishers were used in recent times
- BCF fire extinguishers were used in earlier days
- Water was used in fire sprinklers and hose reels in offices and in production areas away from molten metal such as in the Greenmix plant and the Bake Furnace in the Carbon Plant
- Carbon dioxide fire extinguishers were used in areas containing molten metal, such as the Cast House
- Freon gas fire suppression systems were used in the Switchrooms until it was banned and then Inergen gas was used
- Enquiries were made with the former Plant Emergency Operations Manager regarding the type of fire-fighting equipment used in the fire training area in the south west of the storage area to the west of the Pot Lines. The former Plant Emergency Operations Manager indicated that PFAS-containing fire-fighting foams were not used.

5.13 Condition and Surrounding Environment

Table 5-2 provides a summary of the site conditions and surrounding environment. Further information is outlined in Phase 2 ESA (2012) and Stage 2 Phase 2 ESA (2015).

Table 5-2: Summary of Site Conditions and Surrounding Environment

Item	Description
Topography	The Smelter Site is located between low residual hills to the west and low lying swampy land to the north and east. The Smelter is relatively flat with a gentle slope from west to east, from the plant area towards the surrounding water courses in the east and northeast. Low lying areas were filled to create a flat, elevated platform at approximately 14m AHD for construction. The Smelter Site increases in elevation to the west in the vicinity of the Clay Borrow Pit, which is at an elevation of 25m AHD.
Boundary Conditions	The boundary of the Smelter Site is shown in **Figure 2**. The western, northern and southern boundaries are identifiable by roads or tracks, including the recently completed Hunter Expressway on the southern boundary of the Smelter Site. The majority of the eastern boundary is within bushland and is not easily identifiable on the ground.
Visible Signs of Contamination	During site visits conducted by Ramboll on 6 and 15 May 2014, visible signs of contamination were noted in the following areas: • The garden bed at the south-western corner of the Carbon Plant (soils discoloured black). • Staining surrounding the hydraulic rooms of the Carbon Plant and Casting Plant. • Staining surrounding the Heating Transfer Medium (HTM) electric heater room and gas heater room in the Carbon Plant. • Hydraulic oil on the floor of the Butt Crushing Plant.
Visible Signs of Plant Stress	During site visits conducted by Ramboll throughout 2012, 2013 and 2014, visible signs of plant stress were observed down gradient of the Capped Waste Stockpile near the eastern site boundary, as shown in **Figure 2**.
Presence of Drums, Wastes and Fill Material	Some 44 gallon drums of Castrol oil were observed by Ramboll at the drum store in the eastern portion of the Smelter Site on 15 May 2014. Smelter wastes were observed at the Anode Waste Pile, where Ahead of Schedule anodes are stockpiled prior to disposal or reuse and at the Clay Borrow Pit, where refractory bricks and concrete are stockpiled. A second anode waste pile was also observed immediately east of Pot Line 1, where excess anodes have been stockpiled prior to disposal off-site since the closure of the Smelter. Stockpiles of various waste streams were observed on the storage area west of Pot Line 3 during the 2012 site walkover. It is noted that these stockpiles were recycled or disposed of and were not present during the 2014 investigations.
Odours	No odours were noted at the Smelter during the investigations conducted between 23 June and 2 July 2014. It is noted that the Smelter is no longer operational.
Conditions of Buildings and Roads	Roads at the Smelter Site were noted to be in good condition during the investigations undertaken between 23 June and 2 July 2014. Since operations ceased in 2012 and the Smelter was put on a care and maintenance mode, rust has developed on the surface of scrubbers and other plant associated with the pot lines. Office buildings remain in good condition. The care and maintenance team maintain the condition of the buildings at the Smelter Site and additionally are commencing demolition of structures including removal of hazardous materials.
Quality of Surface Water	There are five storage ponds located at the Smelter as shown on Figure 4. Surface water from the Smelter is directed to these storage ponds via open channels and some concrete subsurface drainage lines. Surface

Table 5-2: Summary of Site Conditions and Surrounding Environment

Item	Description
	water ponds known as 'East', 'West' and 'South' are pumped to two North dams where excess surface water is discharged to an irrigation area under license from NSW Office of Environment and Heritage (EPL 1548). Surface water dams were constructed by excavation into the residual underlying extremely weathered bedrock. Surface water quality at the East Surge Pond and North Dams are monitored and fluoride concentrations are elevated compared to background levels. This is likely due to flow from site sources such as the anode pile which was not covered for some time.
Flood Potential	The majority of the Smelter Site is located on low lying swampy ground that has been filled. Low lying areas of the Smelter Site remain susceptible to flooding. The western portion of the Smelter Site is located on ground at a higher elevation and not likely to flood.
Local Sensitive Environment	Sensitive environments including a two creeks and a wetland swamp are located in the vicinity of the Smelter Site. Swamp Creek is located approximately 400m to the south and east of the Smelter Site, flowing in a northerly direction. Swamp Creek flows north into Wentworth Swamp, a large wetland located approximately 1.6km north of the Smelter Site. Swamp Creek is the receptor for groundwater from the eastern portion of the Smelter Site. The location of Swamp Creek is shown on Figure 2. An unnamed creek passes through the Smelter Site between the Smelter site and the Clay Borrow Pit. This creek originally passed through the Smelter site and was relocated during Smelter construction. Black Waterholes Creek is located approximately 700m to the north of the Smelter Site, flowing in a northerly direction. Black Waterholes Creek flows north into the western portion of Wentworth Swamp. Black Waterholes Creek is the receptor for groundwater from the western portion of the Smelter Site.

5.14 Geology and Hydrogeology

Table 5-3 provides a summary of the site conditions and surrounding environment. Further information is outlined in Phase 2 ESA (2012) and Stage 2 Phase 2 ESA (2015).

Table 5-3: Summary of Geology and Hydrogeology

Item	Description
Geology	According to the review of the regional geology described on the Sydney Basin Geological Sheet, the Smelter Site and Hydro Land are underlain by siltstone, marl and minor sandstone from the Permian aged Rutherford Formation (Dalwood Group) in the Sydney Basin.
Location and Extent of Fill	The Smelter is located in low lying land that was filled to create a level area for the construction of the Smelter. The fill material is generally understood to comprise locally derived fill. During the Phase 2 ESA investigations, crushed refractory brick fill was observed within fill material underlying the Carbon Plant and the Pot Lines. A portion of the Smelter Site between the north-western fence line and the Clay Borrow Pit was also filled with material likely to include refractory bricks and concrete waste. This area was recently filled with excess Excavated Natural Material (ENM) from the construction of the Hunter Expressway immediately south of the Smelter Site. A classification of this material was completed by Environ (Classification for Stockpiled Soil, Grahams Lane, dated 8 April 2014) under the Excavated Natural Material Exemption 2012.

Table 5-3: Summary of Geology and Hydrogeology

Item	Description
Borehole Logs	During the Phase 2 ESA, Ramboll supervised the drilling of 52 boreholes across the Smelter Site. These boreholes extended to a maximum depth of 16m bgs. The subsurface conditions varied across the Smelter Site, but generally comprised fill material overlying estuarine sediments. The fill material, where encountered, generally comprised clayey gravelly sand and included gravel brick fragments. The estuarine sediments generally comprised fine grained sand, with high plasticity clay encountered in some boreholes.
On-site Wells	During the Phase 2 ESA, Ramboll supervised the installation of 21 monitoring wells at the Smelter Site. The wells were installed at AECs, including the Carbon Plant, the Diesel Spray Area, the Refuelling Area and the Anode Waste Pile. Prior to the Phase 2 ESA, a pair of shallow and deep nested wells were installed at the Carbon Plant as part of the geotechnical investigations for the bake furnace reconstructions.
Depth to Groundwater Table	Groundwater in the east of the Smelter Site was identified at shallow depths within the estuarine sands, between 1m and 5m bgs during the Phase 2 ESA. At the Clay Borrow Pit in the west of the Smelter Site, groundwater was identified within residual clay at depths ranging between 8m and 9m bgs.
Aquifers present	Two aquifer systems are present at the site, one shallow aquifer within alluvium and one deeper aquifer within the underlying bedrock/ residual clay. The shallow aquifer system is limited in extent due to the nature of the alluvium (interbedded sands and clays, with groundwater limited to the sands). There are a number of licensed groundwater bores located within the shallow alluvium immediately east of the Smelter Site, which are used for monitoring of the leachate plume from the Capped Waste Stockpile. Groundwater bores licensed for uses such as domestic, recreation, irrigation and stock watering are located at distances of greater than 3km from the Smelter Site.
Direction and Rate of Groundwater Flow	During the Phase 2 ESA, groundwater was identified flowing north to north east across the Smelter Site. Douglas Partners (2002) measured permeability within the fill of 5x10**-6** m/s and in the sand of 8x10**-6** m/s. At the Clay Borrow Pit, groundwater is expected to be towards the north east following topography.
Direction of Surface Water Runoff	Stormwater water runoff is managed at the Smelter Site via a series of drainage channels and three surge ponds. Surge ponds discharge to the two North Dams, from which excess stormwater is spray irrigated over an adjacent paddock in accordance with EPL1548. There are no other surface water bodies located on the Smelter Site.
Background Water Quality	A background monitoring well was installed as part of the Phase 2 assessment. The well was installed approximately 60m west of the Smelter in bushland within the Smelter Site. This well was installed in an up-gradient location. Analysis of water from the background well in 2012 was completed and the results were below the adopted guidelines, including ANZECC (2000) 95% protection of fresh water species, irrigation and stock watering guidelines for heavy metals aside from zinc, fluoride, free cyanide, PAHs, Semi Volatile Organic Compounds (SVOCs). The zinc concentration (78µg/L) marginally exceeded the ANZECC (2000) hardness modified trigger value of 70µg/L.
Preferential Water Courses	The 1951 historical aerial photograph shows a former water course extending in a northeast/ southwest direction towards Wentworth Swamp in the west of the Smelter Site. It is understood this water course was filled in and relocated to the west to provide a level platform on which to

Table 5-3: Summary of Geology and Hydrogeology

Item	Description
	construct Pot Lines 2 and 3. The water course is now an ephemeral unnamed creek situated on the sites western boundary.
Summary of Local Meteorology	Median, daily highest and lowest hourly average temperatures have been collected over the past 20 years. AECOM (2013) indicate that the 2012 temperatures were above average for summer days and nights. AECOM (2013) indicates annual rainfall in 2012 was 515mm, which is below the 20 year average of 619mm. AECOM (2013) indicates quarterly wind roses show the usual pattern of strongest winds from the northwest in winter, moderate winds from the south and southwest in spring and autumn and moderate to strong southeast winds in summer.

5.15 Nature and Extent of Soil Contamination

Ramboll conducted a Phase 2 Environmental Site Assessment at the Smelter Site in 2012 followed by additional investigations in 2014 to delineate identified soil contamination and to assess areas that were previously inaccessible. These investigations identified all key contaminants at the Smelter site, including aluminium smelter-specific contaminants of fluoride, cyanide, aluminium and PAHs; contaminants associated with industrial sites including the use of petroleum hydrocarbons (mainly diesel), solvents, heavy metals in building materials and paints, transformer oils containing polychlorinated biphenyls (PCBs) and potential use of Aqueous Film Forming Foams (AFFF) fire water. These investigations also identified all key Areas of Concern (AECs) and Potential Areas of Concern (PAECs) across the Smelter site. The locations of all AECs and PAECs identified at the Smelter site are marked out in **Figure 12**.

The main AEC was the Capped Waste Stockpile, used to stockpile spent pot lining and other wastes associated with aluminium smelting, including cryolite, alumina, floor sweepings (alumina, cryolite and carbon), shot blast dust (carbon, steel shot), cement, potlining mix and small amounts of materials including plastics, wood, bonded and friable asbestos and steel. The spent pot lining has leached fluoride and cyanide into shallow groundwater beneath the Stockpile and a leachate plume has been identified extending approximately 300m from the north-east corner of the Stockpile.

Soil impacts identified at the Smelter Site are primarily associated with PAH impacts, in particular carcinogenic PAHs (Benzo(a)Pyrene Toxicity Equivalence Quotient (BaP TEQ). PAH impacts to soil were observed to be shallow, within the fill material and generally less than 0.6m below ground surface (bgs). PAH contamination is limited in vertical extent and has not impacted underlying natural soils.

Seven AECs were identified as requiring remediation due to PAH impacts in shallow surface soils. Each AEC and the associated contaminant concentrations are shown in **Table 5-4** and a summary of soil concentrations are shown in **Table 5-5**. Each sample location for each AEC are shown on **Figures 5 to 11**. Photographs of the AECs are included in **Appendix 5**.

One AEC, Area East of the Playing Fields, included aesthetic issues with fill material and buried wastes to a depth of 1.0m bgs.

Table 5-4: Summary of Site Soil Contamination

Site Activity	Site Area	Description	CoC	Sample Identification	Sample Concentration in excess of HIL 'D' ^{A} (mg/kg)	Sample Concentration in excess of EIL 'C/I' ^{B} (mg/kg)	Depth of Soil Impact (m bgs)
Waste stockpiling	Capped Waste Stockpile (AEC 1) **Figure 5**	Long term stockpiling of spent pot lining and other wastes.	Fluoride cyanide PAHs asbestos TPH/BTEX Heavy metals	NA	NA	NA	NA
	Anode Waste Pile (AEC 2) **Figure 6**	Long term stockpiling of 'ahead of schedule anodes' in low lying ground adjacent to the Capped Waste Stockpile.	BaP TEQ	MW12	56.9	--	0-0.4, fill extends to 0.9
				SB105	55	--	
				MW103	42	--	
				MW103	**250**	160	
Fill Importation	Diesel Spray Area (AEC 4) **Figure 7**	Likely that impacted fill material was used to level this portion of the site.	BaP TEQ	SB18	70.1	--	0.4-0.6
				MW19	**150.2**	101	
				SB112	55	--	
				TP202	66	--	
Site Operations	Carbon Plant (AEC 8) **Figure 9**	Impacts in the vicinity are likely due to the accumulation of dust from the Carbon Plant. Impacts in garden beds and grassed areas.	BaP TEQ	MW18	58.5	--	0-0.4
				HA107	**140**	98	
				HA107	**260**	180	
				HA110	82	--	
				HA111	75	--	
				HA111	67	--	
	Bake Furnace	Impacts associated with the accumulation of black sandy	BaP TEQ	HA115	**440**	230	>0.3

Table 5-4: Summary of Site Soil Contamination

Site Activity	Site Area	Description	CoC	Sample Identification	Sample Concentration in excess of HIL 'D' ^{A} (mg/kg)	Sample Concentration in excess of EIL 'C/I' ^{B} (mg/kg)	Depth of Soil Impact (m bgs)
	Scrubber (PAEC 26) **Figure 10**	material likely to be spilt Ring Furnace Reacted Alumina.		HA115	94	--	0-0.3
		Impacts to shallow surface soil beneath the scrubber duct work.		HA116	90	--	
				HA117	**120**	--	
Burial of Waste	Area East of Playing Fields (PAEC 29) **Figure 11**	Waste materials, including concrete, refractory brick, metal sheeting, metal reinforcement, plastic sheeting, timber, fence posts, broken glass, electrical wire, steel posts and old cable.	BaP TEQ	TP117	**310**	220	0.5, fill extends to 1.6
Drainage	Drainage Lines (AEC 5) **Figure 8**	PAH contaminated sediments have accumulated in the drainage line adjacent to the Anode Waste Pile.	BaP TEQ	D6	149.6	85.6	0-0.3
				D7	96.3	--	
				D8	102	--	
	East Surge Pond (AEC 6) **Figure 8**	PAH contaminated sediments have accumulated within the East Surge Pond, which is immediately down gradient of the drainage lines near the Anode Waste Pile.	BaP TEQ	D11	56.2	**--**	0-0.2

NA Not Applicable - Soil sampling has not been undertaken at the Capped Waste Stockpile
A NEPM (2013) Health Investigation Level 'D' (Commercial/ Industrial) guideline value for Benzo(a)Pyrene TEQ = 40mg/kg
B Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects) guideline value = 72mg/kg
Results shown in bold are considered a 'hotspot' of contamination i.e. >2.5 times the guideline value.

Table 5-5 Summary of Soil Results

CoC	No. of Sample	Maximum Concentration (mg/kg)	Minimum Concentration (mg/kg)	Average Concentration (mg/kg)	No. exceeding Site Criteria	Criteria Exceeded (mg/kg)
AEC 2: Anode Waste Stockpile						
B(a)P	13	160	0.05	27.8	1	72 (EIL)
B(a)P TEQ	13	250	0.5	46.5	4	40 (HIL)
AEC 4: Diesel Spray Area						
B(a)P	32	101	0.5	15.8	1	72 (EIL)
B(a)P TEQ	32	150.2	0.5	24.3	4	40 (HIL)
AEC 8: Carbon Plant						
B(a)P	30	180	0.05	19.1	1	72 (EIL)
B(a)P TEQ	30	260	0.5	28	6	40 (HIL)
PAEC 26: Ring Furnace Scrubber						
BaP	16	230	0.26	26.3	1	72 (EIL)
BaP TEQ	16	440	0.5	50.1	4	40 (HIL)
PAEC 29: Area East of Playing Fields						
B(a)P	10	220	0.06	22.3	1	72 (EIL)
B(a)P TEQ	10	310	0.5	31.7	1	40 (HIL)
AEC5: Drainage Lines						
B(a)P	7	85.6	0.5	31.6	1	72 (EIL)
B(a)P TEQ	7	149.6	1.6	63.4	3	40 (HIL)
AEC 6: East Surge Pond						
B(a)P	4	21.7	0.9	12.9	0	72 (EIL)
B(a)P TEQ	4	56.1	1.9	28.7	1	40 (HIL)

5.16 Characterisation of the Capped Waste Stockpile

In consultation with the NSW EPA waste group, the inclusion of the Capped Waste Stockpile in a remediation strategy must consider the contents of the Capped Waste Stockpile as ‘waste’ and thereby classify the materials in accordance with the NSW EPA *Waste Classification Guidelines* (2014). This evaluation has been completed in this section, and is discussed in **Section 8**.

5.16.1 Waste content

The following materials are understood to be contained within the Capped Waste Stockpile:

- Spent pot lining
- Carbon Plant shot blast refuse, including grit and dust;
- Carbon Plant dust collector product;
- Collar mix (coke, pitch) spillage;
- Carbon Plant floor sweepings;
- Packing coke oversize;

- Contaminated bath;
- Rotary breaker oversize;
- Pot lining mix (hot ramming paste);
- Rodding mix (coke, graphite, pitch and anthracene oil);
- Stud joining mix;
- Pitch spills/ pencil pitch;
- Aluminium swarf;
- Scrap aluminium billets;
- Anode cover material;
- Butt from spent anodes;
- Ahead of schedule anodes;
- Dross;
- Pot bottom aluminium;
- Consumable gaskets and insulation material (Synthetic mineral fibre and asbestos); and
- General rubbish, including plastic, wood and steel.

With the exception of spent pot lining, the majority of these materials are associated with the Carbon Plant, which produced carbon anodes from liquid pitch and petroleum coke. The main chemicals of concern for these materials are Polycyclic Aromatic Hydrocarbons (PAHs). PAHs associated with pitch, coke and anodes have a low solubility in water and are unlikely to generate leachable concentrations.

Spent pot lining is a waste produced during aluminium smelting using the Hall-Heroult reduction process. The process of aluminium smelting takes place in electrolytic cells or pots. The pots consist of a steel container lined with refractory brick with an inner lining of carbon that protects the steel container against corrosion. The pot lining continuously uptakes electrolytic bath and other chemicals during its service life. Pot failure occurs when the molten bath and metal breach the carbon and refractory lining. When pot failure occurs, the spent pot lining, comprising refractory brick and carbon, is broken up and extracted from the steel shell for disposal.

The electrolytic bath, which the pot lining is in contact with, comprises cryolite (Na_3AlF_6) and other fluoride salts. Subsequently, the spent pot lining contains high concentrations of leachable fluoride and sodium. The spent pot lining also contains cyanide-forming materials.

The Materials Safety Data Sheet (MSDS) indicates that the composition of spent pot lining is typically as follows:

• Carbon	26-72%
• Alumina	11-22%
• Fluorides	7-22%
• Total sodium	13-17%
• Aluminium	5-20%
• Silicates	<10%
• Calcium oxide	<3%
• Iron oxide	<1.4%
• Cyanides	<0.7%
• Magnesium oxide	<0.35%
• Total sulphur	<0.2%

For the Smelter, both first and second cut spent pot lining have been chemically characterised as shown in **Table 5-6**.

Table 5-6: Analysis of Spent Pot Lining

Analyte	Waste Classification				First Cut Range (%)		Second Cut Range (%)	
	CT1 %	CT2 %	SCC1 %	SCC2 %	Lower Value	Higher Value	Lower Value	Higher Value
Carbon	--	--	--	--	41	70	5	10
Silicon Dioxide	--	--	--	--	0.9	7	25	40
Calcium Oxide	--	--	--	--	2	3	0.06	7
Sulphur	--	--	--	--	0.45	0.63	0.1	1.07
Vanadium Pentoxide	--	--	--	--	0.06	0.09	0.06	0.09
Phosphorous Pentoxide	--	--	--	--	0.01	0.02	0.06	0.08
Sodium Oxide	--	--	--	--	14.1	18	12.9	14.9
Aluminium Oxide	--	--	--	--	4	11	17	21
Fluoride	0.3	1.2	1	4	**7.5**	**8**	**3.7**	**6.5**
Iron Oxide	--	--	--	--	1	3	3	4
Potassium Oxide	--	--	--	--	0.1	4	0.8	2
Manganese Oxide	--	--	--	--	0.07	0.08	0.1	0.1
Titanium Dioxide	--	--	--	--	0.01	0.08	0.02	0.04
Cyanide (Total)	0.0320	0.1280	0.059	2.36	0.0164	0.0311	0.0004	0.0178
Aluminium Carbide	--	--	--	--	0.5	3	Not present	Not present
Aluminium Nitride	--	--	--	--	0.05	1.5	Not present	Not present
Al Metal	--	---	--	--	0.05	3	0.05	1
Na Metal	**--**	**--**	**--**	**--**	0.005	0.1	0.005	0.01

5.16.2 Leachate

Leachate from the Capped Waste Stockpile impacts groundwater in a localised area. Dames and Moore (1992) presents the quality of leachate pond effluent within the Capped Waste Stockpile prior to capping to comprise:

Sodium	4800 to 15300mg/L
Fluoride	1100 to 3420 mg/L
Sulphate	4000 to 6740 mg/L
Total Cyanide	70 to 200 mg/L

Two leachate samples were collected on 3 and 4 June 2015 to evaluate concentrations in leachate at the toe of the mound, where leachate is intercepted by an active trench. Results are included in **Table 5-7.**

Table 5-7: Capped Waste Stockpile Leachate Concentrations (mg/L)

Chemical	LT01 (3/6/2015)	LT02 (4/6/15)
pH (pH units)	9.7	9.7
Electrical Conductivity (µS/cm)	15,000	16,000
Aluminium	46	42
Iron	33	31
Fluoride	480	490
Total Cyanide	79	85
Mercury	<0.00005	<0.00005
Calcium	7	<5
Potassium	18	13
Sodium	5,600	5,600
Magnesium	3.6	2.4
Hydroxide Alkalinity as CaCO3	<5	<5
Bicarbonate Alkalinity as CaCO3	3,300	3,500
Carbonate Alkalinity as CaCO3	4,600	4,700
Total Alkalinity as CaCO3	7,900	8,200
Sulphate	1,900	2,000
Chloride	160	150
TRH C6-C10	<0.01	<0.01
TRH C10-40	<0.1	<0.1
BTEX	<0.002	<0.002
Benzo(a)pyrene	<0.001	<0.001
Total PAHs	<0.002	<0.002
PCBs	<0.002	<0.002

Leachate has additionally been monitored since 1992 in groundwater in the immediate vicinity of the site for fluoride. Concentrations are presented in **Figure 13** and show the concentration decline in the aquifer since capping in 1995.

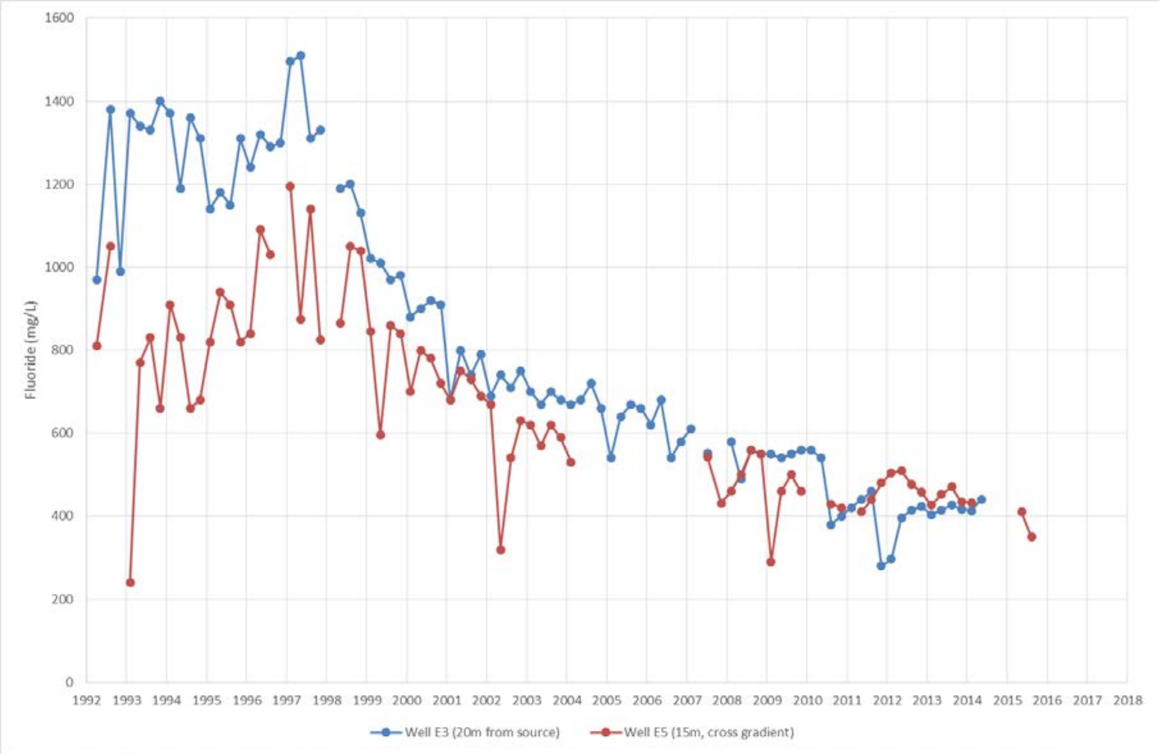

Figure 13 Fluoride concentrations in groundwater

5.16.3 Gas

The MSDS indicates that hazardous decomposition can occur with the interaction of spent pot lining with water, which creates ammonia, hydrogen and methane, and interaction with high temperatures or acids, which can release fluorides, hydrogen cyanide and oxides of sulphur.

Between 1969 and 1992, the process used to remove spent pot lining from a pot involved the use of water to soak the pot linings to cool the lining and minimise dust during demolition. The use of water also created a reaction between the sodium, carbides and nitrides in the spent pot lining to form sodium carbonate, hydrogen, methane and ammonia. Information from the *Environmental Impact Statement, Upgrades to Waste Storage Facilities at the Alcan Australia Limited Kurri Kurri Smelter* (Dames and Moore, 1992) indicates that the gas generation rate is initially rapid for the three major gases of ammonia, hydrogen and methane, with the liberation of hydrogen and methane ceasing within a matter of hours. Ammonia continues to be generated for a longer time period. Hydrogen fluoride is not produced and requires a high temperature heat source.

The use of water in the breakup of the pot linings, the subsequent storage in a stockpile open to rain water and the rapid gas generation rate suggests that the spent pot lining stored in the Capped Waste Stockpile is likely to have exhausted much of its flammable gas generation potential.

Gas monitoring has been undertaken from gas vents installed within the cap of the Capped Waste Stockpile since its construction in 1995. Gas sampling was initially completed three to four times per year between 1996 and 1998. No sampling was completed in 1999. From 2000, gas sampling was completed annually.

Gas samples were analysed at a NATA accredited laboratory for carbon dioxide, oxygen, methane, carbon monoxide, hydrogen and nitrogen. During the collection of gas samples, Kitagawa detection tubes were also used to collect samples for ammonia, phosphine/ arsine, hydrogen cyanide and hydrogen sulphide.

Methane peaked at 6.4% in February 1996, with methane varying between a maximum of 3.25% and 6.1% until November 1997. The maximum percentage of methane in 1998 was 2.3%, with maximum percentages declining to 0.21% in 2012. Methane concentrations over time in Standpipes 5 and 7 are presented in **Figure 14**, including comparison to the methane Lower Explosive Limit (LEL) of 5%. These two standpipes have the highest methane concentrations.

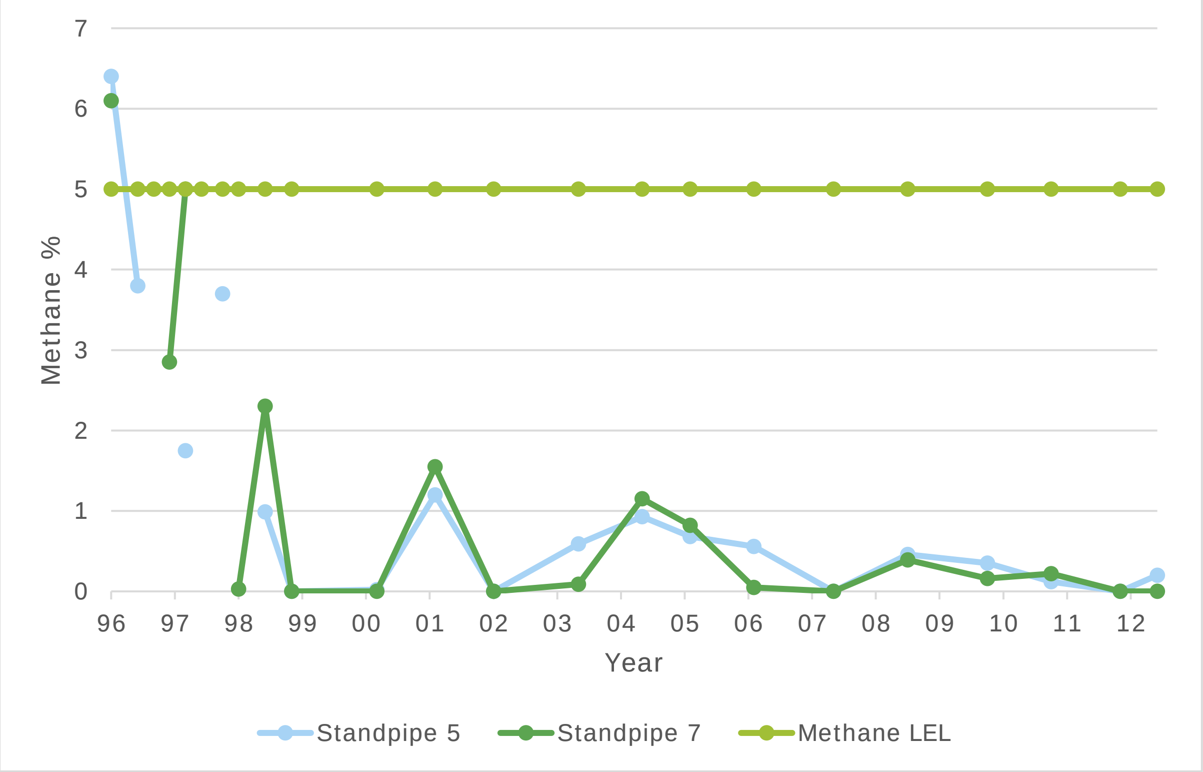

Figure 14 Methane concentrations over time

Ammonia results indicate ammonia generation occurred at low concentrations initially, followed by a period of higher concentrations in a number of standpipes between 2002 and 2007. Ammonia concentrations in other standpipes have increased recently. Results for Standpipes 1 and 4 are included in **Figure 15**, which show ammonia generation between 2000 and 2007 and between 2010 and 2012. **Figure 15** includes comparison to the ammonia Time Weighted Average (TWA) exposure of 25ppm for an 8 hour day.

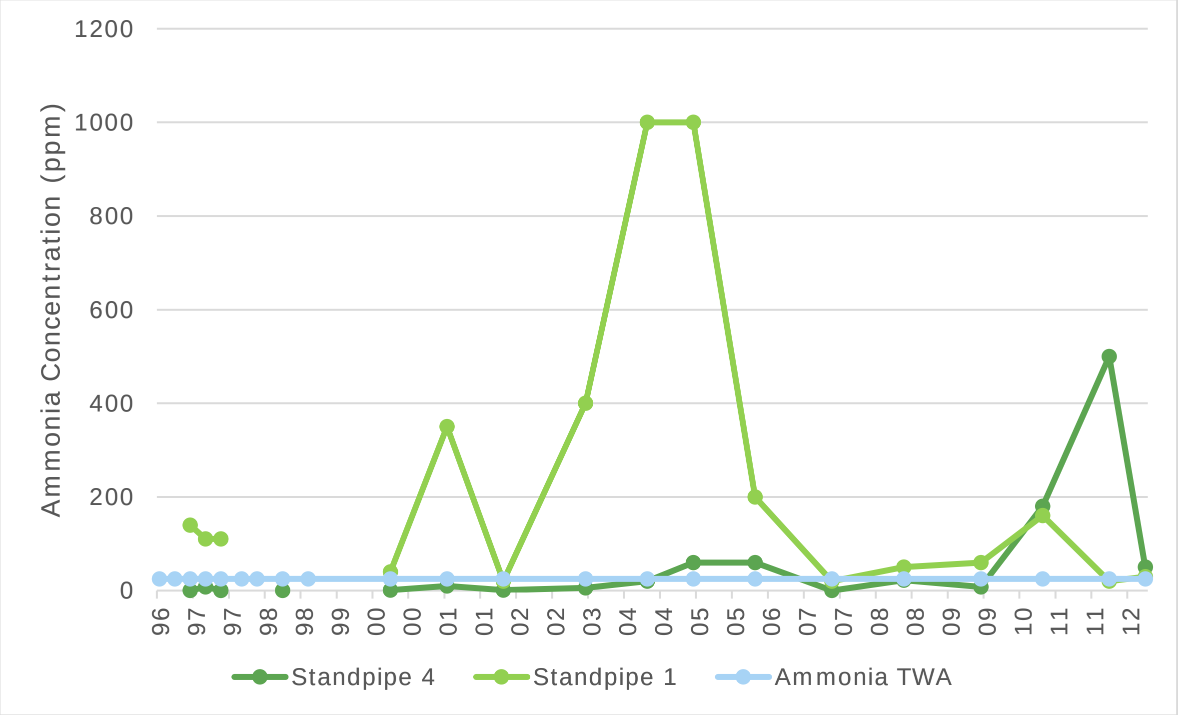

Figure 15 Ammonia concentrations over time

Phosphine/ arsine, hydrogen cyanide and hydrogen sulphide concentrations have not been recorded above the limit of detection since 1996. The hydrogen cyanide and hydrogen sulphide concentrations are as expected based on the information in the MSDS, which indicates release of these gases is only likely if the spent pot lining comes in to contact with high temperatures.

Maximum and average concentrations of these gases are presented in **Table 5-8**.

Table 5-8: Capped Waste Stockpile Gas Concentrations (ppm)

Chemical	Maximum Concentration (ppm)	Average Concentration (ppm)	LEL (ppm)
Ammonia	>800	55.6	150000
Phosphine/Arsine	<0.1	<0.1	18000
Hydrogen cyanide (HCN)	<1	<1	56000
Hydrogen sulfide (H2S)	<1	<1	40000
Hydrogen	2.3%	0.45%	4%
Methane	6.4%	0.67%	5%

Monthly gas monitoring was completed at the Capped Waste Stockpile between December 2016 and October 2017 on the existing 12 gas vents and on six groundwater monitoring wells and six gas wells installed by Ramboll in 2015 (Ramboll, 2018a). Gas monitoring was undertaken for carbon monoxide, carbon dioxide, methane, hydrogen sulphide and oxygen. Monitoring of ammonia was completed for three rounds.

Results from the gas vents identified low flow rates, with a maximum flow rate of 0.4 L/hr and oxygen deficiency in all gas vents. The highest H_2S (200 ppm) and CO (557 ppm) and lowest O_2 (0.6 %) concentrations were detected in gas vents VT05, VT06 and VT07. The highest ammonia concentrations (600 ppm) were recorded in VT05.

Results from the gas wells also identified low flow rates, with a maximum flow rate of 0.3 L/hr and oxygen deficiency in all gas wells. The highest H_2S (320 ppm), CO (1473 ppm) and ammonia concentrations (>900 ppm) were detected in gas well VW04, VW05 and VW06.

Results from the monitoring wells identified a higher maximum flow rate of 3.3 L/hr, although this is still a low flow rate. All monitoring wells were oxygen deficient. The highest H_2S (445 ppm), CO (1402 ppm) and ammonia concentrations (>900 ppm) were detected in MW201, which is screened within the waste in the Capped Waste Stockpile.

The characteristic gas situation and associated risk classification was calculated as per NSW EPA (2012) Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases. The risk classification is low risk in the gas wells and moderate risk in the monitoring wells. The risk classification for the gas vents is low risk for methane and moderate risk for carbon dioxide.

Assessment of the maximum gas concentrations against the lower explosive limit, Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL)/Time Weighted Average (TWA) and Immediate Danger to Health and Life (IDHL) guidelines indicated the gas vents, gas wells and monitoring wells have concentrations of H_2S, CO, CH_4, CO_2 and ammonia that exceed the PEL/TWA and IDLH guidelines. The low maximum flow rate of 3.3 L/hr indicates there is a lack of flow and therefore the gas concentrations identified are not a human health risk currently.

5.16.4 Summary of preliminary waste classification

Following the NSWEPA Waste Classification Guidelines, Part 1: Classifying wastes, wastes are classified following a stepwise process.

Step 1 – Is the waste Special Waste?

The waste is known to contain asbestos in either bonded or friable form.

Where waste is characterised as special waste, but is mixed with restricted solid or hazardous waste, the waste must be classified as both special waste and restricted solid or hazardous (as applicable).

Step 2 – Is the waste Liquid Waste?

No, the waste does not met the definition of liquid waste.

Step 3 – Is the waste pre-classified?

Two commonly generated waste types are potentially included within the capped waste stockpiles. These have been discussed in **Table 5-9.**

Table 5-9: Capped Waste Stockpile Gas Concentrations (ppm)

Pre-classified Waste Type	Comment
“containers, having previously contained a substance of Class 1, 3, 4, 5 or 8 within the meaning of the Transport of Dangerous Goods Code, or a substance to which Division 6.1 of the Transport of Dangerous Goods Code applies, from which residues have not been removed by washing or vacuuming”;	Dangerous goods Class 4.3 material within capped waste stockpile is present. This includes aluminium dross, aluminium skimmings, spent cathodes, spent pot lining, and aluminium salt slags. These materials were disposed directly and not contained. Therefore there are no containers that previously contained Class 4.3 within the stockpile.
“coal tar or coal tar pitch waste (being the tarry residue from the heating, processing or	Coal tar pitch is used in the making of anodes used in the smelting process. These anodes

burning of coal or coke) comprising of more than 1% (by weight) of coal tar or coal tar pitch waste"	are heat treated prior to disposal. Some untreated pitch may be present in the capped waste stockpile, however these are expected to be very small amounts.

Step 4 – Does the waste possess hazardous characteristics?

The waste contains spent pot lining which is classified as a Dangerous Goods 4.3, UN code 3170 applying to aluminium smelting by-products. The definition of Dangerous Goods code 4.3 is substances which in contact with water emit flammable gases that are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

The Dangerous Goods classification applies to aluminium smelter wastes within the Capped Waste Stockpile. Investigations indicate that the aluminium smelter waste has been weathered and/or 'pre-reacted' due to historical de-lining procedures and no longer emitting flammable gases at ignitable levels or in dangerous quantities. This is evidenced by **Figure 14** and **Figure 15**.

Despite exhibiting these characteristics, the Capped Waste Stockpile material still contains material that is classified as a Dangerous Good and therefore is pre-classified as a hazardous waste.

The waste contains aluminium smelter waste which is regulated under the *Environmental Hazardous Chemicals Act 1985*. The Chemical Control Order for Aluminium Smelter Wastes Containing Fluoride and/ or Cyanide requires cyanide and leachable concentrations to be below 150 mg/L and 10 mg/L respectively before disposal. **Table 5-7** shows that the concentrations of these analytes in leachate exceed the Chemical Control Order requirements. The waste from the Capped Waste Stockpile placed in the Containment Cell would be regulated in accordance with a specific immobilised contaminants approval (as described in **Section 14**).

Step 5 determining a waste's classification using chemical assessment

Where wastes are not characterised by steps 1 to 4, chemical characterisation is required. The first component is to classify the waste using a contaminant threshold.

Table 5-6 shows that the fluoride concentrations are above the CT1 and CT2 values, meaning the waste does not meet the classification of solid or restricted solid waste.

Table 5-6 also shows that that the fluoride concentrations are above the SCC2 values, meaning the waste does not meet the classification of solid or restricted solid waste and would therefore be classified as hazardous on the basis of total fluoride concentrations.

On the basis of the classification completed the waste is considered to be special and hazardous waste. Additionally, disposal of the waste without treatment is contrary to the requirements of the Chemical Control Order for Aluminium Smelter Wastes Containing Fluoride and/ or Cyanide. Treatment and agreement for disposal from the EPA is required prior to disposal.

5.17 Site-Wide Assessment of Groundwater

Groundwater beneath the Smelter Site was identified at shallow depths between 1 m and 5 mbgs within shallow sands. This aquifer is limited in extent and has a low yield. Groundwater has been impacted primarily due to the leaching of fluoride and aluminium from smelter materials into groundwater. Fluoride concentrations ranged between 0.22 and 43 mg/L, and aluminium concentrations ranged between 0.08 and 13.6 mg/L over two sampling rounds in 2012 and 2014, excluding the leachate plume at the Capped Waste Stockpile.

Free cyanide was not detected above the laboratory detection limit, aside from a concentration of 7 µg/L in a well at the Anode Waste Pile. As concentrations of free cyanide were below the site guidelines in the 2012 sampling round, further assessment of cyanide in groundwater was not considered to be required.

Low level hydrocarbons were detected in groundwater at the Carbon Plant and down gradient of the Refuelling Area in 2012. Further assessment in 2014 found concentrations to be low and isolated.

Groundwater sampling has been undertaken at locations within the Smelter Site that have the highest risk from contamination, including down gradient of the Capped Waste Stockpile, the Anode Waste Pile, Carbon Plant, Wash Bay, the Diesel Spray Area, Refuelling Area, Pot Rebuild Area and Flammable Liquids Store. Up-gradient and down-gradient locations have also been sampled, as well as other areas of the site such as the Clay Borrow Pit. A third round of groundwater sampling was completed in April 2018 to provide recent data for completion of a human health risk assessment for fluoride and completion of an ecological risk assessment for fluoride and aluminium. A letter report reporting on this round of groundwater sampling is included in **Appendix 8**.

Groundwater immediately down gradient of the Capped Waste Stockpile has been impacted by leachate generated from contact of wastes in the stockpile with shallow groundwater and from the infiltration of water through the Capped Waste Stockpile (prior to capping). The leachate plume is characterised by elevated fluoride, cyanide and sodium concentrations and by a high pH (>9). The leachate plume extends approximately 350m north east of the eastern toe of the Capped Waste Stockpile. The extent of the leachate plume is limited by the geology of this area, with the leachate moving through high permeability coarse grained sand lenses surrounded by low permeability high plasticity clays. The leachate has not moved laterally or vertically through the high plasticity clays due to low porosity. The aquifer impacted by the leachate is close to the ground surface (0.3 m to 2.5 mbgs) within unconsolidated estuarine sediments, is ephemeral in nature and has a low yield.

5.18 Conceptual Site Model

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

The sources of contamination are outlined in **Table 5-4**.

5.19 Assessment of Exposure Routes and Potential Receptors

Human and ecological receptors are presented in **Table 5-10**, together with identified exposure routes from contaminated soil and sediment and groundwater in the context of future industrial/commercial use as well as the acknowledgement of down gradient receptors.

Table 5-10: Exposure Pathways Assessment

Pathways	**Potentially Complete Source-Pathway-Receptor Link ? (Y/N)**				**Justification**
	Current and future on-site employees (non-intrusive)	**Current and future on-site Intrusive Maintenance and Construction Workers**	**Recreational users of Kurri Kurri Speedway**	**Hydro Land Ecological Receptors**	
Shallow Surface Soil					
Dermal contact with soil and dust	N	Y	N	N	Shallow (0-0.4m bgs) impacted soil reported on-site.
Incidental ingestion of dust/soil	N	Y	N	N	
Dermal contact with dust only	Y	N	N	N	Shallow (0-0.4m bgs) impacted soil reported on-site in unpaved areas – potenital for dust generation. The source of aerial dust deposition to off-site areas no longer present as Smelter is closed and soil impacts not identified in previous studies in the Hydro Land (ENVIRON, 2014c-l).
Outdoor dust inhalation	Y	Y	N	N	
Indoor dust inhalation	Y	N	N	N	Outdoor dust can be transported indoors.
BaP Impacts to Buried Fill at the Diesel Spray Area (0.4-0.6m bgs)					
Dermal contact with soil and dust	N	Y	N	N	Impacted fill material identified at a depth of 0.4-0.6m bgs at the Diesel Spray Area.
Incidental ingestion of dust/ soil	N	Y	N	N	

Table 5-10: Exposure Pathways Assessment

Pathways	Potentially Complete Source-Pathway-Receptor Link ? (Y / N)				Justification
	Current and future on-site employees (non-intrusive)	Current and future on-site Intrusive Maintenance and Construction Workers	Recreational users of Kurri Kurri Speedway	Hydro Land Ecological Receptors	
Groundwater					
Dermal contact	N	Y	N	N	Shallow (~0.5-5mbgs) fluoride and aluminium impacted groundwater detected on-site. Shallow (0.5-2.5mbgs) leachate plume identified down-gradient of Capped Waste Stockpile. During times of high rainfall, groundwater exflitrates to the surface in the Buffer Zone and can flow to surface water bodies. Studies have shown that concentrations of fluoride and aluminium in surface waters in the Hydro Land have not impacted on ecology at the downgradient receptor, Swamp Creek (ENVIRON, 2013a and 2013d). On this basis, concentrations of fluoride and aluminium in groundwater at the site are not considered to represent an ecological risk under tha current site use.
Incidental ingestion	N	Y	N	N	
Sediment					
Dermal contact	N	Y	na	na	Impacted sediments detected in the East Surge Pond and associated drainage lines on-site.
Incidental ingestion	N	Y	na	na	

6. REMAINING CSM DATA GAPS

6.1 Soil

The data gaps that currently exist are limited to areas inaccessible during the previous investigations due to existing infrastructure or presence of water within drains and ponds. Following infrastructure removal, additional investigation works will be undertaken in areas beneath and in the immediate vicinity of areas not previously investigated.

The following AECs and PAECs require investigation in the future:

- AEC 15 West Surge Pond: Sampling of the sediment for soluble fluoride should be completed once the sediment is excavated and stockpiled.
- AEC 18 Pot Rebuild Area: Investigation of backfill material used to fill void beneath floor slabs in Pot Rebuild Building.
- PAEC 27 Transformer Yard and Substations: The Transformer Yard and Substations are currently live and in use and cannot be assessed until they are isolated. Assessment of each substation for Polychlorinated Biphenyls (PCBs) and Total Petroleum Hydrocarbons (TPH) should be completed once safe to proceed.
- PAEC 30 Area East of the Clay Borrow Pit: The area has been covered with excess Virgin Excavated Natural Material (VENM) from the construction of the Hunter Expressway. Assessment of buried fill material in this area cannot be completed until the VENM has been removed.
- AEC 2 Anode Waste Pile: the lateral and vertical extent of contamination has not been completely defined as anode waste remains stockpiled in this area. Further investigations can be completed once anode wastes have been removed.

6.2 Groundwater

As illustrated in **Table 5-10** groundwater beneath the Smelter site impacted with fluoride was identified as a concern for on-site maintenance and construction employees. Fluoride concentrations in groundwater (excluding the leachate plume) ranged between 0.22 and 43 mg/L over two groundwater monitoring rounds, exceeding the (2013) site-specific preliminary screening criteria of 1.5 mg/L for recreational use. As the screening criterion is for recreational use, a health risk assessment and derivation of site-specific criterion for fluoride for maintenance and construction employees is recommended.

The health risk assessment is recommended for groundwater beneath the Smelter Site, excluding the leachate plume, which requires remediation and as discussed in the Remedial Action Plan. If the groundwater risk assessment indicates that the risk to on-site maintenance and construction employees is acceptable, then the soil remediation criteria are considered protective of human risks associated with groundwater.

An ecological risk assessment is also recommended in conjunction with the health risk assessment to assess the risk of fluoride and aluminium concentrations in groundwater to ecological receptors. The Ecological Risk Assessments (2013a and 2013d) undertaken did not identify an unacceptable risk, however the risk assessment should be broadened to assess impacts to all relevant receptors.

7. REMEDIAL OPTIONS

7.1 Remediation Goal

The goal of this remediation project is to render the Smelter Site suitable for commercial /industrial land use.

7.2 Extent of Remediation Required

Based on the surface and subsurface contamination identified in **Table 5-4**, remediation is required across these areas. The approximate remediation volume for each AEC is defined below in **Table 7-1**. The volume calculations were determined from an estimation of the lateral and vertical extent determined during site investigations, noting that further lateral delineation is necessary at some AECs. Tonnages were calculated from the anticipated bulk density as shown for each material present. There is inherent uncertainty in the volume estimates.

Table 7-1: Contaminated Soils Quantity Estimates

Type	Volume Estimate (m^3)			Bulk Density (T/m^3)	Mass estimates (T)	
		Range [1]			Range	
	Estimate	Low	High		Low	High
Capped Waste Stockpile (AEC1) including potentially impacted soils beneath the stockpile	159000	145000	206700	2	290000	413400
Anode Waste Pile (AEC 2)	1500	1370	1950	1.8	2470	3510
Area East of Playing Fields (PAEC 29)	7500	6820	9750	0.3-1.8	6820	9750
Carbon Plant (AEC 8)	940	860	1230	1.8	1548	2220
Bake Furnace Scrubber (PAEC 26)	510	470	670	1.8	850	1210
Diesel Spray Area (AEC 4)[2]	450	395	730	1.8	720	1320
Drainage Lines (AEC 5)	220	200	290	1.8	360	530
East Surge Pond (AEC 6)	2300	2100	2990	1.8	3780	5390
West surge pond (AEC 15)	2700	2460	3510	1.8	4430	6320
Area East of Clay Borrow Pit (PAEC 30)	2600	2370	3380	1.8	4270	6090
Transformer yard (PAEC 27)	15500	14100	20150	1.8	25380	36270

1. Low/high -10%, +30%
2. Low/high based on field observations

Additional volumes of contaminated material may be identified at the PAECs yet to be assessed due to access limitations, including the Transformer Yard and Substations, Area to the East of the Clay Borrow Pit and West Surge Pond.

Migration of contaminants vertically through the soil profile is not anticipated however validation of the natural materials within the exposed excavations will be required.

Remediation of the leachate and impacted groundwater within the Capped Waste Stockpile and within shallow natural underlying soils also forms part of the remediation requirements.

In general, **Table 7-1** is a preliminary guide to the extent of remediation required however remediation will be undertaken to the final satisfaction of the Principal or Principal’s representative.

7.3 Remedial Options Assessment

Ramboll completed a Remedial Options Assessment to review potential remediation options for the Smelter Site:

- Ramboll (2016) Hydro Aluminium Kurri Kurri Review of Remedial Options

A summary of the process undertaken in this report is provided below.

Based on the site characterisation presented in **Table 7-1** a review of potential remediation options for the Smelter Site was undertaken in general accordance with the *Guidelines for the NSW Site Auditor Scheme* (third Edition) (EPA 2017). The remedial options assessment has been separated into soil contamination and groundwater contamination, where groundwater contamination is a secondary source comprising groundwater impacted by the Capped Waste Stockpile.

7.3.1 Review of Evaluation Criteria Definitions

Ramboll and Hydro undertook a review of the evaluation criteria used in the original Remedial Options Study to determine if they accurately assess the option and the differences between alternatives. The following sections discuss how the definitions of the evaluation have been amended for the purpose of this review.

7.3.2 Approval Likelihood

Likelihood of approval was originally evaluated following a review of key legislation, regulations and policies. Other key regulations or policies are considered where it is critical to the approval of a particular option.

The likelihood of approval rating in this review also considers the potential for an extended approval process due to the project complexity of potential government agency issues and/or the need to modify the project to attain approval.

7.3.3 Legacy Management and Costs

Legacy costs are based on two key elements:

1. Long term management and monitoring activities.
2. Contingent events, such as a pollution event that may require a level of cell reconstruction.

Financial provisioning for long term management and monitoring costs is a requirement of the regulator. Financial provision can be in the form of a bond or trust or other financial instrument. At this stage the details of the provision are not finalised however it is expecting that the funding model adopted will need to meet the following objectives:

- Provide sufficient funding to cover the management and monitoring costs in perpetuity;
- Be attached to the property, rather than to the property owner;
- Be available only for the purpose of management and monitoring activities.

7.3.4 Risk Rating

The risk rating evaluates risks to the project during the undertaking of the physical works. Post completion risks are captured in the evaluation of legacy costs.

The risk rating is qualitative and evaluates potential risks to the project physical works following the Risk Rating calculation methodology described in **Figure 16**.

	Environmental Consequence	**Commercial Consequence**
Catastrophic	Significant irreversible damage. Significant remediation actions required. Potential for regulatory prosecution.	≥$10mil
Major	Major effect, but long term reversible. Significant remediation actions required.	≥$5mil - <$10mil
Moderate	Serious effect, but short term reversible. Remediation actions required.	≥$0.5mil - <$5mil
Minor	Medium effect	≥$0.1mil - <$0.5mil
Insignificant	Minor effect	<$0.1mil

	Likelihood
Rare	May occur only in exceptional circumstances
Unlikely	Could occur at some time
Possible	Might occur at some time
Likely	Will probably occur in most circumstances
Almost Certain	Is expected to occur in most circumstances

Risk Rating Matrix

Catastrophic	5	10	15	20	25
Major	4	8	12	16	20
Moderate	3	6	9	12	15
Minor	2	4	6	8	10
Insignificant	1	2	3	4	5
	Rare	Unlikely	Possible	Likely	Almost certain

Figure 16 Risk Rating

7.3.5 Sustainability Analysis

Ramboll completed a Sustainability Analysis in 2016 to assess the sustainability of the identified remediation options:

- Ramboll (2016) Hydro Aluminium Smelter Kurri Kurri Remedial Action Plan Sustainability Analysis Results

The Sustainability Analysis definition was reviewed and included a combination of quantitative and qualitative assessments for a range of environmental, social, climatic and cultural factors. **Table 7-2** identifies these factors and how they are assessed.

Table 7-2: Sustainability Factors

Factor	Definition
Ecological	Area of native vegetation clearance
Aboriginal	Disturbance of known Aboriginal heritage relics Extent of disturbance of areas potentially containing Aboriginal heritage relics
Greenhouse Gas/ Energy	Subjective assessment of potential energy consumption/ greenhouse gas generation sources: • Vehicle movements • Machinery (including destruction facilities) operation • Vegetation clearance • Landfill gas generation
Climate Change	Susceptibility of the option to climate change impacts
Local community impacts	Subjective assessment of the potential impacts on the local community from: • Air quality (dust generation) • Noise • Traffic
Community Perception	Likely perception of/ concern about the option in the local community
Ethics and Equity	Displacement (geographical, generational) of potential environmental issues and responsibilities.

Each of these factors was considered with equal weighting to generate an overall sustainability score (out of 35). Options with a greater overall sustainability have a lower score.

7.3.6 Project Time

Elements of each project that occur in series were summed to determine the overall project timeline.

7.3.7 Qualitative Assessment Summary

Whilst the above remedial options review was completed following both the qualitative and quantitative process outline above, only a summary of the qualitative review is presented in the following. Information regarding remedial costs and ongoing management costs is regarded as confidential information.

Table 7-3: Assessment of Remedial Options

Option	Description	Advantages	Disadvantages
SOIL			
1. Do Nothing	Leave contamination onsite without treatment	Cost effective solution. Only acceptable if a risk assessment for PAHs demonstrates that the concentrations present do not represent an unacceptable risk to human or ecological health. May not require an EMP registered with Council. Has a low carbon footprint compared to other options.	Does not address the aesthetic issues. Planning approval may be required. Impacts on land value and sale ability. Retains potential long term liability for Hydro.
2.Encapsulate in-situ	Encapsulation barriers could include surface filling, hardstands, roads and buildings. It has been assumed that the barrier is formed by the placement of 0.5m of clean soil over the contaminant footprint. Improvements to the Capped Waste Stockpile could be incorporated in-situ comprising a subsurface cut-off wall to control groundwater migration. The current cap surface has been shown to be effective.	Material remains in-situ and removes health and safety risks from excavation. Cost effective. Has a low carbon footprint compared to other options.	Requires long term management of disconnected land parcels and registration of an Environmental Management Plan with Council. May reduce property value. Exclusion of wastes may be required or preferred. (i.e. remove and dispose of these separately to landfill off site). Retains Capped Waste Stockpile in close proximity to a sensitive receptor and shallow groundwater.
3.Move to specifically designed landfill adjacent to the capped waste stockpile	The material would be placed in a cell adjacent and adjoining the capped waste stockpile.	Relocates long term management requirements to a centralised area. Improves land value for Smelter Site. Has a moderate carbon footprint compared to other options.	Remaining excavations need rehabilitation with clean fill. Environmental Management Plan with Council. Planning approval for disposal site will be required.
4.Encapsulate in purpose built containment cell	Encapsulation on site within a purpose built containment cell. This would involve excavation of contaminated soil, sorting and transfer to cell. Any municipal waste will be disposed offsite to a licensed waste facility.	Consolidation of all wastes and contaminated soils in one location, in a cell that includes segregated compartments Has a moderate carbon footprint compared to other options.	Liability associated with keeping material onsite

Table 7-3: Assessment of Remedial Options

Option	Description	Advantages	Disadvantages
5.Treat and encapsulate in purpose built containment cell	Encapsulation on site within a purpose built containment cell in combination with a pre-treatment step to remove PAHs, cyanides and fluorides from the contaminated soils and capped waste stockpile.	Consolidation of all wastes and contaminated soils in one location, in a cell that includes segregated compartments. Less liability as reduced contaminant concentrations from treatment	Higher cost of treating soil than Option 4. Friable asbestos present in the capped waste stockpile resulting in associated health risks with treatment. Liability associated with keeping material onsite. Capped Waste Stockpile is a highly variable mixed waste and treatment is difficult to achieve in a uniform manner. Has a high carbon footprint compared to other options.
7.Excavate, sort and dispose off-site	Material would be removed and transported to a licensed waste management facility. Soils to be removed off-site would be required to be classified in accordance with the NSW EPA (2008) Waste Classification Guidelines.	This option provides a reduced remediation timeframe, increased confidence in source removal, reduced liability to Hydro and improves land value.	Excavation and disposal of all soils over the criteria to a licensed waste facility is generally considered unsustainable and costly. Reassigns responsibility to a third party. Has a high carbon footprint compared to other options.
8. On-site treatment to achieve complete destruction	Onsite treatment of contaminants so that the contaminant is either destroyed or reduced to an acceptable level.	Complete destruction of contaminants, production of an inert re-useable material.	High costs associated with onsite treatment. Technology not proven. Risk with treated product still requiring landfilling or management. Unlikely to be able to manage variability of the Capped Waste Stockpile contents. Has a high carbon footprint compared to other options, however this could be negated if the treatment plant uses fuel derived from the waste as an energy source.

Table 7-3: Assessment of Remedial Options

Option	Description	Advantages	Disadvantages
LEACHATE PLUME IN GROUNDWATER AT THE CAPPED WASTE STOCKPILE			
1. Do Nothing	Leave leachate plume as is. Current monitoring indicates fluoride concentrations are between 400mg/L and 1200mg/L close to the Capped Waste Stockpile and between 50mg/L and 400mg/L down gradient of the source.	As the leachate plume is constrained by geology, this is a cost effective option. The ENVIRON (2015) Groundwater Fate And Transport Modelling Report concludes that based on existing hydrogeological conditions and the presence of an on-going source from the Capped Waste Stockpile, the model estimated a fluoride concentration of 4.3mg/L at the receptor distance (1000m) compared to a guideline of 1.5mg/L. Has a low carbon footprint.	On-going visual impact of daylighting leachate in down-gradient areas. Recovery of vegetation impacted area likely to be slower than for other options.
2. Leachate Interception	Interception of leachate at the toe of the Capped Waste Stockpile prior to its down-gradient migration. Disposal of captured leachate a designed treatment plant and then through on-site stormwater management.	This option will reduce the volume of leachate moving down-gradient from the toe of the Capped Waste Stockpile. The fluoride concentration at a receptor distance (1000m) would be less than 4.3mg/L, as the ENVIRON (2015) Groundwater Fate and Transport Modelling Report assumed a continuous source of leachate.	Has a high carbon footprint as pumping will be required for a longer timeframe as this option is reliant on rain events to mobilise the plume.
3. Source Removal to the extent practicable	Removal of the source of the leachate – spent potlining and other wastes disposed of in the Capped Waste Stockpile.	Source removal will eliminate the on-going generation of leachate. The fluoride concentration at a receptor distance (1000m) would be less than 4.3mg/L, as the ENVIRON (2015) Groundwater Fate and Transport Modelling Report assumed a continuous source of leachate. Improves land value for Smelter Site.	Remaining excavations will need rehabilitation with clean fill. Some leachate within the groundwater system will remain. Has a high carbon footprint compared with other options due to source removal.
4.Reactive Barrier Wall	Construction of a reactive barrier wall at the toe of the Capped Waste Stockpile to reduce fluoride and cyanide concentrations in the leachate.	Reduction in concentrations of fluoride and cyanide in leachate down-gradient of the wall.	High costs associated with on-going treatment. Difficult chemistry to achieve required reductions in fluoride and cyanide concentrations. Has a moderate carbon footprint.

Table 7-3: Assessment of Remedial Options

Option	Description	Advantages	Disadvantages
5. Monitored Natural Attenuation	The leachate plume is constrained in its down-gradient movement by the geology of this area. On-going monitoring to demonstrate that the leachate plume is stable. Attenuation would be achieved through physical processes, such as dispersion, diffusion and sorption.	As the leachate plume is constrained by geology, this is a cost effective option. The fluoride concentration at a receptor distance (1000m) would be less than 4.3mg/L, as the ENVIRON (2015) Groundwater Fate and Transport Modelling Report assumed a continuous source of leachate. Has a low carbon footprint.	On-going visual impact of daylighting leachate in down-gradient areas.
6. Combination of source removal to the extent practicable, leachate removal and monitored natural attenuation	Refer to No. 2, 3 and 5.	Refer to No. 2, 3 and 5.	Refer to No. 2, 3 and 5.

7.4 Proposed Remediation Strategy

The disposal of site materials during decommissioning and demolition was also considered when evaluating remediation options. The preferred option identified for soil from **Table 7.3** is the relocation and consolidation of all contaminated soils and the contents of the Capped Waste Stockpile in one specifically designed Containment Cell. This option was considered most favourable when compared to other options in terms of cost, risk of failure, long term legacy and onsite management, corporate responsibility and sustainability.

The Containment Cell will be constructed at the location of the Clay Borrow Pit and will be constructed using best demonstrated available technology to contain contaminated soils and smelter wastes in perpetuity. The Clay Borrow Pit has been identified as a suitable location based on a Preliminary Containment Cell Study (ENVIRON 2013c) which evaluated possible cell locations. The site is situated more than three metres above the groundwater table level and within competent bedrock. The cell would be situated approximately 200m from the closest ephemeral surface water body.

A conceptual Containment Cell design is included in **Appendix 4** and details the components of the cell. The cell design comprises a base liner combining compacted clay and with high density polyethylene liners. Leachate drainage layers and leachate collection capability is included in the liner. Materials placed within the cell are not putrescible and therefore leachate generation is expected to be minimal.

The cell cap design comprises a liner system comprising clay and geosynthetic liners. Gas venting, drainage layers, fauna protection and vegetation layers are included in the cap design.

Cap slopes are designed to promote surface water diversion and surface water runoff as well as ensure stability of the Containment Cell.

Detailed design of the Containment Cell is currently being prepared. The detailed design will be consistent with the performance standard of the concept design. The system will be designed to maximise infiltration reduction and will be evaluated in terms of long term performance and compatibility with the leachate present.

The cell will be constructed to hold a volume of 266,000 m^3 over an area of approximately six hectares. The cell is designed to accommodate additional volume (if required) by increasing height.

The preferred option identified for the leachate plume in groundwater at the Capped Waste Stockpile from **Table 7-3** is Option 6, a combination of leachate interception, source removal to the extent practicable and monitored natural attenuation. Leachate interception was employed in April 2014 with the installation of a leachate interception trench that collects leachate and pumps to the East Surge Pond. Source removal to the extent practicable will be achieved during the soil remediation works by the relocation of the Capped Waste Stockpile contents to the containment cell. At this time, leachate contained within the wastes will be drained to a sump within the Capped Waste Stockpile bund. The sump will be clay or HDPE lined and will be at a low point in the cell to allow gravity drainage. Details of the sump design, drainage and water treatment system will be developed in the constructability review. Leachate will be extracted and treated through the water treatment plant to a level suitable for discharge to the North Dam, which is irrigated under EPL. The EPL will be modified to reflect remediation activities that will impact surface water management at the Smelter Site.

The sump within the Capped Waste Stockpile will remain and groundwater will continue to be treated until visible signs of leachate are removed from the upper sand aquifer. Both visual and chemical analysis will be adopted to validate the removal of leachate from the sand aquifer. The Capped Waste Stockpile footprint will then be backfilled and reshaped to above the groundwater table.

Mass reduction of the leachate plume will be achieved via removal of the primary source (waste within the Capped Waste Stockpile) and secondary source (entrained leachate). Monitored natural attenuation will be achieved via physical processes, such as dispersion, diffusion and sorption. Natural attenuation is considered appropriate as the plume has been shown to be stable or reducing and risk assessment has shown no risks to current receptors (ENVIRON, 2013D). On-going monitoring will be used to determine the success of leachate interception and source removal as a remedial strategy for the leachate plume. Monitoring is proposed both during and post-remediation to monitor plume behaviour and will continue until the plume is shown to be stable or decreasing.

This combination of remedial strategies is considered to be a suitable option, as the ENVIRON (2015) Groundwater Fate And Transport Modelling Report concluded that based on existing hydrogeological conditions and the presence of an on-going source from the Capped Waste Stockpile, the model estimated a fluoride concentration of 4.3 mg/L at the receptor distance (1000m) compared to a guideline of 1.5 mg/L. Whilst over the guideline, this concentration is considered to represent a low risk based on the following:

- Modelling assumed no source reduction, which will occur
- Modelling assumed no transformation of the contaminant, so attenuation occurs due to mechanical means only
- Modelling did not include chemical attenuation, which is likely to occur
- Modelling did not consider dilution at the receptor (Swamp Creek)
- Monitoring at the point of receptor discharge is routinely completed by Hydro as part of the surface water monitoring program required under the EPL. A contingency trigger will be included in the Validation Plan for unacceptable results at this monitoring point.

Removal of the source and leachate interception will further reduce this potential fluoride concentration at the nearest receptor.

Source removal and attenuation is likely to result less alkaline conditions within the leachate plume. The change from alkaline conditions to less alkaline conditions may impact bioavailability, solubility and toxicity of fluoride and cyanide. Evaluation of the behaviour of free and weak acid dissociable (WAD) cyanide and fluoride complexations will be undertaken to assess behaviours under changing pH conditions (see **Section 9.2**).

7.5 Contingency Plan

Table 7-4 outlines the potential failure scenarios that could occur and the contingency mechanisms that will be implemented to achieve the overall remediation objective.

Table 7-4: Remediation Contingency Planning

Failure Scenario	Contingency Response
Increased volumes of contaminated material	Excavated materials will be managed onsite via a tracking system, controlled by the contract. The Containment Cell design allows for increased capacity by increasing the cell height. The detailed cell design will include a capacity for an additional 50% of estimate material.
All foreign materials cannot be excavated due to safety or other risks	While all efforts will be undertaken to remove identified wastes/contamination, if a situation arises where it becomes impractical to completely remove fill/soil to meet the remediation objectives, (e.g. physical constraints or safety), alternative strategies may be employed to justify leaving contamination in place (e.g. specific risk assessment and/ or long term management requirements). Such alternatives will not proceed without consultation and full written approval of Hydro.

Table 7-4: Remediation Contingency Planning

Failure Scenario	Contingency Response
Identification of Asbestos Containing Material (ACM)	In the event that ACM is identified during the remedial works, works in the vicinigty of the material will cease until such time as sufficient controls are put in place and remedial works are completed in accordance with NSW WorkCover the NSW *Work Health and Safety Act 2011* and the requirements of the NSW Occupational Health and Safety Commission (NOHSC) *Asbestos Code of Practice and Guidance Notes*. A visual inspection by a qualified person capable of undertaking and providing clearance inspections (Class A) will be undertaken to confirm that the location is free of visible ACM. All validation samples will be collected for asbestos in areas identified to contain asbestos at the rate defined in **Section 10.5**. These measures would be implemented through an Unexpected Hazardous Materials Protocol that would be developed as an appendix to the EMP.
Discovery of unexpected materials excluding ACM	Contact the Principal's representative, then sort materials to a segregated stockpile and discuss possible disposal options with the Principal or the Principal's representative. Reactive materials within the Capped Waste Stockpile are a not expected however could occur. Prior to commencement of works a methodology for the treatment of potentially reactive materials will be developed and approved by the NSW EPA.
Treatment of leachate within the Capped Waste Stockpile is unable to remove visible signs of leachate	Develop a trigger protocol of contingencies in the Validation Plan (refer to Section 9.2). Evaluate the remaining concentrations and assess fate and transport to the receptor. Determine if the concentrations remaining represent a risk of harm and the requirement for long term management.
On-going monitoring indicates that concentrations of fluoride and cyanide in the leachate plume are not reducing following source removal.	Evalute the risk to receptors from the remaining concentrations. Identify suitable active remedial options, such as further interception, that would further intercept/remove fluoride and cyanide impacted groundwater. Investigate other possible options for treatment and/ or management e.g. long term restrictions to groundwater use through a long term management plan.

7.6 Interim Site Management Plan

The Smelter Site is located within the Hydro site boundaries and is not accessible to the public. On this basis, there is not considered to be a requirement for interim site management.

8. REMEDIAL ACTION PLAN

8.1 Preliminaries

The remedial works will be undertaken by an appropriately qualified and experienced Contractor with support from an appropriately qualified and experienced Contractor’s Environmental Representative.

Prior to commencing works, the Remediation Contractor would provide a proposed remediation works methodology to the Principal for written approval. The methodology is to describe:

- Mobilisation and site facilities required;
- Methods of excavation, sorting, materials tracking and backfilling;
- Compaction specification for backfilled areas;
- Environmental control procedures consistent with the Works Environmental Management Plan (the EMP) (refer to **Section 10**), supporting specialist management plans and the RAP; and
- Quality control procedures that demonstrate how the requirements of the RAP, including validation, will be met and documented.

It should be noted that the remedial works form part of the activities at the Smelter defined as the “Works”, which includes the following key activities:

- Demolition of remaining Smelter buildings (known as Stage 2 Demolition);
- Management of demolition waste, including temporary stockpiling before:
  - Processing for reuse on site (concrete and bricks);
  - Transportation off-site for recycling (scrap metal);
  - On site disposal of non-recyclable waste;
- Remediation activities (as described in this RAP);
- Construction of the Containment Cell;
- Placement of contaminated soils and non-recyclable wastes in the Containment Cell; and
- Leachate and groundwater treatment.

8.2 Site Establishment

The required personnel and plant are to be mobilised to site, define the boundaries of each area of concern and set up work controls including environmental and safety systems and controls in accordance with the Works EMP. These controls will include, but are not limited to:

- Locate and isolate all overhead and underground services in the proximity of the works;
- Assess traffic control requirements around the Smelter Site, cognisant of other site activities (consistent with the Smelter Access Plan);
- Work area security fencing; and
- Implement stormwater runoff and sediment controls (consistent with the Works Soil and Water Management Plan).

8.3 Prior to Remediation Works

In order to allow access to areas previously not characterised due to access issues, all decommissioning and demolition works of existing infrastructure and associated services will be undertaken prior to remediation works. The areas that decommissioning and demolition works will provide access to are:

- AEC 15: West Surge Pond;
- PAEC 27: Substations;
- PAEC 30: Area East of the Clay Borrow Pit;
- AEC 18: Pot Rebuild Area; and
- AEC 2: Anode Waste Pile.

8.3.1 West Surge Pond

Sediments in the West Surge Pond contained elevated concentrations of total fluoride in the 2012 Phase 2 ESA. Two samples were collected and the total fluoride concentrations (5850 mg/kg and 38,500 mg/kg) exceeded the criteria used during this investigation. Subsequently a site-specific criteria was developed in the 2013 Health Risk Assessment, which relates to soluble fluoride, the bio-available portion of this contaminant. Sampling of the sediments in the West Surge Pond is required to assess soluble fluoride concentrations against the site-specific criteria.

Water from the West Surge Pond is to be pumped to the South Surge Pond and then through the stormwater system to the North Dams for spray irrigation. Prior to pumping, two water samples will be collected from the West Surge Dam to assess fluoride concentrations. Fluoride concentrations will be compared to long term monthly monitoring of the North Dams completed by Hydro.

Sediments from the West Surge Pond are to be excavated and stockpiled on hardstand adjacent to the dam. Sediment controls such as hay bales will be used to retain stormwater runoff. Once the sediments have dried out, sampling shall be completed and analysis undertaken for soluble fluoride. Analytical results shall be compared against the site-specific criterion of 17,000mg/kg for commercial/ industrial landuse.

The number of samples to be collected will be dependent on the volume of sediment excavated from the West Surge Dam. Procedure B of NSW EPA (1995) Sampling Design Guidelines will be used to determine the number of samples required.

In the event that soluble fluoride concentrations are below the site-specific criteria, the sediments can be reused on the Smelter Site. In the event that the soluble fluoride concentrations exceed the site-specific criteria, the sediments shall be relocated to the Containment Cell.

8.3.2 Substations

There are 16 substations and one transformer yard at the Smelter Site. The substations are identified as:

- Buildings 3AN, 3AS, 3BN, 3BS, 3CN, 3CS and 3CC: Pot Room Substations.
- Buildings 4A and 4B Substations.
- Building 5A/ 8A Substation.
- Building 8B: Rodding Building Substation.
- Building 26A: Substation.
- Building 26C: Substation.
- Building 29A/C: Pot Room Electrical Control Buildings and Substation.
- Building 65C: Butt Cleaning Station Substation.
- Building 78A: Pot Rebuild Substation.
- Transformer Yard: Includes Substations 1A, 1B and 1C.

A trial of the remediation of Substation 3CC was completed in November 2017 (refer to **Section 5.11**). The trial was completed to develop a methodology for the removal and segregation of potential PCB and hydrocarbon impacted materials (concrete, ballast and soil). The methodology outlined in the trial report is to be followed for remediation of all substations.

Stained material from each substation will be excavated either for off-site disposal where PCB containing oils were known to have been used or relocation to the Containment Cell where PCB containing oils were not used.

8.3.3 Area East of the Clay Borrow Pit

The Area East of the Clay Borrow Pit is currently covered by a stockpile of Excavated Natural Material (ENM) derived from the construction of the Hunter Expressway immediately south of the Smelter Site.

Access to this area will not be available until the ENM stockpile has been removed. Assessment of the potential for buried wastes should be completed via test pitting at this time.

8.3.4 Pot Rebuild Area

The Pot Rebuild Building has a void beneath the floor slabs that was backfilled with unknown material. Removal of the floor slabs and excavation of the fill material to assess its potential for contamination is required.

Visual assessment of the backfill material will be undertaken initially. In the event that the fill material is stained, odourous or contains anthropogenic material, soil sampling will be undertaken. Soil samples will be analysed for fluoride, cyanide, PAHs, TRH and heavy metals including aluminium.

8.3.5 Anode Waste Pile

The majority of the Anode Waste Pile is currently covered by ahead of schedule anodes and concrete slabs.

Access to this area will not be available until the remaining anodes and concrete slabs have been removed. Delineation of the lateral and vertical extent of shallow PAH contamination in surface fill material should be completed at this time.

8.4 Potential for Contamination due to Demolition

Decommissioning and demolition works will be completed concurrently with remediation. Demolition of the Smelter buildings has the potential to cause contamination to surface soils. Following demolition and prior to closure of the Containment Cell, a site walkover shall be conducted to identify any areas of the Smelter Site to validate these areas. The following observations should be recorded:

- Areas where staining is present;
- Areas where residues are present;
- Areas where asbestos containing material (ACM) fragments are present; and
- Areas where former sumps or pits were located.

Remediation via excavation and relocation to the Containment Cell may be required for stained areas or residues. Areas of former pits and sumps will be inspected for staining and soil surrounding the sump or pit remediation if required.

ACM fragments will be collected via hen picking for disposal at the Containment Cell. An asbestos management protocol is outlined in **Section 13.1**.

8.5 Survey

A survey of each contaminated area will be undertaken by a registered surveyor. The survey will involve:

- Pre-remediation survey on the surface of each AEC;
- Following excavation of contaminated soils, but prior to backfilling and completion of the remediation; and
- Post-remediation, following backfilling, topsoiling and landscaping or hardscaping.

The survey should be conducted such that a 3D model of each AEC can be located laterally and vertically on a registered survey plan, suitable for potential attachment to a land title.

This survey forms part of the validation requirements described in **Section 9**.

8.6 Remedial Methodology

In general, the remedial methodology is as follows:

- Identify the extent of contaminated surface soils at each AEC using site plans and GPS information provided in the Phase 2 ESA reports;
- Excavate contaminated surface soils from each AEC;
- Transport contaminated soils to the designated stockpile area or directly to the Containment Cell;
- Relocate contaminated soils from the stockpile area to the Containment Cell;
- Validate soils remaining at each AEC; and
- Where required, re-instate each AEC with validated crushed concrete or refractory brick to appropriate site levels.

Specific information for each AEC is provided below.

8.6.1 Capped Waste Stockpile

The extent of the Capped Waste Stockpile is shown in **Figure 5**. The Capped Waste Stockpile contains spent pot lining and other wastes associated with aluminium smelting which was capped with clay to prevent human contact and infiltration of precipitation in the mid-1990s. The capping from the Stockpile needs to be removed, with separation of the capping layers and stockpiling for later reuse. The capping layers include the following:

- 150mm vegetation layer: imported topsoil;
- 450mm drainage layer: imported clean river sand containing less than 10% fines and having a permeability of not less than $1x10^{-3}$cm/sec;
- 900mm hydraulic barrier: clay material obtained from the Clay Borrow Pit; and
- 150mm buffer/ gas control layer: imported, clean, unbound gravel containing less than 5% fines and having a permeability of less than $1x10^{-3}$cm/sec.

The capping layers will be removed in stages to minimise the surface area of waste exposed to rainfall. Once the capping layer is removed from a stage, the waste will be excavated directly to truck and removed to the Containment Cell.

With the inclusion of the gypsum application (as discussed in **Section 5.9**), the following steps would be implemented for the removal, relocation and placement of the Capped Waste Stockpile material:

- Loading of the trucks within the stockpiling and processing area. The loading area would be maintained so that any material spilled during truck loading would be regularly cleaned from the ground.
- Materials that could potentially damage liner materials (such as steel bars) would be separated from the other Capped Waste Stockpile material for separate transportation and placement.
- Trucks would travel over a wheel wash to remove any contaminants prior to proceeding to the haul road.
- Loaded trucks would be driven over a weighbridge to ascertain total weight.
- Gypsum would be added to the loaded waste at the pre-determined weight to weight percentage (10%) using a front end loader with an attached weighing system within a specified tolerance.
- Trucks would travel along the haul road to the Containment Cell. Trucks transporting Capped Waste Stockpile materials would have priority on the haul road.
- Transportation of the material would cease during rain events.

Leachate within the Capped Waste Stockpile will be drained to a sump and treated through a water treatment plant established on site. The water treatment plant will be designed to treat water to a level suitable for discharge to site water management system. Treatment will continue until the contents of the Capped Waste Stockpile are removed from the area. The design of the leachate treatment system forms part of the detailed design for the Containment Cell. A water balance will be included in the design so that volumes are understood.

Impacts to natural soils beneath the Capped Waste Stockpile have occurred to depths of less than 1.0m below the waste/natural soil interface. Excavation of these soils for relocation to the Containment Cell will also be required. Treatment of groundwater from this excavation will also be undertaken by draining groundwater to a sump. Where groundwater within the excavation is treated (removed), remediation of groundwater will be considered complete.

8.6.2 Anode Waste Pile

The extent of the Anode Waste Pile is shown in **Figure 6.** PAH contamination was identified in surface soils, associated with the compaction of ahead-of-schedule anodes into fill material in this area. Carcinogenic PAHs were identified in one borehole MW103 at the mid-northern boundary of the Anode Waste Pile at a concentration more than 2.5 times the site criteria (considered to be a 'hot spot') at a depth of 0.3-0.4mbgl.

Shallow PAH contamination has not been adequately delineated vertically or laterally due to the presence of ahead of schedule anodes and concrete slabs. Additional delineation works are outlined in **Section 8.3.5**. Following delineation, surface soils are to be excavated and stockpiled for relocation to the Containment Cell.

8.6.3 Area East of Playing Field

Waste materials including concrete, refractory brick, metal sheeting, metal reinforcement, plastic sheeting, timber, fence posts, broken glass, electrical wire, steel posts and old cables have been buried to a depth of 1mbgl in the paddock east of the playing fields, as shown on **Figure 11**.

The dumped waste materials are to be excavated and sorted for disposal. Coarse high level sorting is to be conducted so that fill materials are sorted on both a size and composition basis. Coarser materials will be split in to:

- Concrete fragments;
- Broken/ whole refractory bricks;
- "other" including metal, plastic, timber and other inert materials; and
- Fine materials including soil and below a 'sortable' size, materials will necessarily be mixed and include soil-sized materials.

All materials will be transported to identified recycling areas, identified temporary storage areas, or directly to the Containment Cell.

Although the site assessment did not identify asbestos containing materials, a protocol detailing actions where unexpected materials (including ACM) are encountered during the excavation works is required.

Carcinogenic PAHs were identified in shallow soil (0.5mbgs) at test pit TP117 at a concentration more than 2.5 times the site criteria (considered to be a 'hot spot'). Test pit TP117 is located in the south-east corner of the paddock. Due to the presence of this 'hot spot', all soil that is sorted into the fine materials stockpile will be relocated to the Containment Cell.

8.6.4 Carbon Plant

The extent of the grassed areas and garden beds where surface soils have been impacted by PAHs at the western end of the Carbon Plant are shown in **Figure 9**. Surface soils to a depth of 0.3mbgs are to be excavated and stockpiled for relocation into the Containment Cell.

8.6.5 Bake Furnace Scrubber

The extent of grassed areas where surface soils have been impacted by PAHs at the Bake Furnace Scrubber are shown in **Figure 10**. Surface soils to a depth of 0.3mbgs are to be excavated and stockpiled for relocation into the Containment Cell.

Carcinogenic PAHs were identified in surface soil (0-0.1mbgs) at hand auger hole HA115 at a concentration more than 2.5 times the guideline (considered to be a ‘hot spot’). The surface soils comprised black ash/ gravel material, likely to be spilt Ring Furnace Reacted Alumina, which contains unburnt coal tar pitch. This material was not vertically delineated during the previous investigations. Excavation works in the northern portion of grassed area should extend both vertically and laterally until all black ash/ gravel material has been removed.

8.6.6 Diesel Spray Area

Fill material at depths of 0.4m to 0.6mbgs has been impacted by PAHs. The extent of the impact to fill material is shown on **Figure 7**. There is no visual indicator of the contamination within the fill material. The PAHs have not impacted underlying estuarine sediments.

The fill material is to be excavated and stockpiled prior to relocation to the Containment Cell. As the fire system pump house and water tank are to be retained, the area of potential contamination beneath these buildings will not be excavated.

8.6.7 Drainage Lines

The extent of sediments impacted by PAHs in the drainage lines associated with the East Surge Pond are shown on **Figure 8**. Sediments from these drainage lines are to be excavated and stockpiled for dewatering prior to relocation into the Containment Cell.

Sediments are to be stockpiled to allow retained water to drain to the site stormwater management system.

8.6.8 East Surge Pond

Sediments to a depth of 0.2m in the East Surge Pond have been impacted by PAHs. The East Surge Pond is to be drained, then surface sediment to a depth of 0.2m are to be scraped from the pond and stockpiled prior to relocation into the Containment Cell.

Sediments are to be stockpiled to allow retained water to drain to the site stormwater management system.

8.6.9 Materials Tracking

All materials excavated from each AEC shall be tracked from the AEC to the stockpile location within the Smelter Site. The Remediation Contractor shall implement a procedure that includes:

- Logging of material destinations from each AEC to its stockpile location;
- Tracking of each stockpile in the stockpile area;
- Provide a weekly Materials Tracking Report; and
- If any material is taken off-site to landfill, all waste facility tipping dockets will be retained on file by the Contractor’s Environmental Representative and be correlated to the truck logging sheets in a weekly Materials Tracking Report.

8.6.10 Backfilling and Final Landform

AECs will be backfilled where required to achieve:

- A final landform that is consistent with the surrounding topography without steep slopes or abrupt changes in shape;
- The levels and grades of the finished landform shall be such that it encourages the shedding of incident stormwater but at grades that will not result in erosion; and
- The finished landform shall comprise a surface layer that is acceptable to the Principal.

Materials such as crushed concrete and crushed brick validated as suitable for use on the site will be used. Use of these materials should be covered with soil or similar to remove any aesthetic impacts.

8.7 Remediation of Secondary Source, Groundwater - Capped Waste Stockpile

The remedial methodology for leachate impacted groundwater at the Capped Waste Stockpile is as follows:

- Set up water treatment plant at the Capped Waste Stockpile;
- Construct a sump following the removal of the capping layers of the Capped Waste Stockpile;
- Drain leachate into the sump and pump to the water treatment plant during removal of stockpiled wastes from the Capped Waste Stockpile;
- Once all wastes and contaminated soil are removed from the Capped Waste Stockpile, maintain the sump within the residual clay soils and drain groundwater from residual soils during soil removal;
- Once the bulk of the leachate from beneath the Capped Waste Stockpile has been removed for treatment, backfill the sump and reinstate the ground surface as required for development;
- Continue quarterly on-going monitoring of groundwater wells down-gradient of the Capped Waste Stockpile in accordance with the EPL;
- Following 2 years of quarterly monitoring, complete trend analysis to evaluate plume stability and determine if source removal of stockpiled wastes and secondary removal of leachate has resulted in lowering of fluoride and cyanide concentrations immediately down-gradient of the Capped Waste Stockpile.

9. VALIDATION PLAN

Validation of the remediation works includes the following components:

- Validation that data gaps have been addressed, including PAECs that have yet to be assessed due to access issues
- Validation that all source zones (AECs) have been effectively remediated
- Validation that the cell is constructed in accordance with the design and that contaminated materials are appropriately placed
- Validation of remediation of the leachate plume
- Validation of the suitability of materials reused on site following demolition
- Validation that subsurface voids are suitable prior to backfilling
- Validation that the remainder of the Smelter Site is suitable for commercial/ industrial landuse following demolition works

In addition, the following risk assessment are to be completed:

- A human health risk assessment for elevated fluoride in groundwater in relation to maintenance/ construction workers at the Smelter Site
- An ecological risk assessment for fluoride (the driver for toxicity) in relation to groundwater receptors. Aluminium will not be included in this risk assessment as it is not the driver for toxicity.

Validation information is further discussed below in relation to the containment cell in **Section 9.1** and the remainder of the Smelter Site in **Section 9.2**. A generalised set of Data Quality Objectives (DQOs) has been developed in **Section 9.3**.

9.1 Containment Cell Validation

Validation requirements for the construction of the Containment Cell will form part of the detailed Cell Design. Validation requirements will be described in a standalone validation specification that will form part of the technical specification for the Containment Cell Contractor. The Validation Specification will be review by the Site Auditor to ensure that the final validation report is sufficiently comprehensive to allow Site Auditor provision of a Part A Site Audit Statement. In development of the Containment Cell Validation Specification, the principles outlined below will be followed.

9.2 Validation of Remainder of Smelter Site

Validation activities will be required at each AEC:

- AEC 1: Capped Waste Stockpile, including soil and leachate impacted groundwater;
- AEC 2: Anode Waste Pile;
- AEC 4: Diesel Spray Area;
- AEC 6: Drainage Lines;
- AEC 6: East Surge Pond;
- AEC 8: Carbon Plant;
- AEC 26: Bake Furnace Scrubber;
- AEC 28: Area East of the Playing Field.

In addition to the identified AECs, validation of areas following structure demolition will be required. These include sumps and drainage lines, transformers. Broad validation of the entire site will also be undertaken on a systematic grid following the completion of all demolition and remedial works. This will include the densely vegetated portion of the site in the west and south-west that has previously had limited assessment and those areas of the site between AECs and PAECs that have had limited assessment.

Validation requirements for the remainder of the Smelter Site will be detailed in a Smelter Site Validation Plan. The Smelter Site Validation Plan will summarise environmental reports previously prepared for the site, the nature and extent of contamination at the Smelter Site, the preferred remedial option and remediation requirements. The Smelter Site Validation Plan will then detail validation requirements for each of the primary components outlined above. Individual DQOs will be developed for each component.

The Smelter Site Validation Plan will include detailed information pertaining to the following components:

- AECs, demolition works, filling of subsurface voids: Materials tracking requirements
- Leachate plume: Assessment of change in alkaline conditions, water treatment requirements
- AECs, including Capped Waste Stockpile: Justification of validation sampling densities and COCs for laboratory analysis
- AECs and leachate plume: Surface water management plans
- Leachate plume: Trigger protocol for contingencies in the event that validation cannot be achieved

Information required to demonstrate that the source areas have been remediated is outlined in the sampling and analysis quality plan (SAQP) in **Section 9.3**.

9.3 Validation Data Quality Objectives

In order to achieve the objectives and purpose of the validation program, both the field and laboratory programs must be representative of the actual extent of contamination in soil. As such, specific Data Quality Objectives (DQOs) have been developed for the validation of field and analytical data obtained during the remediation. The DQO process is a systemic, seven step process that defines the criteria that the validation sampling should satisfy in accordance with the requirements of DEC (2006) *Guidelines for the NSW Site Auditor Scheme* (Third Edition). The DQOs are as follows:

9.3.1 Step 1: State the Problem

The Smelter Site has historically been used as an aluminium smelter and is proposed to be redeveloped for commercial and industrial landuse. Previous investigations, as outlined in **Section 5**, have identified seven AECs that require remediation in order to make the Smelter Site suitable for the proposed landuse. In addition, the demolition of the Smelter and temporary stockpiling of materials at the Smelter Site will require validation following completion.

Validation of demolition and remedial works is required to demonstrate that the identified health-based and environmental risks to future users of the Smelter Site have been adequately remediated to render the site suitable for the proposed development.

Step 2: Identify the Decisions

The validation SAQP is to ensure that all relevant contamination has been identified at each AEC and that remediation has been carried out successfully. To validate the effectiveness of the remediation strategy, validation sampling and analysis at each AEC is required. The site will be considered remediated when the remediation and validation program has been carried out successfully. Remediation is deemed to be successful when:

- All contaminated soils have been excavated from each AEC and relocated to the Containment Cell;
- Validation sampling at each AEC has found that concentrations in soil for all contaminants of concern are below remediation acceptance criteria;
- Validation sampling has found that the 95%UCL average of the mean concentrations for all COCs in soil is below the remediation acceptance criteria and no analyte concentration is in excess of 250% of the remediation acceptance criteria or where the above criteria cannot be

achieved due to site or project constraints, such as practical or economical limits, a risk based assessment of the contaminant may be required;

- Groundwater at the capped waste stockpile has been extracted and treated and monitoring of the down gradient well network indicates that concentrations of fluoride and cyanide in the groundwater are below the remediation criteria; and
- Excavations have been reinstated with suitable materials to an accepted landform.

9.3.2 Step 3: Identify Inputs to the Decision

For each Area of Concern at the Smelter Site, the following inputs into the decision making process are required:

- A comprehensive evaluation of soil contaminant concentrations is required following remediation. It is proposed that the evaluation will comprise sampling and analysis as described in **Table 9-1**, **Table 9-2** and **Table 9-3**.
- Documented material tracking that demonstrates all materials have been appropriately relocated as described in **Section 7.1**.
- Final survey that demonstrates the landform has been reinstated to achieve the objectives of the final landform as described in **Section 7.1.**

9.3.3 Step 4: Define the Study Boundary

For the purpose of remedial works at the Smelter Site, the boundaries of the study (Step 4) are defined as follows:

The boundary of the Smelter Site is outlined in **Section 3.2** and shown in **Figure 2**. As AECs, PAECs and the extent of demolition is limited to the developed area of the Smelter Site, the study boundary includes only the developed area of the Smelter Site and excludes surrounding bushland, as shown in **Figure 3**. For groundwater within the leachate plume downgradient of the Capped Waste Stockpile, the study boundary extends into bushland to the east of the developed portion of the smelter, as shown in **Figure 12.**

The boundaries of each AEC are outlined in **Figures 5** to **11**.The vertical study boundary is to a maximum depth of 1.5 m bgs. Impacts to soil were observed to be shallow, within fill material and generally less than 0.6 m bgs. PAH contamination is limited in vertical extent and has not impacted underlying natural soils with the exception of the Capped Waste Stockpile. Demolition of the smelter buildings and associated below ground structures will be completed to a maximum depth of 1.5 m bgs.

There is no temporal boundary to this project.

9.3.4 Step 5: Development of Decision Rules

The decision rules for the project will be as follows:

- If the results of the analytical data quality control assessment are acceptable, then the data will be deemed suitable for the purpose of the project. In this regard, data will be assessed against completeness, comparability, representativeness, precision and accuracy; and
- If the reported assessment and validation results are below relevant assessment thresholds provided within applicable regulatory guidelines, then the site soils will be considered suitable for the proposed land use.
- If visual observations indicate that all anthropogenic materials have been removed from the footprint of the Capped Waste Stockpile, then source removal will be considered to have been achieved for the leachate plume in groundwater.
- If quarterly monitoring of the leachate plume indicates that the concentrations of fluoride and cyanide are stable or reducing within 2 years then groundwater an evaluation of the groundwater monitoring program will be undertaken. Monitoring of the leachate impacted groundwater is currently undertaken under EPL and consultation and reporting to the EPA will be required.
- If the site surveys of each AEC are conducted by an appropriately qualified surveyor, then the survey will be deemed suitable for the purposes of the project.

9.3.5 Step 6: Specific Limits of Decision Error

Acceptable limits and the manner of addressing possible decision errors are outlined in the sections below:

Accuracy: Accuracy is defined as the nearness of a result to the true value, where all random errors have been statistically removed. Internal accuracy is measured using percent recovery '%R' and external accuracy is measured using the Relative Percent Difference '%RPD'.

Internal accuracy will be tested utilising:

Surrogates	Surrogates are QC monitoring spikes, which are added to all field and QA/QC samples at the beginning of the sample extraction process in the laboratory, where applicable. Surrogates are closely related to the organic target analytes being measured, are to be spiked at similar concentrations, and are not normally found in the natural environment;
Laboratory control samples	An externally prepared and supplied reference material containing representative analytes under investigation. These will be undertaken at a frequency of one per analytical batch;
Matrix spikes	Field samples which are injected with a known concentration of contaminant and then tested to determine the potential for adsorption onto the matrix. These will be undertaken at a frequency of 5%.

Recovery data shall be categorised into one of the following control limits:

- 70%-130%R confirming acceptable data, note that there are some larger %R for intractable substances;
- 69%-20%R indicates discussion required. May be considered acceptable data, or may be regarded with uncertainty;
- 10-19 %R indicating that the data should be treated as an estimate result; and
- <10 %R indicating that the data should be rejected.

External accuracy will be determined by the submission of interlaboratory duplicates at a frequency of 5%. Data will be analysed in accordance with the following control limits:

- 60% RPD at concentration levels greater than ten times the PQL.
- 85% RPD at concentrations between five to ten times the PQL.
- 100% RPD at concentration levels between two and five times the PQL.

Where concentration levels are less than two times the PQL, the Absolute Difference (AD) shall be calculated. Data will be considered acceptable if the AD <2.5 times the PQL.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

Precision: The degree to which data generated from replicate or repetitive measurements differ from one another due to random errors. Precision is measured using the standard deviation 'SD' or Relative Percent Difference '%RPD'.

Internal precision will be determined by the undertaking of laboratory duplicates, where two sub samples from a submitted sample are analysed. These will be undertaken at a frequency of 10%. A RPD analysis is calculated and results compared to:

- 50% RPD at concentration levels greater than ten times the PQL.
- 75% RPD at concentrations between five to ten times the PQL.

- 100% RPD at concentration levels between two and five times the PQL.

Where concentration levels are less than two times the PQL, the Absolute Difference (AD) shall be calculated. Data will be considered acceptable if the: AD <2.5 times the PQL.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

External precision will be determined by the submission of intralaboratory duplicates at a frequency of 5%. The external duplicate samples are to be obtained by mixing and then splitting the primary sample to create two identical sub samples. Field duplicate samples are to be labelled with a unique identification that does not reveal the association between the primary and duplicate samples e.g., QA1.

It must be noted that significant variation in duplicate results is often observed (particularly for solid matrix samples) due to sample heterogeneity or concentrations reported near the Practical Quantification Limit (PQL).

Data will be analysed in accordance with the following control limits:

- 50% RPD at concentration levels greater than ten times the PQL.
- 75% RPD at concentrations between five to ten times the PQL.
- 100% RPD at concentration levels between two and five times the PQL.

Where concentration levels are less than two times the PQL, the Absolute Difference (AD) shall be calculated. Data will be considered acceptable if the: AD <2.5 times the PQL.

Any data which does not conform to these acceptance criteria will be examined for determination of suitability for the purpose of site characterisation.

Blank samples will be submitted with the analytical samples and analysed for the contaminants of concern:

- Field Blank One per matrix type each batch samples/each day;

The laboratory will additionally undertake a method blank with each analytical batch of samples. Laboratory method blank analyses are to be below the PQLs. Results shall be examined and any positive results shall be examined. Positive blank results may not be subtracted from sample results.

Positive results may be acceptable if sample analyte concentrations are significantly greater than the amount reported in the blank (ten times for laboratory reagents such as methylene chloride, chloroform, and acetone etc., and five times for all other analytes). Alternatively, the laboratory PQL may be raised to accommodate blank anomalies provided that regulatory guidelines are not compromised by any adjustment made to the PQL.

Completeness: The completeness of the data set shall be judged as:

- The percentage of data retrieved from the field compared to the proposed scope of works. The acceptance criterion is 95%.
- The percentage of data regarded as acceptable based on the above data quality objectives. 95% of the retrieved data must be reliable.
- The reliability of data based on cumulative sub-standard performance of data quality objectives.

Where two or more data quality objectives indicate less reliability than what the acceptance criteria dictates, the data will be considered with uncertainty.

Representativeness: Sufficient samples must have been collected from the soil present at the site. This will be calculated for soil samples by Procedure B, NSWEPA Sampling Design Guidelines, 1995.

Samples must be collected and preserved in accordance with the sampling methodology proposed in Step 7 to ensure that the sample is representative of the assessed stratum.

Comparability: The data must show little to no inconsistencies with results and field observations and include likely associates e.g. TPH C6-C9 and BTEX.

Decision Error Protocol

If the data received is not in accordance with the defined acceptable limits outlined in Steps 5 and 6, it may be considered to be an estimate or be rejected. Determination of whether this data may be used or if re-sampling is required will be based on the following considerations:

- Closeness of the result to the guideline concentrations.
- Specific contaminant of concern (e.g. response to carcinogens may be more conservative).
- The area of site and the potential lateral and vertical extent of questionable information.
- Whether the uncertainty can be effectively incorporated into site management controls.

Rectifying Non-conformances

If any of the validation procedures or criteria identified are not followed or met, this will constitute a non- conformance. The significance of the non-conformance will determine if rectification is required after discussion with the site auditor. In order to address any non-conformances, the Contractor's Environmental Consultant must assess the significance of each non-conformance and put their conclusion and recommendation to the auditor for approval.

9.3.6 Step 7: Optimise the Design for Obtaining Data – Soil Validation

All validation samples are to be collected in accordance with the DQOs outlined in this Section.

The sampling methodology for the site remediation work is outlined below.

The objective of the sampling pattern is to demonstrate that the adopted sample density and total number of samples collected is suitable for the proposed commercial/industrial land use. The excavations will be validated following removal of the materials and potential contaminants of concern.

Validation samples, frequency of collection, the analysis required, and justification presented in **Table 9-1** for the Capped Waste Stockpile and **Table 9-2** in for the remaining AECs. **Table 9-3** outlines the validation requirements for the remainder of the Smelter Site.

Table 9-1: Validation of the Capped Waste Stockpile

Validation Method	Validation Requirements	Chemical Analysis
Visual validation - soil	Visual documentation of the removal of all waste materials will be completed at the Capped Waste Stockpile. Excavations are to be photographed showing the complete removal of all buried waste materials. A photographic log shall be maintained and included in the Validation Report.	NA

Table 9-1: Validation of the Capped Waste Stockpile

Validation Method	Validation Requirements	Chemical Analysis
Chemical validation - soil	Sampling and analysis to demonstrate the removal of wastes. The walls and base of the Capped Waste Stockpile excavation shall be sampled as follows: • Excavated Base: Sampling across each area is to be undertaken on 30m grid spacing. This sampling program is in accordance with NSW EPA (1995) *Sampling Design Guidelines*. • Excavation Walls: One sample for each soil type present within the face of the excavation per 10 lineal metres.	Fluoride, cyanide, PAHs, TRH, BTEX, Heavy Metals, Asbestos (if encountered during excavation works)
	Sampling and analysis of capping soils to demonstrate suitability for reuse will be undertaken from soil stockpiles. Samples will be collected at rates of: • 1 per 1000m3. This rate is based on the low likelihood of contamination of the capping soils, which are high plasticity clays excavated from the Clay Borrow Pit. A statistical analysis of the data set will be undertake to assess data set variability and determine if additional sampling is required to further evaluate contaminant concentration.	Fluoride, cyanide, PAHs, TRH, BTEX, Heavy Metals, Asbestos (if encountered during excavation works)
Visual validation – leachate impacted groundwater	Leachate impacted groundwater is readily identified by brown staining. Leachate will be removed from the footprint of the Capped Waste Stockpile until it is no longer visually observed to be present.	NA
Chemical validation – leachate impacted groundwater	Validation that source removal (excavation of stockpiled wastes and contaminated soil) and secondary removal (extraction and treatment of leachate within the shallow residual soil profile of the Capped Waste Stockpile footprint) has been successful in reducing fluoride and cyanide concentrations within the down gradient plume will be completed via at least 2 years of quarterly monitoring of those wells required to be monitored under the EPL. In the event that fluoride and cyanide concentrations in the down gradient plume have not reduced following 2 years of monitoring, the contingency plan in **Table 7.3** will be enacted.	Fluoride, cyanide, aluminium, pH

Table 9-2: Validation of Remaining AECs

Validation Method	Validation Requirements	Chemical Analysis
Visual validation: Area East of Playing Fields	Visual documentation of the removal of all waste materials will be completed at the Area East of the Playing Fields. Excavations are to be photographed showing the complete removal of all buried waste materials. A photographic log shall be maintained and included in the Validation Report.	NA
Chemical validation: **Anode Waste Pile** **Carbon Plant** **Diesel Spray Area** **Bake Furnace Scrubber** **East Surge Pond** **Area East of Playing Fields**	Sampling and analysis to demonstrate the removal of wastes. The walls and base of the excavations shall be sampled as follows: • Excavated Base: Sampling across each area is to be undertaken on 30m grid spacing. This sampling program is in accordance with NSW EPA (1995) Sampling Design Guidelines. • Excavation Walls: One sample for each soil type present within the face of the excavation per 10 lineal metres. This sampling density is considered sufficient to confirm the absence of a contaminant hot spot greater than 5m in diameter.	PAHs

Table 9-3: Validation of Stockpiling and Demolition Areas

Validation Method	Validation Requirements	Chemical Analysis
Demolition areas	Potential impacts to ground may occur during demolition. Such activities are: • Dust deposition; and • Subsurface sump and tank removal.	Identified contaminants of concern based on source information.
Stockpile areas	Materials, including waste materials, may be temporarily stockpiled on site prior to placement in the Containment Cell. Validation of these areas following removal of the materials will be required. Validation will include both visual assessment and chemical evaluation of surface soils. Surface soil sampling across each area is to be undertaken on 30m grid spacing. This sampling program is in accordance with NSW EPA (1995) Sampling Design Guidelines.	Identified contaminants of concern based on stockpile contents.

Validation of the entire Smelter site following all demolition and remedial activities will be undertaken by sampling the surface of the Smelter site on a systematic grid, with analysis for PAHs.

- The sampling density is dependent on the homogeneity of the soil material sampled. All surfaces to be validated will be inspected visually before sampling and a determination of variability of the media will be made. Should the visual inspection show significant variability, an increased sampling density will be determined and a justification will be outlined within the Validation Report.
- Discrete sampling will be undertaken by collecting surface soil using a steel trowel or collection directly from the soil surface by hand. Discrete samples will be spaced in a 30m grid formation across the area to ensure that an even coverage of the excavation base is achieved.
- Decontamination of sampling equipment will be undertaken before sampling and between samples by cleaning with "Decon 90/Xtran" and potable water.
- Disposable gloves will be worn for all sample collection.
- Where walls of excavations are present and are not proposed to be excavated and are deeper than 0.2m, discrete sampling will be undertaken from each soil type present every 10 lineal metres.

Contingency for validation sampling:

- In the event that visually impacted (including ACM) or odorous soils are excavated as part of the remedial works, validation sampling of the base of the excavation in the vicinity of the visually impacted or odorous soils will be completed;.
- The analytical suite for the validation samples will vary and will depend on the visual impact or odour. Soils impacted with an oily sheen or hydrocarbon odour will result in validation sampling for hydrocarbons. Discoloured soils will result in validation sampling for a suite of analytes, including heavy metals, fluoride and cyanide. Material with ACM fragments will result in validation sampling for asbestos (as well as the implementation of the Asbestos Management Protocol in **Section 13.1**).
- In the event that ACM fragments are identified during the excavation works, an asbestos clearance certificate will be required by a suitably qualified and experienced person at the completion of the remedial works.

9.3.6.1 Imported Fill Sampling

Any imported fill that is proposed to be brought to the site during the remediation project is to be VENM or ENM. The history of the source site and accompanying laboratory certification must show that the site has not been previously contaminated and a visual inspection of the source material is to be conducted. VENM material must be accompanied by a VENM certificate as outlined by the EPA. Refer to http://www.epa.nsw.gov.au/wr/venm.htm.

Imported ENM is to meet the criteria outlined in the ENM exemption issued under the Protection of the Environment Operations (Waste) Regulation 2005 – General Exemption Under Part 6, Clause 51 and 51A, The excavated natural material exemption 2012.

9.4 Soil Validation Criteria

9.4.1 Contaminants of Concern

Contaminants of Concern (CoCs) are those contaminants that have been found to be present in soil and sediments at the Smelter Site at concentrations which exceed the adopted screening criteria:

- Polycyclic Aromatic Hydrocarbons (PAHs).

Intrusive investigations have not been undertaken at the Capped Waste Stockpile. Contaminants of Concern at the Capped Waste Stockpile are known to include the following:

- Fluoride and cyanide.
- Other potential contaminants of concern include:
  - PAHs, TRH, BTEX, heavy metals and asbestos.

9.4.2 Soil Criteria

The guidelines proposed as remediation acceptance criteria at the Smelter Site are sourced from the following references:

- NEPC (1999) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM).

The variation to the National Environmental Protection (Assessment of Site Contamination) Measure (NEPM 2013) was approved on 19 June 2013 by the NSWEPA under the *Contaminated Land Management Act 1997*. NEPM (2013) provide revised health-based soil investigation levels (HILs) and ecological-based investigation levels (EILs) for various land uses.

The remediation acceptance criteria adopted for the Smelter Site from the NEPM are as follows:

- HIL D – Health investigation level for commercial/industrial such as shops, offices, factories and industrial sites. The HILs are applicable for assessing human health risk via all relevant pathways of exposure. The HILs are generic to all soil types and apply generally to a depth of 3 m below the surface for industrial use.
- EIL for commercial/ industrial use – ecological investigations levels applicable for assessing risk to terrestrial ecosystems. EILs depend on specific soil physicochemical properties and generally apply to the top 2 m of soil.
- ESLs for commercial/ industrial use – ecological screening levels developed for selected petroleum hydrocarbon compounds and fractions and are applicable for assessing risk to terrestrial ecosystems. These are also generally applicable to the top 2m of soil.

NEPM (2013) do not provide criteria for fluoride and aluminium in soils in Australia. Therefore, Ramboll Environ (2013) conducted a preliminary level Human Health Risk Assessment (HHRA) specific to fluoride and aluminium in order to derive a specific preliminary screening level for fluoride for the Hydro Aluminium Kurri Kurri Smelter. The screening levels are protective of the range of human receptors.

The applicable remediation assessment criteria for heavy metals and PAHs in soil are presented in **Table 9-4**.

Site specific guideline values for copper, nickel and zinc were derived using the average for pH, cation exchange capacity (CEC) and total organic carbon (TOC) at four locations on the Smelter Site. Values were derived using the interactive (Excel) Calculation Spreadsheet Standing Council on Environment and Water (SCEW) website for aged contaminants (greater than 2 years), as shown in **Table 9-4.** The laboratory report for the four samples and the Calculation Spreadsheets are included in **Appendix 7**.

Table 9-4: Remediation Assessment Criteria (mg/kg) – Health and Ecological Investigation Levels

Analyte	HIL D	EIL
Aluminium	NL (site-specific)[3]	-
Arsenic	3000	160
Cadmium	900	-
Chromium (VI)	3600	-
Chromium (III)	-	310 (1% clay)
Copper	240 000	210[1]
Lead	1500	1800
Nickel	6000	140[1]
Zinc	400 000	440[1]

Analyte	HIL D	EIL
Mercury (inorganic)	730	-
Fluoride	17,000 (site-specific)[2]	-
Cyanide (free)	1500	**-**
Carcinogenic PAHs (as BaP TEQ)	40	**-**
Total PAHs	4000	**-**
Naphthalene	**-**	370

[1] EILs were calculated using the average CEC (11.8 meq/100g), soil pH (6.2), percentage clay (7.5%) and total organic carbon (8.1%) values from four soil samples collected from the Smelter Site in April 2018. The NEPM (2013) EIL calculator spreadsheet was used to generate the numbers and a site-specific ambient background concentration (ABC) was not included (rather a default ABC was used as calculated in the EIL calculator).
[2] Site-specific industrial fluoride value calculated in the Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)
[3] NL: indicates that the site-specific risk-based aluminium screening criteria for industrial soil is a concentration greater than physically possible in soil, and therefore the criteria is defined as 'Non-Limiting' or NL (ENVIRON 2013).

The applicable remediation assessment criteria for petroleum hydrocarbons in soil are presented in **Table 9-5** and **Table 9-6**.

Table 9-5: Soil Assessment Criteria for Vapour Intrusion - HSL D (mg/kg) – Sand[2]

Analyte	0 to <1m	1m to <2m	2m to <4m	4m+
Toluene	NL	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	230	NL	NL	NL
Naphthalene	NL	NL	NL	NL
Benzene	3	3	3	3
F1[3]	260	370	630	NL
F2[4]	NL	NL	NL	NL

[1] The soil saturation concentration (Csat) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds Csat, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.
[2] (For soil texture classification undertaken in accord with AS 1726, the classifications of sand, silt and clay may be applied as coarse, fine with liquid limit <50% and fine with liquid limit>50% respectively, as the underlying properties to develop the HSLs may reasonably be selected to be similar. Where there is uncertainty, either a conservative approach may be adopted or laboratory analysis should be carried out. Based on review of the borehole logs for the Smelter Site, sand was adopted as the soil classification OR Sand has been adopted for the Smelter Site as it is considered to be the most conservative.
[3] To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.
[4] To obtain F2 subtract naphthalene from the >C10-C16 fraction.

Table 9-6: ESLs and Management Limits for Petroleum Hydrocarbons in Soil

TPH fraction	Soil texture	ESLs (mg/kg dry soil)	Management Limits[1] (mg/kg dry soil)
		Commercial and Industrial	Commercial and Industrial
F1 C6- C10	Coarse	215*[4]	700[2]
F2 >C10-C16	Coarse	170*[5]	1000[2]
F3 >C16-C34	Coarse	1700	3500

Table 9-6: ESLs and Management Limits for Petroleum Hydrocarbons in Soil

TPH fraction	Soil texture	ESLs (mg/kg dry soil)	Management Limits[1] (mg/kg dry soil)
		Commercial and Industrial	Commercial and Industrial
F4 >C34-C40	Coarse	3300	10000
Benzene	Coarse	75	-
Toluene	Coarse	135	-
Ethylbenzene	Coarse	165	-
Xylenes	Coarse	180	-
Benzo(a)pyrene	Coarse	72[6]	-

1 Management limits are applied after consideration of relevant ESLs and HSLs.
2 Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2.
3 ESLs are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability.
4 To obtain F1, subtract the sum of BTEX from C6-C10 fraction.
5 To obtain F2, subtract naphthalene from >C10-C16 fraction.
6 Benzo(a)pyrene ESL criteria from Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and Other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects) Scientific Criteria Document (revised)

NEPM (2013) includes a low reliability ecological screening criterion for benzo(a)pyrene of 1.4 mg/kg for commercial/industrial land use. This criterion has been adopted from Environment Canada (1999) benzo(a)pyrene soil quality guideline, which is based on toxicity data for a single invertebrate species (an earthworm). Environment Canada revised their benzo(a)pyrene soil quality guideline in 2010 using the Species Sensitivity Distribution method, which is the preferred method for the derivation of ecological investigation levels and can only be used where sufficient toxicity data are available that adhere to rigorous quality control requirements. Ramboll has elected to use the revised Environment Canada soil quality guideline of 72 mg/kg, for commercial/industrial land use, as the most relevant ecological investigation level for benzo(a)pyrene at the Smelter Site as this guideline has been derived from a larger and more up-to-date toxicity database than the NEPM (2013) low reliability criterion.

Consistent with the guidance provided in the NEPM, the data will be assessed against the above adopted site guidelines by:

- Comparing individual concentrations against the relevant guidelines and if discrete samples are in excess of the relevant guideline then;
- Comparing the 95% upper confidence limit of mean against the relevant guideline also ensuring that:
  - the standard deviation of the results is less than 50% of the relevant investigation or screening level; and
  - no single value exceeds 250% of the relevant investigation or screening level.

9.5 Groundwater and Surface Water Validation Criteria

9.5.1 Contaminants of Concern

Contaminants of Concern (CoCs) are those contaminants that have been found to be present in groundwater in the vicinity of the Capped Waste Stockpile:

- Cyanide
- Fluoride
- Aluminium
- Sodium
- Elevated pH

9.5.2 Groundwater Criteria

The guidelines proposed for the assessment of groundwater contamination at the Capped Waste Stockpile are 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.

9.5.2.1 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 15 km 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 626 µS/cm to 1520 µS/cm. This surface water body is considered to be a fresh water receptor and supports the following beneficial uses:

- Fresh water aquatic ecosystems;
- Recreational fishing;
- Possible 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.

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 Smelter site, which are known to be associated with monitoring of groundwater impact at the Capped Waste Stockpile. There are no other licensed groundwater bores within 2 km of the site.

The shallow estuarine aquifer beneath the Smelter site is ephemeral in nature with a low yield and as such, this aquifer is not viable for beneficial uses such as drinking water, stock watering or irrigation.

9.5.2.2 Appropriate Criteria for Groundwater

The review of potential beneficial uses of the shallow estuarine groundwater aquifer did not identify any potential beneficial uses. As such, validation criteria for demonstrating successful source removal (excavation of stockpiled wastes and contaminated soil) and secondary removal (extraction and treatment of leachate within the footprint of the Capped Waste Stockpile) will be as follows:

- Trend analysis following a minimum of 2 years of quarterly monitoring of those wells required to be monitored under the EPL. Wells to show stable or reducing trends in the concentrations of fluoride, cyanide, aluminium and pH.

9.5.2.3 Appropriate Criteria for Surface Water

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

The investigation levels presented in ANZECC and 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.

Surface water 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 summary of the remediation acceptance criteria for surface water are provided in **Table 9-7**.

Table 9-7: Surface Water 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** >12,200***	No guideline	No guideline

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

9.6 Validation Reporting

At the completion of the remediation and validation works, a Validation Report will be prepared in general accordance with the relevant sections of NSW OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites*. The Validation Report will include:

- Executive summary;
- Scope of work;
- Site Description;
- Summary of site history and previous investigations;
- Additional investigations completed at PAECs and AECs with access restrictions;
- Description of observations recorded following demolition of buildings, in relation to areas of staining, residues, pits and sumps and ACM fragments;
- Remediation activities undertaken, including the extent of the excavation works at each AEC (survey information) and observations made during excavation works;
- Supporting factual evidence of the remediation work including photographic and field records and materials tracking data;
- Validation sampling and analysis results for each AEC;
- Information relating to the water treatment plant at the Capped Waste Stockpile, including volume of leachate extracted and treated, concentrations of the main contaminants following treatment and the volume of treated water disposed of via on-site irrigation;
- Quarterly monitoring results for those wells required to be monitored under the EPL for a minimum of 2 years;
- Quality assurance/ quality control (QA/QC) protocols for field work and laboratory analysis;
- Health Risk Assessment for fluoride in groundwater for maintenance and construction employees at the Smelter site;
- A statement indicating the suitability of the Smelter Site for the proposed landuse.

The Validation report will be prepared in accordance with the NSWEPA Guidelines for Consultants Reporting on Contaminated Sites (NSWEPA 1997) and the Department of Environment and Conservation Guidelines for the NSW Site Auditor Scheme 3rd Edition (EPA 2017).

10. WORKS ENVIRONMENTAL MANAGEMENT PLAN

10.1 Works Environmental Management Plan

The contractor is to prepare a Works Environmental Management Plan (EMP) consistent with the "Guideline for the Preparation of Environmental Management Plans" (NSW Department of Infrastructure, Planning and Natural Resources, 2004). The EMP is to include the controls presented in **Sections 10.2** to **10.11.**

10.2 Site Access

During remediation works access to the site is to be strictly controlled by the Contractor. The contractor should include signage at the entry to the work area identifying the nature of the works, the contractor details and the Remediation Project Manager's details.

Only authorized persons who have been inducted into the safety and environmental controls on the site will be permitted to work on the site. Visitors to the site will be accompanied by such inducted personnel.

Vehicle access to the site will be along established access roads where possible.

If the construction of additional access tracks is required, these shall be detailed for approval from the Principal's Representative prior to commencement of any construction works.

10.3 Hours of Operation

The Contractor shall only undertake works associated with the Project that may generate an audible noise at the closest residential receptor during the following hours unless under direction from a relevant authority for safety reasons or in the event of an emergency:

- 7.00 am to 6.00 pm, Monday to Friday;
- 7.00 am to 1:00 pm on Saturdays; and
- At no time on Sundays or public holidays.

10.4 Air Controls

10.4.1 Dust Control

Dust emissions shall be managed to avoid dust generation that could impact on a sensitive receiver. The CEMP is to identify the dust control measures the contractor will implement to meet this objective.

The following dust control procedures would be implemented:

- Securely covering all loads entering or exiting the site.
- Use of water carts on unsealed roads, parking and other trafficable areas.
- Control of dust from all stockpiles by water sprays.
- All vehicles to travel on designated access roads.
- Temporarily ceasing an activity that generates dust that could affect a sensitive receiver.

10.4.2 Odour

Given the nature and extent of the stockpiled and buried fill identified at the site, there is a low potential for odours to be emitted.

Should a complaint be received by the Remediation Project Manager regarding odour, the source of the odour is to be located and appropriate control measures identified and implemented.

Control measures could include:

- Use of appropriate covering techniques such as the use of plastic sheeting to cover specific excavation faces or stockpiles.
- Use of fine mist sprays.

- Any equipment and machinery used on site need to have been maintained in accordance with manufacturers' requirements to minimise exhaust emissions.

Records of odours and control measures (if required) shall be kept by the Remediation Project Manager.

10.5 Noise Control

The remediation works shall comply with the "Interim Construction Noise Guideline" (DECCW, 2009). This would include remediation works being restricted to the hours described in **Section 10.3**.

The CEMP is to identify the noise control measures the contractor will implement to comply with the guideline. The following noise control measures should be considered:

- Construction vehicles and machinery would be selected with consideration of noise emissions. Equipment should be fitted with appropriate silencers (where applicable) and be maintained in accordance with manufacturer's requirements. Machines found to produce excessive noise compared to typical noise levels should be removed and replaced, or repaired or modified prior to recommencing works.
- Where possible construction vehicles and machinery would be turned off or throttled down when not in use.
- All site staff would be informed of their obligations to minimise potential noise impacts on residents during the site induction and the need to take reasonable and practical measures to minimise noise.

10.6 Erosion and Sediment Control

The CEMP is to include erosion and sediment control measures consistent with Managing Urban Stormwater: Soils and Construction (4th Ed) (Landcom, 2004).

The erosion and sediment control plan is to be prepared and implemented for the Clay Borrow Pit works area and the Smelter Site stockpile location.

The following erosion and sediment control measures should be considered:

- Installation of silt fences in drainage channels downgradient of the remediation work areas and any stockpile areas.
- Any material which is collected at the silt fences (or other sediment control measures) should be managed with the soil component of the excavated fill material.

Once a week and following rain events the sediment control measures would be inspected and maintained as required.

10.7 Surface Water and Groundwater Control

10.7.1.1 Surface water

Contaminants in soils are present at the surface however comprise low solubility PAHs. Management of turbidity in surface water is therefore necessary in order to manage the migration of PAHs bound to soils. Additionally, surface water controls are required to manage erosion and sediment control (refer to **Section 10.6**), and surface water collected within excavations.

The CEMP is to identify the measures the contractor will implement to manage surface water quality, including turbidity. The following control measures should be considered:

- No surface water is not to discharge from the site. All surface water will be managed through the site wide surface water management system and discharged to the irrigation area under the EPL.
- Erosion and sediment controls outlined in **Section 10.6** are implemented;
- Diversion of surface water upgradient of the excavation and stockpile areas from the areas of disturbance.
- Stockpile areas are to be on flat land where possible and out of any drainage lines.

- Water collected within excavations would drain from the excavation area through sediment controls (as outlined in **Section 10.6**). Where the water is required to be pumped from the excavation it is to be subjected to the sediment controls outlined in **Section 10.6** prior to discharge to the site surface water management system.
- The Contractor is to keep themselves informed of weather conditions and the potential for rain events and proactively manage the site.

10.7.2 Groundwater

Groundwater will be encountered during removal of the Capped Waste Stockpile. Groundwater will be drained to a sump within the Capped Waste Stockpile bund. From here, groundwater will be pumped to the on-site groundwater treatment system. The system will be designed, during a detailed design process, to treat water to a level suitable for discharge to the North Dam and disposed of via irrigation under the existing Environment Protection Licence.

10.8 Traffic Control

It is envisaged that all haulage routes will be within Hydro property. All haulage routes for trucks transporting soil, materials, equipment or machinery to and from the site shall be selected to meet the following objectives:

- Comply with road traffic rules
- Minimise noise, vibration and odour to adjacent premises; and
- Maximise travel on state and arterial roads and avoid use of local roads.

The CEMP is to include a traffic control plan for the Hart Road site access point as per Cessnock City Council guidelines. The plan should also designate internal material haulage routes.

If the traffic control plan includes the placement of signage or other traffic controls within the Hart Road road reserve, the Contractor is to consult with the Cessnock Council and attain any required approvals or permits prior to placing the signage or controls.

The CEMP should also include the following measures:

- Deliveries of soil, materials, equipment or machinery are to occur during standard construction hours (refer to **Section 10.3**).
- Securely cover all loads to prevent any dust or odour emissions during transportation.
- Vehicles are not to track soil, mud or sediment onto the road.

10.9 Spill Response

The Contractor is to develop a spill response protocol to be implemented in the event that site activities result in a spill.

Examples where spills could occur are:

- Transport of contaminated material from the site, involving loss of load anywhere including the Smelter Site, private and public property;
- Fuel spill during machinery use or refuelling that occurs anywhere including private or public property.

10.10 Hazardous Materials

The CEMP shall include measures for the storage, transport and use of any hazardous materials and dangerous goods during site activities. This will reference the guidance and requirements in the following:

- Protection of the Environment Operations Act 1997 and associated regulations;
- Work Health and Safety Act 2011 and the Work Health and Safety Regulation 2011;
- Australian Standard (AS1216) Class Labels for Dangerous Goods;
- Australian Standard (AS1940-2004) The storage and handling of flammable and combustible liquids; and

- Australian Standard (AS3833): The Storage and Handling of mixed classes of dangerous goods in packages and intermediate bulk containers.

Relevant Safe Data Sheets (SDS) for each material, chemical or hazardous substance used at the workplace is to be obtained from the manufacturer or suppliers of those goods prior to its arrival on site. All substances brought on to site must be registered on the SDS Register. This register must be developed and controlled by the site environmental manager who will be responsible for the receipt of such substances / materials in accordance with the Hazardous Substances Regulation, the Dangerous Goods Act and the Dangerous Goods Regulations.

10.11 Waste Materials

Although no asbestos containing materials were identified during investigations at the Smelter Site, there is potential for asbestos contamination materials, including friable asbestos, to be present within the Capped Waste Stockpile and within stockpiles proposed to be disposed in the Containment cell.

The Contractor is to develop and implement an Asbestos Removal Control Plan consistent with the Asbestos Management Protocol included in **Section 13.1**.

10.12 Flora and Fauna

The CEMP is to include procedures for the clearance of vegetation (if required). This should include:

- Strategies for minimising vegetation clearance within the worksite and protection of vegetated areas adjoining the work area.
- Weed control measures.
- Measures for the management and disposal of cleared vegetation matter.
- Stockpiles and other materials are not to be stored below the drip line of any tree.

11. HEALTH AND SAFETY

A site specific health and safety plan detailing procedures and requirements that are to be implemented will need to be developed for the remediation works including as a minimum but not limited to, the requirements described below.

The objectives of the health and safety plan are:

- To apply standard procedures that reduce risks resulting from the works;
- To ensure all employees are provided with appropriate training, equipment and support to consistently perform their duties in a safe manner; and
- To have procedures to protect other site workers and the general public.

These objectives will be achieved by:

- Assignment of responsibilities;
- An evaluation of hazards;
- Establishment of personal protection standards and mandatory safety practices and procedures; and
- Provision for contingencies that may arise while operations are being conducted at the site.

Specifically the Health and Safety plan is to address the following identified hazards:

- The stability of excavations;
- The presence of services;
- The presence of livestock, wildlife including snakes;
- The presence of contaminants as described within this document; and
- The presence of other site personnel, work and traffic.

The Contractors Health and Safety plan is to be compliant with:

- Hydro Aluminium's Contractor Occupational Health Safety and Environment Requirements Version 3 2014. This requires the Contractor and all employees and subcontractors to be inducted to the Hydro site and for Hydro work permits to be obtained prior to starting any work.
- *Work Health and Safety Act 2011*.
- Work Health and Safety Regulation 2011.
- Applicable state and federal regulations, legislation and codes of practice.

12. REMEDIATION SCHEDULE

The final remediation schedule will be discussed with the Contractor. A proposed indicative schedule up to the completion of a draft validation report is outlined in **Table 12-1**. Hydro has prepared a program that is currently being updated to reflect the current status of the approvals process. A copy of this program can be provided if required.

Table 12-1: Remediation Schedule

Task	Estimated Duration
State Significant Development Project Approval	18 – 24 months
Contractor Procurement	2 – 4 months
Preliminaries (documentation)	2 months
Site establishment and mobilisation	2 weeks
Containment Cell Base Establishment and Construction	18 months
Capped Waste Stockpile Removal and Placement in Containment CellSite works	12 months
Contaminated Soils Removal and Placement in Containment Cell	
Containment Cell Capping	6 months
Capped Waste Stockpile Footprint Restoration	12 months
Completion of Surface Restoration and Regrading	12 months
Demobilisation and final laboratory results	2 months
Groundwater and Leachate Treatment	24 months
Validation reporting	2 months
Final Site Auditor sign-off	2 months

13. ENVIRONMENTAL CONTROLS CONTINGENCY PLAN

This section of the RAP describes the contingency plans to respond to site incidents that may occur during remedial works and could impact on the surrounding environment and the community.

The environmental controls described in **Section 10** are designed to be sufficiently protective under the normal range of site conditions. The contingencies presented in **Table 13-1** are to be implemented where unexpected site conditions or circumstances arise.

Table 13-1: Environmental Controls Contingency Plan

Contingency Event	Contingency	Responsibility
Discovery of unexpected materials excluding ACM	Contact the Principal's representative, then sort materials to a segregated stockpile and discuss possible disposal options with the Principal or the Principal's representative.	Principal following notification from the Remediation Contractor.
Unexpected discovery of ACM	Stop work and implement the Asbestos Removal Control Plan. Refer to **Section 13.1**.	Remediation Contractor
Receival of a noise complaint	Identify noise source and implement noise control measures	Remediation Contractor
Receival of a dust or odour complaint	Identify odour or dust source and implement control measures	Remediation Contractor
Flooding event/sediment laden discharge	Assess and improve sediment and erosion control measures and stockpile management.	Remediation Contractor

13.1 Asbestos Management Protocol

The purpose of this protocol is to describe:

- The permits and approvals required to be attained prior to the works for the removal and management of potential asbestos containing materials (ACM) if encountered.
- The procedures to be implemented in the event that ACM is encountered.

13.1.1 Asbestos Related Permits and Approvals

The Contractor is required to possess a Class A friable asbestos removal license issued by WorkCover NSW or an equivalent asbestos removal license issued in another Australian jurisdiction.

The Contractor is responsible for notifying WorkCover NSW of the asbestos removal work **five days prior** to the commencement of the works. The Notification of Asbestos Removal Work is to address the removal of ACM that may be encountered below the surface.

The Contractor is required to prepare an Asbestos Removal Control Plan consistent with this Protocol, which is to be amended (as required); in the event that ACM is encountered.

The Contractor must notify a licensed waste management facility of the requirement to dispose of ACM prior to transporting the material to the facility. The Contractor would be required to provide the Contractor's Environmental Consultant with a docket from the facility confirming that the material was appropriately disposed as ACM at the facility and for that docket to be included in the Validation Report, refer to **Section 9.6**.

13.1.2 Management of ACM

The Contractor is to develop and implement an Asbestos Removal Control Plan consistent with *How to Safely Remove Asbestos: Code of Practice* (WorkCover NSW, 2011) (“the Code”), addressing the following:

- Delineation of and installation of warning signage around the asbestos removal area as appropriate as described in Section 4.2 of the Code.
- Provision of the appropriate personal protective equipment to all asbestos removal personnel as described in Section 4.5 of the Code.
- Removal and containment of asbestos fragments as described in Section 4.8 of the Code.
- Disposal of disposable personal protective equipment in accordance with Section 3.9 of the Code.
- Notification of the waste management facility of the requirement to dispose of ACM waste (refer to previous section).
- Transportation of the contained ACM waste to the licensed waste management facility (including defining the route to be travelled by the disposal vehicle), disposal in accordance with facility requirements, and a disposal docket attained and presented to the Contractors Environmental Consultant.
- The requirement for a clearance inspection to be undertaken by an appropriate person as described in Section 3.10 of the Code upon completion of the ACM removal.
- The procedures to be implemented in the event that unexpected ACM is uncovered.

14. REGULATORY COMPLIANCE REQUIREMENTS

Approvals required for the remediation of the Smelter Site are outlined in **Table 14-1**.

Table 14-1: Key Relevant Legislation and Regulations

Legislation or Regulation	Relevance
State Environmental Planning Policy (State and Regional Development) 2011	Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011 identifies 'waste and resource management facilities' as a category of State Significant Development, including: "(5) Development for the purpose of hazardous waste facilities that transfer, store or dispose of solid or liquid waste classified in the Australian Dangerous Goods Code or medical, cytotoxic or quarantine waste that handles more than 1,000 tonnes per year of waste."
***Protection of the Environment Operations Act 1997* (POEO Act)**	The POEO Act is the primary legislation for the management and control of pollution of the environment. This includes the licensing of premises that are listed as scheduled premises under Schedule 1 of the POEO Act. Hydro currently posses EPL No. 1548. The scheduled activity "contaminated soil treatment" would be added to the EPL to regulate the remediation activities and management of the Containment Cell.
Protection of the Environment Operations (Waste) Regulation 2014	A Specific Immobilised Contaminants Approval issued under the Regulation would be required to immobilisation of the contents of the Capped Waste Stockpile.
Hazardous Chemicals Act 1985	A licence for the storage of aluminium smelter waste applies to the Smelter and would continue to apply to the Smelter Site.

15. KEY PERSONNEL

The key stakeholders and their roles and responsibilities are outlined in **Table 15-1**.

Table 15-1: Roles and Responsibilities

Stakeholder	Name and Contact Details	Role / Responsibility
Principal	Hydro Aluminium Kurri Kurri Pty Ltd	Owner of the Smelter Site and ultimately responsible for all works on the site. Will engage/contract all other parties.
Principal's Environmental Representative	TBA	Person employed by or sub-contracted to Hydro to oversee/provide technical advice on remediation works and ensure works are completed in association with relevant guidelines.
Remediation Contractor	TBA	Company contracted to undertake remediation works. Will supply all plant and personnel to conduct works as outlined in this RAP and as required under local, state and federal legislation.
Remediation Supervisor or Project Manager	TBA	Responsible Person appointed by Contractor to supervise/coordinate all aspects of remedial works on behalf of the Contractor. Is the primary point of contact for the project.
Contractors Environmental Representative	TBA	Responsible for implementation, monitoring and management of the RAP.
Contractor's Environmental Consultant	TBA	Appropriately qualified environmental consulting company/person appointed to validate the implementation of the RAP. The Contractor's Environmental Consultant will supervise the works, conduct validation sampling and undertake all activities necessary to prepare validation report that documents the implementation of the RAP for submission and review by the Principal
Contaminated Land Auditor	TBA	The Contaminated Land Audit will be prepared for the site in accordance with the Contaminated Land Management Act 1997. The Contaminated Land Auditor will be appointed by Hydro.

16. COMMUNITY RELATIONS PLAN

Community consultation for this project is managed through a Community Consultation Plan developed by GHD for the site redevelopment. The plan includes consultation with a Community Reference Group on a monthly basis, newsletter drops, meetings with council, internet articles and drop in sessions. The proposed remediation strategy has been presented on two occasions to the CRG, two occasions to Council and has been subject of two drop in sessions. Further information is provided on the eGrowth Kurri website.

17. LONG-TERM SITE MANAGEMENT PLAN

A Containment Cell Long Term Management Plan (LTMP) will be required for the management of the Containment Cell in perpetuity. A number of organisational structures are being investigated to determine the most appropriate long term management vehicle. The LTMP will be a stand-alone document that includes:

- A clear description of the objectives of the EMP;
- A description of the land under management and the as-built construction details;
- Description of when the EMP applies and who is responsible for implementing;
- An outline of the constraints on the use of the site for any purpose;
- An outline of the health and safety requirements for any workers at the site;
- An outline of the specific management activities including:
  - Surface cap inspections;
  - Leachate sump inspections;
  - Procedures for repair of cap;
  - Procedures for disposal of leachate;
- An outline of the monitoring and reporting requirements. These will be in accordance with the varied Hydro EPL.
- details of any restrictions to be placed on the land (such as by way of positive covenant) to prevent unacceptable development over the Containment Cell;
- financial assurance mechanisms to secure performance of the long term monitoring and management obligation (which could be incorporated as conditions of the Development Consent or EPL); and
- mechanisms to bind any future owners/occupiers of the Smelter Site, including any suitably qualified consultant engaged to undertake the long term environmental management of the Containment Cell, to comply with the LTMP (such as by way of conditions of the Development Consent or the EPL, positive covenants or a voluntary planning agreement). Hydro will retain overarching responsibility for the long term environmental performance of the Containment Cell.

The remainder of the Smelter Site will not require on-going management following remediation and validation works.

17.1 Leachate Plume

With regard to the residual leachate plume at the Capped Waste Stockpile, the need for a Long Term Management Plan will be assessed following 2 years of quarterly monitoring and assessment of groundwater results at this time. This would include an evaluation of the assumptions made in the ENVIRON (2013) Stage 2 Aquatic Assessment – Ecological Risk Assessment and in the ENVIRON (2015) Groundwater Fate and Transport Modelling report. The need for a further ecological risk assessment or fate and transport modelling will be assessed at this time.

17.2 Enforceability of the LTMP

The key regulatory mechanisms available to ensure the long term environmental management of the Containment Cell are the Development Consent and the EPL. Project Consent is required from the Department of Planning as the remediation triggers State Significant Development criteria.

17.2.1 Development Consent

Any development consent granted for the Project will include a suite of conditions under Section 4.17(1)(a) of the EP&A Act to:

- Prevent, minimise and/or offset adverse environmental impacts;
- Set standards and performance measures for acceptable environmental performance;
- Require regular monitoring and reporting; and

- Provide for the ongoing environmental management of the Project.

Hydro proposes that the Development Consent requires the preparation and implementation of a LTMP. The LTMP would be submitted for approval of the Department of Planning and Environment and the EPA.

Under the EP&A Act the Development Consent would remain with the land and bind, and be enforceable by any person against the person responsible for carrying out the long term environmental management of the Containment Cell. The responsible person could include, for example, the suitably qualified expert that is proposed to be engaged to carry out the long term environmental management of the Containment Cell (Containment Cell Manager) and the owner or occupier of the Containment Cell land.

The Development Consent could also require the registration of a restrictive covenant against the Containment Cell land. The covenant could implement a number of mechanisms to enforce the long term environmental management of the Containment Cell including:

i. Constraining the use of the Containment Cell land so that, for example, any development that presents a risk to the integrity of the Containment Cell is prohibited;
ii. Restricting the Containment Cell Owner from transferring the Containment Cell Land to a third party unless the third party satisfies the appropriate regulatory authority that it has the financial capacity to comply with all the long term management obligations for the Containment Cell

The Development Consent could also require the registration of a positive covenant (pursuant to Section 88E of the *Conveyancing Act 1919*) is imposed on the Containment Cell Land by the appropriate regulatory authority, including a requirement for maintenance and repair (if required) of the property.

Amendments to the EP&A Act implemented in March 2018 include changes that could improve the ability of the Development Consent to ensure the long term environmental management of the Containment Cell. Both Hydro and the Department of Planning and Environment are evaluating these changes in relation to this project.

Hydro is continuing negotiations with the Department of Planning and Environment with regards to the specific planning mechanism/s that would be implemented and reflected in the Development Consent to ensure the long term environmental management of the Containment Cell.

17.2.2 Environment Protection Licence

The occupier of the Containment Cell land would be required to hold an EPL under the POEO Act to authorise the proposed scheduled activity to be carried out on that land. The holder would be required to satisfy the fit and proper person test prescribed in the POEO Act. This test includes, among other matters, satisfying the EPA that they are technically competent and have the financial capacity to undertake the long term environmental management of the Containment Cell.

The EPL is likely to contain a suite of conditions to prevent, minimise and mitigate the environmental impacts of the Containment Cell. The POEO Act also enables the EPA to implement a number of specific mechanisms to ensure the long term funding and resourcing of long term environmental management activities. For example, the EPL could include a condition requiring the holder to provide financial assurance to secure the performance of the environmental obligations set out in the EPL (section 70 of the POEO Act). The amount and form of any financial assurance is proposed to be agreed with the Department of Planning and Environment and the EPA having regard to the following prescribed matters in the POEO Act:

i. The degree of risk of environmental harm associated with the Containment Cell;
ii. The remediation work that may be required because of activities under the licence;

iii. The environmental record of the holder or former holder of the licence or proposed holder of the licence; and
iv. Other matters prescribed in the regulations.

Other relevant conditions that may be inserted by the EPA into the EPL include requirements in respect of environmental insurance (section 72 of the POEO Act) and positive covenants (section 74 of the POEO Act). The nature and extent of such mechanisms are proposed to be agreed with the Department of Planning and Environment and the EPA as part of the finalisation of the Development Consent process, and finalisation and approval of the LTMP. The EPL could not be surrendered, or transferred to another person, except with the consent of the EPA in accordance with the POEO Act. The conditions of the EPL (including maintaining the financial assurance) would remain binding and enforceable against the holder of the EPL.

18. CONCLUSIONS

Ramboll was engaged by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to prepare a Remedial Action Plan (RAP) for the remediation the Hydro Kurri Kurri Aluminium Smelter (the Smelter) and an area known as the Clay Borrow Pit Cell, comprising approximately 140 ha. The Smelter and the Clay Borrow Pit form the location of the proposed demolition, remediation and waste management project proposed by Hydro (the Project). The Smelter Site is located at Hart Road, Loxford, New South Wales (NSW).

A Masterplan has been developed that identifies land proposed for General Industrial (IN1) and Heavy Industrial (IN3) landuse at the Smelter Site. A Development Application for approval of a State Significant Development (supported by an Environmental Impact Statement) has been prepared for the demolition of redundant smelter buildings, remediation of the site and design, construction and operation of containment cell. The Environmental Impact Statement must address the Secretary’s Environmental Assessment Requirements (SEARs).

The SEARS require preparation of a RAP. The SEARs also require an independent audit of the RAP and preparation of a Site Audit Report and Site Audit Statement indicating that the site can be made suitable for its future landuse.

Previous investigations at the Smelter Site have identified contamination associated with waste stockpiling at the Capped Waste Stockpile and the Anode Waste Pile; with fill importation at the Diesel Spray Area; with site operations at the Carbon Plant and Bake Furnace Scrubber; with burial of wastes at the Area East of the Playing Fields; and with drainage at the Drainage Lines and at the East Surge Pond. Secondary impacts to groundwater have also been identified beneath and down gradient of the Capped Waste Stockpile.

Additional investigations are required to delineate the extent of soil contamination at the Anode Waste Pile and the Diesel Spray Area. Investigations are also required at areas that have not been previously accessible, including investigation of sediments in the West Surge Pond and investigation of soil at the substations and the Area East of the Clay Borrow Pit. The additional investigation areas are not expected to present material contamination issues.

The RAP was commissioned by Hydro to detail the preferred methodology to remediate the impacted soils at each Area of Concern, which involves excavation and on-site containment; the requirement for the treatment of groundwater at the Capped Waste Stockpile; and to detail the required validation.

Ramboll considers that following implementation of the remedial measures and associated validation activities documented in the RAP and provision of a Validation Report, the Smelter Site can be made suitable for the proposed landuse outlined in the Masterplan.

19. REFERENCES

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

Canadian Council of Ministries of the Environment (2010) Candian Soil Quality Guidelines, Carcinogenic and Other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects) Scientific Criteria Document (revised)

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National Environment Protection Council (2013) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM 2013)

National Health and Medical Research Council (2008) Guidelines for Managing Risks in Recreational Water

National Health and Medical Research Council (2011) Australian Drinking Water Guidelines

NSW EPA (2017) Guidelines for the NSW Site Auditor Scheme (Third Edition)

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

19.1 Previous Ramboll Reports

ENVIRON, Stage 1 Phase 2 Environmental Site Assessment, Hydro Kurri Kurri Aluminium Smelter, prepared for Hydro Aluminium Kurri Kurri Pty Ltd, November 2012. (ENVIRON, 2012)

ENVIRON, Tier 2 Ecological Risk Assessment Hydro Kurri Kurri Aluminium Smelter, prepared for Hydro Aluminium Kurri Kurri Pty Ltd, March 2013. (ENVIRON, 2013a)

ENVIRON, Preliminary Screening Level for Human Health Risk Assessment Hydro Kurri Kurri Aluminium Smelter, prepared for Hydro Aluminium Kurri Kurri Pty Ltd, April 2013. (ENVIRON, 2013b)

ENVIRON, Preliminary Containment Cell Study, Hydro Aluminium Kurri Kurri NSW, prepared for Hydro Aluminium Kurri Kurri Pty Ltd, April 2013. (ENVIRON, 2013c)

ENVIRON, Stage 2 Aquatic Assessment – Ecological Risk Assessment, Kurri Kurri Aluminium Smelter, June 2013. (ENVIRON 2013d)

ENVIRON, Phase 1 Environmental Site Assessment, Hydro Kurri Kurri Aluminium Smelter, prepared for Hydro Aluminium Kurri Kurri Pty Ltd, October 2013. (ENVIRON, 2013e)

ENVIRON, Stage 2 Phase 2 Environmental Site Assessment, Hydro Kurri Kurri Aluminium Smelter, prepared for Hydro Aluminium Kurri Kurri Pty Ltd, January 2015. (ENVIRON, 2015)

ENVIRON, Remedial Options Study, Hydro Kurri Kurri Aluminium Smelter, prepared for Hydro Aluminium Kurri Kurri Pty Ltd, May 2014. (ENVIRON, 2014a)

ENVIRON, Remedial Action Works Plan Clay Borrow Pit Area, Hydro Kurri Kurri Aluminium Smelter, prepared for Hydro Aluminium Kurri Kurri Pty Ltd, December 2014. (ENVIRON, 2014b)

ENVIRON, Hazardous Materials Audit Stage 1, Maintenance Workshops and Storage Sheds, October 2014 (ENVIRON, 2014c)

ENVIRON, Hazardous Materials Audit Stage 2, Administration, Personal Training Centre, Gatehouse, Medical Centre and Personnel, Bathhouse and EOHS, October 2014 (ENVIRON, 2014d)

ENVIRON, Hazardous Materials Audit Stage 3, Cast House and Associated Buildings, October 2014 (ENVIRON, 2014e)

ENVIRON, Hazardous Materials Audit Stage 4, Pot Rooms and Associated Structures, October 2014 (ENVIRON, 2014f)

ENVIRON, Hazardous Materials Audit Stage 5, Carbon Plant and Associated Buildings, November 2014 (ENVIRON, 2014g)

ENVIRON, Hazardous Materials Audit Stage 6, Transformer Yard, Substation and Miscellaneous Areas, October 2014 (ENVIRON, 2014h)

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

Ramboll, Capped Waste Stockpile Assessment, April 2016 (Ramboll 2016a)

Ramboll, Hydro Aluminium Kurri Kurri Review of Remedial Options (Ramboll 2016b)

Ramboll, Hydro Aluminium Smelter Kurri Kurri Remedial Action Plan Sustainability Analysis Results (Ramboll 2016c)

Ramboll, Hydro Aluminium Kurri Kurri Substations Assessment Trial – 3CC (Ramboll, 2017)

Ramboll, Draft 2017 Annual Landfill Gas Monitoring Report, Hydro Aluminium, February 2018 (Ramboll 2018a)

Ramboll, Environmental Site Assessment, Diesel Spray Area, Hydro Aluminium Smelter, April 2018 (Ramboll, 2018b)

20. LIMITATIONS

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

A representative program of sampling and laboratory analyses was undertaken as part of this investigation, based on past and present known uses of the site. While every care has been taken, concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. We cannot therefore preclude the presence of materials that may be hazardous.

Site conditions may change over time. This report is based on conditions encountered at the site at the time of the report and Ramboll disclaims responsibility for any changes that may have occurred after this time.

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

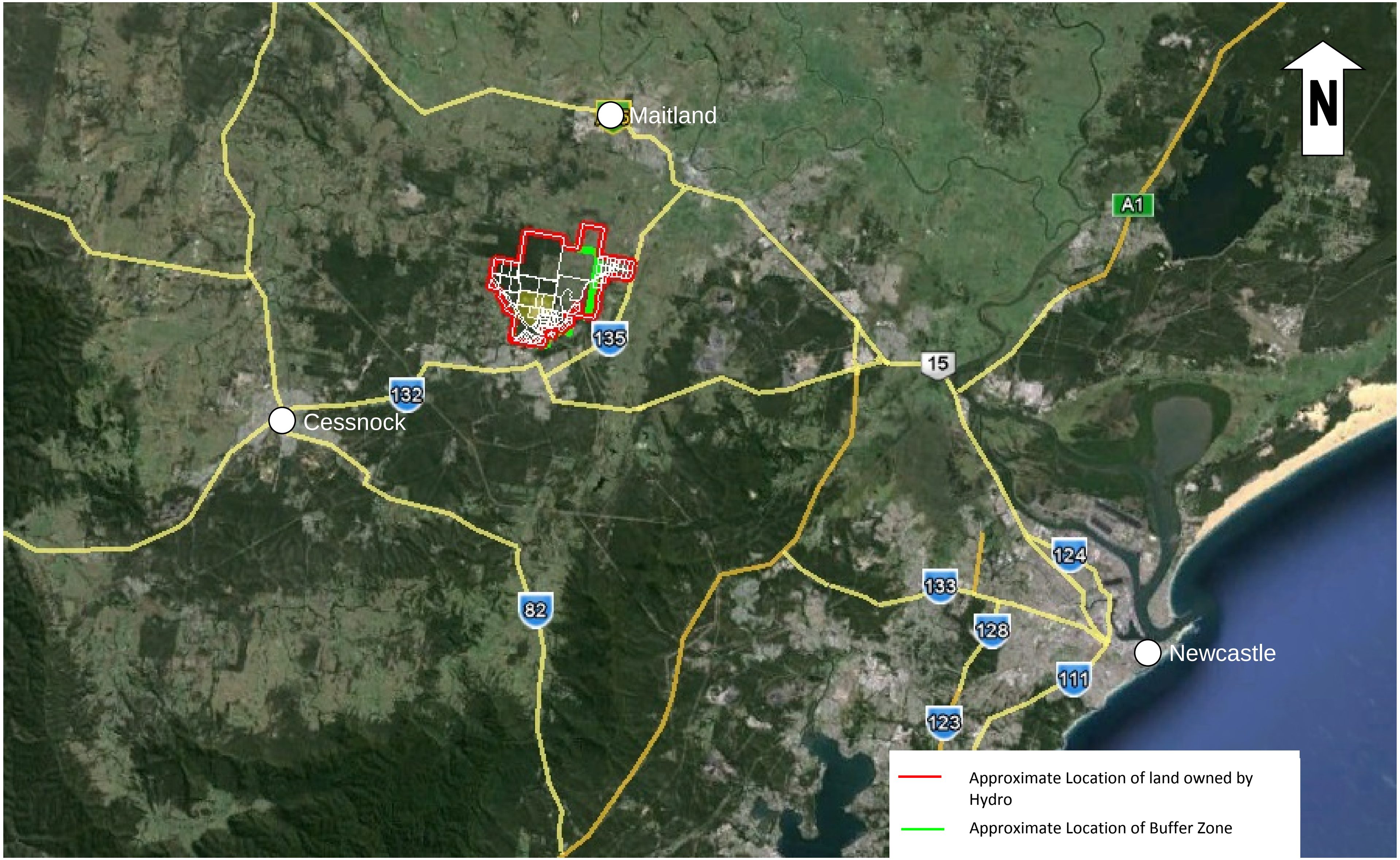
Ramboll did not independently verify all of the written or oral information provided to ENVIRON during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided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

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

20.1 User Reliance

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

FIGURES



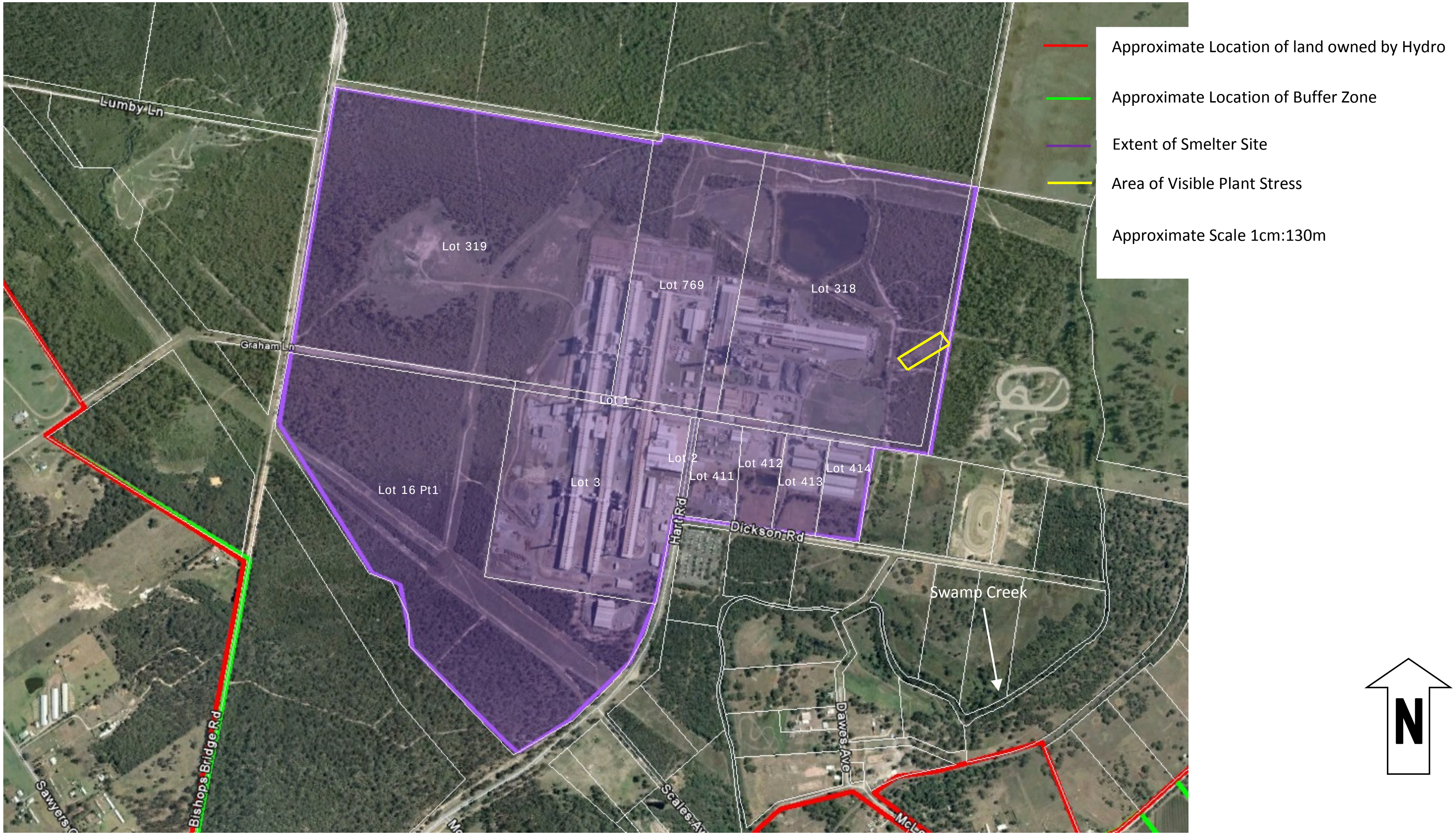
Hydro Aluminium Kurri Kurri: Remedial Action Plan

Site Location

JOB NO: AS130349

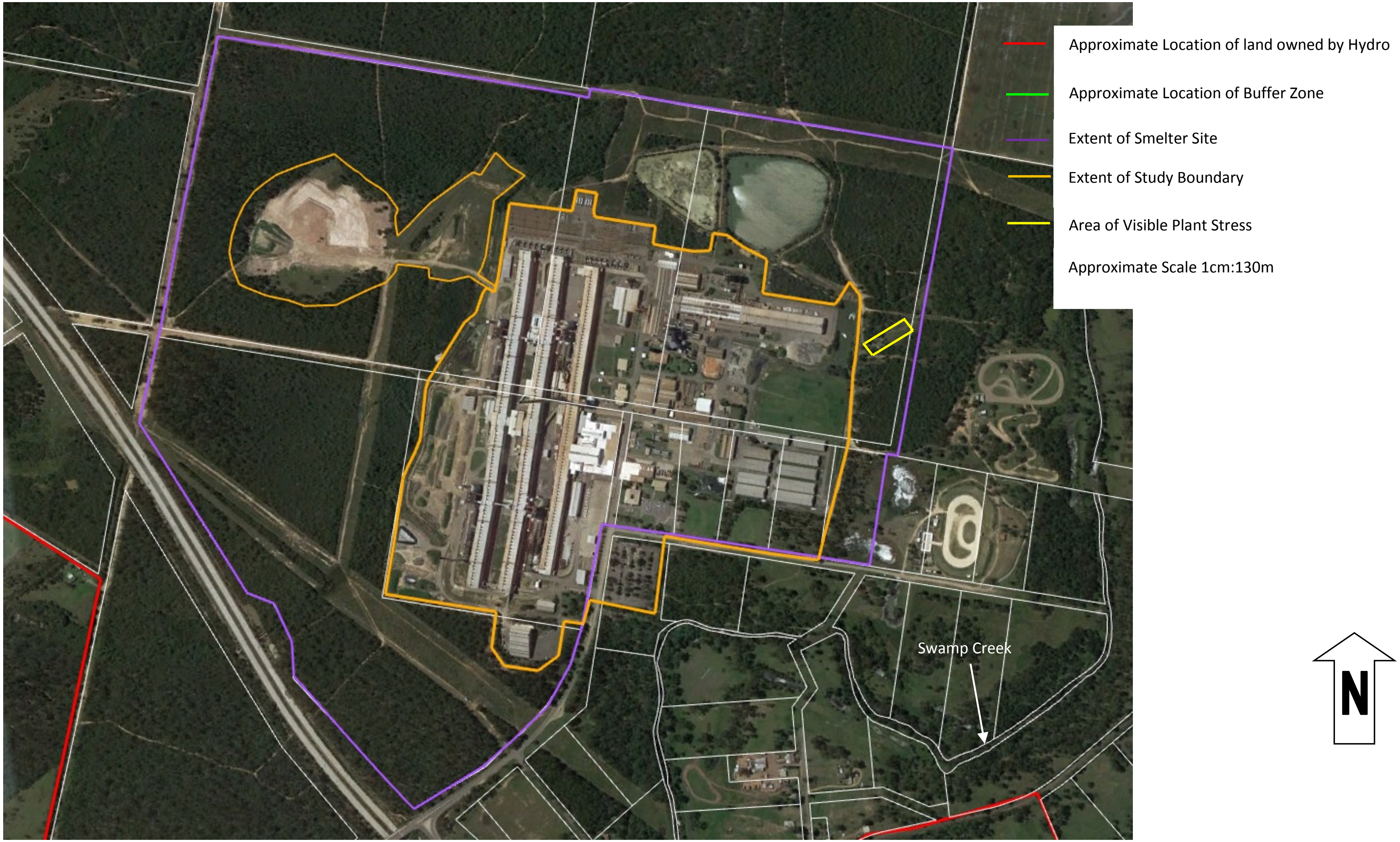
DATE: July 2016

FIGURE 1



Hydro Aluminium Kurri Kurri: Remedial Action Plan	Smelter Site Plan

RAMBOLL JOB NO: AS130349 DATE: July 2016 FIGURE 2



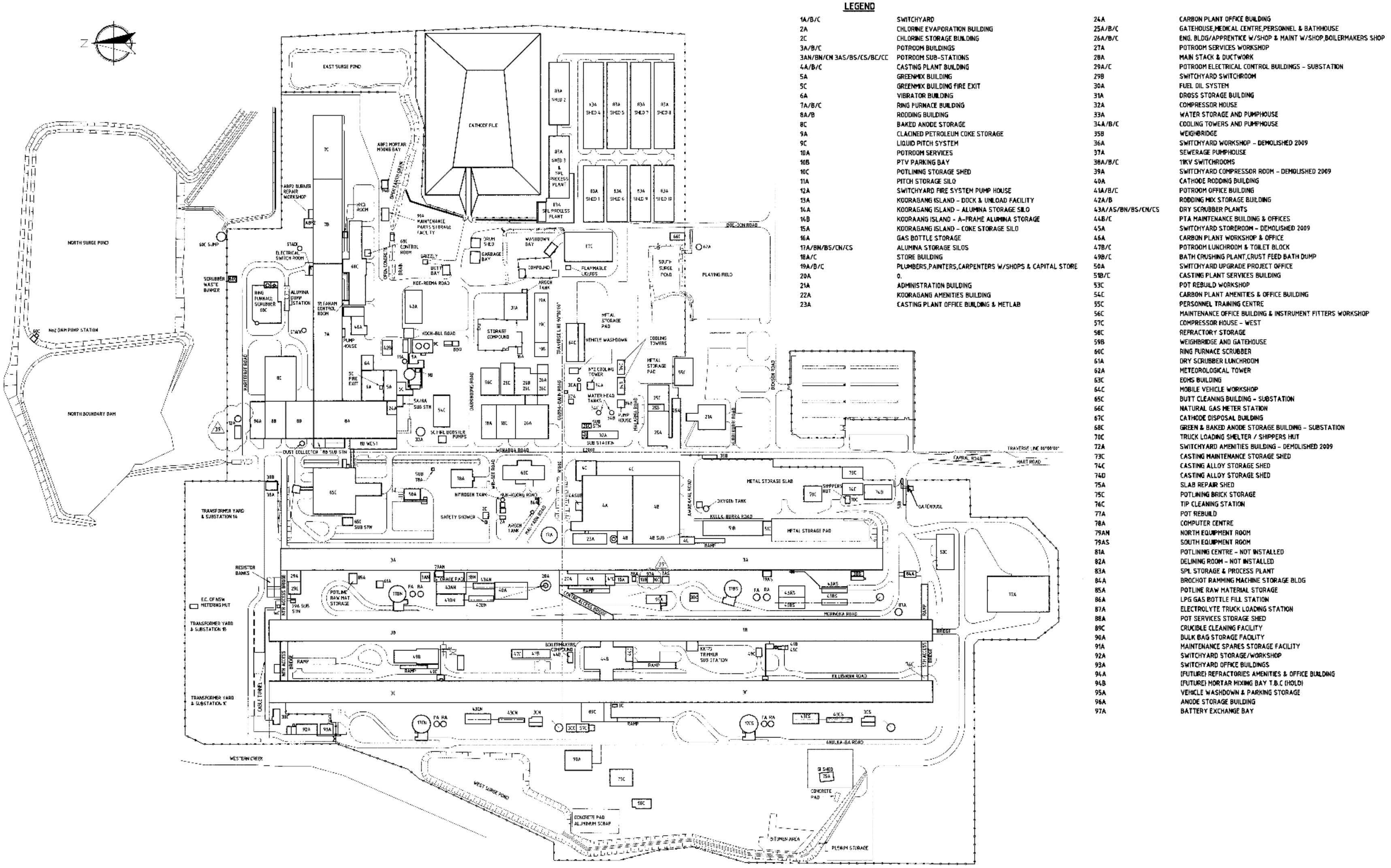
Hydro Aluminium Kurri Kurri: Smelter Validation Plan

Study Boundary

JOB NO: 318000301

DATE: March 2018

FIGURE 3



LEGEND

1A/B/C	SWITCHYARD
2A	CHLORINE EVAPORATION BUILDING
2C	CHLORINE STORAGE BUILDING
3A/B/C	POTROOM BUILDINGS
3AN/BN/CN 3AS/BS/CS/BC/CC	POTROOM SUB-STATIONS
4A/B/C	CASTING PLANT BUILDING
5A	GREENMIX BUILDING
5C	GREENMIX BUILDING FIRE EXIT
6A	VIBRATOR BUILDING
7A/B/C	RING FURNACE BUILDING
8A/B	RODDING BUILDING
8C	BAKED ANODE STORAGE
9A	CLACINED PETROLEUM COKE STORAGE
9C	LIQUID PITCH SYSTEM
10A	POTROOM SERVICES
10B	PTV PARKING BAY
10C	POTLINING STORAGE SHED
11A	PITCH STORAGE SILO
12A	SWITCHYARD FIRE SYSTEM PUMP HOUSE
13A	KOORAGANG ISLAND – DOCK & UNLOAD FACILITY
14A	KOORAGANG ISLAND – ALUMINA STORAGE SILO
14B	KOORAANG ISLAND - A-FRAME ALUMINA STORAGE
15A	KOORAGANG ISLAND – COKE STORAGE SILO
16A	GAS BOTTLE STORAGE
17A/BN/BS/CN/CS	ALUMINA STORAGE SILOS
18A/C	STORE BUILDING
19A/B/C	PLUMBERS,PAINTERS,CARPENTERS W/SHOPS & CAPITAL STORE
20A	0.
21A	ADMINISTRATION BUILDING
22A	KOORAGANG AMENITIES BUILDING
23A	CASTING PLANT OFFICE BUILDING & METLAB
24A	CARBON PLANT OFFICE BUILDING
25A/B/C	GATEHOUSE,MEDICAL CENTRE,PERSONNEL & BATHHOUSE
26A/B/C	ENG. BLDG/APPRENTICE W/SHOP & MAINT W/SHOP,BOILERMAKERS SHOP
27A	POTROOM SERVICES WORKSHOP
28A	MAIN STACK & DUCTWORK
29A/C	POTROOM ELECTRICAL CONTROL BUILDINGS – SUBSTATION
29B	SWITCHYARD SWITCHROOM
30A	FUEL OIL SYSTEM
31A	DROSS STORAGE BUILDING
32A	COMPRESSOR HOUSE
33A	WATER STORAGE AND PUMPHOUSE
34A/B/C	COOLING TOWERS AND PUMPHOUSE
35B	WEIGHBRIDGE
36A	SWITCHYARD WORKSHOP – DEMOLISHED 2009
37A	SEWERAGE PUMPHOUSE
38A/B/C	11KV SWITCHROOMS
39A	SWITCHYARD COMPRESSOR ROOM – DEMOLISHED 2009
40A	CATHODE RODDING BUILDING
41A/B/C	POTROOM OFFICE BUILDING
42A/B	RODDING MIX STORAGE BUILDING
43A/AS/BN/BS/CN/CS	DRY SCRUBBER PLANTS
44B/C	PTA MAINTENANCE BUILDING & OFFICES
45A	SWITCHYARD STOREROOM – DEMOLISHED 2009
46A	CARBON PLANT WORKSHOP & OFFICE
47B/C	POTROOM LUNCHROOM & TOILET BLOCK
49B/C	BATH CRUSHING PLANT,CRUST FEED BATH DUMP
50A	SWITCHYARD UPGRADE PROJECT OFFICE
51B/C	CASTING PLANT SERVICES BUILDING
53C	POT REBUILD WORKSHOP
54C	CARBON PLANT AMENITIES & OFFICE BUILDING
55C	PERSONNEL TRAINING CENTRE
56C	MAINTENANCE OFFICE BUILDING & INSTRUMENT FITTERS WORKSHOP
57C	COMPRESSOR HOUSE – WEST
58C	REFRACTORY STORAGE
59B	WEIGHBRIDGE AND GATEHOUSE
60C	RING FURNACE SCRUBBER
61A	DRY SCRUBBER LUNCHROOM
62A	METEOROLOGICAL TOWER
63C	EOHS BUILDING
64C	MOBILE VEHICLE WORKSHOP
65C	BUTT CLEANING BUILDING - SUBSTATION
66C	NATURAL GAS METER STATION
67C	CATHODE DISPOSAL BUILDING
68C	GREEN & BAKED ANODE STORAGE BUILDING – SUBSTATION
70C	TRUCK LOADING SHELTER / SHIPPERS HUT
72A	SWITCHYARD AMENITIES BUILDING – DEMOLISHED 2009
73C	CASTING MAINTENANCE STORAGE SHED
74C	CASTING ALLOY STORAGE SHED
74D	CASTING ALLOY STORAGE SHED
75A	SLAB REPAIR SHED
75C	POTLINING BRICK STORAGE
76C	TIP CLEANING STATION
77A	POT REBUILD
78A	COMPUTER CENTRE
79AN	NORTH EQUIPMENT ROOM
79AS	SOUTH EQUIPMENT ROOM
81A	POTLINING CENTRE – NOT INSTALLED
82A	DELINING ROOM – NOT INSTALLED
83A	SPL STORAGE & PROCESS PLANT
84A	BROCHOT RAMMING MACHINE STORAGE BLDG
85A	POTLINE RAW MATERIAL STORAGE
86A	LPG GAS BOTTLE FILL STATION
87A	ELECTROLYTE TRUCK LOADING STATION
88A	POT SERVICES STORAGE SHED
89C	CRUCIBLE CLEANING FACILITY
90A	BULK BAG STORAGE FACILITY
91A	MAINTENANCE SPARES STORAGE FACILITY
92A	SWITCHYARD STORAGE/WORKSHOP
93A	SWITCHYARD OFFICE BUILDINGS
94A	(FUTURE) REFRACTORIES AMENITIES & OFFICE BUILDING
94B	(FUTURE) MORTAR MIXING BAY T.B.C (HOLD)
95A	VEHICLE WASHDOWN & PARKING STORAGE
96A	ANODE STORAGE BUILDING
97A	BATTERY EXCHANGE BAY

Hydro Aluminium Kurri Kurri: Remedial Action Plan

Smelter Layout

RAMBOLL

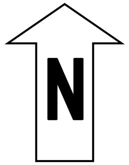
JOB NO: AS130349

DATE: July 2016

FIGURE 4

🟦 Capped Waste Stockpile

Approximate Scale 1cm:15m



Hydro Aluminium Kurri Kurri: Remedial Action Plan

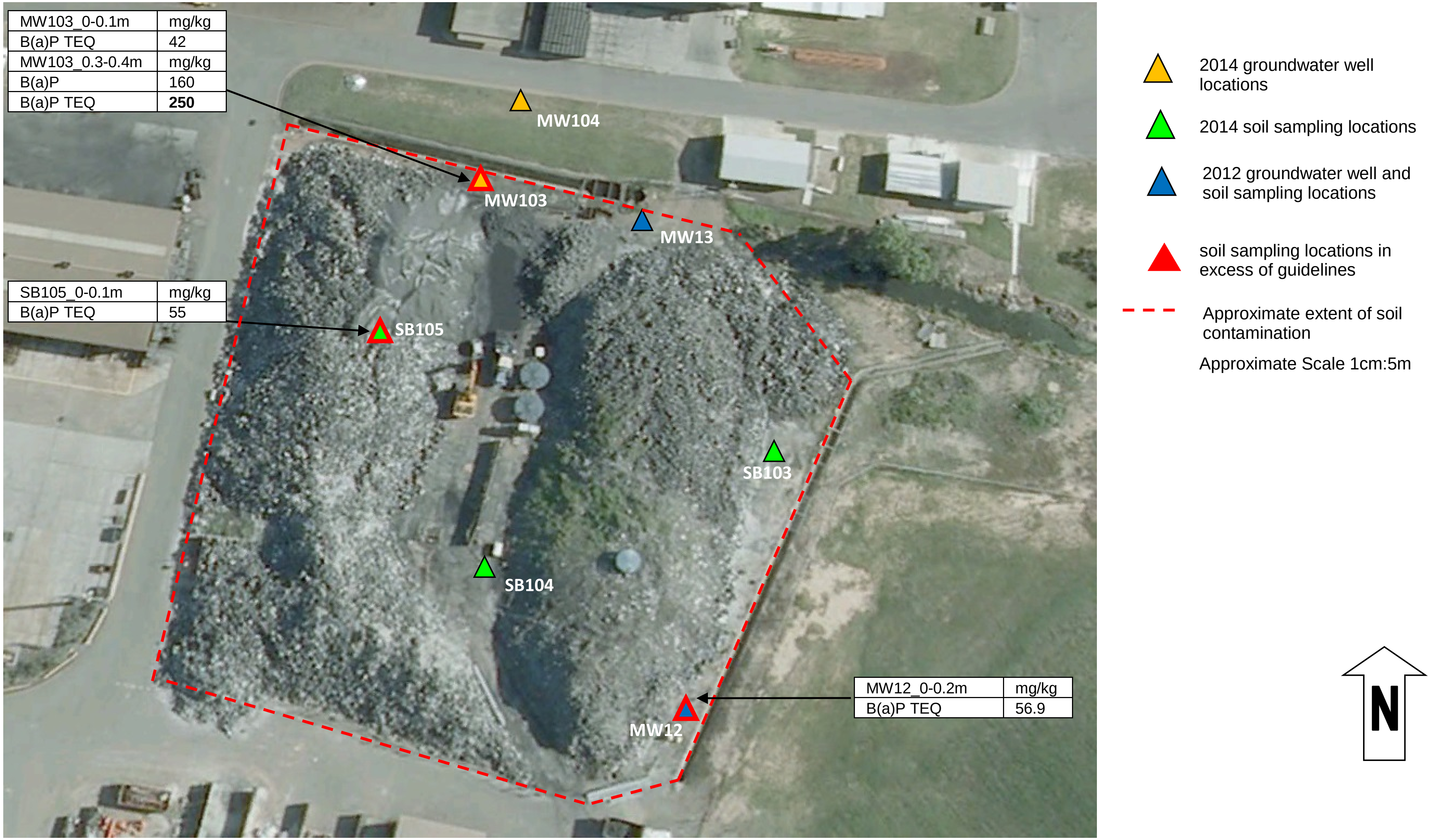
Capped Waste Stockpile

RAMBOLL

JOB NO: AS130349

DATE: July 2016

FIGURE 5



MW103_0-0.1m	mg/kg
B(a)P TEQ	42
MW103_0.3-0.4m	mg/kg
B(a)P	160
B(a)P TEQ	**250**

SB105_0-0.1m	mg/kg
B(a)P TEQ	55

MW12_0-0.2m	mg/kg
B(a)P TEQ	56.9

Hydro Aluminium Kurri Kurri: Remedial Action Plan		AEC 2 – Anode Waste Pile
RAMBOLL JOB NO: AS130349	DATE: July 2016	FIGURE 6

Hydro Aluminium Kurri Kurri Remedial Action Plan

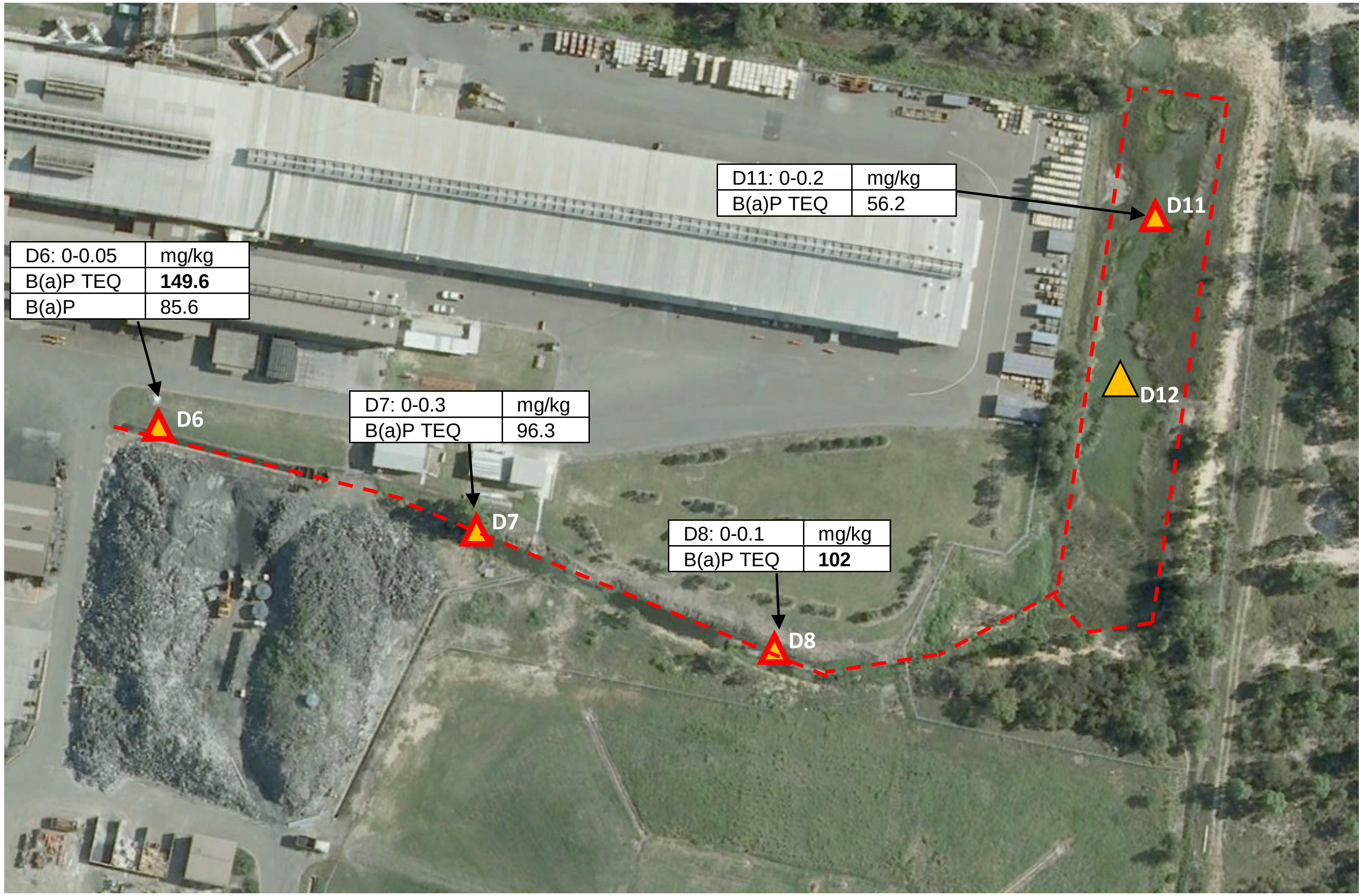
AEC 4 - Diesel Spray Area Plan

RAMBOLL

JOB NO: AS130349

DATE: March 2018

FIGURE 7



△ 2012 soil sampling locations

▲ Soil sampling locations with PAHs > guidelines

- - Approximate extent of shallow soil contamination

Approximate Scale 1cm:8m

N

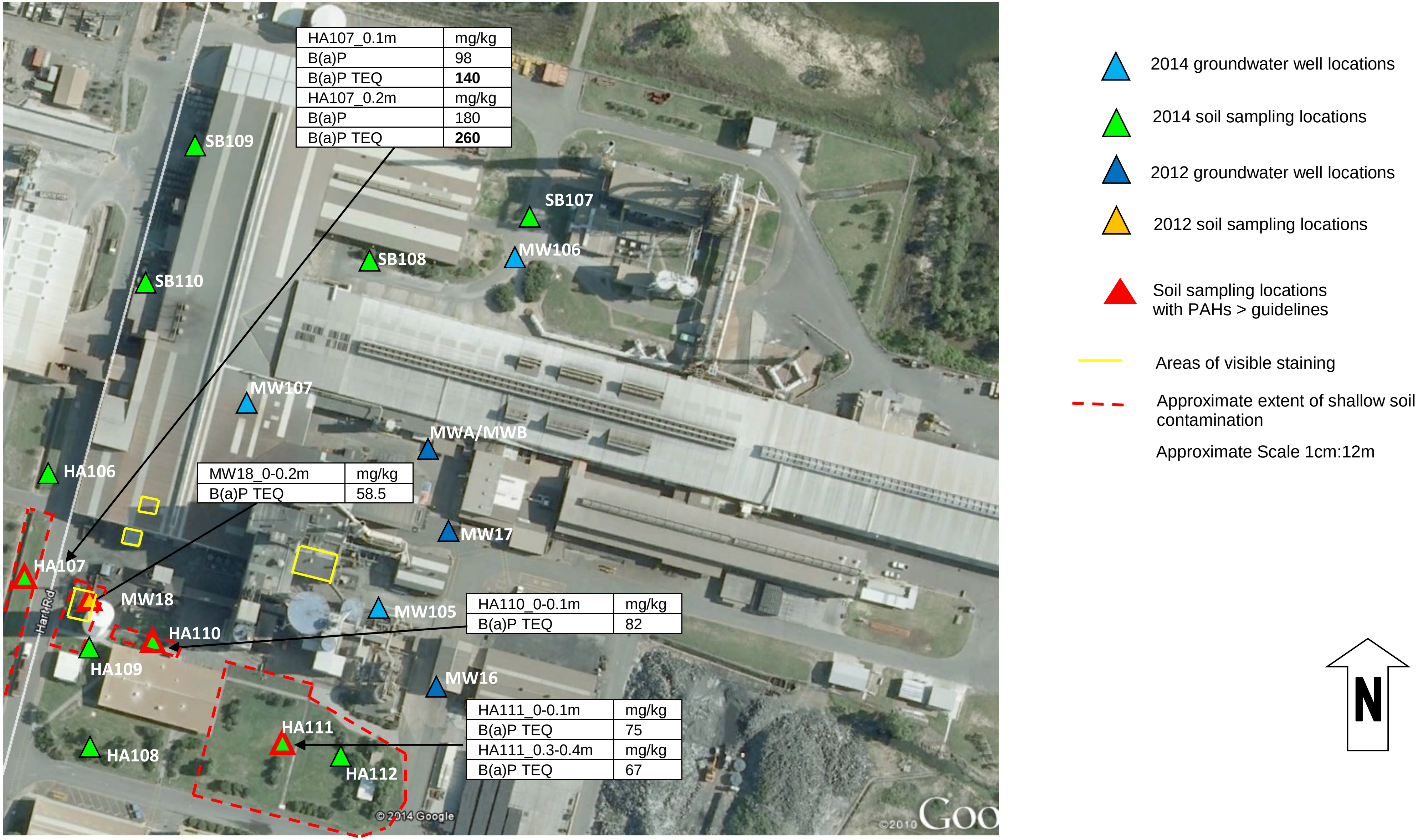
Hydro Aluminium Kurri Kurri: Remedial Action Plan

AEC 6: East Surge Pond and Associated Drainage Line

JOB NO: AS130349

DATE: July 2016

FIGURE 8



HA107_0.1m	mg/kg
B(a)P	98
B(a)P TEQ	**140**
HA107_0.2m	mg/kg
B(a)P	180
B(a)P TEQ	**260**

MW18_0-0.2m	mg/kg
B(a)P TEQ	58.5

HA110_0-0.1m	mg/kg
B(a)P TEQ	82

HA111_0-0.1m	mg/kg
B(a)P TEQ	75
HA111_0.3-0.4m	mg/kg
B(a)P TEQ	67

Hydro Aluminium Kurri Kurri: Remedial Action Plan

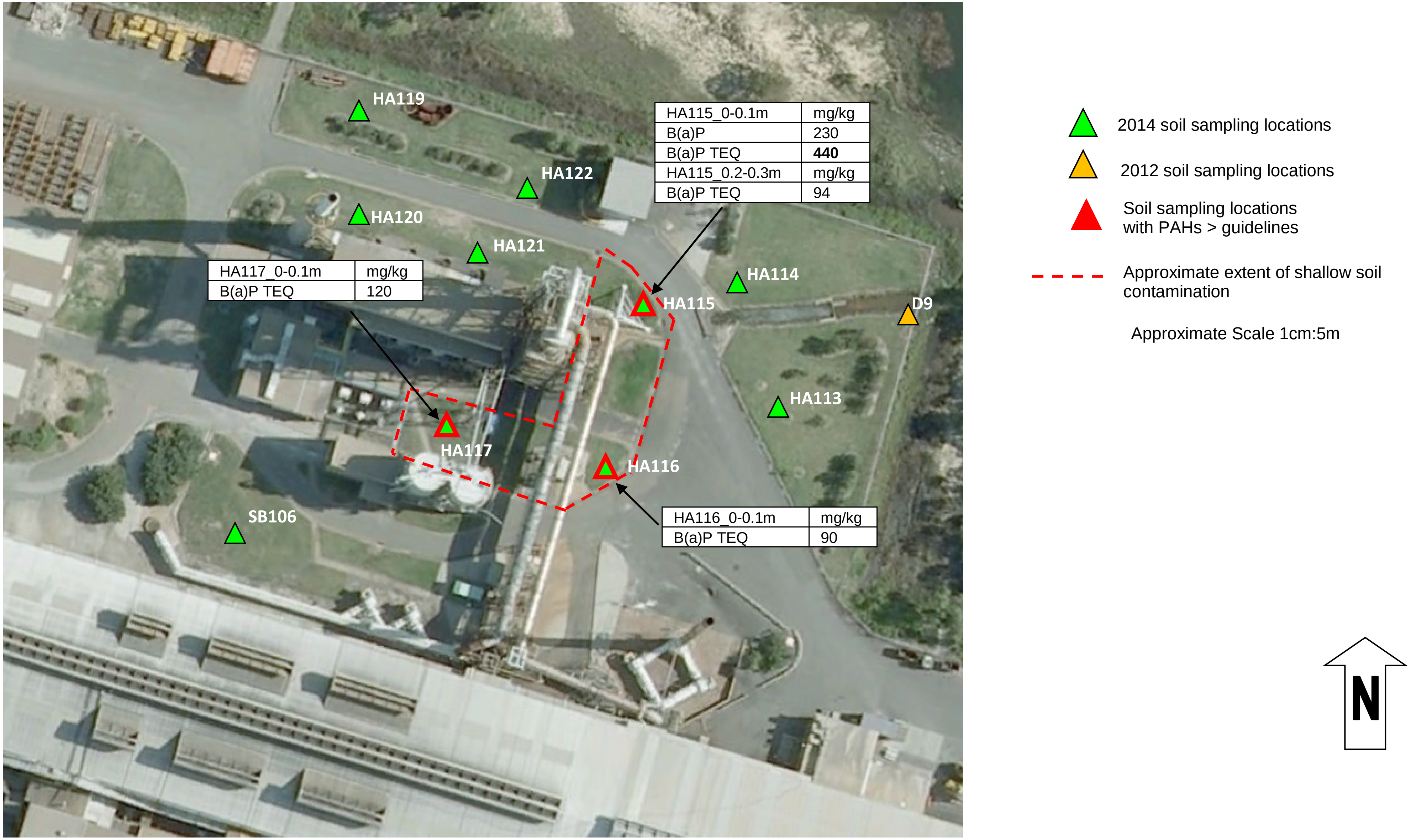
AEC 8 - Carbon Plant (western end)

RAMBOLL

JOB NO: AS130349

DATE: July 2016

FIGURE 9



HA115_0-0.1m	mg/kg
B(a)P	230
B(a)P TEQ	**440**
HA115_0.2-0.3m	mg/kg
B(a)P TEQ	94

HA117_0-0.1m	mg/kg
B(a)P TEQ	120

HA116_0-0.1m	mg/kg
B(a)P TEQ	90

Hydro Aluminium Kurri Kurri: Remedial Action Plan

AEC 26 – Bake Furnace Scrubber

JOB NO: AS130349

DATE: July 2016

FIGURE 10

▲ 2014 soil sampling locations

▲ Soil sampling location with PAHs > guidelines

- - - Approximate extent of buried fill

Approximate Scale 1cm:9m

N

Hydro Aluminium Kurri Kurri: Remedial Action Plan

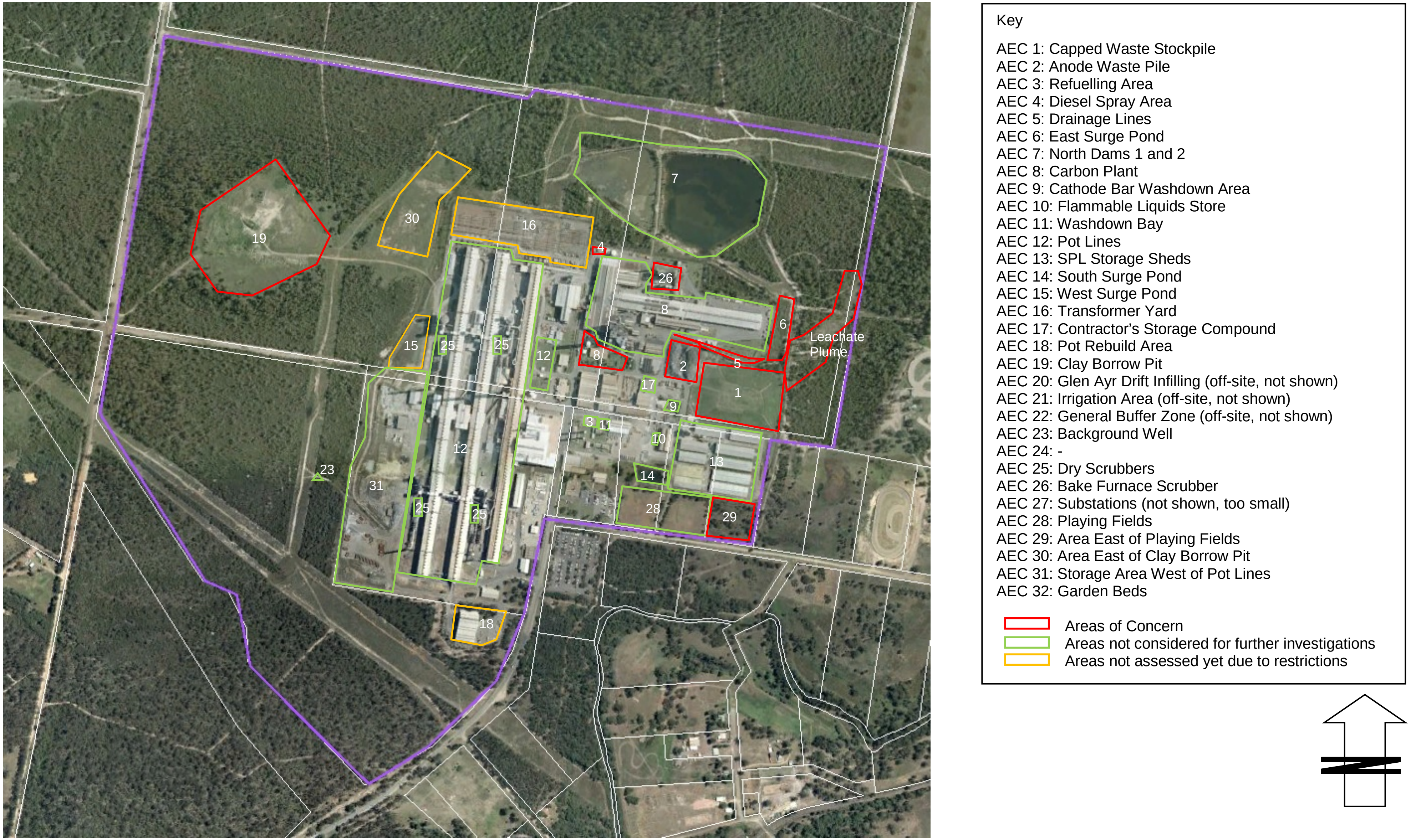
AEC 28 – Area East of Playing Fields

RAMBOLL

JOB NO: AS130349

DATE: July 2016

FIGURE 11



Key

AEC 1: Capped Waste Stockpile
AEC 2: Anode Waste Pile
AEC 3: Refuelling Area
AEC 4: Diesel Spray Area
AEC 5: Drainage Lines
AEC 6: East Surge Pond
AEC 7: North Dams 1 and 2
AEC 8: Carbon Plant
AEC 9: Cathode Bar Washdown Area
AEC 10: Flammable Liquids Store
AEC 11: Washdown Bay
AEC 12: Pot Lines
AEC 13: SPL Storage Sheds
AEC 14: South Surge Pond
AEC 15: West Surge Pond
AEC 16: Transformer Yard
AEC 17: Contractor's Storage Compound
AEC 18: Pot Rebuild Area
AEC 19: Clay Borrow Pit
AEC 20: Glen Ayr Drift Infilling (off-site, not shown)
AEC 21: Irrigation Area (off-site, not shown)
AEC 22: General Buffer Zone (off-site, not shown)
AEC 23: Background Well
AEC 24: -
AEC 25: Dry Scrubbers
AEC 26: Bake Furnace Scrubber
AEC 27: Substations (not shown, too small)
AEC 28: Playing Fields
AEC 29: Area East of Playing Fields
AEC 30: Area East of Clay Borrow Pit
AEC 31: Storage Area West of Pot Lines
AEC 32: Garden Beds

🟥 Areas of Concern
🟩 Areas not considered for further investigations
🟧 Areas not assessed yet due to restrictions

Hydro Aluminium Kurri Kurri: Remedial Action Plan

Smelter Site with AECs and PAECs

JOB NO: AS130349

DATE: Sept 2015

FIGURE 12

APPENDIX 1
2012 SOIL AND GROUNDWATER INVESTIGATION RESULTS TABLES

TABLE LR1 Soil Analytical Results for the Site

Sample Identification	PQL	Guideline					MW06	MW06	SB11	SB12	SB13	MW14	MW15	MW16	MW16	MW17	MW17	MW18	MW18	SB15	SB15	SB16	SB16	MW07	MW07	MW08	MW08	SB17	SB18	MW19	MW19
Sample Depth (m)		HIL D[A]	HSL D[B]	EIL C/I[C]	Management Limits[D]	ESL C/I[E]	0-0.1	0.5-0.6	0.2-0.4	1.8-1.9	1.0-1.2	0-0.4	0.1-0.4	0.2-0.4	1.8-2.0	0.2-0.4	0.8-1.0	0-0.2	0.8-1.0	0.3-0.5	1-1.2	0.2-0.4	1-1.2	0-0.2	0.8-1.0	0.15-0.3	0.4-0.6	0.3-0.4	0.5-0.6	FILL 1	FILL 2
Date							13/04/2012	13/04/2012	17/04/2012	18/04/2012	18/04/2012	19/04/2012	19/04/2012	18/04/2012	18/04/2012	18/04/2012	18/04/2012	19/04/2012	19/04/2012	16/04/2012	16/04/2012	16/04/2012	16/04/2012	16/04/2012	16/04/2012	16/04/2012	16/04/2012	18/04/2012	18/04/2012	19/04/2012	19/04/2012
Sample Profile							ALLUVIAL	RESIDUAL	FILL	FILL	FILL	FILL	FILL	FILL	ESTUARINE	FILL	ESTUARINE	FILL	ESTUARINE	ESTUARINE	ESTUARINE	ESTUARINE	ESTUARINE	TOPSOIL	ESTUARINE	FILL	ESTUARINE	FILL	FILL	FILL	FILL
PAEC Sampled							Background	Background	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Refuelling	Refuelling	Refuelling	Refuelling	Refuelling	Refuelling	Refuelling	Refuelling	DSA	DSA	DSA	DSA
Sample collected by							KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG
Metals																															
Aluminium	50	NL*	-	-	-	-	2270	10700	9550	10300	14200	14700	13800	7740	3180	6740	1310	32700	8210	620	12500	3410	1720	7710	5720	690	4280				
Arsenic	1	3000	-	160	-	-	0.9	3.4	10.9	16.5	3.4	6.3	5.1	0.9	1.2	0.8	0.2	12	1.8	0.2	1.2	0.8	0.3	4.4	1.8	<0.1	0.2				
Cadmium	0.1	900	-	-	-	-	<0.1	<0.1	<0.1	<0.1	0.1	0.1	2.4	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.2	<0.1				
Chromium (VI)	1	3600	-	320**	-	-	2.5	15.1	7.3	7.9	52.1	25.5	18	5	3.2	5.3	1.4	26.9	6	1.9	26.6	3.9	5.7	10.5	21.2	3.9	3.6				
Copper	2	240,000	-	210**	-	-	0.4	0.6	13.6	14.2	16	15.6	44.5	7.8	0.2	4.2	0.3	21.9	0.3	0.8	5.8	0.5	0.6	32.8	2.2	4.1	0.4				
Nickel	1	6000	-	140**	-	-	1.3	2	11	12.4	34.4	53	27.8	6.4	1.8	2	0.6	51.6	4.6	1.1	11.2	3.3	2.6	8.1	11.9	2.7	5.8				
Lead	2	1500	-	1800	-	-	2.3	8.1	6.3	6.5	25.8	9.2	44.4	3.6	1.8	37	0.6	20.6	3.3	2.5	12.8	4.8	1.2	49.4	4.6	3.6	1.4				
Zinc	5	400,000	-	440**	-	-	5.3	2.9	51.6	53.4	178	70.4	115	18.8	0.6	43.4	0.5	288	1.4	2.6	32.6	2.8	1.3	384	7	59.9	12.1				
Mercury (inorganic)	0.05	730	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				
Fluoride	40	17000*	-	-	-	-	150	140	240	150	1960	2350	3950	700	60	200	80	7740	650	830	100	60	280	3240	90	90	130				
Non Metallic Inorganics																															
Total Cyanide	1	1500	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	3	<1	<1	<1	<1	<1												
Polycyclic Aromatic Hydrocarbons (PAH)																															
Naphthalene	0.5	-	-	370	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4.0	<0.5
Acenaphthylene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4.0	<0.5
Acenaphthene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	1.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.8	8.4	1.6
Fluorene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.2	4.2	0.8
Phenanthrene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	16.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	30.2	46.7	7.8
Anthracene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	6.3	9.6	1.6
Fluoranthene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	3.8	<0.5	<0.5	<0.5	<0.5	41.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.6	<0.5	<0.5	59.7	137	21.6
Pyrene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	3	<0.5	<0.5	<0.5	<0.5	38.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.6	<0.5	<0.5	59.1	133	21.7
Benz(a)anthracene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	5.3	<0.5	<0.5	<0.5	<0.5	47.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.5	<0.5	<0.5	46.7	103	24.3
Chrysene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	8.1	<0.5	<0.5	<0.5	<0.5	50.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	45.6	97.3	23.5
Benzo(b)&(k)fluoranthene	1	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	9.6	<0.5	<0.5	<0.5	<0.5	67.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.9	<0.5	<0.5	60.3	140	31
Benzo(k)fluoranthene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.1	<0.5	<0.5	<0.5	<0.5	20.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	21.2	47.7	10
Benzo(a) pyrene	0.5	-	-	-	-	72[F]	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	2.1	<0.5	<0.5	<0.5	<0.5	33.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	43.4	101	19.2
Indeno(1,2,3-c,d)pyrene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.5	<0.5	<0.5	<0.5	<0.5	29.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	41.6	57.5	17.5
Dibenz(a,h)anthracene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	7.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8.8	12.8	4.6
Benzo(g,h,i)perylene	0.5	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.8	<0.5	<0.5	<0.5	<0.5	28.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	46.1	65	19.9
Benzo(a)pyrene TEQ		40	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.87	4.5	<0.5	<0.5	<0.5	<0.5	58.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	70.1	150.2	31.6
Sum of reported PAH	--	4000	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	5.8	38.6	0.8	<0.5	<0.5	<0.5	387	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.2	3.2	<0.5	<0.5	475	963	205
Total Petroleum Hydrocarbons (TPH)																															
TPH C6-C9	10	-	260	-	800	-														<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
TPH C10-C14	50	-	NL	-	1000	170														<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TPH C15-C28	100	-	-	-	5000	1700														<100	<100	<100	<100	<100	<100	1400	<100	<100	980	1870	400
TPH C29-C36	100	-	-	-	10,000	3300														<100	<100	<100	<100	120	<100	1960	<100	<100	1040	1890	470
TPH C10-C36	--	-	-	-	-	-														<50	<50	<50	<50	120	<50	3360	<50	<50	2020	3760	870
Polychlorinated Biphenyls																															
Total PCBs	1	-	-	-	-	-																									
Semi Volatile Organic Compounds																															
Total PAHs	1	4000	-	-	-	-														<LOR	<LOR	<LOR	<LOR	<LOR	<LOR						
Total Phenols	1	240,000	-	-	-	-														<LOR	<LOR	<LOR	<LOR	<LOR	<LOR						
Phthalate Esters	5	-	-	-	-	-														<LOR	<LOR	<LOR	<LOR	<LOR	<LOR						
Nitrosamines	1	-	-	-	-	-														<LOR	<LOR	<LOR	<LOR	<LOR	<LOR						
Nitroaromatics and Ketones	1	-	-	-	-	-														<LOR	<LOR	<LOR	<LOR	<LOR	<LOR						
Haloethers	0.5	-	-	-	-	-														<LOR	<LOR	<LOR	<LOR	<LOR	<LOR						
Chlorinated Hydrocarbons	1	-	-	-	-	-														<LOR	<LOR	<LOR	<LOR	<LOR	<LOR						
Anilines and Benzidines	1	-	-	-	-	-														<LOR	<LOR	<LOR	<LOR	<LOR	<LOR						
Organochlorine Pesticides	1	-	-	-	-	-														<LOR	<LOR	<LOR	<LOR	<LOR	<LOR						
Organophosphorus Pesticides	0.5	-	-	-	-	-														<LOR	<LOR	<LOR	<LOR	<LOR	<LOR						
Miscellaneous Compounds	0.5	-	-	-	-	-														<LOR	<LOR	<LOR	<LOR	<LOR	<LOR						
Volatile Organic Compounds																															
Monocyclic Aromatic Hydrocarbons	5	-	-	-	-	-																									
Oxygenated Compounds	0.5	-	-	-	-	-																									
Sulfonated Compounds	1	-	-	-	-	-																									
Fumigants	0.5	-	-	-	-	-																									
Halogenated Aliphatic Compounds	5	-	-	-	-	-																									
Halogenated Aromatic Compounds	0.5	-	-	-	-	-																									
Trihalomethanes	0.5	-	-	-	-	-																									

All results are in units of mg/kg.

Blank Cell indicates testing was not completed

PQL = Practical Quantitation Limit.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Soil Health Screening Level for Vapour Intrusion 'D' Commercial/ Industrial

[C] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[D] NEPM (2013) Management Limits for TPH Fractions F1 to F4 in soil - note that the F1 to F4 fractions are different to the fractions reported here

[E] NEPM (2013) Ecological Screening Level for Commercial/ Industrial

[F] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects)

* Fluoride (soluble) and aluminium Preliminary Screening Criteria from ENVIRON (2013) 'Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium'

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the March 2014 investigations

Results shown in shading are in excess of the primary health acceptance criteria

Results showin in underline are in excess of the primary ecological acceptance criteria

<LOR = Less than the Limit of Reporting

PAECs

CBP	Clay Borrow Pit
FLS	Flammable Liquids Store
AWP	Anode Waste Pile
DSA	Diesel Spray Area
CBWB	Cathode Bay Washdown Bay
PRA	Pot Rebuild Area

TABLE LR1 Soil Analytical Results for the Site

Sample Identification	PQL	Guideline					SB1	SB2	SB3	SB4	SB5	SB6	SB7	SB8	SB14	SB14	MW09	MW10	SB9	SB9	MW11	SB10	SB10	MW12	MW12	MW13	SB20 (i)	MW01	MW02	MW03A	MW05	MW21
Sample Depth (m)		HIL D[A]	HSL D[B]	EIL C/I[C]	Management Limits[D]	ESL C/I[E]	0-0.05	0-0.05	0-0.05	0-0.05	0-0.05	0-0.05	0-0.05	0-0.05	0-0.4	0.6-0.8	0.1-0.3	0.2-0.4	0.3-0.4	0.6-0.8	0-0.2	0.5-0.6	1-1.2	0-0.2	0.4-0.6	0.2-0.4	0-0.05	0.3-0.4	0-0.05	0.4-0.5	1.8-2.0	0.2-0.4
Date							12/04/2012	12/04/2012	12/04/2012	12/04/2012	12/04/2012	12/04/2012	12/04/2012	12/04/2012	18/04/2012	18/04/2012	17/04/2012	16/04/2012	16/04/2012	16/04/2012	16/04/2012	17/04/2012	17/04/2012	17/04/2012	17/04/2012	17/04/2012	13/04/2012	11/04/2012	11/04/2012	12/04/2012	12/04/2012	16/04/2012
Sample Profile							FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	ESTUARINE	FILL	FILL	FILL	FILL	FILL	FILL	TOPSOIL	FILL	FILL	FILL	TOPSOIL	FILL	FILL	FILL	FILL	FILL
PAEC Sampled							Pot Lines	Pot Lines	Pot Lines	Pot Lines	SPL Sheds	SPL Sheds	SPL Sheds	SPL Sheds	Maintenance	Maintenance	FLS	FLS	Washbay	Washbay	Washbay	CBWB	CBWB	AWP	AWP	AWP	Switchyard	CBP	CBP	CBP	CBP	PRA
Sample collected by							FR	FR	FR	FR	FR	FR	FR	FR	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	FR	KJG	KJG	KJG	KJG	KJG
Metals																																
Aluminium	50	NL*	-	-	-	-	53300	139000	138000	41700	26900	23700	11800	11000	11600	2820	5460	20500	39800	12600	15000	60800	4640	55800	3260	36700		10400	14400	17600	9510	15800
Arsenic	1	3000	-	160	-	-	4.5	28.9	8.8	14.6	5.1	3.4	2.4	1.9	3.6	0.9	6.4	16.4	17.1	23.9	5.8	10.8	1.4	10.1	1	10.5		4.9	7.9	4.1	4.9	1.3
Cadmium	0.1	900	-	-	-	-	0.7	1.8	1.4	0.8	0.2	0.2	0.1	0.1	<0.1	<0.1	0.1	0.8	11.1	0.2	0.2	4	<0.1	1.4	<0.1	<0.1		<0.1	<0.1	1	0.1	<0.1
Chromium (VI)	1	3600	-	320**	-	-	26.8	35	14.8	36	39.6	36.5	21.9	14.2	22.4	3.5	12.8	13.2	59.5	18.8	23.7	51.2	8.7	46.8	4.4	10.9		14.6	22.4	27.9	16.3	44
Copper	2	240,000	-	210**	-	-	21.1	280	18.9	89.8	33.7	28	12.4	11.6	17.8	0.4	21.9	71.4	82	62	36.3	55.2	1.7	41.1	0.3	6.7		7.9	1.8	12.4	11.1	34.6
Nickel	1	6000	-	140**	-	-	98	159	166	65.7	49	39.3	24.1	18.6	69.9	1.9	59.9	14.7	152	29.4	24.5	77.4	6.5	103	3.4	79.9		13.3	4.9	35.4	15.8	27.6
Lead	2	1500	-	1800	-	-	25	430	28.7	247	18.3	39.7	8.6	10.1	8.8	1.9	18	107	185	66.4	48	58	3.3	34.1	2.6	7.5		8.4	11.1	26.2	15	2.8
Zinc	5	400,000	-	440**	-	-	229	5400	444	1210	232	179	65.3	362	90.7	1.1	260	1380	578	621	420	425	4.9	304	1	21.3		31.6	15.4	75.5	76.7	59.2
Mercury (inorganic)	0.05	730	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1
Fluoride	40	17000*	-	-	-	-	13400	26400	41900	20900	1470	680	520	1440	970	70	700	16200	39000	1230	960	10600	190	47100	1010	17700		310	190	2120	1030	190
Non Metallic Inorganics																																
Total Cyanide	1	1500	-	-	-	-											<1	<1			<1	4	<1	<1	1	<1						
Polycyclic Aromatic Hydrocarbons (PAH)																																
Naphthalene	0.5	-	-	370	-	-											<0.5	<0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	
Acenaphthylene	0.5	-	-	-	-	-											<0.5	<0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	
Acenaphthene	0.5	-	-	-	-	-											<0.5	<0.5			<0.5	<0.5	<0.5	1.4	<0.5	0.6		<0.5	<0.5	<0.5	<0.5	
Fluorene	0.5	-	-	-	-	-											<0.5	<0.5			<0.5	<0.5	<0.5	0.9	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	
Phenanthrene	0.5	-	-	-	-	-											<0.5	<0.5			0.6	1.8	<0.5	15.2	<0.5	5		<0.5	<0.5	<0.5	<0.5	
Anthracene	0.5	-	-	-	-	-											<0.5	<0.5			<0.5	0.6	<0.5	4.1	<0.5	1.1		<0.5	<0.5	0.8	<0.5	
Fluoranthene	0.5	-	-	-	-	-											<0.5	1.1			2	10.6	<0.5	56.5	<0.5	20.4		<0.5	<0.5	0.7	<0.5	
Pyrene	0.5	-	-	-	-	-											<0.5	1			1.9	9.4	<0.5	52.2	<0.5	20.5		<0.5	<0.5	<0.5	<0.5	
Benz(a)anthracene	0.5	-	-	-	-	-											<0.5	0.5			1.8	13.8	<0.5	52.6	<0.5	17.3		<0.5	<0.5	0.9	0.6	
Chrysene	0.5	-	-	-	-	-											0.6	0.5			2	24.3	<0.5	74.3	<0.5	17		<0.5	<0.5	2.2	1.4	
Benzo(b)&(k)fluoranthene	1	-	-	-	-	-											1.1	0.8			3.3	39	<0.5	88.6	<0.5	26.6		1	<1	3	3	
Benzo(k)fluoranthene	0.5	-	-	-	-	-											<0.5	<0.5			1.2	10.8	<0.5	31.2	<0.5	11.8		<0.5	<0.5	<0.5	<0.5	
Benzo(a) pyrene	0.5	-	-	-	-	72[F]											<0.5	<0.5			1.7	8.9	<0.5	29.4	<0.5	16.1		0.7	<0.5	1.2	1	
Indeno(1,2,3-c,d)pyrene	0.5	-	-	-	-	-											<0.5	<0.5			1.2	10.3	<0.5	20.7	<0.5	11.4		<0.5	<0.5	<0.5	<0.5	
Dibenz(a,h)anthracene	0.5	-	-	-	-	-											<0.5	<0.5			<0.5	3.1	<0.5	7.2	<0.5	2.5		<0.5	<0.5	0.5	<0.5	
Benzo(g,h,i)perylene	0.5	-	-	-	-	-											<0.5	<0.5			1.5	16	<0.5	24	<0.5	14.5		<0.5	<0.5	<0.5	<0.5	
Benzo(a)pyrene TEQ		40	-	-	-	-											<0.5	<0.5			2.98	19.79	<0.5	56.9	<0.5	25.6		<0.5	<0.5	1.52	1.34	
Sum of reported PAH	--	4000	-	-	-	-											1.7	3.9			17.2	149	<0.5	458	<0.5	165		0.5	<0.5	0.7	<0.5	
Total Petroleum Hydrocarbons (TPH)																																
TPH C6-C9	10	-	260	-	800	-																										
TPH C10-C14	50	-	NL	-	1000	170																										
TPH C15-C28	100	-	-	-	5000	1700																										
TPH C29-C36	100	-	-	-	10,000	3300																										
TPH C10-C36	--	-	-	-	-	-																										
Polychlorinated Biphenyls																																
Total PCBs	1	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01																	<0.1					
Semi Volatile Organic Compounds																																
Total PAHs	1	4000	-	-	-	-									<LOR	<LOR	<LOR	<LOR										<LOR	<LOR	<LOR	<LOR	<LOR
Total Phenols	1	240,000	-	-	-	-									<LOR	<LOR	<LOR	<LOR										<LOR	<LOR	<LOR	<LOR	<LOR
Phthalate Esters	5	-	-	-	-	-									<LOR	<LOR	<LOR	<LOR										<LOR	<LOR	<LOR	<LOR	<LOR
Nitrosamines	1	-	-	-	-	-									<LOR	<LOR	<LOR	<LOR										<LOR	<LOR	<LOR	<LOR	<LOR
Nitroaromatics and Ketones	1	-	-	-	-	-									<LOR	<LOR	<LOR	<LOR										<LOR	<LOR	<LOR	<LOR	<LOR
Haloethers	0.5	-	-	-	-	-									<LOR	<LOR	<LOR	<LOR										<LOR	<LOR	<LOR	<LOR	<LOR
Chlorinated Hydrocarbons	1	-	-	-	-	-									<LOR	<LOR	<LOR	<LOR										<LOR	<LOR	<LOR	<LOR	<LOR
Anilines and Benzidines	1	-	-	-	-	-									<LOR	<LOR	<LOR	<LOR										<LOR	<LOR	<LOR	<LOR	<LOR
Organochlorine Pesticides	1	-	-	-	-	-									<LOR	<LOR	<LOR	<LOR										<LOR	<LOR	<LOR	<LOR	<LOR
Organophosphorus Pesticides	0.5	-	-	-	-	-									<LOR	<LOR	<LOR	<LOR										<LOR	<LOR	<LOR	<LOR	<LOR
Miscellaneous Compounds	0.5	-	-	-	-	-									<LOR	<LOR	<LOR	<LOR										<LOR	<LOR	<LOR	<LOR	<LOR
Volatile Organic Compounds																																
Monocyclic Aromatic Hydrocarbons	5	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01																	<LOR					
Oxygenated Compounds	0.5	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01																	<LOR					
Sulfonated Compounds	1	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01																	<LOR					
Fumigants	0.5	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01																	<LOR					
Halogenated Aliphatic Compounds	5	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01																	<LOR					
Halogenated Aromatic Compounds	0.5	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01																	<LOR					
Trihalomethanes	0.5	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01																						

All results are in units of mg/kg.

Blank Cell indicates testing was not completed

PQL = Practical Quantitation Limit.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Soil Health Screening Level for Vapour Intrusion 'D' Commercial/ Industrial

[C] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[D] NEPM (2013) Management Limits for TPH Fractions F1 to F4 in soil - note that the F1 to F4 fractions are different to the fractions reported here

[E] NEPM (2013) Ecological Screening Level for Commercial/ Industrial

[F] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHs) (Enviro

* Fluoride (soluble) and aluminium Preliminary Screening Criteria from ENVIRON (2013) 'Preliminary Screening Level Health Risk Assessment for Fluoride and Alumin

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the March 2014 investigations

Results shown in shading are in excess of the primary health acceptance criteria

Results showin in underline are in excess of the primary ecological acceptance criteria

<LOR = Less than the Limit of Reporting

PAECs

CBP	Clay Borrow Pit
FLS	Flammable Liquids Store
AWP	Anode Waste Pile
DSA	Diesel Spray Area
CBWB	Cathode Bay Washdown Bay
PRA	Pot Rebuild Area

TABLE LR2 Soil Analytical Results for Drainage Lines and Dams

Sample Identification	PQL						D1	D2	D3	D5	D6	D7	D8	D8-BASE	D9	D10	D11	D11-1	D12	D12-1
Sample Depth (m)		HIL D[A]	HSL D[B]	EIL C/I[C]	Management Limits[D]	ESL C/I[E]	0-0.3	0-0.2	0-0.2	0-0.2	0-0.05	0-0.3	0-0.1	0.1-0.35	0-0.2	0-0.05	0-0.2	0.2-0.4	0-0.2	0.3-0.4
Date							13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012

Sample Profile							SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	CLAY	RESIDUAL	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	CLAY
PAECs Sampled							Western Dam	Western Dam	Southern Dam	Drain at SPL Sheds	Drain at AWP	Drain at AWP	Drain at Alcan Mound	Drain at Alcan Mound	Drain near Carbon Plant	Drain near DSA	East Surge Dam	East Surge Dam	East Surge Dam	East Surge Dam
Sample collected by							FR	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR
Metals																				
Aluminium	50	NL*	-	-	-	-	166000	31900	14200	25100	26800	39200	40900	15100	10900	23900	12800	13500	56000	5030
Arsenic	1	3000	-	160	-	-	14.1	9.3	5.9	5.7	9.2	17	16.1	3.2	6.7	4	5.7	3	16	0.6
Cadmium	0.1	900	-	-	-	-	2.6	0.6	0.2	0.6	3	2	4.4	<0.1	<0.1	1.1	1.2	0.3	4.5	<0.1
Chromium	1	3600	-	320**	-	-	25.8	23.2	23.2	27.8	41.4	35.9	49.5	18.8	13.5	15.5	16	13.7	55.4	6.4
Copper	2	240,000	-	210**	-	-	43.6	10.7	12.9	10	40.8	31.4	45.7	3.7	5.4	11.6	3.7	2	35.9	1
Nickel	1	6000	-	140**	-	-	173	78	21.1	22.2	118	87	119	10.7	9	49.6	10.9	6.9	103	3.7
Lead	2	1500	-	1800	-	-	49.9	17.9	24.3	24.7	52.1	71.4	79.6	11.4	12.2	31.8	12.7	7.7	63.2	3.8
Zinc	5	400,000	-	440**	-	-	1290	328	122	132	707	599	955	43	110	197	72.4	28.4	671	5.9
Mercury	0.05	730	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1
Fluoride	40	17000*	-	-	-	-	38500	5850	150	1110	3810	7350	3790	520	750	3330	1480	3010	2510	210
Non Metallic Inorganics																				
Total Cyanide	1	1500	-	-	-	-	2	<1	<1	<1	1	2	24	2	<1		2	2	86	4
Polycyclic Aromatic Hydrocarbons (PAH)																				
Naphthalene	0.5	-	-	370	-	-	<0.5	<0.5	<0.8	<0.8	<8.0	<0.5	<0.8	<0.5	<0.5	<0.5	<4.0	<0.5	<0.8	<0.5
Acenaphthylene	0.5	-	-	-	-	-	<0.5	<0.5	<0.8	<0.8	<8.0	<0.5	<0.8	<0.5	<0.5	<0.5	<4.0	<0.5	<0.8	<0.5
Acenaphthene	0.5	-	-	-	-	-	1.4	<0.5	<0.8	<0.8	<8.0	2.8	2.5	<0.5	<0.5	<0.5	<4.0	<0.5	<0.8	<0.5
Fluorene	0.5	-	-	-	-	-	1.2	<0.5	<0.8	<0.8	<8.0	2.2	1.5	<0.5	<0.5	<0.5	<4.0	<0.5	<0.8	<0.5
Phenanthrene	0.5	-	-	-	-	-	3.4	<0.5	<0.8	<0.8	38.3	20	18.1	1.7	<0.5	0.7	<4.0	<0.5	2.3	<0.5
Anthracene	0.5	-	-	-	-	-	0.7	<0.5	<0.8	<0.8	14.1	5.1	4.6	0.5	<0.5	<0.5	<4.0	<0.5	<0.8	<0.5
Fluoranthene	0.5	-	-	-	-	-	5.5	0.6	2.4	0.9	107	86.4	65.4	7.9	<0.5	3.7	33.1	0.7	12.9	<0.5
Pyrene	0.5	-	-	-	-	-	4.3	0.5	2.1	0.8	102	79.9	60.4	7.9	<0.5	3.6	31.3	0.8	12.5	<0.5
Benz(a)anthracene	0.5	-	-	-	-	-	3.4	0.6	2.6	1.1	109	73.3	63.4	8.5	<0.5	4.4	46.2	1.3	17.8	<0.5
Chrysene	0.5	-	-	-	-	-	3.8	0.8	4.6	1.3	116	84.8	64.9	11.2	<0.5	6.8	91	2.1	23.4	<0.5
Benzo(b)&(k)fluoranthene	1	-	-	-	-	-	6.1	1.6	8.6	2.4	224	145	151	30.1	0.6	11.5	172	3.9	46.5	<0.5
Benzo(k)fluoranthene	0.5	-	-	-	-	-	1.5	<0.5	2	<0.8	61.7	46.2	35.9	7.7	<0.5	3	37.2	0.9	11	<0.5
Benzo(a) pyrene	0.5	-	-	-	-	72[F]	2.4	0.6	2.1	0.8	85.6	57.1	58.8	15.1	<0.5	3.4	21.7	0.9	16	<0.5
Indeno(1,2,3-c,d)pyrene	0.5	-	-	-	-	-	1.4	<0.5	1.5	<0.8	54.6	32.2	46.3	13	<0.5	2.8	16.2	0.6	10.9	<0.5
Dibenz(a,h)anthracene	0.5	-	-	-	-	-	<0.5	<0.5	<0.8	<0.8	17.2	8.3	12.3	3	<0.5	0.9	6.2	<0.5	3.1	<0.5
Benzo(g,h,i)perylene	0.5	-	-	-	-	-	1.9	0.6	2.2	<0.8	66.9	38.2	59.9	16.6	<0.5	3.7	20.4	0.9	14.2	<0.5
Benzo(a)pyrene TEQ		40	-	-	-	-	3.9	1.1	4.0	1.6	149.6	96.3	102.0	24.3	<0.5	6.6	56.2	1.9	28.1	<0.5
Sum of reported PAH	--	4000	-	-	-	-	37	5.3	28.1	7.3	996	682	645	123	0.6	44.5	475	12.1	171	<0.5

All results are in units of mg/kg.

Blank Cell indicates testing was not completed

PQL = Practical Quantitation Limit.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Soil Health Screening Level for Vapour Intrusion 'D' Commercial/ Industrial

[C] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[D] NEPM (2013) Management Limits for TPH Fractions F1 to F4 in soil - note that the F1 to F4 fractions are different to the fractions reported here

[E] NEPM (2013) Ecological Screening Level for Commercial/ Industrial

[F] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects)

* Fluoride (soluble) and aluminium Preliminary Screening Criteria from ENVIRON (2013) 'Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium'

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the March 2014 investigations

Results shown in shading are in excess of the primary health acceptance criteria

Results showin in underline are in excess of the primary ecological acceptance criteria

<LOR = Less than the Limit of Reporting

TABLE LR2 Soil Analytical Results for Drainage Lines and Dams

Sample Identification	PQL	HIL D[A]	HSL D[B]	EIL C/I[C]	Management Limits[D]	ESL C/I[E]	COMPOSITE 1	COMPOSITE 2	COMPOSITE 3	COMPOSITE 4	ND4-BASE	ND7-BASE
Sample Depth (m)											0.25-0.35	0.1-0.15
Date							13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012	13/04/2012
Sample Profile							SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	CLAY	CLAY
PAECs Sampled							North Dam	North Dam	North Dam	North Dam	North Dam	North Dam
Sample collected by							FR	FR	FR	FR	FR	FR
Metals												
Aluminium	50	NL*	-	-	-	-	26300	24300	22800	8940	10300	15600
Arsenic	1	3000	-	160	-	-	7	6.4	5	2.9	3	4.6
Cadmium	0.1	900	-	-	-	-	5.4	3.7	1.6	0.5	<0.1	0.1
Chromium	1	3600	-	320**	-	-	24.9	19.3	16.4	8.9	13.6	21.2
Copper	2	240,000	-	210**	-	-	7.7	10.2	6.8	4.4	0.7	1.5
Nickel	1	6000	-	140**	-	-	27.4	41.3	70.3	28.6	4.2	7.6
Lead	2	1500	-	1800	-	-	23.8	19.2	10.8	6.2	5.8	9.2
Zinc	5	400,000	-	440**	-	-	308	677	840	184	6.8	46
Mercury	0.05	730	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoride	40	17000*	-	-	-	-	1390	1580	1880	860	340	7350
Non Metallic Inorganics												
Total Cyanide	1	1500	-	-	-	-	<1	<1	<1	<1	<1	<1
Polycyclic Aromatic Hydrocarbons (PAH)												
Naphthalene	0.5	-	-	370	-	-	<0.8	<0.8	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	0.5	-	-	-	-	-	<0.8	<0.8	<0.5	<0.5	<0.5	<0.5
Acenaphthene	0.5	-	-	-	-	-	<0.8	<0.8	<0.5	<0.5	<0.5	<0.5
Fluorene	0.5	-	-	-	-	-	<0.8	<0.8	<0.5	<0.5	<0.5	<0.5
Phenanthrene	0.5	-	-	-	-	-	<0.8	<0.8	<0.5	<0.5	<0.5	<0.5
Anthracene	0.5	-	-	-	-	-	<0.8	<0.8	<0.5	<0.5	<0.5	<0.5
Fluoranthene	0.5	-	-	-	-	-	7.4	<0.8	<0.5	<0.5	<0.5	<0.5
Pyrene	0.5	-	-	-	-	-	6.9	<0.8	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	0.5	-	-	-	-	-	11.4	<0.8	<0.5	<0.5	<0.5	<0.5
Chrysene	0.5	-	-	-	-	-	24	<0.8	0.7	<0.5	<0.5	<0.5
Benzo(b)&(k)fluoranthene	1	-	-	-	-	-	36.9	0.8	1.2	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	0.5	-	-	-	-	-	9.8	<0.8	<0.5	<0.5	<0.5	<0.5
Benzo(a) pyrene	0.5	-	-	-	-	72[F]	7.4	<0.8	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-c,d)pyrene	0.5	-	-	-	-	-	6.9	<0.8	<0.5	<0.5	<0.5	<0.5
Dibenz(a,h)anthracene	0.5	-	-	-	-	-	2.6	<0.8	<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	0.5	-	-	-	-	-	9.1	<0.8	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ		40	-	-	-	-	16.8	<0.8	<0.5	<0.5	<0.5	<0.5
Sum of reported PAH	--	4000	-	-	-	-	122	0.8	1.9	<0.5	<0.5	<0.5

All results are in units of mg/kg.

Blank Cell indicates testing was not completed

PQL = Practical Quantitation Limit.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Soil Health Screening Level for Vapour Intrusion 'D' Commercial/ Industrial

[C] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[D] NEPM (2013) Management Limits for TPH Fractions F1 to F4 in soil - note that the F1 to F4 fractions are different to the fractions reported

[E] NEPM (2013) Ecological Screening Level for Commercial/ Industrial

[F] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hy

* Fluoride (soluble) and aluminium Preliminary Screening Criteria from ENVIRON (2013) 'Preliminary Screening Level Health Risk Assessm

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the

Results shown in shading are in excess of the primary health acceptance criteria

Results showin in underline are in excess of the primary ecological acceptance criteria

<LOR = Less than the Limit of Reporting

TABLE LR4 Groundwater Analytical Results

Sample Identification	PQL	Guideline			MW06	MW01	MW01	MW03	MW03	MW04	MW04	MW05	MW05	MW07	MW08	MW09	MW10	MW11	MW12	MW13
Date		95% Fresh ^{A}	Irrigation	Stock	2/5/12	2/5/12	24/7/12	2/5/12	24/7/12	2/5/12	24/7/12	2/5/12	24/7/12	1/5/12	1/5/12	30/4/12	30/4/12	1/5/12	30/4/12	1/5/12
PAEC Sampled					Background	CBP	CBP	CBP	CBP	CBP	CBP	CBP	CBP	Refuelling	Refuelling	FLS	FLS	Washbay	AWP	AWP
Sample Appearance					Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Cloudy	Turbid	Milky	Brown	Cloudy
Sample collected by					KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG
Metals																				
Aluminium pH>6.5	10	55	5000	5000	10	20		590		2530		30		30	150	10	<10	380	13,600	2,150
Arsenic	1	24	100	500	<10	<10	<1	<10	3	<10	<1	2	2	13	3	3	2	18	16	4
Cadmium	0.1	0.2	10	10	<1	<1	1.1	<1	2	3.1	2.7	0.1	0.2	0.2	<1	<0.1	<0.1	<0.1	2.1	<0.1
Chromium	1	1	100	1000	<10	<10	<1	<10	4	<10	<1	<1	<1	<10	2	<1	<1	2	29	4
Copper	1	1.4	200	1000	<10	<10	5	<10	3	<10	4	3	3	10	<1	2	1	2	88	1
Nickel	1	11	200	1000	22	<10	58	488	420	938	600	15	15	30	2	16	19	5	110	2
Lead	1	3.4	2000	100	<10	<10	<1	<10	3	<10	<1	1	<1	<1	<1	<1	<1	<1	133	<1
Zinc	5	8	2000	20,000	78	<50	64	847	1100	1840	1000	30	9	28	12	9	10	28	699	25
Mercury	0.1	0.6	2	2	<0.1	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoride	100	5000*	1000	2000	1000	1200		2500		5500		15000		1300	4900	1000	1200	3900	1700	43000
Non Metallic Inorganics																				
Free Cyanide	4	7			<4											<8	<4	<4	<8	7
Total Cyanide	4	NA			<4											<8	<4	13	<8	40
Total Petroleum Hydrocarbons (TPH)																				
TPH C6-C9	20													<20	<20					
TPH C10-C14	50													<50	<50					
TPH C15-C28	10													<100	330					
TPH C29-C36	50													<50	<50					
TPH C6-C36		*7*	LOR	LOR										<50	330					
Polycyclic Aromatic Hydrocarbons (PAH)																				
3-Methylcholanthrene	0.1				<0.1									<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
2-Methylnaphthalene	0.1				<0.1									<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
7.12-Dimethylbenz(a)anthracene	0.1				<0.1									<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	0.1				<0.1									<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Acenaphthylene	0.1				<0.1									<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	0.1	*0.4*			<0.1									<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Benz(a)anthracene	0.1				<0.1									<0.1	<0.1	0.3	<0.1	<0.1	0.3	4
Benzo(a)pyrene	0.05	0.2			<0.05									<0.05	<0.05	0.58	<0.05	<0.05	0.4	6.46
Benzo(b)fluoranthene	0.1				<0.1									<0.1	<0.1	1.4	<0.1	<0.1	0.6	8.1
Benzo(e)pyrene	0.1				<0.1									<0.1	<0.1	0.7	<0.1	<0.1	0.3	3.4
Benzo(g.h.i)perylene	0.1				<0.1									<0.1	<0.1	0.4	<0.1	<0.1	0.2	2.6
Benzo(k)fluoranthene	0.1				<0.1									<0.1	<0.1	0.4	<0.1	<0.1	0.2	2.7
Chrysene	0.1				<0.1									<0.1	<0.1	0.6	<0.1	<0.1	0.2	3.6
Coronene	0.1				<0.1									<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5
Dibenz(a.h)anthracene	0.1				<0.1									<0.1	<0.1	0.1	<0.1	<0.1	<0.1	1
Fluoranthene	0.1	1.4			<0.1									<0.1	<0.1	0.2	<0.1	<0.1	0.3	4.8
Fluorene	0.1				<0.1									<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1.2.3.cd)pyrene	0.1				<0.1									<0.1	<0.1	0.2	<0.1	<0.1	0.2	3
N-2-Fluorenyl Acetamide	0.1				<0.1									<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	0.1	16			<0.1									<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Perylene	0.1				<0.1									<0.1	<0.1	0.2	<0.1	<0.1	0.1	1.9
Phenanthrene	0.1	2			<0.1									<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.9
Pyrene	0.1				<0.1									<0.1	<0.1	0.2	<0.1	<0.1	0.3	5
Semivolatile Organic Compounds (SVOCs)																				
Organochlorine Pesticides (OCP)																				
alpha-BHC	2				<2	<2		<2		<2		<2				<2	<2			
HCB	2				<2	<2		<2		<2		<2				<2	<2			
delta-BHC	2				<2	<2		<2		<2		<2				<2	<2			
Heptachlor	2	0.09			<2	<2		<2		<2		<2				<2	<2			
Aldrin	2	*0.001*			<2	<2		<2		<2		<2				<2	<2			
Heptachlor epoxide	2				<2	<2		<2		<2		<2				<2	<2			
Chlordane	2	0.08			<2	<2		<2		<2		<2				<2	<2			
Endosulfan	2	0.2			<2	<2		<2		<2		<2				<2	<2			
Dieldrin	2	*0.01*			<2	<2		<2		<2		<2				<2	<2			
DDE	2	*0.03*			<2	<2		<2		<2		<2				<2	<2			
Endrin	2	0.02			<2	<2		<2		<2		<2				<2	<2			
DDD	2				<2	<2		<2		<2		<2				<2	<2			
Endrin aldehyde	2				<2	<2		<2		<2		<2				<2	<2			
Endosulfan sulfate	2				<2	<2		<2		<2		<2				<2	<2			
DDT	4	0.01			<4	<4		<4		<4		<4				<4	<4			

TABLE LR4 Groundwater Analytical Results

Sample Identification	PQL	Guideline			MW06	MW01	MW01	MW03	MW03	MW04	MW04	MW05	MW05	MW07	MW08	MW09	MW10	MW11	MW12	MW13
Date		95% Fresh ^{A}	Irrigation	Stock	2/5/12	2/5/12	24/7/12	2/5/12	24/7/12	2/5/12	24/7/12	2/5/12	24/7/12	1/5/12	1/5/12	30/4/12	30/4/12	1/5/12	30/4/12	1/5/12
PAEC Sampled					Background	CBP	CBP	CBP	CBP	CBP	CBP	CBP	CBP	Refuelling	Refuelling	FLS	FLS	Washbay	AWP	AWP
Sample Appearance					Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Cloudy	Turbid	Milky	Brown	Cloudy
Sample collected by					KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG
Organophosphorous Pesticides (OPP)																				
Dichlorvos	2				<2	<2		<2		<2		<2				<2	<2			
Dimethoate	2	0.15			<2	<2		<2		<2		<2				<2	<2			
Diazinon	2	0.01			<2	<2		<2		<2		<2				<2	<2			
Chlorpyrifos-methyl	2				<2	<2		<2		<2		<2				<2	<2			
Malathion	2	0.05			<2	<2		<2		<2		<2				<2	<2			
Fenthion	2	0.2			<2	<2		<2		<2		<2				<2	<2			
Chlorpyrifos	2				<2	<2		<2		<2		<2				<2	<2			
Bromophos-ethyl	2				<2	<2		<2		<2		<2				<2	<2			
Chlorfenvinphos	2				<2	<2		<2		<2		<2				<2	<2			
Prothiofos	2				<2	<2		<2		<2		<2				<2	<2			
Ethion	2				<2	<2		<2		<2		<2				<2	<2			
Polynuclear Aromatic Hydrocarbons																				
Naphthalene	2					<2		3		<2		<2								
2-Methylnaphthalene	2					<2		<2		<2		<2								
2-Chloronaphthalene	2					<2		<2		<2		<2								
Acenaphthylene	2					<2		<2		<2		<2								
Acenaphthene	2					<2		<2		<2		<2								
Fluorene	2					<2		<2		<2		<2								
Phenanthrene	2					<2		<2		<2		<2								
Anthracene	2					<2		<2		<2		<2								
Fluoranthene	2					<2		<2		<2		<2								
Pyrene	2					<2		<2		<2		<2								
N-2-Fluorenyl Acetamide	2					<2		<2		<2		<2								
Benz(a)anthracene	2					<2		<2		<2		<2								
Chrysene	2					<2		<2		<2		<2								
Benzo(b) & Benzo(k)fluoranthene	4					<4		<4		<4		<4								
7.12-Dimethylbenz(a)anthracene	2					<2		<2		<2		<2								
Benzo(a)pyrene	2					<2		<2		<2		<2								
3-Methylcholanthrene	2					<2		<2		<2		<2								
Indeno(1.2.3.cd)pyrene	2					<2		<2		<2		<2								
Dibenz(a.h)anthracene	2					<2		<2		<2		<2								
Benzo(g.h.i)perylene	2					<2		<2		<2		<2								
Phenols																				
Total Phenolics	4	320			<4	<4		<4		<4		<4				<4	<4			
Phthalate Esthers																				
Dimethylphthalate	2	3700			<2	<2		<2		<2		<2				<2	<2			
Diethylephthalate	2	1000			<2	<2		<2		<2		<2				<2	<2			
Nitrosamines																				
Total Nitrosamines	2				<2	<2		<2		<2		<2				<2	<2			
Nitroaromatics and Ketones																				
Total Nitroaromatics and Ketones	2				<2	<2		<2		<2		<2				<2	<2			
Haloethers																				
Total Haloethers	2				<2	<2		<2		<2		<2				<2	<2			
Chlorinated Hydrocarbons																				
Total Chlorinated Hydrocarbons	2				<2	<2		<2		<2		<2				<2	<2			
Anilines and Benzidines																				
Total Anilines and Benzidines	2				<2	<2		<2		<2		<2				<2	<2			
Miscellaneous Compounds																				
Total Misscellaneous Compounds	2				<2	<2		<2		<2		<2				<2	<2			

All results in µg/L

PQL = Practical Quantitation Limit.

^{A} ANZECC 2000 95% Protection Level for Receiving Water Type

Guidelines in *italics* are low level reliability guidelines

^{B} NHMRC Australian Drinking Water Guidelines, 20110

* 5000µg/L for Fluoride is based on the value used by another Aluminium Smelter

ANZECC arsenic guideline based on As (III) for marine and As (V) for fresh, the lowest of presented guidelines.

NHMRC arsenic guidelines are based on total arsenic

ANZECC and NHMRC guidelines for chromium are based on Cr (VI)

Total Phenolics guideline based on Phenol

ANZECC guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

NHMRC guidelines for total cyanide are based on cyanogen chloride (as cyanide).

Results for TRH have been compared to TPH guidelines.

Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC

PAECs	
CBP	Clay Borrow Pit
FLS	Flammable Liquids Store
AWP	Anode Waste Pile
DSA	Diesel Spray Area
CBWB	Cathode Bay Washdown Bay
PRA	Pot Rebuild Area

TABLE LR4 Groundwater Analytical Results

Sample Identification	PQL	Guideline			MW14	MW15	MW16	MW17	MW18	S3A	S3B	SUMP	MW19	MW20	MW21
Date		95% Fresh ^{A}	Irrigation	Stock	1/5/12	3/5/12	3/5/12	3/5/12	3/5/12	3/5/12	3/5/12	3/5/12	1/5/12	3/5/12	2/5/12
PAEC Sampled					Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	DSA	DSA	PRA
Sample Appearance					Yellow	Yellow	Clear	Cloudy	Clear	Clear	Clear	Clear	Milky	Cloudy	Clear
Sample collected by					KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG
Metals															
Aluminium pH>6.5	10	55	5000	5000	110	200	100	3,260	3,120	50	270	40			20
Arsenic	1	24	100	500	2	<1	4	12	2	5	2	4			<1
Cadmium	0.1	0.2	10	10	0.3	0.2	<0.1	<0.1	<0.1	0.3	<1	3			<0.1
Chromium	1	1	100	1000	<1	<1	1	<1	3	<1	1	<1			<10
Copper	1	1.4	200	1000	7	2	4	10	2	4	2	5			<10
Nickel	1	11	200	1000	10	7	6	14	3	6	1	8			62
Lead	1	3.4	2000	100	<1	<1	<1	34	<1	<1	<1	<1			<10
Zinc	5	8	2000	20,000	32	37	57	40	50	31	24	38			70
Mercury	0.1	0.6	2	2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
Fluoride	100	5000*	1000	2000	3600	4500	1500	800	35000	12000	14000	4400			3000
Non Metallic Inorganics															
Free Cyanide	4	7			<4	<4	<8	<8	<4	<4	<4	<4			
Total Cyanide	4	NA			4	<4	<8	<8	<4	<4	<4	<4			
Total Petroleum Hydrocarbons (TPH)															
TPH C6-C9	20												<20	<20	
TPH C10-C14	50												<50	<50	
TPH C15-C28	10												<100	<100	
TPH C29-C36	50												<50	<50	
TPH C6-C36		*7*	LOR	LOR									<50	<50	
Polycyclic Aromatic Hydrocarbons (PAH)															
3-Methylcholanthrene	0.1				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
2-Methylnaphthalene	0.1				<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
7.12-Dimethylbenz(a)anthracene	0.1				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Acenaphthene	0.1				<0.1	<0.1	9.4	22.9	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	
Acenaphthylene	0.1				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Anthracene	0.1	*0.4*			<0.1	<0.1	0.6	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Benz(a)anthracene	0.1				<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Benzo(a)pyrene	0.05	0.2			0.06	<0.05	0.22	<0.05	0.06	0.14	0.08	<0.05	<0.05	<0.05	
Benzo(b)fluoranthene	0.1				0.1	<0.1	0.2	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	
Benzo(e)pyrene	0.1				<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Benzo(g.h.i)perylene	0.1				<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Benzo(k)fluoranthene	0.1				<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Chrysene	0.1				<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Coronene	0.1				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Dibenz(a.h)anthracene	0.1				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Fluoranthene	0.1	1.4			0.1	<0.1	1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Fluorene	0.1				<0.1	<0.1	1.1	2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Indeno(1.2.3.cd)pyrene	0.1				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
N-2-Fluorenyl Acetamide	0.1				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Naphthalene	0.1	16			<0.1	<0.1	5.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Perylene	0.1				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Phenanthrene	0.1	2			<0.1	<0.1	0.6	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Pyrene	0.1				0.1	<0.1	0.7	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Semivolatile Organic Compounds (SVOCs)															
Organochlorine Pesticides (OCP)															
alpha-BHC	2														<2
HCB	2														<2
delta-BHC	2														<2
Heptachlor	2	0.09													<2
Aldrin	2	*0.001*													<2
Heptachlor epoxide	2														<2
Chlordane	2	0.08													<2
Endosulfan	2	0.2													<2
Dieldrin	2	*0.01*													<2
DDE	2	*0.03*													<2
Endrin	2	0.02													<2
DDD	2														<2
Endrin aldehyde	2														<2
Endosulfan sulfate	2														<2
DDT	4	0.01													<4

TABLE LR4 Groundwater Analytical Results

Sample Identification	PQL	Guideline			MW14	MW15	MW16	MW17	MW18	S3A	S3B	SUMP	MW19	MW20	MW21
Date		95% Fresh ^{A}	Irrigation	Stock	1/5/12	3/5/12	3/5/12	3/5/12	3/5/12	3/5/12	3/5/12	3/5/12	1/5/12	3/5/12	2/5/12
PAEC Sampled					Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	DSA	DSA	PRA
Sample Appearance					Yellow	Yellow	Clear	Cloudy	Clear	Clear	Clear	Clear	Milky	Cloudy	Clear
Sample collected by					KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG
Organophosphorous Pesticides (OPP)															
Dichlorvos	2														<2
Dimethoate	2	0.15													<2
Diazinon	2	0.01													<2
Chlorpyrifos-methyl	2														<2
Malathion	2	0.05													<2
Fenthion	2	0.2													<2
Chlorpyrifos	2														<2
Bromophos-ethyl	2														<2
Chlorfenvinphos	2														<2
Prothiofos	2														<2
Ethion	2														<2
Polynuclear Aromatic Hydrocarbons															
Naphthalene	2														<2
2-Methylnaphthalene	2														<2
2-Chloronaphthalene	2														<2
Acenaphthylene	2														<2
Acenaphthene	2														<2
Fluorene	2														<2
Phenanthrene	2														<2
Anthracene	2														<2
Fluoranthene	2														<2
Pyrene	2														<2
N-2-Fluorenyl Acetamide	2														<2
Benz(a)anthracene	2														<2
Chrysene	2														<2
Benzo(b) & Benzo(k)fluoranthene	4														<4
7.12-Dimethylbenz(a)anthracene	2														<2
Benzo(a)pyrene	2														<2
3-Methylcholanthrene	2														<2
Indeno(1.2.3.cd)pyrene	2														<2
Dibenz(a.h)anthracene	2														<2
Benzo(g.h.i)perylene	2														<2
Phenols															
Total Phenolics	4	320													<4
Phthalate Esthers															
Dimethylphthalate	2	3700													<2
Diethylephthalate	2	1000													<2
Nitrosamines															
Total Nitrosamines	2														<2
Nitroaromatics and Ketones															
Total Nitroaromatics and Ketones	2														<2
Haloethers															
Total Haloethers	2														<2
Chlorinated Hydrocarbons															
Total Chlorinated Hydrocarbons	2														<2
Anilines and Benzidines															
Total Anilines and Benzidines	2														<2
Miscellaneous Compounds															
Total Misscellaneous Compounds	2														<2

All results in μg/L

PQL = Practical Quantitation Limit.

^{A} ANZECC 2000 95% Protection Level for Receiving Water Type

Guidelines in *italics* are low level reliability guidelines

^{B} NHMRC Australian Drinking Water Guidelines, 20110

* 5000μg/L for Fluoride is based on the value used by another Aluminium Smelter

ANZECC arsenic guideline based on As (III) for marine and As (V) for fresh, the lowest of presented guidelines.

NHMRC arsenic guidelines are based on total arsenic

ANZECC and NHMRC guidelines for chromium are based on Cr (VI)

Total Phenolics guideline based on Phenol

ANZECC guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

NHMRC guidelines for total cyanide are based on cyanogen chloride (as cyanide).

Results for TRH have been compared to TPH guidelines.

Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC

APPENDIX 2
NSW EPA CORRESPONDENCE

NSW EPA

Our reference: Doc12/35460

Alex Fry
Aluminium Metal
Primary Production Kurri Kurri
PO Box 1
Kurri Kurri
NSW 2327

Dear Alex Fry

Hydro Aluminium Kurri Kurri
Section 60 Notification under the *Contaminated Land Management Act 1997*

Thank you for the Site Contamination Notification dated 11 July 2012 and supporting information provided in accordance with section 60 of the *Contaminated Land Management Act 1997* (the CLM Act) relating to Hydro Aluminium Kurri Kurri.

The notification and attached documents have been considered and I advise that we are unable to make a determination as to whether the contamination at the site warrants regulation under the CLM Act as insufficient information has been provided. In order to progress our assessment, we require the following information:

- Site plans and tables of results summarising the concentrations of contaminants for each of the groundwater monitoring wells. The site plans should also show the extent of the groundwater contamination which exceeds the adopted assessment criteria;
- The nature and extent of the groundwater contamination arising from the leaching of contaminants from the stockpiles. We understand from your letter that these investigations are currently in progress; and
- An assessment of the risks posed to any nearby receptors (including water bodies, livestock and groundwater users) from the potential off-site migration of the contamination.

Would you please provide the above information within 8 weeks from the date of this letter. We will then review the information and assess whether the contamination at the site warrants regulation under the CLM Act or if the contamination would be more appropriately managed by the existing Environment Protection Licence (EPL No. 1548) under the *Protection of the Environment Operations (POEO) Act* 1997.

The site will be added to the public list of notified sites on the Environment Protection Authority (EPA) website, which can be accessed at: www.environment.nsw.gov.au/clm/publiclist.htm. This list includes all sites notified under section 60 of the CLM Act. The listing provides basic information such as the location of the sites, the category of activity that has caused the contamination and the current status of the sites with respect to site assessment and management. If circumstances relating to your site change, you should advise the EPA in writing so that the listing can be amended as appropriate.

If you have any further queries related to this matter, please contact John Coffey on (02) 99955621.

Yours sincerely

18/10/2012

NIALL JOHNSTON
Manager Contaminated Sites
Environment Protection Authority

Our reference: DOC15/40734

Mr Richard Brown
Managing Director
Hydro Aluminium Kurri Kurri Pty Limited
PO Box 1
Kurri Kurri, NSW, 2327

Email: richard.brown@hydro.com

Dear Mr Brown,

Hydro Aluminium Kurri Kurri
Section 60 Notification under the *Contaminated Land Management Act 1997*

Thank you for the information provided in response to our letter dated 18 October 2012 (attached for your reference) following the notification of the site under the *Contaminated Land Management Act 1997* (CLM Act), as well as the more recent updates after Hydro's announcement of the closure of the smelter in May 2014. We note that the demolition and remediation of the site are to be dealt with as State Significant Development by the NSW Department of Planning and Environment who issued Secretary's Environmental Assessment Requirements (SEARs) on 18 November 2014.

The contaminated sites section of the EPA has reviewed the reports provided on the contamination identified at the site and the assessment of potential risks from the contamination. We concur with the findings of the assessment, that under the existing use of the land and with current site configuration, there are unlikely to be any significant risks from the contamination to either human health (site users) or nearby receptors while the management of the leachate contamination is undertaken. Changes to either the land use or configuration would require a reassessment of the risks.

The remediation of the land will be performed in accordance with the requirements of NSW Department of Planning and Environment. The site (including the surrounding Hydro owned buffer lands) is then anticipated to be rezoned for a range of land uses. A site auditor accredited under the CLM Act is required as part of this process to oversee the works on site relating to the contamination issues. The auditor will be required to verify the adequacy of the proposed remedial strategy, suitability of the site for the proposed land use as well as the effectiveness of the remedial works in preventing the migration of contaminated groundwater from the site.

We consider that the site contamination issues can be appropriately managed under the planning process in accordance with the requirements of *State Environmental Planning Policy No. 55 - Remediation of Land*. We do not intend to initiate additional regulation of the remediation work under the CLM Act at this stage and consider that the current and future site issues can be appropriately managed by the existing Environment Protection Licence (EPL No. 1548) under the *Protection of the Environment Operations (POEO) Act* 1997.

The record for the site on the EPA website of sites notified under section 60 of the CLM Act (http://www.epa.nsw.gov.au/clm/publiclist.htm) will be updated to reflect that regulation under the CLM Act is not required.

If you have any further queries related to this matter, please contact John Coffey on (02) 99955621.

Yours sincerely

9th February 2015

NIALL JOHNSTON
Manager Contaminated Sites
Environment Protection Authority

CC: EPA Region – Mr Bill George
Department of Planning and Environment (DPE)

APPENDIX 3
2014 SOIL AND GROUNDWATER INVESTIGATION RESULTS TABLES

TABLE LR1 Soil Analytical Results for AEC 2 Anode Waste Pile (mg/kg)

Sample Identification	PQL				MW12	MW12	MW13	SB103	SB103	SB104	SB104	SB105	SB105	MW103	MW103	MW104	MW104
Sample Depth (m)		HIL D^{A}	EIL C/I^{B}	ESL C/I	0-0.2	0.4-0.6	0.2-0.4	0-0.1	0.3-0.4	0-0.1	0.3-0.4	0-0.1	0.3-0.4	0-0.1	0.3-0.4	0-0.1	0.3-0.4
Date					17-Apr-12	17-Apr-12	17-Apr-12	30-Jun-14	30-Jun-14	30-Jun-14	30-Jun-14	30-Jun-14	30-Jun-14	30-Jun-14	30-Jun-14	30-Jun-14	30-Jun-14
Sample Profile					FILL	FILL	FILL	FILL	ESTUARINE	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL
PAEC Sampled					AWP	AWP	AWP	AWP	AWP	AWP	AWP	AWP	AWP	AWP	AWP	AWP	AWP
Sample collected by					KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG
Metals																	
Aluminium	50	NL*	-	-	55800	3260	36700	-	-	-	-	-	-	-	-	-	-
Arsenic	1	3000	160	-	10.1	1	10.5	-	-	-	-	-	-	-	-	-	-
Cadmium	0.1	900	-	-	1.4	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-
Chromium	1	3600	320**	-	46.8	4.4	10.9	-	-	-	-	-	-	-	-	-	-
Copper	2	240000	210**	-	41.1	0.3	6.7	-	-	-	-	-	-	-	-	-	-
Nickel	1	6000	140**	-	103	3.4	79.9	-	-	-	-	-	-	-	-	-	-
Lead	2	1500	1800	-	34.1	2.6	7.5	-	-	-	-	-	-	-	-	-	-
Zinc	5	400000	440**	-	304	1	21.3	-	-	-	-	-	-	-	-	-	-
Mercury (inorganic)	0.1	730	-	-	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-
Fluoride (soluble)	40	17000*	-	-	-	-	-	890	24	1077	270	970	110	410	430	64	45
Fluoride (total)	40	-	-	-	47100	1010	17700	-	-	-	-	-	-	-	-	-	-
Non Metallic Inorganics																	
Total Cyanide (free)	1	1500	-	-	<1	1	<1	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons (PAH)																	
Naphthalene	0.5	-	370	-	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.5	-	-	-	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	0.5	-	-	-	1.4	<0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Fluorene	0.5	-	-	-	0.9	<0.5	<0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Phenanthrene	0.5	-	-	-	15.2	<0.5	5	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Anthracene	0.5	-	-	-	4.1	<0.5	1.1	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Fluoranthene	0.5	-	-	-	56.5	<0.5	20.4	13	13	13	13	13	13	13	13	13	13
Pyrene	0.5	-	-	-	52.2	<0.5	20.5	12	12	12	12	12	12	12	12	12	12
Benz(a)anthracene	0.5	-	-	-	52.6	<0.5	17.3	11	11	11	11	11	11	11	11	11	11
Chrysene	0.5	-	-	-	74.3	<0.5	17	11	11	11	11	11	11	11	11	11	11
Benzo(b)&(k)fluoranthene	1	-	-	-	88.6	<0.5	26.6	25	25	25	25	25	25	25	25	25	25
Benzo(k)fluoranthene	0.5	-	-	-	31.2	<0.5	11.8	-	-	-	-	-	-	-	-	-	-
Benzo(a) pyrene	0.5	-	-	72^{C}	29.4	<0.5	16.1	15	<0.05	18	21	37	12	28	160	24	0.21
Indeno(1,2,3-c,d)pyrene	0.5	-	-	-	20.7	<0.5	11.4	14	<0.1	16	18	32	8.2	27	120	18	0.2
Dibenz(a,h)anthracene	0.5	-	-	-	7.2	<0.5	2.5	1.4	<0.1	2	1.7	5.2	0.9	4.1	22	2.7	<0.1
Benzo(g,h,i)perylene	0.5	-	-	-	24	<0.5	14.5	12	<0.1	13	16	27	6.6	21	100	15	0.2
Benzo(a) pyrene TEQ		40			56.9	<0.5	25.6	21	<0.5	26	30	55	16	42	250	34	<0.5
Sum of reported PAH	--	4000	--	--	458	<0.5	165	120	NIL (+)VE	140	180	300	85	210	1400	150	1.7

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[C] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects)

Cells with '-' indicates testing was not completed or an appropriate screening criteria was not available

NL: indicates that the site-specific risk-based aluminium screening criteria for industrial soil is at a concentration greater than physically possible in soil, and therefore the criteria is defined as 'Non-Limiting' or NL.

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)'

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the March 2014 investigations

TABLE LR2 Soil Analytical Results for AEC 4 Diesel Spray Area (mg/kg)

Sample Identification	PQL				SB17	SB18	MW19	MW19	SB111	SB111	SB112	SB112	SB112	SB113	SB113	SB114	SB114
Sample Depth (m)		HIL D^{A}	EIL C/I^{B}	ESL C/I	0.3-0.4	0.5-0.6	FILL 1	FILL 2	0.0-0.1	0.4-0.5	0.0-0.1	0.4-0.5	0.8-0.9	0.0-0.1	0.4-0.5	0.0-0.1	0.4-0.5
Date					18-Apr-12	18-Apr-12	19-Apr-12	19-Apr-12	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14
Sample Profile					FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL
PAEC Sampled					DSA	DSA	DSA	DSA	DSA	DSA	DSA	DSA	DSA	DSA	DSA	DSA	DSA
Sample collected by					KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG
Polycyclic Aromatic Hydrocarbons (PAH)																	
Naphthalene	0.5	-	370	-	<0.5	<0.5	<4.0	<0.5	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.5	-	-	-	<0.5	<0.5	<4.0	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	0.5	-	-	-	<0.5	3.8	8.4	1.6	<0.1	<0.1	<0.1	2	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	0.5	-	-	-	<0.5	2.2	4.2	0.8	<0.1	<0.1	<0.1	0.9	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	0.5	-	-	-	<0.5	30.2	46.7	7.8	<0.1	0.4	<0.1	8.1	<0.1	0.2	<0.1	0.1	<0.1
Anthracene	0.5	-	-	-	<0.5	6.3	9.6	1.6	<0.1	<0.1	<0.1	1.7	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	0.5	-	-	-	<0.5	59.7	137	21.6	0.4	1.5	<0.1	30	<0.1	0.4	0.1	1	0.2
Pyrene	0.5	-	-	-	<0.5	59.1	133	21.7	0.5	1.6	<0.1	32	<0.1	0.4	0.1	1	0.2
Benz(a)anthracene	0.5	-	-	-	<0.5	46.7	103	24.3	0.3	1.2	<0.1	29	<0.1	0.3	<0.1	1.4	0.2
Chrysene	0.5	-	-	-	<0.5	45.6	97.3	23.5	1	1.1	<0.1	29	<0.1	0.6	0.1	2.7	0.2
Benzo(b)&(k)fluoranthene	1	-	-	-	<0.5	60.3	140	31	0.9	2.3	<0.2	64	<0.2	0.9	0.2	4.1	0.5
Benzo(k)fluoranthene	0.5	-	-	-	<0.5	21.2	47.7	10	-	-	-	-	-	-	-	-	-
Benzo(a) pyrene	0.5	-	-	72^{C}	<0.5	43.4	101	19.2	0.48	1.5	0.06	38	<0.05	0.42	0.12	0.96	0.16
Indeno(1,2,3-c,d)pyrene	0.5	-	-	-	<0.5	41.6	57.5	17.5	0.3	1.1	<0.1	28	<0.1	0.3	<0.1	0.6	0.1
Dibenz(a,h)anthracene	0.5	-	-	-	<0.5	8.8	12.8	4.6	<0.1	0.1	<0.1	3.8	<0.1	<0.1	<0.1	0.1	<0.1
Benzo(g,h,i)perylene	0.5	-	-	-	<0.5	46.1	65	19.9	0.4	1	<0.1	23	<0.1	0.3	<0.1	0.8	0.1
Benzo(a) pyrene TEQ		40	-	-	<0.5	70.1	150.2	31.6	1	2	<0.5	55	<0.5	1	<0.5	2	<0.5
Sum of reported PAH	-	4000	-	-	<0.5	475	963	205	4.3	12	0.06	290	NIL (+)VE	3.7	0.66	13	1.7

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[C] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects)

Cells with '-' indicates testing was not completed or an appropriate screening criteria was not available

NL: indicates that the site-specific risk-based aluminium screening criteria for industrial soil is at a concentration greater than physically possible in soil, and therefore the criteria is defined as 'Non-Limiting' or NL.

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

TABLE LR3 Soil Analytical Results for AEC 8 Carbon Plant

Sample Identification	PQL				SB11	SB12	SB13	MW14	MW15	MW16	MW16	MW17	MW17	MW18	MW18	SB108	SB109	SB110	MW105	MW105
Sample Depth (m)		HIL D[A]	EIL C/I[B]	ESL C/I	0.2-0.4	1.8-1.9	1.0-1.2	0-0.4	0.1-0.4	0.2-0.4	1.8-2.0	0.2-0.4	0.8-1.0	0-0.2	0.8-1.0	0-0.1	0-0.1	0-0.1	0.15-0.25	0.3-0.4
Date					17-Apr-12	18-Apr-12	18-Apr-12	19-Apr-12	19-Apr-12	18-Apr-12	18-Apr-12	18-Apr-12	18-Apr-12	19-Apr-12	19-Apr-12	30-Jun-14	01-Jul-14	01-Jul-14	30-Jun-14	30-Jun-14
Sample Profile					FILL	FILL	FILL	FILL	FILL	FILL	ESTUARINE	FILL	ESTUARINE	FILL	ESTUARINE	FILL	FILL	FILL	FILL	FILL
PAEC Sampled					Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant
Sample collected by					KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG
Metals																				
Aluminium	50	NL*	-	-	9550	10300	14200	14700	13800	7740	3180	6740	1310	32700	8210	-	-	-	-	-
Arsenic	1	3000	160	-	10.9	16.5	3.4	6.3	5.1	0.9	1.2	0.8	0.2	12	1.8	-	-	-	-	-
Cadmium	0.1	900	-	-	<0.1	<0.1	0.1	0.1	2.4	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	-	-	-	-	-
Chromium	1	3600	320**	-	7.3	7.9	52.1	25.5	18	5	3.2	5.3	1.4	26.9	6	-	-	-	-	-
Copper	2	240000	210**	-	13.6	14.2	16	15.6	44.5	7.8	0.2	4.2	0.3	21.9	0.3	-	-	-	-	-
Nickel	1	6000	140**	-	11	12.4	34.4	53	27.8	6.4	1.8	2	0.6	51.6	4.6	-	-	-	-	-
Lead	2	1500	1800	-	6.3	6.5	25.8	9.2	44.4	3.6	1.8	37	0.6	20.6	3.3	-	-	-	-	-
Zinc	5	400000	440**	-	51.6	53.4	178	70.4	115	18.8	0.6	43.4	0.5	288	1.4	-	-	-	-	-
Mercury	0.05	730	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-
Fluoride (soluble)	40	17000*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride (total)	40	-	-	-	240	150	1960	2350	3950	700	60	200	80	7740	650	-	-	-	-	-
Non Metallic Inorganics																				
Total Cyanide	1	--	-	-	<1	<1	<1	<1	<1	3	<1	<1	<1	<1	<1	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons (PAH)																				
Naphthalene	0.5	-	370	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	4	0.2
Acenaphthylene	0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	1.9	<0.5	0.1	0.1	<0.1	7.3	0.4
Fluorene	0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.1	<0.1	<0.1	2.7	0.2
Phenanthrene	0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	16.6	<0.5	1.3	0.7	<0.1	3.4	0.2
Anthracene	0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.4	<0.5	0.3	0.3	<0.1	0.9	<0.1
Fluoranthene	0.5	-	-	-	<0.5	<0.5	<0.5	0.7	3.8	<0.5	<0.5	<0.5	<0.5	41.2	<0.5	6	2.2	<0.1	5.9	0.1
Pyrene	0.5	-	-	-	<0.5	<0.5	<0.5	0.7	3	<0.5	<0.5	<0.5	<0.5	38.3	<0.5	6	2	<0.1	4.6	0.1
Benz(a)anthracene	0.5	-	-	-	<0.5	<0.5	<0.5	0.7	5.3	<0.5	<0.5	<0.5	<0.5	47.1	<0.5	3.4	0.8	<0.1	0.8	<0.1
Chrysene	0.5	-	-	-	<0.5	<0.5	<0.5	0.8	8.1	<0.5	<0.5	<0.5	<0.5	50.3	<0.5	3.8	0.8	0.1	0.9	<0.1
Benzo(b)&(k)fluoranthene	1	-	-	-	<0.5	<0.5	<0.5	1.1	9.6	<0.5	<0.5	<0.5	<0.5	67.2	<0.5	10	1.5	<0.2	1.3	<0.2
Benzo(k)fluoranthene	0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	2.1	<0.5	<0.5	<0.5	<0.5	20.4	<0.5	-	-	-	-	-
Benzo(a) pyrene	0.5	-	-	72[C]	<0.5	<0.5	<0.5	0.6	2.1	<0.5	<0.5	<0.5	<0.5	33.6	<0.5	4.9	0.88	<0.05	0.44	<0.05
Indeno(1,2,3-c,d)pyrene	0.5	-	-	-	<0.5	<0.5	<0.5	0.6	1.5	<0.5	<0.5	<0.5	<0.5	29.2	<0.5	4.7	0.6	<0.1	0.4	<0.1
Dibenz(a,h)anthracene	0.5	-	-	-	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	7.7	<0.5	0.5	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	0.5	-	-	-	<0.5	<0.5	<0.5	0.6	1.8	<0.5	<0.5	<0.5	<0.5	28.8	<0.5	4.1	0.6	<0.1	0.3	<0.1
Benzo(a) pyrene TEQ		40	-	-	<0.5	<0.5	<0.5	1.87	4.5	<0.5	<0.5	<0.5	<0.5	58.5	<0.5	7	1	<0.5	1	<0.5
Sum of reported PAH	--	4000	-	-	<0.5	<0.5	<0.5	5.8	38.6	0.8	<0.5	<0.5	<0.5	387	<0.5	46	10	0.1	33	1.2

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[C] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects)

Cells with '-' indicates testing was not completed or an appropriate screening criteria was not available

NL: indicates that the site-specific risk-based aluminium screening criteria for industrial soil is at a concentration greater than physically possible in soil, and therefore the criteria is defined as 'Non-Limiting' or NL.

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)'

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the March 2014 investigations

TABLE LR3 Soil Analytical Results for AEC 8 Carbon Plant

Sample Identification	PQL	HIL D[A]	EIL C/I[B]	ESL C/I	MW106	MW107	HA106	HA106	HA107	HA107	HA108	HA109	HA109	HA110	HA110	HA111	HA111	HA112
Sample Depth (m)					0.0-0.1	0.15-0.25	0.1	0.15	0.1	0.2	0-0.1	0-0.1	0.3-0.4	0-0.1	0.3-0.4	0-0.1	0.3-0.4	0.1
Date					30-Jun-14	30-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14
Sample Profile					FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL
PAEC Sampled					Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant
Sample collected by					KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG
Metals																		
Aluminium	50	NL*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	1	3000	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	0.1	900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	1	3600	320**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	2	240000	210**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	1	6000	140**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	2	1500	1800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	5	400000	440**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	0.05	730	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride (soluble)	40	17000*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride (total)	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non Metallic Inorganics																		
Total Cyanide	1	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons (PAH)																		
Naphthalene	0.5	-	370	-	<0.1	<0.1	<0.1	<0.1	1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.5	-	-	-	<0.1	<0.1	<0.1	<0.1	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	0.5	-	-	-	<0.1	<0.1	0.6	0.7	4.3	8.3	0.4	0.4	0.2	1.5	0.1	1.2	1.1	0.2
Fluorene	0.5	-	-	-	<0.1	<0.1	0.3	0.3	2.6	3.6	0.2	0.2	<0.1	1	<0.1	0.8	0.4	0.1
Phenanthrene	0.5	-	-	-	0.1	<0.1	5.5	6.3	24	68	3.5	3.4	1.5	15	1.8	12	12	2.4
Anthracene	0.5	-	-	-	<0.1	<0.1	1.2	1.3	5.7	11	0.8	0.9	0.4	3.8	0.5	3.1	3.7	0.6
Fluoranthene	0.5	-	-	-	0.6	<0.1	19	20	76	220	12	11	4.5	43	7.8	37	46	9.3
Pyrene	0.5	-	-	-	0.6	<0.1	19	19	72	220	12	10	4.5	40	7.8	35	46	9
Benz(a)anthracene	0.5	-	-	-	0.7	<0.1	18	14	70	150	9	10	2.6	40	5.5	36	34	9.3
Chrysene	0.5	-	-	-	0.9	<0.1	19	13	70	130	9.3	10	2.5	41	5.5	37	34	9.8
Benzo(b)&(k)fluoranthene	1	-	-	-	2.4	<0.2	46	30	170	290	22	25	5.6	96	13	86	76	25
Benzo(k)fluoranthene	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a) pyrene	0.5	-	-	72[C]	0.72	<0.05	25	18	98	180	13	14	3.7	55	8.1	50	47	14
Indeno(1,2,3-c,d)pyrene	0.5	-	-	-	0.7	<0.1	19	15	63	150	9.1	10	2.4	41	5.8	38	36	10
Dibenz(a,h)anthracene	0.5	-	-	-	0.1	<0.1	2.7	2	15	16	0.9	1.7	0.3	9.4	0.7	8.4	4.4	1.4
Benzo(g,h,i)perylene	0.5	-	-	-	0.7	<0.1	18	14	59	130	8.9	9.7	2.3	37	5.5	33	32	9.2
Benzo(a) pyrene TEQ		40	-	-	1	<0.5	36	26	140	260	18	21	5	82	11	75	67	20
Sum of reported PAH	--	4000	-	-	7.6	NIL (+)VE	190	150	730	1600	100	110	30	420	63	380	370	100

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[C] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinoge

Cells with '-' indicates testing was not completed or an appropriate screening criteria was not available

NL: indicates that the site-specific risk-based aluminium screening criteria for industrial soil is at a con

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening Level Health Risk Asse

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collec

TABLE LR4 Soil Analytical Results for AEC 11 Washdown Bay

Sample Identification	PQL	Guideline		SB9	SB9	MW11	SB101	SB101
Sample Depth (m)		HIL D[A]	EIL C/I[B]	0.3-0.4	0.6-0.8	0-0.2	0.0-0.1	0.3-0.4
Date				16-Apr-12	16-Apr-12	16-Apr-12	30-Jun-14	30-Jun-14
Sample Profile				FILL	FILL	FILL	FILL	FILL
PAEC Sampled				Washbay	Washbay	Washbay	Washbay	Washbay
Sample collected by				KJG	KJG	KJG	KJG	KJG
Metals								
Aluminium	50	NL*	-	39800	12600	15000	-	-
Arsenic	1	3000	160	17.1	23.9	5.8	-	-
Cadmium	0.1	900	-	11.1	0.2	0.2	-	-
Chromium	1	3600	320**	59.5	18.8	23.7	-	-
Copper	2	240000	210**	82	62	36.3	-	-
Nickel	1	6000	140**	152	29.4	24.5	-	-
Lead	2	1500	1800	185	66.4	48	-	-
Zinc	5	400000	440**	578	621	420	-	-
Mercury	0.05	730	-	0.2	<0.1	<0.1	-	-
Fluoride (soluble)	40	17000*	-	-	-	-	94	73
Fluoride (total)	40	-	-	39000	1230	960	-	-
Non Metallic Inorganics								
Total Cyanide	1	1500	-	-	-	<1	-	-

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

Cells with '-' indicates testing was not completed or an appropriate screening criteria was not available

NL: indicates that the site-specific risk-based aluminium screening criteria for industrial soil is at a concentration greater than physically possible in soil, and therefore the criteria is defined as 'Non-Limiting' or NL.

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)'

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the March 2014 investigations

TABLE LR5 Soil Analytical Results for AEC 12 Pot Lines and PAEC 25 Dry Scrubbers

Sample Identification	PQL			SB1	SB2	SB3	SB4	SB115	SB116	SB116	SB117	SB117	SB118	SB118	SB119	SB119	SB120	SB121
Sample Depth (m)		HIL D[A]	EIL C/I[B]	0-0.05	0-0.05	0-0.05	0-0.05	0.0-0.1	0.0-0.1	0.1-0.2	0.0-0.1	0.1-0.2	0.0-0.1	0.2-0.3	0.0-0.1	0.3-0.4	0.0-0.1	0.0-0.1
Date				12/04/2012	12/04/2012	12/04/2012	12/04/2012	01-Jul-14	01-Jul-14	01-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14
Sample Profile				FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL
PAEC Sampled				Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers
Sample collected by				FR	FR	FR	FR	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG
Metals																		
Aluminium	50	NL*	-	53300	139000	138000	41700	-	-	-	-	-	-	-	-	-	-	-
Arsenic	1	3000	160	4.5	28.9	8.8	14.6	-	-	-	-	-	-	-	-	-	-	-
Cadmium	0.1	900	-	0.7	1.8	1.4	0.8	-	-	-	-	-	-	-	-	-	-	-
Chromium	1	3600	320**	26.8	35	14.8	36	-	-	-	-	-	-	-	-	-	-	-
Copper	2	240000	210**	21.1	280	18.9	89.8	-	-	-	-	-	-	-	-	-	-	-
Nickel	1	6000	140**	98	159	166	65.7	-	-	-	-	-	-	-	-	-	-	-
Lead	2	1500	1800	25	430	28.7	247	-	-	-	-	-	-	-	-	-	-	-
Zinc	5	400000	440**	229	5400	444	1210	-	-	-	-	-	-	-	-	-	-	-
Mercury (inorganic)	0.05	730	-	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-
Fluoride (soluble)	40	17000*	-	-	-	-	-	73	140	48	13	24	17	29	55	36	3.1	20
Fluoride (total)	40	-	-	13400	26400	41900	20900	-	-	-	-	-	-	-	-	-	-	-

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

Cells with '-' indicates testing was not completed or an appropriate screening criteria was not available

NL: indicates that the site-specific risk-based aluminium screening criteria for industrial soil is at a concentration greater than physically possible in soil, and therefore the criteria is defined as 'Non-Limiting' or NL.

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)'

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the March 2014 investigations

TABLE LR5 Soil Analytical Results for AEC 12 Pot Line

Sample Identification	PQL			SB121	SB122	SB123	SB123	SB124	SB125	SB126	SB127	SB127	SB127	SB128	SB129	SB129	SB129	SB131
Sample Depth (m)		HIL D[A]	EIL C/I[B]	0.1-0.2	0.0-0.1	0.0-0.1	0.1-0.2	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.1-0.2	0.4-0.6	0.0-0.1	0.0-0.1	0.1-0.2	0.9-1.0	0.0-0.1
Date				01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	01-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14
Sample Profile				FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	ALLUVIAL	FILL	FILL	FILL	FILL	FILL
PAEC Sampled				Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers
Sample collected by				KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG
Metals																		
Aluminium	50	NL*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	1	3000	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	0.1	900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	1	3600	320**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	2	240000	210**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	1	6000	140**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	2	1500	1800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	5	400000	440**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury (inorganic)	0.05	730	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride (soluble)	40	17000*	-	7.8	44	87	140	87	210	250	7.5	14	0.6	23	23	16	2.7	10
Fluoride (total)	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

Cells with '-' indicates testing was not completed or an appropriate screening crite

NL: indicates that the site-specific risk-based aluminium screening criteria for ind

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening L

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and T

TABLE LR5 Soil Analytical Results for AEC 12 Pot Line

Sample Identification	PQL	HIL D[A]	EIL C/I[B]	SB131	SB132	SB133	SB133	SB134	SB135	SB135	HA101	HA101	HA101	HA102	HA102	HA102	HA103	HA103	HA104
Sample Depth (m)				0.3-0.4	0.0-0.1	0.2-0.3	0.3-0.4	0-0.1	0-0.1	0.3-0.4	Surface	0.1	0.2	Surface	0.1	0.15	Surface	0.1	Surface
Date				02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	26/06/2014	26/06/2014	26/06/2014	26/06/2014	26/06/2014	26/06/2014	26/06/2014	26/06/2014	26/06/2014
Sample Profile				ALLUVIAL	FILL	ALLUVIAL	ALLUVIAL	FILL	FILL	FILL									
PAEC Sampled				Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines	Pot Lines
Sample collected by				KG	KG	KG	KG	KG	KG	KG	KW	KW	KW	KW	KW	KW	KW	KW	KW
Metals																			
Aluminium	50	NL*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	1	3000	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	0.1	900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	1	3600	320**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	2	240000	210**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	1	6000	140**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	2	1500	1800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	5	400000	440**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury (inorganic)	0.05	730	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride (soluble)	40	17000*	-	52	2.3	5	27	2.3	22	36	28	180	62	53	78	120	140	180	90
Fluoride (total)	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

Cells with '-' indicates testing was not completed or an appropriate screening crite

NL: indicates that the site-specific risk-based aluminium screening criteria for ind

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening L

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and T

TABLE LR5 Soil Analytical Results for AEC 12 Pot Line

Sample Identification	PQL	HIL D[A]	EIL C/I[B]	HA104	HA105	HA105	HA105
Sample Depth (m)				0.1	Surface	0.1	0.2
Date				26/06/2014	26/06/2014	26/06/2014	26/06/2014
Sample Profile							
PAEC Sampled				Pot Lines	Pot Lines	Pot Lines	Pot Lines
Sample collected by				KW	KW	KW	KW
Metals							
Aluminium	50	NL*	-	-	-	-	-
Arsenic	1	3000	160	-	-	-	-
Cadmium	0.1	900	-	-	-	-	-
Chromium	1	3600	320**	-	-	-	-
Copper	2	240000	210**	-	-	-	-
Nickel	1	6000	140**	-	-	-	-
Lead	2	1500	1800	-	-	-	-
Zinc	5	400000	440**	-	-	-	-
Mercury (inorganic)	0.05	730	-	-	-	-	-
Fluoride (soluble)	40	17000*	-	82	100	120	67
Fluoride (total)	40	-	-	-	-	-	-

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

Cells with '-' indicates testing was not completed or an appropriate screening crite

NL: indicates that the site-specific risk-based aluminium screening criteria for ind

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening L

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and T

TABLE LR6 Soil Analytical Results for PAEC 26 Ring furnace Scrubber

Sample Identification	PQL				HA113	HA113	HA114	HA115	HA115	HA116	HA116	HA117	HA117	HA119	HA119	HA120	HA121	HA122	HA122	SB106
Sample Depth (m)		HIL D[A]	EIL C/I[B]	ESL C/I	0-0.1	0.3-0.4	0-0.1	0-0.1	0.2-0.3	0-0.1	0.3-0.4	0-0.1	0.25-0.35	0-0.1	0.3-0.4	0-0.1	0-0.1	0-0.1	0.3-0.4	0.0-0.1
Date					27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	27-Jun-14	30-Jun-14
Sample Profile					FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL	FIILL
PAEC Sampled					27/06/2014	27/06/2014	27/06/2014	27/06/2014	27/06/2014	27/06/2014	27/06/2014	27/06/2014	27/06/2014	27/06/2014	27/06/2014	27/06/2014	27/06/2014	27/06/2014	27/06/2014	30/06/2014
Sample collected by					KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KG
Metals																				
Fluoride (soluble)	40	17000*		-	40	130	29	7.9	-	28	-	13	-	76	130	13	17	39	68	38
Polycyclic Aromatic Hydrocarbons (PAH)																				
Naphthalene	0.1	-	370	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.1	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	0.1	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	0.1	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	0.1	-	-	-	2.7	0.9	0.4	16	2.2	4.2	0.2	4	<0.1	5.6	1.5	1.4	0.1	0.4	0.7	<0.1
Anthracene	0.1	-	-	-	0.7	0.3	<0.1	3.5	0.6	0.8	<0.1	1.3	<0.1	1	0.4	0.4	<0.1	<0.1	0.2	<0.1
Fluoranthene	0.1	-	-	-	15	3.2	3.1	210	40	41	3.4	38	0.3	17	5.8	12	1.2	2.4	2.6	0.2
Pyrene	0.1	-	-	-	14	3.1	3	240	50	41	3.4	38	0.3	16	5.6	11	1.2	2.3	2.5	0.3
Benz(a)anthracene	0.1	-	-	-	9.5	1.5	4.4	300	61	57	3.1	52	0.2	16	3.2	14	1.5	2.4	1.4	0.3
Chrysene	0.1	-	-	-	12	1.6	8.1	490	110	110	5.8	110	0.3	21	3.3	26	2.8	4.2	1.7	0.3
Benzo(b)&(k)fluoranthene	0.2	-	-	-	28	3.6	18	990	230	240	12	300	0.8	53	7.4	69	7.4	8.8	3.8	0.7
Benzo(a) pyrene	0.05	-	-	72[C]	8.6	1.9	3.7	230	44	42	1.7	47	0.26	19	4.3	12	1.4	2.2	1.7	0.3
Indeno(1,2,3-c,d)pyrene	0.1	-	-	-	7.4	1.3	3.1	190	44	48	2.9	76	0.3	17	3.1	20	2.2	2.1	1.2	0.3
Dibenz(a,h)anthracene	0.1	-	-	-	1.4	0.2	0.8	60	15	12	0.7	25	<0.1	3	0.3	4.9	0.5	0.4	0.2	<0.1
Benzo(g,h,i)perylene	0.1	-	-	-	7.5	1.2	3.3	190	42	53	2.9	81	0.3	16	2.9	21	2.4	2.1	1.3	0.3
Benzo(a) pyrene TEQ	0.5	40	-	-	15	3	7	440	94	90	4	120	<0.5	31	6	28	3	4	3	<0.5
Sum of reported PAH	--	4000	-	-	110	19	47	2900	640	640	37	770	2.8	190	38	190	21	27	17	2.7

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[C] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects)

Cells with '-' indicates testing was not completed or an appropriate screening criteria was not available

NL: indicates that the site-specific risk-based aluminium screening criteria for industrial soil is at a concentration greater than physically possible in soil, and therefore the criteria is defined as 'Non-Limiting' or NL.

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)'

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the March 2014 investigations

TABLE LR7 Soil Analytical Results for PAEC 28 Playing Fields

Sample Identification	PQL	HIL D^A	HSL D^B	EIL C/I^C	Management Limits^D	ESL C/I^E	TP101	TP104	TP107	TP111	TP113	TP115	TP116
Sample Depth (m)							0.2	0-0.2	0.5	0-0.3	0.4-0.5	0.4-0.5	0.1-0.3
Date							23-Jun-14	23-Jun-14	23-Jun-14	23-Jun-14	23-Jun-14	23-Jun-14	23-Jun-14
Sample Profile							Estuarine	Estuarine	Estuarine	Fiill	Estuarine	Estuarine	Fill
PAEC Sampled							Playing Fields	Playing Fields	Playing Fields	Playing Fields	Playing Fields	Playing Fields	Playing Fields
Sample collected by							KW	KW	KW	KW	KW	KW	KW
Metals													
Arsenic	4	3000		160			<4	<4	<4	<4	<4	<4	63
Cadmium	0.4	900		-			<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.5
Chromium	1	3600		320**			3	12	<1	23	17	11	12
Copper	1	240,000		210**			2	2	<1	2	<1	<1	590
Lead	1	1500		1800			5	10	1	12	24	4	1600
Mercury	0.1	730		-			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	1	6000		140**			8	5	1	6	3	1	5
Zinc	1	400,000		440**			32	36	3	35	5	2	5600
Fluoride (soluble)	0.5	17000*		-			45	16	19	22	<0.5	2.1	31
Polycyclic Aromatic Hydrocarbons (PAH)													
Naphthalene	0.1			370			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	0.1						0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	0.1						0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Benz(a)anthracene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b)&(k)fluoranthene	0.2						<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a) pyrene	0.05					72^F	0.07	0.12	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenz(a,h)anthracene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a) pyrene TEQ	0.5	40					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of reported PAH	--	4000					0.35	0.69	NIL (+)VE	NIL (+)VE	NIL (+)VE	NIL (+)VE	NIL (+)VE
Total Petroleum Hydrocarbons (TPH)													
TRH C6-C10	25				800		<25	<25	<25	<25	<25	<25	<25
TRH >C10-C16	50				1000	170	<50	<50	<50	<50	<50	<50	<50
TRH >C16-C34	100				5000	2500	<100	<100	<100	<100	<100	<100	<100
TRH >C34-C40	100				10000	6600	<100	<100	<100	<100	<100	<100	<100
TRH C6-C10 - BTEX (F1)	25		260			215	<25	<25	<25	<25	<25	<25	<25
TRH >C10-C36 - Naph (F2)	50		NL				<50	<50	<50	<50	<50	<50	<50
Benzene, Toluene, Ethyl benene, Xylene (BTEX)													
Benzene	0.2		3			75	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.5		NL			135	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	2		NL			165	<2	<2	<2	<2	<2	<2	<2
Xylenes	1		230			180	<1	<1	<1	<1	<1	<1	<1

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Soil Health Screening Level for Vapour Intrusion 'D' Commercial/ Industrial

[C] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[D] NEPM (2013) Management Limits for TPH Fractions F1 to F4 in soil

[E] NEPM (2013) Ecological Screening Level for Commercial/ Industrial

[F] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects)

Cells with '-' indicates testing was not completed or an appropriate screening criteria was not available

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)'

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the March 2014 investigations

NL: If the derived soil HSL exceeds the soil saturation concentration the HSL is shown as 'not limiting' or 'NL'.

TABLE LR8 Soil Analytical Results for PAEC 29 Area East of Playing Fields

Sample Identification	PQL	HIL D^{A}	HSL D^{B}	EIL C/I^{C}	Management Limits^{D}	ESL C/I^{E}	TP117	TP118	TP119	TP120	TP122	TP123	TP124	TP125	TP126	TP127
Sample Depth (m)							0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Date							25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14
Sample Profile							FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL
PAEC Sampled							EPF	EPF	EPF	EPF	EPF	EPF	EPF	EPF	EPF	EPF
Sample collected by							KW	KW	KW	KW	KW	KW	KW	KW	KW	KW
Metals																
Arsenic	4	3000		160			<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Cadmium	0.4	900		-			<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	1	3600		320**			11	5	3	3	5	7	7	7	5	6
Copper	1	240,000		210**			17	4	3	2	1	2	3	2	5	3
Lead	1	1500		1800			23	7	8	18	6	9	7	8	6	6
Mercury	0.1	730		-			0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	1	6000		140**			18	6	4	4	3	7	5	6	4	4
Zinc	1	400,000		440**			51	41	20	22	14	26	12	57	23	13
Fluoride (soluble)	40	17000*		-			340	22	28	17	26	23	17	27	15	19
Polycyclic Aromatic Hydrocarbons (PAH)																
Naphthalene	0.1			370			1.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	0.1						7.6	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	0.1						2.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	0.1						130	0.2	0.1	<0.1	0.1	0.2	<0.1	0.1	0.1	0.2
Anthracene	0.1						33	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	0.1						390	0.5	0.5	0.2	0.5	0.7	0.1	0.4	0.4	0.6
Pyrene	0.1						380	0.4	0.5	0.2	0.5	0.7	<0.1	0.4	0.4	0.5
Benz(a)anthracene	0.1						180	0.2	0.4	0.1	0.3	0.4	<0.1	0.3	0.2	0.2
Chrysene	0.1						170	0.2	0.4	0.1	0.4	0.4	<0.1	0.3	0.2	0.2
Benzo(b)&(k)fluoranthene	0.2						320	0.4	1.2	0.2	0.8	1	<0.2	0.8	0.4	0.3
Benzo(a) pyrene	0.05					72^{F}	220	0.23	0.58	0.13	0.47	0.56	0.06	0.41	0.21	0.17
Indeno(1,2,3-c,d)pyrene	0.1						120	0.2	0.5	0.1	0.4	0.5	<0.1	0.4	0.2	0.1
Dibenz(a,h)anthracene	0.1						26	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	0.1						120	0.2	0.4	0.1	0.4	0.4	<0.1	0.3	0.1	0.1
Benzo(a) pyrene TEQ	0.5	40					310	<0.5	1	<0.5	1	1	<0.5	1	<0.5	<0.5
Sum of reported PAH	--	4000					2100	2.5	4.8	1	4	4.8	0.18	3.5	2.3	2.2
Total Petroleum Hydrocarbons (TPH)																
TRH C6-C10	25				800		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH >C10-C16	50				1000	170	<50	<50	<50	<50	<50	61	<50	<50	<50	<50
TRH >C16-C34	100				5000	2500	5100	<100	<100	<100	<100	150	<100	<100	<100	<100
TRH >C34-C40	100				10000	6600	1000	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRH C6-C10 - BTEX (F1)	25		260			215	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH >C10-C36 - Naph (F2)	50		NL				<50	<50	<50	<50	<50	61	<50	<50	<50	<50
Benzene, Toluene, Ethyl benene, Xylene (BTEX)																
Benzene	0.2		3			75	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.5		NL			135	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	2		NL			165	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Xylenes	1		230			180	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Soil Health Screening Level for Vapour Intrusion 'D' Commercial/ Industrial

[C] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[D] NEPM (2013) Management Limits for TPH Fractions F1 to F4 in soil

[E] NEPM (2013) Ecological Screening Level for Commercial/ Industrial

[F] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects)

Cells with '-' indicates testing was not completed or an appropriate screening criteria was not available

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

TABLE LR9 Soil Analytical Results for PAEC 31 Storage Area west of Pot Line 3

Sample Identification	PQL	HIL D[A]	HSL D[B]	EIL C/I[C]	Management Limits[D]	ESL C/I[E]	TP128	TP128	TP129	TP130	TP130	TP131	TP132	TP132	TP133	TP134	TP135	TP135	TP136	TP137	TP137
Sample Depth (m)							0.1	0.2	0-0.3	0-0.3	0.6-0.7	0.1-0.3	0.1	0.4	0.1-0.2	0.2	0.1	0.4	0.1	0.1	0.4
Date							25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14	25-Jun-14
Sample Profile							FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL	FILL
PAEC Sampled							SAPL3	SAPL3	SAPL3	SAPL3	SAPL3	SAPL3	SAPL3	SAPL3	SAPL3	SAPL3	SAPL3	SAPL3	SAPL3	SAPL3	SAPL3
Sample collected by							KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW	KW
Metals																					
Arsenic	4	3000		160			30	6	6	<4	<4	7	20	<4	8	7	9	6	6	<4	5
Cadmium	0.4	900		-			<0.4	<0.4	<0.4	<0.4	<0.4	4.3	<0.4	<0.4	<0.4	0.4	0.6	<0.4	<0.4	<0.4	<0.4
Chromium	1	3600		320**			17	8	15	9	29	29	33	15	11	10	19	13	6	20	18
Copper	1	240,000		210**			94	12	8	12	1	48	44	2	22	28	140	12	10	24	<1
Lead	1	1500		1800			120	8	9	11	8	23	13	10	21	47	38	16	7	29	17
Mercury	0.1	730		-			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	1	6000		140**			18	14	47	54	8	130	27	3	16	21	17	6	10	12	4
Zinc	1	400,000		440**			510	48	47	86	15	240	130	8	140	220	210	47	42	76	22
Fluoride (soluble)	40	17000*		-			220	800	200	1463	120	87	58	0.9	1.1	110	110	4.6	13	2.2	7
Polycyclic Aromatic Hydrocarbons (PAH)																					
Naphthalene	0.1			370			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	0.1						<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	0.1						<0.1	<0.1	0.4	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	0.1						<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	0.1						<0.1	<0.1	1	1	<0.1	0.2	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	0.1						<0.1	<0.1	0.9	1	<0.1	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benz(a)anthracene	0.1						<0.1	<0.1	0.5	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	0.1						<0.1	<0.1	0.5	0.6	<0.1	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b)&(k)fluoranthene	0.2						<0.2	<0.2	1.1	1	<0.2	0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a) pyrene	0.05					72[F]	0.08	<0.05	0.64	0.56	<0.05	0.11	0.06	<0.05	0.11	<0.05	0.05	<0.05	<0.05	0.08	<0.05
Indeno(1,2,3-c,d)pyrene	0.1						<0.1	<0.1	0.5	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenz(a,h)anthracene	0.1						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	0.1						<0.1	<0.1	0.5	0.4	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1
Benzo(a) pyrene TEQ	0.5	40					<0.5	<0.5	1	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of reported PAH	--	4000					0.08	NIL (+)VE	6.2	5.7	NIL (+)VE	0.76	0.06	0.13	0.84	NIL (+)VE	0.05	NIL (+)VE	NIL (+)VE	0.18	NIL (+)VE
Total Petroleum Hydrocarbons (TPH)																					
TRH C6-C10	25				800		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH >C10-C16	50				1000	170	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRH >C16-C34	100				5000	2500	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	590	<100
TRH >C34-C40	100				10000	6600	<100	<100	<100	<100	<100	<100	<100	<100	120	<100	<100	<100	<100	<100	<100
TRH C6-C10 - BTEX (F1)	25		260			215	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
TRH >C10-C36 - Naph (F2)	50		NL				<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
benzene, Toluene, Ethyl benzene, Xylene (BTEX)																					
Benzene	0.2		3			75	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	0.5		NL			135	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	2		NL			165	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Xylenes	1		230			180	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

All results are in units of mg/kg.

[A] NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

[B] NEPM (2013) Soil Health Screening Level for Vapour Intrusion 'D' Commercial/ Industrial

[C] NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

[D] NEPM (2013) Management Limits for TPH Fractions F1 to F4 in soil

[E] NEPM (2013) Ecological Screening Level for Commercial/ Industrial

[F] Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHs) (Environmental and Human Health Effects)

Cells with '-' indicates testing was not completed or an appropriate screening criteria was not available

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)'

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the March 2014 investigations

NL: If the derived soil HSL exceeds the soil saturation concentration the HSL is shown as 'not limiting' or 'NL'.

TABLE LR9 Soil Analytical Results for PAEC 31 Storage Area west of Pot Line 3

Sample Identification	PQL	HIL D^{A}	HSL D^{B}	EIL C/I^{C}	Management Limits^{D}	ESL C/I^{E}	TP138	TP139	TP140
Sample Depth (m)							0.2	0.1	0.1
Date							25-Jun-14	25-Jun-14	25-Jun-14
Sample Profile							FILL	FILL	FILL
PAEC Sampled							SAPL3	SAPL3	SAPL3
Sample collected by							KW	KW	KW
Metals									
Arsenic	4	3000		160			<4	4	<4
Cadmium	0.4	900		-			<0.4	<0.4	<0.4
Chromium	1	3600		320**			7	17	7
Copper	1	240,000		210**			<1	26	1
Lead	1	1500		1800			8	33	13
Mercury	0.1	730		-			<0.1	<0.1	<0.1
Nickel	1	6000		140**			3	15	5
Zinc	1	400,000		440**			41	280	7
Fluoride (soluble)	40	17000*		-			5.5	79	50
Polycyclic Aromatic Hydrocarbons (PAH)									
Naphthalene	0.1			370			<0.1	0.4	<0.1
Acenaphthylene	0.1						<0.1	<0.1	<0.1
Acenaphthene	0.1						<0.1	0.6	<0.1
Fluorene	0.1						<0.1	0.6	<0.1
Phenanthrene	0.1						<0.1	2.3	<0.1
Anthracene	0.1						<0.1	0.3	<0.1
Fluoranthene	0.1						<0.1	3.8	<0.1
Pyrene	0.1						<0.1	3.4	<0.1
Benz(a)anthracene	0.1						<0.1	2.4	<0.1
Chrysene	0.1						<0.1	2.7	<0.1
Benzo(b)&(k)fluoranthene	0.2						<0.2	5.6	<0.2
Benzo(a) pyrene	0.05					72^{F}	<0.05	2.9	<0.05
Indeno(1,2,3-c,d)pyrene	0.1						<0.1	2.1	<0.1
Dibenz(a,h)anthracene	0.1						<0.1	0.3	<0.1
Benzo(g,h,i)perylene	0.1						<0.1	1.9	<0.1
Benzo(a) pyrene TEQ	0.5	40					<0.5	4	<0.5
Sum of reported PAH	--	4000					NIL (+)VE	29	NIL (+)VE
Total Petroleum Hydrocarbons (TPH)									
TRH C6-C10	25				800		<25	<25	<25
TRH >C10-C16	50				1000	170	<50	<50	<50
TRH >C16-C34	100				5000	2500	<100	<100	<100
TRH >C34-C40	100				10000	6600	<100	<100	<100
TRH C6-C10 - BTEX (F1)	25		260			215	<25	<25	<25
TRH >C10-C36 - Naph (F2)	50		NL				<50	<50	<50
benzene, Toluene, Ethyl benzene, Xylene (BTEX)									
Benzene	0.2		3			75	<0.2	<0.2	<0.2
Toluene	0.5		NL			135	<0.5	<0.5	<0.5
Ethylbenzene	2		NL			165	<2	<2	<2
Xylenes	1		230			180	<1	<1	<1

All results are in units of mg/kg.

^{A} NEPM (2013) Health Investigation Level 'D' (Industrial/ Commercial)

^{B} NEPM (2013) Soil Health Screening Level for Vapour Intrusion 'D' Commercial/ Industrial

^{C} NEPM (2013) Ecological Investigation Levels for Commercial/ Industrial

^{D} NEPM (2013) Management Limits for TPH Fractions F1 to F4 in soil

^{E} NEPM (2013) Ecological Screening Level for Commercial/ Industrial

^{F} Canadian Council of Ministries of the Environment (2010) Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocar

Cells with '-' indicates testing was not completed or an appropriate screening criteria was not available

PQL = Practical Quantitation Limit.

Results shown in shading are in excess of the human health criteria

Results shown in underline are in excess of the ecological criteria

<LOR or <value = Less than the laboratory Limit of Reporting

* Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIR

** EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and TOC (1.3%) data collected from the Buffer Zone during the March 2

NL: If the derived soil HSL exceeds the soil saturation concentration the HSL is shown as 'not limiting' or 'NL'.

TABLE LR10 Groundwater Analytical Results (µg/L)

Sample Identification	PQL	Guideline				MW06	MW06	MW101	MW102	MW07	MW07	MW08	MW08	MW09	MW09	MW10	MW10	MW11	MW11	MW12	MW12	MW13	MW13	MW103	MW104
Date		95% Fresh [A]	Recreational	Irrigation	Stock	2/5/12	10/7/14	9/7/14	9/7/14	1/5/12	9/7/14	1/5/12	9/7/14	30/4/12	9/7/14	30/4/12	9/7/14	1/5/12	9/7/14	30/4/12	9/7/14	1/5/12	9/7/14	9/7/14	9/7/14
PAEC Sampled						Background	Background	Refuelling	Refuelling	Refuelling	Refuelling	Refuelling	Refuelling	FLS	FLS	FLS	FLS	Washbay	Washbay	AWP	AWP	AWP	AWP	AWP	AWP
Sample Appearance						Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Cloudy	Clear	Turbid	Clear	Milky	Clear	Brown	Clear	Cloudy	Brown	Clear	Clear
Sample collected by						KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG
Metals																									
Aluminium pH>6.5	10	55	9000	5000	5000	10	180	<10	<10	30	<10	150	1200	10	30	<10	2900	380	390	13,600	<10	2,150	2,500	7,700	1,300
Arsenic	1	24	100	100	500	<10	1	2	1	13	6	3	<1	3	2	2	3	18	1	16	<1	4	<1	1	2
Cadmium	0.1	2*	20	10	10	<1	<0.1	<0.1	<0.1	0.2	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.1	<0.1	<0.1	<0.1	0.2	<0.1
Chromium	1	27*	500	100	1000	<10	<1	<1	<1	<10	<1	2	1	<1	<1	<1	3	2	<1	29	<1	4	6	<1	6
Copper	1	12*	20,000	200	500	<10	1	4	2	10	<1	<1	<1	2	1	1	<1	2	<1	88	<1	1	<1	<1	3
Nickel	1	97*	200	200	1000	22	20	9	2	30	2	2	<1	16	14	19	24	5	6	110	15	2	<1	18	5
Lead	1	87*	100	2000	100	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	133	<1	<1	<1	<1	<1
Zinc	5	70*	30,000	2000	20,000	78	16	10	4	28	3	12	<1	9	1	10	9	28	2	699	8	25	2	92	8
Mercury	0.1	0.6	10	2	2	<0.1	<0.05	<0.05	<0.05	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	<0.05	<0.05
Fluoride	100		1500	1000	2000	1000	220	460	3200	1300	1400	4900	6700	1000	560	1200	2100	3900	8300	1700	220	43000	40000	12000	13000
Non Metallic Inorganics																									
Free Cyanide	4	7	800			<4								<8		<4		<4		<8		7			
Total Cyanide	4	NA				<4								<8		<4		13		<8		40			
Total Petroleum Hydrocarbons (TPH)																									
TPH C6-C9	20							<10	18	<20	<10	<20	<10												
TPH C10-C14	50							<50	<50	<50	<50	<50	<50												
TPH C15-C28	100							<100	<100	<100	<100	330	<100												
TPH C29-C36	100							<100	<100	<50	<100	<50	<100												
TPH C6-C36		LOR		LOR	LOR			<100	18	<50	<100	330	<100												
Polycyclic Aromatic Hydrocarbons (PAH)																									
Naphthalene	0.1	16				<0.1				<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	0.1					<0.1				<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	0.1					<0.1				<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	<0.1	0.2	<0.1	<0.1	<0.1
Fluorene	0.1					<0.1				<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	0.1	*2*				<0.1				<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	<0.1	0.9	<0.1	<0.1	<0.1
Anthracene	0.1	*0.4*				<0.1				<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	<0.1	0.2	<0.1	<0.1	<0.1
Fluoranthene	0.1	*1.4*				<0.1				<0.1		<0.1		0.2		<0.1		<0.1		0.3	<0.1	4.8	<0.1	<0.1	0.1
Pyrene	0.1					<0.1				<0.1		<0.1		0.2		<0.1		<0.1		0.3	<0.1	5	<0.1	<0.1	0.2
Benz(a)anthracene	0.1					<0.1				<0.1		<0.1		0.3		<0.1		<0.1		0.3	<0.1	4	<0.1	<0.1	<0.1
Chrysene	0.1					<0.1				<0.1		<0.1		0.6		<0.1		<0.1		0.2	<0.1	3.6	<0.1	<0.1	0.1
Benzo(b)&(k)fluoranthene	0.2					<0.2				<0.2		<0.2		1.8		<0.2		<0.2		0.8	<0.2	10.8	<0.2	<0.2	<0.2
Benzo(a) pyrene	0.05	*0.2*				<0.05				<0.05		<0.05		<0.05		<0.05		<0.05		0.4	<0.05	6.46	<0.05	<0.05	0.1
Indeno(1,2,3-c,d)pyrene	0.1					<0.1				<0.1		<0.1		0.2		<0.1		<0.1		0.2	<0.1	3	<0.1	<0.1	0.1
Dibenz(a,h)anthracene	0.1					<0.1				<0.1		<0.1		0.1		<0.1		<0.1		<0.1	<0.1	1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	0.1					<0.1				<0.1		<0.1		0.4		<0.1		<0.1		0.2	<0.1	2.6	<0.1	<0.1	0.1
Semivolatile Organic Compounds (SVOCs)																									
Organochlorine Pesticides (OCP)																									
alpha-BHC	2					<2								<2		<2									
HCB	2					<2								<2		<2									
delta-BHC	2					<2								<2		<2									
Heptachlor	2	0.09				<2								<2		<2									
Aldrin	2	*0.001*				<2								<2		<2									
Heptachlor epoxide	2					<2								<2		<2									
Chlordane	2	0.08				<2								<2		<2									
Endosulfan	2	0.2				<2								<2		<2									
Dieldrin	2	*0.01*				<2								<2		<2									
DDE	2	*0.03*				<2								<2		<2									
Endrin	2	0.02				<2								<2		<2									
DDD	2					<2								<2		<2									
Endrin aldehyde	2					<2								<2		<2									
Endosulfan sulfate	2					<2								<2		<2									
DDT	4	0.01				<4								<4		<4									
Organophosphorous Pesticides (OPP)																									
Dichlorvos	2					<2								<2		<2									
Dimethoate	2	0.15				<2								<2		<2									
Diazinon	2	0.01				<2								<2		<2									
Chlorpyrifos-methyl	2					<2								<2		<2									
Malathion	2	0.05				<2								<2		<2									
Fenthion	2	0.2				<2								<2		<2									
Chlorpyrifos	2					<2								<2		<2									
Bromophos-ethyl	2					<2								<2		<2									
Chlorfenvinphos	2					<2								<2		<2									
Prothiofos	2					<2								<2		<2									
Ethion	2					<2								<2		<2									
Phenols																									
Total Phenolics	4	320				<4								<4		<4									
Phthalate Esthers																									
Dimethylphthalate	2	3700				<2								<2		<2									
Diethylephthalate	2	1000				<2								<2		<2									
Nitrosamines																									
Total Nitrosamines	2					<2								<2		<2									
Nitroaromatics and Ketones																									
Total Nitroaromatics and Ketones	2					<2								<2		<2									
Haloethers																									
Total Haloethers	2					<2								<2		<2									
Chlorinated Hydrocarbons																									
Total Chlorinated Hydrocarbons	2					<2								<2		<2									
Anilines and Benzidines																									
Total Anilines and Benzidines	2					<2								<2		<2									
Miscellaneous Compounds																									
Total Misscellaneous Compounds	2					<2								<2		<2									

All results in υg/L

PQL = Practical Quantitation Limit.

[A] ANZECC 2000 95% Protection Level for Receiving Water Type

Guidelines in *italics* are low level reliability guidelines

[B] NHMRC Australian Drinking Water Guidelines, 2011

* Hardness Modified Trigger Values for Cd, Cr (III), Cu, Ni, Pb, Zn

NHMRC arsenic guidelines are based on total arsenic

NHMRC guidelines for chromium are based on Cr (VI)

Total Phenolics guideline based on Phenol

ANZECC guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

NHMRC guidelines for total cyanide are based on cyanogen chloride (as cyanide).

Results for TRH have been compared to TPH guidelines.

Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC (2011)

TABLE LR10 Groundwater Analytical Results (µg/L)

Sample Identification	PQL	Guideline				MW14	MW14	MW15	MW15	MW16	MW16	MW17	MW17	MW18	MW18	MW105	MW106	MW107	S3A	S3A	S3B	S3B	SUMP	MW19	MW19	MW20	MW20	MW21
Date		95% Fresh ^{A}	Recreational	Irrigation	Stock	1/5/12	9/7/14	3/5/12	11/7/14	3/5/12	10/7/14	3/5/12	10/7/14	3/5/12	10/7/14	10/7/14	10/7/14	11/7/14	3/5/12	10/7/14	3/5/12	10/7/14	3/5/12	1/5/12	10/7/14	3/5/12	10/7/14	2/5/12
PAEC Sampled						Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	Carbon Plant	DSA	DSA	DSA	DSA	PRA
Sample Appearance						Yellow	Clear	Yellow	Clear	Clear	Clear	Cloudy	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Milky	Clear	Cloudy	Clear	Clear
Sample collected by						KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG	KJG
Metals																												
Aluminium pH>6.5	10	55	9000	5000	5000	110	<10	200	180	100	<10	3,260	3,800	3,120	750	20	50	5,000	50	630	270	1400	40	-	8	-	1500	20
Arsenic	1	24	100	100	500	2	2	<1	2	4	<1	12	12	2	<1	1	2	<1	5	1	2	5	4	-	<0.1	-	2	<1
Cadmium	0.1	2*	20	10	10	0.3	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.2	<1	0.2	3	-	1	-	<0.1	<0.1
Chromium	1	27*	500	100	1000	<1	<1	<1	<1	1	<1	<1	4	3	<1	2	5	2	<1	1	1	2	<1	-	<1	-	2	<10
Copper	1	12*	20,000	200	500	7	3	2	<1	4	2	10	1	2	<1	1	<1	<1	4	<1	2	3	5	-	<1	-	<1	<10
Nickel	1	97*	200	200	1000	10	7	7	9	6	<1	14	8	3	<1	4	2	3	6	2	1	7	8	-	7	-	4	62
Lead	1	87*	100	2000	100	<1	<1	<1	<1	<1	<1	34	1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	-	<1	-	<1	<10
Zinc	5	70*	30,000	2000	20,000	32	7	37	2	57	1	40	6	50	4	4	15	7	31	64	24	13	38	-	2	-	6	70
Mercury	0.1	0.6	10	2	2	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.1	<0.05	<0.1	-	<0.05	-	<0.05	<0.1
Fluoride	100		1500	1000	2000	3600	850	4500	2700	1500	2300	800	1100	35000	17000	1100	7400	10000	12000	8200	14000	12000	4400	-	370	-	670	3000
Non Metallic Inorganics																												
Free Cyanide	4	7	800			<4		<4		<8		<8		<4					<4		<4		<4					
Total Cyanide	4	NA				4		<4		<8		<8		<4					<4		<4		<4					
Total Petroleum Hydrocarbons (TPH)																												
TPH C6-C9	20										<10					240								<20		<20		
TPH C10-C14	50										<50					180								<50		<50		
TPH C15-C28	100										<100					1400								<100		<100		
TPH C29-C36	100										<100					<100								<50		<50		
TPH C6-C36		LOR		LOR	LOR						<100					1820								<50		<50		
Polycyclic Aromatic Hydrocarbons (PAH)																												
Naphthalene	0.1	16				<0.1		<0.1		5.2	<0.1	0.2	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Acenaphthylene	0.1					<0.1		<0.1		<0.1	<0.1	22.9	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Acenaphthene	0.1					<0.1		<0.1		9.4	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Fluorene	0.1					<0.1		<0.1		1.1	<0.1	2	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Phenanthrene	0.1	*2*				<0.1		<0.1		0.6	<0.1	0.4	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Anthracene	0.1	*0.4*				<0.1		<0.1		0.6	<0.1	0.1	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Fluoranthene	0.1	*1.4*				0.1		<0.1		1	<0.1	0.2	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Pyrene	0.1					0.1		<0.1		0.7	<0.1	0.1	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Benz(a)anthracene	0.1					<0.1		<0.1		0.2	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Chrysene	0.1					<0.1		<0.1		0.2	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Benzo(b)&(k)fluoranthene	0.2					0.1		<0.2		0.3	<0.2	<0.2	<0.2	<0.2	<0.2		<0.2		0.2		<0.2		<0.2	<0.2		<0.2		
Benzo(a) pyrene	0.05	*0.2*				0.06		<0.05		0.22	<0.05	<0.05	<0.05	0.06	<0.05		<0.05		0.14		0.08		<0.05	<0.05		<0.05		
Indeno(1,2,3-c,d)pyrene	0.1					<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Dibenz(a,h)anthracene	0.1					<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Benzo(g,h,i)perylene	0.1					<0.1		<0.1		0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		<0.1		<0.1	<0.1		<0.1		
Semivolatile Organic Compounds (SVOCs)																												
Organochlorine Pesticides (OCP)																												
alpha-BHC	2																											<2
HCB	2																											<2
delta-BHC	2																											<2
Heptachlor	2	0.09																										<2
Aldrin	2	*0.001*																										<2
Heptachlor epoxide	2																											<2
Chlordane	2	0.08																										<2
Endosulfan	2	0.2																										<2
Dieldrin	2	*0.01*																										<2
DDE	2	*0.03*																										<2
Endrin	2	0.02																										<2
DDD	2																											<2
Endrin aldehyde	2																											<2
Endosulfan sulfate	2																											<2
DDT	4	0.01																										<4
Organophosphorous Pesticides (OPP)																												
Dichlorvos	2																											<2
Dimethoate	2	0.15																										<2
Diazinon	2	0.01																										<2
Chlorpyrifos-methy	2																											<2
Malathion	2	0.05																										<2
Fenthion	2	0.2																										<2
Chlorpyrifos	2																											<2
Bromophos-ethy	2																											<2
Chlorfenvinphos	2																											<2
Prothiofos	2																											<2
Ethion	2																											<2
Phenols																												
Total Phenolics	4	320																										<4
Phthalate Esthers																												
Dimethylphthalate	2	3700																										<2
Diethylephthalate	2	1000																										<2
Nitrosamines																												
Total Nitrosamines	2																											<2
Nitroaromatics and Ketones																												
Total Nitroaromatics and Ketones	2																											<2
Haloethers																												
Total Haloethers	2																											<2
Chlorinated Hydrocarbons																												
Total Chlorinated Hydrocarbons	2																											<2
Anilines and Benzidines																												
Total Anilines and Benzidines	2																											<2
Miscellaneous Compounds																												
Total Misscellaneous Compounds	2																											<2

All results in υg/L

PQL = Practical Quantitation Limit.

[A] ANZECC 2000 95% Protection Level for Receiving Water Type

Guidelines in *italics* are low level reliability guidelines

[B] NHMRC Australian Drinking Water Guidelines, 2011

* Hardness Modified Trigger Values for Cd, Cr (III), Cu, Ni, Pb, Zn

NHMRC arsenic guidelines are based on total arsenic

NHMRC guidelines for chromium are based on Cr (VI)

Total Phenolics guideline based on Phenol

ANZECC guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

NHMRC guidelines for total cyanide are based on cyanogen chloride (as cyanide).

Results for TRH have been compared to TPH guidelines.

Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC (2011)

TABLE LR11 Groundwater Analytical Results for VOCs and SVOCs

Sample Identification	PQL	Guideline			MW06	MW09	MW10	MW105	MW107	MW21
Date		95% Fresh ^{A}	Irrigation	Stock	2/5/12	30/4/12	30/4/12	10/7/14	11/7/14	2/5/12
PAEC Sampled					Background	FLS	FLS	Carbon Plant	Carbon Plant	PRA
Sample Appearance					Clear	Cloudy	Turbid	Cloudy	Clear	Clear
Sample collected by					KJG	KJG	KJG	KJG	KJG	KJG
Volatile Organic Compounds (VOCs) and Semivolatile Organic Compounds (SVOCs)										
Monocyclic Aromatics										
Benzene					<2	<2	<2	1	<2	<2
Other Monocyclic Aromatics					<2	<2	<2	<2	<2	<2
Chlorinated Hydrocarbons										
Cis-1, 2-dichloroethane					<1	<1	<1	1	<1	<1
Chloroform					<1	<1	<1	5	<1	<1
Chlorobenzene					<1	<1	<1	150	<1	<1
1,4-dichlorobenzene					<1	<1	<1	9	<1	<1
Organochlorine Pesticides (OCP)										
All OCPs	2				<2	<2	<2	<2	<2	<2
Organophosphorous Pesticides (OPP)										
All OPPs	2				<2	<2	<2	<2	<2	<2
Sulfonated Compounds										
Carbon Disulfide	4	320			<4	<4	<4	<4	<4	<4
Fumigants										
Total Fumigants	4	320			<4	<4	<4	<4	<4	<4
Oxygenated Compounds										
Total Oxygenated Compounds	4	320			<4	<4	<4	<4	<4	<4
Phenols										
Total Phenolics	4	320			<4	<4	<4	<4	<4	<4
Phthalate Esthers										
Dimethylphthalate	2	3700			<2	<2	<2	<2	<2	<2
Diethylephthalate	2	1000			<2	<2	<2	<2	<2	<2
Nitrosamines										
Total Nitrosamines	2				<2	<2	<2	<2	<2	<2
Nitroaromatics and Ketones										
Total Nitroaromatics and Ketones	2				<2	<2	<2	<2	<2	<2
Haloethers										
Total Haloethers	2				<2	<2	<2	<2	<2	<2
Anilines and Benzidines										
Total Anilines and Benzidines	2				<2	<2	<2	<2	<2	<2
Miscellaneous Compounds										
Total Misscellaneous Compounds	2				<2	<2	<2	<2	<2	<2

All results in µg/L

PQL = Practical Quantitation Limit.

^{A} ANZECC 2000 95% Protection Level for Receiving Water Type

Guidelines in *italics* are low level reliability guidelines

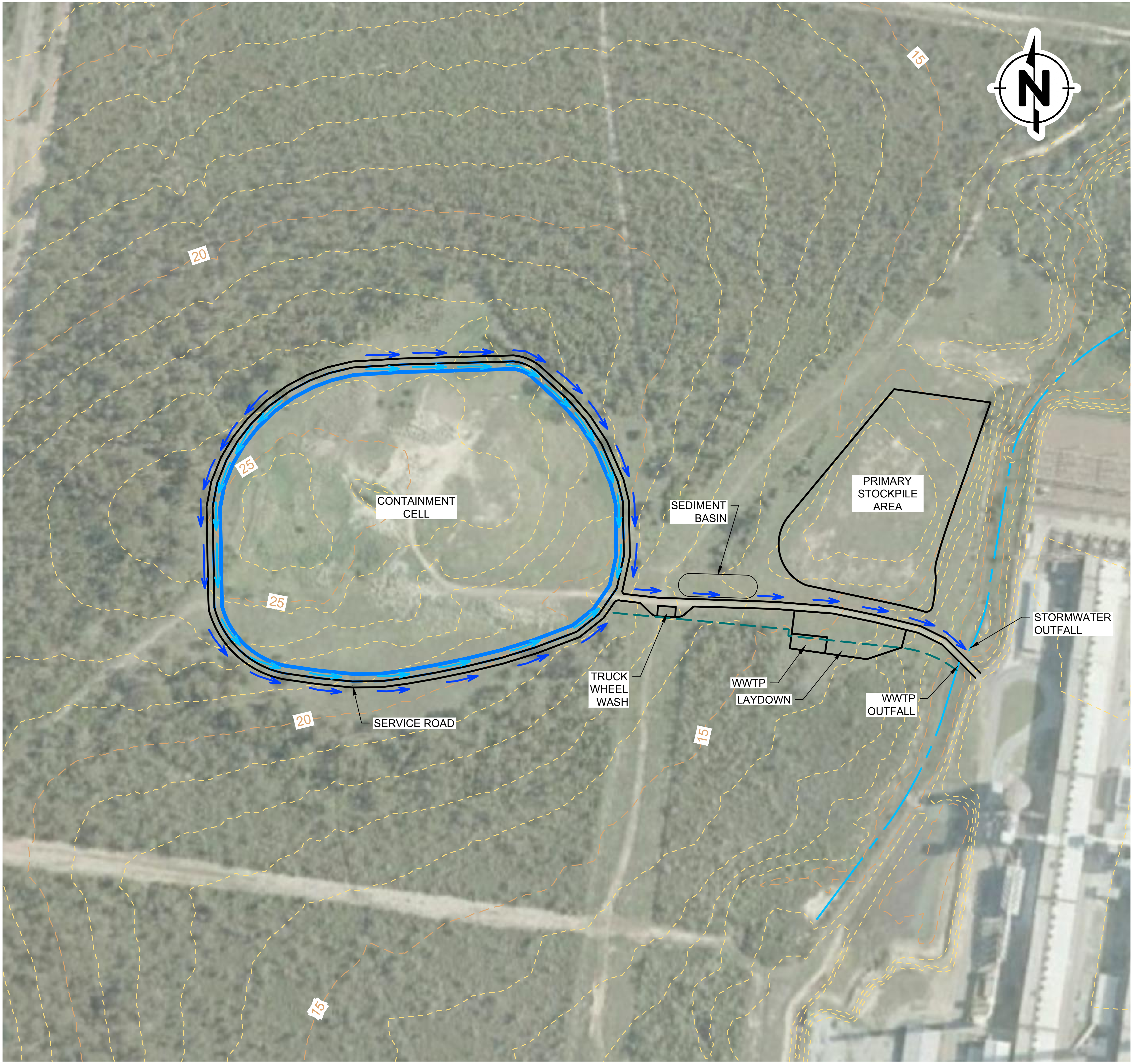
^{B} NHMRC Australian Drinking Water Guidelines, 20110

Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC

FLS - Flammable Liquids Store

PRA - Pot Rebuild Area

APPENDIX 4
CONTAINMENT CELL CONCEPT DESIGN



LEGEND

━━━━	CONTAINMENT CELL LIMIT (CONCEPTUAL)
— — — —	CONTAINMENT CELL CAP LIMIT (CONCEPTUAL)
– – – 25 – – –	EXISTING CONTOUR MAJOR (5 METRE)
- - - 24 - - -	EXISTING CONTOUR MINOR (1 METRE)
→ →	STORMWATER DRAINAGE CHANNEL
→ →	TOE DRAIN
— — — —	UNDERGROUND LEACHATE / WWTP PIPING
—— – ——	EPHEMERAL CREEK

NOTES:

1. THE PRIMARY STOCKPILE WILL STORE EXCAVATED CLAY TO BE REUSED IN THE CONTAINMENT CELL LINER AND CAP, AND CRUSHED REFRACTORY/CONCRETE TO BE REUSED IN ACCESS ROADS. IT IS ASSUMED THAT REFRACTORY AND CONCRETE WILL BE CRUSHED IN THE SMELTER BUILDINGS.
2. THE FOOTPRINT OF THE WWTP IS BASED ON THE SYSTEM SPECIFIED IN "STAGE 2 WATER TREATMENT OPTIONS REPORT"' AND IS SUBJECT TO DETAILED DESIGN.
3. THE PROPOSED SUPPORT STRUCTURE DETAILS AND POSITIONING WILL NEED TO BE REASSESSED DURING THE DETAILED DESIGN STAGE.
4. THE ACCESS ROAD CROSSING THE EPHEMERAL CREEK TO BE ASSESSED TO DETERMINE IF UPGRADES ARE NECESSARY TO SUPPORT TRUCK TRAFFIC AND ADDITIONAL HYDRAULIC STRESSES FROM ADDITIONAL FLOW FROM THE PROPOSED STORMWATER OUTFALL.
5. CELL FILLING WILL BE UNDERTAKEN LOGISTICALLY BASED ON SITE SEQUENCING.
6. SEDIMENT BASIN POSITIONING AND DESIGN WILL BE PROVIDED DURING DETAILED DESIGN.

SOURCE:

AERIAL IMAGE: GOOGLE EARTH PRO©

0 75

SCALE IN METRES
1:2500

SITE LAYOUT

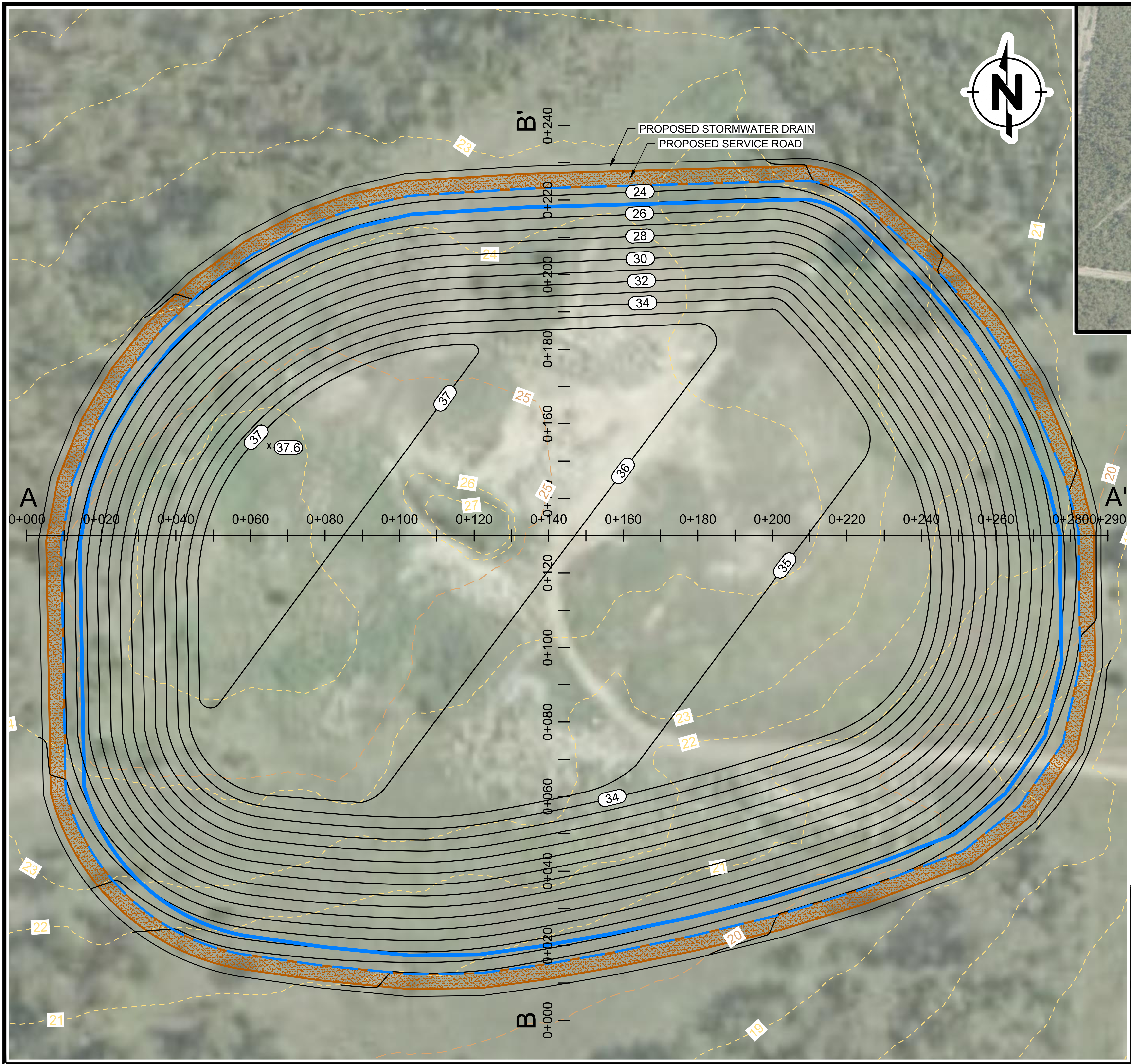
HYDRO ALUMINUM SMELTER KURRI KURRI
NEW SOUTH WALES, AUSTRALIA

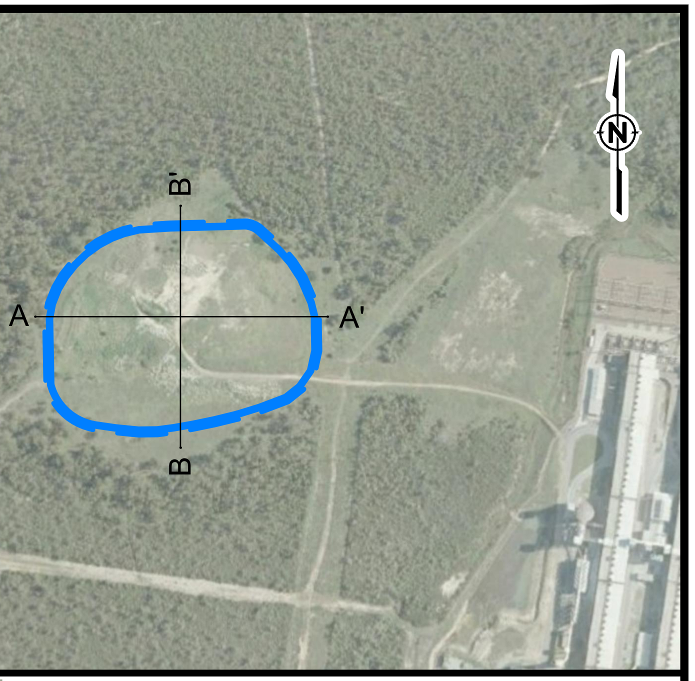
RAMBOLL ENVIRON

FIGURE
1

DRAFTED BY: PRM/MSB
DATE: 07/07/2016
AS130349

MBLEI 7/7/16 [SL_AS130349] F:\AS130349_NSW SMELTER_LANDFILL DESIGN REV





KEY MAP
1:7,500

LEGEND

━━━	CONTAINMENT CELL LIMIT (CONCEPTUAL)
━ ━ ━	CONTAINMENT CELL CAP LIMIT (CONCEPTUAL)
– – 25 – –	EXISTING CONTOUR MAJOR (5 METRE)
- - 24 - -	EXISTING CONTOUR MINOR (1 METRE)
—(25)—	PROPOSED CONTOUR MAJOR (5 METRE)
—(24)—	PROPOSED CONTOUR MINOR (1 METRE)

SOURCE:

AERIAL IMAGE: GOOGLE EARTH PRO©

0 30
SCALE IN METRES
1:1000

CONCEPTUAL CONTAINMENT CELL FINAL GRADING

HYDRO ALUMINUM SMELTER KURRI KURRI
NEW SOUTH WALES, AUSTRALIA

RAMBOLL ENVIRON

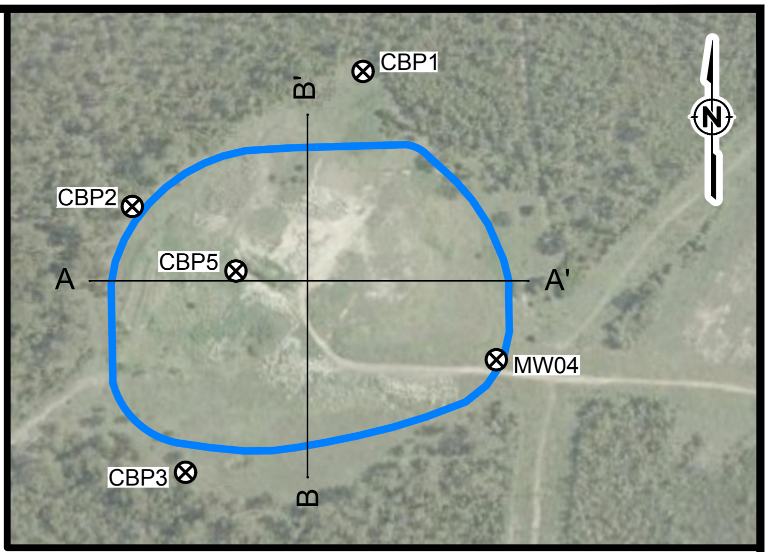
FIGURE
2

DRAFTED BY: PRM/MSB
DATE: 07/07/2016
AS130349

MBLEI 7/7/16 [REM_DESIGN_AS130349] F:\AS130349_NSW SMELTER_LANDFILL DESIGN REV

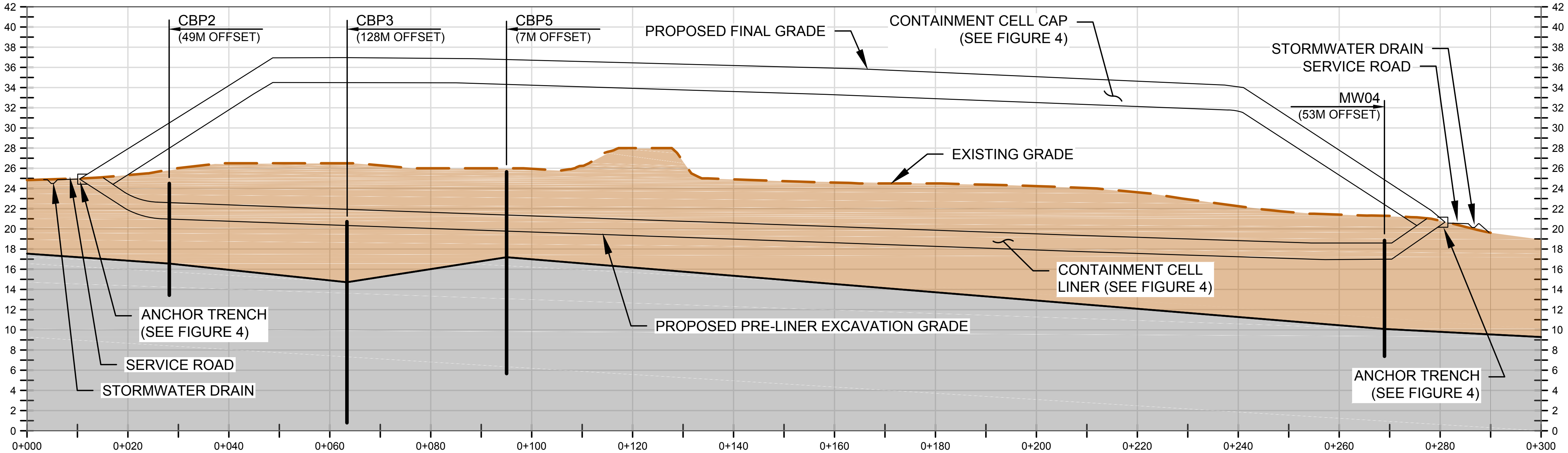
NOTES:

1. THE PROPOSED CONTAINMENT CELL FOOTPRINT HAS A CAPACITY OF 410,000 CU. M. THE CAPACITY WILL ACCOMODATE THE MAXIMUM VOLUME OF MATERIAL FOR ON-SITE CONTAINMENT PRESENTED IN THE REMEDIAL OPTION STUDY REPORT - 265,000 CU. M - PLUS DAILY COVER. IF NEEDED, ADDITIONAL CAPACITY CAN BE REALIZED BY INCREASING THE HEIGHT OF THE CONTAINMENT CELL WITHOUT ADJUSTING THE FOOTPRINT.
2. CONTAINMENT CELL DIMENSIONS WERE DETERMINED BASED ON EXISTING TEST PIT AND SOILING BORING LOGS, AND ASSUMING 3:1 (H:V) SIDE SLOPES, A 2% GRADE FOR LEACHATE DRAINAGE, AND MAINTAINING 3 M DISTANCE BETWEEN THE BEDROCK AND THE BOTTOM OF THE CONTAINMENT CELL LINER.
3. EXPECT NATIVE MATERIAL TO BE ADEQUATE FOR REUSE FOR CLAY IN THE LINER AND CAP, BUT THIS WILL NEED TO BE VERIFIED BY A LICENSED GEOTECHNICAL ENGINEER.
4. A PERMEABLE MARKER LAYER WILL BE ADDED TO DELINEATE SPENT POTLINING REPOSITORY EXTENT.
5. SURFACE DRAINAGE FOLLOWING CAPPING WILL BE DESIGNED AND IMPLEMENTED TO PROMOTE SURFACE RUNOFF AND PREVENT SCOURING OF THE CAP SURFACE.
6. CELL FILLING WILL BE UNDERTAKEN LOGISTICALLY BASED ON SITE SEQUENCING.



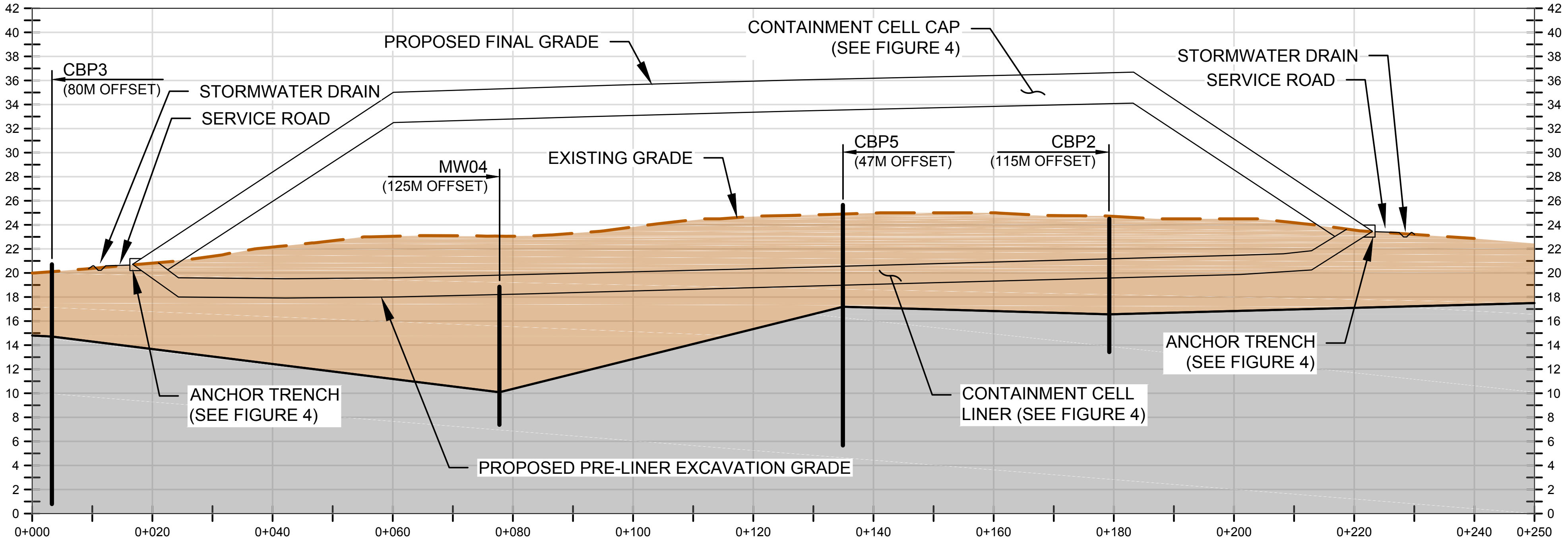
KEY MAP

1:5,000



CROSS SECTION A-A'

HORZ: 1:1000
VERT: 1:500
(VERTICAL EXAGGERATION OF 2)



CROSS SECTION B-B'

HORZ: 1:1000
VERT: 1:500
(VERTICAL EXAGGERATION OF 2)

LEGEND

━━	CONTAINMENT CELL LIMIT (CONCEPTUAL)
🟧	RESIDUAL CLAY (SANDY/SILTY)
⬜	SILTSTONE

SOURCE:

AERIAL IMAGE: GOOGLE EARTH PRO©

0 30

SCALE IN METRES
1:1000

CONCEPTUAL CONTAINMENT CELL CROSS SECTIONS

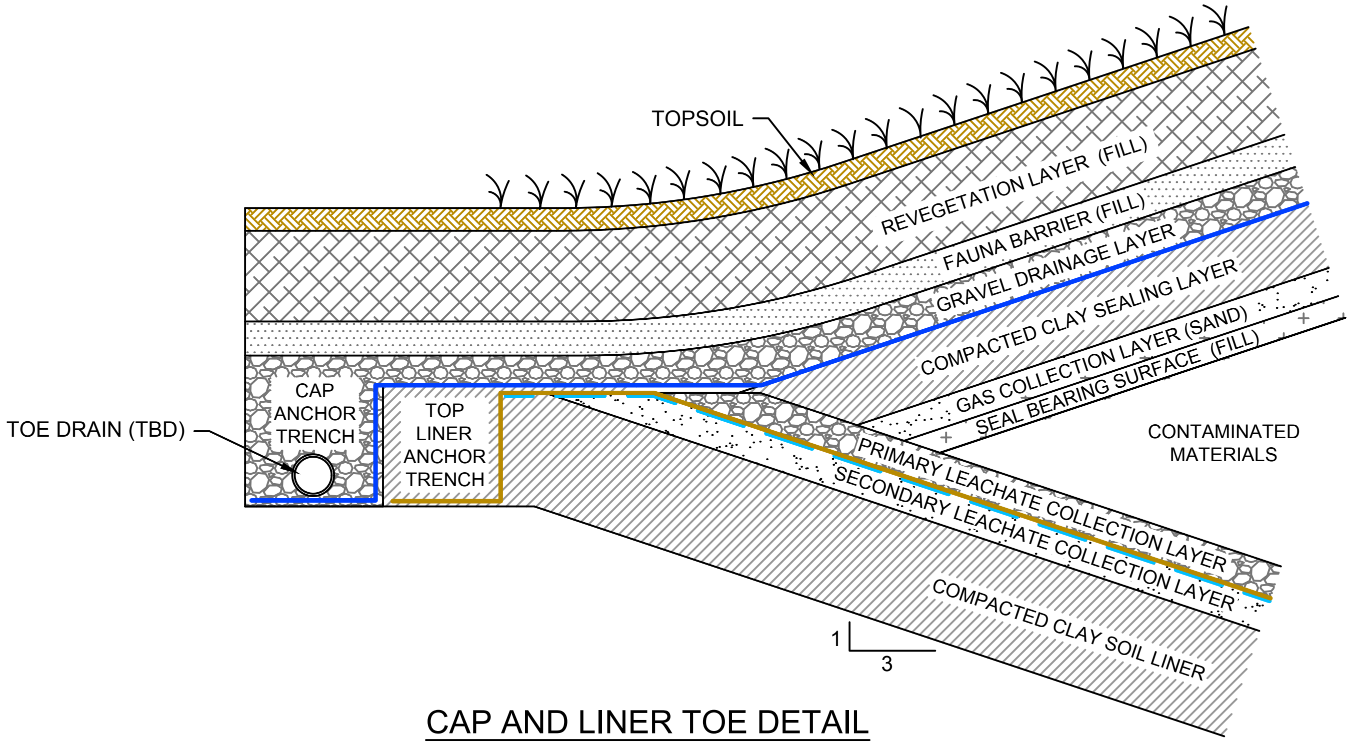
HYDRO ALUMINUM SMELTER KURRI KURRI
NEW SOUTH WALES, AUSTRALIA

RAMBOLL ENVIRON

FIGURE
3

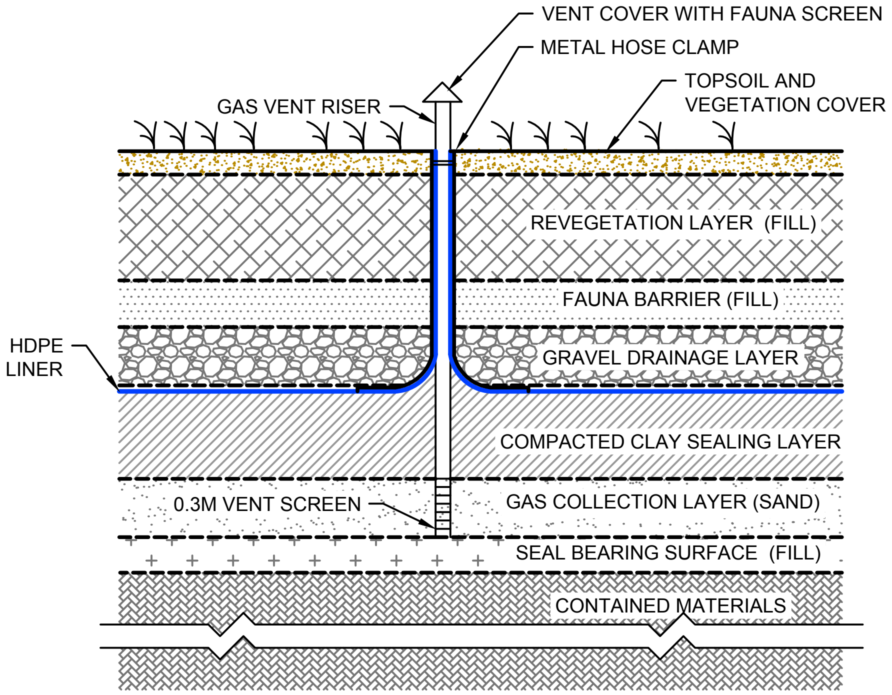
DRAFTED BY: PRM/MSB
DATE: 07/07/2016
AS130349

MBLEI 7/7/16 [REM_DESIGN_AS130349] F:\AS130349_NSW SMELTER_LANDFILL DESIGN REV



CAP AND LINER TOE DETAIL

N.T.S.

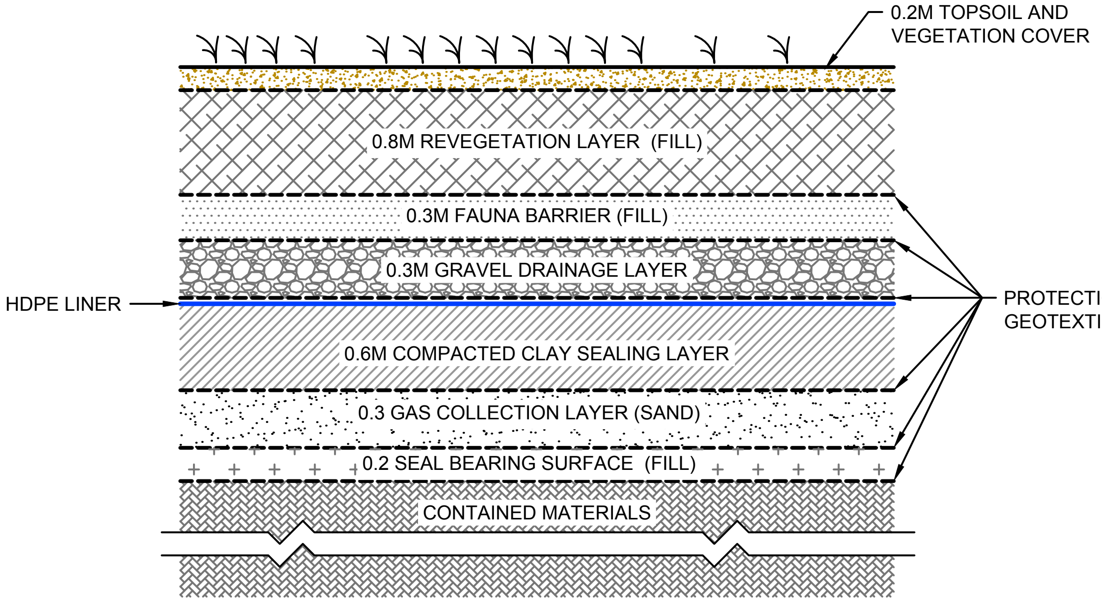


TYPICAL GAS VENT PENETRATION THROUGH CAP DETAIL

N.T.S.

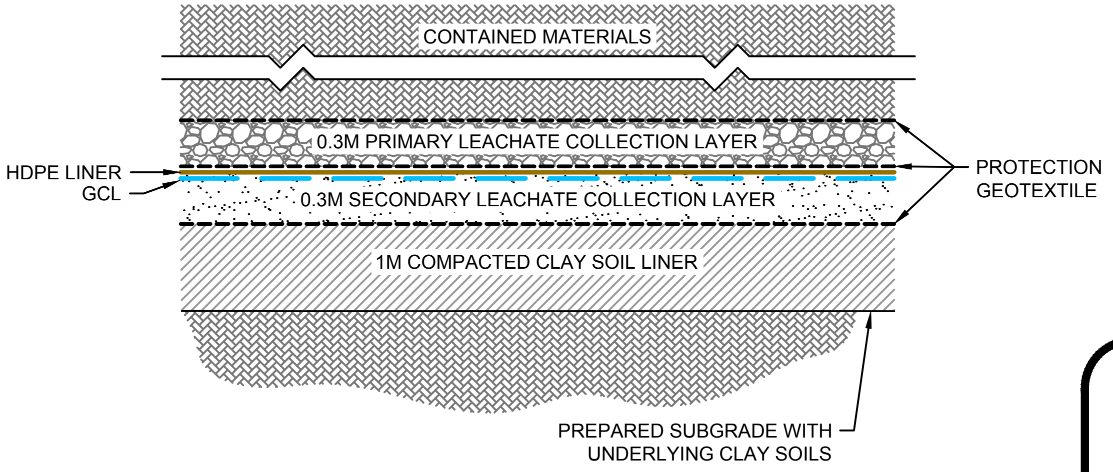
NOTES:

1. THE NUMBER AND DIMENSIONS OF THE GAS VENTS TO BE DETERMINED DURING DETAILED DESIGN.
2. THE GAS VENT DETAIL SHOWN IS SUBJECT TO CHANGE DURING DETAILED DESIGN. CONSTRUCTION METHODS WILL FOLLOW THE MANUFACTURER'S RECOMMENDATIONS, THE REQUIREMENTS OF THE QUALITY CONTROL PLAN, AND THE MATERIALS WILL BE BUSHFIRE, CHEMICAL AND CORROSION RESISTANT.
3. HDPE LINER SPECIFICATIONS TO BE DETERMINED DURING DETAILED DESIGN. TYPICAL CONTAINMENT CELL HDPE LINERS ARE SPECIFIED AS 1.5-2.0 MM THICK TEXTURED SURFACE, FORMULATED TO BE RESISTANT TO THE CHEMICALS EXPECTED IN THE LEACHATE, AND CONSTRUCTED PER A SPECIFIC QUALITY CONTROL PLAN.
4. GEOSYNTHETIC CLAY LINER (GCL) OF PERMEABILITY LESS THAN $5x10^{-11}$ M/S, TO MEET SPECIFICATIONS OUTLINED IN NSW EPA SOLID WASTE GUIDELINES 2016.
5. THE LINER AND CAP DETAILS ARE SUBJECT TO CHANGE BASED ON ECONOMIC OR FUNCTIONAL CONSIDERATIONS DURING DETAILED DESIGN.
6. GRAVEL DRAINAGE LAYER IS TO COMPRISE ROUNDED GRAVEL OR ALTERNATE GEOSYNTHETIC MATERIAL COULD BE CONSIDERED, EG/ GEONET OR SIMILAR.



CAP DETAIL

N.T.S.



LINER DETAIL

N.T.S.

CONCEPTUAL CONTAINMENT CELL DETAIL CAP AND LINER

HYDRO ALUMINUM SMELTER KURRI KURRI
NEW SOUTH WALES, AUSTRALIA

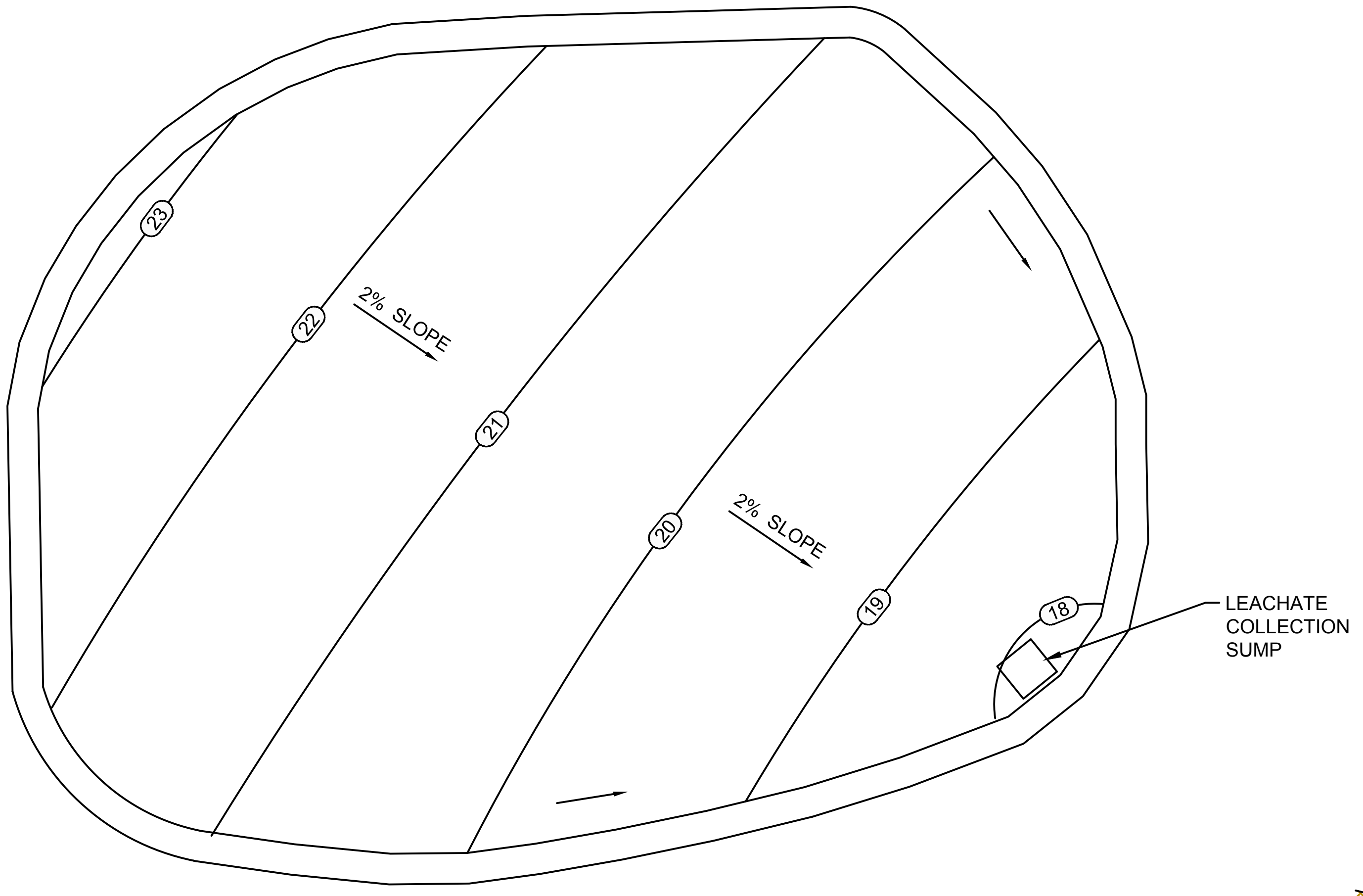
RAMBOLL ENVIRON

FIGURE
4

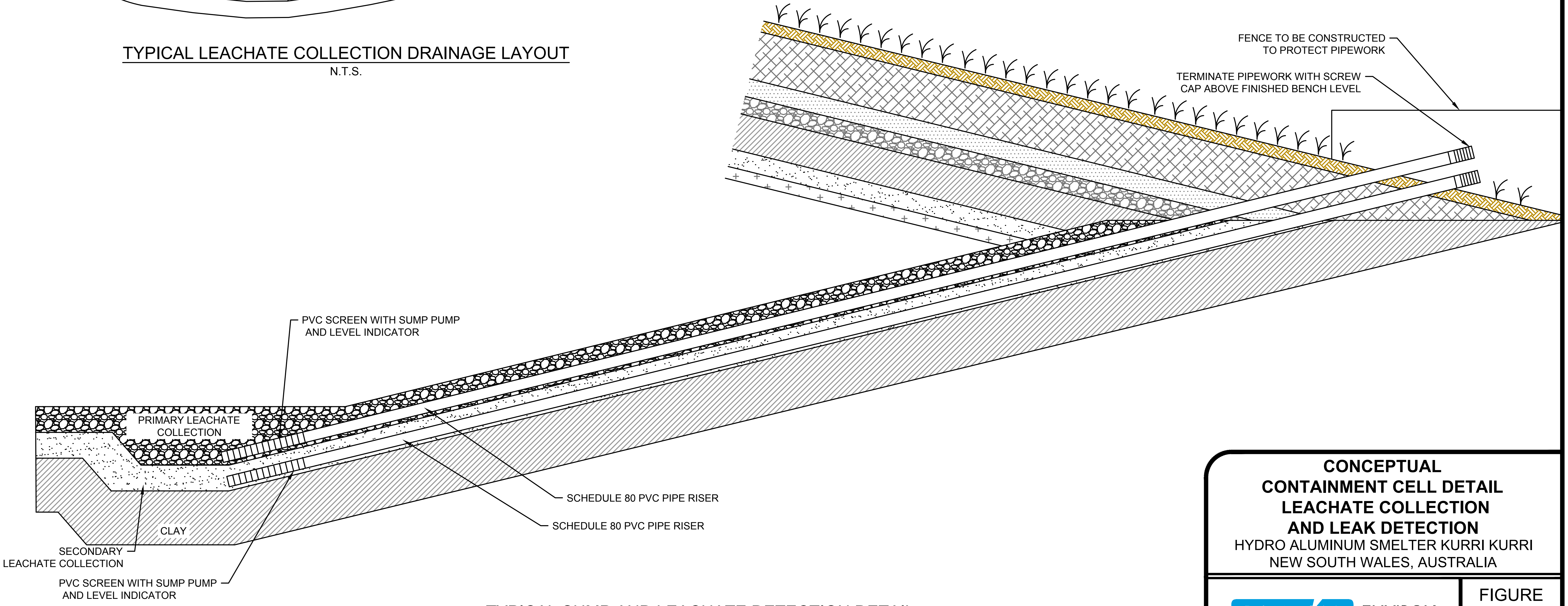
DRAFTED BY: PRM/MSB
DATE: 07/07/2016
AS130349

NOTES:

1. LEACHATE COLLECTION SYSTEM MAY INCLUDE PERFORATED COLLECTION PIPING. SPACING AND QUANTITY OF PIPING WILL BE DETERMINED DURING DETAILED DESIGN.
2. WATER MANAGEMENT DURING CONSTRUCTION AND FILLING WILL COMPRISE SEGREGATION OF CLEAN AND DIRTY WATER. THE WATER MANAGEMENT PLAN WILL BE DEVELOPED DURING DETAILED DESIGN.
3. CONTAINMENT CELL LINER ELEVATION AND GRADE SHOWN IS APPROXIMATE AND IS SUBJECT TO CHANGE DURING DETAILED DESIGN.



TYPICAL LEACHATE COLLECTION DRAINAGE LAYOUT
N.T.S.



TYPICAL SUMP AND LEACHATE DETECTION DETAIL
N.T.S.

MBLEI 7/7/16 [DETAILS_AS130349] F:\AS130349_NSW SMELTER_LANDFILL DESIGN REV

CONCEPTUAL
CONTAINMENT CELL DETAIL
LEACHATE COLLECTION
AND LEAK DETECTION
HYDRO ALUMINUM SMELTER KURRI KURRI
NEW SOUTH WALES, AUSTRALIA

RAMBOLL ENVIRON

FIGURE
5

DRAFTED BY: PRM/MSB
DATE: 07/07/2016
AS130349

APPENDIX 5
PHOTOGRAPHS OF AECS REQUIRING REMEDIATION

Plate 1: Capped Waste Stockpile (right-hand side of photo)

Plate 2: Anode Waste Pile

Plate 3: Diesel Spray Area

Plate 4: Drainage Lines near Capped Waste Stockpile and Anode Waste Pile

Plate 5: East Surge Pond

Plate 6: Carbon Plant

Plate 7: Carbon Plant – Western End

Plate 8: Bake Furnace Scrubber

Plate 9: Bake Furnace Scrubber

Plate 10: Area East of Playing Fields

APPENDIX 6
LETTER REPORT ON 2018 GROUNDWATER MONITORING

RAMBOLL

ENVIRONMENT
& HEALTH

20 April 2018

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RE: Addendum to Remedial Action Plan

1. INTRODUCTION

Ramboll was engaged to undertake groundwater sampling of the Smelter Site located at the former Hydro Aluminium Kurri Kurri Smelter for Hydro Aluminium Kurri Kurri Pty Ltd (Hydro).

This report is an addendum to the Remedial Action Plan (RAP) and should be read in conjunction with the RAP.

1.1 Project Understanding

The developed portion of the Smelter Site has historically been used as an aluminium smelter and is proposed to be demolished and redeveloped for commercial and industrial land use. The use of the Smelter Site to smelt aluminium over a period of approximately 40 years has resulted in elevated aluminium and fluoride concentrations in groundwater beneath the Smelter Site.

The Conceptual Site Model within the RAP identified a complete exposure pathway between current and future on-site intrusive maintenance and construction workers and shallow groundwater beneath the Smelter Site. Over two groundwater monitoring rounds, fluoride concentrations in groundwater (excluding the leachate plume) ranged between 0.22 and 43 mg/L, exceeding the (2013) site-specific preliminary screening criteria of 1.5 mg/L for incidental ingestion. As the screening criterion is for incidental ingestion, a health risk assessment and derivation of site-specific criterion for maintenance and construction employees is required.

This report sets out the current groundwater monitoring results completed in April 2018.

2. SAMPLING ANALYSIS AND QUALITY PLAN

2.1 Objective

The objective of the groundwater sampling is to provide concentrations of key contaminants of concern (aluminium and fluoride) in groundwater for inputs into the human health and ecological risk assessment to derive site specific criterion for intrusive maintenance workers and ecological receptors.

2.2 Scope of Works

The scope of works included the following:

- The collection of groundwater samples and measurement of water level in 26 wells.
- Field analysis for physico-chemcial parameters including pH, electrical conductivity, dissolved oxygen and redox.
- Laboratory analysis of groundwater samples for soluble fluoride, free cyanide, pH, electrical conductivity and dissolved aluminium.

2.3 Fieldwork Methodology

Fieldwork was completed on the 10 and 11 April 2018. The fieldwork methodology for the collection of groundwater samples is outlined in **Table 2.1**.

Table 2.1: Field Methodology for Quarterly Groundwater Monitoring

Activity	Details
Well Gauging	Monitoring wells were gauged using a water interface probe prior to sampling.
Well Purging	Monitoring wells were purged prior to sampling by pumping water from the wells using low flow peristaltic pump until the physico-chemical parameters, including pH, temperature, EC, redox and dissolved oxygen stabilised to within 10% of three consecutive readings. 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. Samples that were unable to be field filtered were placed in unpreserved bottles and filtered by the laboratory on arrival.
Chain of Custody	Groundwater samples were dispatched to the laboratory under chain of custody conditions.

2.4 Data Quality Objectives

Data quality objectives for the groundwater monitoring are outlined in **Table 2.2**.

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Table 2.2: Data Quality Objectives

DQO	Outcome
State the Problem	To collect groundwater data from a network of wells on the Smelter Site for input into the site specific human health and ecological risk assessments.
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 1, Appendix 1), 2) complete analysis of collected groundwater samples for soluble fluoride, total cyanide, dissolved aluminium, pH and EC and 3) analyse the data and compare to the two previous groundwater monitoring events.
Define the Study Boundaries	The Smelter Site. 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 investigation. The action levels are the Assessment Criteria outlined in Section x and the historical groundwater concentrations where available for the monitoring wells. The Decision Rules for groundwater are: Groundwater concentrations were assessed against the acceptance criteria outlined in Section x in combination with a comparison against previous data where applicable. An evaluation of significance was also undertaken.
Specify Limits on Decision Errors	As this investigation involves a series of groundwater monitoring events, decision errors relate to the comparability of data between monitoring events. As such, all 26 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.

2.5 Data Quality Indicators

Project data quality indicators have been established to set acceptance limits on field and laboratory data collected as part of the groundwater monitoring program. The data quality indicators are outlined in **Table 2.3**.

Table 2.3: Data Quality Indicators

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

2.6 Field Quality Assurance and Quality Control

The following quality assurance/quality control (QA/QC) procedures were employed during the sampling program to ensure representative samples were collected:

- All samples were collected by personnel, trained and experienced in the collection of water samples for analysis, using standard industry techniques for sample collection
- Clean, single-use, sampling equipment was used to collect each sample to minimise the opportunity for cross contamination, equipment that was re-used was washed with Decon90 and rinsed with potable water prior to sampling each well
- All samples were placed in clean, laboratory-supplied containers
- All samples were labelled with unique names, identifying location and date
- All samples were placed in eskies with ice after a short period of time due to the distance from the well
- Samples were submitted within holding times with the exception of pH which has a 1 day holding time.

- Samples were submitted under the laboratory under chain-of custody protocols.
- The following quality control samples were collected and submitted for analysis:
  - Two field duplicates– analysed for all parameters
  - One field triplicate – analysed for all parameters
  - Two field blanks – analysed for all parameters

Field quality control results are summarised in **Table 4, Appendix 2.** Results for the field blanks found no detectable concentrations for soluble fluoride, free cyanide and dissolved aluminium and a pH of 6 and EC less than 6µS/cm. Review of the calculated relative percent difference (RPD) found all sample concentrations within the RPD criteria of ±30%, with the exception of:

- Slightly elevated RPD for soluble fluoride for MW09 and triplicate QA102. The RPD was only slightly above the assessment limit of 30% and the duplicate sample reported an RPD of 0%, as such is not considered to be of concern.

2.7 Labortory Quality Assurance / Quality Control

Envirolab was the primary laboratory used to undertake the analysis. Envirolab is NATA accredited for the analyses conducted and are experienced in the analytical requirements for potentially contaminated groundwater. As part of the analytical procedures, Envirolab undertook internal quality assurance testing. Results are contained within the laboratory report sheets, **Appendix 3**. Internal laboratory review indicated no significant outliers in internal duplicates, method blanks, laboratory control samples and matrix spikes with the exception of the following:

- Holding times for pH were overdue. pH has a holding time of 1 day. Comparison of the field pH results to the laboratory results were relatively similar.
- Matrix spike for dissolved metals were below the frequency control of 5% for ALS.
- Percent recovery from the laboratory spike was not possible for sample 3 however an LCS was obtained.
- Samples MW06, MW08, MW10, MW11, MW12, MW13, MW16, MW20, MW104, MW105, MW106, S3B and QA103 were filtered by the laboratory from the unpreserved bottle, therefore there is a possibility some elements may be underestimated.

Overall, the analytical results are considered to be of suitable quality for review.

3. RESULTS

3.1 Field Results and Observations

A summary of the field parameters for each sample location are shown in **Table 1, Appendix 2**. The field sheets are attached in **Appendix 4.**

The groundwater sample parameters generally indicate:

- Slightly neutral pH conditions at all wells with the exception of wells MW103 and MW107 which indicated acidic to slightly acidic pH conditions.
- Anaerobic conditions at nearly all wells, with the exception MW08, MW09, S3A and MW106
- Reducing, conditions at nearly all wells, with the exception of MW08, MW09, MW10 and MW12
- Saline/brackish conditions.

3.2 Laboratory Results

The April 2018 groundwater monitoring event have been compared to the assessment criteria outlined in the RAP and tabulated in **Table 2, Appendix 2.**

Elevated concentrations of soluble fluoride were reported above the assessment criteria for wells; MW08, MW11, MW13, MW15, MW16, MW18, MW19, MW21, S3A, S3B, MW103, MW104, MW106 and MW107.

Elevated concentrations of dissolved aluminium were reported above the assessment criteria for wells; MW08, MW11, MW13, MW15, MW18, S3B, MW103, MW104 and MW107.

3.3 Comparison to Historical Results

Comparison of the soluble fluoride and dissolved aluminium for April 2018 were compared to the two previous groundwater monitoring events completed in 2012 and 2014. Wells MW101 to MW107 were only sampled in 2014 after installation by Ramboll (formerly ENVIRON). A cumulative table of historical results is shown in **Table 3, Appendix 2**.

The trends for dissolved aluminium and soluble fluoride are shown in Figure 1 and Figure 2.

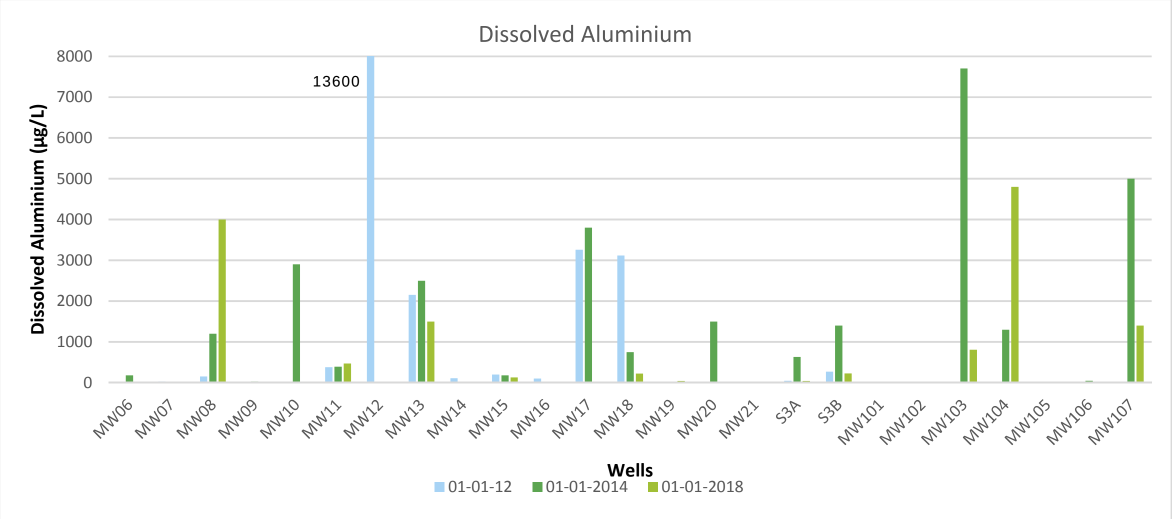


Figure 1: Dissolved Aluminium trends from 2012, 2014 and 2018 groundwater sampling rounds

No distinct trends in dissolved aluminium were reported, with the majority of wells generally indicating comparable concentrations to previous rounds. Increased concentrations for this round were reported at wells MW08 and MW104 when compared to the previous rounds.

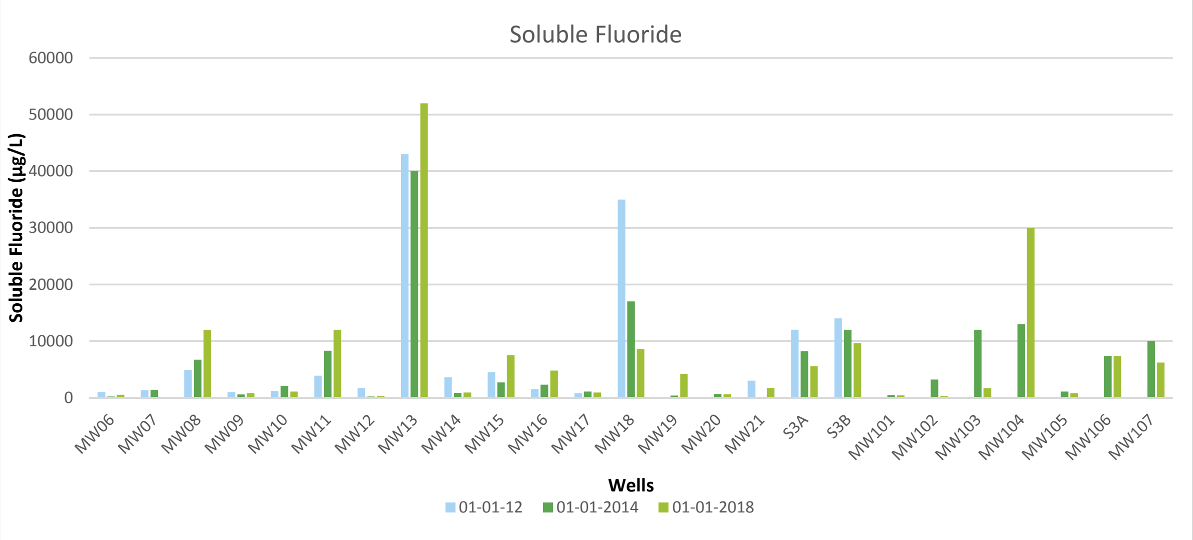


Figure 2: Soluble Fluodie trends from 2012, 2014 and 2018 groundwater sampling rounds i

Review of the limited data set shows soluble fluoride reported an increase in concentration when compared to the previous rounds at wells MW08, MW11, MW13, MW15, MW16, MW19 and MW104. The highest concentration was at MW13 for the three rounds. A decreasing trend was reported at wells MW18, S3A, S3B, MW103 and MW107. The remaining wells indicated a stable trend.

4. CONCLUSIONS

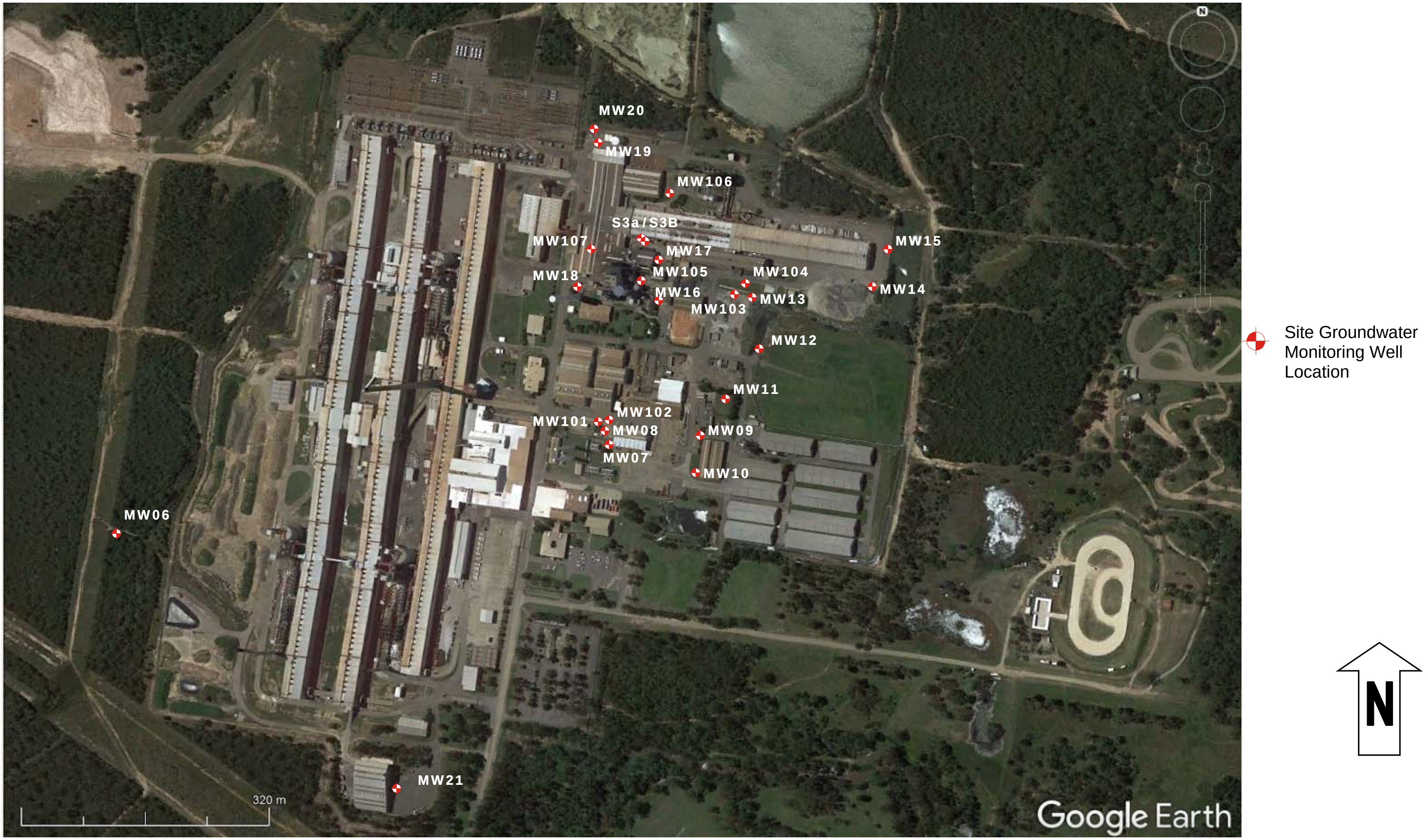
Ramboll completed a groundwater sampling event at the Hydro Smelter Site. The objective of the groundwater sampling was to provide concentrations of key contaminants of concern (aluminium and fluoride) in groundwater for inputs into the human health and ecological risk assessments.

The groundwater sampling results were compared against the assessment criteria. The results indicated nine wells with concentrations of dissolved aluminium above the assessment criteria and 14 wells above the assessment criteria for soluble fluoride.

A comparison of the results for dissolved aluminium and soluble fluoride were compared to two previous sampling events completed in 2012 and 2014. The results indicated relatively stable concentrations in dissolved aluminium when compared to the previous rounds, with only two wells indicating an increase in concentrations in the April 2018 round. Soluble fluoride reported relatively stable or decreasing trends, with the exception of the following wells which reported an increase in concentrations for the April 2018 round; MW08, MW11, MW13, MW15, MW16, MW19 and MW104.

Based on a review of the quality assurance and quality controls as well as a comparison to the previous groundwater sampling events, Ramboll consider the data suitable for use in the human health and ecological risk assessment.

APPENDIX 1
FIGURES



Hydro Aluminium Kurri Kurri: Addendum to RAP

Site Groundwater Monitoring Wells

JOB NO: 318000445

DATE: April 2018

FIGURE 1

APPENDIX 2
SUMMARY OF RESULTS

Table 1: Physico-Chemical Parameters

Well ID / Surface Water ID	Date	SWL (mbtoc)	Temperature (°C)	Spec Cond. (mS/cm)	1000	pH	DO (mg/L)	Redox (mV)	Comments
MW06	11-04-18	2.22	21.5	14.16	14160	6.66	0.51	-126.4	clear, slight sulphide odour
MW07	10-04-18	--	--	--	--	--	--	--	DRY
MW08	10-04-18	1.36	26.3	0.45	450	6.31	3.44	108.7	grey/brown, turbid, no odour
MW09	10-04-18	2.17	24.7	3.71	3710	7.51	2.55	95.3	turbid, grey, brown, no odour
MW10	10-04-18	3.41	22.1	8.55	8550	6.47	1.09	103.7	light brown, no odour
MW11	10-04-18	1.99	21.8	2.57	2570	6.03	0.59	-29.9	turbid, light brown, no odour
MW12	10-04-18	6.9	22.7	13.97	13970	6.15	-	63.5	light brown, turbid, no odour
MW13	10-04-18	1.73	25.3	4.73	4730	6.51	0.55	-90.2	light brown, no odour
MW14	10-04-18	2.68	23.7	5.4	5400	6.26	0.69	-49.6	clear, no odour
MW15	10-04-18	1.59	27	1.57	1570	7.41	0.7	-60.4	clear, no odour
MW16	11-04-18	0.31	27.8	0.54	540	7.12	0.39	-130.4	slightly yellow, no odour
MW17	10-04-18	1.23	25.8	0.97	970	6.93	0.51	-12.8	light brown, small orange particulates, no odour
MW18	10-04-18	1.6	26	0.267	267	6.63	0.36	-173.5	light grey/ clear, some orange particulates, some odour
MW19	10-04-18	2.21	26.8	1.19	1190	6.25	0.68	-44.0	clear, no odour
MW20	11-04-18	2.6	23.6	1.85	1850	6.03	0.76	-45.0	turbid, pale grey
MW21	11-04-18	2.105	23.1	15.82	15820	6.71	0.67	-38.5	clear, no odour
S3A	11-04-18	1.73	24	0.45	450	6.99	3.58	-15.8	clear, no odour
S3B	11-04-18	4.70	24.00	1.06	1060	6.35	0.66	-25.90	clear, no odour
MW101	11-04-18	1.92	27.20	0.54	540	6.30	0.37	-45.50	clear, no odour
MW102	10-04-18	1.80	27.00	0.51	510	6.50	0.42	-16.20	clear, tiny orange particulates, no odour
MW103	10-04-18	1.64	25.00	1.72	1720	4.51	1.14	146.20	-
MW104	10-04-18	1.69	26.60	3.28	3280	6.90	0.17	-207.40	copper brown, turbid, no odour
MW105	11-04-18	0.64	26.10	1.11	1110	6.73	0.36	-133.00	slightly brown, hydrocarbon odour
MW106	10-04-18	4.82	24.90	1.06	1060	7.07	4.80	-26.80	light brown, turbid, no odour
MW107	11-04-18	1.19	22.90	0.72	720	5.67	0.79	-37.10	clear, no odour

Notes

mbtoc = metres below top of casing

L = Litre

DO = Dissolved Oxygen

ppm = parts per million

EC = Electrical Conductivity

µS/cm = milliSiemens per centimetre

mV = milli Volts

Table 2: 2018 Groundwater Analytical Results

Sample Identification	PQL	Units	Guideline				MW06	MW07	MW08	MW09	MW10	MW11	MW12	MW13	MW14	MW15	MW16	MW17	MW18	MW19	MW20
Date			95% Fresh ^{A}	Recreational	Irrigation	Stock	11-04-18	10-04-18	10-04-18	10-04-18	10-04-18	10-04-18	10-04-18	10-04-18	10-04-18	10-04-18	11-04-18	10-04-18	10-04-18	10-04-18	11-04-18
PAEC Sampled																					
Sample Appearance							clear, slight sulphide odour	DRY	grey/brown, turbid, no odour	turbid, grey, brown, no odour	light brown, no odour	turbid, light brown, no odour	light brown, turbid, no odour	light brown, no odour	clear, no odour	clear, no odour	slightly yellow, no odour	light brown, small orange particulates, no odour	clear, no odour	light grey/ clear, some orange particulates, some odour	clear, no odour
Sample collected by							CG	NG	NG	NG	NG	NG	NG	NG	NG	NG	CG	NG	CG	NG	NG
Physico-chemical Parameters																					
Field pH		ph Unit					6.66	--	6.31	7.51	6.47	6.03	6.15	6.51	6.26	7.41	7.12	6.93	6.63	6.25	6.03
Lab pH		ph Unit					6.8	---	6.3	7.5	6.7	6.6	7	8	7.1	7.3	7.2	7	7	7	6.8
Difference							2%	---	0%	0%	3%	9%	10%	14%	13%	1%	1%	4%	5%	11%	12%
Field EC		µS/cm					14160	--	450	3710	8550	2570	13970	4730	5400	1570	540	970	267	1190	1850
Lab EC		µS/cm					12000		350	3100	8400	2100	16000	3900	4900	1200	380	760	200	940	1500
Difference							17%	---	25%	18%	2%	20%	14%	19%	10%	27%	35%	24%	29%	23%	21%
Metals																					
Aluminium pH>6.5	10	µg/L	55	9000	5000	5000	<10	---	4000	<10	<10	470	<10	1500	<10	130	<10	<10	220	40	<10
Fluoride	100	µg/L		1500	1000	2000	500	---	12000	800	1100	12000	300	52000	900	7500	4800	900	8600	4200	600
Non Metallic Inorganics																					
Free Cyanide	4	µg/L	7	800			<4	---	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4

PQL = Practical Quantitation Limit.

[A] ANZECC 2000 95% Protection Level for Receiving Water Type

[B] NHMRC Australian Drinking Water Guidelines, 2011

Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC (2011)

Table 2: 2018 Groundwater Analytical Results

Sample Identification	PQL	Units	Guideline				MW21	S3A	S3B	MW101	MW102	MW103	MW104	MW105	MW106	MW107	QA101	QA103	QC102	QC101
Date			95% Fresh ^{A}	Recreational	Irrigation	Stock	11-04-18	11-04-18	11-04-18	11-04-18	10-04-18	10-04-18	10-04-18	11-04-18	10-04-18	11-04-18	10-04-18	10-11/4/18	10-11/4/18	10-11/4/18
PAEC Sampled																				
Sample Appearance							turbid, pale grey	clear, no odour	clear, no odour	clear, no odour	clear, no odour	clear, tiny orange particulates, no odour	-	copper brown, turbid, no odour	slightly brown, hydrocarbon odour	light brown, turbid, no odour	Duplicate of MW9	Duplicate of MW6	Field blank	Field blank
Sample collected by							CG	CG	CG	CG	CG	NG	NG	NG	CG	NG	NG	CG	NG	CG
Physico-chemical Parameters																				
Field pH		ph Unit					6.71	6.99	6.35	6.30	6.50	4.51	6.90	6.73	7.07	5.67	---	---	---	---
Lab pH		ph Unit					7.1	7.7	6.8	6.7	6.7	5.0	7.2	6.9	7.7	6.5	7.6	6.9	6.2	6.0
Difference							6%	10%	7%	6%	3%	10%	4%	2%	9%	14%	---	---	---	---
Field EC		µS/cm					15820	450	1060	540	510	1720	3280	1110	1060	720	---	---	---	---
Lab EC		µS/cm					20000	340	840	400	380	1400	2600	790	840	560	3100	13000	6	<1
Difference							23%	28%	23%	30%	29%	21%	23%	34%	23%	25%	---	---	---	---
Metals																				
Aluminium pH>6.5	10	µg/L	55	9000	5000	5000	<10	40	230	<10	<10	810	4,800	<10	<10	1,400	<10	<10	<10	<10
Fluoride	100	µg/L		1500	1000	2000	1700	5600	9600	400	300	1700	30000	800	7400	6200	800	600	<100	<100
Non Metallic Inorganics																				
Free Cyanide	4	µg/L	7	800			<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4

PQL = Practical Quantitation Limit.

[A] ANZECC 2000 95% Protection Level for Receiving Water Type

[B] NHMRC Australian Drinking Water Guidelines, 2011

Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC (2

TABLE LR10 Groundwater Analytical Results (ug/L)

Sample Identification	PQL	Guideline				MW06	MW06	MW06	MW07	MW07	MW07	MW08	MW08	MW08	MW09	MW09	MW09	MW10	MW10	MW10	MW11	MW11
Date		95% Fresh [A]	Recreational	Irrigation	Stock	2-5-12	10-7-14	12-4-18	1-5-12	9-7-14	12-4-18	1-5-12	9-7-14	12-4-18	30-4-12	9-7-14	12-4-18	30-4-12	9-7-14	12-4-18	1-5-12	9-7-14
Sample Appearance						Clear	Clear	clear, slight sulphide odour	Clear	Clear	DRY	Clear	Clear	grey/brown, turbid, no odour	Cloudy	Clear	turbid, grey, brown, no odour	Turbid	Clear	light brown, no odour	Milky	Clear
Sample collected by						KJG	KJG	CG	KJG	KJG	NG	KJG	KJG	NG	KJG	KJG	NG	KJG	KJG	NG	KJG	KJG
Physico-chemical Parameters																						
pH								6.8						6.3			7.5			6.7		
EC								12000						350			3100			8400		
Metals																						
Aluminium pH>6.5	10	55	9000	5000	5000	10	180	<10	30	<10		150	1200	4000	10	30	<10	<10	2900	<10	380	390
Fluoride	100		1500	1000	2000	1000	220	500	1300	1400		4900	6700	12000	1000	560	800	1200	2100	1100	3900	8300
Non Metallic Inorganics																						
Free Cyanide	4	7	800			<4		<4						<4	<8		<4	<4		<4	<4	

All results in υg/L

PQL = Practical Quantitation Limit.

[A] ANZECC 2000 95% Protection Level for Receiving Water Type

Guidelines in *italics* are low level reliability guidelines

[B] NHMRC Australian Drinking Water Guidelines, 2011

* Hardness Modified Trigger Values for Cd, Cr (III), Cu, Ni, Pb, Zn

NHMRC arsenic guidelines are based on total arsenic

NHMRC guidelines for chromium are based on Cr (VI)

Total Phenolics guideline based on Phenol

ANZECC guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

NHMRC guidelines for total cyanide are based on cyanogen chloride (as cyanide).

Results for TRH have been compared to TPH guidelines.

Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC (2011)

TABLE LR10 Groundwater Analytical Results (ug/L)

Sample Identification	PQL	Guideline				MW11	MW12	MW12	MW12	MW13	MW13	MW13	MW14	MW14	MW14	MW15	MW15	MW15	MW16	MW16	MW16	MW17
Date		95% Fresh [A]	Recreational	Irrigation	Stock	12-4-18	30-4-12	9-7-14	12-4-18	1-5-12	9-7-14	12-4-18	1-5-12	9-7-14	12-4-18	3-5-12	11-7-14	12-4-18	3-5-12	10-7-14	12-4-18	3-5-12
Sample Appearance						turbid, light brown, no odour	Brown	Clear	light brown, turbid, no odour	Cloudy	Brown	light brown, no odour	Yellow	Clear	clear, no odour	Yellow	Clear	clear, no odour	Clear	Clear	slightly yellow, no odour	Cloudy
Sample collected by						NG	KJG	KJG	NG	KJG	KJG	NG	KJG	KJG	NG	KJG	KJG	NG	KJG	KJG	CG	KJG
Physico-chemical Parameters																						
pH						6.6			7			8			7.1			7.3			7.2	
EC						2100			16000			3900			4900			1200			380	
Metals																						
Aluminium pH>6.5	10	55	9000	5000	5000	470	13,600	<10	<10	2,150	2,500	1500	110	<10	<10	200	180	130	100	<10	<10	3,260
Fluoride	100		1500	1000	2000	12000	1700	220	300	43000	40000	52000	3600	850	900	4500	2700	7500	1500	2300	4800	800
Non Metallic Inorganics																						
Free Cyanide	4	7	800			<4	<8		<4	7		<4	<4		<4	<4		<4	<8		<4	<8

All results in υg/L
PQL = Practical Quantitation Limit.
[A] ANZECC 2000 95% Protection Level for Receiving Water Type
Guidelines in *italics* are low level reliability guidelines
[B] NHMRC Australian Drinking Water Guidelines, 2011
* Hardness Modified Trigger Values for Cd, Cr (III), Cu, Ni, Pb, Zn
NHMRC arsenic guidelines are based on total arsenic
NHMRC guidelines for chromium are based on Cr (VI)
Total Phenolics guideline based on Phenol
ANZECC guidelines for mercury are based on inorganic mercury.
NHMRC guidelines for mercury are based on total mercury.
NHMRC guidelines for total cyanide are based on cyanogen chloride (as cyanide).
Results for TRH have been compared to TPH guidelines.
Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC (2011)

TABLE LR10 Groundwater Analytical Results (ug/L)

Sample Identification	PQL	Guideline				MW17	MW17	MW18	MW18	MW18	MW19	MW19	MW19	MW20	MW20	MW20	MW21	MW21	S3A	S3A	S3A	S3B	S3B
Date		95% Fresh ^{A}	Recreational	Irrigation	Stock	10-7-14	12-4-18	3-5-12	10-7-14	12-4-18	1-5-12	10-7-14	12-4-18	3-5-12	10-7-14	12-4-18	2-5-12	12-4-18	3-5-12	10-7-14	12-4-18	3-5-12	10-7-14
Sample Appearance						Clear	light brown, small orange particulates, no odour	Clear	Clear	clear, no odour	Milky	Clear	light grey/ clear, some orange particulates, some odour	Cloudy	Clear	clear, no odour	Clear	turbid, pale grey	Clear	Clear	clear, no odour	Clear	Clear
Sample collected by						KJG	NG	KJG	KJG	CG	KJG	KJG	NG	KJG	KJG	NG	KJG	CG	KJG	KJG	CG	KJG	KJG
Physico-chemical Parameters																							
pH							7			7			7			6.8		7.1			7.7		
EC							760			200			940			1500		20000			340		
Metals																							
Aluminium pH>6.5	10	55	9000	5000	5000	3,800	<10	3,120	750	220		8	40		1500	<10	20	<10	50	630	40	270	1400
Fluoride	100		1500	1000	2000	1100	900	35000	17000	8600		370	4200		670	600	3000	1700	12000	8200	5600	14000	12000
Non Metallic Inorganics																							
Free Cyanide	4	7	800				<4	<4		<4			<4			<4		<4	<4		<4	<4	

All results in υg/L
PQL = Practical Quantitation Limit.
^{A} ANZECC 2000 95% Protection Level for Receiving Water Type
Guidelines in *italics* are low level reliability guidelines
^{B} NHMRC Australian Drinking Water Guidelines, 2011
* Hardness Modified Trigger Values for Cd, Cr (III), Cu, Ni, Pb, Zn
NHMRC arsenic guidelines are based on total arsenic
NHMRC guidelines for chromium are based on Cr (VI)
Total Phenolics guideline based on Phenol
ANZECC guidelines for mercury are based on inorganic mercury.
NHMRC guidelines for mercury are based on total mercury.
NHMRC guidelines for total cyanide are based on cyanogen chloride (as cyanide).
Results for TRH have been compared to TPH guidelines.
Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC (2011)

TABLE LR10 Groundwater Analytical Results (ug/L)

Sample Identification	PQL	Guideline				S3B	MW101	MW101	MW102	MW102	MW103	MW103	MW104	MW104	MW105	MW105	MW106	MW106	MW107	MW107	SUMP
Date		95% Fresh ^{A}	Recreational	Irrigation	Stock	12-4-18	9-7-14	12-4-18	9-7-14	12-4-18	9-7-14	12-4-18	9-7-14	12-4-18	10-7-14	12-4-18	10-7-14	12-4-18	11-7-14	12-4-18	3-5-12
Sample Appearance						clear, no odour	Clear	clear, no odour	Clear	clear, no odour	Clear	clear, tiny orange particulates, no odour	Clear	-	Clear	copper brown, turbid, no odour	Clear	slightly brown, hydrocarbon odour	Clear	light brown, turbid, no odour	Clear
Sample collected by						CG	KJG	CG	KJG	CG	KJG	NG	KJG	NG	KJG	NG	KJG	CG	KJG	NG	KJG
Physico-chemical Parameters																					
pH						6.8		6.7		6.7		5		7		7		8		7	
EC						840		400		380		1400		2600		790		840		560	
Metals																					
Aluminium pH>6.5	10	55	9000	5000	5000	230	<10	<10	<10	<10	7,700	810	1,300	4,800	20	<10	50	<10	5,000	1,400	40
Fluoride	100		1500	1000	2000	9600	460	400	3200	300	12000	1700	13000	30000	1100	800	7400	7400	10000	6200	4400
Non Metallic Inorganics																					
Free Cyanide	4	7	800			<4		<4		<4		<4		<4		<4		<4		<4	<4

All results in υg/L
PQL = Practical Quantitation Limit.
^{A} ANZECC 2000 95% Protection Level for Receiving Water Type
Guidelines in *italics* are low level reliability guidelines
^{B} NHMRC Australian Drinking Water Guidelines, 2011
* Hardness Modified Trigger Values for Cd, Cr (III), Cu, Ni, Pb, Zn
NHMRC arsenic guidelines are based on total arsenic
NHMRC guidelines for chromium are based on Cr (VI)
Total Phenolics guideline based on Phenol
ANZECC guidelines for mercury are based on inorganic mercury.
NHMRC guidelines for mercury are based on total mercury.
NHMRC guidelines for total cyanide are based on cyanogen chloride (as cyanide).
Results for TRH have been compared to TPH guidelines.
Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC (2011)

TABLE LR10 Groundwater Analytical Results (ug/L)

Sample Identification	MW09	QA101	*RPD %*	MW09	QA102	*RPD %*	MW06	QA103	*RPD %*	QC102	QC101
Sample Type	Intralaboratory			Triplicate			Triplicate			10-11/4/18	10-11/4/18
Date	09-07-14			09-07-14			09-07-14			Field blank	Field blank
Sample Appearance	turbid, grey, brown, no odour			turbid, grey, brown, no odour			clear, slight sulphide odour				---
Sample collected by	NG			NG			CG			NG	CG
Physico-chemical Parameters											
pH	7.5	8	*1.3*	7.5	8	*3.5*	6.8	7	*1.4*	6	6
EC	3100	3100	*0.0*	3100	3270	*5.2*	12000	13000	*7.7*	6	<1
Metals											
Aluminium pH>6.5	<10	<10	*nc*	<10	<10	*nc*	<10	<10	*nc*	<10	<10
Fluoride	800	800	*0.0*	800	600	***33.3***	500	600	*16.7*	<100	<100
Non Metallic Inorganics											
Free Cyanide	<4	<4	*nc*	<4	<4	*nc*	<4	<4	*nc*	<4	<4

PQL = Pratical Quantitation Limit

<value = Less than the laboratory PQL

Bold and Shaded cells exceed RPD >30%

Bold indicates when above the acceptance criteria for Trip Spikes/Blanks and Rinsates

nc = not calculated as one or more results are below the PQL

APPENDIX 3
LABORATORY REPORT

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CERTIFICATE OF ANALYSIS 189291

Client Details

Client	Ramboll Australia Pty Ltd
Attention	Natalie Gilbert
Address	PO Box 560, North Sydney, NSW, 2060

Sample Details

Your Reference	**Smelter Site GW Monitoring / 318000 / Hydro**
Number of Samples	28 Water
Date samples received	12/04/2018
Date completed instructions received	12/04/2018

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	16/04/2018
Date of Issue	16/04/2018

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Results Approved By
Diego Bigolin, Team Leader, Inorganics
Jaimie Loa-Kum-Cheung, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

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COMPETENCE

Miscellaneous Inorganics						
Our Reference		189291-1	189291-2	189291-3	189291-4	189291-5
Your Reference	UNITS	MW06	MW08	MW09	MW10	MW11
Date Sampled		11/04/2018	10/04/2018	10/04/2018	10/04/2018	10/04/2018
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018
Date analysed	-	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018
pH	pH Units	6.8	6.3	7.5	6.7	6.6
Electrical Conductivity	µS/cm	12,000	350	3,100	8,400	2,100
Fluoride, F	mg/L	0.5	12	0.8	1.1	12
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		189291-6	189291-7	189291-8	189291-9	189291-10
Your Reference	UNITS	MW12	MW13	MW14	MW15	MW16
Date Sampled		10/04/2018	10/04/2018	10/04/2018	10/04/2018	11/04/2018
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018
Date analysed	-	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018
pH	pH Units	6.8	7.5	7.1	7.3	7.2
Electrical Conductivity	µS/cm	16,000	3,900	4,900	1,200	380
Fluoride, F	mg/L	0.3	52	0.9	7.5	4.8
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference		189291-11	189291-12	189291-13	189291-14	189291-15
Your Reference	UNITS	MW17	MW18	MW19	MW20	MW21
Date Sampled		10/04/2018	10/04/2018	10/04/2018	11/04/2018	11/04/2018
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018
Date analysed	-	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018
pH	pH Units	7.2	7.0	7.0	6.8	7.1
Electrical Conductivity	µS/cm	760	200	940	1,500	20,000
Fluoride, F	mg/L	0.9	8.6	4.2	0.6	1.7
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference	UNITS	189291-16	189291-17	189291-18	189291-19	189291-20
Your Reference		MW101	MW102	MW103	MW104	MW105
Date Sampled		11/04/2018	10/04/2018	10/04/2018	10/04/2018	11/04/2018
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018
Date analysed	-	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018
pH	pH Units	6.7	6.7	5.0	7.2	6.9
Electrical Conductivity	µS/cm	400	380	1,400	2,600	790
Fluoride, F	mg/L	0.4	0.3	1.7	30	0.8
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics						
Our Reference	UNITS	189291-21	189291-22	189291-23	189291-24	189291-25
Your Reference		MW106	MW107	S3A	S3B	QA101
Date Sampled		10/04/2018	11/04/2018	11/04/2018	11/04/2018	10/04/2018
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018
Date analysed	-	12/04/2018	12/04/2018	12/04/2018	12/04/2018	12/04/2018
pH	pH Units	7.7	6.5	7.7	6.8	7.6
Electrical Conductivity	µS/cm	840	560	340	840	3,100
Fluoride, F	mg/L	7.4	6.2	5.6	9.6	0.8
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004

Miscellaneous Inorganics				
Our Reference	UNITS	189291-26	189291-27	189291-28
Your Reference		QA103	QC102	QC101
Date Sampled		11/04/2018	11/04/2018	11/04/2018
Type of sample		Water	Water	Water
Date prepared	-	12/04/2018	12/04/2018	12/04/2018
Date analysed	-	12/04/2018	12/04/2018	12/04/2018
pH	pH Units	6.9	6.2	6.0
Electrical Conductivity	µS/cm	13,000	6	<1
Fluoride, F	mg/L	0.6	<0.1	<0.1
Free Cyanide in Water	mg/L	<0.004	<0.004	<0.004

All metals in water-dissolved						
Our Reference		189291-1	189291-2	189291-3	189291-4	189291-5
Your Reference	UNITS	MW06	MW08	MW09	MW10	MW11
Date Sampled		11/04/2018	10/04/2018	10/04/2018	10/04/2018	10/04/2018
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Date analysed	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Aluminium-Dissolved	µg/L	<10	4,000	<10	<10	470

All metals in water-dissolved						
Our Reference		189291-6	189291-7	189291-8	189291-9	189291-10
Your Reference	UNITS	MW12	MW13	MW14	MW15	MW16
Date Sampled		10/04/2018	10/04/2018	10/04/2018	10/04/2018	11/04/2018
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Date analysed	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Aluminium-Dissolved	µg/L	<10	1,500	<10	130	<10

All metals in water-dissolved						
Our Reference		189291-11	189291-12	189291-13	189291-14	189291-15
Your Reference	UNITS	MW17	MW18	MW19	MW20	MW21
Date Sampled		10/04/2018	10/04/2018	10/04/2018	11/04/2018	11/04/2018
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Date analysed	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Aluminium-Dissolved	µg/L	<10	220	40	<10	<10

All metals in water-dissolved						
Our Reference		189291-16	189291-17	189291-18	189291-19	189291-20
Your Reference	UNITS	MW101	MW102	MW103	MW104	MW105
Date Sampled		11/04/2018	10/04/2018	10/04/2018	10/04/2018	11/04/2018
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Date analysed	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Aluminium-Dissolved	µg/L	<10	<10	810	4,800	<10

All metals in water-dissolved						
Our Reference		189291-21	189291-22	189291-23	189291-24	189291-25
Your Reference	UNITS	MW106	MW107	S3A	S3B	QA101
Date Sampled		10/04/2018	11/04/2018	11/04/2018	11/04/2018	10/04/2018
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Date analysed	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Aluminium-Dissolved	µg/L	<10	1,400	40	230	<10

All metals in water-dissolved				
Our Reference	UNITS	189291-26	189291-27	189291-28
Your Reference		QA103	QC102	QC101
Date Sampled		11/04/2018	11/04/2018	11/04/2018
Type of sample		Water	Water	Water
Date prepared	-	13/04/2018	13/04/2018	13/04/2018
Date analysed	-	13/04/2018	13/04/2018	13/04/2018
Aluminium-Dissolved	µg/L	<10	<10	<10

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
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	Determination of various metals by ICP-MS.

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	189291-22
Date prepared	-			12/04/2018	1	12/04/2018	12/04/2018		12/04/2018	12/04/2018
Date analysed	-			12/04/2018	1	12/04/2018	12/04/2018		12/04/2018	12/04/2018
pH	pH Units		Inorg-001	[NT]	1	6.8	6.8	0	102	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	12000	12000	0	93	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	1	0.5	0.5	0	96	92
Free Cyanide in Water	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	108	107

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	189291-2
Date prepared	-			[NT]	11	12/04/2018	12/04/2018		12/04/2018	12/04/2018
Date analysed	-			[NT]	11	12/04/2018	12/04/2018		12/04/2018	12/04/2018
pH	pH Units		Inorg-001	[NT]	11	7.2	7.2	0	102	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	[NT]	11	760	760	0	95	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	11	0.9	0.9	0	101	93
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	11	<0.004	<0.004	0	105	110

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	12/04/2018	12/04/2018		[NT]	[NT]
Date analysed	-			[NT]	21	12/04/2018	12/04/2018		[NT]	[NT]
pH	pH Units		Inorg-001	[NT]	21	7.7	7.7	0	[NT]	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	[NT]	21	840	840	0	[NT]	[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	21	7.4	7.4	0	[NT]	[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	21	<0.004	<0.004	0	[NT]	[NT]

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	189291-8
Date prepared	-			13/04/2018	11	13/04/2018	13/04/2018		13/04/2018	13/04/2018
Date analysed	-			13/04/2018	11	13/04/2018	13/04/2018		13/04/2018	13/04/2018
Aluminium-Dissolved	µg/L	10	Metals-022	<10	11	<10	<10	0	104	94

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	189291-22
Date prepared	-			[NT]	3	13/04/2018	13/04/2018		13/04/2018	13/04/2018
Date analysed	-			[NT]	3	13/04/2018	13/04/2018		13/04/2018	13/04/2018
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	3	<10	<10	0	97	#

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	23	13/04/2018	13/04/2018		[NT]	[NT]
Date analysed	-			[NT]	23	13/04/2018	13/04/2018		[NT]	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	23	40	40	0	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	

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.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

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

Dissolved Metals: no filtered, preserved sample was received for samples 1, 2, 4-7, 10, 14, 19-21, 24 and 26, therefore the unpreserved sample was filtered through 0.45 μm filter at the lab.
Note: there is a possibility some elements may be underestimated.

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

Client: Ramboll
Contact Person: Natalie Gilbert
Project Mgr: Natalie Gilbert
Sampler: Natalie Gilbert/ Craig Goodbody
Address:
Level 2, suite 19, 50 Glebe Road, The Junction
Phone:
Mob: 432184301
Email: ngilbert@ramboll.com

Client Project Name / Number / Site etc (ie report title): Smelter Site GW Monitoring / 318000 / Hydro
PO No.: P1082
Envirolab Quote No. : Quotation – 18SY036
Date results required:
Or choose: standard / same day / 1 day / [✓ 2 day] / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Report format: esdat / equis /
Lab Comments: Please filter metals samples as required

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt Myaree, WA 6154
Ph 08 9317 2505 / lab@mpl.com.au

Melbourne Lab - Envirolab Services
1A Dalmore Drive Scoresby VIC 3179
Ph 03 9763 2500 / melbourne@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
Ph 07 3266 9532 / brisbane@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
Ph 0406 350 706 / adelaide@envirolab.com.au

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	pH	EC	soluble fluoride	dissolved aluminium	cyanide (free)											Provide as much information about the sample as you can
~~MW06~~			W		X	X	X	X	X											
MW06	1			11/4/18	X	X	X	X	X											
~~MW07~~	dry				X	X	X	X	X											Envirolab Services 12 Ashley St
MW08	2			10/4/18	X	X	X	X	X											Chatswood NSW 2067 Ph: (02) 9910 6200
MW09	3				X	X	X	X	X											Job No: 189291
MW10	4				X	X	X	X	X											Date Received: 12/4/2018
MW11	5				X	X	X	X	X											Time Received: 10.15
MW12	6				X	X	X	X	X											Received by: PR
MW13	7				X	X	X	X	X											Temp: [✓ Cool]/Ambient
MW14	8				X	X	X	X	X											Cooling: [✓ Ice]/Icepack 10.2
MW15	9				X	X	X	X	X											Security: [✓ Intact]/Broken/None
MW16	10			11/4/18	X	X	X	X	X											
MW17	11			10/4/18	X	X	X	X	X											

Relinquished by (Company): Ramboll
Print Name: ~~N.Gilbert~~ C. Goodbody
Date & Time: ~~06-04-18~~ 11/4/18 15:50
Signature: Craig Goodbody

Received by (Company): ELS
Print Name: P.Ray
Date & Time: 12/4/2018 10.15
Signature: PR

Lab use only:
Samples Received: [✓ Cool] or Ambient (circle one)
Temperature Received at: 10.2 **(if applicable)**
Transported by: Hand delivered / [✓ courier]

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

Page No: 1 of 3

CHAIN OF COUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt Myaree, WA 6154
Ph 08 9317 2505 / lab@mpl.com.au

Melbourne Lab - Envirolab Services
1A Dalmore Drive Scoresby VIC 3179
Ph 03 9763 2500 / melbourne@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
Ph 07 3266 9532 / brisbane@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
Ph 0406 350 706 / adelaide@envirolab.com.au

Client: Ramboll
Contact Person: Natalie Gilbert
Project Mgr: Natalie Gilbert
Sampler: Natalie Gilbert/ Craig Goodbody
Address: Level 2, suite 19, 50 Glebe Road, The Junction
Phone: **Mob:** 432184301
Email: ngilbert@ramboll.com

Client Project Name / Number / Site etc (ie report title): Smelter Site GW Monitoring / 318000 / Hydro
PO No.: P1082
Envirolab Quote No. : Quotation – 18SY036
Date results required:
Or choose: standard / same day / 1 day / [✓ 2 day] / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Report format: esdat / equis /
Lab Comments:

Sample Information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	pH	EC	soluble fluoride	dissolved aluminium	cyanide (free)											Provide as much information about the sample as you can
MW18	12		W	10/4/18	X	x	x	x	x											
MW19	13			10/4/18	X	x	x	x	x											
MW20	14			11/4/18	X	x	x	x	x											
MW21	15			11/4/18	X	x	x	x	x											
MW101	16			11/4/18	X	x	x	x	x											
MW102	17			10/4/18	X	x	x	x	x											
MW103	18			10/4/18	X	x	x	x	x											
MW104	19			10/4/18	X	x	x	x	x											
MW105	20			11/4/18	X	x	x	x	x											
MW106	21			10/4/18	X	x	x	x	x											
MW107	22			11/4/18	X	x	x	x	x											
S3A	23			11/4/18	X	x	x	x	x											
S3B	24			11/4/18	X	x	x	x	x											

Relinquished by (Company): Ramboll
Print Name: N.Gilbert
Date & Time: 06-04-18
Signature:

Received by (Company): ELS
Print Name: P.Raj
Date & Time: 12/4/2018 10.15
Signature:

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

Page No: 2 of 3

189291

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt Myaree, WA 6154
Ph 08 9317 2505 / lab@mpl.com.au

Melbourne Lab - Envirolab Services
1A Dalmore Drive Scoresby VIC 3179
Ph 03 9763 2500 / melbourne@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
Ph 07 3266 9532 / brisbane@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
Ph 0406 350 706 / adelaide@envirolab.com.au

Client: Ramboll
Contact Person: Natalie Gilbert
Project Mgr: Natalie Gilbert
Sampler: Natalie Gilbert/ Craig Goodbody
Address:
Level 2, suite 19, 50 Glebe Road, The Junction
Phone:
Mob: 432184301
Email: ngilbert@ramboll.com

Client Project Name / Number / Site etc (ie report title): Smelter Site GW Monitoring / 318000 / Hydro
PO No.: P1082
Envirolab Quote No. : Quotation – 18SY036
Date results required:
Or choose: standard / same day / 1 day / [✓ 2 day] / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Report format: esdat / equis /
Lab Comments: ⊛ Interlab Triplicate ~~[illegible]~~ QA102 please

Fwd to ALS for analysis

Sample information					Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	pH	EC	soluble fluoride	dissolved aluminium	cyanide (free)											Provide as much information about the sample as you can
QA101	25		10/4/18	W	X	x	x	x	x											
QA102 –	ALS		10/4/18		X	x	x	x	x											
QA103	[illegible] 26		11/4/18		X	x	x	x	x											
⊛ ~~QA104~~					X	x	x	x	x											
QC101 NR	–		10/4/18		X	x	x	x	x											
QC102	27		11/4/18		X	x	x	x	x											
~~QC103~~					X	x	x	x	x											
FB extra.	28				x	x	x	x	x											
QC101																				
	Frtz																			

Relinquished by (Company): Ramboll
Print Name: N.Gilbert
Date & Time: 06-04-18
Signature:

Received by (Company): ELS
Print Name: P. Raj
Date & Time: 12/4/2018 10:15
Signature:

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

Page No: 3 of 3

189291

Andrew Fitzsimons

From:	Natalie Gilbert <ngilbert@ramboll.com>
Sent:	Friday, 13 April 2018 8:36 AM
To:	Andrew Fitzsimons
Subject:	RE: 318000 (189291)

Hi Andrew,

Could you please label FB as QC101 and undertake the analysis requested for QC101.

Thanks!

Yours sincerely
Natalie Gilbert

BEng (Env) (Hons)
Senior Environmental Engineer

D +61 2 4962 5444
M +61 4 32184301
ngilbert@ramboll.com

Connect with us

Ramboll
Level 2, Suite 18 Eastpoint
50 Glebe Road
PO Box 435
The Junction
NSW 2291
Australia
www.ramboll.com

Ramboll Australia Pty Ltd.
ACN 095 437 442
ABN 49 095 437 442

From: Andrew Fitzsimons [mailto:AFitzsimons@envirolab.com.au]
Sent: Thursday, April 12, 2018 2:13 PM
To: Natalie Gilbert <ngilbert@ramboll.com>
Subject: 318000 (189291)

Hi Natalie

For this job (COC attached) we did not receive sample QC101, and we received sample FB. Did you need any testing on FB?

Cheers,

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Ramboll Australia Pty Ltd
Attention	Natalie Gilbert

Sample Login Details

Your reference	Smelter Site GW Monitoring / 318000 / Hydro
Envirolab Reference	189291
Date Sample Received	12/04/2018
Date Instructions Received	12/04/2018
Date Results Expected to be Reported	16/04/2018

Sample Condition

Samples received in appropriate condition for analysis	YES
No. of Samples Provided	28 Water
Turnaround Time Requested	2 days
Temperature on Receipt (°C)	10.2
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Sample ID	pH	Electrical Conductivity	Fluoride, F	Free Cyanide in Water	All metals in water-dissolved
MW06	✓	✓	✓	✓	✓
MW08	✓	✓	✓	✓	✓
MW09	✓	✓	✓	✓	✓
MW10	✓	✓	✓	✓	✓
MW11	✓	✓	✓	✓	✓
MW12	✓	✓	✓	✓	✓
MW13	✓	✓	✓	✓	✓
MW14	✓	✓	✓	✓	✓
MW15	✓	✓	✓	✓	✓
MW16	✓	✓	✓	✓	✓
MW17	✓	✓	✓	✓	✓
MW18	✓	✓	✓	✓	✓
MW19	✓	✓	✓	✓	✓
MW20	✓	✓	✓	✓	✓
MW21	✓	✓	✓	✓	✓
MW101	✓	✓	✓	✓	✓
MW102	✓	✓	✓	✓	✓
MW103	✓	✓	✓	✓	✓
MW104	✓	✓	✓	✓	✓
MW105	✓	✓	✓	✓	✓
MW106	✓	✓	✓	✓	✓
MW107	✓	✓	✓	✓	✓
S3A	✓	✓	✓	✓	✓
S3B	✓	✓	✓	✓	✓
QA101	✓	✓	✓	✓	✓
QA103	✓	✓	✓	✓	✓
QC102	✓	✓	✓	✓	✓
QC101	✓	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order : **ES1810554**
Client : **RAMBOLL AUSTRALIA PTY LTD**
Contact : MS NATALIE GILBERT
Address : PO BOX 560
NORTH SYDNEY NSW, AUSTRALIA 2060
Telephone : 02 4962 5444
Project : Smelter Site GW Monitoring 318000
Order number : P1082
C-O-C number : ----
Sampler : Natalie Gilbert/ Craig Goodbody
Site : Hydro
Quote number : EN/222/17
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 2
Laboratory : Environmental Division Sydney
Contact : Sepan Mahamad
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61-2-8784 8555
Date Samples Received : 12-Apr-2018 16:51
Date Analysis Commenced : 12-Apr-2018
Issue Date : 17-Apr-2018 11:45

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

Analytical Results

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

			Client sample ID	QA102	----	----	----	----
			Client sampling date / time	10-Apr-2018 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES1810554-001**	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.77**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**3270**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	10	µg/L	<10	----	----	----	----
EK025SF: Free CN by Segmented Flow Analyser								
Free Cyanide	----	0.004	mg/L	<0.004	----	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.6**	----	----	----	----

QUALITY CONTROL REPORT

Work Order : **ES1810554**

Client : **RAMBOLL AUSTRALIA PTY LTD**
Contact : MS NATALIE GILBERT
Address : PO BOX 560
NORTH SYDNEY NSW, AUSTRALIA 2060

Telephone : 02 4962 5444
Project : Smelter Site GW Monitoring 318000
Order number : P1082
C-O-C number : ----
Sampler : Natalie Gilbert/ Craig Goodbody
Site : Hydro
Quote number : EN/222/17
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 3

Laboratory : Environmental Division Sydney
Contact : Sepan Mahamad
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone : +61-2-8784 8555
Date Samples Received : 12-Apr-2018
Date Analysis Commenced : 12-Apr-2018
Issue Date : 17-Apr-2018

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ashesh Patel	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA005P: pH by PC Titrator (QC Lot: 1563822)									
ES1810554-001	QA102	EA005-P: pH Value	----	0.01	pH Unit	7.77	7.83	0.769	0% - 20%
ES1810543-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	4.98	4.93	1.01	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 1563821)									
ES1810554-001	QA102	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	3270	3260	0.320	0% - 20%
ES1810499-013	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	790	796	0.785	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 1564577)									
EP1804513-005	Anonymous	EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.00	No Limit
ES1810327-002	Anonymous	EG020A-F: 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: 1568324)									
ES1810554-001	QA102	EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	<0.004	0.00	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 1563817)									
ES1810363-003	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	1.3	1.3	0.00	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 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*
EA010P: Conductivity by PC Titrator (QCLot: 1563821)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	2000 µS/cm	104	95	113
EG020F: Dissolved Metals by ICP-MS (QCLot: 1564577)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	93.4	80	116
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 1568324)								
EK025SF: Free Cyanide	----	0.004	mg/L	<0.004	0.2 mg/L	107	88	128
EK040P: Fluoride by PC Titrator (QCLot: 1563817)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	105	82	116

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	*SpikeRecovery(%)*	*Recovery Limits (%)*	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 1568324)							
ES1810554-001	QA102	EK025SF: Free Cyanide	----	0.2 mg/L	77.2	70	130
EK040P: Fluoride by PC Titrator (QCLot: 1563817)							
ES1810363-001	Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	121	70	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1810554**	Page	: 1 of 4
Client	: **RAMBOLL AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS NATALIE GILBERT	Telephone	: +61-2-8784 8555
Project	: Smelter Site GW Monitoring 318000	Date Samples Received	: 12-Apr-2018
Site	: Hydro	Issue Date	: 17-Apr-2018
Sampler	: Natalie Gilbert/ Craig Goodbody	No. of samples received	: 1
Order number	: P1082	No. of samples analysed	: 1

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

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

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method **Container** / Client Sample ID(s)	*Extraction / Preparation* *Date extracted*	 *Due for extraction*	 **Days overdue**	*Analysis* *Date analysed*	 *Due for analysis*	 **Days overdue**
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
QA102	----	----	----	12-Apr-2018	10-Apr-2018	**2**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type Method	Count QC	 Regular	Rate (%) Actual	 Expected	Quality Control Specification
Matrix Spikes (MS)					
Dissolved Metals by ICP-MS - Suite A	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

Method *Container / Client Sample ID(s)*	***Sample Date***	*Extraction / Preparation* ***Date extracted***	 *Due for extraction*	 *Evaluation*	*Analysis* ***Date analysed***	 *Due for analysis*	 *Evaluation*
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P)							
QA102	**10-Apr-2018**	**----**	----	----	**12-Apr-2018**	10-Apr-2018	✗
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P)							
QA102	**10-Apr-2018**	**----**	----	----	**12-Apr-2018**	08-May-2018	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
QA102	**10-Apr-2018**	**----**	----	----	**13-Apr-2018**	07-Oct-2018	✓
EK025SF: Free CN by Segmented Flow Analyser							
Opaque plastic bottle - NaOH (EK025SF)							
QA102	**10-Apr-2018**	**----**	----	----	**16-Apr-2018**	24-Apr-2018	✓
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
QA102	**10-Apr-2018**	**----**	----	----	**12-Apr-2018**	08-May-2018	✓

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)							
Conductivity by PC Titrator	EA010-P	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	1	**200.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Conductivity by PC Titrator	EA010-P	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Conductivity by PC Titrator	EA010-P	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	0	1	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Free CN by Segmented Flow Analyser	EK025SF	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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*
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
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)
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)

WORKORDER No: ES1801554

ENVIROLAB GROUP

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

Client: Ramboll
Contact Person: Natalie Gilbert
Project Mgr: Natalie Gilbert
Sampler: Natalie Gilbert/ Craig Goodbody
Address: Level 2, suite 19, 50 Glebe Road, The Junction
Phone:
Mob: 432184301
Email: ngilbert@ramboll.com

Client Project Name / Number / Site etc (ie report title): Smelter Site GW Monitoring / 318000 / Hydro
PO No.: P1082
Envirolab Quote No. : Quotation – 18SY036
Date results required:
Or choose: standard / same day / 1 day / [✓ 2 day] / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Report format: esdat / equis /
Lab Comments: (*) Interlab Triplicate ~~[illegible]~~ ~~[illegible]~~. QA102 please

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt Myaree, WA 6154
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Melbourne Lab - Envirolab Services
1A Dalmore Drive Scoresby VIC 3179
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Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
Ph 0406 350 706 / adelaide@envirolab.com.au

Fwd to ALS for analysis

Sample information					Tests Required					Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	pH	EC	soluble fluoride	dissolved aluminium	cyanide (free)	Provide as much information about the sample as you can
QA101	25		10/4/18	W	X	X	X	X	X	
① QA102	ALS		10/4/18		X	X	X	X	X	
(*) QA103	26		11/4/18		X	X	X	X	X	
~~QA104~~					X	X	X	X	X	
QC101 NR	–		10/4/18		X	X	X	X	X	
QC102	27		11/4/18		X	X	X	X	X	
~~QC103~~					X	X	X	X	X	
FB extra.	28									

TAT

Environmental Division
Sydney
Work Order Reference
ES1810554

Telephone : + 61-2-8784 8555

Relinquished by (Company): Ramboll ELS
Print Name: N.Gilbert JACK EMLEN
Date & Time: 06-04-18 12.4.18 13:40
Signature:

Received by (Company): ELS
Print Name: P. Raj
Date & Time: 12/4/2018 10:15
Signature: M

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

Page No: 3 of 3

Rec - [illegible] 12/4/18 ~~16~~.51 59

189291

APPENDIX 4
FIELD SHEETS

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 10/4/18
Project: P1082	**Well Number:** MW104
Location: Hydro	**Sampler(s):** NG.

Field Measurements

Organic vapours in well: ppm		Measurement device:
Depth to Groundwater:	1.69 m	Measurement Device:
Correction:	+0.45. m	
Groundwater Elevation :	m	
Depth to Immiscible Layer:	m	Measurement Device:
Thickness to Immiscible Layer:	m	
Well Depth:	4.50. m	
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or [✓ mS/cm])	pH	DO (mg/L or ppm)	Redox (mV)	~~TDS (mg/L~~ mmHg ~~or ppm~~)	Comments (appearance, odour, etc)
3.05	26.5	3.37	7.21	0.35	-178.9	763.3	copper brown, no odour, turbid
3.06	26.5	3.36	7.00	0.21	-192.6	763.3	''
3.07	26.6	3.32	6.91	0.17	-202.9	763.3	
3.08	26.6	3.28	6.90	0.17	-207.4	763.2	
3.09pm							

Miscellaneous Field Comments

Well Head Integrity: head @ end = 1.75.

Duplicate: N/A

Triplicate: N/A

Rinsate: N/A

Samples Filtered metals.

Weather Condition: sunny

Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 10/4/18
Project: P1082	**Well Number:** MW13.
Location: Hydro.	**Sampler(s):** NG

Field Measurements

Organic vapours in well: ppm	Measurement device:
Depth to Groundwater: 1.73 m	Measurement Device:
Correction: -+0.88 m	
Groundwater Elevation : m	
Depth to Immiscible Layer: m	Measurement Device:
Thickness to Immiscible Layer: m	
Well Depth: ~~4.~~ 3.80 m	
Thickness to Groundwater Column: m	

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or [✓ mS/cm])	pH	DO (mg/L or [✓ ppm])	Redox (mV)	mmHg ~~TDS (mg/L or ppm)~~	Comments (appearance, odour, etc)
3.28	25.3	4.74	6.48	0.61	-79.2	763.6	light brown, no odour
3.29	25.2	4.73	6.48	0.58	-85.1	763.6	"
3.30	25.3	4.73	6.51	0.55	-90.2	763.6	"

Miscellaneous Field Comments

Well Head Integrity: head @ end - 2.23.

Duplicate:

Triplicate:

Rinsate:

Samples Filtered

Weather Condition:

Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:
Date: 10/4/18
Project: P1082
Well Number: MW103
Location: Hydro.
Sampler(s): NG

Field Measurements

Organic vapours in well:	ppm	Measurement device:	
Depth to Groundwater: 1·64	m	Measurement Device:	
Correction: +0·80	m		
Groundwater Elevation :	m		
Depth to Immiscible Layer:	m	Measurement Device:	
Thickness to Immiscible Layer:	m		
Well Depth: 6·86.	m		
Thickness to Groundwater Column:	m		

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer
Start Sampling: 3.45
End Sampling:
Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or [✓ mS/cm])	pH	DO (mg/L or [✓ ppm])	Redox (mV)	mm Hg ~~TDS (mg/L or ppm)~~	Comments (appearance, odour, etc)
3·47	24·9	1·74	4·64	0·97	137·2	763.6	
3.48	25·0	1·73	4·61	1·03	140·3	763·7	
3·49	25·0	1·72	4·54	1·12	144·6	763·6	
3·50	25·0	1·72	4·51	1·14	146·2	763·7	

Miscellaneous Field Comments

Well Head Integrity: head @ end = 2·45
Duplicate: N/A
Triplicate: N/A
Rinsate: N/A
Samples Filtered metals.
Weather Condition: Sunny.
Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:
Project: P1082
Location: Hydro
Date: 10/4/18
Well Number: MW10
Sampler(s): NG

Field Measurements

Organic vapours in well: ppm
Measurement device: I.P dipper.
Depth to Groundwater: 3.41 m
Measurement Device:
Correction: +0.71 m
Groundwater Elevation : 6.92. m
Depth to Immiscible Layer: m
Measurement Device:
Thickness to Immiscible Layer: m
Well Depth: m
Thickness to Groundwater Column: m

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer
Start Sampling: 7.23
End Sampling: 7.33
Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or ~~mS/cm~~)	pH	DO (mg/L or ppm)	Redox (mV)	mm Hg TDS (mg/L or ppm)	Comments (appearance, odour, etc)
7.26	21.8	8.73	6.58	1.19	113.1	764.8	light brown, turbid, no odour
7.27	22.0	8.68	6.50	1.07	107.3	764.8	〃
7.28	22.1	8.58	6.48	1.06	104.9	764.8	〃
7.29	22.1	8.55	6.47	1.09	103.7	764.7	〃

Miscellaneous Field Comments

Well Head Integrity: dropped 3.57, backed off pump - stabilised @
Duplicate: N/A
Triplicate: N/A.
Rinsate: N/A
Samples Filtered metals - aluminium.
Weather Condition: Sunny.
Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 10/4/18
Project: P1082.	**Well Number:** MW9
Location: Hydro.	**Sampler(s):** NS

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	2.17	m	Measurement Device:
Correction:	+0.71	m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	4.85	m	
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer

Start Sampling: 8.52 End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or [✓ mS/cm])	pH	DO (mg/L or [✓ ppm])	Redox (mV)	mmHg ~~TDS (mg/L or ppm)~~	Comments (appearance, odour, etc)
7.55	24.8	3.69	7.67	3.48	96.5	765.0	clear, no odour
7.56	24.7	3.77	7.66	3.66	95.1	765.0	turbid, grey, brown no odour
7.57	24.7	~~2683~~ 3.71	7.56	2.72	95.4	765.0	"
7.58	24.7	3.71	7.51	2.55	95.3	765.0	"
~~7.59~~							

* DO kept dropping. would not stabilise.

Miscellaneous Field Comments

Well Head Integrity:

Duplicate: Yes QA101

Triplicate: Yes QA102.

Rinsate: N/A.

Samples Filtered metals

Weather Condition: sunny.

Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:
Date: 10/4/18.
Project: e1082
Well Number: MW07.
Location: Hyoro.
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: 2.23 m
Thickness to Groundwater Column: m

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer
Start Sampling:
End Sampling:
Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)

Miscellaneous Field Comments

Well Head Integrity:
Duplicate:
Triplicate:
Rinsate:
Samples Filtered
Weather Condition:
Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:
Project: P1082
Location: Hydro
Date: 10/4/18.
Well Number: MW08.
Sampler(s): NG

Field Measurements

Organic vapours in well: ppm
Measurement device: I.P dipper
Depth to Groundwater: 1.36 m
Measurement Device:
Correction: - 0.12 m
Groundwater Elevation : m
Depth to Immiscible Layer: m
Measurement Device:
Thickness to Immiscible Layer: m
Well Depth: 2.31 m
Thickness to Groundwater Column: m

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer
Start Sampling: 8.38.
End Sampling:
Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or ~~mS/cm~~)	pH	DO (mg/L or ~~ppm~~)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)
8.40	26.0	0.460	7.94	4.13	101.2	765.0	red/brown, turbid.
8.41	25.8	0.456	7.15	4.07	104.8	765.0	becoming clear.
8:42	26.2	0.450	6.77	3.10	108.3	765.0	clear, no odour
8.43	26.2	0.451	6.63	3.11	108.5	765.0	grey/brown, turbid, no odour
8.44	26.2	0.450	6.48	3.27	108.9	765.0	"
8.45	26.2	0.450	6.38	3.35	109.3	765.0	"
8.46	26.3	0.450	6.31	3.44	108.7	7650	"

Miscellaneous Field Comments

Well Head Integrity: 8:42 dropped, then stabilised.
Duplicate: N/A
Triplicate: N/A.
Rinsate:
Samples Filtered metals.
Weather Condition: Sunny
Other:

head kept dropping. pumping rate at lowest possible.

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 10/4/18.
Project: P/082.	**Well Number:** MW102.
Location: Hydro.	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	1.80	m	Measurement Device: I.P dipper
Correction:	-0.11	m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	4.92	m	
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer

Start Sampling: 9.08 End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or ~~mS/cm~~)	pH	DO (mg/L or [✓ ppm])	Redox (mV)	mnlty ~~TDS (mg/L or ppm)~~	Comments (appearance, odour, etc)
9.09	266	0.54	8.11	0.78	-4.3	765.1	clear, tiny orange
9.10	26.6	0.64	7.54	0.63	-8.7	765.1	particulates, no odour
9.11	26.8	0.54	6.92	0.53	-8.9	765.1	"
9.12	26.9	0.52	6.81	0.48	-9.9	765.1	"
9.13.	26.9	0.52	6.76	0.46	-11.3	765.1	"
9.14	26.9	0.52	6.64	0.46	-13.2	765.1	"
9.15	27.0	0.52	6.56	0.40	-14.9	765.1	"
9.16	27.0	0.51	6.50	0.42	-16.2	765.3	

Miscellaneous Field Comments

Well Head Integrity: head @ end 2.31

Duplicate: N/A.

Triplicate: N/A.

Rinsate: N/A

Samples Filtered metals.

Weather Condition: sunny

Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:
Date: 10/4/18.
Project: P1082.
Well Number: MW11
Location: Hydro
Sampler(s): NG

Field Measurements

Organic vapours in well: ppm
Measurement device:
Depth to Groundwater: 1.99 m
Measurement Device:
Correction: +0.75 m
Groundwater Elevation : m
Depth to Immiscible Layer: m
Measurement Device:
Thickness to Immiscible Layer: m
Well Depth: 4.77 m
Thickness to Groundwater Column: m

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer
Start Sampling: 11.02 -
End Sampling:
Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ~~ppm~~)	Redox (mV)	mmHg ~~TDS (mg/L~~ or ~~ppm)~~	Comments (appearance, odour, etc)
11.04	21.8	2.57	6.09	0.90	-16.6	765.1	turbid light brown, no odour
11.05	21.8	2.58	6.03	0.74	-24.7	765.1	"
11.06	21.8	2.58	6.03	0.66	-26.9	765.1	"
11.07	21.8	2.57	6.03	0.59	-29.9	765.1	"

Miscellaneous Field Comments

Well Head Integrity: 2.01 after sampling.
Duplicate: N/A
Triplicate: N/A
Rinsate: N/A
Samples Filtered metals.
Weather Condition: cloudy humid.
Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:
Project: P1082.
Location: Hycb d.
Date: 10/4
Well Number: MW12
Sampler(s): NG.

Field Measurements

Organic vapours in well: ppm
Depth to Groundwater: 6.90 m
Correction: +0.50 m
Groundwater Elevation : m
Depth to Immiscible Layer: m
Thickness to Immiscible Layer: m
Well Depth: 13.09. m
Thickness to Groundwater Column: m
Measurement device:
Measurement Device:
Measurement Device:

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer
Start Sampling: 11.30
End Sampling:
Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or ~~mS/cm~~)	pH	DO (mg/L or ppm)	Redox (mV)	mmHg ~~TDS (mg/L or ppm~~)	Comments (appearance, odour, etc)
11.34	23.0	12.84	6.38	–	69.5	765.2	very turbid, grey, pulled tube
11.35	22.9	13.11	6.27	–	68.1	765.2	up, light brown, turbid
11.36	22.9	13.41	6.20	–	67.3	765.1	no odour
11.37	22.8	13.70	6.16	–	65.2	765.2	''
11.38	22.7	13.97	6.15	–	63.5	765.2	''

Miscellaneous Field Comments

Well Head Integrity: head after sampling = 7.52
Duplicate: N/A
Triplicate: N/A
Rinsate: N/A.
Samples Filtered metals
Weather Condition: overcast, humid
Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number: P1082
Date: 10/4/18.
Project:
Well Number: MW17
Location: Hydro.
Sampler(s): NG

Field Measurements

Organic vapours in well: ppm
Measurement device:
Depth to Groundwater: 1.23 m
Measurement Device:
Correction: -0.09 m
Groundwater Elevation : m
Depth to Immiscible Layer: m
Measurement Device:
Thickness to Immiscible Layer: m
Well Depth: 5.12 m
Thickness to Groundwater Column: m

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer
Start Sampling: 12.11
End Sampling:
Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or ~~mS/cm~~)	pH	DO (mg/L or [✓ ppm])	Redox (mV)	mmHg ~~TDS (mg/L or ppm)~~	Comments (appearance, odour, etc)
~~12.13~~							
12.14	26.0	1.00	7.44	0.87	-2.9	765.0	light brown small orange
12.15	25.9	0.98	7.12	0.60	-8.4	765.0	particulates, no odour
12.16	25.9	0.97	7.03	0.57	-10.0	765.0	"
12.17	25.8	0.97	6.96	0.54	-11.8	765.0	"
12.18	25.8	0.97	6.93	0.51	-12.8	765.0	"

Miscellaneous Field Comments

Well Head Integrity:
Duplicate: N/A
Triplicate: N/A
Rinsate: N/A
Samples Filtered metals.
Weather Condition: cloudy, humid.
Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 10/4/18.
Project: P1082	**Well Number:** MW106
Location: Hydro.	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	4.82	m	Measurement Device:
Correction:	+0.55	m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	6.04	m	
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer

Start Sampling: 1.52. End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or [✓ ppm])	Redox (mV)	mm Hg ~~TDS (mg/L or ppm)~~	Comments (appearance, odour, etc)
1.53	24.9	1.11	7.33	3.77	-26.7	763.8	light brown, turbid, no odour
1.54	24.9	1.10	7.24	3.82	-27.2	763.8	"
1.55	24.9	1.09	7.13	4.19	-27.9	763.8	"
1.56	24.9	1.08	7.09	4.51	-27.4	763.8	"
1.57	24.9	1.06	7.07	4.80	-26.8	763.8	"

Miscellaneous Field Comments

Well Head Integrity: head @ end = 5.21

Duplicate: N/A

Triplicate: N/A

Rinsate: N/A.

Samples Filtered metals.

Weather Condition: sunny.

Other:

RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:		**Date:**	10/4/18.
Project:	P1082	**Well Number:**	MW18
Location:	Tomago.	**Sampler(s):**	Ne.

Field Measurements

Organic vapours in well:	ppm	Measurement device:	
Depth to Groundwater:	1.60 m	Measurement Device:	
Correction:	+0.74 m		
Groundwater Elevation :	m		
Depth to Immiscible Layer:	m	Measurement Device:	
Thickness to Immiscible Layer:	m		
Well Depth:	4.10 ~~+76.~~ m		
Thickness to Groundwater Column:	m		

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer

Start Sampling: ~~12~~ 12-47. | End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or [✓ mS/cm])	pH	DO (mg/L or [✓ ppm])	Redox (mV)	mm Hg ~~TDS (mg/L or ppm)~~	Comments (appearance, odour, etc)
12.49	25.7	0.269	7.51	0.72	-137.0	764.5	light grey/clear, some
12.51	25.6	0.268	7.18	0.53	-149.6	764.5	orange particulates,
12.52	25.7	0.267	7.04	0.46	-156.6	764.5	some odour
12.53	25.8	0.266	6.91	0.41	-163.0	764.4	"
12.54	26.0	0.266	6.78	0.38	-169.6	764.4	"
12.55	26.1	0.267	6.69	0.38	-171.9	764.4	"
12.56	26.0	0.267	6.63	0.36	-173.5	764.4	"

Miscellaneous Field Comments

Well Head Integrity: head @ end = 2.13

Duplicate: N/A

Triplicate: N/A

Rinsate: N/A.

Samples Filtered: metals.

Weather Condition: sunny, humid/hot.

Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 10/4/18
Project: P1082.	**Well Number:** MW19
Location:	**Sampler(s):** NG

Field Measurements

Organic vapours in well:	ppm	Measurement device:	
Depth to Groundwater: 2.21	m	Measurement Device:	
Correction: -0.09	m		
Groundwater Elevation :	m		
Depth to Immiscible Layer:	m	Measurement Device:	
Thickness to Immiscible Layer:	m		
Well Depth: 5.15	m		
Thickness to Groundwater Column:	m		

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer

Start Sampling: 1.27. End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	mmHg ~~TDS (mg/L or ppm)~~	Comments (appearance, odour, etc)
1.28	26.6	1.22	7.05	1.72	-18.3	764.1	clear, no odor
1.29	26.5	1.22	6.68	1.22	-19.6	764.0	"
1.30	26.5	1.22	6.46	0.74	-25.8	764.1	"
1.31	26.6	1.21	6.35	0.70	-31.1	764.1	"
1.32	26.7	1.20	6.25	0.68	-41.7	764.1	"
1.33	26.8	1.19	6.25	0.68	-44.0	764.2	"

Miscellaneous Field Comments

Well Head Integrity: head @ end = 3.21.

Duplicate: N/A

Triplicate: N/A

Rinsate: N/A.

Samples Filtered metals

Weather Condition: sunny.

Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:	**Date:** 10/4/18
Project: P1082	**Well Number:** MW15
Location: Hydro.	**Sampler(s):** NG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	1.59	m	Measurement Device:
Correction:	-0.1	m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	5.20	m	
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: 2.15 | End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or [✓ mS/cm])	pH	DO (mg/L or [✓ ppm])	Redox (mV)	mmHg ~~TDS (mg/L or ppm)~~	Comments (appearance, odour, etc) Clear
2.19	27.3	1.54	7.83	0.79	-47.2	763.5	~~light brown, turbid~~, no odour
2.20	27.1	1.58	7.68	0.80	-51.5	763.6	"
2.21	27.0	1.58	7.55	0.76	-56.4	763.6	"
2.22	27.0	1.57	7.43	0.70	-59.8	763.7	"
2.23	27.0	1.57	7.41	0.70	-60.4		"

Miscellaneous Field Comments

Well Head Integrity: head @ end = 1.79

Duplicate: N/A

Triplicate: N/A

Rinsate: N/A

Samples Filtered metals.

Weather Condition: Sunny.

Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:
Project: P1082.
Location: Hydro
Date: 10/4/18
Well Number: MW14
Sampler(s): NG.

Field Measurements

Organic vapours in well: ppm
Measurement device:
Depth to Groundwater: 2.68 m
Measurement Device:
Correction: +0.73 m
Groundwater Elevation : m
Depth to Immiscible Layer: m
Measurement Device:
Thickness to Immiscible Layer: m
Well Depth: 8.25 m
Thickness to Groundwater Column: m

Well Sampling

Method: ☐ Micro-Purge ☒ Peristaltic ☐ Bailer
Start Sampling: 2.39.
End Sampling:
Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or [✓ mS/cm])	pH	DO (mg/L or [✓ ppm])	Redox (mV)	mm Hg ~~TDS (mg/L or ppm~~)	Comments (appearance, odour, etc).
2.41	23.8	6.01	6.68	0.84	-228	763.5	clear, no odour
2.42	23.6	6.02	6.55	0.74	-29.7	763.5	"
2.43	23.6	5.83	6.39	0.64	-41.6	763.5	"
2.44	23.8	5.54	6.31	0.66	-45.7	763.5	"
2.45	23.8	5.47	6.29	0.67	-47.1	763.4	"
2.46	23.7	5.40	6.26	0.69	-49.6	763.5	"

Miscellaneous Field Comments

Well Head Integrity: 3.35m after sampling.
Duplicate:
Triplicate:
Rinsate:
Samples Filtered
Weather Condition:
Other:

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number: 318000xxx (P1082)	**Date:** 11/4/18
Project: Hydro GW	**Well Number:** MW21
Location:	**Sampler(s):** CG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	2·105	m	Measurement Device:
Correction:	−0·06	m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	11·48	m	
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling:

End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)
8:22	23·1	11·31 mS	6·60	1·06	27·4	–	clear, no odour
8:23	22·9	13·03	6·69	0·79	4·2	–	" "
8:24	23·0	13·99	6·72	0·72	−9·4	–	" "
8:25	23·0	14·68	6·72	0·66	−20·2	–	" "
8:27	23·1	15·36	6·72	0·64	−31·7	–	WL 3·65 drawing down at lowest pump rate
8:28	23·1	15·54	6·72	0·67	−34·5	–	clear, no odour.
8:29	23·1	15·82	6.71	0·67	−38·5	–	" "

Miscellaneous Field Comments

Well Head Integrity:

Duplicate:

Triplicate:

Rinsate:

Samples Filtered

Weather Condition:

Other:

sample ID: MW21 @ 8:30 11/4/18

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number: P1082
Date: 11/4/18
Project: Hydro GW Smelter Site
Well Number: MW06
Location: west of L3
Sampler(s): CG

Field Measurements

Organic vapours in well:	ppm	Measurement device:
Depth to Groundwater: 2.22	m	Measurement Device:
Correction: +0.74	m	
Groundwater Elevation :	m	
Depth to Immiscible Layer:	m	Measurement Device:
Thickness to Immiscible Layer:	m	
Well Depth: 6.93	m	
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling:
End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)
9:13	21.5	15.11mS	7.08	0.74	-92.4	-	clear, slight Sulphide odour
9:14	21.5	14.88	6.97	0.66	-103.3	-	" "
9:15	21.5	14.48	6.86	0.62	-115.4	-	WL - 2.60 m btoc
9:17	21.5	14.34	6.76	0.58	-122.7	-	clear.
9:18	21.5	14.21	6.70	0.52	-124.4	-	"
9:19	21.5	14.16	6.66	0.51	-126.4	-	" "

Miscellaneous Field Comments

Well Head Integrity:
Duplicate: QA103
Triplicate:
Rinsate:
Samples Filtered
Weather Condition:
Other:

WL drawing down at lowest rate

MW06, QA103 @ 9:20 11/4/18

RAMBØLL

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number: P1082
Date: 11/4/18
Project: Hydro GW Smelter Site
Well Number: MW20
Location: outside Smelter Site N
Sampler(s): CG

Field Measurements

Organic vapours in well: ppm
Measurement device:
Depth to Groundwater: 2.60 m
Measurement Device:
Correction: +0.65 m
Groundwater Elevation : m
Depth to Immiscible Layer: m
Measurement Device:
Thickness to Immiscible Layer: m
Well Depth: 6.18 m
Thickness to Groundwater Column: m

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer
Start Sampling:
End Sampling:
Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)
10:40	23.7	1.89mS	7.09	1.10	-39.1	—	turbid, pale grey.
10:41	23.6	1.89	6.63	0.97	-37.6	—	" "
10:42	23.6	1.88	6.34	0.85	-38.8	—	" "
10:43	23.6	1.86	6.14	0.79	-41.6	—	" "
10:44	23.6	1.85	6.07	0.76	-44.2	—	" "
10:45	23.6	1.85	6.03	0.76	-45.0	—	" "

Miscellaneous Field Comments

Well Head Integrity:
Duplicate:
Triplicate:
Rinsate: QC102
Samples Filtered
Weather Condition:
Other:

Sample ID MW20 @ 10:50 11/4/18

RAMBOLL

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:	P1082	**Date:**	11/4/18
Project:	Hydro GW Smelter Site	**Well Number:**	MW107
Location:	carbon plant(?)	**Sampler(s):**	CG

Field Measurements

Organic vapours in well:	ppm	Measurement device:	
Depth to Groundwater: 1.185	m	Measurement Device:	
Correction: −0.095	m		
Groundwater Elevation :	m		
Depth to Immiscible Layer:	m	Measurement Device:	
Thickness to Immiscible Layer:	m		
Well Depth: 3.65	m		
Thickness to Groundwater Column:	m		

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)
11:20	23.0	0.74	6.03	1.03	-20.7	–	clear, no odour
11:21	22.9	0.73	5.78	0.89	-26.8	–	〃 〃
11:22	23.0	0.73	5.67	0.83	-33.0	–	〃 〃
11:23	23.0	0.72	5.66	0.81	-35.2	–	〃 〃
11:24	22.9	0.72	5.67	0.79	-37.1	–	〃 〃

Miscellaneous Field Comments

Well Head Integrity:

Duplicate:

Triplicate:

Rinsate:

Samples Filtered

Weather Condition:

Other:

Sample ID MW107

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number: P1082
Project: Hydro GW Smelter Site
Location: Carbon plant
Date: 11/4/18
Well Number: ~~MW8/S38~~ MW17
Sampler(s): CG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	1·255	m	Measurement Device:
Correction:	0·055	m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	5·13	m	
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer
Start Sampling: End Sampling:
Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)
11:49	26·3	1·10mS	6·40	1·73	−26·7	—	clear, no odour.
11:50	25·7	1·11	6·28	0·75	−46·9	—	〃 〃
11:51	25·7	1·11	6·28	0·69	−49·4	—	〃 〃
11:52	25·7	1·11	6·28	0·67	−52·2	—	〃 〃
11:53	25·8	1·11	6·29	0·63	−56·10	—	〃 〃
11:54	25·7	1·10	6·30	0·60	−59·7	—	〃 〃

Miscellaneous Field Comments

Well Head Integrity:
Duplicate:
Triplicate:
Rinsate:
Samples Filtered
Weather Condition:
Other:

sampled in error
sample
discarded

sample ID MW~~8~~17 @ 11:55 11/4/18

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number: P1082	**Date:** 11/4/18
Project: Hydro Kw smelter Site	**Well Number:** S3A / MWA
Location: Carbon plant	**Sampler(s):** CG

Field Measurements

Organic vapours in well:	ppm	Measurement device:
Depth to Groundwater: 1.73	m	Measurement Device:
Correction: +0.97	m	
Groundwater Elevation :	m	
Depth to Immiscible Layer:	m	Measurement Device:
Thickness to Immiscible Layer:	m	
Well Depth: 11.00	m	
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)
12:22	28.4	0.455	7.19	5.52	0.7	–	clear no odour
12:23	24.3	0.451	6.98	4.23	-2.5	–	" "
12:25	24.2	0.450	6.91	3.76	-7.6	–	" "
12:26	24.1	0.450	6.94	3.70	-11.5	–	" "
12:27	24.1	0.450	6.96	3.64	-13.7	–	" "
12:28	24.0	0.450	6.99	3.58	-15.8	–	" "

Miscellaneous Field Comments

Well Head Integrity:

Duplicate:

Triplicate:

Rinsate:

Samples Filtered

Weather Condition:

Other:

sample ID ~~MWA~~ S3A @ 12:30 11/4/18

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number:	P1082	**Date:**	11/4/18
Project:	Hydro Smelter Site	**Well Number:**	S3B / MWB
Location:	carbon plant	**Sampler(s):**	CG

Field Measurements

Organic vapours in well:	ppm	Measurement device:	
Depth to Groundwater: 4·70	m	Measurement Device:	
Correction: + 0·97	m		
Groundwater Elevation :	m		
Depth to Immiscible Layer:	m	Measurement Device:	
Thickness to Immiscible Layer:	m		
Well Depth: 11·52	m		
Thickness to Groundwater Column:	m		

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)
12:38	24·0	1·06	6·62	1·41	-7·2	–	clear no odour
12:39	23·9	1.07	6·51	0·88	-12·7	–	" "
12:40	23·9	1·06	6·44	0·72	-18·2	–	" "
12:41	23·9	1·06	6·40	0·69	-22·2	–	" "
12:42	24·0	1·06	6·37	0·68	-24·1	–	" "
12:43	24·0	1·06	6·35	0·66	-25·9	–	" "

Miscellaneous Field Comments

Well Head Integrity:

Duplicate:

Triplicate:

Rinsate:

Samples Filtered

Weather Condition:

Other:

sample ID S3B @ 12:45 11/4/18

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number: P1082	**Date:** 11/4/18
Project: Hydro GW Smelter Site.	**Well Number:** MW105
Location:	**Sampler(s):** CG

Field Measurements

Organic vapours in well:	ppm	Measurement device:
Depth to Groundwater: 0·64	m	Measurement Device:
Correction: – 0·13	m	
Groundwater Elevation :	m	
Depth to Immiscible Layer:	m	Measurement Device:
Thickness to Immiscible Layer:	m	
Well Depth: 3·82	m	
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)
13:09	26.0	1·13	7·29	0·51	-124·9	–	clear no odour
13:10	26·0	1-12	7·04	0·44	-127·5	–	slightly brown hydrocarbon odour.
13:11	26·0	1·11	6·90	0·41	-129·7	–	" "
13:12	26·0	1·11	6·85	0·39	-130·5	–	" "
13:13	26.0	1·11	6·76	0·35	-132·5	–	" "
13:14	26·1	1·11	6·73	0·36	-133·0	–	" "

Miscellaneous Field Comments

Well Head Integrity: damaged bolt. Opened with hammer.

Duplicate:

Triplicate:

Rinsate:

Samples Filtered

Weather Condition:

Other: oily water in well cover pumed out with peristaltic.

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number: P1082	**Date:** 11/4/18
Project: Hydro GW Smelter Site	**Well Number:** MW16
Location: Pitch Tanks (?)	**Sampler(s):** CG

Field Measurements

Organic vapours in well:		ppm	Measurement device:
Depth to Groundwater:	0·31	m	Measurement Device:
Correction:	– 0·085	m	
Groundwater Elevation :		m	
Depth to Immiscible Layer:		m	Measurement Device:
Thickness to Immiscible Layer:		m	
Well Depth:	2·19	m	
Thickness to Groundwater Column:		m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance: red-brown, slightly turbid.

TIME	TEMP (ºc)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)
13:34	28·2	0·60	8·36	5·21	-140·7	–	slightly yellow, no odour
13:35	27·5	0·57	7·78	0·56	-144·6	–	" "
13:36	27·6	0·55	7·53	0·41	-140·9	–	" "
13:37	27·8	0·54	7·31	0·37	-135·9	–	" "
13:38	27·9	0·54	7·19	0·41	-131·6	–	" "
13:39	27·9	0·54	7·12	0·39	-130·4	–	" "

Miscellaneous Field Comments

Well Head Integrity:

Duplicate:

Triplicate:

Rinsate:

Samples Filtered

Weather Condition:

Other:

sample ID MW16 @ 13:40 11/4/18

Low Flow Groundwater Sampling Field Parameter Form

Ref. Number: P1082	**Date:** 11/4/18
Project: Hydro GW Smelter Site	**Well Number:** MW101
Location: adj. to diesel fuel pump	**Sampler(s):** CG

Field Measurements

Organic vapours in well:	ppm	Measurement device:
Depth to Groundwater: 1.92	m	Measurement Device:
Correction: −0.08	m	
Groundwater Elevation :	m	
Depth to Immiscible Layer:	m	Measurement Device:
Thickness to Immiscible Layer:	m	
Well Depth: 4.92	m	
Thickness to Groundwater Column:	m	

Well Sampling

Method: ☐ Micro-Purge ☑ Peristaltic ☐ Bailer

Start Sampling: End Sampling:

Sample Appearance:

TIME	TEMP (°c)	SPEC. COND. (µS/cm or mS/cm)	pH	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)
14:04	27.2	0.55	6.93	0.88	−28.6	–	clear, no odour
14:05	27.1	0.55	6.75	0.50	−30.6	–	" "
14:06	27.1	0.55	6.61	0.47	−32.3	–	" "
14:07	27.1	0.55	6.53	0.44	−34.2	–	" "
14:08	27.2	0.55	6.45	0.42	−37.5	–	" "
14:09	27.1	0.55	6.37	0.39	−41.3	–	" "
14:10	27.2	0.54	6.30	0.37	−45.5	–	" "

Miscellaneous Field Comments

Well Head Integrity:

Duplicate:

Triplicate:

Rinsate:

Samples Filtered

Weather Condition:

Other:

Sample ID MW101 @ 14:12 11/4/18

APPENDIX 7
LABORATORY REPORT AND EIL CALCULATION SPREADSHEETS

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt Myaree, WA 6154
Ph 08 9317 2505 / lab@mpl.com.au

Melbourne Lab - Envirolab Services
1A Dalmore Drive Scoresby VIC 3179
Ph 03 9763 2500 / melbourne@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
Ph 07 3266 9532 / brisbane@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
Ph 0406 350 706 / adelaide@envirolab.com.au

Client: RAMBOLL
Contact Person: KIRSTY GREENFIELD
Project Mgr: " " "
Sampler: " " "
Address: Suite 18, Level 2
50 Glebe Rd
The Junction NSW 2291
Phone: 49625444 **Mob:** 0407149176
Email: kgreenfield@ramboll

Client [✓ Project Name] / Number / Site etc (ie report title): HYDRO 318000344
PO No.:
Envirolab Quote No.: 18SY036
Date results required:
Or choose: [✓ standard] / same day / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharges apply
Report format: esdat / equis /
Lab Comments:

Sample information | **Tests Required** | **Comments**

Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	pH	CEC	% organic carbon	% clay	Provide as much information about the sample as you can
1	HYDRO SOIL 1	Surface	10/4/18	SOIL	X	X	X	X	
2	HYDRO SOIL 2	↓	↓	↓	X	X	X	X	
3	HYDRO SOIL 3				X	X	X	X	
4	HYDRO SOIL 4				X	X	X	X	

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No. 189258
Date Received: 12/4/2018
Time Received: 10:15
Received by: R
Temp: [✓ Cool]/Ambient 18Y
Cooling: Ice/[✓ Icepack]
Security: [✓ Intact]/Broken/None

Relinquished by (Company): RAMBOLL
Print Name: KIRSTY GREENFIELD
Date & Time: 11/4/18 4pm
Signature: KGreenfield

Received by (Company): Env
Print Name: Pkay
Date & Time: 12/4/2018 10.15
Signature: R

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

Page No:

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

CERTIFICATE OF ANALYSIS 189258

Client Details

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

Sample Details

Your Reference	**Hydro 318000344**
Number of Samples	4 Soil
Date samples received	12/04/2018
Date completed instructions received	12/04/2018

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.

Report Details

Date results requested by	19/04/2018
Date of Issue	18/04/2018

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Results Approved By
Leon Ow, Chemist
Nick Sarlamis, Inorganics Supervisor

Authorised By

Jacinta Hurst, Laboratory Manager

Clay 50-120g					
Our Reference		189258-1	189258-2	189258-3	189258-4
Your Reference	UNITS	Hydro Soil 1	Hydro Soil 2	Hydro Soil 3	Hydro Soil 4
Date Sampled		10/04/2018	10/04/2018	10/04/2018	10/04/2018
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Date analysed	-	18/04/2018	18/04/2018	18/04/2018	18/04/2018
Clay in soils <2μm	% (w/w)	8	7	9	6

CEC					
Our Reference		189258-1	189258-2	189258-3	189258-4
Your Reference	UNITS	Hydro Soil 1	Hydro Soil 2	Hydro Soil 3	Hydro Soil 4
Date Sampled		10/04/2018	10/04/2018	10/04/2018	10/04/2018
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Date analysed	-	13/04/2018	13/04/2018	13/04/2018	13/04/2018
Exchangeable Ca	meq/100g	7.0	18	5.7	4.1
Exchangeable K	meq/100g	0.6	0.8	0.5	0.2
Exchangeable Mg	meq/100g	2.0	4.9	1.1	0.78
Exchangeable Na	meq/100g	<0.1	0.95	<0.1	<0.1
Cation Exchange Capacity	meq/100g	9.7	25	7.4	5.1

Misc Inorg - Soil					
Our Reference		189258-1	189258-2	189258-3	189258-4
Your Reference	UNITS	Hydro Soil 1	Hydro Soil 2	Hydro Soil 3	Hydro Soil 4
Date Sampled		10/04/2018	10/04/2018	10/04/2018	10/04/2018
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	16/04/2018	16/04/2018	16/04/2018	16/04/2018
Date analysed	-	16/04/2018	16/04/2018	16/04/2018	16/04/2018
pH 1:5 soil:water	pH Units	6.1	5.7	6.3	6.6
Total Organic Carbon (Walkley Black)	mg/kg	59,000	200,000	47,000	20,000

Method ID	Methodology Summary
AS1289.3.6.3	Determination Particle Size Analysis using AS1289.3.6.3 and AS1289.3.6.1 and in house method INORG-107. Clay fraction at <2µm reported.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-036	Total Organic Carbon or Matter - A titrimetric method that measures the oxidisable organic content of soils.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.

QUALITY CONTROL: CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			13/04/2018	1	13/04/2018	13/04/2018		13/04/2018	[NT]
Date analysed	-			13/04/2018	1	13/04/2018	13/04/2018		13/04/2018	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	1	7.0	7.0	0	103	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	1	0.6	0.6	0	104	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	1	2.0	1.9	5	98	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	1	<0.1	<0.1	0	101	[NT]

Client Reference: Hydro 318000344

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			16/04/2018	1	16/04/2018	16/04/2018		16/04/2018	[NT]
Date analysed	-			16/04/2018	1	16/04/2018	16/04/2018		16/04/2018	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	6.1	[NT]		102	[NT]
Total Organic Carbon (Walkley Black)	mg/kg	1000	Inorg-036	<1000	1	59000	59000	0	98	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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.

Measurement Uncertainty estimates are available for most tests upon request.

EIL Calculation Spreadsheet
Copper

Inputs
Select contaminant from list below
Cu
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
11.8
Enter soil pH (calcium chloride method) (values from 1 to 14)
6.2
Enter organic carbon content (%OC) (values from 0 to 50%)
8.1
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
7
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Cu soil-specific EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	70	85
Urban residential and open public spaces	120	210
Commercial and industrial	170	310

EIL Calculation Spreadsheet
Chromium III

Inputs

Select contaminant from list below

Cr_III

Below needed to calculate fresh and aged ACLs

Enter % clay (values from 0 to 100%)

7.5

Below needed to calculate fresh and aged ABCs

Measured background concentration (mg/kg). Leave blank if no measured value

or for fresh ABCs only

Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration

7

or for aged ABCs only

Enter State (or closest State)

NSW

Enter traffic volume (high or low)

low

Outputs

Land use	Cr III soil-specific EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	120	120
Urban residential and open public spaces	220	370
Commercial and industrial	320	610

EIL Calculation Spreadsheet
Nickel

Inputs
Select contaminant from list below
Ni
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
11.8
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
7
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs

Land use	Ni soil-specific EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	35	35
Urban residential and open public spaces	85	190
Commercial and industrial	140	320

EIL Calculation Spreadsheet
Zinc

Inputs
Select contaminant from list below
Zn
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
11.8
Enter soil pH (calcium chloride method) (values from 1 to 14)
6.2
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
7
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	**Zn soil-specific EILs** (mg contaminant/kg dry soil)	
	Fresh	**Aged**
National parks and areas of high conservation value	80	180
Urban residential and open public spaces	210	540
Commercial and industrial	310	790

APPENDIX 2
DICKSON ROAD SOUTH REMEDIATION ACTION PLAN

Intended for
Hydro Aluminium Kurri Kurri Pty Ltd

Document type
Remedial Action Plan

Date
November 2020

REMEDIAL ACTION PLAN
DICKSON ROAD, LOXFORD, NSW

RAMBOLL Bright ideas. Sustainable change.

REMEDIAL ACTION PLAN
DICKSON ROAD, LOXFORD, NSW

Revision	**Final**
Date	**9/11/2020**
Made by	**Steve Maxwell**
Checked by	**Kirsty Greenfield CEnvP Site Contamination Specialist No. SC40104**
Approved by	**Fiona Robinson CEnvP Site Contamination Specialist No. SC40100**
Description	**Ramboll has prepared a remediation strategy for contaminated soils at Dickson Road associated with the former Hydro Aluminium Kurri Kurri Smelter. The strategy is presented in this Remedial Action Plan.**

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ACN 095 437 442
ABN 49 095 437 442

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ABBREVIATIONS

Abbreviation	Description
ACM	Asbestos Containing Materials
AEC	Area of Environmental Concern
AHD	Australian Height Datum
ALS	Australian Laboratory Services
ASET	Australian Safer Environment and Technology Pty Ltd. (Laboratory)
ANZECC	Australian and New Zealand Environment and Conservation Council
B(a)P	Benzo(a)pyrene
BGS	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene & Xylenes (Monocyclic Aromatic Hydrocarbons)
CN	Cyanide (total or free)
CT	Certificate of Title
DP	Deposited Plan
DQO	Data Quality Objective
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
ESA	Environmental Site Assessment
Ha	Hectare
km	Kilometres
LOR	Limit of Reporting
m	Metres
MAH	Monocyclic Aromatic Hydrocarbons
Mercury	Inorganic mercury unless noted otherwise
Metals	As: Arsenic, Cd: Cadmium, Cr: Chromium, Cu: Copper, Fe: Iron, Ni: Nickel, Pb: Lead, Zn: Zinc, Hg: Mercury
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
m BGS	Metres below ground surface
mg/L	Micrograms per Litre
MW	Monitoring well
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
OCPs	Organochlorine Pesticides
OH&S	Occupational Health & Safety
OPPs	Organophosphorus Pesticides
PAEC	Potential Area of Environmental Concern
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PQL	Practical Quantitation Limit
pH	a measure of acidity, hydrogen ion activity
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
SILs	Soil Investigation Levels
SVOCs	Semi Volatile Organic Compounds
TPHs	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
VENM	Virgin Excavated Natural Material
VOCs	Volatile Organic Compounds
µg/L	Micrograms per Litre

EXECUTIVE SUMMARY

Ramboll has been commissioned by Hydro Aluminium Kurri Kurri Pty Limited (Hydro) to prepare this Remedial Action Plan (RAP) for the implementation of remedial works at the site known as Dickson Road site, off Dickson Road, Loxford, New South Wales, 2320.

Hydro own a former aluminium smelter comprising approximately 80 hectares of land (Smelter Site) and surrounded by approximately 1,940 hectares of buffer zone land (Buffer Zone) that is managed by Hydro (together the Hydro Land). The Dickson Road site is owned and managed by Hydro as part of Buffer Zone land associated with the former smelter operations. Smelter closure was announced in May 2014 and Hydro is now preparing land for future divestment and redevelopment.

A portion of the parcel of land comprising the Dickson Road site is proposed to be rezoned as General Industrial (IN1) land use. The majority of the parcel will remain under its current zoning of Rural Landscape (RU2) and remediation of the land for these zonings is required. The objective of this RAP is to describe the works necessary to render the site suitable for future land uses. Under the zonings future land uses may comprise residential with accessible soil, child care, day care and primary school, secondary school, rural land use and industrial/ commercial land use.

The Dickson Road site is zoned Rural Landscape (RU2) under the Cessnock Local Environment Plan 2011. Historically, the site comprised two residential dwellings which were demolished in the late 1970s. The land has remained vacant since this time and an embankment in the south of the site was progressively backfilled with smelter wastes in the 1980s. The types of smelter wastes buried on site include concrete, timber, brick, steel strapping, electrical wiring, PVC piping, hydraulic hoses, crushed 22 gallon drums, lumps of steel, Kaowool, carbon fluxing tubes, steel fence posts, packing foam, bulker bags, carbon, Perspex®, plywood packing cases, steel casting tools, solenoid, plastic, bag house socks, spent anode and a drum of old ramming compound. An evaluation of soil identified impacts to the soil matrix in the form of fluoride and polycyclic aromatic hydrocarbons. The presence of disposed wastes was also recognised to represent an impact on visual amenity.

An evaluation of groundwater and surface water identified fluoride in the down-gradient well at concentrations exceeding the site criteria, indicating that fluoride has leached from the wastes and migrated to groundwater. The nearest surface water receptor is located on the southern site boundary. Concentrations of fluoride in Swamp Creek are marginally above some site criteria.

A review of remediation options was undertaken and also included a review of remedial options applicable to all Hydro owned lands (a whole-of-site strategy). Remediation options were considered in terms of cost, risk of failure, long term legacy and onsite management, corporate responsibility and sustainability. The preferred strategy was excavation of the filled materials and reinstatement with clean fill in order to remove all contaminant management requirements from the Dickson Road site. Excavated materials are proposed to be coarsely sorted for municipal waste disposal, recycling where permissible and relocation to the Smelter site. Materials proposed for relocation to the Smelter site will be stockpiled for later beneficial reuse where permissible, or incorporated within a whole-of-site remediation strategy.

This RAP outlines the remedial plan to be implemented at the site to achieve the remediation objective. The RAP includes a detailed works methodology including validation requirements and environmental controls to be implemented during the works. At the completion of works a validation report will be compiled including a clear statement of the suitability of the site for the current Rural Landscape (RU2) and proposed future General Industrial (IN1) and Environmental Conservation (E2) use.

1. INTRODUCTION

The following Remedial Action Plan (RAP) details site conditions and requirements for remediation of an area of land known as the ‘Dickson Road site’, located within the Buffer Zone of the former Hydro Kurri Kurri Aluminium Smelter off Hart Road, Loxford, NSW 2326.

The 1,940 hectare Buffer Zone has been separated into 18 parcels for the purpose of environmental investigations. The Dickson Road site is located within Parcel 16, which is located to the south-east of the Smelter Site, as shown in **Figure 1, Appendix 1**.

1.1 Background

Hydro owns the former Hydro Aluminium Kurri Kurri Aluminium Smelter (the Smelter) located at Hart Road, Loxford NSW 2326. The Smelter comprises approximately 80 hectares of land (Smelter Site) and is surrounded by approximately 1,940 hectares of buffer zone land (Buffer Zone) that is owned and managed by Hydro (together the Hydro Land).

The Smelter commenced operations in 1969, however, smelting activities ceased in September 2012. In May 2014 Hydro formally announced the closure of the Smelter. Since this time Hydro has evaluated the future use of the Smelter and the Hydro Land including investigations of contamination at the Smelter Site and Buffer Zone.

A Phase 1 Environmental Site Assessment (ESA) (Environ 2013) was previously prepared for all Hydro Land and evaluated the potential for contamination and identified the presence of buried smelter waste materials in an area to the south of Dickson Road within Parcel 16.

A Phase 2 ESA (Environ 2013) was conducted at the Dickson Road site, which included a site inspection, excavation of test pits, installation of groundwater monitoring wells, soil sampling and analysis, surface water and groundwater sampling and analysis. The assessment confirmed the presence of smelter-derived waste materials and soil within the fill matrix was found to be impacted with fluoride and polycyclic aromatic hydrocarbons (PAHs). Perched groundwater was found to be impacted with fluoride.

A Phase 2 ESA (Ramboll 2020) was conducted on the broader Parcel 16, which did not identify any additional contamination issues at this parcel.

Hydro is in the process of preparing the Hydro Land for divestment. The Dickson Road site is currently zoned Rural Landscape (RU2). A Rezoning Masterplan has been developed that identifies Dickson Road to comprise land suitable for General Industrial (IN1) and Environmental Conservation (E2) landuse. Remediation of smelter-derived waste materials and contaminated fill at the Dickson Road site is required to make this site suitable for the proposed land use.

1.2 Objective

The objective of the works is to remediate the Dickson Road site to a level suitable for the the current Rural Landscape (RU2) landuse and the proposed General Industrial (IN1) and Environmental Conservation (E2) land use. This RAP forms part of those works and provides a description of the impacted areas requiring remediation and the methodology to remediate and validate those areas in order to meet the project objective.

1.3 Scope of Work

To meet the objective, Ramboll has completed the following scope of work:

- Review all previous reports prepared for the Smelter Site including:
  - ENVIRON (October 2013) Phase 1 Environmental Site Assessment, Hydro Kurri Kurri Aluminium Smelter
  - ENVIRON (November 2012) Phase 2 Environmental Site Assessment, Dickson Road, Loxford

  - Ramboll (2018) Phase 2 Environmental Site Assessment, Parcel 16 Former Hydro Aluminium Kurri Kurri Smelter
- Identify and evaluate possible remedial options for the site including consultation with Hydro personnel in order to determine the most appropriate remedial option;
- Consultation with regulatory guidelines
- Outline how the remedial options will be undertaken to meet the remediation objective
- Establish Data Quality Objectives (DQOs) for the development of the validation plan
- Develop a validation plan to validate completion of the site remediation and confirm the suitability of the site for the proposed use.

1.4 Regulatory Framework and Guidelines

This document has been prepared in reference to the following legislation and guidelines:

- *Contaminated Land Management Act 1997*
- *Protection of the Environment Operations Act 1997*
- *Environmental Planning and Assessment Act 1979*
- NEPC (1999) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM 2013)
- NSW EPA (1994) Sampling Design Guidelines
- NSW EPA (2018) Guidelines for the NSW Site Auditor Scheme (3rd Edition)
- NSW EPA (2020) Guidelines for Consultants Reporting on Contaminated Land

2. SITE IDENTIFICATION

2.1 Site Location

The 'site' which is the subject of this RAP is known as the Dickson Road site and is described as Lots 424 and 425 in DP755231, which is a sub-area of Parcel 16. Parcel 16 is one of 18 land parcels within the Buffer Zone of the former Hydro Aluminium Kurri Kurri Smelter.

Table 2-1 presents site identification and location details.

Table 2-1: Site Identification

Item	Detail
Site Owner	Hydro Aluminium Kurri Kurri Pty Ltd (subject to Deed of Company Arrangement)
Street Address	Dickson Road, Loxford, New South Wales, Australia, 2327
Local Government Area	Cessnock City Council
County	Northumberland
Distance from Nearest CBD	Approximately 2.4 km north-west of Kurri Kurri, and 30 km north-west of Newcastle.
Geographical Coordinates	Latitude 32º47.652' S, Longitude 151º29.283' E
Lot and DP Numbers	Lots 424 and 425 in DP755231
Site Area	7.1 Ha
Zoning (current)	Rural Landscape (RU2)
Zoning (future)	General Industrial (IN1) and Rural Landscape (RU2)
Site Elevation	Approximately 6 m to 02 m AHD

2.2 Site Boundaries

The site is located within the following boundaries:

East:	Rural properties within the Buffer Zone owned by Hydro
North:	Dickson Road, then the Kurri Kurri Speedway and Junior Motorcycle Track within bushland in the Buffer Zone owned by Hydro
West:	Rural properties within the Buffer Zone owned by Hydro
South:	Swamp Creek and rural residential properties within the Buffer Zone owned by Hydro

2.3 Future Land use

Future land uses that may occur and are not prohibited under the zoning include:

- Residential land use including accessible soil
- Agriculture including irrigation
- Industrial development
- School, preschools and day care

The above are considered in the assessment of land use suitability and development of assessment criteria in **Section 5**.

3. SITE CONDITIONS

3.1 Topography

The Dickson Road site is located in an area of low-lying swampy land at approximately 10 m AHD. The northern portion of the Dickson Road site is generally flat, while the southern portion slopes down to the south to an elevation of 8 m AHD. The southern boundary of the Dickson Road site borders Swamp Creek.

The topography indicates the central portion of the Dickson Road site has been filled over natural lower lying land creating a bank to Swamp Creek.

3.2 Geology

According to the review of the regional geology described on the Sydney Basin Geological Sheet, the Dickson Road site is underlain by siltstone, marl and minor sandstone from the Permian-aged Rutherford Formation (Dalwood Group) in the Sydney Basin.

The Sydney Basin is a sedimentary basin consisting of Permian and Triassic sedimentary rocks, which extends from Newcastle in the north to Batemans Bay in the south and to Lithgow, just west of the Blue Mountains. The basin overlies older basement rocks of the Lachlan Fold Belt. The sedimentary rocks of the basin generally consist of near horizontal sandstones and shales, with some recent igneous dykes. Only minor folding and faulting has occurred since these sedimentary rock sequences first formed. The Dalwood Group is stratigraphically located near the base of the Sydney Basin below the Great Coal Measures and Newcastle Coal Measures and was deposited in a marine environment.

Undifferentiated Quaternary alluvium occurs to the northeast of the site associated with surface water bodies. Quaternary sediments which are associated with Swamp Creek (bordering the site to the south), Wentworth Swamp and the Hunter River consist of gravel, sand, silt and clay.

3.3 Regional Hydrogeology

Regional groundwater is expected to follow topography and flow northeast towards surface water bodies that feed into the Hunter River. Locally, groundwater beneath the site is expected to flow south to Swamp Creek located on the southern boundary of the Dickson Road site.

According to the Office of Industry and Investment, NSW, there are 17 licensed groundwater abstractions (bores) located to the north of the Dickson Road site, within the Buffer Zone of the Hydro Aluminium Kurri Kurri Smelter.

Fourteen of these bores are located within the Rutherford Formation close to or north-east of evaporation ponds associated with the Smelter. The remaining three bores are located within Quaternary Alluvium on the western bank of Swamp Creek. Data associated with these bores is limited, with no information regarding the depth of the bores, water bearing zone, or standing water depth. Information from one bore indicates it was installed in 1999. It is understood that these bores were installed for monitoring purposes, not stock watering or domestic use.

The Hunter River Alluvium Groundwater Management Unit (GMU) is an important groundwater resource to the region. Groundwater extraction for irrigation, urban supply, drought supply, stock, domestic and commercial/ industrial use occurs, with volumes in excess of 10,000ML per annum extracted from the Hunter River Alluvium GMU. Aquifer storage and recovery is also an important use of this GMU. It is noted that the Hunter River GMU is not the primary drinking water supply in the region, although the protection of drinking water is a water quality objective for the Hunter River (NSW Water Quality and River Flow Objectives) (www.environment.nsw.gov.au/ieo/Hunter/index.htm).

3.4 Local Hydrology

Surface water at the Dickson Road site is expected to infiltrate into the subsurface and to follow topography and flow south towards Swamp Creek on the southern boundary.

3.5 Site Sensitivity

The site's sensitivity with respect to surface water and groundwater is considered to be moderate based on the following:

- Surface water and groundwater discharge into Swamp Creek, which is located 3.5 km from Wentworth Swamp and 15 km from the Hunter River within the Fishery Creek Catchment
- Declining stream water quality and a reduction in diversity of native plants and animals has occurred within the Fishery Creek Catchment and water quality down gradient of the site has been impacted by historical coal mining (HCTM 2000)
- The Hunter River GMU is used for irrigation, urban supply, drought supply, stock, domestic and commercial/ industrial use but it is not the main drinking water supply in the region.

4. SUMMARY OF PREVIOUS INVESTIGATIONS

Environmental assessments previously completed at the Dickson Road Site that were reviewed for the RAP are summarised below.

4.1 Phase 2 Environmental Site Assessment of Dickson Road Site

Disposal of smelter wastes at the Dickson Road site was identified as an Area of Environmental Concern (AEC) in 2012 during initial environmental investigations of the Hydro Land. A Phase 2 ESA (ENVIRON 2012) was completed in 2012 to assess the potential for contamination at this AEC.

The objectives of the assessment were to identify, review and report on the potential for contamination at the site based on historical and current land use and to assess the implication of any identified contamination in terms of the current and proposed land use.

The scope of work performed to meet the objective comprised:

- A review of available information relating to land use at the site to assess the potential for soil, groundwater or surface water contamination arising from historic and current activities
- A review of published geological, hydrogeological and hydrological data associated with the site to establish the site environmental setting and sensitivity
- Fieldwork, including the excavation of test pits and the drilling and installation of groundwater monitoring wells; visual assessment of the subsurface profile and the collection of soil samples during test pitting; assessment of groundwater flow conditions and groundwater sampling
- Laboratory analysis of soil, groundwater and surface water samples
- Data interpretation including comparison against relevant guidelines and a discussion of the findings in terms of human health and environment risk under the current and future land use scenarios.

The site was observed to comprise an undeveloped portion of land within the Buffer Zone of the Hydro Aluminium Kurri Kurri Smelter. Natural topography indicated that prior to filling, the bushland site was flat adjacent to Dickson Road in the north, then sloped steeply in the south towards Swamp Creek. It appeared that this embankment was used as a location to progressively fill with waste from the smelter over a period of time. Following filling to the height of the flat land in the north, the waste was covered with a shallow sand layer that is currently grassed.

The depth of the waste varied between 1.5 m and 1.8 m below ground surface (BGS). The depth of the waste was shallower in the west, with a depth of 1.2 m BGS. The percentage of waste was estimated to vary between 30% and 80% in the soil matrix. Perched water was observed inflowing at a depth of 1 m to 1.2 m BGS in test pits near the northern extent of the waste.

The types of waste identified during test pitting included smelter-specific wastes such as aluminium casts, carbon fluxing tubes, 'Kaowool', baghouse socks, spent anode, bulker bags, bricks including some furnace bricks, steel casting tools, solenoid and a drum of old ramming compound, which consisted of approximately 30% of waste in the soil matrix. The remaining 70% of the waste included concrete blocks and smaller concrete pieces, plastic, plastic strapping and steel strapping, plywood packing cases, electrical conduit, hydraulic hoses and air hoses, PVC and steel pipes, timber, crushed 22 and 44 gallon drums, tyres and lumps of steel.

The approximate volume of waste and soil within the waste disposal area was estimated at 14,150 m^3 or approximately 21,225 tonnes. This was based on an estimation of the areal extent from aerial imagery and a bulk density of 1.5 kg/m^3 for waste and soil combined. It was estimated that there was an average 60% by volume of waste within the soil matrix. Approximately 8,490 tonnes of soil comprising clayey sand, 3,821 tonnes of smelter specific waste and 8,914 tonnes of general waste was estimated.

Perched groundwater was identified in the northern edge of the buried waste. A groundwater aquifer situated in the estuarine sands and clays was identified at between 1 m and 6 m BGS (5.5 and 5.9 m AHD) near to the base of the waste. This was consistent with the water level observations during test pitting, which found the waste profile to be dry with the exception of perched water within the northern section. Seasonal water table fluctuations may result in groundwater occurring within the waste profile. Groundwater was observed to flow south towards Swamp Creek, the closest groundwater receptor which is located on the southern site boundary.

As the waste was (and remains) buried, direct human exposure to the contamination was considered unlikely to occur under the current site use. The movement of wastes such as the ramming compound within the soil matrix was considered unlikely. It was considered likely that contaminants associated with these wastes would remain distributed within the fill where waste material was dumped, meaning the distribution of contamination within the soil matrix would be random.

Migration of contaminants through percolation of rainwater can occur and contaminants such as fluoride, aluminium, cyanide and PAHs, could potentially leach to groundwater which flows into Swamp Creek. Groundwater is not in use at the site. Downgradient, water from Swamp Creek is potentially used for stock watering and irrigation. Swamp Creek is within an area where declining stream water quality and a reduction in diversity of native plants and animals have occurred in the last ten years.

Sampling of the soil matrix identified fluoride, benzo(a)pyrene, polycyclic aromatic hydrocarbons and heavy fraction total petroleum hydrocarbons at concentrations exceeding the selected criteria. Sampling of natural soils beneath the buried waste indicated that contaminants have not impacted the underlying natural sands.

Sampling of groundwater up gradient and down gradient of the waste indicated elevated fluoride concentrations in groundwater between the waste and Swamp Creek, the nearest surface water receptor. Sampling of Swamp Creek found that the fluoride concentration immediately down gradient of the waste was elevated above the upstream concentrations and the upstream, mid-stream and downstream fluoride concentrations exceeded the stock watering and irrigation criteria.

The presence of the waste materials was not considered to represent a risk of harm under the current land use, i.e. fenced, inaccessible to the public and undeveloped. A change to a more sensitive land use in the future would require remediation of the waste materials to make the site suitable for such a land use.

Based on the results of the assessment, Ramboll made the following recommendations:
1. Based on the site characterisation and the potential for the site use to change in the future, it was recommended that a Remedial Action Plan be developed to assess the remedial options for the site
2. Completion of a risk assessment of elevated fluoride in Swamp Creek given the potential use of water from Swamp Creek for stock watering and irrigation.

4.2 Tier 2 Ecological Risk Assessment

A Tier 2 Ecological Risk Assessment (ERA) was completed in March 2013 (ENVIRON 2013a) to address the recommendation made in the Phase 2 ESA in relation to fluoride concentrations in Swamp Creek. The objective of the ERA was to review existing information on contaminants of concern for the protection of terrestrial and aquatic flora and fauna specific to the area surrounding the smelter and for livestock on nearby properties, in particular a small ephemeral dam, a large semi-permanent dam and Swamp Creek to the east of the smelter.

Feeding guilds potentially exposed to fluoride and aluminium and their dominant exposure routes were identified to include soil microbes (via direct contact with soil); terrestrial plants (via direct contact with soil); terrestrial fauna (via ingestion of drinking water); aquatic plants (via direct contract with surface water and/ or sediment); aquatic vertebrates (via direct contact with surface water); aquatic birds (via ingestion of drinking water and aquatic species); and cattle (via ingestion of drinking water).

The exposure assessment for microbes, terrestrial plants, aquatic plant, invertebrates and fish were based solely on fluoride and aluminium concentrations within the relevant media (soil or surface water). Exposures for birds and mammals were estimated from concentrations of fluoride and aluminium in surface water and measurement endpoints focused on the comparison of estimates of dose (in units of mg/kg/day) to published dose-based toxicity reference values (TRVs). TRVs for Australian receptors are lacking and therefore the exposure assessment for birds and mammals was based on published wildlife toxicity benchmarks from the US, using data for species that, as far as possible, were from similar taxonomic groups, trophic levels and body size.

No unacceptable risk from fluoride and aluminium was identified for terrestrial bird and mammal species through their use of surface water for drinking. Results indicated that surface water within the semi-permanent dam could pose an unacceptable risk to aquatic invertebrates and fish species. No reliable benchmark was sourced for aquatic plants but it was assumed that aquatic plants were also potentially at risk from fluoride contamination within the semi-permanent dam. Results also indicated that aluminium concentrations within the surface water of the semi-permanent dam could pose an unacceptable risk to aquatic invertebrates and aquatic plants but are unlikely to pose an unacceptable risk to fish species. These risk scenarios were based on low reliability benchmarks for non-Australian species under non-field conditions and the risk rating is unlikely to translate into actual impacts within the investigation area.

Swamp Creek is the ultimate water feature within the investigation area that could potentially receive fluoride and aluminium from impacted groundwater. Based on conservative toxicity benchmarks, the concentration of fluoride within the surface water of Swamp Creek is unlikely to pose an unacceptable risk to aquatic invertebrates and fish (Hazard Quotients less than 1) and a broadly similar risk profile was apparent for fluoride concentrations at all other Swamp Creek downstream sites as well as two ‘reference’ locations upstream of the investigation area. These results indicate that there is a low level ‘background’ of fluoride concentrations in the vicinity of the investigation area.

The reference locations, while not representative of the natural background water quality in the region, provide a useful comparison between the quality of surface water in Swamp Creek upstream and downstream of the inflow of surface water within the investigation area. On that basis, there was no significant change in risk from fluoride concentrations in Swamp Creek as a result of surface water inflow from the investigation area.

There were no apparent risks from aluminium concentrations within surface water in Swamp Creek except as the location furthest downstream from the investigation area. This isolated result was unrelated to surface water originating from within the investigation area.

Swamp Creek water is also used for watering local livestock. The concentrations of fluoride and aluminium in Swamp Creek surface waters do not pose an unacceptable risk to livestock according to criteria based on the ANZECC (2000) livestock drinking water guidelines.

On the basis of the results of the Tier 2 ESA, the following recommendations relevant to the Dickson Road site were made:

- Further investigate the range of ‘background’ concentrations of fluoride and aluminium in soil and surface water within the Buffer Zone to better understand variability with respect to potential smelter impacts
- Undertake sampling and chemical analysis of sediments and surface water within the semi-permanent dam to provide a more rigorous chemical basis for the assessment of risk to the aquatic community within the dam

- Undertake sampling and analysis of aquatic invertebrates from within the semi-permanent dam and a suitable reference locations to assess whether the risk profile calculated for the dam is apparent as community effects.

4.3 Stage 2 Aquatic Assessment - Ecological Risk Assessment

A Stage 2 aquatic assessment was completed in June 2013 (ENVIRON 2013c) in response to the recommendations made in the Tier 2 ERA.

Surface water, sediment and macroinvertebrate samples were collected at three sites within the semi-permanent dam and at two reference dams within the Buffer Zone in May 2013. Sample data successfully characterised the surface water and sediment quality and the complexity of the macroinvertebrate community within each of the three dams, enabling an assessment of aquatic quality within the semi-permanent dam relative to 'natural' background conditions in nearby dams. The results of the sample and data analysis indicated the following:

- Surface water quality within the semi-permanent dam was not different from the reference dams except for elevated concentrations of total fluoride;
- Sediment within the semi-permanent dam had elevated concentrations of total and bioavailable aluminium and total and soluble fluoride;
- Concentrations of aluminium in sediments within the semi-permanent dam were well below the available benchmark for impact to benthic species;
- Concentrations of fluoride in sediments within the semi-permanent dam were expected to be strongly bound to clay particles under the existing conditions of pH > 5.5;
- Macroinvertebrate diversity and abundance within the semi-permanent dam was similar if not marginally higher than for the reference dams;
- The differences in water and sediment quality noted above had not caused a noticeable impact on aquatic habitats within the semi-permanent dam;
- Risk profiles that identify potential unacceptable risk to aquatic species from elevated fluoride and aluminium concentrations within the semi-permanent dam were unfounded in terms of ecological measures and were likely to be overly conservative due to the use of limited toxicity information to derive the risk profiles.

In conclusion, the results of the Stage 2 Aquatic Assessment indicated that there is no discernible impact to the aquatic ecology within the semi-permanent dam as a result of elevated concentrations of fluoride in surface water and sediments.

4.4 Annual Cattle Monitoring Reports

Hydro has completed annual surveys of livestock that are agisted within the Buffer Zone. Ramboll reviewed '2012 Annual Cattle Monitoring Report' by Kerry McNaughton which presents the findings of the 29th annual survey of livestock in the vicinity of the Hydro Aluminium smelter. The 2012 annual survey included examination of cattle for general health and condition, teeth were photographed and given a dental score, tail bone biopsies were completed for fluoride assay and information on management and feeding practices were recorded. The 2012 annual report found that trends in the 2012 survey indicate that the surveyed herds (including one herd from the buffer zone and a control herd) were not being subjected to fluoride damage and all fluoride measurements remained below toxic thresholds. Cattle surveys indicate that no effects on cattle have occurred at within the Buffer Zone.

4.5 Phase 1 Environmental Site Assessment

The Phase 1 ESA was completed in October 2013 (ENVIRON 2013d) with the objectives of identifying the potential for historic and current contamination across the Hydro Land. The scope of work comprised:

- A review of historical reports (listed below) relating to land use and operations at the Smelter Site and Buffer Zone to assess the potential for soil, groundwater or surface water contamination arising from historic and current uses

- A review of published geological, hydrogeological and hydrological data associated with the site to establish the site environmental setting and sensitivity
- Detailed review of historical aerial photographs from 1951 (earliest available aerial photo), 1957, 1961, 1966, 1975, 1978, 1987, 1994, 2001, 2006 and 2013
- Detailed site walkover
- Interview with site environmental manager Kerry McNaughton
- Review of previous investigations.

In these investigations the Dickson Road Site and Lot 423 DP755231 are referred to as Parcel 16. The Parcel 16 site history review indicated that this portion of the Buffer Zone comprised land that was divided into 25 acre lots for returned soldiers in the 1950s prior to the construction of the Smelter. Houses were located on the Dickson Road frontage at Lots 423, 424 and 425. These houses were demolished in the early 1990s.

Asbestos was identified as a potential contamination issues relating to the demolition of former houses located on the Dickson Road frontage of Lots 423, 424 and 425. The presence of smelter wastes at the rear of Lots 424 and 425 was identified as previously assessed within the Phase 2 ESA report.

4.6 Phase 2 Environmental Site Assessment of Parcel 16

A Phase 2 ESA (ENVIRON 2015, updated Ramboll 2020) was completed in 2015 to assess the potential for contamination at Parcel 16 based on historical and current land use and to assess the suitability of Parcel 16 for the purposes of the current Rural Landscape (RU2) land use and the proposed General Industrial (IN1) and Environmental Conservation (E2) land use.

The scope of work performed to meet the objectives comprised:

- A review of available information relating to land use to assess the potential for soil, groundwater or surface water contamination arising from historic and current activities
- A review of published geological, hydrogeological and hydrological data to establish the environmental setting and sensitivity
- Field work comprising:
  - Collection of surface soil samples to provide a coarse grid assessment to assess the potential for dust deposition from the smelter operations
  - A site walkover to evaluate other potential locations of buried waste or illegal dumping
  - Intrusive investigations by backhoe to investigate disturbed ground
  - Data interpretation including comparison against relevant guidelines and a discussion of the findings in terms of human health and environment risk under the current and future land use scenarios
  - Review of options available for remediation or management to render Parcel 16 suitable for the proposed land use

The site walkover identified Parcel 16 to comprise open bushland with mature trees in the northern portion of the parcel and denser bushy shrubs in the southern portion where the parcel slopes down towards Swamp Creek. The locations of the former dwellings on Lots 423, 424 and 425 were identified and a 10 m by 10 m screening survey was completed for asbestos. No asbestos containing material (ACM) fragments were identified on surface soils. Following the walkover screening survey, a backhoe was used to excavate into soil at the footprints of the houses and no buried demolition waste was observed. Visual inspection of the surface of Parcel 16 did not identify evidence of smelter waste outside of the Dickson Road site previously identified.

Surface soil samples were collected from Parcel 16 to assess the potential for the aerial deposition of fluoride from the smelter. Soluble fluoride concentrations in the four samples ranged from 4 mg/kg to 14 mg/kg, with concentrations in three samples exceeding the Tier 1 ecological screening criterion of 4.3 mg/kg. These elevated concentrations were not considered to represent a risk to flora based on the results of a vegetation health survey completed in 2017 (‘Kurri Hydro Aluminium, Buffer Zone Vegetation Health Survey’ dated August 2017 by Eco Logical

Australia). No symptoms of fluoride injury were observed at Parcel 16.

Site contamination was considered to likely be limited to placement of smelter waste as historically identified. The presence of the waste materials was not considered to represent a risk of harm under the current land use (fenced without access). Remediation of smelter waste was recommended to render the site suitable for use of the land under the current Rural Landscape (RU2) and the proposed General Industrial (IN1) and Environmental Conservation (E2) zoning.

Characterisation of contamination at the Dickson Road site within Parcel 16 is further outlined in **Section 6**.

5. ASSESSMENT CRITERIA

5.1 Contaminants of Concern

Based on the results of the previous investigations, contaminants of concern associated with the burial of smelter-derived wastes are considered to include the following:

- Fluoride
- Aluminium
- Cyanide
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Petroleum hydrocarbons
- Heavy metals

Asbestos containing materials (ACM) were not identified within the wastes at the Dickson Road site during the previous investigations. ACM is considered a potential contaminant of concern and its identification would be considered an Unexpected Find.

5.2 Soil

The guidelines proposed for the assessment of soil contamination at the Dickson Road site were sourced from the following references:

- *NEPC (1999) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM)*
- Fluoride: ENVIRON (2013) Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium

The variation to the NEPM was registered on 15 May 2013 by NSW EPA under the Contaminated Land Management Act 1997. The NEPM amendment 2013 provides revised health-based soil investigation levels (HILs), health-based screening levels (HSLs), ecological-based investigation levels (EILs) and ecological based screening levels (ESLs) for various land uses.

The Dickson Road Site within Parcel 16 is currently zoned Rural Landscape (RU2) which allows home occupations. In the future, a portion of Parcel 16 is proposed to be zoned General Industrial (IN1) and Environmental Conservation (E2). Under these land uses, it is anticipated that the most sensitive use by humans will be for residential land use with access to soil. For the protection of ecology, guidelines for areas of ecological significance are considered to be the most relevant.

The guidelines adopted for the site from the NEPM are as follows:

- HIL A – residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake, (no poultry), also includes children’s day care centres, preschools and primary. Schools. The HILs are applicable for assessing human health risk via all relevant pathways of exposure. The HILs are generic to all soil types and apply generally to a depth of 3 m below the surface for industrial use.
- EIL for areas of ecological significance – ecological investigations levels applicable for assessing risk to terrestrial ecosystems. EILs depend on specific soil physicochemical properties and generally apply to the top 2 m of soil.
- ESLs for areas of ecological significance – ecological screening levels developed for selected petroleum hydrocarbon compounds and fractions and are applicable for assessing risk to terrestrial ecosystems. These are also generally applicable to the top 2m of soil.
- Management Limits where concentrations above these limits may indicate poor aesthetics, high odour and potentially explosive vapour. Management limits are to be applied after consideration of relevant ESLs and HSLs.

The applicable guidelines for heavy metals, PAHs, cyanide and fluoride in soil are presented in **Table 5-1**.

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Table 5-1: Soil Assessment Criteria (mg/kg) – Health and Ecological Investigation Levels

	HIL A	EIL
Fluoride (soluble)	440 (site-specific)[1]	4.3[2]
Aluminium	100,000 (NL)[1]	-
Cyanide (free)	240 [4]	-
Arsenic	100	100
Cadmium	20	-
Chromium (VI)	100	70[3] CrIII 1% clay
Copper	6000	65[3]
Lead	300	
Mercury (inorganic)	40	
Nickel	400	20[3]
Zinc	7400	140[3]
Naphthalene	See Table 5-2	10
Carcinogenic PAHs (as BaP TEQ)	3	-
BaP	-	0.7
Total PAHs	300	-

1. Site-specific residential fluoride value calculated in the *Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)*
2. Background fluoride concentration for Smelter Site and Buffer Zone lands, see **Appendix 2**
3. EILs were derived using the NEPM (2013) EIL Calculation Spreadsheet and data from all Hydro owned land averaged for CEC (7.2 cmol/kg), soil pH (6.04) and TOC (1.2%). The data and EIL Spreadsheet are included in **Appendix 2**
4. Cyanide value for recreational land use adopted as lower of the values.

Petroleum hydrocarbons are assessed for vapour intrusion into a residential building. The applicable vapour intrusion criteria for petroleum hydrocarbons in soil are presented in **Table 5-2**.

Table 5-2: Vapour Intrusion Criteria for Petroleum Hydrocarbons in Soil (mg/kg)[2]

TRH Fraction	Soil Texture	0 to <1m	1m to <2m	2m to <4m	4m+
Toluene	Coarse	160	220	310	540
Ethyl benzene	Coarse	55	NL[1]	NL	NL
Xylenes	Coarse	40	60	95	170
Benzene	Coarse	0.5	0.5	0.5	0.5
Naphthalene	Coarse	3	NL	NL	NL
F1[3] C6-C10	Coarse	45	70	110	200
F2[4] >C10-C16	Coarse	110	240	440	NL

[1] The soil saturation concentration (Csat) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds Csat, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.

[2] (For soil texture classification undertaken in accord with AS 1726, the classifications of sand, silt and clay may be applied as coarse, fine with liquid limit <50% and fine with liquid limit>50% respectively, as the underlying properties to develop the HSLs may reasonably be selected to be similar. Where there is uncertainty, either a conservative approach may be adopted or laboratory analysis should be carried out.

[3] To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.

[4] To obtain F2 subtract naphthalene from the >C10-C16 fraction.

The applicable assessment criteria for petroleum hydrocarbons in soil are presented in **Table 5-3**.

Table 5-3: ESLs and Management Limits[1] for Petroleum Hydrocarbons in Soil

TPH fraction	Soil texture	ESLs (mg/kg dry soil)	Management Limits[1] (mg/kg dry soil)
		Areas of Ecological Significance	Residential, Parkland and Public Open Space
F1 [2, 4] C6- C10	Coarse	125*	700
F2 >C10-C16	Coarse	25*	1000
F3 >C16-C34	Coarse	-	2500
F4 >C34-C40	Coarse	-	10,000
Benzene	Coarse	10	-
Toluene	Coarse	10	-
Ethyl benzene	Coarse	1.5	-
Xylene	Coarse	10	-
Benzo(a)pyrene	Coarse	0.7	-

[1] Management limits are applied after consideration of relevant ESLs and HSLs.

[2] Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2.

[3] ESLs are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability.

[4] To obtain F1, subtract the sum of BTEX from C6-C10 fraction.

Consistent with the guidance provided in the NEPM, the data was assessed against the above adopted site guidelines by:

- Comparing individual concentrations against the relevant guidelines and if discrete samples are in excess of the relevant guideline then;
- Comparing the 95% upper confidence limit of mean against the relevant guideline also ensuring that:
  - the standard deviation of the results is less than 50% of the relevant investigation or screening level, and
  - no single value exceeds 250% of the relevant investigation or screening level.

5.3 Surface Water and Groundwater

The assessment criteria proposed for the assessment of surface water and groundwater contamination at the Dickson Road site were sourced from the following references:

- *NSW DEC (2007) Guidelines for the Assessment and Management of Groundwater Contamination*
- *ANZECC & ARMCANZ (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality*
- *ANZECC & ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality*

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 is Swamp Creek, which is located on the southern site boundary. Swamp Creek discharges into a drainage area called Wentworth Swamp, which is part of the Fisheries Creek Catchment. In turn, Wentworth Swamp discharges to the Hunter River approximately 15 km north-east of the site near Maitland.

Surface water within Swamp Creek is described as neutral to slightly alkaline, 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 south towards Swamp Creek. Water level gauging completed during the investigations confirmed the groundwater flow direction to the south.

According to the Office of Industry and Investment, NSW, there are 17 licensed groundwater abstractions (bores) located to the north of 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 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 located on the Chichester River
- The Kurri Waste Water Treatment Works is located immediately up gradient of the site. The Works has a licensed discharge point into Swamp Creek

5.3.1 Appropriate Criteria for Groundwater and Surface Water

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

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

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

Groundwater results will be compared against trigger values for the protection of 95% of freshwater species. A 95% protection of 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. The 99% level of protection of fresh water species will be selected for persistent contaminants.

ANZECC (2000) indicates there is currently insufficient data to derive a high reliability trigger value for TPH but propose a low reliability trigger value of 7µg/L. This guideline is considered by industry to be overly conservative and is well below the TPH detection limit that most laboratories can achieve. Therefore the limit of reporting (LOR) will be adopted as a screening trigger for TPH.

Trigger values for cadmium, copper, nickel, lead and zinc can be modified for hardness, as the bioavailability of these heavy metals decreases with increasing hardness. Total hardness was calculated for the receiving waters of Swamp Creek using calcium and magnesium concentrations, with results indicating hard water (134 mg/L $CaCO_3$). Trigger values modified for hard waters have been used, as per Table 3.4.3 of ANZECC (2000).

Groundwater results will also be compared against trigger values for irrigation and stock watering. Section 4.3.4 of ANZECC (2000) indicates that stock watering trigger values for heavy metals and metalloids are for total concentrations, irrespective of whether the constituent is dissolved, complexed with an organic compound or bound to suspended solids. Fluoride is included in this section.

The long term trigger value has been used for irrigation guidelines. Section 9.2.5.11 of ANZECC (2000) indicates that the long term trigger value for fluoride is based on the assumption that the irrigation water could potentially be phytotoxic to sensitive plant species or could contaminate stock drinking water. As stock watering guidelines are for total metal and metalloid concentrations, total fluoride concentrations will be used.

A summary of the assessment criteria for groundwater are provided in **Table 5-4**.

Table 5-4: Groundwater Assessment Criteria (µg/L)

	95% Protection for Aquatic Ecosystems	Irrigation – Long Term Trigger Values	Stock Watering
Arsenic	1[1]	100	500
Cadmium	0.84[2]	10	10
Chromium	1	100	1000
Copper	5.46[2]	200	1000
Lead	25.84[2]	2000	100
Nickel	42.9[2]	200	1000
Zinc	31.2[2]	2000	20000
Mercury	0.06	2	2
Fluoride	-	1000	2000
Cyanide (complex)	7	-	-
TPH C6-C36	LOR[3]	LOR	LOR

1. 99% protection for persistent contaminants
2. Hardness Modified Trigger Values
3. Limit of Reporting

6. SITE CHARACTERISATION

6.1 Assessment of Contamination

Intrusive investigations into soil, surface water and groundwater were completed at the Dickson Road Site during the Phase 2 ESA in 2012 and the Phase 2 ESA over the larger Parcel 16 in 2015. The 2012 investigations comprised:

- A detailed walkover of the Dickson Road site which identified the site to comprise vacant, vegetated land with a grassed field that slopes down towards Swamp Creek on the southern site boundary. A white peg, identifying the location where waste was previously excavated, was located in the grassed field. The southern edge of the stockpiles was also observable, with a change in elevation of approximately 1 m to 1.5 m down towards Swamp Creek. The stockpile landform indicated that the site had been filled by pushing out of material from the north of the site, as there was no observable change in topography in the north of the site to indicate where the edge of the stockpiling is located. The edges of the stockpiles were observed to be grassed, with some waste such as metal pipes, protruding from some stockpiles.
- Excavation of 15 test pits around the grassed field to identify the extent of the buried waste. The test pits were extended into natural sands, unless refusal on waste occurred.
- Collection of one to two soil samples from each test pit. Analysis of soil samples for potential contaminants of concern including aluminium, fluoride, cyanide, heavy metals, PAHs and TPH.
- Drilling and installation of three groundwater wells, with one well up-gradient of the buried waste and two wells down-gradient, one immediately east of the buried waste and one to the south between the buried waste and Swamp Creek.
- One round of groundwater sampling was completed, with samples analysed for cations/ anions, heavy metals, cyanide, fluoride and Semi-Volatile Organic Compounds (SVOCs).
- Collection of three surface water samples from Swamp Creek, one from an upstream location, one from a mid-stream location immediately down gradient of the buried waste and one from a down-stream location. Surface water samples were analysed for cations/ anions, heavy metals, cyanide, fluoride and Semi-Volatile Organic Compounds (SVOCs).

Smelter wastes were observed in ten of the sixteen test pits at depths ranging between 0 m BGS and 1.8 m BGS. The extent of the waste was identified during the investigation to the north, south, east and west. The extent of the waste to the east and south can be easily identified in the field where stockpiled material has been pushed out over lower-lying flat ground.

A generalised site lithology is presented in **Table 6-1**. The extent of the buried waste identified during the investigation is shown in **Figure 2, Appendix 1**. Photographs are included in **Appendix 3**. Test pit logs are included in **Appendix 4**.

Table 6-1: Generalised Site Lithology

Depth (m bgs)	Soil Description
0.0 – 0.4	TOPSOIL: clayey sand, brown, fine grained with some rootlets
0.4 - >1	SAND: yellow, fine grained
0.0 – 1.8	FILL: Gravelly, clayey sand, fine grained, with some concrete, timber, brick, steel strapping, electrical wiring, PVC piping, hydraulic hoses, crushed 22 gallon drums, lumps of steel, Kaowool, carbon fluxing tubes, steel fence posts, packing foam, bulker bags, carbon, Perspex®, plywood packing cases, steel casting tools, solenoid, plastic, bag house socks, spent anode, drum of old ramming compound (no longer used at Smelter). Waste made up between 30% and 80% of the soil matrix.

Depth (m bgs)	Soil Description
1.8 – 5	SAND: yellow, fine grained
5 - >9.5	CLAY, black, high plasticity

During drilling, groundwater was found in black clay underlying the natural sands up gradient of the waste at a depth of 5.7 m BGS (DR1). Groundwater was observed in the natural sands to the east of the waste (down gradient, DR2) at a depth of 3.8 m BGS. Between the waste and Swamp Creek, groundwater was observed at a depth of 0.53 m BGS within natural sands (DR3). Depth to water measured during groundwater sampling indicated that groundwater flow direction is south towards Swamp Creek and that the groundwater gradient beneath the buried waste is relatively flat. Perched groundwater was also identified within the fill material, particularly in the northern portion of the fill.

Depth to groundwater information is outlined in **Table 6-2**.

Table 6-2: Depth to Groundwater (28 August 2012)

Well ID	Easting	Northing	Screened Interval	Top of Casing (m AHD)	Depth to Water (m bgs)	Groundwater Surface Elevation (m AHD)
DR1	358344	6370539	6.6-9.6	12.1	6.6	5.5
DR2	358468	6370513	2.5-5.5	8.97	3.0	5.9
CR3	358443	6370452	0.5-3.5	6.63	1.0	5.6

The 2015 Phase 2 ESA investigations over the larger Parcel 16 comprised:

- Collection of four surface soil samples to provide a coarse grid assessment to assess the potential for dust deposition from the smelter operations, with analysis for soluble fluoride
- A site walkover to evaluate other potential locations of buried waste or illegal dumping, including the set up and walkover of 10 m grids over the three house footprints
- Intrusive investigations by backhoe to investigate disturbed ground at the three house footprints

No ACM fragments were identified during the site walkover or grid-based walkover of the house footprints. No buried demolition wastes were identified during intrusive investigations into the three house footprints.

6.2 Soil Results

Soil samples from the Dickson Road site were analysed for contaminants of concern including fluoride, aluminium, cyanide, heavy metals, petroleum hydrocarbons and PAHs.

A summary of the soil results is presented in **Table 6-3**. Summary tables presenting analytical results compared to adopted site criteria are presented in **Appendix 5**. Laboratory reports are included in **Appendix 6.**

Table 6-3: Summary of Soil Results

Analyte	No. of Samples	Maximum Concentration (mg/kg)	No. exceeding Site Criteria	Criteria Exceeded (mg/kg)
Aluminium	18	35000	0	
Arsenic	18	10	0	
Cadmium	18	<0.5	0	
Chromium	18	32	0	
Copper	18	150	**1**	65 (EIL)
Lead	18	210	0	
Nickel	18	54	**5**	20 (EIL)
Zinc	18	2900	**7**	140 (EIL)
Mercury	18	0.1	0	
Total Fluoride[1]	18	56,000	**10/ 18**	440 (site-specific HIL A)/ 4.3 (Ecological)
Soluble Fluoride	4	14	**0/3**	4.3 (Ecological)
Total Cyanide	18	5.4	0	
Naphthalene	9	2200	**2**	3 (HSL A)/10 (ESL)
BaP TEQ	9	510.4	**4**	3 (HIL A)
BaP	9	350	**8**	0.7 (ESL)
Total PAHs	9	9930	**1**	300 (HIL A)
TPH C6-C9[2]	9	<25	0	
TPH C10-C14[2]	9	7300	**1**	1000 (Management Limit)
TPH C15-C28[2]	9	19,000	**1**	2500 (Management Limit)
TPH C29-C36[2]	9	5300	0	

[1] Fluoride was analysed as total fluoride. Soluble fluoride is the bioavailable portion of fluoride.

[2] The TPH fractions used in NEPM (2013) are different to the TPH fractions that were analysed for assessment in 2012. The F1 fraction is for TPH C6-C10 and the F2 fraction is for TPH >C10-C16. These results are approximate only.

Concentrations of benzo(a)pyrene, total PAHs, TPHs, fluoride, petroleum hydrocarbons, copper, nickel and zinc within fill soils in the matrix of the buried waste exceeded the site criteria. Concentrations of these contaminants in natural sands were below the site criteria, indicating that contaminants within the waste have not impacted on underlying natural sands.

During the 2012 Phase 2 ESA, analysis was undertaken for total fluoride. Soluble fluoride is the bioavailable portion of fluoride and as such, the total fluoride concentrations over-estimate the amount of bioavailable fluoride at the Dickson Road site.

During the 2015 Phase 2 ESA, soluble fluoride analysis was undertaken on four samples collected on a broad grid across Parcel 16. Soluble fluoride concentrations ranged between 4 mg/kg to 14 mg/kg, with concentrations in three samples exceeding the Tier 1 ecological screening criterion. Although these concentrations are considered elevated above the background concentration of 4.3 mg/kg, these elevated concentrations are not considered to represent a risk to flora based on the results of a vegetation health survey completed in 2017 (‘Kurri Hydro Aluminium, Buffer Zone Vegetation Health Survey’ dated August 2017 by Eco Logical Australia). No symptoms of fluoride injury were observed at Parcel 16.

The objective of the vegetation health survey was to establish the geographical extent of visible fluoride injury to plant species that could be attributed to activities at the smelter, predominantly fluoride emissions. Whilst the study focuses on impact from emissions, impacts to vegetation occurring from soil or water concentrations of fluoride are also captured. The August 2017 survey was completed five years following the closure of the smelter, with atmospheric fluoride emissions no longer being released from the smelter however soil concentrations remain unchanged. The report found that the geographical extent of fluoride injury has markedly reduced in comparison to the 2013 results, with detectable visible injury to all fluoride sensitive plant species in 2017 limited to within close proximity of the smelter. As such, it can be concluded that the soluble fluoride concentrations present in surface soil at Parcel 16 are acceptable for vegetation.

6.3 Groundwater Results

A summary of the groundwater results is presented in **Table 6-4**.

Table 6-4: Summary of Groundwater Results

Analyte	No. of Samples	Maximum Concentration (µg/L)	No. exceeding Site Criteria	Criteria Exceeded (µg/L)
Arsenic	3	1	0	
Cadmium	3	0.6	0	
Chromium	3	<1	0	
Copper	3	5	0	
Lead	3	<1	0	
Nickel	3	120	**1**	42.9[1]
Zinc	3	170	**2**	31.2[1]
Mercury	3	<0.05	0	
Fluoride	3	10,000	**1/1**	1000[2]/ 2000[3]
Total Cyanide	3	61	**1**	7[4]
Polycyclic Aromatic Hydrocarbons	3	<LOR	0	
Phenols	3	<LOR	0	
Other SVOCs	3	<LOR	0	

1 Protection of 95% aquatic species; 2 Irrigation; 3 Stock Watering; 4 criterion is for free cyanide

Results for heavy metals are generally below the trigger levels, aside from nickel and zinc in the up gradient well DR1 and zinc in the cross gradient well DR2, which exceeded the 95% protection level for fresh water species. Heavy metals concentrations in the down gradient well DR3 were below the site criteria, indicating that elevated copper, nickel and zinc concentrations within the fill matrix has not impacted on down gradient groundwater.

Elevated concentrations of cyanide and fluoride were identified in DR3, the well located between the fill material and Swamp Creek. The fluoride concentration of 10,000 µg/L exceeded the trigger levels for irrigation and stock watering or 1000 µg/L and 2000 µg/L respectively. The total cyanide concentration was 61 µg/L. There is no guideline for total cyanide, however the guideline for protection of 95% of fresh water species for free cyanide is 7 µg/L.

6.4 Surface Water Results

A summary of the surface water results from Swamp Creek is presented in **Table 6-5**.

Table 6-5: Summary of Surface Water Results

Analyte	No. of Samples	Maximum Concentration (µg/L)	No. exceeding Site Criteria	Criteria Exceeded (µg/L)
Arsenic	3	15	**3**	1[1]
Cadmium	3	0.6	0	
Chromium	3	5	**3**	1[1]
Copper	3	20	**2**	5.46[1]
Lead	3	10	0	
Nickel	3	67	**1**	42.9[1]
Zinc	3	210	**3**	31.2[1]
Mercury	3	0.4	**2**	0.06[1]
Fluoride	3	3600	**3**	1000
Total Cyanide	3	<4	0	
Organochlorine Pesticides	3	<LOR	0	
Organophosphorous Pesticides	3	<LOR	0	
Polycyclic Aromatic Hydrocarbons	3	<LOR	0	
Phenols	3	<LOR	0	
Other SVOCs	3	<LOR	0	

1 Protection of 95% aquatic species modified for hardness; 2 Irrigation; 3 Stock Watering

Results for fluoride exceeded the trigger levels for stock watering and irrigation. Results for arsenic, chromium, copper, nickel, mercury and zinc exceeded the criteria for 95% protection of aquatic species. Results for total cyanide, PAHs and SVOCs were below the laboratory limit of reporting.

6.5 Conceptual Site Model

A conceptual site model (CSM) has been developed based on known source(s) of contamination, the pathway(s) by which contaminants may migrate through the environmental media and the populations (human or ecological) that may potentially be exposed. This relationship is commonly known as a Source-Pathway-Receptor (SPR) linkage. Where one or more elements of the SPR linkage are missing, the exposure pathway is considered to be incomplete and no further assessment is required.

Human and ecological receptors are presented in **Table 6-6**, together with identified exposure routes from contaminated soil, surface water and groundwater in the context of future use as well as the acknowledgement of downgradient receptors.

Table 6-6: Conceptual Site Model, Exposure Pathway Assessment

Pathway	**Potentially Complete Source-Pathway-Receptor Linkage? (Yes/No/Potential/ Not Applicable)**			**Justification**
	Current and future users	**Hydro Lands ecological receptors**	**Ecological receptors of Swamp Creek**	
Fill Material with Smelter Waste				
Dermal contact with impacted soil	No	Potential	No	Elevated concentrations of fluoride, PAHs, petroleum hydrocarbons, copper, nickel and zinc were detected in fill soils associated with buried smelter wastes. Currently the wastes are covered with a shallow sand layer and grass that provides a barrier between human receptors and the contamination within the waste materials. Ecological receptors such as microbes may come into contact with contaminated soil.
Incidental ingestion of impacted soil	No	Potential	No	
Dust inhalation	No	No	NA	
Surface Water				
Dermal contact with impacted surface water	No	NA	NA	The nearest surface water receptor is Swamp Creek on the southern site boundary. Elevated fluoride concentrations have been detected in Swamp Creek. There is a complete exposure pathway between elevated fluoride concentrations in groundwater and ecological receptors of the Hydro Lands and ecological receptors of Swamp Creek.
Incidental ingestion of impacted surface water	No	NA	NA	
Root uptake	NA	**Yes**	**Yes**	
Groundwater				
Dermal contact with impacted groundwater	No	No	**Yes**	

Pathway	**Potentially Complete Source-Pathway-Receptor Linkage? (Yes/No/Potential/ Not Applicable)**			**Justification**
Incidental ingestion of impacted groundwater	No	No	**Yes**	Perched groundwater was located within the deeper, northern portion of the buried wastes. Perched groundwater is likely to be isolated and not connected to true groundwater. Groundwater was detected down gradient of the buried wastes at a depth of 1m BGS in close proximity to Swamp Creek. Groundwater at this location was impacted by elevated fluoride and total cyanide concentrations. True groundwater would be connected to surface water within Swamp Creek. There is a complete exposure pathway between elevated fluoride and total cyanide concentrations in groundwater the ecological receptors that utilise Swamp Creek.
Root uptake	NA	**Yes**	**Yes**	

6.6 Statement of Suitability for Existing and Proposed Site Use

As there is a complete exposure pathway between contamination within the Dickson Road Site and ecological receptors, and potential for human exposure under future land uses, remediation of the buried waste and associated soil and perched groundwater contamination is required.

7. REMEDIAL ACTION PLAN

7.1 Remediation Goal

The goal of this remediation project is to remediate buried smelter waste and associated soil and perched groundwater contamination at the Dickson Road site to render the site suitable for the current and future landuses.

7.2 Extent of Remediation Required

Remediation of buried smelter wastes and associated soil and perched groundwater contamination is required at the Dickson Road site. The lateral extent of remediation required includes the entire extent of the buried smelter wastes and is shown in **Figure 2, Appendix 1**. The depth of buried smelter wastes is between 0.4 m BGS and 1.8 m BGS, with the deepest waste profile along the northern boundary of the waste disposal area. The depth of the waste profile shallows to the south, east and west. Perched groundwater was encountered within deepest waste profile in the north at a depth of 1 m to 1.2 m BGS .

The approximate fill volume estimates are presented in **Table 7-1**. The volume calculations were estimated from the approximate lateral and vertical extent assessed during the Phase 2 ESA completed in 2012. Tonnages were calculated from the anticipated bulk density as shown for each material present. There is inherent uncertainty in the volume estimates.

Table 7-1: Fill Quantity Estimates

Type	Volume estimates (m^3)			Bulk Density (T/m^3)	Mass estimates (T)	
	Range				Range	
	Estimate	Low	High		Low	High
Smelter derived wastes	8,490	8,490	16,980	1.5	12,735	25,470
Contaminated soils	5,660	5,660	11,320	1.8	10,188	20,376

In general, the fill quantity estimate is a preliminary guide to the extent of remediation required however remediation will be undertaken to the final satisfaction of the Principal or Principal's representative.

7.3 Remediation Options

Based on the site characterisation presented in **Section 6**, a review of potential remediation options for the Dickson Road site was undertaken.

Table 7-2 presents a summary of the available remedial options considered for the Dickson Road site and the contaminants present.

Table 7-2: Assessment of Remediation Options

Option	Description	Advantages	Disadvantages
1	Do nothing	Not an option due to proposal for redevelopment of land	

Option	Description	Advantages	Disadvantages
2	Excavate, sort and dispose to waste facility. Removal of perched water and disposal off site.	Removes risk from site under future land use scenarios Removes long term management requirement from site. Removes the source of contaminants leaching to groundwater and allows perched groundwater to be extracted and treated. Improves land value. Planning approval requirements straightforward.	Consumes off site waste facility space. Disposal costs are high. Remaining void may need rehabilitation with clean fill.
3	Encapsulation of smelter-derived wastes at another location within Hydro owned land. Extraction of perched water for treatment onsite.	Removes risk from site under future land use scenarios Relocates long term management requirements to a centralised area. Removes the source of the contaminants leaching to groundwater and allows perched groundwater to be extracted and treated. Improves land value.	Remaining void may need rehabilitation with clean fill. Planning approval for disposal site will be required. Timeline is reliant on whole of site solution.
4	Encapsulate and manage in-situ	Encapsulation allows for capping and then rehabilitation by a green corridor or similar.	Does not address leaching of contaminants to groundwater or treatment of perched groundwater. Requires long term management and registration of an Environmental Management Plan with Council. May reduce property value or limit redevelopment potential Planning approval required.

7.4 Rationale for the Selection of the Recommended Remedial Option

Remediation options were considered in terms of cost, risk of failure, long term legacy and onsite management, corporate responsibility and sustainability. In terms of these evaluators Option 3 was preferred.

Hydro has conducted a whole-of-site remediation options study in 2014 to identify the most appropriate remediation strategy applicable to the issues across all Hydro owned lands. Option 3 allows smelter derived wastes from the Dickson Road site to be incorporated with other smelter derived wastes that require remediation on another part of the Smelter Site. This option will include removal of the source of the fluoride and other contaminants that have the potential to leach into groundwater and the extraction of groundwater for treatment in the water treatment plant being established for the broader remedial program.

The Remedial Action Works Plan presented in **Section 8** details the steps required to complete the remediation program.

7.5 Contingency if the Remediation Strategy Fails

Table 7-3 outlines the potential failure scenarios that could occur and the contingency mechanisms that will be implemented to achieve the overall remediation objective.

Table 7-3: Contingency Options

Failure Scenario	Contingency Response
All smelter derived wastes cannot be excavated due to safety or other risks	While all efforts will be undertaken to remove identified wastes/contamination, if a situation arises where it becomes impractical to completely remove fill/soil to meet the remediation objectives, (eg physical constraints, safety etc), alternative strategies may be employed to justify leaving contamination in place (eg specific risk assessment).
Unexpected materials are encountered such as asbestos-containing materials	An unexpected finds protocol (UFP) will be followed in the field. Any UFPs will be removed to the on-site landfill if consistent with other materials in the landfill. If inconsistent, an assessment of compatibility will be undertaken, or materials will be disposed off-site.
A whole-of-site strategy is not approved that incorporates the Dickson Road wastes	Consider the hierarchy of other preferred options. Where off-site disposal of waste is required, waste disposal would be completed by an appropriately licensed contractor to a licensed facility.
Impacts to groundwater outside of the footprint of the excavation are identified	Undertake a risk assessment evaluating the risk to the receiving environment.

7.6 Interim Site Management Plan

The Dickson Road Site is currently fenced and not generally accessible to the public. The existing conditions are considered suitable short-term controls.

8. REMEDIAL ACTION WORKS PLAN

8.1 Hold Point

The remedial works will be supervised by an appropriately qualified and experienced Remediation Contractor with support from an appropriately qualified and experienced Environmental Consultant. Hydro is the Principal on the remediation project.

Prior to commencing works, the Remediation Contractor is to provide the Principal for written approval a proposed remediation works methodology. The methodology is to describe:

- Mobilisation and site facilities required
- Methods of excavation and sorting
- Method for removal of perched groundwater
- Identification of a suitable stockpile area within the Smelter Site
- Proposed materials tracking
- Quality control procedures that demonstrate how the requirements of the RAP, including validation, will be met and documented

The general objectives are outlined in the following Sections. The works methodology is to consider the objective of this remediation project.

8.2 Site Establishment

Mobilisation and setup on site of the required plant, personnel and controls. These controls will include, but are not limited to:

- Locate and isolate all overhead and underground services in the proximity of the works
- Assess traffic control requirements, cognisant of other site activities
- Work area security fencing
- Sediment fencing
- Implement stormwater runoff and sediment controls

The Principal is to inspect the site following site establishment and implementation of controls.

8.3 Survey

A survey of the Dickson Road site will be undertaken by a registered surveyor. The survey will involve:

- Pre-remediation survey of the surface of the area encompassing the buried waste
- Following excavation of contaminated soils
- Post-remediation, following landscaping

The survey should be conducted such that a 3D model of the Dickson Road site can be located laterally and vertically on a registered survey plan, suitable for potential attachment to a land title.

This survey forms part of the validation requirements described in **Section 9**.

8.4 Remedial Methodology

Excavation and sorting of materials at the Dickson Road site is required. Materials are to be sorted and temporarily stored, excavations are to be validated and the area is to be reinstated to its original condition.

Further description of the remedial methodology is described below.

8.4.1 Excavation

The Contractor may schedule excavation works in stages to allow partial excavation, validation and reshaping of filled areas before proceeding on to the next stage. If remediation is undertaken in this fashion, the Contractor will still need to comply with the validation and survey requirements as set out in this RAP.

The Dickson Road site is located adjacent to Swamp Creek and remedial works cannot be undertaken within 40 m of this waterway without development consent. The Contractor is to provide a methodology for excavation in this area that manages the distance required between the works and Swamp Creek.

8.4.2 Sorting

Sorting of smelter waste is to be conducted at the Dickson Road site and is coarse, high-level sorting.

It is envisaged that waste materials will be sorted in a way that is feasible and achievable. Coarser materials that can be easily separated (concrete, spent anodes, aluminium casts) should be separated during excavation.

At the Contractor’s discretion, large fragments of concrete or steel may be transported directly to an appropriate recycling facility. All materials transported to recycling should be approved in writing by the Environmental Consultant. Alternatively, this material can be transported to the Smelter Site stockpile area.

Finer material, including soil will be transported to the Smelter Site stockpile area for a whole-of-site remediation solution as part of a later stage of work.

8.4.3 Spoil Management

The following general principles should be incorporated into management of stockpiles:

- No stockpiles or other materials shall be placed on steep slopes
- Stockpiles will be located at a distance greater than 40 m from the natural watercourse of Swamp Creek
- Stockpiles will be placed on a level area as a low elongated mound
- Control of dust from stockpiles

Further erosion and sediment controls in accordance with the CEMP (refer to Section 11.8) are to be implemented.

8.4.4 Materials Tracking

A procedure shall be provided by the Contactor that includes:

- Tracking of materials as they are removed from the Dickson Road site
- Truck logging at the site entrances and exits or materials being relocated to the Smelter Site stockpile area
- Provision of a weekly materials tracking report

It is not proposed that any contaminated soils will be transported from the site. The Dickson Road site is within the boundary of Hydro’s Environmental Protection Licence (EPL). Dickson Road will be used to transport smelter wastes and contaminated soil from one part of the EPL site to another part of the EPL site. As contaminated soils are being retained on the EPL site, waste tracking is not required.

8.4.5 Groundwater Remediation

Perched groundwater within the buried smelter waste has been impacted with fluoride. The Remediation Contractor must develop a methodology to extract perched groundwater from the excavation footprint. The methodology is expected to include the following:

- Excavation of a sump to allow perched water to progressively drain from the waste
- The sump can be dewatered by pumping via layflat to the onsite stormwater detention basin and managed through the stormwater on the Smelter Site

Monitoring of impacts to groundwater will be undertaken following removal of the buried waste. Validation of fluoride concentrations in groundwater is described in **Section 9**. As groundwater monitoring is required as part of the validation works, the Remediation Contractor must not damage the three site wells, which are located outside the extent of buried smelter waste.

8.4.6 Validation of Remediation

Detailed validation requirements are presented in **Section 9.**

Generally validation will be undertaken after visual inspection identifies the excavation is free of all smelter waste followed by sampling and analysis of soils to confirm concentrations of contaminants of concern in the natural soils within the excavated area are below the adopted site criteria.

Validation of the exposed excavation shall be undertaken prior to reshaping of the excavation. Excavation reshaping is not permitted until the Environmental Consultant is satisfied that validation results show the remediation goal has been achieved **or, where the goal has not been achieved then** following written approval from the Principal.

8.4.7 Reshaping and Final Landform

Following excavation of smelter waste and associated contaminated soil and satisfactory validation of the soils remaining in the resultant void, reshaping of the remediation area can proceed. The aim of reshaping is to return the area to its original condition prior to filling, that is, a shallow embankment sloping down to Swamp Creek.

All reshaping works shall comply with the following requirements:

- The final landform shall be reshaped to conform with the surrounding topography
- The levels and grades of the finished landform shall be such that it encourages the shedding of incident stormwater to Swamp Creek but are at grades that would not result in erosion
- The finished landform shall comprise a surface layer not less than 100 mm of topsoil and shall be vegetated with native grasses

The Principal is to inspect the site following completion of the final landform and soil stabilisation measures.

8.4.8 Smelter Site Stockpile Area

The Contractor will be responsible for the preparation of the Smelter Site stockpile area on the Smelter Site. The Principal shall identify the area to be used for stockpiling. Materials transported from the Dickson Road site will be stored at this location in the interim prior to relocation into the Containment Cell.

As discussed above, it is envisaged that the following broad categories of materials will require stockpiling at the Smelter Site stockpile area:

- Coarse wastes including concrete, spent anodes, aluminium casts. As discussed above, the Contractor may nominate to transport larger concrete, (excluding refractory bricks) directly to a recycling facility, dependent on suitability
- Wastes including timber, brick, steel strapping, electrical wiring, PVC piping, hydraulic hoses, crushed 22 gallon drums, lumps of steel, Kaowool, carbon fluxing tubes, steel fence posts, packing foam, bulker bags, carbon, Perspex®, plywood packing cases, steel casting tools, solenoid, plastic and bag house socks
- Finer materials down to soil sized

The Contractor shall undertake site preparation works, (in the area identified by the Principal) to ensure:

- The layout of the Smelter Site stockpile area will be suitable for placement of the anticipated material volumes (or as indicated by the Principal), in terms of allowance for space and access
- During active construction of the stockpiles, appropriate erosion and sediment controls have been installed (refer to **Section 10.6**)
- Upon completion of the stockpiling works, (following the Dickson Road remediation works), the Contractor shall undertake works to ensure long-term stabilization of the stockpile. These are envisaged to include:
    - Placement, shaping and compaction of stockpile landform to encourage runoff but not erosion
    - Placement of a topsoil layer (min 100 mm) and vegetation (eg, hydromulch) over the finer materials stockpile. Hydro has a stockpile of ENM material available that could be used for this topsoil material. The Remediation Contractor is to satisfy itself that this material is suitable
    - Surface water diversion and erosion control measures as appropriate to divert stormwater away from and around stockpiles, and capture any sediment in runoff from the stockpiles.

The Principal is to inspect the works at the Smelter Site stockpile site on completion of these works.

8.4.9 Demobilisation

At the completion of the works, the Remediation Contractor is to demobilise. The Remediation Contractor is to remove all project infrastructure and wastes unless agreed to remain in writing by the Principal.

9. VALIDATION SAMPLING AND ANALYSIS QUALITY PLAN

The following is the validation sampling and analysis quality plan (SAQP) to be implemented to validate the remedial objective has been achieved for the Dickson Road site.

Validation sampling of soil and groundwater will be required to demonstrate that, following excavation of all waste and associated contaminated soil, remaining soils are within the adopted criteria for the site and that concentrations of contaminants of concern in groundwater are returning to background concentrations.

9.1 Validation Data Quality Objectives

In order to achieve the objectives and purpose of the validation program, both the field and laboratory programs must be representative of the actual extent of contamination in soil. As such, specific Data Quality Objectives (DQOs) have been developed for the validation of field and analytical data obtained during the remediation. The DQO process is a systemic, seven step process that defines the criteria that the validation sampling should satisfy in accordance with the requirements of EPA (2017) *Guidelines for the NSW Site Auditor Scheme* (3rd Edition). The DQOs are outlined in **Table 9-1**.

Table 9-1 Data Quality Objectives

DQO	Outcome
Step 1: State the Problem	In its current state, the Dickson Road site is not considered suitable for the proposed land uses and remediation of the following site contaminants is required: • Buried smelter waste • Associated soil contaminated with fluoride, petroleum hydrocarbons and PAHs • Perched groundwater contaminated with fluoride The remediation process involves the excavation of smelter wastes and associated contaminated soil for temporary storage at the Smelter Site and later inclusion in a whole-of-site remediation strategy. Remediation will also involve removal of perched groundwater to the Smelter Site stormwater system. Validation of these remedial works is required to demonstrate that the Dickson Road site is suitable for the proposed future land uses described in **Section 2.3**.
Step 2: Identify the Decisions	The validation SAQP is to ensure remediation has been carried out successfully. To validate the effectiveness of the remediation strategy, visual validation of the removal of smelter wastes is required, as well as chemical validation of soil remaining in the excavation and chemical validation of groundwater. The site will be considered remediated when the remediation and validation program has been carried out successfully. Remediation is deemed to be successful when: • All waste materials have been removed from the Dickson Road site • Chemical data indicates that concentrations of contaminants of concern within the excavation are below the site criteria • Chemical data indicates that concentrations of fluoride within groundwater are reducing to background concentrations
Step 3: Identify Inputs to the Decision	For the Dickson Road site, the following inputs into the decision-making process are required: • A visual evaluation of the removal of all smelter wastes from excavation • Concentrations of contaminants of concern within soil validation samples • Concentrations of fluoride in groundwater
Step 4: Define the Study Boundary	The site boundaries were outlined and defined within the RAP and are presented in **Figure 1, Appendix 1.** Remediation applies to area of the Dickson Road site impacted by buried smelter waste. The temporal boundary comprises the timeframe during which remediation works required by the RAP are completed.

DQO	Outcome
Step 5: Development of Decision Rules	Decision rules for the validation of the remedial works are based around visual validation of the removal of buried smelter wastes and chemical validation of soil and groundwater. The decision rules are as follows: • Can it be visually confirmed that buried smelter wastes have been removed from the Dickson Road site? • If visual validation cannot be confirmed, additional excavation should be completed until the excavation can be validated free of smelter wastes • Can it be confirmed via validation sampling and analysis of soil that contaminated soil has been removed from the excavation? • Can it be confirmed via sampling and analysis of groundwater that fluoride concentrations in groundwater are reducing to background concentrations?
Step 6: Specific Limits of Decision Error	Acceptable limits and the manner of addressing possible decision errors are outlined in the sections below: • The decision to be made is that all smelter wastes have been excavated from the Dickson Road site and that the resultant excavation is within alluvial sand. Possible decision errors include deciding that all buried smelter wastes have been removed when they have not.
Step 7: Optimise the Design for Obtaining Data	The design for obtaining validation data is outlined in **Section 9.2**.

9.2 Design for Obtaining Validation Data

Validation data will confirm that the Dickson Road site is suitable for the current Rural Landscape (RU2) use and proposed General Industrial (IN1) and Rural Landscape (RU2) use. Validation data will include soil, groundwater and surface water data. Validation samples, frequency of collection, the analysis required, and justification presented in **Table 9-2**. Chemical analysis has been limited to those Contaminants of Concern that exceeded the site criteria in the Phase 2 ESA.

Table 9-2: Validation Sampling Program

Validation Method	Validation Requirements	Chemical Analysis
Visual validation of the removal of buried wastes	Excavations are to be photographed and a photographic log maintained and included in the Validation Report.	Not Applicable Contingency: Visual validation of the removal of bonded asbestos will be completed if bonded asbestos is identified
Base of Excavation	Sampling and analysis to demonstrate the removal of contaminated soils. The base of the excavation shall be sampled as follows: Sampling across each area is to be undertaken on 15 m grid spacing. This sampling program is in accordance with NSW EPA (1995) Sampling Design Guidelines.	Fluoride (soluble), PAHs, TRH, BTEX, heavy metals (Cu, Ni, Zn) Contingency: Asbestos analysis will be undertaken if friable asbestos is identified
Walls of Excavation	Sampling and analysis to demonstrate the removal of contaminated soils. The walls of the excavation shall be sampled as follows: One sample for each soil type present within the face of the excavation per 10 lineal metres. This sampling density is considered sufficient to confirm	Fluoride (soluble), PAHs, TRH, BTEX, heavy metals (Cu, Ni, Zn) Contingency: Asbestos analysis will be undertaken if friable asbestos is identified

Validation Method	Validation Requirements	Chemical Analysis
	the absence of a contaminant hot spot greater than 10m in diameter.	
Stockpile Areas	Materials, including waste materials, may be temporarily stockpiled on site prior to relocation to the Smelter Site. Validation of these areas following removal of the materials will be required. Validation will include both visual assessment and chemical evaluation of surface sols. Surface soil sampling across each area is to be undertaken on 15 m grid spacing. This sampling program is in accordance with NSW EPA (1995) Sampling Design Guidelines.	Fluoride (soluble), PAHs, TRH, BTEX, heavy metals (Cu, Ni, Zn)
Groundwater	Two rounds of groundwater sampling in the three onsite wells six months apart following the completion of the excavation works (source removal) to assess if source removal has led to normalisation contaminant concentrations in groundwater.	Fluoride (soluble), PAHs, TRH, BTEX, heavy metals (Ni, Zn), cyanide.
Surface water in Swamp Creek	Two rounds of surface water sampling of Swamp Creek six months apart following the completion of the excavation works (source removal) assess if source removal has led to normalisation of fluoride concentrations in groundwater.	Fluoride (soluble)

Validation sampling requirements include:

- The sampling density is dependent on the homogeneity of the soil material sampled. All surfaces to be validated will be inspected visually before sampling and a determination of variability of the media will be made. Should the visual inspection show significant variability, an increased sampling density will be determined and a justification will be outlined within the Validation Report
- Discrete sampling will be undertaken by collecting surface soil using a steel trowel or collection directly from the soil surface by hand. Discrete samples will be spaced in a 15 m grid formation across the area to ensure that an even coverage of the excavation base is achieved
- Decontamination of sampling equipment will be undertaken before sampling and between samples by cleaning with "Decon 90/Xtran" and potable water
- Disposable gloves will be worn for all sample collection
- All samples will be given a unique identifier, GPS coordinate will be logged and sample locations photographed and marked on a plan

Contingency for validation sampling:

- In the event that visually impacted (including ACM) or odorous soils are excavated as part of the remedial works, validation sampling of the base of the excavation in the vicinity of the visually impacted or odorous soils will be completed
- The analytical suite for the validation samples will vary and will depend on the visual impact or odour. Soils impacted with an oily sheen or hydrocarbon odour will result in validation sampling for hydrocarbons. Discoloured soils will result in validation sampling for a suite of analytes, including heavy metals and cyanide. Material with ACM fragments will result in validation sampling for asbestos (as well as the implementation of the Asbestos Management Protocol in **Section 14.1**)
- In the event that ACM fragments are identified during the excavation works, an asbestos clearance certificate will be required by a suitably qualified and experienced person at the completion of the remedial works

9.3 Data Quality Indicators

DQIs were established to set acceptance limits on field and laboratory data collected as part of the validation sampling. The DQIs are outlined in **Table 9-3**.

Table 9-3 Data Quality Indicators

DQI	Field	Laboratory
Completeness – a measure of the amount of useable data from a data collection activity	Site visits completed during remedial works Photographic log of excavation maintained All required validation soil samples collected Sufficient rounds of groundwater sampling completed to show downward trend in fluoride concentrations Documentation correct.	All critical samples analysed. All analysis completed according to standard operating procedures. Appropriate methods Appropriate Practical Quantitation Limits (PQLs).
Comparability – the confidence that data may be considered to be equivalent for each sampling and analytical event	Same team used for validation sampling Same methodology used for sampling Same types of samples collected using approved sampling methods. Same methodology adopted for completing visual inspection.	Same analytical methods used. Same sample PQLs. Same units.
Representativeness – the confidence that data are representative of each medium present onsite.	Sufficient validation samples collected from the excavation Collection of rinsate blank samples from reusable sampling equipment Collection of trip blank and trip spike	All samples analysed by a NATA accredited laboratory using approved methods. Analysis of method blanks and matrix spikes
Precision – a quantitative measure of the variability of the data.	Collection of intra-laboratory duplicates at a rate of 1 in 10 primary samples	Analysis of field duplicate samples, analysis of laboratory duplicate samples, relative percent difference (RPDs) to be <30%.

DQI	Field	Laboratory
Accuracy – a quantitative measure of the closeness of the reported data to the "true" value.	Sampling methodologies appropriate and complied with for validation sampling Collection of inter-laboratory duplicates at a rate of 1 in 20 primary samples	Analysis of surrogates, laboratory control samples, laboratory duplicate samples and matrix spikes at appropriate frequencies 70-130% recovery for surrogates, laboratory control samples and matrix spikes Relative percent difference (RPDs) to be

9.4 Remediation Acceptance Criteria

Remediation acceptance criteria are presented in **Section 5**.

9.5 Validation Reporting

At the completion of the remediation and validation works, a Validation Report will be prepared in general accordance with the relevant sections of NSW EPA (2020) *Guidelines for Consultants Reporting on Contaminated Sites* and the NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme* 3rd Edition. The Validation Report will include:

- Executive summary
- Scope of work
- Site Description
- Summary of site history and previous investigations
- Remediation activities undertaken, including the extent of the excavation works at the Dickson Road site (survey information) and observations made during excavation works
- Supporting factual evidence of the remediation work including photographic and field records and materials tracking data
- Validation sampling and analysis results
- Quality assurance/ quality control (QA/QC) protocols for field work and laboratory analysis;
- A statement indicating the suitability of the Dickson Road Site for the current and proposed land use described in **Section 2.3**.

10. CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

10.1 Construction Environmental Management Plan

The Remediation Contractor is to prepare a CEMP consistent with the "Guideline for the Preparation of Environmental Management Plans" (NSW Department of Infrastructure, Planning and Natural Resources, 2004). The CEMP is to include the controls presented in **Sections 11.2** to **11.11.**

10.2 Site Access

During remediation works access to the site is to be strictly controlled by the Remediation Contractor. The Remediation Contractor should include signage at the entry to the work area identifying the nature of the works, the contact details and the Remediation Contractor's details.

Only authorized persons who have been inducted into the safety and environmental controls on the site will be permitted to work on the site. Visitors to the site will be accompanied by such inducted personnel.

Vehicle access to the site will be along established tracks where possible.

If the construction of additional access tracks is required, these shall be detailed for approval from the Principal prior to commencement of any construction works.

10.3 Hours of Operation

The Remediation Contractor shall only undertake works associated at the site that may generate an audible noise at the closest residential receptor during the following hours unless under direction from a relevant authority for safety reasons or in the event of an emergency:

1. 7.00 am to 6.00 pm, Monday to Friday
2. 7.00 am to 1:00 pm on Saturdays
3. At no time on Sundays or public holidays

10.4 Air Controls

10.4.1 Dust Control

Dust emissions shall be managed to avoid dust generation that could impact on a sensitive receiver. The CEMP is to identify the dust control measures the contractor will implement to meet this objective.

The following dust control procedures would be implemented:

1. Securely covering all loads entering or exiting the site
2. Use of water carts on unsealed roads, parking and other trafficable areas
3. Control of dust from all stockpiles by water sprays
4. All vehicles to travel on designated access roads
5. Temporarily ceasing an activity that generates dust that could affect a sensitive receiver

10.4.2 Odour

Given the nature and extent of the smelter wastes identified at the site, there is a low potential for odours to be emitted.

Should a complaint be received by the Remediation Contractor regarding odour, the source of the odour is to be located and appropriate control measures identified and implemented.

Control measures could include:

- Use of appropriate covering techniques such as the use of plastic sheeting to cover specific excavation faces or stockpiles

- Use of fine mist sprays
- Any equipment and machinery used on site need to have been maintained in accordance with manufacturers' requirements to minimise exhaust emissions

Records of odours and control measures (if required) shall be kept by the Remediation Contractor.

10.5 Noise Control

The remediation works shall comply with the "Interim Construction Noise Guideline" (DECCW, 2009). This would include remediation works being restricted to the hours described in **Section 10.3**.

The CEMP is to identify the noise control measures the contractor will implement to comply with the guideline. The following noise control measures should be considered:

- Construction vehicles and machinery would be selected with consideration of noise emissions. Equipment should be fitted with appropriate silencers (where applicable) and be maintained in accordance with manufacturer's requirements. Machines found to produce excessive noise compared to typical noise levels should be removed and replaced, or repaired or modified prior to recommencing works.
- Where possible construction vehicles and machinery would be turned off or throttled down when not in use.
- All site staff would be informed of their obligations to minimise potential noise impacts on residents during the site induction and the need to take reasonable and practical measures to minimise noise.

10.6 Erosion and Sediment Control

The CEMP is to include erosion and sediment control measures consistent with *Managing Urban Stormwater: Soils and Construction* (4th Ed) (Landcom, 2004).

The erosion and sediment control plan is to be prepared and implemented for the Dickson Road site works area and the Smelter site stockpile location.

The following erosion and sediment control measures should be considered:

- Installation of silt fences in drainage channels downgradient of the remediation work areas and any stockpile areas.
- Any material which is collected at the silt fences (or other sediment control measures) should be managed with the soil component of the excavated fill material.

Once a week and following rain events the sediment control measures would be inspected and maintained as required.

10.7 Surface Water and Groundwater Control

10.7.1 Surface water

Previous analysis of soils has identified that potential contaminants of concern were generally identified at concentrations below the laboratory detection limits and therefore the generation of dissolved contaminants in surface water runoff is not expected. Surface water controls are required to manage erosion and sediment control (refer to **Section 10.6**), and surface water collected within excavations.

The CEMP is to identify the measures the contractor will implement to manage surface water quality. The following control measures should be considered:

- Erosion and sediment controls outlined in **Section 10.6** are implemented
- Diversion of surface water upgradient of the excavation and stockpile areas from the areas of disturbance
- Stockpile areas are to be on flat land where possible and out of any drainage lines

- Water collected within excavations would drain from the excavation area through sediment controls (as outlined in **Section 10.6**). Where the water is required to be pumped from the excavation it is to be subjected to the sediment controls outlined in **Section 10.6** prior to discharge to the site surface water management system
- The Contractor is to keep themselves informed of weather conditions and the potential for rain events and proactively manage the site

10.7.2 Groundwater

Perched groundwater will be encountered during removal of the waste materials from the Dickson Road site. Groundwater will be drained to a sump within the excavation bund. From here, groundwater can be pumped to the South Surge Dam. Water from the South Surge Dam will discharge to the North Dam and be disposed of via irrigation under the existing Environment Protection Licence.

10.8 Traffic Control

It is envisaged that all haulage routes will be within Hydro property. All haulage routes for trucks transporting soil, materials, equipment or machinery to and from the site shall be selected to meet the following objectives:

- Comply with road traffic rules
- Minimise noise, vibration and odour to adjacent premises
- Maximise travel on state and arterial roads and avoid use of local roads

The CEMP is to include a traffic control plan for the Hart Road site access point as per Cessnock City Council guidelines. The plan should also designate internal material haulage routes.

If the traffic control plan includes the placement of signage or other traffic controls within the Hart Road road reserve, the Contractor is to consult with the Cessnock Council and attain any required approvals or permits prior to placing the signage or controls.

The CEMP should also include the following measures:

- Deliveries of soil, materials, equipment or machinery are to occur during standard construction hours (refer to **Section 10.3**)
- Securely cover all loads to prevent any dust or odour emissions during transportation
- Vehicles are not to track soil, mud or sediment onto the road

10.9 Spill Response

The Contractor is to develop a spill response protocol to be implemented in the event that site activities result in a spill.

Examples where spills could occur are:

- Transport of contaminated material from the site, involving loss of load anywhere including private and public property
- Fuel spill during machinery use or refuelling that occurs anywhere including private or public property

10.10 Hazardous Materials

The CEMP shall include measures for the storage, transport and use of any hazardous materials and dangerous goods during site activities. This will reference the guidance and requirements in the following:

- P*rotection of the Environment Operations Act 1997* and associated regulations
- *Work Health and Safety Act 2011* and the *Work Health and Safety Regulation 2011*

- Australian Standard (AS1216) *Class Labels for Dangerous Goods*
- Australian Standard (AS1940-2004) *The storage and handling of flammable and combustible liquids*
- Australian Standard (AS3833): *The Storage and Handling of mixed classes of dangerous goods in packages and intermediate bulk containers*

Relevant Safe Data Sheets (SDS) for each material, chemical or hazardous substance used at the workplace is to be obtained from the manufacturer or suppliers of those goods prior to its arrival on site. All substances brought on to site must be registered on the SDS Register. This register must be developed and controlled by the site environmental manager who will be responsible for the receipt of such substances / materials in accordance with the *Hazardous Substances Regulation*, the *Dangerous Goods Act* and the *Dangerous Goods Regulations*.

10.11 Waste Materials

Although no asbestos containing materials were identified during investigations at the Dickson Road site, there is potential for asbestos contamination materials, including friable asbestos, to be present at the site.

The Remediation Contractor is to develop and implement an Asbestos Removal Control Plan consistent with the Asbestos Management Protocol included in **Section 13.1**.

10.12 Flora and Fauna

The CEMP is to include procedures for the clearance of vegetation (if required). This should include:

- Strategies for minimising vegetation clearance within the worksite and protection of vegetated areas adjoining the work area
- Weed control measures
- Measures for the management and disposal of cleared vegetation matter
- Stockpiles and other materials are not to be stored below the drip line of any tree

11. HEALTH AND SAFETY

A site-specific health and safety plan detailing procedures and requirements that are to be implemented will need to be developed for the remediation works including as a minimum but not limited to, the requirements described below.

The objectives of the health and safety plan are:

- To apply standard procedures that reduce risks resulting from the works
- To ensure all employees are provided with appropriate training, equipment and support to consistently perform their duties in a safe manner
- To have procedures to protect other site workers and the general public

These objectives will be achieved by:

- Assignment of responsibilities
- An evaluation of hazards
- Establishment of personal protection standards and mandatory safety practices and procedures
- Provision for contingencies that may arise while operations are being conducted at the site

Specifically the Health and Safety plan is to address the following identified hazards:

- The stability of excavations
- The presence of services
- The presence of livestock, wildlife including snakes
- The presence of contaminants as described within this document
- The presence of other site personnel, work and traffic

The Contractors Health and Safety plan is to be compliant with:

- Hydro Aluminium’s Contractor Work Health and Safety Plan Revision 8. This requires the Contractor and all employees and subcontractors to be inducted to the Hydro site and for Hydro work permits to be obtained prior to starting any work
- *Work Health and Safety Act 2011*
- *Work Health and Safety Regulation 2017*
- Applicable state and federal regulations, legislation and codes of practice

12. REMEDIATION SCHEDULE

The final remediation schedule will be coordinated with the Principal, Remediation Contractor and Environmental Consultant. A proposed indicative schedule up to the completion of a draft validation report is outlined below.

Table 13-1: Remediation Schedule

Task	Estimated Duration	Estimated Completion Date
Cessnock City Council Category 2 Notification	30 days	TBA
Contractor Procurement	4 – 6 weeks	TBA
Preliminaries (documentation)	3 weeks	TBA
Site establishment and mobilisation	1 week	TBA
Site works	6 – 8 weeks	TBA
Demobilisation	1 week	TBA
Groundwater sampling following remediation	6 months	TBA
Validation reporting	2 weeks following groundwater sampling	TBA

13. ENVIRONMENTAL CONTROLS CONTINGENCY PLAN

This section of the RAP describes the contingency plans to respond to site incidents that may occur during remedial works and could impact on the surrounding environment and the community.

The environmental controls described in **Section 10** are designed to be sufficiently protective under the normal range of site conditions. The contingencies presented in **Table 13.1** are to be implemented where unexpected site conditions or circumstances arise.

Table 13-1: Environmental Controls Contingency Plan

Contingency Event	Contingency	Responsibility
Discovery of unexpected materials excluding ACM	Contact the Principal's representative, then sort materials to a segregated stockpile and discuss possible disposal options with the Principal or the Principal's representative.	Principal following notification from the Remediation Contractor.
Unexpected discovery of ACM	Stop work and implement the Asbestos Removal Control Plan. Refer to **Section 13.1.**	Remediation Contractor
Receival of a noise complaint	Identify noise source and implement noise control measures	Remediation Contractor
Receival of a dust or odour complaint	Identify odour or dust source and implement control measures	Remediation Contractor
Flooding event/sediment laden discharge	Assess and improve sediment and erosion control measures and stockpile management.	Remediation Contractor

13.1 Asbestos Management Protocol

The purpose of this protocol is to describe:

- The permits and approvals required to be attained prior to the works for the removal and management of potential asbestos containing materials (ACM) if encountered
- The procedures to be implemented in the event that ACM is encountered

13.1.1 Asbestos Related Permits and Approvals

The Remediation Contractor is required to possess a Class A friable asbestos removal license issued by SafeWork NSW or an equivalent asbestos removal license issued in another Australian jurisdiction.

In the event that ACM is encountered, the Remediation Contractor is responsible for notifying SafeWork NSW of the asbestos removal work **five days prior** to the commencement of works to remove ACM. The Notification of Asbestos Removal Work is to address the removal of ACM that may be encountered below the surface.

The Remediation Contractor is required to prepare an Asbestos Removal Control Plan consistent with this Protocol, which is to be amended (as required); in the event that ACM is encountered.

The Remediation Contractor must notify a licensed waste management facility of the requirement to dispose of ACM prior to transporting the material to the facility. The Remediation Contractor would be required to provide the Environmental Consultant with a docket from the facility confirming that the material was appropriately disposed as ACM at the facility and for that docket to be included in the Validation Report.

13.1.2 Management of Unexpected ACM Finds

ACM was not encountered during the previous investigations at the Dickson Road site. However, there is the potential for ACM to be present and uncovered when undertaking earthworks to remove smelter-derived wastes. In the event that ACM is identified, the Principal is to be notified immediately.

The Remediation Contractor is to develop and implement an Asbestos Removal Control Plan consistent with *How to Safely Remove Asbestos: Code of Practice* (WorkCover NSW, 2011) ("the Code"), addressing the following:

- Delineation of and installation of warning signage around the asbestos removal area as appropriate as described in Section 4.2 of the Code
- Provision of the appropriate personal protective equipment to all asbestos removal personnel as described in Section 4.5 of the Code
- Removal and containment of asbestos fragments as described in Section 4.8 of the Code
- Disposal of disposable personal protective equipment in accordance with Section 3.9 of the Code
- Notification of the waste management facility of the requirement to dispose of ACM waste (refer to previous section)
- Transportation of the contained ACM waste to the licensed waste management facility (including defining the route to be travelled by the disposal vehicle), disposal in accordance with facility requirements, and a disposal docket attained and presented to the Contractors Environmental Consultant
- The requirement for a clearance inspection to be undertaken by an appropriate person as described in Section 3.10 of the Code upon completion of the ACM removal
- The procedures to be implemented in the event that unexpected ACM is uncovered

14. REGULATORY COMPLIANCE REQUIREMENTS

Approvals required for the remediation of the Dickson Road site site are outlined in **Table 14-1**.

Table 14-1: Key Relevant Legislation and Regulations

Legislation or Regulation	Relevance
State Environmental Planning Policy 55 – Remediation of Land (SEPP 55)	Under SEPP 55 remediation work are permissible in any zone, regardless of any provision in another environmental planning instrument (such as a local environmental plan). SEPP 55 also establishes: Category 1 remediation works: remediation that required development consent. This includes remediation that is: designated development; likely to have a significant impact on ecological values; deemed as requiring development consent by another SEPP; within a sensitive land zone under a local environmental plan; or not consistent with a contaminated land planning guideline made by the relevant council. Category 2 remediation works: remediation which does not require development consent. This is any remediation that is not deemed category 1 remediation works. The Dickson Road site remediation works are considered to fall under Category 2 and Hydro will notify Cessnock City Council 30 days prior to commencement of remediation works.
Contaminated Land Management Act 1997 (CLM Act)	The objective of the CLM Act is to establish a process for investigating and (where appropriate) remediating land that the EPA considers to be contaminated significantly enough to require regulation. Section 60 of the CLM Act requires landowners to notify the EPA if their activities have resulted in contamination of the land. It was concluded that the Smelter does not warrant regulation under the Act.
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act is the primary legislation for the management and control of pollution of the environment. This includes the licensing of premises that are listed as scheduled premises under Schedule 1 of the POEO Act. The Smelter site storage area is regulated under Environment Protection Licence (EPL) 1548. Activities proposed for the remediation works are consistent with the scheduled activities permitted by the EPL.
Environmental Planning and Assessment Act 1979 (EP&A Act)	EP&A Act and Environmental Planning and Assessment Regulation 2000 (the EP&A Regulation) are the principal pieces of environmental legislation which provide for development planning and control in NSW. The EP&A Act and the EP&A Regulation (and the various environmental planning instruments established under the EP&A Act) describe which activities require development consent, determination by a public authority, or can be undertaken without approval. SEPP 55 is an environmental planning instrument established under the EP&A Act. As noted above the remediation of the site is Category 2

Legislation or Regulation	Relevance
	remediation works under SEPP 55 and therefore do not require development consent.
Cessnock Local Environmental Plan 2011 (Cessnock LEP)	The Cessnock LEP is the key local land use planning document for the Cessnock local government area. Category 2 remediation works are permissible without consent however SEPP55 requires notification to Council, as outlined above.
Local Land Services Act 2013 (LLS Act)	The LLS Act regulates the management of native vegetation in rural zoned lands within specific local government areas, including Cessnock. Native vegetation clearing associated with environmental protection works (such as remediation) and/or associated with an activity that does not require development consent (such as Category 2 remediation works) does not require approval.
National Parks and Wildlife Act 1974 (NPW Act)	Under the NPW Act it is an offence to harm protected fauna. Protected fauna are native fauna species. In the event that a tree is required to be removed the contractor is to avoid harm to native fauna.
Water Act 1912	A groundwater interception licence is required for works that intercept groundwater. However minor temporary dewatering activities that is estimated to be less than three megalitres per year (including both construction dewatering and subsequent managed inflows) will generally not require a licence or approval from the Office of Water. Groundwater is not expected to be intercepted during the works. In the event that it is intercepted, it is likely to require dewatering of less than 3 megalitres per year. Perched water is expected to be intercepted during the works. This perched water is not considered to be groundwater.
Waste Avoidance and Recovery Act 2001 (WARR Act)	The WARR Act establishes a hierarchy of waste management (avoid, recover, dispose) encouraging efficient use of resources and minimising waste. Waste materials generated during remediation of the site would be managed consistent with the principles of the waste management hierarchy referred to in the WARR Act.

15. KEY PERSONNEL

The key stakeholders and their roles and responsibilities are outlined in **Table 15-1**.

Table 15-1: Roles and Responsibilities

Stakeholder	Name and Contact Details	Role/Responsibility
Principal	Hydro Aluminium Kurri Kurri Pty Ltd	Owner of the Smelter site and ultimately responsible for all works on the site. Will engage/contract all other parties.
Remediation Contractor	TBA	Company contracted to undertake remediation works. Will supply all plant and personnel to conduct works as outlined in this RAP and as required under local, state and federal legislation.
Remediation Supervisor or Project Manager	TBA	Responsible Person appointed by Contractor to supervise/coordinate all aspects of remedial works on behalf of the Contractor. Is the primary point of contact for the project.
Environmental Consultant	Ramboll	Appropriately qualified environmental consulting company/person appointed to validate the implementation of the RAP. The Environmental Consultant will supervise the works, conduct validation sampling and undertake all activities necessary to prepare validation report that documents the implementation of the RAP for submission and review by the Principal.
Contaminated Land Auditor	Ross McFarland, AECOM	A Contaminated Land Audit will be prepared for the site in accordance with the *Contaminated Land Management Act 1997*.

16. COMMUNITY RELATIONS PLAN

Keeping the community informed about activities at the Smelter and the future of the Hydro Land has been an integral activity in the development of the future of the Hydro Land.

Hydro has implemented a number of community engagement activities to inform the community about the remediation works and to identify the community's concerns and issues.

Table 16-1 describes the community engagement activities undertaken by Hydro in planning for remedial works at the Hydro Land.

Table 16-1: Hydro Community Engagement Activities

Engagement Format	Detail
Information and Feedback Mechanisms	The following communication methods have been and will continue to be available throughout the remediation works to provide the community with a range of ways to contact the Hydro team, gain access to information and provide comment. Website: http://www.hydro.com/en/Press-room/Kurri-Kurri/Community-input/ Email: community.kurri@hydro.com Phone: 1800 066 243 Mailing Address: PO Box 1, Kurri Kurri NSW 2327 Information about the remediation works continues to be uploaded onto the website to provide the community ready access to information about the proposed works.
Community Reference Group	Hydro established the Community Reference Group in 2014. The group is comprised of local community representatives with the following aims: 1. Create a forum for discussion and exchange of information on topics related to the Project. 2. Assist Hydro to understand the values, aspirations and preferences that the community has for the Smelter Site and identify related local issues that will need to be taken into consideration in the development, environmental assessment and management, construction/demolition and rezoning/divestment phases of the project. 3. Act as a communication link between Hydro, the community and other stakeholders. The first meeting of the Community Reference Group was held in July 2014 and it continues to meet on a bi-monthly basis. Minutes of the Community Reference Group meetings are posted on the Hydro Aluminium Kurri Kurri website.
Community Drop-In Sessions	Community drop in sessions were held on 23 April 2015 (the Project Site), 28 May 2015 (Weston), 2 June 2015 (Gillieston Height) and 10 June 2015 (Kurri Kurri). The drop-in sessions were held to allow interested parties to ask questions about the remediation works and raise any concerns.
Community Information Notices and Fact Sheets	Hydro has developed a number of Community Information Notices and Information Newsletters on the various aspects of the future of the Hydro Land, including the Project. This has included: Information Notices in the Cessnock Advertiser and Maitland Mercury providing information on demolition activities, contamination and remediation, and the future land uses at the Smelter and the Hydro Land. Information Newsletters on these elements were placed on the Hydro Aluminium Kurri Kurri website.
Issues Database	Through the activities described above, Hydro has received a number of community submissions, raising various issues including traffic congestion, recycling of waste materials, flora and fauna and conservation.

17. LONG TERM MANAGEMENT

This RAP has been designed to remove any requirement for long term site management from the Dickson Road site in relation to contamination. Once remediation is complete and the site has been validated as suitable for the proposed land use, no further remediation management is proposed.

Interim management will be required following remediation and prior to development. Interim management will be undertaken in accordance with the site CEMP. Interim management will encompass soil, erosion and measures required to prevent illegal dumping or re-contamination of the land. This will likely involve regular site visits by Hydro personnel, maintenance of perimeter fences and other security measures such as surveillance cameras if required.

Management of stockpiled materials at the Smelter Site stockpile area is required until such time the disposal method is determined and available. For this period the stockpile management will be in accordance with the current Hydro site management practices.

18. REFERENCES

ANZECC & NHMRC (ANZECC 1992) Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites

ENVIRON Australia Pty Ltd (ENVIRON 2012) Phase 2 Environmental Site Assessment, Dickson Road, Loxford, 17 December 2012

Eco Logical Australia (August 2017) Kurri Hydro Aluminium, Buffer Zone Vegetation Health Survey'

ENVIRON Australia Pty Ltd (ENVIRON 2013a) Tier 2 Ecological Risk Assessment, Kurri Kurri Aluminium Smelter, Part of the Kurri Kurri Aluminium Smelter, Hart Road, Loxford, 20 March 2013

ENVIRON Australia Pty Ltd (ENVIRON 2013b) Preliminary Screening Level, Health Risk Assessment for Fluoride and Aluminium, Part of the Kurri Kurri Aluminium Smelter, Hart Road, Loxford, 2 April 2013

ENVIRON Australia Pty Ltd (ENVIRON 2013c) Stage 2 Aquatic Assessment – Ecological Risk Assessment, Kurri Kurri Aluminium Smelter, June 2013

ENVIRON Australia Pty Ltd (ENVIRON 2013d) Phase 1 ESA, Hydro Kurri Kurri Aluminium Smelter, 22 October 2013

Hunter Catchment Management Trust (HCTM 2000) Wallis and Fishery Creeks Total Catchment Management Strategy

NEPC (1999) National Environmental Protection (Assessment of Site Contamination) Amendment Measure (NEPM) 2013

NSW EPA (NSW DEC 2017) Guidelines for the NSW Site Auditor Scheme (Third Edition)

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

NSW DECC (2008) Waste Classification Guidelines

NSW EPA (2020) Guidelines for Consultants Reporting on Contaminated Sites

Ramboll (2020) Phase 2 Environmental Site Assessment, Parcel 16 Former Hydro Aluminium Kurri Kurri Smelter

19. LIMITATIONS

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

A representative program of sampling and laboratory analyses was undertaken as part of this investigation, based on past and present known uses of the site. While every care has been taken, concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. We cannot therefore preclude the presence of materials that may be hazardous.

Site conditions may change over time. This report is based on conditions encountered at the site at the time of the report and Ramboll disclaims responsibility for any changes that may have occurred after this time.

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

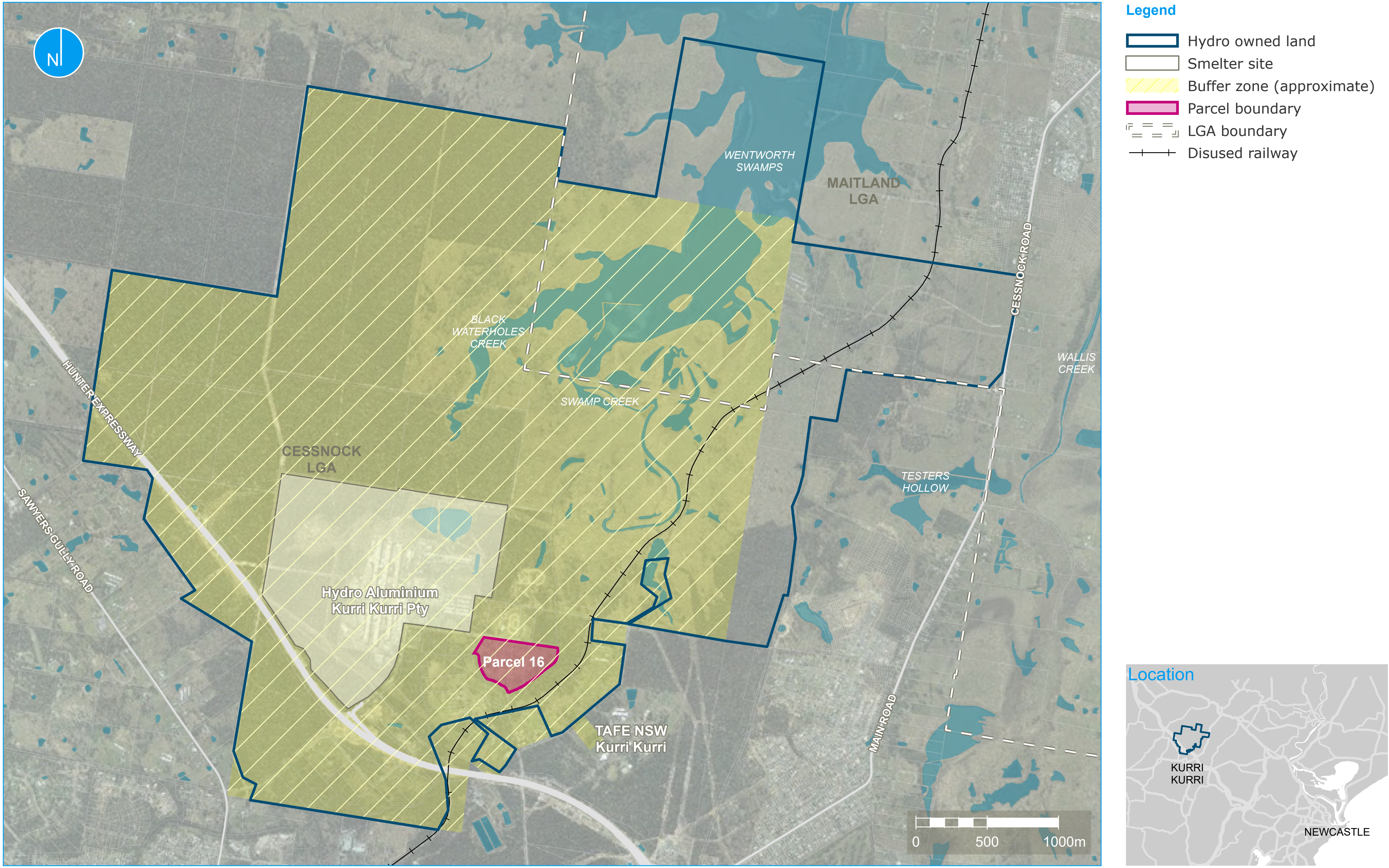
Ramboll did not independently verify all of the written or oral information provided to Ramboll during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided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

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

19.1 User Reliance

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

APPENDIX 1
FIGURES

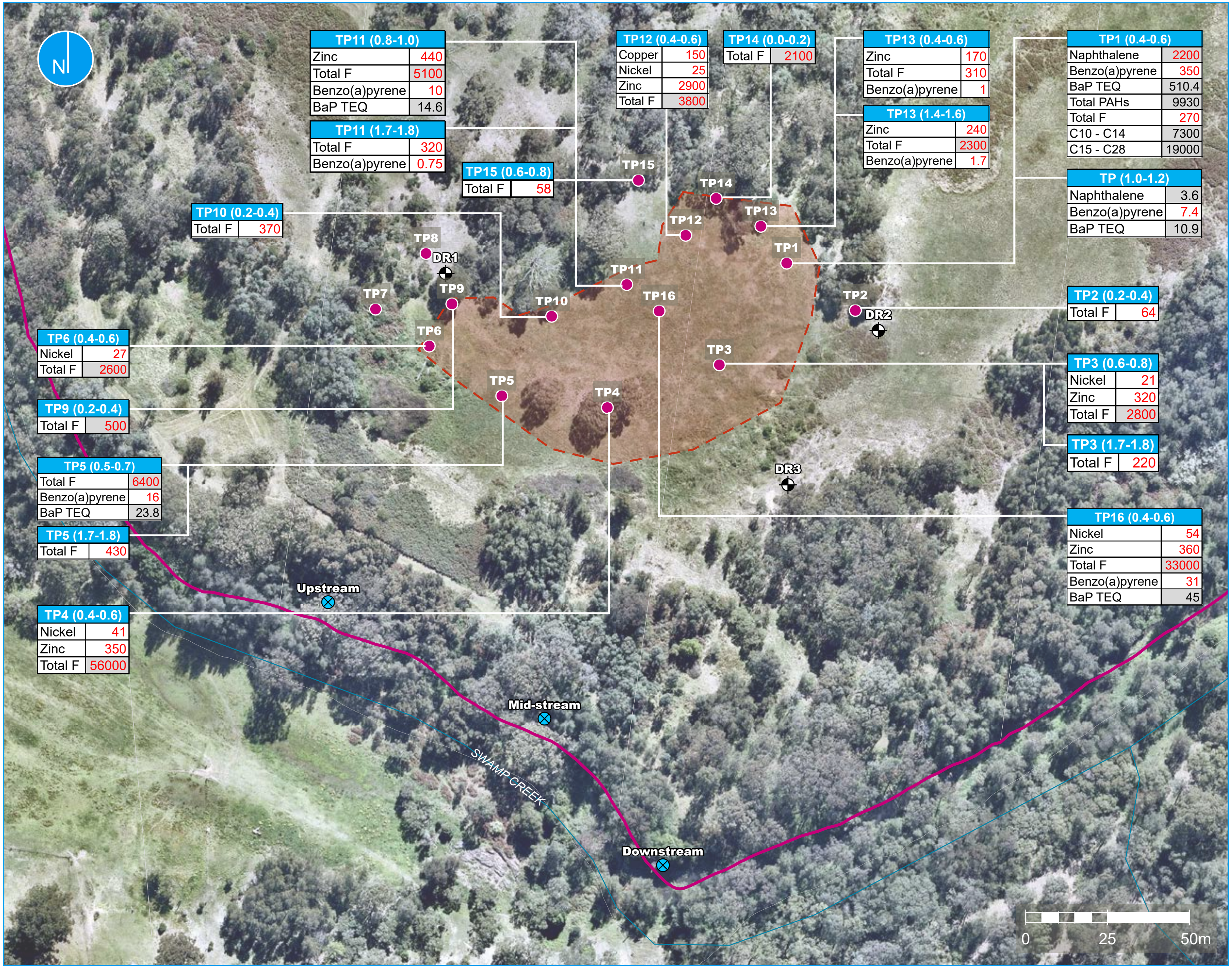


Imagery © Department Finance, Services and Innovation 2020

A4
1:35,000

FIGURE 1 | Site location parcel 16

RAMBOLL AUSTRALIA - GIS MAP file : 318000240_GIS_P002_DicksonRdLandfillRAP | F001_Locality_P16_V01 | 30/01/2020



Aerial photography by Nearmap, flown 18.10.2019

Legend

▭ Parcel boundary
⬚ Extent of waste and extent of remediation required
⌖ Groundwater well
● Test pit
⊗ Surface water

Exceedance criteria

Analyte (mg/kg)	EIL/ESL for Areas of Ecological Significance	HIL/HSL for Residential use	Management Limits
Copper	65 (1)	6000	
Nickel	20 (1)	400	
Zinc	140 (1)	7400	
Total F	4.3 (2)	440 (3)	
Naphthalene	10	3	
Benzo(a)pyrene	0.7		
BaP TEQ		3	
Total PAHs		300	
F2 >C10 - C16	25	110	1000
F3 >C16 – C34	-	-	2500
F4 >C34 – C40	-	-	10000

(1) EILs derived using NEPM (2013) EIL Calculation Spreadsheet and data from all Hydro owned land averaged for CEC (7.2 cmol/kg), soil pH (6.04) and TOC (1.2%)
(2) Background fluoride concentration for Smelter Site and Buffer Zone land
(3) Site-specific residential fluoride criterion calculated in Environ (2013) Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium

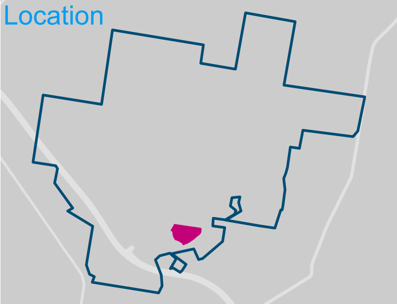


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FIGURE 2 | Extent of buried waste

APPENDIX 2
NEPM EIL CALCULATIONS

HYDRO BUFFER ZONE SOIL SAMPLES

Area	Sample Location	Sample ID	Date Sampled	Soil pH	TOC (%)	Cation Exchange Capacity (meq/100g) or (cmol/kg)
Residential Parcel 1	Residential Parcel 1	Tranche 1	27/08/2013	7.6	-	18
Residential Parcel 1	Residential Parcel 1	Tranche 4	27/08/2013	7.6	-	17
Residential Parcel 1	Residential Parcel 1	Tranche 7	27/08/2013	7.1	-	15
Residential Parcel 1	Residential Parcel 1	Tranche 10	27/08/2013	7.9	-	22
Buffer Zone	Parcel 8	TP2 0.2-0.5	19/03/2014	4.7	0.8	0.7
Buffer Zone	Parcel 4 Lot 422	TP3 0-0.3	17/03/2014	6.1	1.8	5
Buffer Zone	Parcel 4 Lot 420	TP3 0.05-0.25	18/03/2014	8	0.5	5.1
Buffer Zone	Parcel 4 Lot16	TP2 0.1-0.2	18/03/2014	6.8	2.6	14.4
Buffer Zone	Parcel 14	TP2 0.3-0.5	19/03/2014	4.6	0.5	8.1
Buffer Zone	Parcel 15	TP1 0.2-0.5	18/03/2014	5.2	0.5	7.7
Buffer Zone	Parcel 13 Lot 463	TP3 0.3-0.4	21/03/2014	4	2.7	2.4
Buffer Zone	Parcel 13 Lot 459	TP12	1/04/2014	4.9	-	14.7
Buffer Zone	Parcel 9	TP2 0.3-0.5	17/12/2013	6.5	1.7	5.9
Buffer Zone	Parcel 9	TP4 0.5-0.7	17/12/2013	6.6	0.6	3.8
Buffer Zone	Parcel 9	TP4 0.6	17/12/2013	6.4	0.8	4.2
Buffer Zone	Parcel 9	TP5 0.5-0.7	17/12/2013	6	1	5.2
Buffer Zone	Parcel 9	TP6 0.3-0.5	17/12/2013	6.9	<0.5	0.8
Buffer Zone	Parcel 9	TP7 0.4-0.6	17/12/2013	6.8	0.7	6.4
Buffer Zone	Parcel 9	TP7 01.5-1.6	17/12/2013	7.1	<0.5	3.1
Buffer Zone	Parcel 9	TP8 0.4-0.6	17/12/2013	6.7	0.7	3.3
Buffer Zone	Parcel 9	TP9 0.5-0.7	17/12/2013	6.5	<0.5	1.6
Buffer Zone	Parcel 9	TP9 1.4-1.5	17/12/2013	6.4	1	2
Buffer Zone	Parcel 9	TP12 0.5-0.7	17/12/2013	7	1.1	6
Buffer Zone	Parcel 9	TP12 1.4-1.6	17/12/2013	5.7	0.7	1
			AVERAGE	6.04245	1.227273	7.225

Inputs
Select contaminant from list below
Cr_III
Below needed to calculate fresh and aged ACLs
Enter % clay (values from 0 to 100%)
1.2
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
7
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Cr III soil-specific EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	100	70
Urban residential and open public spaces	150	200
Commercial and industrial	210	340

Inputs
Select contaminant from list below
Cu
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
7.2
Enter soil pH (calcium chloride method) (values from 1 to 14)
6.04
Enter organic carbon content (%OC) (values from 0 to 50%)
1.2
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
7
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Cu soil-specific EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	55	65
Urban residential and open public spaces	90	150
Commercial and industrial	130	220

Inputs
Select contaminant from list below
Ni
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
7.2
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
7
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Ni soil-specific EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	30	20
Urban residential and open public spaces	50	80
Commercial and industrial	75	140

Inputs
Select contaminant from list below
Zn
Below needed to calculate fresh and aged ACLs
Enter cation exchange capacity (silver thiourea method) (values from 0 to 100 cmolc/kg dwt)
7.2
Enter soil pH (calcium chloride method) (values from 1 to 14)
6.04
Below needed to calculate fresh and aged ABCs
Measured background concentration (mg/kg). Leave blank if no measured value
or for fresh ABCs only
Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
7
or for aged ABCs only
Enter State (or closest State)
NSW
Enter traffic volume (high or low)
low

Outputs		
Land use	Zn soil-specific EILs (mg contaminant/kg dry soil)	
	Fresh	Aged
National parks and areas of high conservation value	65	140
Urban residential and open public spaces	150	390
Commercial and industrial	220	560

APPENDIX 3
SITE PHOTOGRAPHS

Photograph 1 Test Pit 1, located at the white peg, showing metal pipes and plastic waste. Photograph taken 26 July 2012.	
Photograph 2 Test Pit 4, located on the southern edge, showing bulker bags, bricks and metal. Photograph taken 26 July 2012.	
Photograph 3 Test Pit 11, located on the northern edge, showing metal and wood waste. Photograph taken 26 July 2012.	

Photograph 4

Test Pit 13, located on the northern edge, showing plastic, brick and concrete.

Photograph taken 26 July 2012.

Photograph 5

Test Pit 14, located on the northern edge, showing aluminium, metal and wood waste.

Photograph taken 26 July 2012.

APPENDIX 4
TEST PIT AND BOREHOLE LOGS

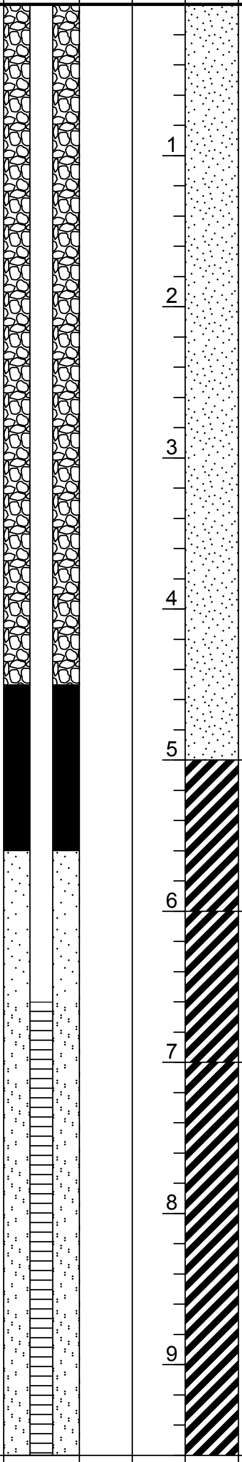
RAMBOLL ENVIRON

BOREHOLE NUMBER DR1

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 16/8/12
COMPLETED 16/8/12
R.L. SURFACE
DATUM
DRILLING CONTRACTOR TerraTest
SLOPE 90°
BEARING ---
EQUIPMENT Solid Auger
HOLE LOCATION Next to TP8
HOLE SIZE
LOGGED BY SC
CHECKED BY KG
NOTES



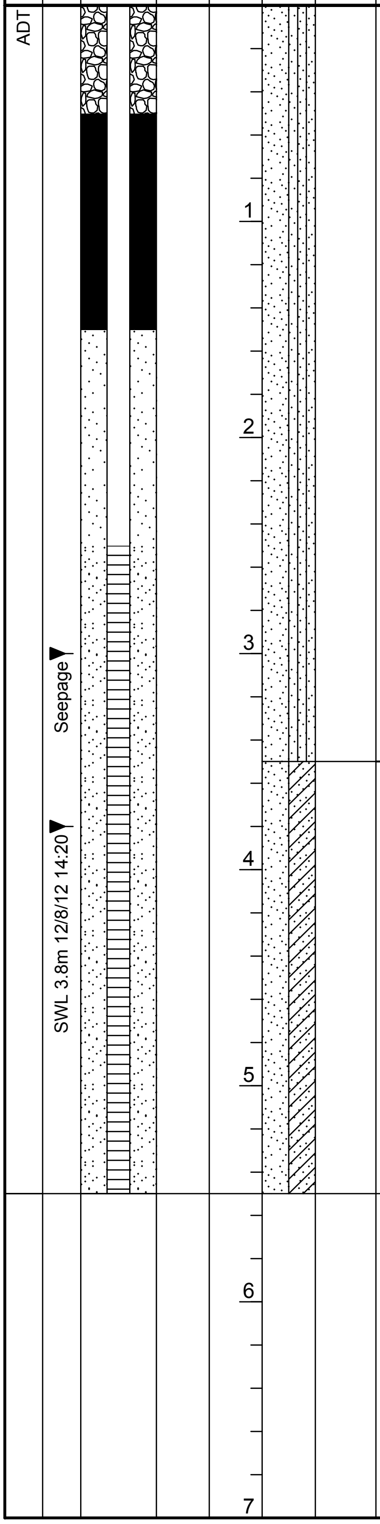
Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
ADT				1 2 3 4 5			SAND; brown, fine to medium grained, moist, bands of light grey and brown. Varying amounts of silt (5 - 12%)		
	SWL 5.71 at 10:00 17/8/12			6			CLAY/Sandy CLAY; red-brown, high plasticity, some fine sand, moist mc>pl		
				7			Becoming black CLAY; high plasticity, moist at approx. 5.8m		
	SWL 7.3 at 15:15 18/8/12			8 9			Becoming wet CLAY		
				10			Borehole DR1 terminated at 9.6m		

BOREHOLE NUMBER DR2

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 16/8/12
COMPLETED 16/8/12
R.L. SURFACE
DATUM
DRILLING CONTRACTOR TerraTest
SLOPE 90°
BEARING ---
EQUIPMENT Solid Auger
HOLE LOCATION Next to TP 2
HOLE SIZE
LOGGED BY SC
CHECKED BY KG
NOTES



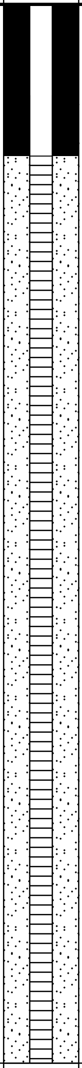
Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
ADT							SAND with some silt, brown, fine grained, moist.		
	Seepage SWL 3.8m 12/8/12 14:20						becoming SAND/Clayey SAND, light brown, medium plasticity fines, moist/wet at 3.5 - 4.0m depth		
							Borehole DR2 terminated at 5.5m		

BOREHOLE NUMBER DR3

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 16/8/12 **COMPLETED** 16/8/12
R.L. SURFACE
DATUM
DRILLING CONTRACTOR TerraTest
SLOPE 90°
BEARING ---
EQUIPMENT Solid Auger
HOLE LOCATION South of TP4 on River terrace
HOLE SIZE
LOGGED BY SC
CHECKED BY KG
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
ADT	SWL at 0.53m 21/08/12 10:10			0,5 1,0 1,5 2,0 2,5 3,0 3,5		OH	Silty SAND; brown to light brown, fine grained, some low plasticity fines, moist. Moist/wet and 0.5m, becoming SAND with some silt. Silt content decreases with depth.		
				4,0 4,5 5,0			Borehole DR3 terminated at 3.5m		

RAMBOLL ENVIRON

BOREHOLE NUMBER Pump

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri

PROJECT NAME Dickson Road

PROJECT NUMBER

PROJECT LOCATION Kurri Kurri

DATE STARTED 16/8/12

COMPLETED 16/8/12

R.L. SURFACE

DATUM

DRILLING CONTRACTOR TerraTest

SLOPE 90°

BEARING ---

EQUIPMENT Solid Auger

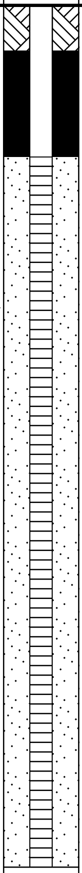
HOLE LOCATION Pump

HOLE SIZE

LOGGED BY SC

CHECKED BY KJG

NOTES



Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
ADT						SPG	FILL; Silty sandy GRAVEL; tan, brick fragments to 150mm, moist		
				0,5		SP-SM	SAND; white/cream, fine, medium grained, trace of carbonaceous material, moist.		
	▼ 22/8/2012			1,0		SP-SM	Becoming SAND/SAND with some SILT; light brown, fine-medium grained, silty fines (non plastic), moist.		
				1,5					
				2,0					
				2,5					
				3,0					
				3,5					
				4,0					
				4,5					
				5,0					

Borehole Pump terminated at 5m

TEST PIT NUMBER TP01

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri

PROJECT NAME Dickson Road

PROJECT NUMBER

PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12 **COMPLETED** 26/7/12

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR

SLOPE ---

BEARING ---

EQUIPMENT Backhoe

TEST PIT LOCATION At White Peg

TEST PIT SIZE

LOGGED BY KJG

CHECKED BY FR

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			0,5 1,0 1,5	▨		FILL; sand, coarse grained, yellow/brown with metal pipe, plastic bags, wood, a shovel, cylinder of unknown material, part of 44 gallon drum, drum of old ramming compound (no longer used) - very odourous and sampled, pitch odour 50% waste/50% soil.		
			2,0			Borehole TP01 terminated at 1.7m		EOH @ 1.7m - Refusal

RAMBOLL ENVIRON

TEST PIT NUMBER TP02

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12 **COMPLETED** 26/7/12
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR
SLOPE ---
BEARING ---
EQUIPMENT Backhoe
TEST PIT LOCATION East of White Peg - bottom of slope
TEST PIT SIZE
LOGGED BY KJG
CHECKED BY FR
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						SAND; fine grained, brown, with some rootlets.		
						SAND; fine grained, yellow		
			0,5					
						Borehole TP02 terminated at 0.9m		EOH @ 0.9m
			1,0					
			1,5					
			2,0					

RAMBOLL ENVIRON

TEST PIT NUMBER TP03

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12
COMPLETED 26/7/12
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR
SLOPE ---
BEARING ---
EQUIPMENT Backhoe
TEST PIT LOCATION Southern edge
TEST PIT SIZE
LOGGED BY KJG
CHECKED BY FR
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			0,5 1,0 1,5	▨		FILL; gravelly clay, low plasticity, brown, with metal pipe, plastic pipe, brick, plastic bags, timber drum, rubber hoses, electrical conduit, wiring, concrete, reo bar, 50% waste, 50% soil.		
				⁘		SAND; yellow, fine grained, wet		
			2,0			Borehole TP03 terminated at 1.8m		EOH @ 1.8m

TEST PIT NUMBER TP04

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12
COMPLETED 26/7/12
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR
SLOPE ---
BEARING ---
EQUIPMENT Backhoe
TEST PIT LOCATION Between trees on Southern edge
TEST PIT SIZE
LOGGED BY KJG
CHECKED BY FR
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				▨		FILL; clay, brown, low plasticity with 2 bulker bags, brick, wood, metal, plastic, tyre, 20-30% waste		
			0,5	▨			DUPA	
			1,0	▨				
			1,5	▨				
				░		SAND; fine grained, yellow		
						Borehole TP04 terminated at 1.8m		EOH @ 1.8m
			2,0					

TEST PIT NUMBER TP05

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12 **COMPLETED** 26/7/12
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR
SLOPE ---
BEARING ---
EQUIPMENT Backhoe
TEST PIT LOCATION Near Southern edge
TEST PIT SIZE
LOGGED BY KJG
CHECKED BY FR
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				▩		FILL; gravelly clay, brown, low plasticity with spent anode, plywood packing case, furnace bricks, concrete, plastic, plastic wrapping, plastic strapping, air hoses, polypipe, crushed 22 gal. tins, timber, slight tar odour, electrical conduit, 60% waste		
			0.5	▩				
			1.0	▩				
			1.5	▩				
				⁘		SAND; brown, fine grained, wet		
						Borehole TP05 terminated at 1.8m		EOH @ 1.8m
			2.0					
			2.5					

TEST PIT NUMBER TP06

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri

PROJECT NAME Dickson Road

PROJECT NUMBER

PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12 **COMPLETED** 26/7/12

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR

SLOPE ---

BEARING ---

EQUIPMENT Backhoe

TEST PIT LOCATION Near South Western edge

TEST PIT SIZE

LOGGED BY KJG

CHECKED BY FR

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				▩		FILL; sand, yellow, fine grained		
			0,5 1,0	▩		FILL; gravelly clayey sand, fine grained, timber, brick, thermos exhaust damper sock, wiring, steel strapping, rubber mud flap, large piece of concrete - unknown size, plastic, 50% waste.		
				⁙		SAND; yellow, fine grained		
			1,5 2,0			Borehole TP06 terminated at 1.3m		

TEST PIT NUMBER TP07

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12
COMPLETED 26/7/12
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR
SLOPE ---
BEARING ---
EQUIPMENT Backhoe
TEST PIT LOCATION Western edge
TEST PIT SIZE
LOGGED BY KJG
CHECKED BY FR
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL; clayey sand, brown, fine grained with some rootlets		
			0,5			SAND; yellow, fine grained		
			1,0					
						Borehole TP07 terminated at 1m		
			1,5					
			2,0					

TEST PIT NUMBER TP08

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri

PROJECT NAME Dickson Road

PROJECT NUMBER

PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12 **COMPLETED** 26/7/12

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR

SLOPE ---

BEARING ---

EQUIPMENT Backhoe

TEST PIT LOCATION Track on Northern side

TEST PIT SIZE

LOGGED BY KJG

CHECKED BY FR

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL; clayey sand, brown, fine grained		
			0,5 1,0			SAND; fine grained, yellow, moist		
			1,5 2,0			Borehole TP08 terminated at 1.1m		

TEST PIT NUMBER TP09

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri

PROJECT NAME Dickson Road

PROJECT NUMBER

PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12 **COMPLETED** 26/7/12

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR

SLOPE ---

BEARING ---

EQUIPMENT Backhoe

TEST PIT LOCATION North of TP6

TEST PIT SIZE

LOGGED BY KJG

CHECKED BY FR

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				▩		FILL?; sand, dark brown, fine grained with 1 large log		
			0,5	⁘		SAND; fine grained, yellow/grey		
			1,0	⁘				
						Borehole TP09 terminated at 1.2m		
			1,5					
			2,0					

TEST PIT NUMBER TP10

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri

PROJECT NAME Dickson Road

PROJECT NUMBER

PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12 **COMPLETED** 26/7/12

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR

SLOPE ---

BEARING ---

EQUIPMENT Backhoe

TEST PIT LOCATION Northern edge

TEST PIT SIZE

LOGGED BY KJG

CHECKED BY FR

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
							DUPB/B1	
			0,5					
			1,0					
				▩		FILL; sand, brown, fine grained with some clay, concrete, timber dunnage, earthware pipe, baghouse sock, 20% waste		
			1,5	⁙		SAND; yellow, fine grained		
						Borehole TP10 terminated at 1.6m		
			2,0					

TEST PIT NUMBER TP11

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12 **COMPLETED** 26/7/12
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR
SLOPE ---
BEARING ---
EQUIPMENT Backhoe
TEST PIT LOCATION Northern edge
TEST PIT SIZE
LOGGED BY KJG
CHECKED BY FR
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				▨		FILL; sand, dark brown, fine grained with some clay/gravel and bricks, hose, strapping, timber, steel shelving, drums, plastic, electric wiring, cable tray, concrete, PVC piping, plastic, 80% waste		
			0,5	▨				
			1,0	▨				
	►			▨				
			1,5	▨				
				⁘		SAND; fine grained, dark brown, wet		
						Borehole TP11 terminated at 1.8m		
			2,0					

RAMBOLL ENVIRON

TEST PIT NUMBER TP12

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12
COMPLETED 26/7/12
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR
SLOPE ---
BEARING ---
EQUIPMENT Backhoe
TEST PIT LOCATION Central Northern portion
TEST PIT SIZE
LOGGED BY KJG
CHECKED BY FR
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				▨		FILL; sand, fine grained, brown with some gravel and 44 gallon drum with shot in it, tyre, kao wool *, tins, concrete bricks, metal pipe, packing paper, 30% waste		
			0,5	▨				
			1,0	▨				* Large piece 60cm x 40cm + smaller pieces
			1,5	⁘		SAND; grey, fine grained		
						Borehole TP12 terminated at 1.5m		
			2,0					

RAMBOLL ENVIRON

TEST PIT NUMBER TP13

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12
COMPLETED 26/7/12
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR
SLOPE ---
BEARING ---
EQUIPMENT Backhoe
TEST PIT LOCATION North Eastern corner
TEST PIT SIZE
LOGGED BY KJG
CHECKED BY FR
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				▨		FILL; sand, dark brown, fine grained with some gravel, concrete blocks, concrete, strapping, electrical conduit, fence posts (steel), wiring, large lumps of steel, plastic, Kao Wool *, carbon fluxing tubes, bricks, timber, 70% waste		* small piece 5cm x 3cm
			0,5	▨			DUP C	
			1,0	▨				
	►			▨				
			1,5	▨				
						Borehole TP13 terminated at 1.6m		EOH @ 1.6 Refusal on Concrete
			2,0					

RAMBOLL ENVIRON

TEST PIT NUMBER TP14

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri

PROJECT NAME Dickson Road

PROJECT NUMBER

PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12

COMPLETED 26/7/12

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR

SLOPE ---

BEARING ---

EQUIPMENT Backhoe

TEST PIT LOCATION Between TP12 and TP13, North

TEST PIT SIZE

LOGGED BY KJG

CHECKED BY FR

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				▩		FILL; sand, dark brown, fine grained with some gravel, plastic, rubber matting, timber, strapping, rubber hose, electrical conduit, bricks, packing foam, bulker bags, aluminium, PVC pipe, steel pipe, carbon, 80% waste		
			0,5	▩				
	▶		1,0	▩				
			1,5	▩				
				▧		Clayey SAND; grey, fine grained, wet.		
						Borehole TP14 terminated at 1.8m		
			2,0					

RAMBOLL ENVIRON

TEST PIT NUMBER TP15

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri
PROJECT NAME Dickson Road
PROJECT NUMBER
PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12 **COMPLETED** 26/7/12
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR
SLOPE ---
BEARING ---
EQUIPMENT Backhoe
TEST PIT LOCATION North of TP14
TEST PIT SIZE
LOGGED BY KJG
CHECKED BY FR
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				▨		SAND; grey, fine grained		
			0,5				DUP D/D1	
			1,0					
						Borehole TP15 terminated at 1m		
			1,5					
			2,0					

RAMBOLL ENVIRON

TEST PIT NUMBER TP16

PAGE 1 OF 1

CLIENT Hydro Aluminium Kurri Kurri

PROJECT NAME Dickson Road

PROJECT NUMBER

PROJECT LOCATION Kurri Kurri

DATE STARTED 26/7/12 **COMPLETED** 26/7/12

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR

SLOPE ---

BEARING ---

EQUIPMENT Backhoe

TEST PIT LOCATION Middle of waste dump

TEST PIT SIZE

LOGGED BY KJG

CHECKED BY FR

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			0,5 1,0	▩		FILL; sand, dark brown, fine grained with some gravel, solinoid, steel pipe, steel strapping, steel casting tools, crop sheet, bulker bags, concrete slab, bricks, plastic, steel flat bar, electrical conduit, perspex, ply packing case, 70% waste.		
			1,5	░		SAND; grey, fine grained, moist		
			2,0			Borehole TP16 terminated at 1.6m		

APPENDIX 5
LABORATORY TABLES

Client: Hydro Aluminium
Job No: AS130419
Project Name: Dickson Road Remedial Action Plan
June 2020

Table 1: Soil Sampling Results

RAMBOLL

Analyte grouping/Analyte	NEPM 2013 HIL A Residential	NEPM 2013 Soil HSLs for Vapour Intrusion HSL A	NEPM 2013 ESLs/ Site Specific EIL for Areas of Ecological Significance	NEPM 2013 Management Limits Residential, Park Land and Open Space	Units	LOR					
Sample type:							**Soil**	**Soil**	**Soil**	**Soil**	**Soil**
Sample ID:							TP1	TP1	TP2	TP3	TP3
Sample depth:							0.4-0.6	1.0-1.2	0.2-0.4	0.6-0.8	1.7-1.8
Sample date:							26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12
Project name:							Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP
Site:							Dickson Road Landfill	Dickson Road Landfill	Dickson Road Landfill	Dickson Road Landfill	Dickson Road Landfill
Sample profile:							FILL	FILL	SAND	FILL	SAND
Sample collected by:							KJG	KJG	KJG	KJG	KJG
Miscellaneous Inorganics											
Moisture					%	0.1	9.7	11	15	14	15
Total Cyanide	240				mg/kg	0.5	5.8	-	<0.5	0.6	<0.5
Total Fluourde	440*		4.3		mg/kg	50	**270**	-	**64**	**2800**	**220**
Soluble Fluourde	440*		4.3		mg/kg	50					
Total Metals											
Aluminium	100,000				mg/kg	1	5800	-	2800	13000	2300
Arsenic	100		100		mg/kg	4	<4	-	<4	4	<4
Cadmium	20				mg/kg	0.5	<0.5	-	<0.5	<0.5	<0.5
Chromium	100		70		mg/kg	1	9	-	5	20	4
Copper	6000		65		mg/kg	1	6	-	<1	19	<1
Lead	300				mg/kg	1	6	-	5	25	4
Mercury	40				mg/kg	0.1	22	-	<0.1	<0.1	<0.1
Nickel	400		20		mg/kg	1	<0.1	-	8	**21**	4
Zinc	7400		140		mg/kg	1	10	-	3	**320**	7
Polynuclear Aromatic Hydrocarbons											
Naphthalene		3	10		mg/kg	<0.1	**2200**	3.6	-	-	-
Acenaphthylene					mg/kg	<0.1	360	1	-	-	-
Acenaphthene					mg/kg	<0.1	84	0.8	-	-	-
Fluorene					mg/kg	<0.1	580	2.9	-	-	-
Phenanthrene					mg/kg	<0.1	1800	13	-	-	-
Anthracene					mg/kg	<0.1	490	2.5	-	-	-
Fluoranthene					mg/kg	<0.1	1300	14	-	-	-
Pyrene					mg/kg	<0.1	1000	12	-	-	-
Benzo(a)anthracene					mg/kg	<0.1	450	6.7	-	-	-
Chrysene					mg/kg	<0.1	360	7.1	-	-	-
Benzo(b+k)fluoranthene					mg/kg	<0.2	560	12	-	-	-
Benzo(a)pyrene			0.7		mg/kg	<0.05	**350**	**7.4**	-	-	-
Indeno(1,2,3-c,d)pyrene					mg/kg	<0.1	180	4.8	-	-	-
Dibenzo(a,h)anthracene					mg/kg	<0.1	36	1	-	-	-
Benzo(g,h,i)perylene					mg/kg	<0.1	180	5	-	-	-
Carcinogenic PAHs (as BaP TEQ)	3				mg/Kg	-	510.4	10.9	-	-	-
Total PAHs	300				mg/Kg	-	9930	93.8	-	-	-
Total Petroleum Hydrocarbons											
C6 - C9 Fraction (NEPM 2013 F1)		45	125	700	mg/kg	25	<25	<25	-	-	-
C10 - C14 Fraction (NEPM 2013 F2)		110	25	1000	mg/kg	50	7300	<50	-	-	-
C15 - C28 Fraction (NEPM 2013 F3)				2500	mg/kg	100	19000	<100	-	-	-
C29 - C36 Fraction (NEPM 2013 F4)				10,000	mg/kg	100	5300	<100	-	-	-

Blank Cell indicates no criterion available

LOR = Limit of Reporting

- means not analysed

National Environment Protection Council (2013) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM).

*Site-specific recreational fluoride value calculated in the Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)

EILs were derived using the NEPM (2013) EIL Calculation Spreadsheet and data from all Hydro owned land averaged for CEC (7.2 cmol/kg), soil pH (6.04) and TOC (1.2%).

Concentration in a grey box exceed the adopted HIL/HSL 'A' for Residential use

Concentration in **red** exceed the adopted Site Specific EIL

CRC Care Technical Report no.10, *Health Screening Levels for petroleum hydrocarbons in soil and groundwater* September 2011

^{B} The most conservative ESL guideline value has been adopted for all analytes

^{C} Management limits are applied after consideration of relevant ESLs and HSLs. Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2.

^{D} Direct Contact are applied to surface soils or soils that could result in immediate contact.

Health Investigation Levels for chromium based on chromium (VI)

TPH analysis was completed in 2012 and fractions do not directly correlate to NEPM 2013 fractions

To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.

To obtain F2 subtract naphthalene from the >C10-C16 fraction.

Where one or more guideline value is exceeded, the highest guidline value will be highlighted

Table 1: Soil Sampling Results

	NEPM 2013 HIL A Residential	NEPM 2013 Soil HSLs for Vapour Intrusion HSL A	NEPM 2013 ESLs/ Site Specific EIL for Areas of Ecological Significance	NEPM 2013 Management Limits Residential, Park Land and Open Space	Soil	Soil	Soil	Soil	Soil	Soil
					TP4	TP5	TP5	TP6	TP9	TP10
					0.4-0.6	0.5-0.7	1.7-1.8	0.4-0.6	0.2-0.4	0.2-0.4
					26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12
					Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP
					Dickson Road Landfill	Dickson Road Landfill	Dickson Road Landfill	Dickson Road Landfill	Dickson Road Landfill	Dickson Road Landfill
					FILL	FILL	SAND	FILL	SAND	FILL
					KJG	KJG	KJG	KJG	KJG	KJG
Analyte grouping/Analyte										
Miscellaneous Inorganics										
Moisture					6.9	15	18	14	10	9.7
Total Cyanide	240				<0.5	3.7	<0.5	5.4	<0.5	<0.5
Total Fluourde	440*		4.3		**56000**	**6400**	**430**	**2600**	**500**	**370**
Soluble Fluourde	440*		4.3							
Total Metals										
Aluminium	100,000				25000	19000	1700	33000	3100	5800
Arsenic	100		100		7	6	<4	11	<4	<4
Cadmium	20				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	100		70		13	20	2	21	5	6
Copper	6000		65		36	17	<1	14	4	5
Lead	300				86	18	2	9	5	7
Mercury	40				<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Nickel	400		20		**41**	16	3	**27**	7	6
Zinc	7400		140		**350**	110	2	49	36	35
Polynuclear Aromatic Hydrocarbons										
Naphthalene		3	10		-	2.6	<0.1	-	-	-
Acenaphthylene					-	0.6	<0.1	-	-	-
Acenaphthene					-	1.3	<0.1	-	-	-
Fluorene					-	2	<0.1	-	-	-
Phenanthrene					-	14	<0.1	-	-	-
Anthracene					-	2.6	<0.1	-	-	-
Fluoranthene					-	22	<0.1	-	-	-
Pyrene					-	20	<0.1	-	-	-
Benzo(a)anthracene					-	13	<0.1	-	-	-
Chrysene					-	14	<0.1	-	-	-
Benzo(b+k)fluoranthene					-	27	<0.2	-	-	-
Benzo(a)pyrene			0.7		-	**16**	<0.05	-	-	-
Indeno(1,2,3-c,d)pyrene					-	11	<0.1	-	-	-
Dibenzo(a,h)anthracene					-	2.4	<0.1	-	-	-
Benzo(g,h,i)perylene					-	11	<0.1	-	-	-
Carcinogenic PAHs (as BaP TEQ)	3				-	23.8	<LOR	-	-	-
Total PAHs	300				-	159.5	<LOR	-	-	-
Total Petroleum Hydrocarbons										
C6 - C9 Fraction (NEPM 2013 F1)		45	125	700	-	<25	<25	-	-	-
C10 - C14 Fraction (NEPM 2013 F2)		110	25	1000	-	<50	<50	-	-	-
C15 - C28 Fraction (NEPM 2013 F3)				2500	-	240	<100	-	-	-
C29 - C36 Fraction (NEPM 2013 F4)				10,000	-	290	<100	-	-	-

Blank Cell indicates no criterion available

LOR = Limit of Reporting

- means not analysed

National Environment Protection Council (2013) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM).

*Site-specific recreational fluoride value calculated in the Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)

EILs were derived using the NEPM (2013) EIL Calculation Spreadsheet and data from all Hydro owned land averaged for CEC (7.2 cmol/kg), soil pH (6.04) and TOC (1.2%

Concentration in a grey box exceed the adopted HIL/HSL 'A' for Residential use

Concentration in **red** exceed the adopted Site Specific EIL

CRC Care Technical Report no.10, *Health Screening Levels for petroleum hydrocarbons in soil and groundwater* September 2011

^{B} The most conservative ESL guideline value has been adopted for all analytes

^{C} Management limits are applied after consideration of relevant ESLs and HSLs. Separate management limits for BTEX and naphthalene are not available hence these shou

^{D} Direct Contact are applied to surface soils or soils that could result in immediate contact.

Health Investigation Levels for chromium based on chromium (VI)

TPH analysis was completed in 2012 and fractions do not directly correlate to NEPM 2013 fractions

To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.

To obtain F2 subtract naphthalene from the >C10-C16 fraction.

Where one or more guideline value is exceeded, the highest guidleline value will be highlighted

Client: Hydro Aluminium
Job No: AS130419
Project Name: Dickson Road Remedial Action Plan
June 2020

Table 1: Soil Sampling Results

	NEPM 2013 HIL A Residential	NEPM 2013 Soil HSLs for Vapour Intrusion HSL A	NEPM 2013 ESLs/ Site Specific EIL for Areas of Ecological Significance	NEPM 2013 Management Limits Residential, Park Land and Open Space	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**
					TP11	TP11	TP12	TP13	TP13	TP14
					0.8-1.0	1.7-1.8	0.4-0.6	0.4-0.6	1.4-1.6	0.0-0.2
					26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12
					Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP
					Dickson Road Landfill	Dickson Road Landfill	Dickson Road Landfill	Dickson Road Landfill	Dickson Road Landfill	Dickson Road Landfill
					FILL	SAND	FILL	FILL	FILL	FILL
					KJG	KJG	KJG	KJG	KJG	KJG
Analyte grouping/Analyte										
Miscellaneous Inorganics										
Moisture					18	16	17	18	26	9.5
Total Cyanide	240				1.2	<0.5	<0.5	<0.5	0.5	<0.5
Total Fluourde	440*		4.3		**5100**	**320**	**3800**	**310**	**2300**	**2100**
Soluble Fluourde	440*		4.3							
Total Metals										
Aluminium	100,000				5800	2400	13000	9400	19000	14000
Arsenic	100		100		<4	<4	21	8	5	4
Cadmium	20				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	100		70		5	2	17	14	20	11
Copper	6000		65		22	3	**150**	12	21	7
Lead	300				39	3	210	14	28	8
Mercury	40				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	400		20		9	4	**25**	12	16	13
Zinc	7400		140		**440**	12	**2900**	**170**	**240**	42
Polynuclear Aromatic Hydrocarbons										
Naphthalene		3	10		2.7	<0.1	-	<0.1	<0.1	-
Acenaphthylene					1.5	<0.1	-	<0.1	<0.1	-
Acenaphthene					0.3	<0.1	-	<0.1	<0.1	-
Fluorene					1.6	<0.1	-	<0.1	<0.1	-
Phenanthrene					8	0.2	-	0.3	0.6	-
Anthracene					2.3	<0.1	-	<0.1	0.1	-
Fluoranthene					18	0.8	-	0.8	1.7	-
Pyrene					16	0.8	-	0.9	1.7	-
Benzo(a)anthracene					8.7	0.6	-	0.8	1.5	-
Chrysene					7.5	0.6	-	0.9	1.9	-
Benzo(b+k)fluoranthene					16	1.2	-	2	3.8	-
Benzo(a)pyrene			0.7		**10**	**0.75**	-	**1**	**1.7**	-
Indeno(1,2,3-c,d)pyrene					6.5	0.4	-	0.7	1.2	-
Dibenzo(a,h)anthracene					1.3	0.1	-	0.2	0.3	-
Benzo(g,h,i)perylene					6.2	0.4	-	0.8	1.3	-
Carcinogenic PAHs (as BaP TEQ)	3				14.6	1.1	-	1.6	2.7	-
Total PAHs	300				106.6	5.9	-	8.4	15.8	-
Total Petroleum Hydrocarbons										
C6 - C9 Fraction (NEPM 2013 F1)		45	125	700	<25	<25	-	<25	<25	-
C10 - C14 Fraction (NEPM 2013 F2)		110	25	1000	<50	<50	-	<50	<50	-
C15 - C28 Fraction (NEPM 2013 F3)				2500	140	<100	-	<100	<100	-
C29 - C36 Fraction (NEPM 2013 F4)				10,000	110	<100	-	<100	<100	-

Blank Cell indicates no criterion available

LOR = Limit of Reporting

- means not analysed

National Environment Protection Council (2013) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM).

*Site-specific recreational fluoride value calculated in the Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)

EILs were derived using the NEPM (2013) EIL Calculation Spreadsheet and data from all Hydro owned land averaged for CEC (7.2 cmol/kg), soil pH (6.04) and TOC (1.2%

Concentration in a grey box exceed the adopted HIL/HSL 'A' for Residential use

Concentration in **red** exceed the adopted Site Specific EIL

CRC Care Technical Report no.10, *Health Screening Levels for petroleum hydrocarbons in soil and groundwater* September 2011

[B] The most conservative ESL guideline value has been adopted for all analytes

[C] Management limits are applied after consideration of relevant ESLs and HSLs. Separate management limits for BTEX and naphthalene are not available hence these shou

[D] Direct Contact are applied to surface soils or soils that could result in immediate contact.

Health Investigation Levels for chromium based on chromium (VI)

TPH analysis was completed in 2012 and fractions do not directly correlate to NEPM 2013 fractions

To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.

To obtain F2 subtract naphthalene from the >C10-C16 fraction.

Where one or more guideline value is exceeded, the highest guidline value will be highlighted

Table 1: Soil Sampling Results

	NEPM 2013 HIL A Residential	NEPM 2013 Soil HSLs for Vapour Intrusion HSL A	NEPM 2013 ESLs/ Site Specific EIL for Areas of Ecological Significance	NEPM 2013 Management Limits Residential, Park Land and Open Space	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**	**Soil**
					TP15	TP16	EMP3-SF1	EMP3-SF2	EMP3-SF3	EMP3-SF4
					0.6-0.8	0.4-0.6	0-0.05	0-0.05	0-0.05	0-0.05
					26/Jul/12	26/Jul/12	30/Oct/13	30/Oct/13	30/Oct/13	30/Oct/13
					Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP
					Dickson Road Landfill	Dickson Road Landfill	Phase 2 ESA	Phase 2 ESA	Phase 2 ESA	Phase 2 ESA
					FILL	FILL	Topsoil	Topsoil	Topsoil	Topsoil
					KJG	KJG	SC	SC	SC	SC
Analyte grouping/Analyte										
Miscellaneous Inorganics										
Moisture					13	8.2	-	-	-	-
Total Cyanide	240				<0.5	1.3	-	-	-	-
Total Fluourde	440*		4.3		**58**	**33000**	-	-	-	-
Soluble Fluourde	440*		4.3				**13**	**7**	**4**	**14**
Total Metals										
Aluminium	100,000				4	35000	-	-	-	-
Arsenic	100		100		<4	10	-	-	-	-
Cadmium	20				<0.5	<0.5	-	-	-	-
Chromium	100		70		<1	32	-	-	-	-
Copper	6000		65		<1	45	-	-	-	-
Lead	300				<1	24	-	-	-	-
Mercury	40				<0.1	0.1	-	-	-	-
Nickel	400		20		2	**54**	-	-	-	-
Zinc	7400		140		1	**360**	-	-	-	-
Polynuclear Aromatic Hydrocarbons										
Naphthalene		3	10		-	0.9	-	-	-	-
Acenaphthylene					-	0.1	-	-	-	-
Acenaphthene					-	1.3	-	-	-	-
Fluorene					-	1.2	-	-	-	-
Phenanthrene					-	13	-	-	-	-
Anthracene					-	2.7	-	-	-	-
Fluoranthene					-	27	-	-	-	-
Pyrene					-	26	-	-	-	-
Benzo(a)anthracene					-	23	-	-	-	-
Chrysene					-	24	-	-	-	-
Benzo(b+k)fluoranthene					-	48	-	-	-	-
Benzo(a)pyrene			0.7		-	**31**	-	-	-	-
Indeno(1,2,3-c,d)pyrene					-	20	-	-	-	-
Dibenzo(a,h)anthracene					-	4.5	-	-	-	-
Benzo(g,h,i)perylene					-	18	-	-	-	-
Carcinogenic PAHs (as BaP TEQ)	3				-	45.0	-	-	-	-
Total PAHs	300				-	240.7	-	-	-	-
Total Petroleum Hydrocarbons										
C6 - C9 Fraction (NEPM 2013 F1)		45	125	700	-	<25	-	-	-	-
C10 - C14 Fraction (NEPM 2013 F2)		110	25	1000	-	<50	-	-	-	-
C15 - C28 Fraction (NEPM 2013 F3)				2500	-	450	-	-	-	-
C29 - C36 Fraction (NEPM 2013 F4)				10,000	-	610	-	-	-	-

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National Environment Protection Council (2013) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM).

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To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.

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Where one or more guideline value is exceeded, the highest guidleline value will be highlighted

	95% Fresh Water Protection for Aquatic Ecosystems [C]	Long-term value in Irrigation Water [G]	Livestock Drinking Water [F]	**Sample type:**		Water	Water	Water	Water	Water	Water
				Sample ID:		DR1	DR2	DR3	Upstream	Midstream	Downstream
				Sample depth:		N/A	N/A	N/A	N/A	N/A	N/A
				Sample date:		28/08/12	28/08/12	28/08/12	28/08/12	28/08/12	28/08/12
				Project Name:		Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP	Dickson Road RAWP
				Sample appearance:		Clear	Clear	Clear	Clear	Clear	Clear
				Sample collected by:		SC	SC	SC	SC	SC	SC
Analyte grouping/Analyte				**Units**	**LOR**						
Miscellaneous Inorganics											
pH				pH Units		5.1	6	6.5	6.2	6.5	6.6
Electrical Conductivity				µS/cm	1	2000	1900	3400	230	260	240
Total Cyanide	7			µg/L	4	<4	<4	61	<4	<4	<4
Total Fluoride		1000	2000	µg/L	100	180	140	10000	2400	3600	2700
Dissolved Metals in Water											
Arsenic	1	100	500	µg/L	1	1	<1	1	-	-	-
Cadmium	0.84	10	10	µg/L	0.1	0.6	<0.1	<0.1	-	-	-
Chromium	1	100	1000	µg/L	1	<1	<1	<1	-	-	-
Copper	5.46	200	1000	µg/L	1	<1	<1	5	-	-	-
Lead	25.84	2000	100	µg/L	1	<1	<1	<1	-	-	-
Mercury	0.06	2	2	µg/L	0.05	<0.05	<0.05	<0.05			
Nickel	42.9	200	1000	µg/L	1	120	9	20	-	-	-
Zinc	31.2	2000	20000	µg/L	1	170	57	18	-	-	-
Total Metals in Water											
Arsenic	1	100	500	µg/L	1	-	-	-	3	12	15
Cadmium	0.84	10	10	µg/L	0.1	-	-	-	<0.1	0.3	0.6
Chromium	1	100	1000	µg/L	1	-	-	-	2	5	4
Copper	5.46	200	1000	µg/L	1	-	-	-	3	10	20
Lead	25.84	2000	100	µg/L	1	-	-	-	4	9	10
Mercury	0.06	2	2	µg/L	0.05	-	-	-	<0.05	0.4	0.2
Nickel	42.9	200	1000	µg/L	1	-	-	-	19	38	67
Zinc	31.2	2000	20000	µg/L	1	-	-	-	74	160	210
Ion Balance											
Calcium - Dissolved				mg/L	0.5	5.6	14	24	-	-	-
Potassium - Dissolved				mg/L	0.5	7.5	5.3	4.9	-	-	-
Sodium - Dissolved				mg/L	0.5	310	320	710	-	-	-
Magnesium - Dissolved				mg/L	0.5	34	15	36	-	-	-
Hydroxide Alkalinity (OH-) as $CaCO_3$				mg/L	5	<5	<5	<5	-	-	-
Bicarbonate Alkalinity as $CaCO_3$				mg/L	5	8	56	530	-	-	-
Carbonate Alkalinity as $CaCO_3$				mg/L	5	<5	<5	<5	-	-	-
Total Alkalinity as $CaCO_3$				mg/L	5	8	56	530	-	-	-
Sulphate, SO4				mg/L	1	120	210	650	-	-	-
Chloride, Cl				mg/L	1	530	400	330	-	-	-
Ionic Balance				%		-2.5	-2.3	2.2	-	-	-
PAHs in Water											
Naphthalene [J]	16			µg/L	1	<1	<1	<1	<1	<1	<1
Acenaphthylene				µg/L	1	<1	<1	<1	<1	<1	<1
Acenaphthene				µg/L	1	<1	<1	<1	<1	<1	<1
Fluorene				µg/L	1	<1	<1	<1	<1	<1	<1
Phenanthrene [K]	*2*			µg/L	1	<1	<1	<1	<1	<1	<1
Anthracene [K]	*0.4*			µg/L	1	<1	<1	<1	<1	<1	<1
Fluoranthene [K]	*1.4*			µg/L	1	<1	<1	<1	<1	<1	<1
Pyrene				µg/L	1	<1	<1	<1	<1	<1	<1
Benzo(a)anthracene				µg/L	1	<1	<1	<1	<1	<1	<1
Chrysene				µg/L	1	<1	<1	<1	<1	<1	<1
Benzo(b+k)fluoranthene				µg/L	2	<2	<2	<2	<2	<2	<2
Benzo(a)pyrene [K]	*0.2*			µg/L	1	<1	<1	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene				µg/L	1	<1	<1	<1	<1	<1	<1
Dibenzo(a,h)anthracene				µg/L	1	<1	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene				µg/L	1	<1	<1	<1	<1	<1	<1
SVOC's in Water											
Phenol	320			µg/L	10	<10	<10	<10	<10	<10	<10
Bis (2-chloroethyl) ether				µg/L	10	<10	<10	<10	<10	<10	<10
2-Chlorophenol [J]	490			µg/L	10	<10	<10	<10	<10	<10	<10
1,3-Dichlorobenzene				µg/L	10	<10	<10	<10	<10	<10	<10
1,4-Dichlorobenzene				µg/L	10	<10	<10	<10	<10	<10	<10
2-Methylphenol				µg/L	10	<10	<10	<10	<10	<10	<10
1,2-Dichlorobenzene				µg/L	10	<10	<10	<10	<10	<10	<10
bis-(2-Chloroisopropyl) ether				µg/L	10	<10	<10	<10	<10	<10	<10
3/4-Methylphenol				µg/L	20	<20	<20	<20	<20	<20	<20
N-nitrosodi-n-propylamine				µg/L	10	<10	<10	<10	<10	<10	<10
Hexachloroethane				µg/L	10	<10	<10	<10	<10	<10	<10
Nitrobenzene				µg/L	10	<10	<10	<10	<10	<10	<10
Isophorone				µg/L	10	<10	<10	<10	<10	<10	<10
2,4-Dimethylphenol	2			µg/L	10	<10	<10	<10	<10	<10	<10
2-Nitrophenol	2			µg/L	10	<10	<10	<10	<10	<10	<10
bis (2-Chloroethoxy) methane				µg/L	10	<10	<10	<10	<10	<10	<10
2,4-Dichlorophenol	160			µg/L	10	<10	<10	<10	<10	<10	<10
1,2,4-Trichlorobenzene				µg/L	10	<10	<10	<10	<10	<10	<10
Naphthalene				µg/L	10	<10	<10	<10	<10	<10	<10
4-Chloroaniline				µg/L	10	<10	<10	<10	<10	<10	<10
Hexachlorobutadiene				µg/L	10	<10	<10	<10	<10	<10	<10
2-Methylnaphthalene				µg/L	10	<10	<10	<10	<10	<10	<10
Hexachlorocyclopentadiene				µg/L	10	<10	<10	<10	<10	<10	<10
2.4.6-Trichlorophenol [J]	20			µg/L	10	<10	<10	<10	<10	<10	<10
2.4.5-Trichlorophenol	0.5			µg/L	10	<10	<10	<10	<10	<10	<10
2-Chloronaphthalene				µg/L	10	<10	<10	<10	<10	<10	<10
2-Nitroaniline				µg/L	10	<10	<10	<10	<10	<10	<10
Dimethyl phthalate				µg/L	10	<10	<10	<10	<10	<10	<10
2,6-Dinitrotoluene				µg/L	10	<10	<10	<10	<10	<10	<10
Acenaphthylene				µg/L	10	<10	<10	<10	<10	<10	<10
3-Nitroaniline				µg/L	10	<10	<10	<10	<10	<10	<10
Acenaphthene				µg/L	10	<10	<10	<10	<10	<10	<10
2,4-Dinitrophenol				µg/L	100	<100	<100	<100	<100	<100	<100
4-Nitrophenol				µg/L	100	<100	<100	<100	<100	<100	<100
Dibenzofuran				µg/L	10	<10	<10	<10	<10	<10	<10
Diethylphthalate				µg/L	10	<10	<10	<10	<10	<10	<10
4-Chlorophenylphenylether				µg/L	10	<10	<10	<10	<10	<10	<10
4-Nitroaniline				µg/L	10	<10	<10	<10	<10	<10	<10
Fluorene				µg/L	10	<10	<10	<10	<10	<10	<10
2-methyl-4,6-dinitrophenol				µg/L	100	<100	<100	<100	<100	<100	<100
Azobenzene				µg/L	10	<10	<10	<10	<10	<10	<10
4-Bromophenylphenylether				µg/L	10	<10	<10	<10	<10	<10	<10
Hexachlorobenzene	*0.1*			µg/L	10	<10	<10	<10	<10	<10	<10
Pentachlorophenol [J]	10			µg/L	100	<100	<100	<100	<100	<100	<100
Phenanthrene				µg/L	10	<10	<10	<10	<10	<10	<10
Anthracene				µg/L	10	<10	<10	<10	<10	<10	<10
Carbazole				µg/L	10	<10	<10	<10	<10	<10	<10
Di-n-butylphthalate				µg/L	10	<10	<10	<10	<10	<10	<10
Fluoranthene				µg/L	10	<10	<10	<10	<10	<10	<10
Pyrene				µg/L	10	<10	<10	<10	<10	<10	<10
Butylbenzylphthalate				µg/L	10	<10	<10	<10	<10	<10	<10
Bis(2-ethylhexyl) phthalate				µg/L	10	<10	<10	<10	<10	<10	<10
Benzo(a)anthracene				µg/L	10	<10	<10	<10	<10	<10	<10
Chrysene				µg/L	10	<10	<10	<10	<10	<10	<10
Di-n-octylphthalate				µg/L	10	<10	<10	<10	<10	<10	<10
Benzo(b)fluoranthene				µg/L	10	<10	<10	<10	<10	<10	<10
Benzo(k)fluoranthene				µg/L	10	<10	<10	<10	<10	<10	<10
Benzo(a)pyrene				µg/L	10	<10	<10	<10	<10	<10	<10
Indeno(1,2,3-c,d)pyrene				µg/L	10	<10	<10	<10	<10	<10	<10
Dibenzo(a,h)anthracene				µg/L	10	<10	<10	<10	<10	<10	<10
Benzo(g,h,i)perylene				µg/L	10	<10	<10	<10	<10	<10	<10
Ethylmethanesulfonate				µg/L	10	<10	<10	<10	<10	<10	<10
Aniline				µg/L	10	<10	<10	<10	<10	<10	<10
Pentachloroethane				µg/L	10	<10	<10	<10	<10	<10	<10
Benzyl alcohol				µg/L	10	<10	<10	<10	<10	<10	<10
Acetophenone				µg/L	10	<10	<10	<10	<10	<10	<10
N-nitrosomorpholine				µg/L	10	<10	<10	<10	<10	<10	<10
N-nitrosopiperidine				µg/L	10	<10	<10	<10	<10	<10	<10
2,6-Dichlorophenol	*34*			µg/L	10	<10	<10	<10	<10	<10	<10
Hexachloropropene-1				µg/L	10	<10	<10	<10	<10	<10	<10
N-nitroso-n-butylamine				µg/L	10	<10	<10	<10	<10	<10	<10
Safrole				µg/L	10	<10	<10	<10	<10	<10	<10
1,2,4,5-Tetrachlorobenzene				µg/L	10	<10	<10	<10	<10	<10	<10
Trans-iso-safrole				µg/L	10	<10	<10	<10	<10	<10	<10
1,3-Dinitrobenzene				µg/L	10	<10	<10	<10	<10	<10	<10
Pentachlorobenzene				µg/L	10	<10	<10	<10	<10	<10	<10
1-Naphthylamine				µg/L	10	<10	<10	<10	<10	<10	<10
2,3,4,6-Tetrachlorophenol				µg/L	10	<10	<10	<10	<10	<10	<10
2-Naphthylamine				µg/L	10	<10	<10	<10	<10	<10	<10
5-Nitro-o-toluidine				µg/L	10	<10	<10	<10	<10	<10	<10
Diphenylamine				µg/L	10	<10	<10	<10	<10	<10	<10
Phenacetin				µg/L	10	<10	<10	<10	<10	<10	<10
Pentachloronitrobenzene				µg/L	10	<10	<10	<10	<10	<10	<10
Dinoseb				µg/L	10	<10	<10	<10	<10	<10	<10
Methapyrilene				µg/L	10	<10	<10	<10	<10	<10	<10
p-Dimethylaminoazobenzene				µg/L	10	<10	<10	<10	<10	<10	<10
2-Acetylaminofluorene				µg/L	10	<10	<10	<10	<10	<10	<10
7,12-Dimethylbenz(a)anthracene				µg/L	10	<10	<10	<10	<10	<10	<10
3-Methylcholanthrene				µg/L	10	<10	<10	<10	<10	<10	<10
a-BHC				µg/L	10	<10	<10	<10	<10	<10	<10
b-BHC				µg/L	10	<10	<10	<10	<10	<10	<10
g-BHC				µg/L	10	<10	<10	<10	<10	<10	<10
d-BHC				µg/L	10	<10	<10	<10	<10	<10	<10
Heptachlor	0.09			µg/L	10	<10	<10	<10	<10	<10	<10
Aldrin	*0.001*			µg/L	10	<10	<10	<10	<10	<10	<10
Heptachlor Epoxide				µg/L	10	<10	<10	<10	<10	<10	<10
g-Chlordane				µg/L	10	<10	<10	<10	<10	<10	<10
a-Chlordane				µg/L	10	<10	<10	<10	<10	<10	<10
Endosulfan I				µg/L	10	<10	<10	<10	<10	<10	<10
p,p'-DDE				µg/L	10	<10	<10	<10	<10	<10	<10
Dieldrin				µg/L	10	<10	<10	<10	<10	<10	<10
Endrin	0.02			µg/L	10	<10	<10	<10	<10	<10	<10
p,p'-DDD				µg/L	10	<10	<10	<10	<10	<10	<10
Endosulfan II				µg/L	10	<10	<10	<10	<10	<10	<10
Endrin Aldehyde				µg/L	10	<10	<10	<10	<10	<10	<10
p,p'-DDT				µg/L	10	<10	<10	<10	<10	<10	<10
Endosulfan Sulphate	0.2			µg/L	10	<10	<10	<10	<10	<10	<10

Blank Cell indicates no criterion available

All results are in µg/L unless stated

LOR = Limit of Reporting

Concentrations below the LOR noted as <value

Concentration in a grey box exceed the adopted criteria for 95% Fresh Water Protection for Aquatic Ecosystems

Concentration in **red** exceed the adopted criteria for Long-term value in Irrigation Water

Concentrations in a box exceed the adopted criteria for Livestock Drinking Water

[A] National Environment Protection Council (2013) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM) Health Screening Levels for Groundwater.

[B] National Environment Protection Council (2013) National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (NEPM) Groundwater Investigation Levels for Fresh and Marine Water Quality. Investigation levels apply to typical slightly-moderately disturbed systems. See ANZECC & ARMCANZ

[C] Australia and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

[D] National Health and Medical Research Council, National Resource Management Ministerial Council (2011) Australian Drinking Water Guidelines, updated November 2016.

[E] National Health and Medical Research Council (2008) Guidelines for Managing Risks in Recreational Water

[F] Recommended water quality trigger values (low risk) for heavy metals and metalloids in livestock drinking water. Higher concentrations may be tolerated in some situations (details provided in ANZECC Volume 3, Section 9.3.5)

[G] The long-term trigger value (LTV) is the maximum concentration (mg/L) of contaminant in the irrigation water which can be tolerated assuming 100 years of irrigation, based on the irrigation loading assumptions described in ANZECC Volume 3, Section 9.2.5. The short-term trigger value (STV) is the maximum concentration (mg/L) of

[H] USEPA RSL residential tap water value (updated June 2017), non-carcinogenic value adjusted for incidental ingestion of groundwater by applying a x10 factor (NHMRC 2008)

[I] WHO (2008) Drinking Water Guidelines for Total Petroleum Hydrocarbons - aromatic C8-C35 value, adjusted for incidental ingestion of groundwater by x10 factor (NHMRC, 2008)

[J] Figure may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance.

[K] Chemical for which possible bioaccumulation and secondary poisoning effects should be considered, refer to ANZECC & ARMCANZ (2000) for further guidance.

[L] ANZECC endosulfan guideline value was compared to endosulfan sulfate listed in the table.

[M] PFAS National Environmental Management Plan collaborative from the Heads of EPAs Australia and New Zealand (HEPA) and Australian Government Department of the Environment and Energy, October 2016. Ecological screening criteria supported by OEH Contaminants and Risk, Environment Protection Science Branch (as of 20/04/

[N] PFAS National Environmental Management Plan collaborative from the Heads of EPAs Australia and New Zealand (HEPA) and Australian Government Department of the Environment and Energy, October 2016. Department of Health (2017) derived guidance values for drinking water and recreational water using Food Standards Austral

[O] For soil texture classification undertaken in accord with AS 1726, the classifications of sand, silt and clay may be applied as coarse, fine with liquid limit <50% and fine with liquid limit>50% respectively, as the underlying properties to develop the HSLs may reasonably be selected to be similar. Where there is uncertainty, either a cons

* USEPA RSL residential tap water value (updated June 2017), adjusted for a cancer risk level of 1:100,000 and adjusted for incidental ingestion of groundwater by applying a x10 factor (NHMRC 2008)

Guideline values exist for both meta-xylene and para-xylene as per ANZECC (2000). The guideline value for meta- & para-Xylene guideline has been adopted as the meta-Xylene value from ANZECC (2000) as it is the most conservative of the two guideline values.

Chlordane guideline value was comapred to Total Chlordane listed in the table

Guidelines in *italics* are low level reliability guidelines

Underlined indicates freshwater value adopted for marine value in accordance with ANZECC (2000).

Bold indicates the 99% protection level should be adopted for slightly-moderately disturbed ecosystems protection level due to potential for bio-accumulation or acute toxicity to particular species

Arsenic guideline based on As (V) for fresh, the lowest of presented guidelines for ANZECC.

NHMRC arsenic guidelines are based on total arsenic

ANZECC, NEPM and NHMRC guidelines for chromium are based on Cr (VI)

ANZECC, NEPM and NHMRC guidelines for mercury are based on total mercury.

NEPM GIL and NHMRC guidelines for endosulfan sulfate are based on endosulfan

Client: Hydro Aluminium
Job No: AS130419
Project Name: Remedial Action Plan
18/06/2020

Table 3: Soil QA Results

	Sample Type:		**Soil**	**Soil**	RPD %	**Soil**	**Soil**	RPD %	**Soil**	**Soil**	RPD %
	Sample ID:		TP10	DUP B		TP10	DUP B1		TP13	DUP C	
	Sample depth:		0.2-0.4			0.2-0.4			0.4-0.6		
	Duplicate type:		Intra-laboratory			Inter-laboratory			Intra-laboratory		
	Sample profile:		FILL			FILL			FILL		
	Sample collected by:		KJG			KJG			KJG		
Analyte grouping/Analyte	**Units**	**LOR**									
Moisture	%	0.1	9.7	12	21.2	9.7	11.4	16.1	18	18	0.0
Total Cyanide	mg/kg	0.5	<0.5	<0.5	*nc*	<0.5	<1	*nc*	<0.5	0.6	*nc*
Total Fluourde	mg/kg	50	370	780	71.3	370	640	53.5	310	1600	135.1
Total Metals											
Aluminium	mg/kg	1	5800	7500	*25.6*	5800	5040	*14.0*	9400	9100	*3.2*
Arsenic	mg/kg	4	<4	<4	*nc*	<4	<5	*nc*	8	5	*46.2*
Cadmium	mg/kg	0.5	<0.5	<0.5	*nc*	<0.5	<1	*nc*	<0.5	<0.5	*nc*
Chromium	mg/kg	1	6	7	*15.4*	6	4	*40.0*	14	11	*24.0*
Copper	mg/kg	1	5	6	*18.2*	5	7	*33.3*	12	17	*34.5*
Lead	mg/kg	1	7	9	*25.0*	7	7	*0.0*	12	8	*40.0*
Mercury	mg/kg	0.1	<0.1	<0.1	*nc*	<0.1	<0.1	*nc*	<0.1	<0.1	*nc*
Nickel	mg/kg	1	6	7	*15.4*	6	6	*0.0*	14	11	*24.0*
Zinc	mg/kg	1	35	39	*10.8*	35	33	*5.9*	170	75	*77.6*
Polynuclear Aromatic Hydrocarbons											
Naphthalene	mg/kg	0.1	-	-	-	-	-	-	<0.1	2.1	*nc*
Acenaphthylene	mg/kg	0.1	-	-	-	-	-	-	<0.1	0.1	*nc*
Acenaphthene	mg/kg	0.1	-	-	-	-	-	-	<0.1	0.6	*nc*
Fluorene	mg/kg	0.1	-	-	-	-	-	-	<0.1	1.9	*nc*
Phenanthrene	mg/kg	0.1	-	-	-	-	-	-	0.3	11.0	*189.4*
Anthracene	mg/kg	0.1	-	-	-	-	-	-	<0.1	1.8	*nc*
Fluoranthene	mg/kg	0.1	-	-	-	-	-	-	0.8	11.0	*172.9*
Pyrene	mg/kg	0.1	-	-	-	-	-	-	0.9	8.9	*163.3*
Benzo(a)anthracene	mg/kg	0.1	-	-	-	-	-	-	0.8	4.8	*142.9*
Chrysene	mg/kg	0.1	-	-	-	-	-	-	0.9	4.6	*134.5*
Benzo(b+k)fluoranthene	mg/kg	0.2	-	-	-	-	-	-	2	7.8	*118.4*
Benzo(a)pyrene	mg/kg	0.05	-	-	-	-	-	-	1	4.5	*127.3*
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	-	-	-	-	-	-	0.7	2.7	*117.6*
Dibenzo(a,h)anthracene	mg/kg	0.1	-	-	-	-	-	-	0.2	0.6	*100.0*
Benzo(g,h,i)perylene	mg/kg	0.1	-	-	-	-	-	-	0.8	2.6	*105.9*

Note all units in mg/kg
<value = Less than the laboratory Limit of Reporting (LOR)
nc = not calculated as one or more results are below the LOR.
Shaded cells exceed RPD >30%

Client: Hydro Aluminium
Job No: AS130419
Project Name: Remedial Action Plan
18/06/2020

Table 4: Groundwater QA Results

RAMBOLL

	Sample type:		Water	Water	RPD %
	Sample ID:		DR2	QC01	
	Sample depth:		N/A	N/A	
	Sample date:		28/08/12	28/08/12	
	Project Name:		Dickson Road RAWP	Dickson Road RAWP	
	Sample appearance:		Clear	Clear	
	Sample collected by:		SC	SC	
Guidelines	**Duplicate type:**		Intra-laboratory		
Analyte grouping/Analyte	**Units**	**LOR**			
Miscellaneous Inorganics					
pH	pH Units		6	6	*0.0*
Electrical Conductivity	µS/cm	1	1900	1900	*0.0*
Total Cyanide	µg/L	4	<4	<4	*nc*
Total Fluoride	µg/L	100	140	150	6.9
Dissolved Metals in Water					
Arsenic	µg/L	1	<1	<1	*nc*
Cadmium	µg/L	0.1	<0.1	<0.1	*nc*
Chromium	µg/L	1	<1	<1	*nc*
Copper	µg/L	1	<1	<1	*nc*
Lead	µg/L	1	<1	<1	*nc*
Mercury	µg/L	0.05	<0.05	<0.05	*nc*
Nickel	µg/L	1	9	9	0.0
Zinc	µg/L	1	57	44	25.7
PAHs in Water					
Naphthalene	µg/L	1	<1	<1	*nc*
Acenaphthylene	µg/L	1	<1	<1	*nc*
Acenaphthene	µg/L	1	<1	<1	*nc*
Fluorene	µg/L	1	<1	<1	*nc*
Phenanthrene	µg/L	1	<1	<1	*nc*
Anthracene	µg/L	1	<1	<1	*nc*
Fluoranthene	µg/L	1	<1	<1	*nc*
Pyrene	µg/L	1	<1	<1	*nc*
Benzo(a)anthracene	µg/L	1	<1	<1	*nc*
Chrysene	µg/L	1	<1	<1	*nc*
Benzo(b+k)fluoranthene	µg/L	2	<2	<2	*nc*
Benzo(a)pyrene	µg/L	1	<1	<1	*nc*
Indeno(1,2,3-c,d)pyrene	µg/L	1	<1	<1	*nc*
Dibenzo(a,h)anthracene	µg/L	1	<1	<1	*nc*
Benzo(g,h,i)perylene	µg/L	1	<1	<1	*nc*
SVOC's in Water					
Phenol	µg/L	10	<10	<10	*nc*
Bis (2-chloroethyl) ether	µg/L	10	<10	<10	*nc*
2-Chlorophenol	µg/L	10	<10	<10	*nc*
1,3-Dichlorobenzene	µg/L	10	<10	<10	*nc*
1,4-Dichlorobenzene	µg/L	10	<10	<10	*nc*
2-Methylphenol	µg/L	10	<10	<10	*nc*
1,2-Dichlorobenzene	µg/L	10	<10	<10	*nc*
bis-(2-Chloroisopropyl) ether	µg/L	10	<10	<10	*nc*
3/4-Methylphenol	µg/L	20	<20	<20	*nc*
N-nitrosodi-n-propylamine	µg/L	10	<10	<10	*nc*
Hexachloroethane	µg/L	10	<10	<10	*nc*
Nitrobenzene	µg/L	10	<10	<10	*nc*
Isophorone	µg/L	10	<10	<10	*nc*
2,4-Dimethylphenol	µg/L	10	<10	<10	*nc*
2-Nitrophenol	µg/L	10	<10	<10	*nc*
bis (2-Chloroethoxy) methane	µg/L	10	<10	<10	*nc*
2,4-Dichlorophenol	µg/L	10	<10	<10	*nc*
1,2,4-Trichlorobenzene	µg/L	10	<10	<10	*nc*
Naphthalene	µg/L	10	<10	<10	*nc*
4-Chloroaniline	µg/L	10	<10	<10	*nc*
Hexachlorobutadiene	µg/L	10	<10	<10	*nc*
2-Methylnaphthalene	µg/L	10	<10	<10	*nc*
Hexachlorocyclopentadiene	µg/L	10	<10	<10	*nc*
2,4,6-Trichlorophenol	µg/L	10	<10	<10	*nc*
2,4,5-Trichlorophenol	µg/L	10	<10	<10	*nc*
2-Chloronaphthalene	µg/L	10	<10	<10	*nc*
2-Nitroaniline	µg/L	10	<10	<10	*nc*
Dimethyl phthalate	µg/L	10	<10	<10	*nc*
2,6-Dinitrotoluene	µg/L	10	<10	<10	*nc*
Acenaphthylene	µg/L	10	<10	<10	*nc*
3-Nitroaniline	µg/L	10	<10	<10	*nc*
Acenaphthene	µg/L	10	<10	<10	*nc*
2,4-Dinitrophenol	µg/L	100	<100	<100	*nc*
4-Nitrophenol	µg/L	100	<100	<100	*nc*
Dibenzofuran	µg/L	10	<10	<10	*nc*
Diethylphthalate	µg/L	10	<10	<10	*nc*
4-Chlorophenylphenylether	µg/L	10	<10	<10	*nc*
4-Nitroaniline	µg/L	10	<10	<10	*nc*
Fluorene	µg/L	10	<10	<10	*nc*
2-methyl-4,6-dinitrophenol	µg/L	100	<100	<100	*nc*
Azobenzene	µg/L	10	<10	<10	*nc*
4-Bromophenylphenylether	µg/L	10	<10	<10	*nc*
Hexachlorobenzene	µg/L	10	<10	<10	*nc*
Pentachlorophenol	µg/L	100	<100	<100	*nc*
Phenanthrene	µg/L	10	<10	<10	*nc*
Anthracene	µg/L	10	<10	<10	*nc*
Carbazole	µg/L	10	<10	<10	*nc*
Di-n-butylphthalate	µg/L	10	<10	<10	*nc*
Fluoranthene	µg/L	10	<10	<10	*nc*
Pyrene	µg/L	10	<10	<10	*nc*
Butylbenzylphthalate	µg/L	10	<10	<10	*nc*
Bis(2-ethylhexyl) phthalate	µg/L	10	<10	<10	*nc*
Benzo(a)anthracene	µg/L	10	<10	<10	*nc*
Chrysene	µg/L	10	<10	<10	*nc*
Di-n-octylphthalate	µg/L	10	<10	<10	*nc*
Benzo(b)fluoranthene	µg/L	10	<10	<10	*nc*
Benzo(k)fluoranthene	µg/L	10	<10	<10	*nc*
Benzo(a)pyrene	µg/L	10	<10	<10	*nc*
Indeno(1,2,3-c,d)pyrene	µg/L	10	<10	<10	*nc*
Dibenzo(a,h)anthracene	µg/L	10	<10	<10	*nc*
Benzo(g,h,i)perylene	µg/L	10	<10	<10	*nc*
Ethylmethanesulfonate	µg/L	10	<10	<10	*nc*
Aniline	µg/L	10	<10	<10	*nc*
Pentachloroethane	µg/L	10	<10	<10	*nc*
Benzyl alcohol	µg/L	10	<10	<10	*nc*
Acetophenone	µg/L	10	<10	<10	*nc*
N-nitrosomorpholine	µg/L	10	<10	<10	*nc*
N-nitrosopiperidine	µg/L	10	<10	<10	*nc*
2,6-Dichlorophenol	µg/L	10	<10	<10	*nc*
Hexachloropropene-1	µg/L	10	<10	<10	*nc*
N-nitroso-n-butylamine	µg/L	10	<10	<10	*nc*
Safrole	µg/L	10	<10	<10	*nc*
1,2,4,5-Tetrachlorobenzene	µg/L	10	<10	<10	*nc*
Trans-iso-safrole	µg/L	10	<10	<10	*nc*
1,3-Dinitrobenzene	µg/L	10	<10	<10	*nc*
Pentachlorobenzene	µg/L	10	<10	<10	*nc*
1-Naphthylamine	µg/L	10	<10	<10	*nc*
2,3,4,6-Tetrachlorophenol	µg/L	10	<10	<10	*nc*
2-Naphthylamine	µg/L	10	<10	<10	*nc*
5-Nitro-o-toluidine	µg/L	10	<10	<10	*nc*
Diphenylamine	µg/L	10	<10	<10	*nc*
Phenacetin	µg/L	10	<10	<10	*nc*
Pentachloronitrobenzene	µg/L	10	<10	<10	*nc*
Dinoseb	µg/L	10	<10	<10	*nc*
Methapyrilene	µg/L	10	<10	<10	*nc*
p-Dimethylaminoazobenzene	µg/L	10	<10	<10	*nc*
2-Acetylaminofluorene	µg/L	10	<10	<10	*nc*
7,12-Dimethylbenz(a)anthracene	µg/L	10	<10	<10	*nc*
3-Methylcholanthrene	µg/L	10	<10	<10	*nc*
a-BHC	µg/L	10	<10	<10	*nc*
b-BHC	µg/L	10	<10	<10	*nc*
g-BHC	µg/L	10	<10	<10	*nc*
d-BHC	µg/L	10	<10	<10	*nc*
Heptachlor	µg/L	10	<10	<10	*nc*
Aldrin	µg/L	10	<10	<10	*nc*
Heptachlor Epoxide	µg/L	10	<10	<10	*nc*
g-Chlordane	µg/L	10	<10	<10	*nc*
a-Chlordane	µg/L	10	<10	<10	*nc*
Endosulfan I	µg/L	10	<10	<10	*nc*
p,p'-DDE	µg/L	10	<10	<10	*nc*
Dieldrin	µg/L	10	<10	<10	*nc*
Endrin	µg/L	10	<10	<10	*nc*
p,p'-DDD	µg/L	10	<10	<10	*nc*
Endosulfan II	µg/L	10	<10	<10	*nc*
Endrin Aldehyde	µg/L	10	<10	<10	*nc*
p,p'-DDT	µg/L	10	<10	<10	*nc*
Endosulfan Sulphate	µg/L	10	<10	<10	*nc*

Note all units in mg/kg
<value = Less than the laboratory Limit of Reporting (LOR)
nc = not calculated as one or more results are below the LOR.
Shaded cells exceed RPD >30%

APPENDIX 6
LABORATORY REPORTS

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: ENVIRON
Contact person: KIRSTY GREENFIELD
Project Mgr:
Sampler:
Address:

Phone:
Fax:
Email:

Client Project Name / Number / Site etc (ie report title): AS130309C DICKSON RD
PO No.:
Envirolab Quote No. :
Date results required:

Or choose: [✓ standard] / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharge applies
Lab comments:

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: Shuk Li

Sample information				Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Date sampled	Type of sample	ALUMINIUM	FLUORIDE	CYANIDE	PAH	TPH	HEAVY METALS 8									HOLD	Provide as much information about the sample as you can
1	TP1:0·4–0·6	26/7/12	SOIL	X	X	X	X	X	X										
2	TP1:1·0–1·2						X	X											
3	TP2: 0·2–0·4			X	X	X			X										76609
4	TP2: 0·8–0·9																	X	
5	TP3: 0·6–0·8			X	X	X			X										received
6	TP3:1·7–1·8			X	X	X			X										27/7/12
7	TP4:0·4–0·6			X	X	X			X										
8	TP4:1·7–1·8																	X	
9	TP5: 0·5–0·7			X	X	X	X	X	X										
10	TP5:1·7–1·8			X	X	X	X	X	X										
11	TP6: 0·4–0·6			X	X	X			X										
12	TP6: 1·2–1·3																	X	
13	TP7: 0·8–1·0	↓	↓															X	

Relinquished by (company):
Print Name:
Date & Time:
Signature:

Received by (company): ELS
Print Name: SS
Date & Time: 31/7
Signature:

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

Form: 302 - Chain of Custody-Client, Issued 16/03/10, Version 4, Page 1 of 1.

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: ENVIRON
Contact person: KIRSTY GREENFIELD
Project Mgr:
Sampler:
Address:

Phone:
Fax:
Email:

Client Project Name / Number / Site etc (ie report title): AS130309C DICKSON ROAD
PO No.:
Envirolab Quote No. :
Date results required:

Or choose: standard / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharge applies
Lab comments:

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: Shuk Li

Sample information				Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Date sampled	Type of sample	ALUMINIUM	FLUORIDE	CYANIDE	PAH	TPH	HEAVY METALS 8									HOLD	Provide as much information about the sample as you can
14	TP8: 0·4–0·6	26/7/12	SOIL															X	
15	TP9: 0·2–0·4			X	X	X			X										
16	TP9: 1·0–1·2																	X	
17	TP10: 0·2–0·4			X	X	X			X										
18	TP10: 1·5–1·6																	X	
19	TP11: 0·8–1·0			X	X	X	X	X	X										
20	TP11: 1·7–1·8			X	X	X	X	X	X										
21	TP12: 0·4–0·6			X	X	X			X										*
22	TP12: 1·4–1·5																	X	
23	TP13: 0·4–0·6			X	X	X	X	X	X										
24	TP13: 1·4–1·6			X	X	X	X	X	X										
25	TP14: 0·0–0·2			X	X	X			X										
26	TP14: 1·7–1·8	↓	↓															X	

Relinquished by (company):
Print Name:
Date & Time:
Signature:

Received by (company): ELS
Print Name: SS
Date & Time: 31/7
Signature:

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

Form: 302 - Chain of Custody-Client, Issued 16/03/10, Version 4, Page 1 of 1.

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: ENVIRON
Contact person: KIRSTY GREENFIELD
Project Mgr:
Sampler:
Address:

Phone:
Fax:
Email:

Client Project Name / Number / Site etc (ie report title): AS130309C DICKSON ROAD
PO No.:
Envirolab Quote No. :
Date results required:

Or choose: standard / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharge applies
Lab comments:

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: Shuk Li

Sample information				Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Date sampled	Type of sample	ALUMINIUM	FLUORIDE	CYANIDE	PAH	TPH	HEAVY METALS 8									HOLD	Provide as much information about the sample as you can
27	TP15: 0.6-0.8	26/7/12	SOIL	X	X	X			X									~~X~~	
28	TP16: 0.4-0.6	↓	↓	X	X	X	X	X	X										
29	TP16: 1.5-1.6																	X	
30	DUP A																	X	
31	DUP B			X	X	X			X										
32	DUP B1			X	X	X			X										→ Pls forward to ACS
33	DUP C			X	X	X	X	X	X									~~X~~	
34	DUP D																	X	
35	DUP D1	↓	↓															X	

Relinquished by (company):
Print Name:
Date & Time:
Signature:

Received by (company): ELS
Print Name: SS
Date & Time: 31/7
Signature:

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

76609

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 76609

Client:

Environ (Newcastle)
Suite 19B, Level 2
50 Glebe Rd
The Junction
NSW 2291

Attention: Fiona Robinson

Sample log in details:

Your Reference:	**AS130309C Dickson Rd**
No. of samples:	35 Soils
Date samples received / completed instructions received	27/07/2012 / 31/07/12

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:	7/08/12 / 7/08/12
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:

Rhian Morgan
Rhian Morgan
Reporting Supervisor

Nick Sarlamis
Inorganics Supervisor

TRH in Soil (C6-C9)						
Our Reference:	UNITS	76609-1	76609-2	76609-9	76609-10	76609-19
Your Reference	-------------	TP1	TP1	TP5	TP5	TP11
Depth	------------	0.4-0.6	1.0-1.2	0.5-0.7	1.7-1.8	0.8-1.0
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Date analysed	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
vTRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
Surrogate aaa-Trifluorotoluene	%	93	118	87	90	94

TRH in Soil (C6-C9)						
Our Reference:	UNITS	76609-20	76609-23	76609-24	76609-28	76609-33
Your Reference	-------------	TP11	TP13	TP13	TP16	DUPC
Depth	------------	1.7-1.8	0.4-0.6	1.4-1.6	0.4-0.6	-
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Date analysed	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
vTRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
Surrogate aaa-Trifluorotoluene	%	86	94	104	84	93

sTRH in Soil (C10-C36)						
Our Reference:	UNITS	76609-1	76609-2	76609-9	76609-10	76609-19
Your Reference	-------------	TP1	TP1	TP5	TP5	TP11
Depth	------------	0.4-0.6	1.0-1.2	0.5-0.7	1.7-1.8	0.8-1.0
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Date analysed	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
TRHC_{10} - C_{14}	mg/kg	7,300	<50	<50	<50	<50
TRHC_{15} - C_{28}	mg/kg	19,000	<100	240	<100	140
TRHC_{29} - C_{36}	mg/kg	5,300	<100	290	<100	110
Surrogate o-Terphenyl	%	#	80	81	82	83

sTRH in Soil (C10-C36)						
Our Reference:	UNITS	76609-20	76609-23	76609-24	76609-28	76609-33
Your Reference	-------------	TP11	TP13	TP13	TP16	DUPC
Depth	------------	1.7-1.8	0.4-0.6	1.4-1.6	0.4-0.6	-
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Date analysed	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
TRHC_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRHC_{15} - C_{28}	mg/kg	<100	<100	<100	450	100
TRHC_{29} - C_{36}	mg/kg	<100	<100	<100	610	<100
Surrogate o-Terphenyl	%	77	86	84	82	79

PAHs in Soil						
Our Reference:	UNITS	76609-1	76609-2	76609-9	76609-10	76609-19
Your Reference	-------------	TP1	TP1	TP5	TP5	TP11
Depth	------------	0.4-0.6	1.0-1.2	0.5-0.7	1.7-1.8	0.8-1.0
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Date analysed	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Naphthalene	mg/kg	2,200	3.6	2.6	<0.1	2.7
Acenaphthylene	mg/kg	360	1.0	0.6	<0.1	1.5
Acenaphthene	mg/kg	84	0.8	1.3	<0.1	0.3
Fluorene	mg/kg	580	2.9	2.0	<0.1	1.6
Phenanthrene	mg/kg	1,800	13	14	<0.1	8.0
Anthracene	mg/kg	490	2.5	2.6	<0.1	2.3
Fluoranthene	mg/kg	1,300	14	22	<0.1	18
Pyrene	mg/kg	1,000	12	20	<0.1	16
Benzo(a)anthracene	mg/kg	450	6.7	13	<0.1	8.7
Chrysene	mg/kg	360	7.1	14	<0.1	7.5
Benzo(b+k)fluoranthene	mg/kg	560	12	27	<0.2	16
Benzo(a)pyrene	mg/kg	350	7.4	16	<0.05	10
Indeno(1,2,3-c,d)pyrene	mg/kg	180	4.8	11	<0.1	6.5
Dibenzo(a,h)anthracene	mg/kg	36	1	2.4	<0.1	1.3
Benzo(g,h,i)perylene	mg/kg	180	5.0	11	<0.1	6.2
Surrogate p-Terphenyl-d_{14}	%	133	105	104	114	105

PAHs in Soil						
Our Reference:	UNITS	76609-20	76609-23	76609-24	76609-28	76609-33
Your Reference	-------------	TP11	TP13	TP13	TP16	DUPC
Depth	------------	1.7-1.8	0.4-0.6	1.4-1.6	0.4-0.6	-
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Date analysed	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Naphthalene	mg/kg	<0.1	<0.1	<0.1	0.9	2.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	0.1	0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	1.3	0.6
Fluorene	mg/kg	<0.1	<0.1	<0.1	1.2	1.9
Phenanthrene	mg/kg	0.2	0.3	0.6	13	11
Anthracene	mg/kg	<0.1	<0.1	0.1	2.7	1.8
Fluoranthene	mg/kg	0.8	0.8	1.7	27	11
Pyrene	mg/kg	0.8	0.9	1.7	26	8.9
Benzo(a)anthracene	mg/kg	0.6	0.8	1.5	23	4.8
Chrysene	mg/kg	0.6	0.9	1.9	24	4.6
Benzo(b+k)fluoranthene	mg/kg	1.2	2.0	3.8	48	7.8
Benzo(a)pyrene	mg/kg	0.75	1.0	1.7	31	4.5
Indeno(1,2,3-c,d)pyrene	mg/kg	0.4	0.7	1.2	20	2.7
Dibenzo(a,h)anthracene	mg/kg	0.1	0.2	0.3	4.5	0.6
Benzo(g,h,i)perylene	mg/kg	0.4	0.8	1.3	18	2.6
Surrogate p-Terphenyl-d_{14}	%	117	113	115	106	105

Acid Extractable metals in soil						
Our Reference:	UNITS	76609-1	76609-3	76609-5	76609-6	76609-7
Your Reference	-------------	TP1	TP2	TP3	TP3	TP4
Depth	------------	0.4-0.6	0.2-0.4	0.6-0.8	1.7-1.8	0.4-0.6
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Date analysed	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Arsenic	mg/kg	<4	<4	4	<4	7
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	mg/kg	9	5	20	4	13
Copper	mg/kg	6	<1	19	<1	36
Lead	mg/kg	6	5	25	4	86
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	10	8	21	4	41
Zinc	mg/kg	22	3	320	7	350
Aluminium	mg/kg	5,800	2,800	13,000	2,300	25,000

Acid Extractable metals in soil						
Our Reference:	UNITS	76609-9	76609-10	76609-11	76609-15	76609-17
Your Reference	-------------	TP5	TP5	TP6	TP9	TP10
Depth	------------	0.5-0.7	1.7-1.8	0.4-0.6	0.2-0.4	0.2-0.4
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Date analysed	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Arsenic	mg/kg	6	<4	11	<4	<4
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	mg/kg	20	2	21	5	6
Copper	mg/kg	17	<1	14	4	5
Lead	mg/kg	18	2	9	5	7
Mercury	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Nickel	mg/kg	16	3	27	7	6
Zinc	mg/kg	110	2	49	36	35
Aluminium	mg/kg	19,000	1,700	33,000	3,100	5,800

Acid Extractable metals in soil						
Our Reference:	UNITS	76609-19	76609-20	76609-21	76609-23	76609-24
Your Reference	-------------	TP11	TP11	TP12	TP13	TP13
Depth	------------	0.8-1.0	1.7-1.8	0.4-0.6	0.4-0.6	1.4-1.6
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Date analysed	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Arsenic	mg/kg	<4	<4	21	8	5
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	mg/kg	5	2	17	14	20
Copper	mg/kg	22	3	150	12	21
Lead	mg/kg	39	3	210	14	28
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	9	4	25	12	16
Zinc	mg/kg	440	12	2,900	170	240
Aluminium	mg/kg	5,800	2,400	13,000	9,400	19,000

Acid Extractable metals in soil						
Our Reference:	UNITS	76609-25	76609-27	76609-28	76609-31	76609-33
Your Reference	-------------	TP14	TP15	TP16	DUPB	DUPC
Depth	------------	0.0-0.2	0.6-0.8	0.4-0.6	-	-
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Date analysed	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/2012
Arsenic	mg/kg	4	<4	10	<4	5
Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	mg/kg	11	<1	32	7	11
Copper	mg/kg	7	<1	45	6	17
Lead	mg/kg	8	<1	24	9	8
Mercury	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Nickel	mg/kg	13	2	54	7	11
Zinc	mg/kg	42	1	360	39	75
Aluminium	mg/kg	14,000	4	35,000	7,500	9,100

Acid Extractable metals in soil			
Our Reference:	UNITS	76609-36	76609-37
Your Reference	-------------	TP1 - Triplicate	TP16 - Triplicate
Depth	------------	0.4-0.6	0.4-0.6
Date Sampled		26/07/2012	26/07/2012
Type of sample		Soil	Soil
Date digested	-	01/08/2012	01/08/2012
Date analysed	-	01/08/2012	01/08/2012
Arsenic	mg/kg	<4	12
Cadmium	mg/kg	<0.5	<0.5
Chromium	mg/kg	10	64
Copper	mg/kg	4	55
Lead	mg/kg	8	27
Mercury	mg/kg	<0.1	0.1
Nickel	mg/kg	9	64
Zinc	mg/kg	18	340
Aluminium	mg/kg	3,400	41,000

Miscellaneous Inorg - soil						
Our Reference:	UNITS	76609-1	76609-3	76609-5	76609-6	76609-7
Your Reference	-------------	TP1	TP2	TP3	TP3	TP4
Depth	------------	0.4-0.6	0.2-0.4	0.6-0.8	1.7-1.8	0.4-0.6
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	07/08/2012	07/08/2012	07/08/2012	07/08/2012	07/08/2012
Date analysed	-	07/08/2012	07/08/2012	07/08/2012	07/08/2012	07/08/2012
Total Fluoride	mg/kg	270	64	2,800	220	56,000
Total Cyanide	mg/kg	5.8	<0.5	0.6	<0.5	<0.5

Miscellaneous Inorg - soil						
Our Reference:	UNITS	76609-9	76609-10	76609-11	76609-15	76609-17
Your Reference	-------------	TP5	TP5	TP6	TP9	TP10
Depth	------------	0.5-0.7	1.7-1.8	0.4-0.6	0.2-0.4	0.2-0.4
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	07/08/2012	07/08/2012	07/08/2012	07/08/2012	07/08/2012
Date analysed	-	07/08/2012	07/08/2012	07/08/2012	07/08/2012	07/08/2012
Total Fluoride	mg/kg	6,400	430	2,600	500	370
Total Cyanide	mg/kg	3.7	<0.5	5.4	<0.5	<0.5

Miscellaneous Inorg - soil						
Our Reference:	UNITS	76609-19	76609-20	76609-21	76609-23	76609-24
Your Reference	-------------	TP11	TP11	TP12	TP13	TP13
Depth	------------	0.8-1.0	1.7-1.8	0.4-0.6	0.4-0.6	1.4-1.6
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	07/08/2012	07/08/2012	07/08/2012	07/08/2012	07/08/2012
Date analysed	-	07/08/2012	07/08/2012	07/08/2012	07/08/2012	07/08/2012
Total Fluoride	mg/kg	5,100	320	3,800	310	2,300
Total Cyanide	mg/kg	1.2	<0.5	<0.5	<0.5	0.5

Miscellaneous Inorg - soil						
Our Reference:	UNITS	76609-25	76609-27	76609-28	76609-31	76609-33
Your Reference	-------------	TP14	TP15	TP16	DUPB	DUPC
Depth	------------	0.0-0.2	0.6-0.8	0.4-0.6	-	-
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	07/08/2012	07/08/2012	07/08/2012	07/08/2012	07/08/2012
Date analysed	-	07/08/2012	07/08/2012	07/08/2012	07/08/2012	07/08/2012
Total Fluoride	mg/kg	2,100	58	33,000	780	1,600
Total Cyanide	mg/kg	<0.5	<0.5	1.3	<0.5	0.6

Moisture						
Our Reference:	UNITS	76609-1	76609-2	76609-3	76609-5	76609-6
Your Reference	-------------	TP1	TP1	TP2	TP3	TP3
Depth	------------	0.4-0.6	1.0-1.2	0.2-0.4	0.6-0.8	1.7-1.8
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	01/08/12	01/08/12	01/08/12	01/08/12	01/08/12
Date analysed	-	02/08/12	02/08/12	02/08/12	02/08/12	02/08/12
Moisture	%	9.7	11	15	14	15

Moisture						
Our Reference:	UNITS	76609-7	76609-9	76609-10	76609-11	76609-15
Your Reference	-------------	TP4	TP5	TP5	TP6	TP9
Depth	------------	0.4-0.6	0.5-0.7	1.7-1.8	0.4-0.6	0.2-0.4
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	01/08/12	01/08/12	01/08/12	01/08/12	01/08/12
Date analysed	-	02/08/12	02/08/12	02/08/12	02/08/12	02/08/12
Moisture	%	6.9	15	18	14	10

Moisture						
Our Reference:	UNITS	76609-17	76609-19	76609-20	76609-21	76609-23
Your Reference	-------------	TP10	TP11	TP11	TP12	TP13
Depth	------------	0.2-0.4	0.8-1.0	1.7-1.8	0.4-0.6	0.4-0.6
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	01/08/12	01/08/12	01/08/12	01/08/12	01/08/12
Date analysed	-	02/08/12	02/08/12	02/08/12	02/08/12	02/08/12
Moisture	%	9.7	18	16	17	18

Moisture						
Our Reference:	UNITS	76609-24	76609-25	76609-27	76609-28	76609-31
Your Reference	-------------	TP13	TP14	TP15	TP16	DUPB
Depth	------------	1.4-1.6	0.0-0.2	0.6-0.8	0.4-0.6	-
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	01/08/12	01/08/12	01/08/12	01/08/12	01/08/12
Date analysed	-	02/08/12	02/08/12	02/08/12	02/08/12	02/08/12
Moisture	%	26	9.5	13	8.2	12

Moisture		
Our Reference:	UNITS	76609-33
Your Reference	-------------	DUPC
Depth	------------	-
Date Sampled		26/07/2012
Type of sample		Soil
Date prepared	-	01/08/12
Date analysed	-	02/08/12
Moisture	%	18

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
NEPM-404	Analysed by ISE after caustic fusion at 600degC.
Inorg-013	Cyanide - total determined colourimetrically after distillation, based on APHA 22nd ED, 4500-CN_C,E. Free cyanide determined colourimetrically after filtration.
Inorg-008	Moisture content determined by heating at 105 deg C for a minimum of 4 hours.

QUALITY CONTROL TRH in Soil (C6-C9)	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			01/08/2012	76609-1	01/08/2012 || 01/08/2012	LCS-2	01/08/2012
Date analysed	-			01/08/2012	76609-1	01/08/2012 || 01/08/2012	LCS-2	01/08/2012
vTRH C_6 - C_9	mg/kg	25	Org-016	<25	76609-1	<25 || <25	LCS-2	121%
Surrogate aaa-Trifluorotoluene	%		Org-016	103	76609-1	93 || 93 || RPD: 0	LCS-2	114%

QUALITY CONTROL sTRH in Soil (C10-C36)	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			01/08/2012	76609-1	01/08/2012 || 01/08/2012	LCS-2	01/08/2012
Date analysed	-			01/08/2012	76609-1	01/08/2012 || 01/08/2012	LCS-2	01/08/2012
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	76609-1	7300 || 15000 || RPD: 69	LCS-2	98%
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	76609-1	19000 || 37000 || RPD: 64	LCS-2	102%
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	76609-1	5300 || 12000 || RPD: 77	LCS-2	84%
Surrogate o-Terphenyl	%		Org-003	82	76609-1	# || #	LCS-2	95%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			01/08/2012	76609-1	01/08/2012 || 01/08/2012	LCS-2	01/08/2012
Date analysed	-			01/08/2012	76609-1	01/08/2012 || 01/08/2012	LCS-2	01/08/2012
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	2200 || 3900 || RPD: 56	LCS-2	97%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	360 || 750 || RPD: 70	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	84 || 190 || RPD: 77	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	580 || 1200 || RPD: 70	LCS-2	98%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	1800 || 3300 || RPD: 59	LCS-2	110%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	490 || 1000 || RPD: 68	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	1300 || 2400 || RPD: 59	LCS-2	113%
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	1000 || 1900 || RPD: 62	LCS-2	119%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	450 || 950 || RPD: 71	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	360 || 750 || RPD: 70	LCS-2	102%
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	76609-1	560 || 1300 || RPD: 80	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	76609-1	350 || 790 || RPD: 77	LCS-2	96%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	180 || 410 || RPD: 78	[NR]	[NR]

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	36 || 85 || RPD: 81	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	76609-1	180 || 400 || RPD: 76	[NR]	[NR]
Surrogate p-Terphenyl-d$_{14}$	%		Org-012 subset	114	76609-1	133 || 133 || RPD: 0	LCS-2	107%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date digested	-			01/08/2012	76609-1	01/08/2012 || 01/08/2012	LCS-1	01/08/2012
Date analysed	-			01/08/2012	76609-1	01/08/2012 || 01/08/2012	LCS-1	01/08/2012
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	76609-1	<4 || <4	LCS-1	99%
Cadmium	mg/kg	0.5	Metals-020 ICP-AES	<0.5	76609-1	<0.5 || <0.5	LCS-1	105%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	76609-1	9 || 7 || RPD: 25	LCS-1	101%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	76609-1	6 || 3 || RPD: 67	LCS-1	102%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	76609-1	6 || 5 || RPD: 18	LCS-1	98%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	76609-1	<0.1 || <0.1	LCS-1	94%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	76609-1	10 || 9 || RPD: 11	LCS-1	101%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	76609-1	22 || 15 || RPD: 38	LCS-1	99%
Aluminium	mg/kg	1	Metals-020 ICP-AES	<1	76609-1	5800 || 4100 || RPD: 34	LCS-1	97%

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			31/07/2012	[NT]	[NT]	LCS-1	31/07/2012
Date analysed	-			31/07/2012	[NT]	[NT]	LCS-1	31/07/2012
Total Fluoride	mg/kg	50	NEPM-404	<50	[NT]	[NT]	LCS-1	105%
Total Cyanide	mg/kg	0.5	Inorg-013	<0.5	[NT]	[NT]	LCS-1	117%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank
Date prepared	-			[NT]
Date analysed	-			[NT]
Moisture	%	0.1	Inorg-008	[NT]

QUALITY CONTROL TRH in Soil (C6-C9)	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	76609-28	01/08/2012 || 01/08/2012	76609-2	01/08/2012
Date analysed	-	76609-28	01/08/2012 || 01/08/2012	76609-2	01/08/2012
vTRH C_6 - C_9	mg/kg	76609-28	<25 || <25	76609-2	101%
Surrogate aaa-Trifluorotoluene	%	76609-28	84 || 94 || RPD: 11	76609-2	108%

QUALITY CONTROL sTRH in Soil (C10-C36)	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	76609-28	01/08/2012 || 01/08/2012	76609-2	01/08/2012
Date analysed	-	76609-28	01/08/2012 || 01/08/2012	76609-2	01/08/2012
TRH C_{10} - C_{14}	mg/kg	76609-28	<50 || <50	76609-2	96%
TRH C_{15} - C_{28}	mg/kg	76609-28	450 || 390 || RPD: 14	76609-2	107%
TRH C_{29} - C_{36}	mg/kg	76609-28	610 || 680 || RPD: 11	76609-2	94%
Surrogate o-Terphenyl	%	76609-28	82 || 81 || RPD: 1	76609-2	102%

QUALITY CONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	76609-28	01/08/2012 || 01/08/2012	76609-2	01/08/2012
Date analysed	-	76609-28	01/08/2012 || 01/08/2012	76609-2	01/08/2012
Naphthalene	mg/kg	76609-28	0.9 || 1.4 || RPD: 43	76609-2	107%
Acenaphthylene	mg/kg	76609-28	0.1 || 0.2 || RPD: 67	[NR]	[NR]
Acenaphthene	mg/kg	76609-28	1.3 || 1.0 || RPD: 26	[NR]	[NR]
Fluorene	mg/kg	76609-28	1.2 || 1.3 || RPD: 8	76609-2	117%
Phenanthrene	mg/kg	76609-28	13 || 13 || RPD: 0	76609-2	#
Anthracene	mg/kg	76609-28	2.7 || 2.7 || RPD: 0	[NR]	[NR]
Fluoranthene	mg/kg	76609-28	27 || 23 || RPD: 16	76609-2	#
Pyrene	mg/kg	76609-28	26 || 22 || RPD: 17	76609-2	#
Benzo(a)anthracene	mg/kg	76609-28	23 || 17 || RPD: 30	[NR]	[NR]
Chrysene	mg/kg	76609-28	24 || 17 || RPD: 34	76609-2	#
Benzo(b+k)fluoranthene	mg/kg	76609-28	48 || 37 || RPD: 26	[NR]	[NR]
Benzo(a)pyrene	mg/kg	76609-28	31 || 23 || RPD: 30	76609-2	#
Indeno(1,2,3-c,d)pyrene	mg/kg	76609-28	20 || 15 || RPD: 29	[NR]	[NR]

QUALITY CONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Dibenzo(a,h)anthracene	mg/kg	76609-28	4.5 || 3.5 || RPD: 25	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	76609-28	18 || 14 || RPD: 25	[NR]	[NR]
Surrogate p-Terphenyl-d$_{14}$	%	76609-28	106 || 106 || RPD: 0	76609-2	104%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date digested	-	76609-28	01/08/2012 || 01/08/2012	LCS-2	01/08/2012
Date analysed	-	76609-28	01/08/2012 || 01/08/2012	LCS-2	01/08/2012
Arsenic	mg/kg	76609-28	10 || 12 || RPD: 18	LCS-2	100%
Cadmium	mg/kg	76609-28	<0.5 || <0.5	LCS-2	103%
Chromium	mg/kg	76609-28	32 || 36 || RPD: 12	LCS-2	102%
Copper	mg/kg	76609-28	45 || 61 || RPD: 30	LCS-2	102%
Lead	mg/kg	76609-28	24 || 44 || RPD: 59	LCS-2	98%
Mercury	mg/kg	76609-28	0.1 || 0.1 || RPD: 0	LCS-2	95%
Nickel	mg/kg	76609-28	54 || 100 || RPD: 60	LCS-2	101%
Zinc	mg/kg	76609-28	360 || 380 || RPD: 5	LCS-2	99%
Aluminium	mg/kg	76609-28	35000 || 40000 || RPD: 13	LCS-2	95%

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	76609-3	31/07/2012
Date analysed	-	[NT]	[NT]	76609-3	31/07/2012
Total Fluoride	mg/kg	[NT]	[NT]	76609-3	95%
Total Cyanide	mg/kg	[NT]	[NT]	76609-3	105%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date digested	-	[NT]	[NT]	76609-3	01/08/2012
Date analysed	-	[NT]	[NT]	76609-3	01/08/2012
Arsenic	mg/kg	[NT]	[NT]	76609-3	91%
Cadmium	mg/kg	[NT]	[NT]	76609-3	93%
Chromium	mg/kg	[NT]	[NT]	76609-3	96%
Copper	mg/kg	[NT]	[NT]	76609-3	100%
Lead	mg/kg	[NT]	[NT]	76609-3	88%
Mercury	mg/kg	[NT]	[NT]	76609-3	95%
Nickel	mg/kg	[NT]	[NT]	76609-3	86%
Zinc	mg/kg	[NT]	[NT]	76609-3	91%
Aluminium	mg/kg	[NT]	[NT]	76609-3	#

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	76609-1	07/08/2012 || 07/08/2012
Date analysed	-	76609-1	07/08/2012 || 07/08/2012
Total Fluoride	mg/kg	76609-1	270 || 270 || RPD: 0
Total Cyanide	mg/kg	76609-1	5.8 || 5.2 || RPD: 11

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	76609-19	07/08/2012 || 07/08/2012
Date analysed	-	76609-19	07/08/2012 || 07/08/2012
Total Fluoride	mg/kg	76609-19	5100 || 5000 || RPD: 2
Total Cyanide	mg/kg	76609-19	1.2 || 1.5 || RPD: 22

Report Comments:

PAH's in soil:# Percent recovery is not possible to report as the high concentration of analytes in the sample/s have caused interference.The RPD for duplicate results is accepted due to the non homogenous nature of the sample/s.

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteriae has been exceeded for 76609-1 for Cu. Therefore a triplicate result has been issued as laboratory sample number 76609-36.

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteriae has been exceeded for 76609-28 for Pb & Ni. Therefore a triplicate result has been issued as laboratory sample number 76609-37.

Acid Extractable Metals in Soil: # Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Total Recoverable Hydrocarbons in soil (semivol):# Percent recovery is not possible to report as the high concentration of analytes in the sample/s have caused interference. The RPD for duplicate results is accepted due to the non homogenous nature of the sample/s.

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
NA: Test not required
<: Less than
PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than
NT: Not tested
NA: Test not required
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 batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

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

Aileen Hie

From: Kirsty Greenfield [kgreenfield@environcorp.com]
Sent: Friday, 10 August 2012 11:38 AM
To: Aileen Hie
Subject: Request for TCLP analysis for Batch 76609

Hi Aileen,

I'd like to arrange for TCLP analysis for Batch 76609 for the following samples:

1 TP1: 0.4-0.6 – BaP and Fluoride
2 TP1: 1.0-1.2 – BaP
7 TP4: 0.4-0.6 – Fluoride
9 TP5: 0.5-0.7 – BaP, Fluoride
19 TP11: 0.8-1.0 – BaP, Fluoride
28 TP16: 0.4-0.6 – BaP, Fluoride

Thanks,

ENVIRON

Kirsty Greenfield | Environmental Consultant
ENVIRON Australia Pty Ltd
Eastpoint Complex | Suite 19B, Level 2
50 Glebe Road | The Junction, NSW 2291
T: 02 4962 5444| F: 02 4962 5888 | M: 0407 149 176
kgreenfield@environcorp.com

Envirolab Ref: 76609A
Due: 17/8/12
Std T/A.

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 76609-A

Client:
Environ (Newcastle)
Suite 19B, Level 2
50 Glebe Rd
The Junction
NSW   2291

Attention: Fiona Robinson

Sample log in details:

Your Reference:	**AS130309C Dickson Rd**
No. of samples:	Additional Testing on 6 Soils
Date samples received / completed instructions received	27/07/2012 / 10/08/12

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:	17/08/12 / 17/08/12
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:

Nick Sarlamis
Inorganics Supervisor

ACCREDITED FOR TECHNICAL COMPETENCE

PAHs in TCLP (USEPA 1311) Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ------------- ------------	76609-A-1 TP1 0.4-0.6 26/07/2012 Soil	76609-A-2 TP1 1.0-1.2 26/07/2012 Soil	76609-A-7 TP4 0.4-0.6 26/07/2012 Soil	76609-A-9 TP5 0.5-0.7 26/07/2012 Soil	76609-A-19 TP11 0.8-1.0 26/07/2012 Soil
pH of soil for fluid# determ.	pH units	7.6	7.1	6.6	8.4	7.3
pH of soil for fluid # determ. (acid)	pH units	1.6	1.6	1.6	1.6	1.6
Extraction fluid used	-	1	1	1	1	1
pH of final Leachate	pH units	4.9	4.9	5.0	5.0	5.1
Date extracted	-	13/08/2012	13/08/2012	[NA]	13/08/2012	13/08/2012
Date analysed	-	14/08/2012	14/08/2012	[NA]	14/08/2012	14/08/2012
Naphthalene in TCLP	mg/L	5.1	<0.001	[NA]	<0.001	0.030
Acenaphthylene in TCLP	mg/L	0.18	<0.001	[NA]	<0.001	0.010
Acenaphthene in TCLP	mg/L	0.028	<0.001	[NA]	<0.001	0.003
Fluorene in TCLP	mg/L	0.12	<0.001	[NA]	<0.001	0.016
Phenanthrene in TCLP	mg/L	0.12	<0.001	[NA]	<0.001	0.022
Anthracene in TCLP	mg/L	0.020	<0.001	[NA]	<0.001	0.004
Fluoranthene in TCLP	mg/L	0.018	<0.001	[NA]	<0.001	0.005
Pyrene in TCLP	mg/L	0.012	<0.001	[NA]	<0.001	0.004
Benzo(a)anthracene in TCLP	mg/L	0.002	<0.001	[NA]	<0.001	<0.001
Chrysene in TCLP	mg/L	0.002	<0.001	[NA]	<0.001	<0.001
Benzo(b+k)fluoranthene in TCLP	mg/L	0.004	<0.002	[NA]	<0.002	<0.002
Benzo(a)pyrene in TCLP	mg/L	0.001	<0.001	[NA]	<0.001	<0.001
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	<0.001	<0.001	[NA]	<0.001	<0.001
Dibenzo(a,h)anthracene in TCLP	mg/L	<0.001	<0.001	[NA]	<0.001	<0.001
Benzo(g,h,i)perylene in TCLP	mg/L	<0.001	<0.001	[NA]	<0.001	<0.001
Surrogate p-Terphenyl-d_{14}	%	97	97	[NA]	102	93

PAHs in TCLP (USEPA 1311) Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ------------- ------------	76609-A-28 TP16 0.4-0.6 26/07/2012 Soil
pH of soil for fluid# determ.	pH units	6.7
pH of soil for fluid # determ. (acid)	pH units	1.6
Extraction fluid used	-	1
pH of final Leachate	pH units	5.1
Date extracted	-	13/08/2012
Date analysed	-	14/08/2012
Naphthalene in TCLP	mg/L	<0.001
Acenaphthylene in TCLP	mg/L	<0.001
Acenaphthene in TCLP	mg/L	<0.001
Fluorene in TCLP	mg/L	<0.001
Phenanthrene in TCLP	mg/L	<0.001
Anthracene in TCLP	mg/L	<0.001
Fluoranthene in TCLP	mg/L	<0.001
Pyrene in TCLP	mg/L	<0.001
Benzo(a)anthracene in TCLP	mg/L	<0.001
Chrysene in TCLP	mg/L	<0.001
Benzo(b+k)fluoranthene in TCLP	mg/L	<0.002
Benzo(a)pyrene in TCLP	mg/L	<0.001
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	<0.001
Dibenzo(a,h)anthracene in TCLP	mg/L	<0.001
Benzo(g,h,i)perylene in TCLP	mg/L	<0.001
Surrogate p-Terphenyl-d_{14}	%	97

Miscellaneous Inorganics						
Our Reference:	UNITS	76609-A-1	76609-A-7	76609-A-9	76609-A-19	76609-A-28
Your Reference	-------------	TP1	TP4	TP5	TP11	TP16
Depth	------------	0.4-0.6	0.4-0.6	0.5-0.7	0.8-1.0	0.4-0.6
Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	26/07/2012
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	15/08/2012	15/08/2012	15/08/2012	15/08/2012	15/08/2012
Date analysed	-	15/08/2012	15/08/2012	15/08/2012	15/08/2012	15/08/2012
Fluoride, F in TCLP	mg/L	11	54	72	45	170

Method ID	Methodology Summary
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using AS 4439 and USEPA 1311.
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP).
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+.
Org-012 subset	Leachates are extracted with Dichloromethane and analysed by GC-MS.
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA 22nd ED, 4500-F-C.

QUALITY CONTROL PAHs in TCLP (USEPA 1311)	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			13/08/2012	[NT]	[NT]	LCS-W1	13/08/2012
Date analysed	-			14/08/2012	[NT]	[NT]	LCS-W1	14/08/2012
Naphthalene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	108%
Acenaphthylene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Acenaphthene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Fluorene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	110%
Phenanthrene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	100%
Anthracene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Fluoranthene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	105%
Pyrene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	102%
Benzo(a)anthracene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Chrysene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	103%
Benzo(b+k)fluoranthene in TCLP	mg/L	0.002	Org-012 subset	<0.002	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	LCS-W1	83%
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene in TCLP	mg/L	0.001	Org-012 subset	<0.001	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d_{14}	%		Org-012	96	[NT]	[NT]	LCS-W1	111%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			15/08/2012	[NT]	[NT]	LCS-W1	15/08/2012
Date analysed	-			15/08/2012	[NT]	[NT]	LCS-W1	15/08/2012
Fluoride, F in TCLP	mg/L	0.1	Inorg-026	<0.1	[NT]	[NT]	LCS-W1	90%

Report Comments:

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
NA: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
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 batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

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

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: ENVIRON AUSTRALIA PTY LTD
Contact person: Kirsty Greenfield
Project Mgr: " "
Sampler: Steve Cadman
Address: Lvl 2, Suite 19B
50 Glebe Rd (PO Box 435)
The Junction NSW 2291.
Phone: 4962 5444
Fax: 4962 5888
Email: kgreenfield@environcorp.com

Client Project Name / Number / Site etc (ie report title): AS130304 DICKSON RD
PO No.:
Envirolab Quote No. :
Date results required:

Or choose: standard / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharge applies
Lab comments:

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: Shuk Li

Sample information				Tests Required															Comments
Envirolab Sample ID	Client Sample ID or information	Date sampled	Type of sample	HEAVY METALS 8 (Dissolved)	PAHs	SVOC	fluoride	cyanide	PH, EC		Total Metals (8)								Provide as much information about the sample as you can
1	DR1-28/8/12	28/8/12	Water	X	X	X	X	X	X										4 Bottles.
2	DR2-28/8/12	"	"	X	X	X	X	X	X										"
3	DR3-28/8/12	"	"	X	X	X	X	X	X										"
4	QC01-28/8/12	"	"	X	X	X	X	X	X										"
5	Upstream-29/8/12	29/8/12	"		X	X	X	X	X		X								4 Bottles.
6	Midstream-29/8/12	"	"		X	X	X	X	X		X								" "
7.	DownStream-29/8/12	"	"		X	X	X	X	X		X								" "
																			" "

Total = 24

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 78151
Date Received: 30/8/12
Time Received: 10:30
Received by: PT
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (company): Environ
Print Name: Steve Cadman
Date & Time: 11:15
Signature:

Received by (company): ELS
Print Name: Pratistha
Date & Time: 30/8/12 10:30
Signature: PT

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

Form: 302 - Chain of Custody-Client, Issued 16/03/10, Version 4, Page 1 of 1.

Geoff Weir

From: Aileen Hie
Sent: Thursday, 30 August 2012 10:55 AM
To: Simon Song; Geoff Weir
Subject: FW: Water samples arriving today

Regards,

Aileen Hie | Customer Service Coordinator | Envirolab Services

Great Chemistry.Great Service.

12 Ashley St Chatswood NSW 2067
T 02 9910 6200 **F** 02 9910 6299
ahie@envirolab.com.au | www.envirolab.com.au

From: Kirsty Greenfield [mailto:kgreenfield@environcorp.com]
Sent: Thursday, 30 August 2012 8:27 AM
To: Aileen Hie
Cc: Steven Cadman
Subject: Water samples arriving today

Hi Aileen,

We have some water samples that should arrive today. Can you please add cations and anions analysis for samples DR1 to DR3. Also, our job reference number is AS130309C (which is on the COC) not AS130314 (which is on the bottles).

Thanks,

ENVIRON

Kirsty Greenfield | Environmental Consultant
ENVIRON Australia Pty Ltd
Eastpoint Complex | Suite 19B, Level 2
50 Glebe Road | The Junction, NSW 2291
T: 02 4962 5444| F: 02 4962 5888 | M: 0407 149 176
kgreenfield@environcorp.com

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 78151

Client:

Environ
PO Box 560
North Sydney
NSW 2060

Attention: Kirsty Greenfield, Steve Cadman

Sample log in details:

Your Reference:	**AS130309C, Dickson Rd**	
No. of samples:	7 waters	
Date samples received / completed instructions received	30/08/12	/ 30/08/12

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:	6/09/12	/ 6/09/12
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:

Nancy Zhang
Chemist

Rhian Morgan
Reporting Supervisor

Nick Sarlamis
Inorganics Supervisor

NATA
ACCREDITED FOR
TECHNICAL
COMPETENCE

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ------------- ------------	78151-1 DR1 28/08/2012 Water	78151-2 DR2 28/08/2012 Water	78151-3 DR3 28/08/2012 Water	78151-4 QC01 28/08/2012 Water	78151-5 UPSTREAM 29/08/2012 Water
Date extracted	-	04/09/2012	04/09/2012	04/09/2012	04/09/2012	04/09/2012
Date analysed	-	05/09/2012	05/09/2012	05/09/2012	05/09/2012	05/09/2012
Naphthalene	µg/L	<1	<1	<1	<1	<1
Acenaphthylene	µg/L	<1	<1	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1	<1	<1
Fluorene	µg/L	<1	<1	<1	<1	<1
Phenanthrene	µg/L	<1	<1	<1	<1	<1
Anthracene	µg/L	<1	<1	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1	<1	<1
Pyrene	µg/L	<1	<1	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1	<1	<1
Chrysene	µg/L	<1	<1	<1	<1	<1
Benzo(b+k)fluoranthene	µg/L	<2	<2	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1	<1	<1
Surrogate p-Terphenyl-d_{14}	%	80	79	69	83	91

PAHs in Water Our Reference: Your Reference Date Sampled Type of sample	UNITS ------------- ------------	78151-6 MIDSTREAM 29/08/2012 Water	78151-7 DOWNSTREAM 29/08/2012 Water
Date extracted	-	04/09/2012	04/09/2012
Date analysed	-	05/09/2012	05/09/2012
Naphthalene	µg/L	<1	<1
Acenaphthylene	µg/L	<1	<1
Acenaphthene	µg/L	<1	<1
Fluorene	µg/L	<1	<1
Phenanthrene	µg/L	<1	<1
Anthracene	µg/L	<1	<1
Fluoranthene	µg/L	<1	<1
Pyrene	µg/L	<1	<1
Benzo(a)anthracene	µg/L	<1	<1
Chrysene	µg/L	<1	<1
Benzo(b+k)fluoranthene	µg/L	<2	<2
Benzo(a)pyrene	µg/L	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1
Surrogate p-Terphenyl-d_{14}	%	84	90

SVOC's in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ------------ ------------	78151-1 DR1 28/08/2012 Water	78151-2 DR2 28/08/2012 Water	78151-3 DR3 28/08/2012 Water	78151-4 QC01 28/08/2012 Water	78151-5 UPSTREAM 29/08/2012 Water
Date extracted	-	04/09/2012	04/09/2012	04/09/2012	04/09/2012	04/09/2012
Date analysed	-	05/09/2012	05/09/2012	05/09/2012	05/09/2012	05/09/2012
Phenol	µg/L	<10	<10	<10	<10	<10
Bis (2-chloroethyl) ether	µg/L	<10	<10	<10	<10	<10
2-Chlorophenol	µg/L	<10	<10	<10	<10	<10
1,3-Dichlorobenzene	µg/L	<10	<10	<10	<10	<10
1,4-Dichlorobenzene	µg/L	<10	<10	<10	<10	<10
2-Methylphenol	µg/L	<10	<10	<10	<10	<10
1,2-Dichlorobenzene	µg/L	<10	<10	<10	<10	<10
bis-(2-Chloroisopropyl) ether	µg/L	<10	<10	<10	<10	<10
3/4-Methylphenol	µg/L	<20	<20	<20	<20	<20
N-nitrosodi-n-propylamine	µg/L	<10	<10	<10	<10	<10
Hexachloroethane	µg/L	<10	<10	<10	<10	<10
Nitrobenzene	µg/L	<10	<10	<10	<10	<10
Isophorone	µg/L	<10	<10	<10	<10	<10
2,4-Dimethylphenol	µg/L	<10	<10	<10	<10	<10
2-Nitrophenol	µg/L	<10	<10	<10	<10	<10
bis (2-Chloroethoxy) methane	µg/L	<10	<10	<10	<10	<10
2,4-Dichlorophenol	µg/L	<10	<10	<10	<10	<10
1,2,4-Trichlorobenzene	µg/L	<10	<10	<10	<10	<10
Naphthalene	µg/L	<10	<10	<10	<10	<10
4-Chloroaniline	µg/L	<10	<10	<10	<10	<10
Hexachlorobutadiene	µg/L	<10	<10	<10	<10	<10
2-Methylnaphthalene	µg/L	<10	<10	<10	<10	<10
Hexachlorocyclopentadiene	µg/L	<10	<10	<10	<10	<10
2,4,6-Trichlorophenol	µg/L	<10	<10	<10	<10	<10
2,4,5-Trichlorophenol	µg/L	<10	<10	<10	<10	<10
2-Chloronaphthalene	µg/L	<10	<10	<10	<10	<10
2-Nitroaniline	µg/L	<10	<10	<10	<10	<10
Dimethyl phthalate	µg/L	<10	<10	<10	<10	<10
2,6-Dinitrotoluene	µg/L	<10	<10	<10	<10	<10
Acenaphthylene	µg/L	<10	<10	<10	<10	<10
3-Nitroaniline	µg/L	<10	<10	<10	<10	<10
Acenaphthene	µg/L	<10	<10	<10	<10	<10
2,4-Dinitrophenol	µg/L	<100	<100	<100	<100	<100
4-Nitrophenol	µg/L	<100	<100	<100	<100	<100
Dibenzofuran	µg/L	<10	<10	<10	<10	<10
Diethylphthalate	µg/L	<10	<10	<10	<10	<10
4-Chlorophenylphenylether	µg/L	<10	<10	<10	<10	<10
4-Nitroaniline	µg/L	<10	<10	<10	<10	<10
Fluorene	µg/L	<10	<10	<10	<10	<10
2-methyl-4,6-dinitrophenol	µg/L	<100	<100	<100	<100	<100
Azobenzene	µg/L	<10	<10	<10	<10	<10

SVOC's in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ------------ ------------	78151-1 DR1 28/08/2012 Water	78151-2 DR2 28/08/2012 Water	78151-3 DR3 28/08/2012 Water	78151-4 QC01 28/08/2012 Water	78151-5 UPSTREAM 29/08/2012 Water
4-Bromophenylphenylether	µg/L	<10	<10	<10	<10	<10
Hexachlorobenzene	µg/L	<10	<10	<10	<10	<10
Pentachlorophenol	µg/L	<100	<100	<100	<100	<100
Phenanthrene	µg/L	<10	<10	<10	<10	<10
Anthracene	µg/L	<10	<10	<10	<10	<10
Carbazole	µg/L	<10	<10	<10	<10	<10
Di-n-butylphthalate	µg/L	<10	<10	<10	<10	<10
Fluoranthene	µg/L	<10	<10	<10	<10	<10
Pyrene	µg/L	<10	<10	<10	<10	<10
Butylbenzylphthalate	µg/L	<10	<10	<10	<10	<10
Bis(2-ethylhexyl) phthalate	µg/L	<10	<10	<10	<10	<10
Benzo(a)anthracene	µg/L	<10	<10	<10	<10	<10
Chrysene	µg/L	<10	<10	<10	<10	<10
Di-n-octylphthalate	µg/L	<10	<10	<10	<10	<10
Benzo(b)fluoranthene	µg/L	<10	<10	<10	<10	<10
Benzo(k)fluoranthene	µg/L	<10	<10	<10	<10	<10
Benzo(a)pyrene	µg/L	<10	<10	<10	<10	<10
Indeno(1,2,3-c,d)pyrene	µg/L	<10	<10	<10	<10	<10
Dibenzo(a,h)anthracene	µg/L	<10	<10	<10	<10	<10
Benzo(g,h,i)perylene	µg/L	<10	<10	<10	<10	<10
Ethylmethanesulfonate	µg/L	<10	<10	<10	<10	<10
Aniline	µg/L	<10	<10	<10	<10	<10
Pentachloroethane	µg/L	<10	<10	<10	<10	<10
Benzyl alcohol	µg/L	<10	<10	<10	<10	<10
Acetophenone	µg/L	<10	<10	<10	<10	<10
N-nitrosomorpholine	µg/L	<10	<10	<10	<10	<10
N-nitrosopiperidine	µg/L	<10	<10	<10	<10	<10
2,6-Dichlorophenol	µg/L	<10	<10	<10	<10	<10
Hexachloropropene-1	µg/L	<10	<10	<10	<10	<10
N-nitroso-n-butylamine	µg/L	<10	<10	<10	<10	<10
Safrole	µg/L	<10	<10	<10	<10	<10
1,2,4,5-Tetrachlorobenzene	µg/L	<10	<10	<10	<10	<10
Trans-iso-safrole	µg/L	<10	<10	<10	<10	<10
1,3-Dinitrobenzene	µg/L	<10	<10	<10	<10	<10
Pentachlorobenzene	µg/L	<10	<10	<10	<10	<10
1-Naphthylamine	µg/L	<10	<10	<10	<10	<10
2,3,4,6-Tetrachlorophenol	µg/L	<10	<10	<10	<10	<10
2-Naphthylamine	µg/L	<10	<10	<10	<10	<10
5-Nitro-o-toluidine	µg/L	<10	<10	<10	<10	<10
Diphenylamine	µg/L	<10	<10	<10	<10	<10
Phenacetin	µg/L	<10	<10	<10	<10	<10
Pentachloronitrobenzene	µg/L	<10	<10	<10	<10	<10
Dinoseb	µg/L	<10	<10	<10	<10	<10

SVOC's in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ------------- ------------	78151-1 DR1 28/08/2012 Water	78151-2 DR2 28/08/2012 Water	78151-3 DR3 28/08/2012 Water	78151-4 QC01 28/08/2012 Water	78151-5 UPSTREAM 29/08/2012 Water
Methapyrilene	µg/L	<10	<10	<10	<10	<10
p-Dimethylaminoazobenzene	µg/L	<10	<10	<10	<10	<10
2-Acetylaminofluorene	µg/L	<10	<10	<10	<10	<10
7,12-Dimethylbenz(a)anthracene	µg/L	<10	<10	<10	<10	<10
3-Methylcholanthrene	µg/L	<10	<10	<10	<10	<10
a-BHC	µg/L	<10	<10	<10	<10	<10
b-BHC	µg/L	<10	<10	<10	<10	<10
g-BHC	µg/L	<10	<10	<10	<10	<10
d-BHC	µg/L	<10	<10	<10	<10	<10
Heptachlor	µg/L	<10	<10	<10	<10	<10
Aldrin	µg/L	<10	<10	<10	<10	<10
Heptachlor Epoxide	µg/L	<10	<10	<10	<10	<10
g-Chlordane	µg/L	<10	<10	<10	<10	<10
a-Chlordane	µg/L	<10	<10	<10	<10	<10
Endosulfan I	µg/L	<10	<10	<10	<10	<10
p,p'-DDE	µg/L	<10	<10	<10	<10	<10
Dieldrin	µg/L	<10	<10	<10	<10	<10
Endrin	µg/L	<10	<10	<10	<10	<10
p,p'-DDD	µg/L	<10	<10	<10	<10	<10
Endosulfan II	µg/L	<10	<10	<10	<10	<10
Endrin Aldehyde	µg/L	<10	<10	<10	<10	<10
p,p'-DDT	µg/L	<10	<10	<10	<10	<10
Endosulfan Sulphate	µg/L	<10	<10	<10	<10	<10
Surrogate 2-fluorophenol	%	64	61	47	64	67
Surrogate Phenol-d_6	%	48	43	31	42	46
Surrogate Nitrobenzene-d_5	%	91	91	77	87	104
Surrogate 2-fluorobiphenyl	%	72	74	64	73	94
Surrogate 2,4,6-Tribromophenol	%	128	140	108	137	129
Surrogate *p*-Terphenyl-d_{14}	%	90	96	78	91	117

SVOC's in water			
Our Reference:	UNITS	78151-6	78151-7
Your Reference	-------------	MIDSTREAM	DOWNSTREAM
Date Sampled	------------	29/08/2012	29/08/2012
Type of sample		Water	Water
Date extracted	-	04/09/2012	04/09/2012
Date analysed	-	05/09/2012	05/09/2012
Phenol	µg/L	<10	<10
Bis (2-chloroethyl) ether	µg/L	<10	<10
2-Chlorophenol	µg/L	<10	<10
1,3-Dichlorobenzene	µg/L	<10	<10
1,4-Dichlorobenzene	µg/L	<10	<10
2-Methylphenol	µg/L	<10	<10
1,2-Dichlorobenzene	µg/L	<10	<10
bis-(2-Chloroisopropyl) ether	µg/L	<10	<10
3/4-Methylphenol	µg/L	<20	<20
N-nitrosodi-n-propylamine	µg/L	<10	<10
Hexachloroethane	µg/L	<10	<10
Nitrobenzene	µg/L	<10	<10
Isophorone	µg/L	<10	<10
2,4-Dimethylphenol	µg/L	<10	<10
2-Nitrophenol	µg/L	<10	<10
bis (2-Chloroethoxy) methane	µg/L	<10	<10
2,4-Dichlorophenol	µg/L	<10	<10
1,2,4-Trichlorobenzene	µg/L	<10	<10
Naphthalene	µg/L	<10	<10
4-Chloroaniline	µg/L	<10	<10
Hexachlorobutadiene	µg/L	<10	<10
2-Methylnaphthalene	µg/L	<10	<10
Hexachlorocyclopentadiene	µg/L	<10	<10
2,4,6-Trichlorophenol	µg/L	<10	<10
2,4,5-Trichlorophenol	µg/L	<10	<10
2-Chloronaphthalene	µg/L	<10	<10
2-Nitroaniline	µg/L	<10	<10
Dimethyl phthalate	µg/L	<10	<10
2,6-Dinitrotoluene	µg/L	<10	<10
Acenaphthylene	µg/L	<10	<10
3-Nitroaniline	µg/L	<10	<10
Acenaphthene	µg/L	<10	<10
2,4-Dinitrophenol	µg/L	<100	<100
4-Nitrophenol	µg/L	<100	<100
Dibenzofuran	µg/L	<10	<10
Diethylphthalate	µg/L	<10	<10
4-Chlorophenylphenylether	µg/L	<10	<10
4-Nitroaniline	µg/L	<10	<10
Fluorene	µg/L	<10	<10
2-methyl-4,6-dinitrophenol	µg/L	<100	<100

SVOC's in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ------------- ------------	78151-6 MIDSTREAM 29/08/2012 Water	78151-7 DOWNSTREAM 29/08/2012 Water
Azobenzene	µg/L	<10	<10
4-Bromophenylphenylether	µg/L	<10	<10
Hexachlorobenzene	µg/L	<10	<10
Pentachlorophenol	µg/L	<100	<100
Phenanthrene	µg/L	<10	<10
Anthracene	µg/L	<10	<10
Carbazole	µg/L	<10	<10
Di-n-butylphthalate	µg/L	<10	<10
Fluoranthene	µg/L	<10	<10
Pyrene	µg/L	<10	<10
Butylbenzylphthalate	µg/L	<10	<10
Bis(2-ethylhexyl) phthalate	µg/L	<10	<10
Benzo(a)anthracene	µg/L	<10	<10
Chrysene	µg/L	<10	<10
Di-n-octylphthalate	µg/L	<10	<10
Benzo(b)fluoranthene	µg/L	<10	<10
Benzo(k)fluoranthene	µg/L	<10	<10
Benzo(a)pyrene	µg/L	<10	<10
Indeno(1,2,3-c,d)pyrene	µg/L	<10	<10
Dibenzo(a,h)anthracene	µg/L	<10	<10
Benzo(g,h,i)perylene	µg/L	<10	<10
Ethylmethanesulfonate	µg/L	<10	<10
Aniline	µg/L	<10	<10
Pentachloroethane	µg/L	<10	<10
Benzyl alcohol	µg/L	<10	<10
Acetophenone	µg/L	<10	<10
N-nitrosomorpholine	µg/L	<10	<10
N-nitrosopiperidine	µg/L	<10	<10
2,6-Dichlorophenol	µg/L	<10	<10
Hexachloropropene-1	µg/L	<10	<10
N-nitroso-n-butylamine	µg/L	<10	<10
Safrole	µg/L	<10	<10
1,2,4,5-Tetrachlorobenzene	µg/L	<10	<10
Trans-iso-safrole	µg/L	<10	<10
1,3-Dinitrobenzene	µg/L	<10	<10
Pentachlorobenzene	µg/L	<10	<10
1-Naphthylamine	µg/L	<10	<10
2,3,4,6-Tetrachlorophenol	µg/L	<10	<10
2-Naphthylamine	µg/L	<10	<10
5-Nitro-o-toluidine	µg/L	<10	<10
Diphenylamine	µg/L	<10	<10
Phenacetin	µg/L	<10	<10

SVOC's in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ------------- ------------	78151-6 MIDSTREAM 29/08/2012 Water	78151-7 DOWNSTREAM 29/08/2012 Water
Pentachloronitrobenzene	µg/L	<10	<10
Dinoseb	µg/L	<10	<10
Methapyrilene	µg/L	<10	<10
p-Dimethylaminoazobenzene	µg/L	<10	<10
2-Acetylaminofluorene	µg/L	<10	<10
7,12-Dimethylbenz(a)anthracene	µg/L	<10	<10
3-Methylcholanthrene	µg/L	<10	<10
a-BHC	µg/L	<10	<10
b-BHC	µg/L	<10	<10
g-BHC	µg/L	<10	<10
d-BHC	µg/L	<10	<10
Heptachlor	µg/L	<10	<10
Aldrin	µg/L	<10	<10
Heptachlor Epoxide	µg/L	<10	<10
g-Chlordane	µg/L	<10	<10
a-Chlordane	µg/L	<10	<10
Endosulfan I	µg/L	<10	<10
p,p'-DDE	µg/L	<10	<10
Dieldrin	µg/L	<10	<10
Endrin	µg/L	<10	<10
p,p'-DDD	µg/L	<10	<10
Endosulfan II	µg/L	<10	<10
Endrin Aldehyde	µg/L	<10	<10
p,p'-DDT	µg/L	<10	<10
Endosulfan Sulphate	µg/L	<10	<10
Surrogate 2-fluorophenol	%	62	77
Surrogate Phenol-d_6	%	47	48
Surrogate Nitrobenzene-d_5	%	93	104
Surrogate 2-fluorobiphenyl	%	77	87
Surrogate 2,4,6-Tribromophenol	%	130	130
Surrogate p-Terphenyl-d_{14}	%	89	102

HM in water - dissolved Our Reference: Your Reference Date Sampled Type of sample	UNITS ------------- ------------	78151-1 DR1 28/08/2012 Water	78151-2 DR2 28/08/2012 Water	78151-3 DR3 28/08/2012 Water	78151-4 QC01 28/08/2012 Water
Date prepared	-	31/08/2012	31/08/2012	31/08/2012	31/08/2012
Date analysed	-	03/09/2012	03/09/2012	03/09/2012	03/09/2012
Arsenic-Dissolved	µg/L	1	<1	1	<1
Cadmium-Dissolved	µg/L	0.6	<0.1	<0.1	<0.1
Chromium-Dissolved	µg/L	<1	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	5	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1
Mercury-Dissolved	µg/L	<0.050	<0.050	<0.050	<0.050
Nickel-Dissolved	µg/L	120	9	20	9
Zinc-Dissolved	µg/L	170	57	18	44

Miscellaneous Inorganics Our Reference: Your Reference Date Sampled Type of sample	UNITS ------------- ------------	78151-1 DR1 28/08/2012 Water	78151-2 DR2 28/08/2012 Water	78151-3 DR3 28/08/2012 Water	78151-4 QC01 28/08/2012 Water	78151-5 UPSTREAM 29/08/2012 Water
Date prepared	-	30/08/2012	30/08/2012	30/08/2012	30/08/2012	30/08/2012
Date analysed	-	30/08/2012	30/08/2012	30/08/2012	30/08/2012	30/08/2012
pH	pH Units	5.1	6.0	6.5	6.0	6.2
Electrical Conductivity	µS/cm	2,000	1,900	3,400	1,900	230
Total Cyanide	mg/L	<0.004	<0.004	0.061	<0.004	<0.004
Fluoride, F	mg/L	0.18	0.14	10	0.15	2.4

Miscellaneous Inorganics Our Reference: Your Reference Date Sampled Type of sample	UNITS ------------- ------------	78151-6 MIDSTREAM 29/08/2012 Water	78151-7 DOWNSTREAM 29/08/2012 Water
Date prepared	-	30/08/2012	30/08/2012
Date analysed	-	30/08/2012	30/08/2012
pH	pH Units	6.5	6.6
Electrical Conductivity	µS/cm	260	240
Total Cyanide	mg/L	<0.004	<0.004
Fluoride, F	mg/L	3.6	2.7

HM in water - total Our Reference: Your Reference	UNITS -------------	78151-5 UPSTREAM	78151-6 MIDSTREAM	78151-7 DOWNSTREAM
Date Sampled	------------	29/08/2012	29/08/2012	29/08/2012
Type of sample		Water	Water	Water
Date prepared	-	31/08/2012	31/08/2012	31/08/2012
Date analysed	-	03/09/2012	03/09/2012	03/09/2012
Arsenic-Total	µg/L	3	12	15
Cadmium-Total	µg/L	<0.1	0.3	0.6
Chromium-Total	µg/L	2	5	4
Copper-Total	µg/L	3	10	20
Lead-Total	µg/L	4	9	10
Mercury-Total	µg/L	<0.05	0.4	0.2
Nickel-Total	µg/L	19	38	67
Zinc-Total	µg/L	74	160	210

Ion Balance Our Reference: Your Reference Date Sampled Type of sample	UNITS ------------- ------------	78151-1 DR1 28/08/2012 Water	78151-2 DR2 28/08/2012 Water	78151-3 DR3 28/08/2012 Water
Date prepared	-	30/08/2012	30/08/2012	30/08/2012
Date analysed	-	30/08/2012	30/08/2012	30/08/2012
Calcium - Dissolved	mg/L	5.6	14	24
Potassium - Dissolved	mg/L	7.5	5.3	4.9
Sodium - Dissolved	mg/L	310	320	710
Magnesium - Dissolved	mg/L	34	15	36
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	8	56	530
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	8	56	530
Sulphate, SO4	mg/L	120	210	650
Chloride, Cl	mg/L	530	400	330
Ionic Balance	%	-2.5	-2.3	2.2

Method ID	Methodology Summary
Org-012 subset	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell and dedicated meter, in accordance with APHA 22nd ED 2510 and Rayment & Lyons.
Inorg-013	Cyanide - total determined colourimetrically after distillation, based on APHA 22nd ED, 4500-CN_C,E. Free cyanide determined colourimetrically after filtration and confirmed by diffusion.
Inorg-026	Fluoride determined by ion selective electrode (ISE) in accordance with APHA 22nd ED, 4500-F-C.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA 22nd ED, 2320-B.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 22nd ED, 4110-B.
Inorg-041	Gravimetric determination of the total solids content of water using APHA 22nd ED 2540B.

QUALITY CONTROL PAHs in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			04/09/2012	[NT]	[NT]	LCS-W1	04/09/2012
Date analysed	-			05/09/2012	[NT]	[NT]	LCS-W1	05/09/2012
Naphthalene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	101%
Acenaphthylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	94%
Phenanthrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	87%
Anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	86%
Pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	98%
Benzo(a)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	90%
Benzo(b+k)fluoranthene	µg/L	2	Org-012 subset	<2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	LCS-W1	93%
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	1	Org-012 subset	<1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d_{14}	%		Org-012 subset	84	[NT]	[NT]	LCS-W1	105%

QUALITY CONTROL SVOC's in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			04/09/2012	[NT]	[NT]	LCS-W1	04/09/2012
Date analysed	-			05/09/2012	[NT]	[NT]	LCS-W1	05/09/2012
Phenol	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	43%
Bis (2-chloroethyl) ether	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2-Chlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	97%
1,3-Dichlorobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
1,4-Dichlorobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	103%
2-Methylphenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
1,2-Dichlorobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
bis-(2-Chloroisopropyl) ether	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
3/4-Methylphenol	µg/L	20	Org-012	<20	[NT]	[NT]	[NR]	[NR]
N-nitrosodi-n-propylamine	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Hexachloroethane	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Nitrobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Isophorone	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4-Dimethylphenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2-Nitrophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
bis (2-Chloroethoxy) methane	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4-Dichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
1,2,4-Trichlorobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Naphthalene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
4-Chloroaniline	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Hexachlorobutadiene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2-Methylnaphthalene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Hexachlorocyclopentadiene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4,6-Trichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,4,5-Trichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2-Chloronaphthalene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2-Nitroaniline	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Dimethyl phthalate	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	111%
2,6-Dinitrotoluene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Acenaphthylene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
3-Nitroaniline	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	105%
2,4-Dinitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	[NR]	[NR]
4-Nitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	LCS-W1	53%
Dibenzofuran	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Diethylphthalate	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	104%
4-Chlorophenylphenylether	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
4-Nitroaniline	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL SVOC's in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Fluorene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2-methyl-4,6-dinitrophenol	µg/L	100	Org-012	<100	[NT]	[NT]	[NR]	[NR]
Azobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
4-Bromophenylphenylether	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Hexachlorobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Pentachlorophenol	µg/L	100	Org-012	<100	[NT]	[NT]	[NR]	[NR]
Phenanthrene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Anthracene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Carbazole	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Di-n-butylphthalate	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Pyrene	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	100%
Butylbenzylphthalate	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Bis(2-ethylhexyl) phthalate	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Benzo(a)anthracene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Di-n-octylphthalate	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Benzo(b)fluoranthene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Benzo(k)fluoranthene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Indeno(1,2,3-c,d)pyrene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Ethylmethanesulfonate	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Aniline	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Pentachloroethane	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Benzyl alcohol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Acetophenone	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
N-nitrosomorpholine	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
N-nitrosopiperidine	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,6-Dichlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Hexachloropropene-1	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
N-nitroso-n-butylamine	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Safrole	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
1,2,4,5-Tetrachlorobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Trans-iso-safrole	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
1,3-Dinitrobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Pentachlorobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
1-Naphthylamine	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2,3,4,6-Tetrachlorophenol	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2-Naphthylamine	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
5-Nitro-o-toluidine	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL SVOC's in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Diphenylamine	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Phenacetin	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Pentachloronitrobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Dinoseb	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Methapyrilene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
p-Dimethylaminoazobenzene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
2-Acetylaminofluorene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
7,12-Dimethylbenz(a) anthracene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
3-Methylcholanthrene	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
a-BHC	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
b-BHC	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
g-BHC	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
d-BHC	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Heptachlor	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Aldrin	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	89%
Heptachlor Epoxide	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
g-Chlordane	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
a-Chlordane	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Endosulfan I	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
p,p'-DDE	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Dieldrin	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Endrin	µg/L	10	Org-012	<10	[NT]	[NT]	LCS-W1	80%
p,p'-DDD	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Endosulfan II	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
p,p'-DDT	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	µg/L	10	Org-012	<10	[NT]	[NT]	[NR]	[NR]
Surrogate 2-fluorophenol	%		Org-012	63	[NT]	[NT]	LCS-W1	66%
Surrogate Phenol-d_6	%		Org-012	43	[NT]	[NT]	LCS-W1	50%
Surrogate Nitrobenzene-d_5	%		Org-012	99	[NT]	[NT]	LCS-W1	102%
Surrogate 2-fluorobiphenyl	%		Org-012	93	[NT]	[NT]	LCS-W1	106%
Surrogate 2,4,6-Tribromophenol	%		Org-012	81	[NT]	[NT]	LCS-W1	117%
Surrogate *p*-Terphenyl-d_{14}	%		Org-012	91	[NT]	[NT]	LCS-W1	104%

QUALITY CONTROL HM in water - dissolved	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			31/08/2012	[NT]	[NT]	LCS-W1	31/08/2012
Date analysed	-			03/09/2012	[NT]	[NT]	LCS-W1	03/09/2012
Arsenic-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	107%
Cadmium-Dissolved	µg/L	0.1	Metals-022 ICP-MS	<0.1	[NT]	[NT]	LCS-W1	109%
Chromium-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	105%
Copper-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	108%
Lead-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	104%
Mercury-Dissolved	µg/L	0.05	Metals-021 CV-AAS	<0.050	[NT]	[NT]	LCS-W1	100%
Nickel-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	108%
Zinc-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	108%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			[NT]	78151-1	30/08/2012 || 30/08/2012	LCS-W1	30/08/2012
Date analysed	-			[NT]	78151-1	30/08/2012 || 30/08/2012	LCS-W1	30/08/2012
pH	pH Units		Inorg-001	[NT]	78151-1	5.1 || [N/T]	LCS-W1	101%
Electrical Conductivity	µS/cm	1	Inorg-002	<1	78151-1	2000 || [N/T]	LCS-W1	104%
Total Cyanide	mg/L	0.004	Inorg-013	<0.004	78151-1	<0.004 || <0.004	LCS-W1	106%
Fluoride, F	mg/L	0.1	Inorg-026	<0.1	78151-1	0.18 || 0.18 || RPD: 0	LCS-W1	91%

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	-			31/08/2012	78151-5	31/08/2012 || 31/08/2012	LCS-W1	31/08/2012
Date analysed	-			03/09/2012	78151-5	03/09/2012 || 03/09/2012	LCS-W1	03/09/2012
Arsenic-Total	µg/L	1	Metals-022 ICP-MS	<1	78151-5	3 || 3 || RPD: 0	LCS-W1	104%
Cadmium-Total	µg/L	0.1	Metals-022 ICP-MS	<0.1	78151-5	<0.1 || <0.1	LCS-W1	107%
Chromium-Total	µg/L	1	Metals-022 ICP-MS	<1	78151-5	2 || 2 || RPD: 0	LCS-W1	101%
Copper-Total	µg/L	1	Metals-022 ICP-MS	<1	78151-5	3 || 3 || RPD: 0	LCS-W1	98%
Lead-Total	µg/L	1	Metals-022 ICP-MS	<1	78151-5	4 || 4 || RPD: 0	LCS-W1	106%
Mercury-Total	µg/L	0.05	Metals-021 CV-AAS	<0.05	78151-5	<0.05 || [N/T]	LCS-W1	104%
Nickel-Total	µg/L	1	Metals-022 ICP-MS	<1	78151-5	19 || 19 || RPD: 0	LCS-W1	98%

QUALITY CONTROL HM in water - total	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Zinc-Total	µg/L	1	Metals-022 ICP-MS	<1	78151-5	74 || 95 || RPD: 25	LCS-W1	103%

QUALITY CONTROL Ion Balance	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			[NT]	78151-1	30/08/2012 || 30/08/2012	LCS-W1	30/08/2012
Date analysed	-			[NT]	78151-1	30/08/2012 || 30/08/2012	LCS-W1	30/08/2012
Calcium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	78151-1	5.6 || [N/T]	LCS-W1	97%
Potassium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	78151-1	7.5 || [N/T]	LCS-W1	102%
Sodium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	78151-1	310 || [N/T]	LCS-W1	105%
Magnesium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	78151-1	34 || [N/T]	LCS-W1	93%
Hydroxide Alkalinity (OH$^-$) as CaCO$_3$	mg/L	5	Inorg-006	<5	78151-1	<5 || [N/T]	[NR]	[NR]
Bicarbonate Alkalinity as CaCO$_3$	mg/L	5	Inorg-006	<5	78151-1	8 || [N/T]	[NR]	[NR]
Carbonate Alkalinity as CaCO$_3$	mg/L	5	Inorg-006	<5	78151-1	<5 || [N/T]	[NR]	[NR]
Total Alkalinity as CaCO$_3$	mg/L	5	Inorg-006	<5	78151-1	8 || [N/T]	LCS-W1	105%
Sulphate, SO4	mg/L	1	Inorg-081	<1	78151-1	120 || 120 || RPD: 0	LCS-W1	103%
Chloride, Cl	mg/L	1	Inorg-081	<1	78151-1	530 || 520 || RPD: 2	LCS-W1	95%
Ionic Balance	%		Inorg-041	[NT]	78151-1	-2.5 || [N/T]	[NR]	[NR]

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	78151-2	30/08/2012
Date analysed	-	[NT]	[NT]	78151-2	30/08/2012
pH	pH Units	[NT]	[NT]	[NR]	[NR]
Electrical Conductivity	µS/cm	[NT]	[NT]	[NR]	[NR]
Total Cyanide	mg/L	[NT]	[NT]	78151-2	102%
Fluoride, F	mg/L	[NT]	[NT]	78151-2	91%

QUALITY CONTROL HM in water - total	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	78151-6	31/08/2012
Date analysed	-	[NT]	[NT]	78151-6	03/09/2012
Arsenic-Total	µg/L	[NT]	[NT]	78151-6	110%
Cadmium-Total	µg/L	[NT]	[NT]	78151-6	104%
Chromium-Total	µg/L	[NT]	[NT]	78151-6	98%
Copper-Total	µg/L	[NT]	[NT]	78151-6	90%
Lead-Total	µg/L	[NT]	[NT]	78151-6	96%
Mercury-Total	µg/L	[NT]	[NT]	[NR]	[NR]
Nickel-Total	µg/L	[NT]	[NT]	78151-6	88%
Zinc-Total	µg/L	[NT]	[NT]	78151-6	#

QUALITY CONTROL Ion Balance	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	78151-2	30/08/2012
Date analysed	-	[NT]	[NT]	78151-2	30/08/2012
Calcium - Dissolved	mg/L	[NT]	[NT]	[NR]	[NR]
Potassium - Dissolved	mg/L	[NT]	[NT]	[NR]	[NR]
Sodium - Dissolved	mg/L	[NT]	[NT]	[NR]	[NR]
Magnesium - Dissolved	mg/L	[NT]	[NT]	[NR]	[NR]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	[NT]	[NT]	[NR]	[NR]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	[NT]	[NT]	[NR]	[NR]
Carbonate Alkalinity as $CaCO_3$	mg/L	[NT]	[NT]	[NR]	[NR]
Total Alkalinity as $CaCO_3$	mg/L	[NT]	[NT]	[NR]	[NR]
Sulphate, SO4	mg/L	[NT]	[NT]	78151-2	115%
Chloride, Cl	mg/L	[NT]	[NT]	78151-2	76%
Ionic Balance	%	[NT]	[NT]	[NR]	[NR]

Report Comments:

Trace Elements:# 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
NA: Test not required
<: Less than
PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than
NT: Not tested
NA: Test not required
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 batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

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

ALS Group
Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1218770**	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	: AS130309C DICKSON ROAD	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 01-AUG-2012
Sampler	: ----	Issue Date	: 08-AUG-2012
Site	: ----		
		No. of samples received	: 1
Quote number	: SY/285/10	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.

WORLD RECOGNISED ACCREDITATION

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*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Dianne Blane	Laboratory Supervisor	Newcastle
Sarah Millington	Senior Inorganic 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

- **EG005T: Poor precision was obtained for Zinc on sample ES1218733#1 due to sample heterogeneity. Results have been confirmed by re-extraction and reanalysis.**

Analytical Results

Sub-Matrix: **SOIL**			*Client sample ID*	**DUPB1**	----	----	----	----
			Client sampling date / time	26-JUL-2012 15:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES1218770-001**	**----**	**----**	**----**	**----**
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	**11.4**	----	----	----	----
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**5040**	----	----	----	----
Arsenic	7440-38-2	5	mg/kg	<5	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	**4**	----	----	----	----
Copper	7440-50-8	5	mg/kg	**7**	----	----	----	----
Lead	7439-92-1	5	mg/kg	**7**	----	----	----	----
Nickel	7440-02-0	2	mg/kg	**6**	----	----	----	----
Zinc	7440-66-6	5	mg/kg	**33**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	1	mg/kg	<1	----	----	----	----
EK040T: Fluoride Total								
Fluoride	16984-48-8	40	mg/kg	**640**	----	----	----	----

Environmental Division

QUALITY CONTROL REPORT

Work Order : **ES1218770**

Client : **ENVIRON AUSTRALIA PTY LTD**
Contact : KIRSTY GREENFIELD
Address : PO BOX 564
MAITLAND NSW, AUSTRALIA 2320

E-mail : kgreenfield@environcorp.com.au
Telephone : +61 02 49344354
Facsimile : +61 02 49344359

Project : AS130309C DICKSON ROAD
Site : ----
C-O-C number : ----
Sampler : ----
Order number : ----

Quote number : SY/285/10

Page : 1 of 5

Laboratory : Environmental Division Sydney
Contact : Client Services
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164

E-mail : sydney@alsglobal.com
Telephone : +61-2-8784 8555
Facsimile : +61-2-8784 8500

QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Date Samples Received : 01-AUG-2012
Issue Date : 08-AUG-2012

No. of samples received : 1
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
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 in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Dianne Blane	Laboratory Supervisor	Newcastle
Sarah Millington	Senior Inorganic 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (QC Lot: 2432951)									
ES1218749-003	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	81.4	81.9	0.6	0% - 20%
ES1218826-012	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	14.0	13.2	5.6	0% - 50%
EG005T: Total Metals by ICP-AES (QC Lot: 2434573)									
ES1218353-004	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	8	8	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	6	6	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	6	8	16.2	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	14	15	9.4	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	12	16	25.4	No Limit
		EG005T: Aluminium	7429-90-5	50	mg/kg	7280	7480	2.6	0% - 20%
ES1218733-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	14	11	25.6	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	10	8	27.3	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	371	370	0.0	0% - 20%
		EG005T: Copper	7440-50-8	5	mg/kg	38	14	93.4	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	39	15	89.4	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	139	104	# 28.3	0% - 20%
		EG005T: Aluminium	7429-90-5	50	mg/kg	2700	2320	15.1	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2434574)									
ES1218353-004	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	0.1	0.2	0.0	No Limit
ES1218733-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	0.2	0.1	0.0	No Limit
EK026G: Total Cyanide By Discrete Analyser (QC Lot: 2431293)									
ES1218326-001	Anonymous	EK026G: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.0	No Limit
ES1218746-008	Anonymous	EK026G: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.0	No Limit
EK040T: Fluoride Total (QC Lot: 2440049)									
ES1218770-001	DUPB1	EK040T: Fluoride	16984-48-8	40	mg/kg	640	660	2.9	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: **SOIL**

				Method Blank (MB) Report	*Laboratory Control Spike (LCS) Report*			
					Spike	*Spike Recovery (%)*	*Recovery Limits (%)*	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EG005T: Total Metals by ICP-AES (QCLot: 2434573)								
EG005T: Aluminium	7429-90-5	50	mg/kg	<50	6134 mg/kg	87.2	----	----
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	96.0	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	90.8	----	----
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	87.7	----	----
EG005T: Copper	7440-50-8	5	mg/kg	<5	32.0 mg/kg	90.3	----	----
EG005T: Lead	7439-92-1	5	mg/kg	<5	40.0 mg/kg	92.3	----	----
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.0 mg/kg	89.5	----	----
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	94.8	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2434574)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	85.5	----	----
EK026G: Total Cyanide By Discrete Analyser (QCLot: 2431293)								
EK026G: Total Cyanide	57-12-5	1	mg/kg	<1	25 mg/kg	98.4	70	130
EK040T: Fluoride Total (QCLot: 2440049)								
EK040T: Fluoride	16984-48-8	40	mg/kg	<40	950 mg/kg	84.6	69	107

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	*Spike Recovery (%)*	*Recovery Limits (%)*	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG005T: Total Metals by ICP-AES (QCLot: 2434573)							
ES1218353-004	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	99.7	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	98.4	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	101	70	130
		EG005T: Copper	7440-50-8	250 mg/kg	103	70	130
		EG005T: Lead	7439-92-1	250 mg/kg	99.8	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	102	70	130
		EG005T: Zinc	7440-66-6	250 mg/kg	99.0	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2434574)							
ES1218353-004	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	71.9	70	130
EK026G: Total Cyanide By Discrete Analyser (QCLot: 2431293)							

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK026G: Total Cyanide By Discrete Analyser (QCLot: 2431293) - continued							
ES1218326-001	Anonymous	EK026G: Total Cyanide	57-12-5	25 mg/kg	96.0	70	130
EK040T: Fluoride Total (QCLot: 2440049)							
ES1218770-001	DUPB1	EK040T: Fluoride	16984-48-8	400 mg/kg	108	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: **SOIL**

				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
EK026G: Total Cyanide By Discrete Analyser (QCLot: 2431293)										
ES1218326-001	Anonymous	EK026G: Total Cyanide	57-12-5	25 mg/kg	96.0	----	70	130	----	----
EG005T: Total Metals by ICP-AES (QCLot: 2434573)										
ES1218353-004	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	99.7	----	70	130	----	----
		EG005T: Cadmium	7440-43-9	50 mg/kg	98.4	----	70	130	----	----
		EG005T: Chromium	7440-47-3	50 mg/kg	101	----	70	130	----	----
		EG005T: Copper	7440-50-8	250 mg/kg	103	----	70	130	----	----
		EG005T: Lead	7439-92-1	250 mg/kg	99.8	----	70	130	----	----
		EG005T: Nickel	7440-02-0	50 mg/kg	102	----	70	130	----	----
		EG005T: Zinc	7440-66-6	250 mg/kg	99.0	----	70	130	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2434574)										
ES1218353-004	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	71.9	----	70	130	----	----
EK040T: Fluoride Total (QCLot: 2440049)										
ES1218770-001	DUPB1	EK040T: Fluoride	16984-48-8	400 mg/kg	108	----	70	130	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1218770**	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	: AS130309C DICKSON ROAD	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 01-AUG-2012
Sampler	: ----	Issue Date	: 08-AUG-2012
Order number	: ----		
		No. of samples received	: 1
Quote number	: SY/285/10	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

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non -volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

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

Method *Container / Client Sample ID(s)*	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103) DUPB1	**26-JUL-2012**	**----**	----	----	**03-AUG-2012**	09-AUG-2012	✓
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) DUPB1	**26-JUL-2012**	**03-AUG-2012**	22-JAN-2013	✓	**06-AUG-2012**	22-JAN-2013	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) DUPB1	**26-JUL-2012**	**03-AUG-2012**	23-AUG-2012	✓	**06-AUG-2012**	23-AUG-2012	✓
EK026G: Total Cyanide By Discrete Analyser							
Soil Glass Jar - Unpreserved (EK026G) DUPB1	**26-JUL-2012**	**02-AUG-2012**	02-AUG-2012	✓	**03-AUG-2012**	16-AUG-2012	✓
EK040T: Fluoride Total							
Pulp Bag (EK040T) DUPB1	**26-JUL-2012**	**02-AUG-2012**	02-AUG-2012	✓	**08-AUG-2012**	02-AUG-2012	×

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(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

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

Quality Control Sample Type		*Count*		*Rate (%)*			*Quality Control Specification*
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	16	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Cyanide By Discrete Analyser	EK026G	2	15	**13.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Fluoride	EK040T	1	7	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	16	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Total Cyanide By Discrete Analyser	EK026G	1	15	**6.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Fluoride	EK040T	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	16	**6.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Total Cyanide By Discrete Analyser	EK026G	1	15	**6.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Fluoride	EK040T	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	16	**6.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Total Cyanide By Discrete Analyser	EK026G	1	15	**6.7**	**5.0**	✓	ALS QCS3 requirement
Total Fluoride	EK040T	1	7	**14.3**	**5.0**	✓	ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	16	**6.3**	**5.0**	✓	ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	20	**5.0**	**5.0**	✓	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*
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2010 Draft) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (1999) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3)
Total Cyanide By Discrete Analyser	EK026G	SOIL	APHA 21st 4500 CN - C & N. Caustic leach extracts of the sample are distilled with sulfuric acid, converting all CN species to HCN. The distillates are analyzed for CN by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Method 403)
Total Fluoride	EK040T	SOIL	(In-house) Total fluoride is determined by ion specific electrode (ISE) in a solution obtained after a Sodium Carbonate / Potassium Carbonate fusion dissolution.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
NaOH leach for TCN in Soils	EK026PR	SOIL	APHA 21st ed., 4500 CN- C & N. Samples are extracted by end-over-end tumbling with NaOH.
Total Fluoride	EK040T-PR	SOIL	(In-house) Samples are fused with Sodium Carbonate / Potassium Carbonate flux.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	USEPA 200.2 Mod. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (1999) Schedule B(3) (Method 202)

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 SW846 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

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	**Analyte**	CAS Number	Data	Limits	**Comment**
Duplicate (DUP) RPDs							
EG005T: Total Metals by ICP-AES	ES1218733-001	Anonymous	**Zinc**	7440-66-6	28.3 %	0-20%	**RPD exceeds LOR based limits**

- **For all matrices, no Method Blank value 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.

Matrix: **SOIL**

Method	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EK040T: Fluoride Total						
Pulp Bag DUPB1	----	----	----	08-AUG-2012	02-AUG-2012	**6**

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.**

750-751

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP

Client: ENVIRON
Contact person: KIRSTY GREENFIELD
Project Mgr:
Sampler:
Address:
Phone:
Fax:
Email:

Client Project Name / Number / Site etc (ie report title): AS130309C DICKSON ROAD
PO No.:
Envirolab Quote No. :
Date results required:
Or choose: standard / 1 day / 2 day / 3 day
Note: Inform lab in advance if urgent turnaround is required - surcharge applies
Lab comments:

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: Shuk Li

Environmental Division
Sydney
Work Order
ES1218770
Telephone : +61-2-8784 8555

Sample information				Tests Required							Comments
Envirolab Sample ID	Client Sample ID or information	Date sampled	Type of sample	ALUMINIUM	FLUORIDE	CYANIDE	PAH	TPH	HEAVY METALS 8	HOLD	Provide as much information about the sample as you can
27	TP15: 0.6-0.8	26/7/12	SOIL	X	X	X			X	~~X~~	
28	TP16: 0.4-0.6			X	X	X	X	X	X		
29	TP16: 1.5-1.6									X	
30	DUP A									X	
31	DUP B			X	X	X			X		
32	DUP B1			X	X	X			X		→ ALS forward to ALS
33	DUP C			X	X	X	X	X	X	~~X~~	
34	DUP D									X	
35	DUP D1									X	

Relinquished by (company): ERS
Print Name: Sophie
Date & Time: 01/08 11:30
Signature:

Received by (company): ELS
Print Name: SS
Date & Time: 31/7
Signature:

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

Form: 302 - Chain of Custody-Client, Issued 16/03/10, Version 4, Page 1 of 1.

Received by ALS

01-8-12 14:40 11.4°C
76609