Intended for

Hydro Aluminium Kurri Kurri Pty Ltd

Document type

Final Report

Date

December, 2020

KURRI KURRI ALUMINIUM SMELTER DECOMMISSIONING, DEMOLITION AND REMEDIATION SOIL AND WATER MANAGEMENT PLAN

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Ref **318000533**

Document ID Hydro Kurri Kurri EMP_Appendix F_FINAL_Soil and Water

Management Plan_20201223

Revision Final Rev 0
Date 23/12/2020

Made by C Whitehill/ T Jackson

Checked by **S Taylor**Approved by **F Robinson**

Description Ramboll Australia was engaged by Hydro Aluminium Kurri Kurri Pty

Ltd to prepare a Remediation Works Environmental Management Plan (RWEMP) to describe how environmental management will be undertaken at the former Hydro Aluminium Kurri Kurri aluminium

smelter at Hart Road Loxford, NSW and the surrounding land owned by Hydro. This Soil and Water Management Plan (SWMP) forms a

component of the RWEMP.

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CONTENTS

ACRONY	MS AND ABBREVIATIONS	I
GLOSSA	RY	II
1.	INTRODUCTION	1
1.1	Background	1
1.2	Objectives	1
1.3	Purpose and Scope	1
1.4	Regulatory Requirements	1
1.4.1	Project Approval	1
1.4.2	Environmental Protection Licence	5
2.	EXISTING ENVIRONMENT AND POTENTIAL IMPACTS	7
2.1	Existing Environment	7
2.1.1	Soils and Geology	7
2.1.1.1	Contaminated Soils	7
2.1.2	Surface Water	7
2.1.3	Groundwater	9
2.1.4	Water Supply and Use	11
2.1.5	Wastewater	11
2.2	Potential Impacts	11
2.2.1	Erosion and Sedimentation	11
2.2.2	Leachate	13
2.2.3	Water Quality and Hydrology	13
2.2.4	Groundwater	13
3.	IMPLEMENTATION	14
3.1	Roles and Responsibilities	14
3.2	Management Measures	15
4.	MONITORING AND REVIEW	21
4.1	Monitoring	21
4.1.1	Surface Water	21
4.1.2	Irrigation	21
4.1.3	Groundwater Monitoring	21
4.1.4	Monitoring Program	22
4.1.5	Soil and Water Management	23
4.2	Reporting	23
4.3	Non-conformances	23
4.4	Complaints	23
4.5	Review and Improvement	23
5.	REFERENCES	26
6.	LIMITATIONS	27
6.1	User Reliance	27

FIGURES

Figure 2-1	Smelter Contaminated Soils Locations	8
Figure 2-2	Existing Smelter Water Management System	. 10
Figure 2-3	Smelter Stockpiling Areas	. 12
Figure 4-1	Surface Water Monitoring Locations	. 24
Figure 4-2	Groundwater Monitoring Locations	. 25
TABLES		
Table 1-1: F	Relevant Project Approval Conditions	3
Table 1-2: F	Relevant EPL Conditions	6
Table 3-1: H	Hydro Personnel and Environmental Management Responsibilities	. 14
Table 3-2: 9	Soil and Water Management Measures	. 16
Table 4-1: 9	Surface Water and Groundwater Monitoring Commitments	. 22

APPENDICES

Appendix 1

Leachate Management Plan

Appendix 2

Contaminated Soils Management Plan

Appendix 3

Initial Remediation Erosion and Sediment Control Plan

ACRONYMS AND ABBREVIATIONS

bgs below ground surface

CN Cyanide

DA Development Application

EC Electrical Conductivity

EMP Environmental Management Plan

EP&A Act Environmental Planning and Assessment Act 1979

EPL Environment Protection Licence

F Fluoride

Hydro Hydro Aluminium Kurri Kurri Pty Ltd

HWC Hunter Water Corporation

LMP Leachate Management Plan

POEO Act Protection of the Environment Operations Act 1997

RAP Remedial Action Plan

RWEMP Remediation Works Environmental Management Plan

SEPP 55 State Environmental Planning Policy 55: Remediation of Land

SSD State Significant Development

SWMP Soil and Water Management Plan

TDS Total Dissolved Solids

TSS Total Suspended Solids

WHS Workplace Health and Safety

GLOSSARY

Council Cessnock City Council

The Department The Department of Planning, Industry and the Environment

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, a 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 Soil and Water Management Plan (SWMP) has been prepared by Ramboll Australia Pty Ltd on behalf of Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to support the Remediation Works Environmental Management Plan (RWEMP) which addresses 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 SWMP are to:

- Detail the controls to be implemented to manage soil and water quality impacts.
- Provide a program to monitor soil and water quality impacts at the Smelter and Hydro Land.
- Provide a mechanism to assess performance against the relevant water quality impact assessment criteria.
- Detail the requirement for reporting exceedances of water quality impact assessment criteria.
- Establish the roles and responsibilities of all parties involved in soil and water quality management.
- Establish supervision, monitoring and reporting framework for the SWMP.

1.3 Purpose and Scope

The purpose of the SWMP is to:

- Specify management procedures for soil and water related issues and impacts during activities at the Smelter and on the Hydro Land, and
- Satisfy the relevant conditions of the development consent for demolition activities (DA 8/2015/399/1; DA 8/2018/45/1)
- Satisfy the relevant conditions of the development consent for remediation activities (SSD 6666)
- Satisfy the relevant conditions of the Environment Protection Licence (EPL) 1548.

1.4 Regulatory Requirements

1.4.1 Project Approval

A list of the development consent conditions related to soil and water management and where they are addressed in this document are outlined in

Table 1-1.

Table 1-1: Relevant Project Approval Conditions

No.	Condition	Location in SWMP		
SSD 6666				
	SOILS, WATER QUALITY AND HYDROLOGY			
	Imported Material for Containment Cell Construction			
B15	The Applicant must:	N/A		
B15(a)	ensure that only VENM, ENM, or other material approved in writing by EPA or site auditor is brought onto the site;	Table 3-2		
B15(b)	keep accurate records of the volume and type of fill to be used; and	Table 3-2		
B15(c)	make these records available to the Planning Secretary upon request.	Table 3-2		
	Erosion and Sediment Control			
B16	Prior to the commencement of any construction or other surface disturbance the Applicant must install and maintain suitable erosion and sediment control measures on-site, in accordance with the relevant requirements of the <i>Managing Urban Stormwater: Soils and Construction - Volume 1: Blue Book</i> (Landcom, 2004) guideline and the Erosion and Sediment Control Plan included in the RWEMP required by Condition C2.			
	Stormwater Management System			
B17	Prior to the completion of remediation works, the Applicant must design, install and operate a stormwater management system for the Containment Cell. The stormwater management system must:	N/A		
B17(a)	be designed by a suitably qualified and experienced person(s);	Table 3-2		
B17(b)	be prepared in consultation with the relevant council;	Table 3-2		
B17(c)	be generally in accordance with the conceptual design in the EIS;	Table 3-2		
B17(d)	be in accordance with applicable Australian Standards; and	Table 3-2		
B17(e)	ensure that the system capacity has been designed in accordance with <i>Australian Rainfall</i> and <i>Runoff</i> (Engineers Australia, 2016) and <i>Managing Urban Stormwater: Council Handbook</i> (EPA, 1997) guidelines.	Table 3-2		
B18	Within two months of the completion of remediation works or within another timeframe agreed by the Planning Secretary, works-as-executed drawings signed by a registered surveyor must be submitted to the Site Auditor demonstrating that the stormwater drainage and finished ground levels have been constructed as detailed in the RAP.	Table 3-2		
B19	The stormwater management system must be operated and maintained for the duration of the containment cell.	Table 3-2		
	Pollution of Water	Table 3-2		
B20	The development must comply with section 120 of the POEO Act, which prohibits the pollution of waters, except as expressly provided for in an EPL.	Table 3-2		
B21	Any servicing or repair work of motor vehicles or mobile plant must be carried out within a sealed area that has environmental controls appropriate for servicing or repair work. This must include bunding where this work could result in liquids being spilled.	Table 3-2		

No.	Condition	Location in SWMP
DA 8/20	015/399/1	
10	Submit to Council an Environmental Management Plan (EMP) for review and written authorisation. The EMP shall contain, but not be limited to, the following specialist plans: Air Quality Management Plan, Noise and Vibration Management Plan, Waste Management, Soil and Water Management Plan, Demolition Strategy, Traffic Management Plan, Stakeholder Engagement and Notification Plan; Work Health and Safety Management Plan; and Heritage Management Measures and shall include, among other things, legislative and regulatory requirements; responsibilities for implementation of the management measures; and the monitoring, recording and improvement for environmental management performance.	This SWMP
12	The applicant must prepare a Soil and Water Management Plan (SWMP) incorporating the following matters.	
	a) Minimise the area of soils exposed ay any one time	Table 3-2
	b) Conservation of top soil	Table 3-2
	c) Identify and protect proposed stockpile locations	Appendix 6
	d) Identify the locations for storage of the various waste streams	Appendix 6
	e) Identify the management measures to be applied to the material and at the storage location	Table 3-2
	f) Prevent soil, sand, sediments leaving the site in an uncontrolled manner	Table 3-2
	 g) Control surface water flows through the site in a manner that: i) Diverts clean runoff around disturbed areas ii) Minimises slope gradient and flow distance within disturbed areas iii) Ensures surface run-off occurs at non erodible velocities iv) Ensures disturbed areas are promptly rehabilitated 	
	h) Sediment and erosion control measures in place before work commences	
	i) Materials are not tracked onto the road by vehicles entering or leaving the site	
	j) Details of drainage to protect and drain the site during works	
DA 8/20	018/46/1	
9	The Applicant must stablish 'no go zones' to ensure that the temporary crushing plant, all machinery, plant and activities is kept a minimum distance of 40 metres from mapped watercourses, including underground draining, on the development site.	Table 3-2
11	The applicant must prepare a Soil and Water Management Plan, being compatible with the Construction Management and Traffic Management Plan referred to in this Development Consent and incorporating the following matters. The plan must be submitted to and approved by Council prior to the commencement of works.	This SWMP
	a) Minimise the area of soils exposed at any one time	Table 3-2
	b) Conservation of topsoil.	Table 3-2
	c) Identify and protect proposed stockpile locations.	ЕМР
	d) Preserve existing vegetation. Identify revegetation technique and materials.	Table 3-2
	e) Prevent soil, sand, sediments leaving the site in an uncontrolled manner.	Table 3-2

No.	Condition	Location in SWMP
	f) Control surface water flows through the site in a manner that: i) Diverts clean-runoff around disturbed areas ii) Minimises slope gradient and flow distance within disturbed areas iii) Ensures surface run-off occurs at non erodible velocities iv) Ensures disturbed areas are promptly rehabilitated.	Table 3-2
	g) Sediment and erosion control measures in place before work commences.	Table 3-2
	h) Materials are not tracked onto the road by vehicles entering or leaving the site.	Table 3-2
	i) Details of drainage to protect and drain the site during works.	Table 3-2
13	The requirements of the Soil and Water Management Plan must be in place prior to the commencement of demolition works and/or construction works and must be maintained throughout the demolition and/or construction process.	Table 3-2
18	The control of erosion, and the prevention of silt discharge into drainage systems and waterways, will be necessary in accordance with Council's "Engineering Requirements for Development", and Landcom's Soils and Construction Manual – April 2004. Erosion control measures are to be implemented prior to the commencement of any earthworks, and shall be maintained until satisfactory completion and restoration of site earthworks, including revegetation of all exposed areas.	Section 2.2.1, Table 3-2 and Appendices 6 and 7
19	Alterations to the natural surface contours must not impede or divert natural surface water runoff, so as to cause a nuisance to adjoining property owners.	Table 3-2
20	During all phases of demolition, excavation and construction, it is the full responsibility of the applicant and their contractors to:	Table 3-2
	a) Ascertain the exact location of the Council stormwater drainage pipeline and associated pits traversing the site in the vicinity of the works.	None impacted
	b) Take measures to protect the in-ground Council stormwater drainage pipeline and associated pits.	N/A
	c) Ensure dedicated overland flow paths are satisfactorily maintained through the site.	Section 2.1.2
	Stormwater drainage pipes can be damaged through applying excessive loading (such as construction machinery, material storage, and the like). All proposed structures and construction activities must be sited fully clear of Council's stormwater drainage pipes, pits, easements, watercourses and overland flow paths on the site.	
	If the Council pipeline is uncovered during construction, all work must cease, and the PCA and Council must be contacted immediately for advice. Any damage caused to the Council stormwater drainage system must be immediately repaired in full as directed, and at no cost to Council.	

1.4.2 Environmental Protection Licence

The *Protection of the Environment Operations Act 1997* (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 EPL No. 1548 for the Smelter operations. The EPL currently contains one licensed point for the purposes of monitoring and/or the setting of limits for discharges of pollutants to water, as well as conditions relating to the groundwater interception trench and leachate management system association with the Capped Waste Stockpile. A list of the EPL conditions related to water management and where they are addressed in this document are outlined in **Table 1-2**.

Table 1-2: Relevant EPL Conditions

No.	Condition	Location in SWMP
P1	Location of monitoring/discharge points and areas	Section 3 and Section 4.1
L1	Pollution of waters	Section 3
04	Effluent application to land	Section 3 and Section 4.1.2
M1	Monitoring records	Section 4.1
R1	Annual return documents	Section 4.1 and Section 4.2
E1	Groundwater interception and monitoring - Capped Waste Stockpile	Section 0 and Section 4.1.3

In addition, the plan aims to comply with the following legislation and guidelines:

- Environmental Planning and Assessment Act 1979
- Protection of the Environment Operations Act 1997
- Water Management Act 2000
- Water Act 2012
- National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC, 2000)
- Managing Urban Stormwater Soils and Construction, Volume 1 (Landcom, 2004)

2. EXISTING ENVIRONMENT AND POTENTIAL IMPACTS

2.1 Existing Environment

2.1.1 Soils and Geology

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.

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 both the Greta Coal Measures and Newcastle Coal Measures and was deposited in a marine environment.

Quaternary sediments which are associated with Swamp Creek (located to the east of the Smelter), Wentworth Swamps and the Hunter River consist of complex interbedded fluvial and marine sands and estuarine muds deposited within an estuarine environment during periods of sea level rise and fall.

2.1.1.1 Contaminated Soils

Contaminated soils within the Smelter, the Capped Waste Stockpile and stockpiled soil from category 2 remediation works under the *State Environmental Planning Policy No. 55:*Remediation of Land (SEPP 55) in the Hydro Land are located within the Smelter site. **Figure 2-1** shows the location of the Capped Waste Stockpile and key areas of contamination within the Smelter, including the temporary stockpile locations.

Contaminated site investigations have identified a number of small areas within the Hydro Land that require remediation. This will involve the excavation and removal of the contaminated soils in accordance with a Remediation Action Plan (RAP). This includes:

- The former Municipal Landfill on Hart Road.
- · Dickson Road South.
- Asbestos contaminated soils at former residential properties.

The remediation of these areas will be category 2 remediation works under SEPP 55 with permanent disposal to the Containment Cell. The measures for the management of contaminated soils in accordance with the RAP is detailed in the Contaminated Soils Management Plan in **Appendix 2**.

2.1.2 Surface Water

Wentworth Swamp is the main water feature on the Hydro land. Swamp Creek, Black Waterholes Creek and several smaller tributaries are tributaries of Wentworth Swamp. Swamp Creek flows in a northerly direction in the east of the Hydro land, while Black Waterholes Creek flows in a northerly direction in the northwest of the Hydro land. Both creeks flow into the Wentworth Swamp discharging to Wallis Creek, which then flows into the Hunter River. Swamp Creek is approximately 180 metres to the east of the southeast corner of the Smelter.

An unnamed watercourse is located approximately 45 metres to the west of the Smelter. This unnamed watercourse is a tributary to Black Waterholes Creek. Other small ephemeral watercourses and low lying areas are located to the east of the Smelter and drain to Swamp Creek.



Aerial photography by Nearmap, flown 15.06.2020



Legend Project site AEC (Area of Ecological Concern) Stockpiled contaminated soil

The Smelter has an existing stormwater and surface water management system. This includes:

- Subsurface and open surface water drainage throughout the Smelter.
- One dam in the west of the Smelter, one in the northeast of the Smelter and one on the southeast of the Smelter. These are the initial collection and treatment points for the water.
- Two dams located to the north of the Smelter. These have previously been used as part of
 the water collection and treatment system for the Smelter. These continue to capture surface
 water runoff from the Smelter, receiving water that has passed through the south, east and
 west surge ponds.
- Irrigation area. To the north of the Smelter is an irrigation area that receives water from the North Dams. The irrigation area is operated in accordance with the requirements of the EPL.

Figure 2-2 shows the existing Smelter water management system.

The demolition and remediation activities require an available water supply for dust suppression use. Going forward, the use of the irrigation area as a point of discharge is not expected to be required as the water contained within the Smelter water management system will be used for onsite dust suppression. The Flood Modelling and Hydrology Review (PCB, 2018) concluded:

- Throughout most of the demolition and remediation activities there will be sufficient water captured and stored within the Smelter water management system to supply dust suppression requirements.
- Based on the rainfall modelling, if a dry period occurred the modelled minimum quantity of stored water will provide for 20 days of dust suppression. Hydro will then access reticulated potable water for dust suppression.
- The Smelter water management system is designed to manage a 20% annual exceedance probability storm event. The use of water for dust suppression will help maintain storage capacity and minimise the potential for overflows from the Smelter water management system.

2.1.3 Groundwater

Regional groundwater is expected to follow topography and flow northeast towards surface water bodies that feed into the Hunter River. Groundwater aquifers are present within both bedrock and unconsolidated sediments.

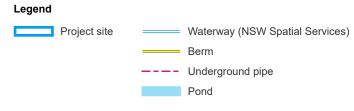
Groundwater flow at the Smelter is typically toward the north east, although the complexity of the system likely results in discontinuities occurring within the flow pathways. Swamp Creek and Wentworth Swamp influence the regional groundwater flow regime. Swamp Creek is the closest identified receptor for groundwater flow from the site.

Two aquifer systems are present within the Smelter:

- A shallow aquifer within the estuarine sand, between 1m and 5m below ground surface (bgs) in the eastern portion of the Smelter and immediately east of the Smelter; and
- A deep, confined aquifer within the underlying bedrock/residual clay between 7m and 11m bgs to the north west of the Smelter at the location of the Containment Cell.

A groundwater interception trench was constructed to intercept leachate impacted water from the Capped Waste Stockpile in order to mitigate potential off-site environmental impacts.





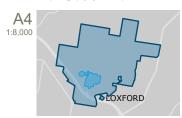


Figure 2-2 | Existing Smelter Water Management System

The groundwater interception trench was constructed with the following objectives:

- To intercept leachate impacted shallow, perched groundwater when it rises towards the ground surface (during high rainfall conditions); and
- Dispose of the captured water via the existing Smelter water management system.

The operating procedure for the groundwater interception trench is included in **Appendix 1**. The groundwater interception trench performance monitoring and reporting requirements are discussed in **Section 4**.

Remediation of the Capped Waste Stockpile will remove the source of groundwater contamination and negate the requirement for the interception trench in the future. Management measures applicable to leachate generation, capture and treatment are provided in the Leachate Management Plan (LMP) in **Appendix 1**.

A perched accumulation of groundwater has occurred within the Dickson Road Landfill. The perched groundwater contains elevated levels of fluoride. Being perched it is not connected to the groundwater system.

2.1.4 Water Supply and Use

The Smelter is currently connected to the Hunter Water Corporation (HWC) potable water supply system. Hydro proposes to maintain connection to this system.

Water will be extracted from the Smelter water management system and supplemented with potable water as required for dust suppression of the following:

- Unsealed access roads.
- Soil, concrete and other dust generating stockpiles.
- Building demolition.
- Concrete crushing.
- Earthworks associated with the construction of the Containment Cell.
- Remediation activities.

Water will also be required for the following activities:

- Grass cover establishment. Water will be extracted from the Dams and supplemented with potable water as required.
- Staff amenities and kitchen facilities. Water will be sourced from the potable water supply.

2.1.5 Wastewater

Since closure of the Smelter operations, wastewater is limited to that generated from the amenity facilities for Smelter personnel located throughout the Smelter. Amenity facilities are connected to the HWC wastewater network. Hydro proposes to maintain this system until these facilities are demolished.

2.2 Potential Impacts

2.2.1 Erosion and Sedimentation

Runoff from stormwater and dust suppression water has the potential to collect and disperse dust, soils (exposed following building demolition, and earthworks in the Hydro Land for contaminated soils remediation) and other particulates beyond the activity areas and into the surface water drainage within the Smelter and watercourses within the Hydro Land.

Sediment controls, such as geotextile fabric, would be installed at appropriate locations to capture and collect soils, dusts and particulates.

The western, northern and southern areas of the Smelter site will be used as a materials stockpile area. Erosion and sediment controls will be established to manage the stockpile area, and individual stockpiles within it as required.

Figure 2-3 shows the Smelter stockpile locations.



Aerial photography by Nearmap, flown 15.06.2020



Legend



2.2.2 Leachate

Water that comes into contact with waste at the Capped Waste Stockpile or the Containment Cell will be classified as leachate and require collection and disposal and/or treatment as described in the LMP (**Appendix 1**).

2.2.3 Water Quality and Hydrology

The existing sealed road network within the Smelter will continue to be used for vehicle access within the Smelter site wherever possible, minimising vehicle movements over exposed soils and unsealed access tracks. The required haul road for transportation of wastes from the Capped Waste Stockpile to the Containment Cell will be constructed to collect and divert stormwater to the Smelter water management system.

The Smelter's existing stormwater and surface water management system will continue to collect surface water within the Smelter site prior to use for dust suppression. This system will be managed where ever practicable to divert existing clean water around operational areas of the Project site and prevent clean and sediment/ leachate laden water from mixing.

Stormwater from upgradient of the Containment Cell will be diverted around the Containment Cell and directed to three sediment detention basins via a series of culverts and swales. Water collected within unfilled cells within the Containment Cell will also be managed as clean water using the same system. As noted in **Section 0** any water collected within a filled cell will be managed in accordance with the LMP (**Appendix 1**).

Stormwater from the side walls and surrounds to the Capped Waste Stockpile will be diverted away from the area disturbed for material removal wherever possible and to the Smelter water management system. As noted in **Section 0** any water collected within the disturbed area of the Capped Waste Stockpile will be managed in accordance with the LMP (**Appendix 1**).

2.2.4 Groundwater

Groundwater interception will be limited to the excavation of the Capped Waste Stockpile, remediation of the Dickson Road Landfill and potentially demolition works below 1.5 metres within the Smelter. Groundwater impacted with fluoride is a potential concern for personnel undertaking subsurface activities, if intercepted.

Groundwater encountered in the Capped Waste Stockpile will be extracted using sumps or extraction wells within the Capped Waste Stockpile and treated as leachate as detailed in the LMP in **Appendix 1**.

Construction of the Containment Cell is not expected to intercept groundwater with the base of excavation to be between one to three metres above the underlying aquifer. A groundwater diversion system is included within the design of the Containment Cell to minimise liner uplift and any potential groundwater intrusion into the Cell. Groundwater intercepted by the diversion system will seep into a groundwater extraction system consisting of:

- Two 2.2m deep collection sumps located in the lowest eastern perimeters of the Containment Cell
- Two pipe extraction risers that contain the extraction pumps to remove any groundwater for collection and disposal at a licensed facility.

Remediation of the Dickson Road Landfill will require removal of the perched groundwater. The quality of this water will be regularly monitored to determine if it needs to be managed as part of the leachate management system (refer to the LMP in **Appendix 1**) or discharged into the Smelter water management system.

The water quality management measures included in this SWMP and appended specialised plans will protect groundwater quality.

3. IMPLEMENTATION

3.1 Roles and Responsibilities

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

Table 3-1: Hydro Personnel and Environmental Management Responsibilities

Position	Position Responsibilities				
OVERALL SITE MANA	OVERALL SITE MANAGEMENT				
Managing Director	Make certain that the Hydro Team and contractors are implementing this SWMP.				
	Provide adequate resources and funding for the implementation of this SWMP.				
	Review and approve RWEMP (including this SWMP).				
Principal Environmental	Provide advice on and assistance in implementation, monitoring and auditing of environmental management and performance.				
Consultant	Review and modify the SWMP 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				

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 soil and water quality), 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 SWMP.				
	Review and approve the SWMP on an annual basis or when changes to activities at the Smelter occur.				
	Facilitate implementation of the SWMP.				
Construction Manager	Verify that the work of contractors and Hydro personnel on the Project are undertaken in accordance with this SWMP, 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 SWMP.				
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 SWMP and other relevant environmental procedures and standards.				
Workplace Health and Safety (WHS)	Provide Hydro personnel with the necessary tools and training to enable effective implementation of the RWEMP.				
Manager	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		
Demolition	Comply with the requirements of the SWMP as it applies to Smelter demolition activities.		
Contractor	Implement the environmental measures and actions as described in the SWMP through a Demolition EMP, sub-plans and specific procedures that comply with this SWMP.		
	Develop and implement procedures for self-checking environmental management compliance with the Demolition Contractor's procedures and this SWMP.		
	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 SWMP as it applies to Smelter and relevant Hydro Land remediation activities.		
	Implement the environmental measures and actions as described in the SWMP through a Remediation EMP, sub-plans and specific procedures that comply with this SWMP.		
	Develop and implement procedures for self-checking management compliance with the Remediation Contractor's procedures and this SWMP.		
	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, MAINTENANC	E AND HYDRO LAND MANAGEMENT ACTIVITIES		
Environmental	Coordinate and implement the environmental monitoring program		
Officer/ Hydro Land Manager	Verify that the work of contractors and Hydro personnel on Hydro Land are undertaken in accordance with this SWMP and relevant environmental procedures and standards.		
	Undertake a weekly inspection of activities on the Hydro Land that will occur for two weeks or more.		
ALL AREAS AND ACT	IVITIES		
Contractors	Comply with the requirements of the SWMP as it applies to site environmental management and control.		
	Implement the environmental measures and actions as described in the SWMP through procedures and management plans that comply with this SWMP.		
	Develop and implement procedures for self-checking management compliance with Contractor's procedures and this SWMP.		
All Personnel	Implementation of the relevant environmental measures described in this SWMP applicable to their activities.		

3.2 Management Measures

Hydro will implement a number of controls to manage soil and water impacts that may be generated from activities at the Smelter and Hydro Lands. The soil and water management measures to be implemented on Site are outlined in **Table 3-2**.

Soil and Water Management Plan 16 of 26

Table 3-2: Soil and Water Management Measures

Management Measures	Action	Timing / Frequency	Responsibility	Further Detail
All personnel will be informed during the site induction of their obligations to minimise erosion and protect water quality.	Soil and water quality management obligations and control measures to be communicated to personnel during site induction.	Prior to and during activities	WHS Manager	Section 3.3.2 of the RWEMP (inductions and training)
Erosion and sediment controls will be installed prior to the commencement of activities.	Erosion and sediment controls (such as geotextile fabric) will be installed and maintained as shown in the Demolition Erosion and Sediment Control Plans	Prior to demolition	Project Manager Demolition Contractor	CMA CEMP Appendix E
	The Demolition Erosion and Sediment Control Plan will be implemented for any demolition activities at the Smelter that will disturb soils or potentially cause dust or particulate runoff.	During demolition	Project Manager Demolition Contractor	Daracon IPMP Appendix 3 of Appendix 4 CMA CEMP Appendix E
	Prior to any remediation activities (including the Capped Waste Stockpile removal) at the Smelter erosion, drainage and sediment controls will be installed as shown in the Containment Cell Erosion and Sediment Control Plan in Appendix 3 . This plan would be updated by the Remediation Contractor throughout the remediation activities to reflect work activities as required.	Prior to and during remediation	Project Manager Remediation Contractor	Appendix 3 Daracon IPMP Appendix 3 of Appendix 4
	An Erosion and Sediment Control Plan is to be developed and implemented prior to any remediation activities in the Hydro Land. This plan would be updated by the Remediation Contractor throughout the remediation activities to reflect work activities as required.	Prior to and during remediation	Project Manager Remediation Contractor	Daracon IPMP Appendix 3 of Appendix 4
	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 3 . This plan would be updated by the Remediation Contractor throughout the remediation activities to reflect work activities as required	Prior to remediation	Project Manager Remediation Contractor	Appendix 3 Daracon IPMP Appendix 3 of Appendix 4

Soil and Water Management Plan 17 of 26

Management Measures	Action	Timing / Frequency	Responsibility	Further Detail
Erosion and sediment controls are to be inspected and maintained.	Erosion and sediment controls will be inspected on a fortnightly basis and after a rain event (greater than 5mm in any one period up to 24 hours in duration).	During activities Fortnightly and after a rain event	WHS Manager Environmental Officer	Section 4.1.4 Section 5.2 of the RWEMP (inspections)
	Where an issue is identified during the inspection, the erosion and sediment controls will be maintained, repaired or improved.	During activities As required	WHS Manager Environmental Officer	Section 4.1.5 Section 5.2 of the RWEMP (inspections) Section 5.4 of the RWEMP (corrective action)
	A record is to be maintained of the inspections and any maintenance, repair or improvement works required.	During activities Fortnightly and after a rain event	WHS Manager Environmental Officer	Section 5.2 of the RWEMP (inspections) Section 5.4 of the RWEMP (corrective action)
	Inspection records are to be made available upon request of the Department, the EPA and Cessnock City Council.	As required	WHS Manager Environmental Officer	
	The Erosion and Sediment Control Plans are to be reviewed and updated as required to reflect the dynamic nature of the activities to ensure adequate protection of surface water quality.	During demolition and remediation	Project Manager Demolition Contractor Remediation Contractor Environmental Officer	
The Smelter surface water management system is to be maintained.	The surface water drainage system will be inspected on a monthly basis.	During activities	WHS Manager Environment Officer	Section 4.1.4 Section 5.2 of the RWEMP (inspections)
	Where an issue is identified during the inspection, the system will be maintained or repaired as required to prevent the uncontrolled escape of stormwater.	During activities	WHS Manager Environment Officer	Section 4.1.5 Section 5.4 of the RWEMP (corrective action)
	Reeds and other vegetation are to be regularly removed from dams and drainage lines to maintain flows and storage capacity within the system	During activities as required	WHS Manager Environment Officer	Section 4.1.5 Section 5.4 of the RWEMP (corrective action)

Soil and Water Management Plan 18 of 26

Management Measures	Action	Timing / Frequency	Responsibility	Further Detail
'No go zones' will be established to ensure that the temporary crushing plant, all machinery, plant and activities is kept a minimum distance of 40 metres from mapped watercourses, including underground draining.	Inspections of no go zones will be undertaken on a regular basis to ensure they are maintained.	During activities	Environmental Officer	Section 5.2 of the RWEMP (inspections)
A stormwater management system will be designed and installed for the Containment Cell prior to completion of remediation.	 A stormwater management system will be designed: By a suitably qualified expert In consultation with Council In accordance with relevant Australian Standards Generally in accordance with the conceptual design in the EIS In accordance with Australian Rainfall and Runoff (Engineers Australia, 2016) and Managing Urban Stormwater: Council Handbook (EPA, 1997) guidelines 	Prior to completion of remediation	Project Manager	Containment Cell Detailed Design
	Within two months of the completion of remediation works or within another timeframe agreed by the Planning Secretary, works-as-executed drawings signed by a registered surveyor will be submitted to the Site Auditor demonstrating that the stormwater drainage and finished ground levels have been constructed as detailed in the Containment Cell Detailed Design and the RAP.	Following completion of remediation	Project Manager	
Stored and temporarily stockpiled gypsum will be managed to minimise the potential for runoff.	The gypsum will be unloaded and stored within the specified enclosed shed.	During remediation	Project Manager Remediation Contractor Environmental Officer	Remediation IPMP Appendix 7 (Materials Management Plan)
	A small daily quantity will be stockpiled at the gypsum application station within a bunded area. The material will be returned to the storage shed at the end of the day and in the event of rain.	During remediation	Remediation Contractor Environmental Officer	Remediation IPMP Appendix 7 (Materials Management Plan)
	The gypsum application station will be cleaned on a weekly basis. Cleaned material will be placed within a loaded truck for disposal within the Containment Cell.	During remediation	Remediation Contractor Environmental Officer	Remediation IPMP Appendix 7 (Materials Management Plan)

Soil and Water Management Plan 19 of 26

Management Measures	Action	Timing / Frequency	Responsibility	Further Detail
	In the event gypsum enters the stormwater system, the water will be collected within the Smelter water management system prior to reuse for dust control or discharged in accordance with the EPL.	During remediation	Remediation Contractor Environmental Officer	
completion of activities in an area, the surface will be treated to reduce the potential for erosion and sediment loss, which may include methods such as grass seeding, jute mesh or crushed concrete depending on the intended future use of the area. Undertake restabilised are stabilised are conduct mai. Vehicles exiting the Smelter site will not track mud or dirt onto public roads. Undertake in vehicles are this requirem. In the event roads, appro	Stabilise disturbed areas with grass seed or cover with appropriate material (such as jute mesh rolled crushed concrete) to prevent dust generation. Stabilisation method depends on the need for future activity in the area.	During demolition Following completion of activities within an area	Project Manager Demolition Contractor Remediation Contractor	Demolition CEMP Appendix E Remediation EMP Appendix 3
	Undertake routine inspection and maintenance activities on stabilised areas to ensure stabilisation has occurred.	During and following activities	Project Manager Demolition Contractor Remediation Contractor	Section 4.1.4
	Conduct maintenance on stabilised areas as required.	As required following stabilisation	Project Manager Demolition Contractor	
	Undertake inspection of vehicles exiting the site to ensure that vehicles are free of mud and dirt. Vehicles that do not meet this requirement will need to be manually cleaned.	Prior to and during activities	Gate Security Project Manager Demolition Contractor Remediation Contractor	Section 5.2 of the RWEMP (inspections)
	In the event that mud or dirt has been trucked onto public roads, appropriate action (based on the quantity of material) is to be taken to remove the deposited material.	As required	Environmental Officer Demolition Contractor Remediation Contractor	Demolition CEMP Appendix E Remediation EMP Appendix 3
Use of chemicals and fuels will be managed to avoid spills and contamination of soil, surface water and groundwater	Vehicle refueling will be undertaken using mobile refueling vehicles equipped with spill containment equipment and a spill kit.	During activities	Project Manager Demolition Contractor Remediation Contractor	Demolition CEMP Appendix E Remediation EMP Appendix 3
	All chemicals and fuels on site will be stored in accordance with the applicable Safety Data Sheet.	During activities	Project Manager Demolition Contractor Remediation Contractor	Demolition CEMP Appendix E Remediation EMP Appendix 3

Soil and Water Management Plan 20 of 26

Management Measures	Action	Timing / Frequency	Responsibility	Further Detail
	An appropriate spill kit is to be on site at all times and any spillage is to be immediately cleaned up. In the event of a large or hazardous spill, the fire brigade, police, ambulance and EPA will be contacted as appropriate, in accordance with Emergency Services Cooperation Agreement.	During activities	Project Manager Demolition Contractor Remediation Contractor	Demolition CEMP Appendix E Remediation EMP Appendix 3
	Any spills will be contained and disposed of at a licensed facility.	As required	Project Manager Demolition Contractor Remediation Contractor	Section 2.3.3 (waste tracking, transport and disposal) of the WMP
	Servicing of vehicles will only be undertaken within a sealed area with the appropriate environmental controls in place, including bunding where required.	During activities	Project Manager Demolition Contractor Remediation Contractor	Demolition CEMP Appendix E Remediation EMP Appendix 3
Implement the surface water monitoring program to assess the impact that activities have on sensitive receiving environments. Record any incidents that cause soil or water quality impacts, either on or off site, and the action taken to resolve the situation in the log book.	Implement the monthly surface water monitoring to assess compliance with the relevant surface water quality criteria.	During activities Monthly monitoring	Environmental Officer	Section 4.1.4
	Record, interpret and report on surface water monitoring data.	Prior to and during activities	Environmental Officer	Section 3.5 of the RWEMP (reporting)
	Record incidents in the incident register, undertake the required investigations and implement corrective actions	During activities As required	WHS Manager Environmental Officer	Section 3.5.4 of the RWEMP (incidents) Section 5.4 of the RWEMP (corrective action)
	Review corrective actions	During activities As required	WHS Manager Environmental Officer	Section 5.4 of the RWEMP (corrective action)

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 in accordance with the *National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000). Surface water monitoring will be undertaken at the locations shown on **Figure 4-1**. The program includes monitoring of pH, electrical conductivity, free cyanide, free fluoride, total suspended solids (TSS) and total dissolved solids (TDS).

The Hydro Environmental Officer will be responsible for the monthly monitoring and the review of sample analysis results and trends in water quality. The Hydro Environmental Officer will be responsible for initiating an investigation when the deviation from background trends could result in environmental harm or when the result varies significantly from background trends. The investigation will be undertaken to assess if a 'potential risk' or an actual problem exists.

4.1.2 Irrigation

As identified in **Section 2.1.2**, use of the irrigation area is not expected during remediation activities as excess water within the Smelter water management system is utilised for dust suppression.

Until that time, Hydro is responsible for ensuring the discharge events to the irrigation area occur in accordance with the conditions contained in EPL 1548. Due to the post operational phase of the Smelter, surface water monitoring is no longer a requirement of the EPL.

4.1.3 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 locations are as shown in **Figure 4-2**. The groundwater monitoring program is further detailed in the LMP (**Appendix 1**)

Quarterly monitoring is undertaken for the following:

- Groundwater level.
- Groundwater quality pH, Electrical Conductivity, Fluoride, Free Cyanide, Dissolved Oxygen and Redox potential.

At the completion of 12 months of monitoring, a report is prepared for the Capped Waste Stockpile monitoring wells for provision to the EPA that includes:

- Tabulated results for depth to water, physiochemical parameters and analytical data.
- Trend analysis of monitored parameters in key wells incorporating data collected since July 2013 (when the quarterly groundwater monitoring in this area commenced).
- Assessment of the impact of the leachate interception trench on the leachate plume.
- Conclusion and recommendations from the assessment of the leachate impacted groundwater.

Soil and Water Management Plan 22 of 26

4.1.4 Monitoring Program

The surface water and groundwater monitoring program is outlined in **Table 4-1**.

Table 4-1: Surface Water and Groundwater Monitoring Commitments

Monitoring Details	Frequency	Locations	Parameters	Person/s Responsible
Visual inspection of erosion and sediment controls	Fortnightly After rain events	Where controls are installed/ implemented	Determine if controls are working or if they require maintenance, repair or replacement	Environmental Officer WHS Manager
Monitoring of surface water quality in water bodies located within the Hydro Land.	Monthly	Dams: ND1, ND2 Swamp Creek: A - up gradient of site, 14 - downgradient of CWS, B - downgradient of Irrigation Area, 62 - Wentworth swamp water quality Surge Ponds: Eastern Surge Pond Southern Surge Pond Western Surge Pond	pH, Conductivity, F, Free Cyanide, TDS, TSS	Environmental Officer
Dam Monitoring - for changes in dam water quality	Weekly	ND1, ND2 and Eastern Surge Dam	pH, F	Environmental Officer
Dam Monitoring - for changes in dam water quality	Monthly	ND1, ND2, West Surge Pond, South Surge Pond and East Surge Pond.	pH, EC, F	Environmental Officer
Visual monitoring of irrigation area during any discharges to this area to ensure no runoff occurs	Monthly	Irrigation Area	No visible water pooling or running off the surface prior to or during irrigation	Environmental Officer
Monitoring of groundwater quality	Quarterly	 Section 1 wells: W2S, W2D, PUMP, W7S, W7M, E5 and E5D Section 2 wells: W1S, W1D, E4 Section 3 wells: W4S, W4D, A7 Section 4 wells: E11, W5S W5D, N2 Wells next to Swamp Creek:F5, F6, G5, G6 	Depth to groundwater, Temperature, pH, F, Free Cyanide, EC, Dissolved oxygen, Redox potential	Environmental Officer Principal Environmental Consultant
Surface water monitoring post rain event	Event based	All areas where leachate is observed following rain events	рН, F	Environmental Officer
Monitoring groundwater level to identify need to engage interception trench	Event Based	W2S, W2D, PUMP, W7S, W7M, E5 and E5D	Depth to groundwater	Environmental Officer

4.1.5 Soil and Water Management

As noted in **Table 3-2** the erosion and sediment controls will be included as part of the regular inspection program and after a rain event (greater than 5mm in any one period up to 24 hours in duration). Also, as noted in **Table 3-2** the existing surface water drains and dams will be inspected on a monthly basis.

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

Records are to be taken (and filed) during these inspections and made available for review upon request of the EPA and Cessnock City Council.

4.2 Reporting

All internal and external environmental reporting requirements will be undertaken in accordance with the RWEMP.

Reporting will also be undertaken in accordance with relevant legislation, guideline and notification requirements, as outlined in **Section 1.4**.

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 the RWEMP.

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.

Investigations will be conducted by the Environment Officer, including provision of feedback to the complainant. Corrective actions will be documented and regularly reviewed until completion and signed off.

Handling of complaints will be undertaken in accordance with the RWEMP.

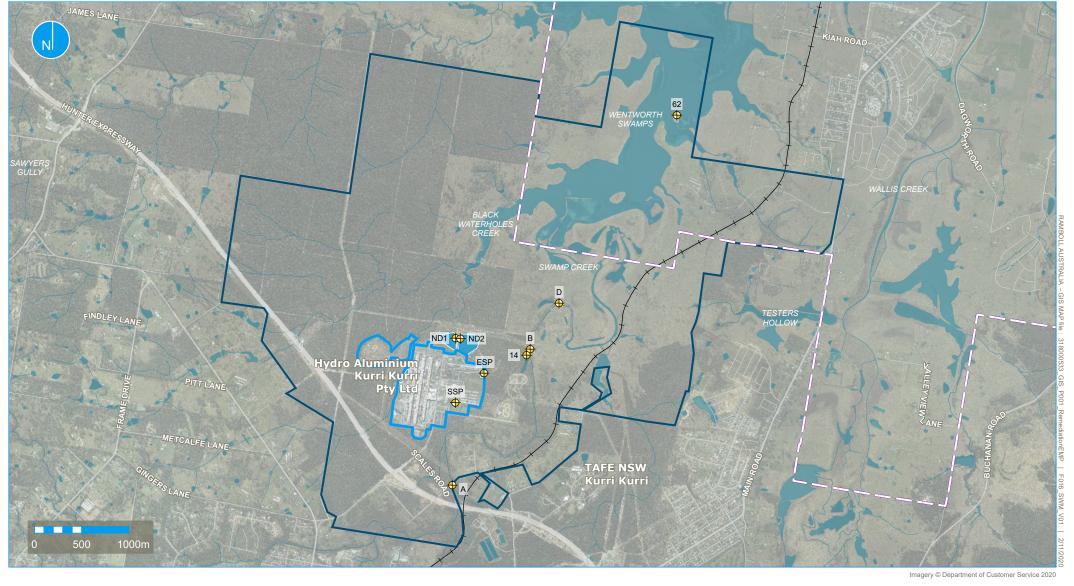
4.5 Review and Improvement

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 RWEMP and specialist management plans is undertaken.

The RWEMP and specialist management plans will be reviewed on an as needs basis if changes to existing operations occur.

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



Hydro owned land Surface water monitoring location
Project site Water course

LGA boundary Water body

A4 1:40,000 KURRI KURRI NEWCASTLE

Figure 4-1 | Surface Water Monitoring Locations

Legend



Legend
Project site Groundwater monitoring location

A4 1:3,000

Figure 4-2 | Groundwater Monitoring Locations

5. REFERENCES

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Ramboll Environ. 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 LEACHATE MANAGEMENT PLAN

Intended for

Hydro Aluminium Kurri Kurri Pty Ltd

Document type

Report

Date

December, 2020

KURRI KURRI ALUMINIUM SMELTER DECOMMISSIONING, DEMOLITION AND REMEDIATION LEACHATE MANAGEMENT PLAN

KURRI KURRI ALUMINIUM SMELTER DECOMMISSIONING AND DEMOLITION LEACHATE MANAGEMENT PLAN

Ref **318000533**

Document ID Hydro Kurri Kurri SWMP_Appendix 1_FINAL Leachate

Management Plan_20201223

Revision Final

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 will be undertaken at the former Hydro Aluminium Kurri Kurri aluminium smelter at Hart Road Loxford, NSW and the surrounding land owned by Hydro. This Leachate Management Plan (LMP) forms a component of the

SWMP.

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CONTENTS

ACRONY	MS AND ABBREVIATIONS	I
GLOSSA	RY	II
1.	INTRODUCTION	1
1.1	Background	1
1.2	Objectives	1
1.3	Purpose and Scope	1
1.4	Regulatory Requirements	1
1.4.1	Development Consent	1
1.4.2	Environmental Protection Licence	1
2.	EXISTING ENVIRONMENT AND POTENTIAL IMPACTS	3
2.1	Groundwater	3
2.2	Surface Water	3
2.3	Leachate	4
2.3.1	Capped Waste Stockpile	4
2.3.2	Containment Cell	4
2.3.3	Dickson Road South	4
2.3.4	Leachate Storage and Treatment	5
2.3.4.1	Leachate Storage	5
2.3.4.2	On Site Treatment Plant	5
2.3.4.3	Off Site Leachate Treatment	5
3.	IMPLEMENTATION	7
3.1	Roles and Responsibilities	7
3.2	Management Measures	8
4.	MONITORING AND REVIEW	12
4.1	Monitoring	12
4.1.1	Leachate Monitoring	12
4.1.2	Surface Water	12
4.1.3	Groundwater Monitoring	12
4.1.4	Monitoring Program	12
4.1.5	Soil and Water Management	12
4.2	Reporting	12
4.3	Non-conformances	12
4.4	Complaints	13
4.5	Review and Improvement	13
5.	REFERENCES	14
6.	LIMITATIONS	15
6.1	User Reliance	15

FIGURES

Figure 2-1	Location of Leachate Management Infrastructure	6
TABLEC		
TABLES		
Table 1-1: F	Relevant EPL Conditions	2
Table 3-1: H	Hydro Personnel and Environmental Management Responsibilities	7
Table 3-2: L	eachate Management Measures	9

ACRONYMS AND ABBREVIATIONS

AEP Annual Exceedance Probability

EC Electrical Conductivity

EMP Environmental Management Plan

EP&A Act Environmental Planning and Assessment Act 1979

F Fluoride

Hydro Aluminium Kurri Kurri Pty Ltd

LMP Leachate Management Plan

SSD State Significant Development

SWMP Soil and Water Management Plan

TDS Total Dissolved Solids

Total CN Total Cyanide

TSS Total Suspended Solids

TWTP Temporary Water Treatment Plant

WHS Workplace Health and Safety

GLOSSARY

Council Cessnock City Council

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, a 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.

Leachate Management Plan 1 of 15

1. INTRODUCTION

1.1 Background

This Leachate Management Plan (LMP) has been prepared by Ramboll Australia Pty Ltd on behalf of Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to support the Soil and Water Management Plan (SWMP) and 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 LMP are to:

- Detail how leachate from the Containment Cell, Capped Waste Stockpile and the Dickson Road Landfill will be managed to protect water quality within and surrounding the Smelter during the material removal and the placement of material in the Containment Cell.
- Provide a program to monitor leachate generation and quality
- Provide a mechanism to assess performance against the relevant assessment criteria.
- Detail the requirement for reporting exceedances of assessment criteria.
- Establish the roles and responsibilities of all parties involved in leachate management.
- Establish supervision, monitoring and reporting framework for the LMP.

1.3 Purpose and Scope

The purpose of the LMP is to:

- Specify procedures for leachate management during remediation of the Capped Waste Stockpile and other contaminated areas, and the placement of material into the Containment Cell
- Satisfy the relevant conditions of the Development Consent for State Significant Development (SSD) 6666 relating to remediation activities and specifically leachate management.

The LMP reflects the design and operational procedures of the Containment Cell leachate collection and management system detailed in the *Containment Cell Detailed Design Report* (GHD, 2018) and measures described in the *Response to Submissions Report: Former Hydro Aluminium Kurri Kurri Smelter Remediation* (Ramboll, 2020) (the RtS).

1.4 Regulatory Requirements

1.4.1 Development Consent

The development consent for SSD 6666 does not include specific conditions relating to leachate management. However as required by condition A2, leachate management will be undertaken in accordance with the Environmental Impact Statement (EIS) and the RtS. This LMP has been prepared to describe how the leachate management measures described in the EIS and RtS will be implemented.

1.4.2 Environmental Protection Licence

The *Protection of the Environment Operations Act 1997* (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 for the Smelter operations. The EPL contains conditions relating to the groundwater interception trench and leachate management system association with the Capped Waste Stockpile. A list of the EPL conditions related to leachate management and where they are addressed in this document are outlined in **Table 1-1**.

Leachate Management Plan 2 of 15

Table 1-1: Relevant EPL Conditions

No.	Condition	Location in LMP
L1	Pollution of waters	Section 2
05	Processes and management	Section 0
M1	Monitoring records	Section 4.1
R1	Annual return documents	Section 4.1
E1	Groundwater interception and monitoring - Capped Waste Stockpile	Section 2.3 and Section 4.1.3

In addition, the plan aims to comply with the following legislation and guidelines:

- Environmental Planning and Assessment Act 1979
- Protection of the Environment Operations Act 1997
- Protection of the Environment Operations (Waste) Regulation 2014
- Water Management Act 2000
- Water Act 2012
- National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC, 2000)
- Managing Urban Stormwater Soils and Construction, Volume 1 (Landcom, 2004)
- Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination (DEC, 2007)

Leachate Management Plan 3 of 15

2. EXISTING ENVIRONMENT AND POTENTIAL IMPACTS

2.1 Groundwater

Groundwater within the Smelter site has been impacted by Smelter activities primarily due to leaching of fluoride and aluminium from smelter materials into groundwater.

Groundwater immediately down gradient of the Capped Waste Stockpile has been impacted by leachate generated from contact of wastes in the Capped Waste Stockpile with shallow groundwater and from the infiltration of water through the Capped Waste Stockpile (prior to capping). The leachate plume extends approximately 350m north east of the eastern toe of the Capped Waste Stockpile and is characterised by elevated fluoride, cyanide and sodium concentrations and by a high pH.

A groundwater interception trench was constructed to intercept leachate impacted water from the Capped Waste Stockpile in order to mitigate potential off-site environmental impacts.

The groundwater interception trench was constructed with the following objectives:

- To intercept leachate impacted shallow, perched groundwater when it rises towards the ground surface (during high rainfall conditions); and
- Dispose of the captured water via the existing Smelter water management system.

The groundwater interception trench performance monitoring and reporting requirements are discussed in **Section 4**.

Groundwater interception during remediation will be limited to the excavation of the Capped Waste Stockpile and demolition works below 1.5m bgs. Construction of the Containment Cell is not expected to intercept groundwater with the base of excavation of the Containment Cell to be between one to three metres above the underlying aquifer however, management of groundwater is required during the initial phases of material emplacement as detailed within the SWMP.

Groundwater encountered in the Capped Waste Stockpile will be extracted using sumps or extraction wells within the Capped Waste Stockpile and either removed for treatment by a licenced waste contractor (**Section 2.3.4.3**) or treated through an on site temporary water treatment plant (**Section 2.3.4.2**) prior to discharge through the Smelter water management system.

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.

2.2 Surface Water

The Smelter has an existing stormwater and surface water management system. This includes:

- Subsurface and open surface water drainage throughout the Smelter.
- One dam in the west of the Smelter, one in the northeast of the Smelter and one on the southeast of the Smelter. These are the initial collection and treatment points for the water.
- Two dams located to the north of the Smelter. These have previously been used as part of
 the water collection and treatment system for the Smelter. These continue to capture surface
 water runoff from the Smelter, receiving water that has passed through the south, east and
 west surge ponds.
- Irrigation area. To the north of the Smelter is an irrigation area that receives water from the North Dams. The irrigation area is operated in accordance with the requirements of the EPL.

Leachate Management Plan 4 of 15

Surface water management of the Smelter site will be focused on the separation of clean stormwater from water that comes into contact with contaminated soils, waste or leachate. Clean stormwater will be directed into the Smelter water management system for dust suppression throughout the demolition and remediation activities. Water that comes into contact with any material from the Capped Waste Stockpile, waste in the Containment Cell or Dickson Road landfill will be classified as leachate and require collection and disposal and/or treatment as described in **Section 2.3.4**.

A stormwater diversion drain will be installed around the perimeter of the Containment Cell (including the perimeter access track) to divert clean water around the Containment Cell and reduce the amount of water requiring treatment.

The Containment Cell will be constructed with four initial internal cells, separated by internal bunds. Material will be placed within one internal cell at a time. This will allow any rain collected within unfilled cells to be managed as clean water; only water within the filled cell will need to be managed as leachate as per **Section 2.3.4**.

2.3 Leachate

Leachate will result from the remediation of the Capped Waste Stockpile and Dickson Road South, and from waste material emplacement into the Containment Cell. The Detailed Design Report (GHD, 2018) has estimated approximately 12,720kL of leachate will be generated and require treatment.

2.3.1 Capped Waste Stockpile

The Capped Waste Stockpile will require continued collection and treatment of the existing leachate as well as any stormwater collected within the exposed stockpile during remediation. Any water that comes in contact with leachate will be classified as leachate and treated accordingly. The remediation of the Capped Waste Stockpile will be staged to minimise the surface area of waste exposed to rainfall.

The area of the Capped Waste Stockpile uncovered at any time will be minimised. This will allow water from the remaining capped area to be diverted away from the exposed material and managed as clean water; only the water from the exposed material will need to be considered and managed as leachate.

Leachate within the Capped Waste Stockpile will be drained to a sump and either transported offsite or treated onsite as described in **Section 2.3.4**. Treatment will continue until the contents of the Capped Waste Stockpile are removed from the area.

2.3.2 Containment Cell

As stated in **Section 2.2**, waste material emplacement within the Containment Cell will occur as a staged process within four internal cells, separated by internal bunds. Each cell will contain a water collection/ sump system to enable the removal of leachate and/ or clean water for treatment or discharge into the Smelter water management system respectively.

Leachate within the Containment Cell will be drained to two sumps and either transported offsite or treated onsite as described in **Section 2.3.4**.

2.3.3 Dickson Road South

Remediation of the Dickson Road South site will require removal of the perched groundwater. The Remedial Action Plan: Dickson Road South, Kurri Kurri, NSW (Ramboll, 2018) concluded that the perched water is expected to be of sufficient quality to be pumped to the South Surge Pond to then be managed as part of the Smelter water management system. This water will be drained to a sump within the excavation bund.

The quality of this water will be regularly monitored to determine if it needs to be managed as part of the leachate management system, or if it can continue to be discharged directly into the Smelter water management system.

As with the Capped Waste Stockpile, the area of the landfill uncovered at any time will be minimised. This will allow water from the remaining capped area to be diverted away from the

Leachate Management Plan 5 of 15

exposed material and managed as clean water; only the water from the exposed material will need to be considered for management as leachate.

2.3.4 Leachate Storage and Treatment

2.3.4.1 Leachate Storage

Figure 2-1 shows the locations of leachate storage within the Project site. This includes the basins at the Containment Cell and adjacent to the temporary water treatment plant.

2.3.4.2 On Site Treatment Plant

A modular temporary water treatment plant will be installed with the capacity to treat: existing leachate from within the Capped Waste Stockpile; contaminated stormwater collected within the exposed stockpile; contaminated stormwater and leachate from the Containment Cell; and the perched groundwater and leachate from Dickson Road South (if required).

The conceptual location of the temporary water treatment plant is shown in **Figure 2-1**. However, the temporary water treatment plant would be modular. This would allow it to be relocated closer to the leachate source and/or to facilitate access for demolition and remediation requirements.

Based on estimates of leachate generation the temporary water treatment plant will have a capacity of approximately 30 KL/day.

The temporary water treatment plant will include filtering and treatment columns to remove key contaminants including suspended solids, pH, fluoride (F) and hydrocarbons. The waste water would be treated to a level suitable to be discharged to the Smelter water management system, where it could be reused during for dust suppression.

2.3.4.3 Off Site Leachate Treatment

The ability to dispose of leachate via a licenced liquid waste contractor for treatment at a licensed waste facility will also be available. Temporary leachate storage dams will be established at the Containment Cell and the Capped Waste Stockpile. The licensed liquid waste contractor will pump the leachate from these dams at a designated location into their truck.

Based on a leachate removal truck with a capacity of 20 kL, this equates to approximately 636 truck movements by a licensed liquid waste contractor if all leachate was transported for off-site treatment. This will equate to approximately eight truck movements per week, or a maximum of two movements per day.



Aerial photography by Nearmap, flown 15.06.2020

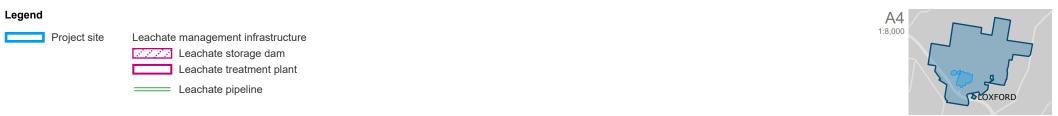


Figure 2-1 | Location of Leachate Management Infrastructure

Leachate Management Plan 7 of 15

3. IMPLEMENTATION

3.1 Roles and Responsibilities

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

Table 3-1: Hydro Personnel and Environmental Management Responsibilities

PositionResponsibilitiesOVERALL SITE MANAGEMENTManaging DirectorMake certain that the Hydro Team and contractors are implementing this LMP.Provide adequate resources and funding for the implementation of this LMP.Review and approve EMP (including the SWMP and associated specialised plans).Principal Environmental ConsultantProvide advice on and assistance in implementation, monitoring and auditing of environmental management and performance.Principal CommunicationsReview and modify the LMP as directed by the Managing Director and/or Project Manager.Manage the mechanisms available for the community to receive information and to make

	, ,
Principal Communications Consultant	Manage the mechanisms available for the community to receive information and to make enquiries or complaints about activities
SMELTER REMEDIA	TION 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 leachate management), 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 LMP.
	Review and approve the LMP on an annual basis or when changes to activities at the Smelter occur.
	Facilitate implementation of the LMP.
Construction Manager	Verify that the work of contractors and Hydro personnel on the Project are undertaken in accordance with this LMP, 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 LMP.
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 LMP 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 and sub plans.
. idilogci	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 environmental and community management (including leachate management).
	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.

Leachate Management Plan 8 of 15

Position	Responsibilities
Remediation Contractor	Comply with the requirements of the LMP as it applies to Smelter and relevant Hydro Land remediation activities.
	Implement the environmental measures and actions as described in the LMP through a Remediation EMP, sub-plans and specific procedures that comply with this LMP.
	Develop and implement procedures for self-checking management compliance with the Remediation Contractor's procedures and this LMP.
	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, MAINTENAN	CE AND HYDRO LAND MANAGEMENT ACTIVITIES
Environmental Officer/ Hydro	Coordinate and implement the environmental monitoring program
Land Manager	Verify that the work of contractors and Hydro personnel on Hydro Land are undertaken in accordance with this LMP and relevant environmental procedures and standards.
	Undertake a weekly inspection of activities on the Hydro Land that will occur for two weeks or more.
ALL AREAS AND AC	TIVITIES
Contractors	Comply with the requirements of the LMP as it applies to site environmental management and control.
	Implement the environmental measures and actions as described in the LMP through procedures and management plans that comply with this LMP.
	Develop and implement procedures for self-checking management compliance with Contractor's procedures and this LMP.
All Personnel	Implementation of the relevant environmental measures described in this LMP applicable to their activities.

3.2 Management Measures

Hydro will implement a number of controls to manage leachate generation, treatment and disposal resulting from activities at the Smelter and Hydro Lands. The leachate management measures to be implemented on Site are outlined in **Table 3-2**.

Leachate Management Plan 9 of 15

Table 3-2: Leachate Management Measures

Management Measures	Action	Timing / Frequency	Responsibility	Further Detail
Water encountering any waste fill will be classified as leachate and require collection and treatment.	Surface water will be diverted around active remediation areas to minimise the volume of leachate generated during remediation activities.	Prior to and during remediation	Project Manager Remediation Contractor	Containment Cell Detailed Design
	Perimeter bunds and diversion drains will be constructed around the Containment Cell, Capped Waste Stockpile and Dickson Road Landfill to prevent stormwater entering the active remediation area.	Prior to and during remediation	Project Manager Remediation Contractor	Containment Cell Detailed Design
	Leachate generation will be minimised by reducing the area of exposed waste at any one time and covering of waste as soon as practicable.	During remediation	Project Manager Remediation Contractor	Containment Cell Detailed Design
Controlled capture of leachate within the Capped Waste Stockpile	A sump will be constructed within the low point of the Capped Waste Stockpile to allow gravity drainage of leachate to one collection point.	Prior to remediation	Project Manager Remediation Contractor	Containment Cell Detailed Design
	The leachate will be transferred to an appropriately lined temporary leachate storage dam.	During remediation	Project Manager Remediation Contractor	Containment Cell Detailed Design
	Leachate will be pumped out by a licensed waste contractor for off site treatment and disposal or to the temporary water treatment plant for onsite treatment.	During remediation	Project Manager Remediation Contractor	Containment Cell Detailed Design
Controlled capture of leachate within the Containment Cell	The Containment Cell will be subdivided into four sub-cells by intracell bunds. The sub-cells will be filled progressively, resulting in potential leachate generation occurring from only one cell at a time.	Prior to and during remediation	Project Manager Remediation Contractor	Containment Cell Detailed Design
	Leachate will be drained to one of two leachate sumps, located at the eastern boundary of the containment cell.	During remediation	Project Manager Remediation Contractor	Containment Cell Detailed Design
	Leachate extraction pumps will be used to extract the leachate and pumped to the leachate buffer storage dam for temporary storage.	During remediation	Project Manager Remediation Contractor	Containment Cell Detailed Design
	The operation depth of leachate in the cell will be limited to no more than 300 mm except during large storm events. Where the level of leachate exceeds 300 mm it shall be lowered to 300 mm as soon as is practicable.	During remediation	Project Manager Remediation Contractor	Containment Cell Detailed Design

Leachate Management Plan 10 of 15

Management Measures	Action	Timing / Frequency	Responsibility	Further Detail
On site leachate treatment through a temporary water treatment plant prior to discharge into the Smelter water	Submit a detailed design for the plant to the Department and the EPA for approval.	Prior to construction of the plant	Project Manager Remediation Contractor	N/A
management system.	The temporary water treatment plant will only operate during remediation activities and be decommissioned upon completion of the Containment Cell.	During remediation	Project Manager Remediation Contractor Environmental Officer	N/A
	Discharge form the temporary water treatment plant will be of a suitable quality to be discharged to the Smelter water management system and applied as dust suppression.	During remediation	Project Manager Remediation Contractor Environmental Officer	N/A
	Discharge from the temporary water treatment plant will be to the Smelter water management system or collected by a licensed contractor (if required).	During remediation	Project Manager Remediation Contractor Environmental Officer	N/A
Leachate transported from the Smelter is to be managed in accordance with the Protection of the Environment Operations (Waste) Regulation 2005 (POEO Waste Regulation) and the <i>Waste Classification</i>	Any leachate requiring transportation from the Smelter to a licensed facility will be subjected to waste tracking.	Prior to and during remediation	Project Manager Remediation Contractor Site Services Manager Waste Removal Contractor	Section 2.3.3 (waste tracking, transport and disposal) of the WMP
Guidelines.	Leachate will be removed from the Smelter to a licensed facility by a licenced waste contractor and transported to a licenced waste facility.	Prior to and during remediation	Project Manager Remediation Contractor Site Services Manager Waste Removal Contractor	Section 2.3.3 (waste tracking, transport and disposal) of the WMP
	A Waste Consignment Authorisation must be obtained, prior to transporting the leachate. The licenced waste contractor who removes the leachate is responsible for completing the Waste Consignment Authorisation.	Prior to and during remediation	Project Manager Remediation Contractor Site Services Manager Waste Removal Contractor	Section 2.3.3 (waste tracking, transport and disposal) of the WMP
	The types, quantity and receiving location for all leachate transported from the Smelter will be recorded within a database.	During remediation	Project Manager Remediation Contractor Site Services Manager Waste Removal Contractor	Section 2.3.3 (waste tracking, transport and disposal) of the WMP
Regular visual inspection of stormwater drainage to ensure stormwater and leachate are segregated.	Conduct fortnightly and event based visual inspection of drainage controls including perimeter bunds and diversion drains.	During remediation	Environmental Officer	Section 5.2 of the EMP (inspections)

Leachate Management Plan 11 of 15

Management Measures	Action	Timing / Frequency	Responsibility	Further Detail
Continue the groundwater monitoring downgradient of the leachate impacted groundwater resulting from the Capped Waste Stockpile.	Continue quarterly on-going monitoring of groundwater wells down-gradient of the Capped Waste Stockpile in accordance with the EPL.	During remediation	Project Manager Remediation Contractor Environmental Officer	Section 4.1 of the SWMP
Continue the surface water monitoring program to assess the impact that activities have on sensitive receiving environments.	Continue the monthly surface water monitoring to assess compliance with the relevant surface water quality criteria.	During activities Monthly monitoring	Environmental Officer	Section 4.1 of the SWMP
_	Record, interpret and report on surface water monitoring data.	Prior to and during demolition	Environmental Officer	Section 4.1 of the SWMP

Leachate Management Plan 12 of 15

4. MONITORING AND REVIEW

4.1 Monitoring

4.1.1 Leachate Monitoring

Within the Containment Cell, leachate monitoring will be undertaken on a quarterly basis or after a significant storm event or immediately following an earthquake. Once the leachate collection sump reaches 300 mm level, it will be pumped out, temporarily stored in the leachate buffer storage dam and either collected by a licenced liquid waste contractor or treated through the water treatment plant.

4.1.2 Surface Water

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

Further details on the surface water monitoring requirements are described in Section 4.1.1 of the SWMP.

4.1.3 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. This includes wells that assess the performance of the Capped Waste Stockpile leachate interception trench and the condition of the leachate plume that the trench was installed to mitigate.

The groundwater wells target the leachate plume that is migrating from the Capped Waste Stockpile in a north-easterly direction. The leading front of the leachate plume is approximately 300 m north-east of the Capped Waste Stockpile. The extent of the plume is shown on the attached figure. Characteristics of the leachate includes elevated concentrations of Fluoride, Cyanide, Aluminium and alkaline pH.

Further details on the groundwater monitoring requirements are described in Section 4.1.3 of the SWMP.

4.1.4 Monitoring Program

The surface water and groundwater monitoring program is described in Table 4-1 of the SWMP.

4.1.5 Soil and Water Management

As noted in **Table 3-2** the erosion and sediment controls including stormwater drainage controls (such as those diverting clean water away from waste materials and leachate) will be inspected fortnightly and after a rain event (greater than 5mm in any one period up to 24 hours in duration). Also, as noted in **Table 3-2** the existing surface water drainage and dams will be inspected prior to commencing remediation activities, and on a monthly basis thereafter.

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

Records are to be taken (and filed) during these inspections and made available for review upon request of the EPA and Cessnock City Council.

4.2 Reporting

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

Reporting will also be undertaken in accordance with relevant legislation, guidelines and notification requirements, as outlined in **Section 1.4**.

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 the EMP.

Leachate Management Plan 13 of 15

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.

Investigations will be conducted by the Environment Officer, including provision of feedback to the complainant. Corrective actions will be documented and regularly reviewed until complete and signed off.

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

4.5 Review and Improvement

Continual improvement of the LMP 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.

Leachate Management Plan 14 of 15

5. REFERENCES

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Department of Environment and Conservation (DEC). 2007. *Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination*.

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Ramboll Environ (2015) Statement of Environmental Effects - Demolition of Former Aluminium Smelter Buildings at Kurri Kurri

Ramboll Environ (2016) Environmental Impact Statement: Former Hydro Aluminium Kurri Kurri Smelter Demolition and Remediation

Ramboll (2018) Environmental Impact Statement: Former Hydro Aluminium Kurri Kurri Smelter Stage 2 Demolition

Ramboll (2020) Response to Submissions Report: Former Aluminium Kurri Kurri Smelter Remediation

Leachate Management Plan 15 of 15

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 2 CONTAMINATED SOILS MANAGEMENT PLAN

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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CONTENTS

ACRON	YMS AND ABBREVIATIONS	I
GLOSSA	ARY	II
1.	INTRODUCTION	1
1.1	Background	1
1.2	Objectives	1
1.3	Purpose and Scope	1
1.4	Regulatory Framework and Guidelines	1
1.4.1	Environmental Protection Licence	1
1.4.2	SSD 6666 Development Consent Conditions	1
2.	EXISTING CONTAMINATION AND POTENTIAL IMPACTS	2
2.1	Smelter Site Contamination	2
2.1.1	Known Contamination	2
2.1.2	Extent of Remediation Required	2
2.2	Dickson Road South	3
2.2.1	Known Contamination	3
2.2.2	Potential Impacts	3
2.2.3	Extent of Remediation Required	3
3.	IMPLEMENTATION	7
3.1	Roles and Responsibilities	7
3.2	Management Measures	8
4.	MONITORING AND REVIEW	12
4.1	Monitoring	12
4.1.1	Surface Water	12
4.1.2	Groundwater Monitoring	12
4.1.3	Visual Inspections	12
4.2	Reporting	12
4.3	Non-conformances	12
4.4	Complaints	12
4.5	Review and Improvement	12
5.	REFERENCES	13
6.	LIMITATIONS	14
6.1	User Reliance	14

FIGURES

Figure 2-1 Smelter Site AECs and PAECs	. 5
Figure 2-2 Dickson Road South	. 6

TABLES

Table 2-1 Smelter Site Fill Quantity Estimates	2
Table 2-2 Dickson Road South Fill Quantity Estimates	
Table 3-1: Hydro Personnel and Environmental Management Responsibilities	7
Table 3-2: Contaminated Soil Management Measures	C

APPENDICES

Appendix 1

Smelter Remediation Action Plan

Appendix 2

Dickson Road South Remediation Action Plan

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 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 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 $\frac{1}{2} \left(\frac{1}{2} \right) = \frac{1}{2} \left(\frac{1}{2} \right) \left(\frac{1}$

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

	Volume Estimate (m³)			Bulk Density (T/m³)	Mass Estimates	
Туре	Range ¹				Range	
	Estimate	Estimate Low High		(17111-)	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

	Volu	me Estimate ((m³)	Bulk	Mass Estimates	
Туре	Range ¹ Estimate Low High			Density (T/m³)	Range Low High	
	LStillate	LOW	iligii		LOW	iligii
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%

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

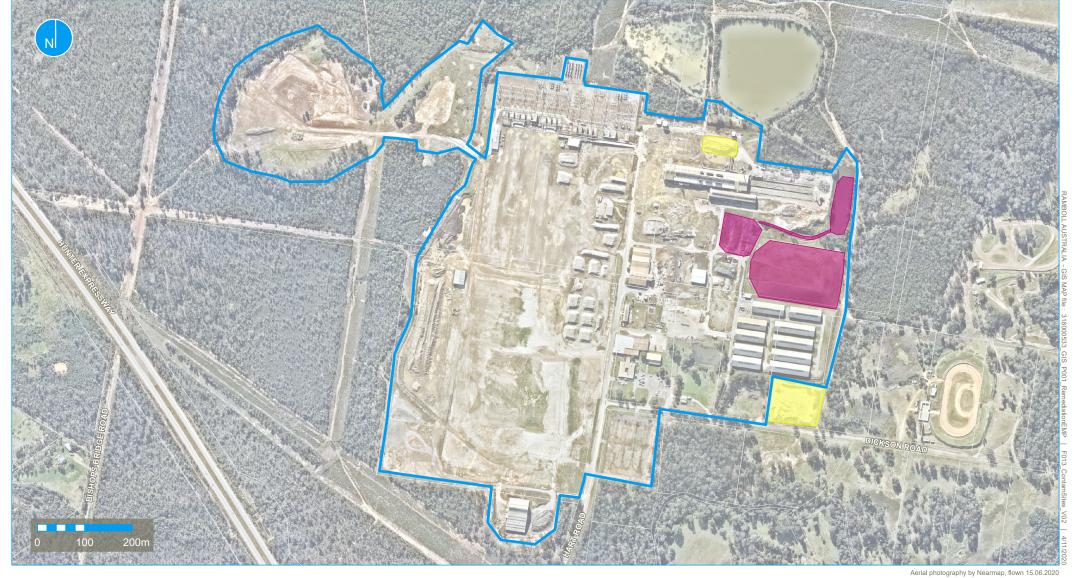
The contaminant profile identified comprises an embankment that has been progressively filled with smelter-derived wastes and then capped with a thin sand layer. Sub-surface contamination including buried wastes in a soil matrix requires remediation across the area identified as Dickson Road South as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

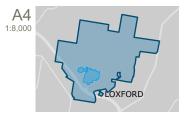
The approximate fill volume estimates are presented in **Table 2-2**. The volume calculations were determined from an estimation of the lateral and vertical extent determined during site investigations. Tonnages were calculated from the anticipated bulk density as shown for each material present. There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

^{2.} Low/high based on field observations

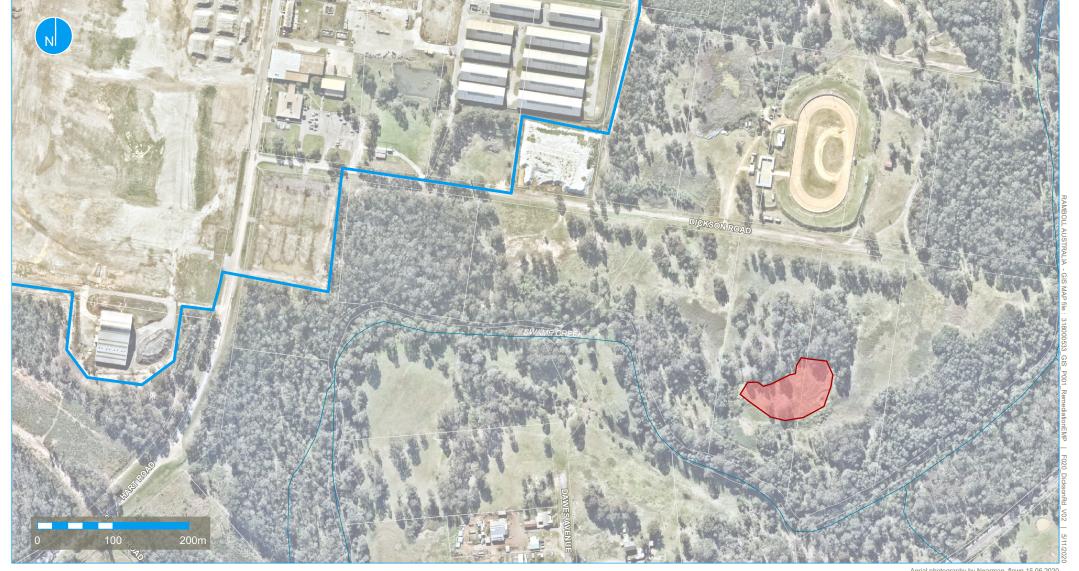
Table 2-2 Dickson Road South Fill Quantity Estimates

	Volum	e estimates	(m³)	Bulk	Mass estimates (T)		
Туре	Range			Density (T/m³)	Rai	Range	
	Estimate	Low	High	(1/m²)	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	





Legend Project site AEC (Area of Ecological Concern) Stockpiled contaminated soil



al photography by Nearmap, flown 15.06.2020



Legend
Project site Approximate extent of Dickson Road South
Water course

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						

Consultant	complaints about activities
SMELTER DECOM	ISSIONING, 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)	Provide Hydro personnel with the necessary tools and training to enable effective implementation of the EMP.
Manager	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	Comply with the requirements of the CSMP as it applies to Smelter demolition activities.				
Contractor	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, MAINTENA	NICE AND HYDRO LAND MANAGEMENT ACTIVITIES				
Environmental	Coordinate and implement the environmental monitoring program				
Officer/ Hydro Land Manager	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.

Contaminated Soils Management Plan 9 of 15

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

Contaminated Soils Management Plan 10 of 15

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

Contaminated Soils Management Plan 11 of 15

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

FINAL V4 Revision 02/07/2018 Date **Kirsty Greenfield** Made by **Fiona Robinson** Checked by Approved by Fiona Robinson

Ramboll has prepared a remediation strategy for Description

> 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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CONTENTS

1.	EXECUTIVE SUMMARY	1-1
2.	INTRODUCTION	2-2
2.1	Background	2-2
2.2	Objective	2-2
2.3	Scope of Work	2-3
2.4	Regulatory Framework and Guidelines	2-3
3.	SITE IDENTIFICATION	3-5
3.1	Site Location	3-5
3.2	Site Boundaries	3-5
3.3	Proposed Landuse	3-5
4.	SITE HISTORY	4-7
4.1	General Operations History	4-7
4.2	Overview of Former Site Operations	4-7
5.	PREVIOUS INVESTIGATIONS	5-9
5.1	Stage 1 of the Phase 2 ESA	5-9
5.2	Capped Waste Stockpile	5-10
5.3	Ecological Risk Assessment	5-12
5.4	Health Risk Assessment	5-12
5.5	Phase 1 ESA	5-12
5.6	Hazardous Materials Audit	5-12
5.7	Stage 2 of the Phase 2 ESA	5-13
5.8	Remedial Action Work Plan for Clay Borrow Pit	5-14
5.9	Environmental Site Assessment – Diesel Spray Area	5-15
5.10	Capped Waste Stockpile Assessment	5-16
5.11	Substation Trial Assessment	5-17
5.12	Emerging Contaminants	5-18
5.13	Condition and Surrounding Environment	5-18
5.14	Geology and Hydrogeology	5-20
5.15	Nature and Extent of Soil Contamination	5-22
5.16	Characterisation of the Capped Waste Stockpile	5-25
5.16.1	Waste content	5-25
5.16.2	Leachate	5-27
5.16.3	Gas	5-29
5.16.4	Summary of preliminary waste classification	5-32
5.17	Site-Wide Assessment of Groundwater	5-33
5.18	Conceptual Site Model	5-34
5.19	Assessment of Exposure Routes and Potential Receptor	s 5-34
6.	REMAINING CSM DATA GAPS	6-37
6.1	Soil	6-37
6.2	Groundwater	6-37
7.	REMEDIAL OPTIONS	7-38
7.1	Remediation Goal	7-38
7.2	Extent of Remediation Required	7-38

7.3	Remedial Options Assessment	7-39
7.3.1	Review of Evaluation Criteria Definitions	7-39
7.3.2	Approval Likelihood	7-39
7.3.3	Legacy Management and Costs	7-39
7.3.4	Risk Rating	7-39
7.3.5	Sustainability Analysis	7-41
7.3.6	Project Time	7-41
7.3.7	Qualitative Assessment Summary	7-41
7.4	Proposed Remediation Strategy	7-46
7.5	Contingency Plan	7-47
7.6	Interim Site Management Plan	7-48
8.	REMEDIAL ACTION PLAN	8-49
8.1	Preliminaries	8-49
8.2	Site Establishment	8-49
8.3	Prior to Remediation Works	8-49
8.3.1	West Surge Pond	8-50
8.3.2	Substations	8-50
8.3.3	Area East of the Clay Borrow Pit	8-51
8.3.4	Pot Rebuild Area	8-51
8.3.5	Anode Waste Pile	8-51
8.4	Potential for Contamination due to Demolition	8-51
8.5	Survey	8-51
8.6	Remedial Methodology	8-52
8.6.1	Capped Waste Stockpile	8-52
8.6.2	Anode Waste Pile	8-53
8.6.3	Area East of Playing Field	8-53
8.6.4	Carbon Plant	8-53
8.6.5	Bake Furnace Scrubber	8-53
8.6.6	Diesel Spray Area	8-54
8.6.7	Drainage Lines	8-54
8.6.8	East Surge Pond	8-54
8.6.9	_	8-54
8.6.10	Materials Tracking Backfilling and Final Landform	8-54
8.7	Remediation of Secondary Source, Groundwater - Ca	
0.7	Waste Stockpile	8-54
0	·	
9 . 9.1	VALIDATION PLAN Containment Cell Validation	9-56 9-56
	Validation of Remainder of Smelter Site	
9.2		9-56
9.3	Validation Data Quality Objectives	9-57
9.3.1	Step 1: State the Problem	9-57
9.3.2	Step 3: Identify Inputs to the Decision	9-58
9.3.3	Step 4: Define the Study Boundary	9-58
9.3.4	Step 5: Development of Decision Rules	9-58
9.3.5	Step 6: Specific Limits of Decision Error	9-59
9.3.6	Step 7: Optimise the Design for Obtaining Data – Soi Validation	ı 9-61
9.3.6.1	Imported Fill Sampling	9-64
9.4	Soil Validation Criteria	9-64
9.4.1	Contaminants of Concern	9-64
9.4.2	Soil Criteria	9-65
9.5	Groundwater and Surface Water Validation Criteria	9-68
9.5.1	Contaminants of Concern	9-68
9.5.2	Groundwater Criteria	9-68
9.5.2.1	Potential Beneficial Uses	9-68

9.5.2.2	Appropriate Criteria for Groundwater	9-69
9.5.2.3	Appropriate Criteria for Surface Water	9-69
9.6	Validation Reporting	9-70
10.	WORKS ENVIRONMENTAL MANAGEMENT PLAN	10-71
10.1	Works Environmental Management Plan	10-71
10.2	Site Access	10-71
10.3	Hours of Operation	10-71
10.4	Air Controls	10-71
10.4.1	Dust Control	10-71
10.4.2	Odour	10-71
10.5	Noise Control	10-72
10.6	Erosion and Sediment Control	10-72
10.7	Surface Water and Groundwater Control	10-72
10.7.1.1	Surface water	10-72
10.7.2	Groundwater	10-73
10.8	Traffic Control	10-73
10.9	Spill Response	10-73
10.10	Hazardous Materials	10-73
10.11	Waste Materials	10-74
10.12	Flora and Fauna	10-74
11.	HEALTH AND SAFETY	11-75
12.	REMEDIATION SCHEDULE	12-76
13.	ENVIRONMENTAL CONTROLS CONTINGENCY PLA	AN 13-
	77	
13.1	Asbestos Management Protocol	13-77
13.1.1	Asbestos Related Permits and Approvals	13-77
13.1.2	Management of ACM	13-78
14.	REGULATORY COMPLIANCE REQUIREMENTS	14-79
15.	KEY PERSONNEL	15-80
16.	COMMUNITY RELATIONS PLAN	16-81
17.	LONG-TERM SITE MANAGEMENT PLAN	17-82
17.1	Leachate Plume	17-82
17.2	Enforceability of the LTMP	17-82
17.2.1	Development Consent	17-82
17.2.2	Environment Protection Licence	17-83
18.	CONCLUSIONS	18-85
19.	REFERENCES	19-86
19.1	Previous Ramboll Reports	19-86
20.	LIMITATIONS	20-88
20.1	User Reliance	20-88

TABLES

Table 2-1: SEARs for the RAP and Where Addressed	2-4
Fable 3-1: Site Identification	3-5
Table 5-1: PAH Impact from Current and Previous Investigations	5-15
Table 5-2: Summary of Site Conditions and Surrounding Environmer	ıt5-19
Table 5-3: Summary of Geology and Hydrogeology	5-20
Table 5-4: Summary of Site Soil Contamination	5-23
Table 5-5 Summary of Soil Results	5-25
Table 5-6: Analysis of Spent Pot Lining	5-27
Table 5-7: Capped Waste Stockpile Leachate Concentrations (mg/L).	5-28
Fable 5-8: Capped Waste Stockpile Gas Concentrations (ppm)	5-31

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Table 5-9: Capped Waste Stockpile Gas Concentrations (ppm)	5-32
Table 5-10: Exposure Pathways Assessment	5-35
Table 7-1: Contaminated Soils Quantity Estimates	7-38
Table 7-2: Sustainability Factors	7-41
Table 7-3: Assessment of Remedial Options	
Table 7-4: Remediation Contingency Planning	7-47
Table 9-1: Validation of the Capped Waste Stockpile	9-61
Table 9-2: Validation of Remaining AECs	9-63
Table 9-3: Validation of Stockpiling and Demolition Areas	9-63
Table 9-4: Remediation Assessment Criteria (mg/kg) – Health and	d Ecological
Investigation Levels	9-65
Table 9-5: Soil Assessment Criteria for Vapour Intrusion - HSL D	(mg/kg) –
Sand ²	9-66
Table 9-6: ESLs and Management Limits for Petroleum Hydrocark	ons in Soil 9-
66	
Table 9-7: Surface Water Assessment Criteria (mg/L)	9-69
Table 12-1: Remediation Schedule	12-76
Table 13-1: Environmental Controls Contingency Plan	13-77
Table 14-1: Key Relevant Legislation and Regulations	14-79
Table 15-1: Roles and Responsibilities	15-80

FIGURES

Figure 1	Site Location
Figure 2	Smelter Site Plan
Figure 3	Study Boundary
Figure 4	Site Layout Showing AECs and PAECs
Figure 5	Capped Waste Stockpile
Figure 6	Anode Waste Pile
Figure 7	Diesel Spray Area
Figure 8	Carbon Plant
Figure 9	Bake Furnace Scrubber
Figure 10	Area East of the Playing Fields
Figure 11	Drainage Lines and East Surge Pond
Figure 12	Smelter Site with AECs and PAECs
Figure 13	Fluoride Concentrations in Groundwater
Figure 14	Methane Concentrations over time
Figure 15	Ammonia Concentrations over time
Figure 16	Risk Rating

APPENDICES

Appendix 1	2012 Soil Investigation Results Tables
Appendix 2	NSW EPA Correspondence
Appendix 3	2014 Soil Investigation Results Tables
Appendix 4	Containment Cell Concept Design
Appendix 5	Photographs of AECs Requiring Remediation
Appendix 6	Letter Report re: 2018 Groundwater Sampling
Appendix 7	Laboratory Report and FIL Calculation Spreadsheet

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 <i>Contaminated Land Management Act 1997</i> .	
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, Loxford, 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 offsite receptors in the down-hydraulic gradient area. The following complete source-pathwayreceptor 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 μ g/L). The fluoride concentration, compared to a background concentration of 1000 μ g/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 m³, with a low estimate of 395 m³ and a high estimate of 730 m³. 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

	e 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	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.
Material	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

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

Table 5-3. Suffittially 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

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	Long term stockpiling of	BaP TEQ	MW12	56.9		0-0.4, fill
	Waste Pile (AEC 2)	'ahead of schedule anodes' in low lying ground adjacent to the Capped Waste Stockpile.		SB105	55		extends to 0.9
	Figure 6			MW103	42		
	•			MW103	250	160	
Fill Importation	Diesel Spray Area	Likely that impacted fill material was used to level this portion of the site.	BaP TEQ	SB18	70.1		0.4-0.6
importation	(AEC 4)			MW19	150.2	101	
	Figure 7			SB112	55		
				TP202	66		
Site Operations	Carbon Plant	Impacts in the vicinity are likely due to the accumulation	BaP TEQ	MW18	58.5		0-0.4
operations -	(AEC 8)	of dust from the Carbon Plant.		HA107	140	98	
	,	Impacts in garden beds and		HA107	260	180	
	Figure 9	grassed areas.		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)	material likely to be spilt Ring Furnace Reacted Alumina.		HA115	94		
	Figure 10						
		Impacts to shallow surface soil beneath the scrubber duct		HA116	90		
		work.		HA117	120		
							0-0.3
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	PAH contaminated sediments	BaP TEQ	D6	149.6	85.6	0-0.3
	Lines (AEC 5)	(AEC have accumulated in the drainage line adjacent to the		D7	96.3		
	Figure 8	Anode Waste Pile.		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 Spr	ray Area							
B(a)P	32	101	0.5	15.8	1	72 (EIL)			
B(a)P	32	150.2	0.5	24.3	4	40 (HIL)			
	TEQ AEC 8: Carbon Plant								
B(a)P	30	180	0.05	19.1	1	72 (EIL)			
B(a)P	30	260	0.5	28	6	40 (HIL)			
TEQ						, ,			
PAEC 2	6: Ring Fu	rnace Scrubber							
BaP	16	230	0.26	26.3	1	72 (EIL)			
BaP	16	440	0.5	50.1	4	40 (HIL)			
TEQ PAEC 29	 9: Area Ea	st of Playing Fi	elds						
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)			
) Prainage L	_ines							
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 Surg	e 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 (Na₃AlF₆) 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%
	Alumina Fluorides Total sodium Aluminium Silicates Calcium oxide Iron oxide Cyanides Magnesium oxide

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 (%)				
			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
ВТЕХ	<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.

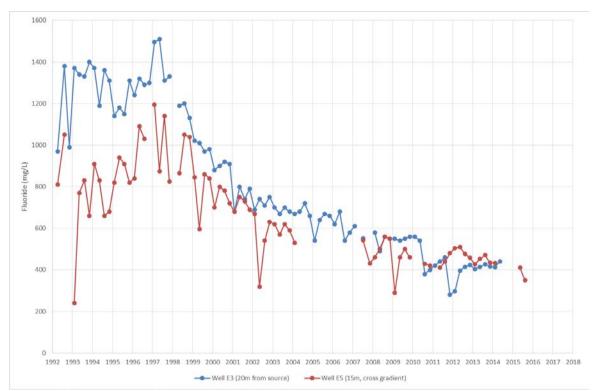


Figure 13 Fluoride concentrations in groundwater

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.

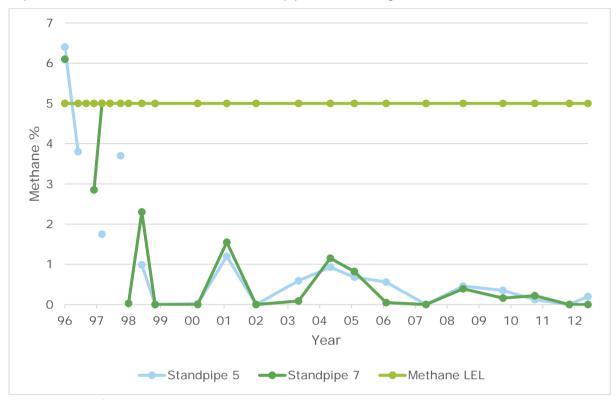


Figure 14 Methane concentrations over time

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.

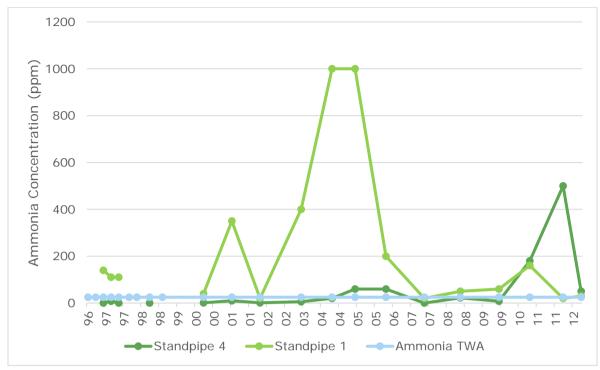


Figure 15 Ammonia concentrations over time

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	Average Concentration	LEL
	Concentration (ppm)	(ppm)	(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 H₂S, CO, CH₄, CO₂ 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 $7 \mu g/L$ 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

Table 5-10: Expos	ure Pathways Assessme	nt					
Pathways	Potentially Comp	olete 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 Surfa	ace Soil						
Dermal contact with soil and dust	N	Υ	N	N	Shallow (0-0.4m bgs) impacted soil reported on-site.		
Incidental ingestion of dust/soil	N	Υ	N	N			
Dermal contact with dust only	Υ	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		
Outdoor dust inhalation	Υ	Υ	N	N	Hydro Land (ENVIRON, 2014c-I).		
Indoor dust inhalation	Υ	N	N	N	Outdoor dust can be transported indoors.		
BaP Impacts t	to Buried Fill at th	e 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	Υ	N	N			

Table 5-10: Exposure Pathways Asse	•ssment

Pathways	Potentially Comp	olete Source-Pathway	-Receptor Link ? (\	//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	r				
Dermal contact	N	Υ	N	N	Shallow (~0.5-5mbgs) fluoride and aluminium impacted groundwater detected on-site.
Incidental ingestion	N	Y	N	N	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.
Sediment					
Dermal contact	N	Υ	na	na	Impacted sediments detected in the East Surge Pond and associated drainage lines on-site.
Incidental ingestion	N	Υ	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 Volu		ne Estimate	(m³)	Bulk			
		Range ¹			Rang	ge	
	Estimate	Low	High	(T/m³)	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)NoiseTraffic
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 ongoing 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

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 m³ 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). Ongoing 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

Table 7-4: Remediation Contingenc	ya.i.iiii
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	Evalute the risk to receptors from the remaining concentrations.
indicates that concentrations of fluoride and cyanide in the leachate plume are not reducing following source removal.	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 1x10⁻³cm/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 1x10⁻³cm/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 southwest 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	
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	Validation Requirements	
Method		
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		Chamical Analysis
Validation	Validation Requirements	Chemical Analysis
Method 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:	Sampling and analysis to demonstrate the removal of wastes. The walls and base of	PAHs
Anode Waste Pile	the excavations shall be sampled as follows:	
Carbon Plant	 Excavated Base: Sampling across each area is to be undertaken on 30m grid 	
Diesel Spray Area	spacing. This sampling program is in accordance with NSW EPA (1995)	
Bake Furnace Scrubber	Sampling Design Guidelines.Excavation Walls: One sample for each soil type present within the face of the	
East Surge Pond	excavation per 10 lineal metres. This sampling density is considered	
Area East of Playing Fields	sufficient to confirm the absence of a contaminant hot spot greater than 5m in diameter.	

Table 9-3: Validation of Stockpiling and Demolition Areas

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.	Identified contaminants of concern based on stockpile contents.
	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.	

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).

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) - Sand²

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'.

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

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).

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.

 $^{^{\}rm 3}$ 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

Table 7-0. L3L3 and Management Limits for Petroleum Hydrocarbons in 30ii			
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.

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.

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)

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 μ S/cm to 1520 μ S/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.

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
pН	6.5 - 8*	No guideline	No guideline	5 - 9
Electrical	No guideline	4500 -	No guideline	No guideline
conductivity		7700**		
(µS/cm)		>12,200***		

Table 9-7: Surface Water Assessment Criteria (mg/L).

^{*} 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 Contaminated Soils Removal and Placement	12 months
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

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

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

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	ТВА	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	ТВА	Responsible for implementation, monitoring and management of the RAP.
Contractor's Environmental Consultant	ТВА	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	ТВА	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 standalone 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)
- National Environment Protection Council (1999) National Environmental Protection (Assessment of Site Contamination) Measure (NEPM 1999)
- 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 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.

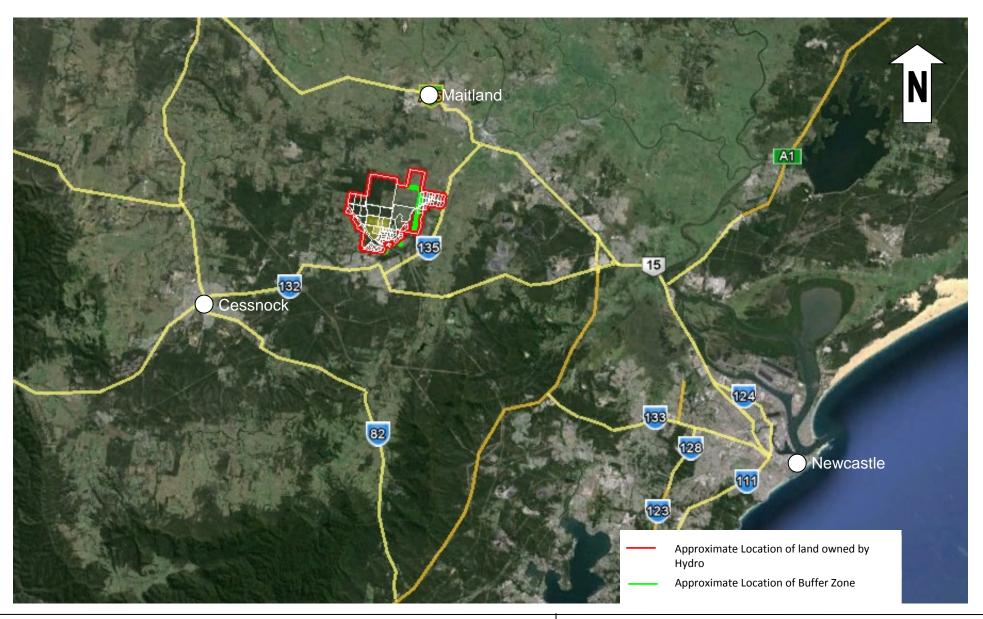
Ramboll did not independently verify all of the written or oral information provided to ENVIRON during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided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

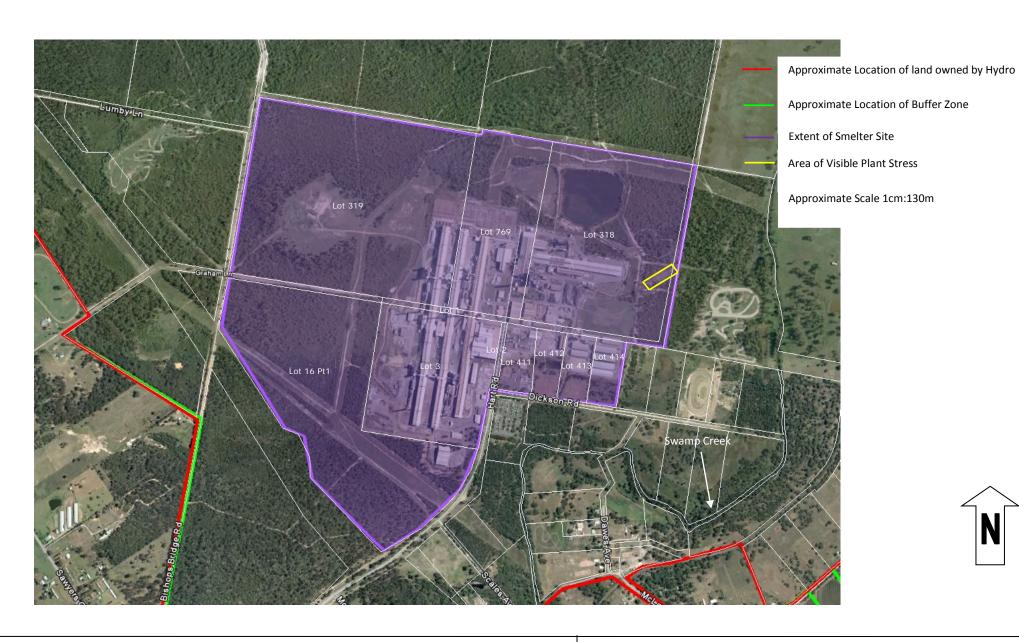
FIGURES



Hydro Aluminium Kurri Kurri: Remedial Action Plan Site Location



JOB NO: AS130349 DATE: July 2016 FIGURE 1





Smelter Site Plan

Hydro Aluminium Kurri Kurri: Remedial Action Plan



JOB NO: AS130349 DATE: July 2016 FIGURE 2



Approximate Location of land owned by Hydro

Approximate Location of Buffer Zone

Extent of Smelter Site

Extent of Study Boundary

Area of Visible Plant Stress

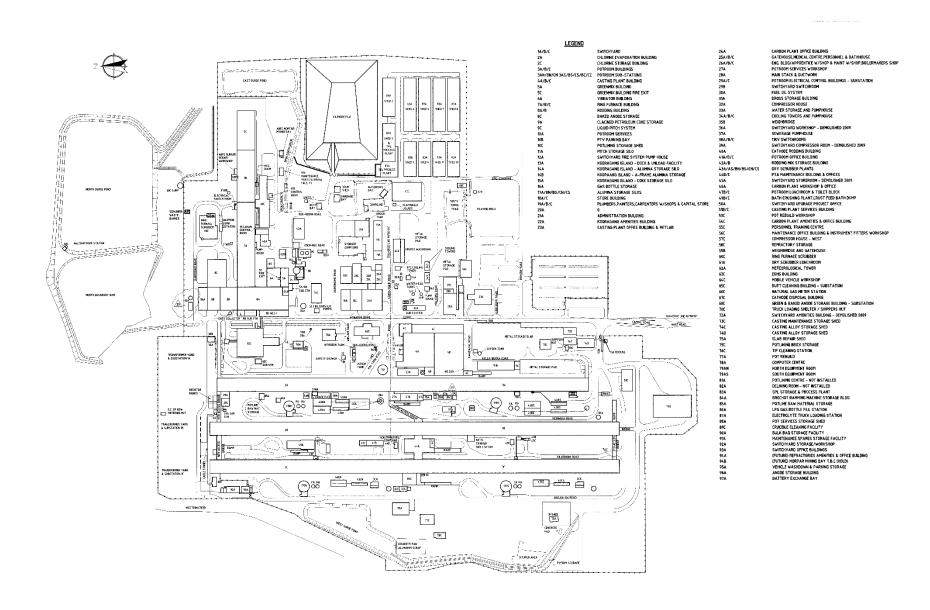
Approximate Scale 1cm:130m



Hydro Aluminium Kurri Kurri: Smelter Validation Plan Study Boundary

RAMBOLL

JOB NO: 318000301 DATE: March 2018 FIGURE 3



Hydro Aluminium Kurri Kurri: Remedial Action Plan

Smelter Layout



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

JOB NO: AS130349 DATE: July 2016 FIGURE 5





2014 groundwater well locations



2014 soil sampling locations



2012 groundwater well and soil sampling locations



soil sampling locations in excess of guidelines



Approximate extent of soil contamination

Approximate Scale 1cm:5m



Hydro Aluminium Kurri Kurri: Remedial Action Plan

AEC 2 – Anode Waste Pile

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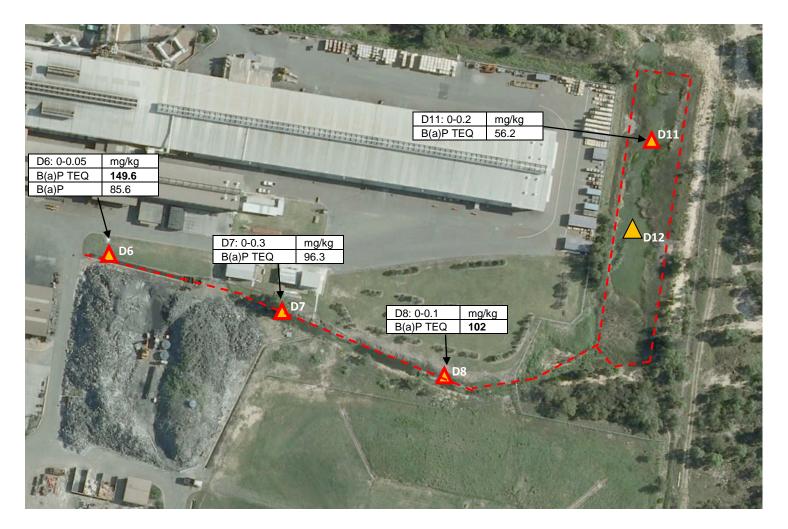
- ▲ 2015 soil sampling locations
- △ 2014 soil sampling locations
- △ 2012 groundwater well locations
- △ 2012 soil sampling locations
- Soil sampling locations with PAHs > guidelines
- Likely Contamination Extent
- Potential Contamination Extent
 Approximate Scale is 1cm: 5m

Hydro Aluminium Kurri Kurri Remedial Action Plan

AEC 4 - Diesel Spray Area Plan



JOB NO: AS130349 DATE: March 2018 FIGURE 7

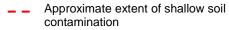




2012 soil sampling locations



Soil sampling locations with PAHs > guidelines



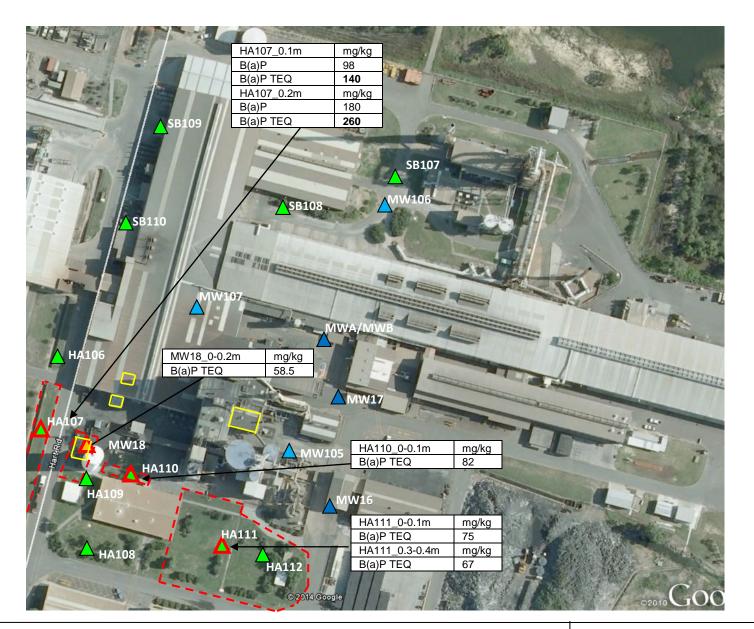
Approximate Scale 1cm:8m



Hydro Aluminium Kurri Kurri: Remedial Action Plan

AEC 6: East Surge Pond and Associated Drainage Line

RAMBOLL



2014

2014 groundwater well locations

2014 soil sampling locations



2012 groundwater well locations



2012 soil sampling locations



Soil sampling locations with PAHs > guidelines



Areas of visible staining



Approximate extent of shallow soil contamination

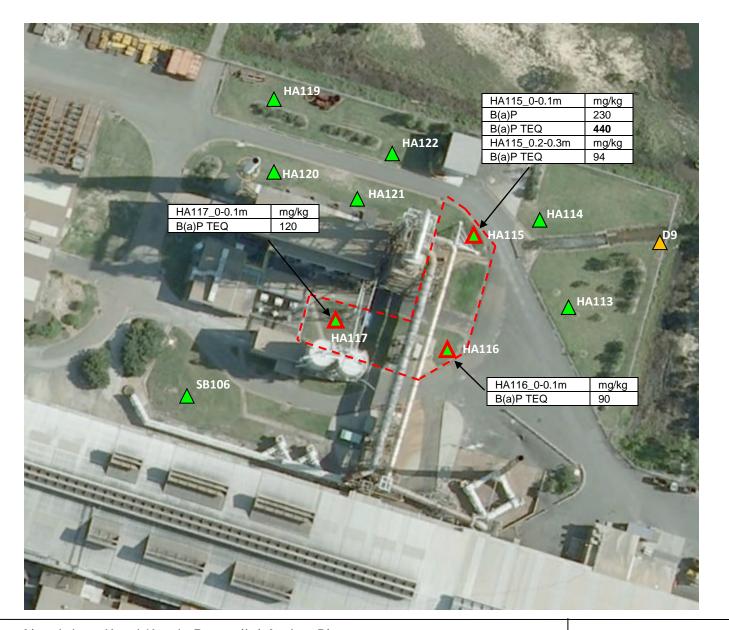
Approximate Scale 1cm:12m



Hydro Aluminium Kurri Kurri: Remedial Action Plan

AEC 8 - Carbon Plant (western end)







2014 soil sampling locations



2012 soil sampling locations



Soil sampling locations with PAHs > guidelines



Approximate extent of shallow soil contamination

Approximate Scale 1cm:5m



Hydro Aluminium Kurri Kurri: Remedial Action Plan

AEC 26 – Bake Furnace Scrubber

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2014 soil sampling locations



Soil sampling location with PAHs > guidelines



Approximate extent of buried fill

Approximate Scale 1cm:9m



Hydro Aluminium Kurri Kurri: Remedial Action Plan

AEC 28 - Area East of Playing Fields

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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

TARLE LRA Coll Association Research																															
TABLE LR1 Soil Analytical Results for t Sample Identification	tne Site			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	MW 19
Sample Depth (m)	PQL				Management	1	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	FUL	HIL D ^A	HSL D ^B	EIL C/IC	Limits ^D	ESL C/F		13/04/2012	17/04/2012	18/04/2012	18/04/2012			18/04/2012					19/04/2012	16/04/2012			16/04/2012		16/04/2012	16/04/2012	16/04/2012	18/04/2012		19/04/2012	19/04/20
Date					Limits		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	19/04/20
0							ALLUVIAL	RESIDUAL	Ca.	FILL	Di i	CV.	DU	DI I	ESTUARINE	DU	ESTUARINE	Eu l	ESTUARINE	ESTUARINE	ESTUARINE	ESTI MRINE	ESTUARINE	TODOOU	ESTI JARINE	Du	ESTUARINE	Ca.	nu.	CV.	FILL
Sample Profile PAEC Sampled							Background	Background	FILL Carbon Plant	Carbon Plant	FILL Carbon Plant	FILL Carbon Plant	FILL Carbon Plant	FILL Carbon Plant	Carbon Plant	FILL Carbon Plant	Carbon Plant	FILL Carbon Plant	Carbon Plant	Refuelling	Refueling	Refueling	Refuelling	TOPSOIL Refuelling	Refuelling	FILL Refuelling	Refuelling	FILL	FILL	FILL	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		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							.50	. 40	_ /0	.50	.500	2330	2330					40	230	230	.50		230		-0						
Total Cyanide	1	1500					<1	<1	<1	<1	<1	<1	<1	3	<1	<1	<1	<1	<1				1			1	1				
Polycyclic Aromatic Hydrocarbons (PAH)	_	1000					- '		~ .																						
Nanhthalene	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		<u> </u>	3/0	-	<u> </u>	<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			-	-	<u> </u>	<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 ^r	< 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)		4000					40.0	40.0	40.0	10.0	40.0	0.0	50.0	0.0	10.0	-0.5	40.0	507	40.0	-0.0	40.0	40.0	40.0	40.0		0.2	40.0	10.0	415	303	200
TPH C6-C9	10		260		800															<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
TPH C10-C14	50		NL NL	-	1000	170														<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TPH C15-C28	100		NL	-	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			-		10,000															<100	<100	<100	<100 <50	120	<100	3360	<50	<100 <50	2020	3760	870
	-			-	-	-																					<50			3760	870
Polychlorinated Biphenyls																						4.00	100	120							
																						450	100	120							
Total PCBs	1	-		-	-	-																100		120							
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Total PCBs Sens Vabilité Organic Compounds Total PAHs Total Phants Total Phants Solvent States Worsanimatics Worsanimatics and Ketones Halboelhers Folkonimated Hydrocarbons Annines and Berudidines Organochristine Pastides	1 1 5 1 1 0.5	4000																		<pre><lor <lor="" <lor<="" td=""><td><lor <lor="" <lor<="" td=""><td>«LOR «LOR «LOR «LOR «LOR «LOR «LOR «LOR</td><td>dOR dOR dOR dOR dOR dOR dOR dOR dOR dOR</td><td>dOR dOR dOR dOR dOR dOR dOR dOR</td><td><lor <lor="" <lor<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td></lor></td></lor></td></lor></pre>	<lor <lor="" <lor<="" td=""><td>«LOR «LOR «LOR «LOR «LOR «LOR «LOR «LOR</td><td>dOR dOR dOR dOR dOR dOR dOR dOR dOR dOR</td><td>dOR dOR dOR dOR dOR dOR dOR dOR</td><td><lor <lor="" <lor<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td></lor></td></lor>	«LOR «LOR «LOR «LOR «LOR «LOR «LOR «LOR	dOR	dOR dOR dOR dOR dOR dOR dOR dOR	<lor <lor="" <lor<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td></lor>						
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Total PCBs Sens Volatis Crganic Compounds Total PArls Total PArls Total PArents Phinhalise Esters Nitocanimes Nito	1 1 5 1 1 0.5 1 1 1 0.5 1 1 0.5 5 5 1 1 1 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	4000																		<pre><lor <lor="" <lor<="" td=""><td><lor <lor="" <lor<="" td=""><td>«LOR «LOR «LOR «LOR «LOR «LOR «LOR «LOR</td><td><pre></pre></td><td>dOR dOR dOR dOR dOR dOR dOR dOR dOR dOR</td><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td></lor<></td></lor></td></lor></pre>	<lor <lor="" <lor<="" td=""><td>«LOR «LOR «LOR «LOR «LOR «LOR «LOR «LOR</td><td><pre></pre></td><td>dOR dOR dOR dOR dOR dOR dOR dOR dOR dOR</td><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td></lor<></td></lor>	«LOR «LOR «LOR «LOR «LOR «LOR «LOR «LOR	<pre></pre>	dOR dOR dOR dOR dOR dOR dOR dOR dOR dOR	<lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td></lor<>						
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Troat PCBs Sem Volatile Organic Compounds Troat PANEs	1 1 5 1 1 0.5 1 1 0.5 1 1 0.5 0.5 0.5 0.5	4000																		<pre><lor <lor="" <lor<="" td=""><td><lor <lor="" <lor<="" td=""><td>«LOR «LOR «LOR «LOR «LOR «LOR «LOR «LOR</td><td><pre></pre></td><td>dOR dOR dOR dOR dOR dOR dOR dOR dOR dOR</td><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td></lor<></td></lor></td></lor></pre>	<lor <lor="" <lor<="" td=""><td>«LOR «LOR «LOR «LOR «LOR «LOR «LOR «LOR</td><td><pre></pre></td><td>dOR dOR dOR dOR dOR dOR dOR dOR dOR dOR</td><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td></lor<></td></lor>	«LOR «LOR «LOR «LOR «LOR «LOR «LOR «LOR	<pre></pre>	dOR dOR dOR dOR dOR dOR dOR dOR dOR dOR	<lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td></lor<>						

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

Page 1 of 2

TABLE LR1 Soil Analytical Results for	or the Site																															
Sample Identification				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)	PQL	HIL D ^A	HSL D ^B	EIL C/IC	Management	ESL C/F	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					Limits ^D		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	ESTI MARINE	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	Maintenance	Maintenance	FLS	FLS	Washbay	Washbay	Washbay	CBWB	CBWB	AWP	AWP	AWP	Switchward	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
LIIC	0.05	400,000 730		440**	-	-	229 <0.1	5400	444 <0.1	1210 <0.1	232 <0.1	179 c0.1	65.3 <0.1	362 <0.1	90.7	1.1 <0.1	260 <0.1	1380 <0.1	578 0.2	621 <0.1	420 <0.1	425 0.1	4.9 <0.1	304 <0.1	<0.1	21.3 <0.1		31.6 <0.1	15.4	75.5 c0.1	76.7 <0.1	59.2 <0.1
Mercury (inorganic) Fluoride	40	730 17000*		-	-	-	<0.1 13400	<0.1 26400	<0.1 41900	<0.1	<0.1 1470	<0.1 680	<0.1 520	<0.1 1440	<0.1 970	<0.1 70	<0.1 700	<0.1 16200	39000	<0.1 1230	<0.1 960	10600	<0.1 190	<0.1 47100	<0.1 1010	<0.1 17700		<0.1 310	<0.1 190	<0.1 2120	<0.1 1030	<0.1 190
Non Metallic Inorganics	40	17000	<u> </u>	-	_		13400	20400	41900	20900	14/0	680	520	1440	9/0	70	700	16200	39000	1230	960	10600	190	4/100	1010	17700		310	190	2120	1030	190
Total Cyanide	1 1	1500					T										<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 Benzo(b)&(k)fluoranthene	0.5	-		-	-	-					_						0.6	0.5			3.3	24.3	<0.5	74.3 88.6	<0.5 <0.5	26.6		<0.5	<0.5	2.2	1.4	
Benzo(k)fluoranthene	0.5	1 -			-												<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) ovrene	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 10,000	1700 3300					_																					
TPH C29-C36 TPH C10-C36	100	-		- :	10,000	3300														+												
Polychlorinated Biphenyls			<u> </u>				1																				1					
Total PCBs	1			-		-	<0.01	<0.01	<0.01	<0.01																	<0.1					
Semi Volatile Organic Compounds																																
Total PAHs	1	4000		-											<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>										<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""></lor<></td></lor<>	<lor< td=""></lor<>
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Phthalate Esters	5														<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>										<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""></lor<></td></lor<>	<lor< td=""></lor<>
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Haloethers	0.5					-									<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<>										<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""></lor<></td></lor<>	<lor< td=""></lor<>
Chlorinated Hydrocarbons Anilines and Benzidines	1 1	-		-	-	-					1				<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 		-							-	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor 	<lor <lor< td=""></lor<></lor
Anilines and Benzidines Organochlorine Pesticides	1		<u> </u>	<u> </u>	-	-	 	-		-	-	 			<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td></td><td>-</td><td></td><td></td><td> </td><td></td><td></td><td></td><td> </td><td><lor <lor< td=""><td><lor< td=""><td><lor <lor< td=""><td><lor ⊲LOR</lor </td><td><lor< td=""></lor<></td></lor<></lor </td></lor<></td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td></td><td>-</td><td></td><td></td><td> </td><td></td><td></td><td></td><td> </td><td><lor <lor< td=""><td><lor< td=""><td><lor <lor< td=""><td><lor ⊲LOR</lor </td><td><lor< td=""></lor<></td></lor<></lor </td></lor<></td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td></td><td>-</td><td></td><td></td><td> </td><td></td><td></td><td></td><td> </td><td><lor <lor< td=""><td><lor< td=""><td><lor <lor< td=""><td><lor ⊲LOR</lor </td><td><lor< td=""></lor<></td></lor<></lor </td></lor<></td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td></td><td>-</td><td></td><td></td><td> </td><td></td><td></td><td></td><td> </td><td><lor <lor< td=""><td><lor< td=""><td><lor <lor< td=""><td><lor ⊲LOR</lor </td><td><lor< td=""></lor<></td></lor<></lor </td></lor<></td></lor<></lor </td></lor<></lor 		-			 				 	<lor <lor< td=""><td><lor< td=""><td><lor <lor< td=""><td><lor ⊲LOR</lor </td><td><lor< td=""></lor<></td></lor<></lor </td></lor<></td></lor<></lor 	<lor< td=""><td><lor <lor< td=""><td><lor ⊲LOR</lor </td><td><lor< td=""></lor<></td></lor<></lor </td></lor<>	<lor <lor< td=""><td><lor ⊲LOR</lor </td><td><lor< td=""></lor<></td></lor<></lor 	<lor ⊲LOR</lor 	<lor< td=""></lor<>
Organochlorine Pesticides Organophosphorus Pesticides	0.5		<u> </u>	<u> </u>	-		-		-		-	+	-	-	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td></td><td>-</td><td>-</td><td></td><td></td><td></td><td></td><td> </td><td> </td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td></td><td>-</td><td>-</td><td></td><td></td><td></td><td></td><td> </td><td> </td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td></td><td>-</td><td>-</td><td></td><td></td><td></td><td></td><td> </td><td> </td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td></td><td>-</td><td>-</td><td></td><td></td><td></td><td></td><td> </td><td> </td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 		-	-					 	 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor 	<lor <lor< td=""></lor<></lor
Miscellaneous Compounds	0.5	-				-	 								<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td> </td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td> </td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td> </td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td> </td><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 									 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor </td></lor<></lor 	<lor <lor< td=""><td><lor <lor< td=""></lor<></lor </td></lor<></lor 	<lor <lor< td=""></lor<></lor
Volatile Organic Compounds	0.0											+ -			ALOIN .	ALON.	ALON	N.LON										*LON	SEON	ALON	ALOIN.	ALOIT
Monocyclic Aromatic Hydrocarbons	- 5						<0.01	<0.01	<0.01	<0.01																	<lor< td=""><td></td><td></td><td></td><td></td><td></td></lor<>					
Oxygenated Compounds	0.5					-	<0.01	<0.01	<0.01	<0.01																	<lor< td=""><td></td><td></td><td></td><td></td><td></td></lor<>					
	1						<0.01	<0.01	<0.01	<0.01																	<lor< td=""><td></td><td></td><td></td><td></td><td></td></lor<>					
Sulfonated Compounds									< 0.01	< 0.01																	<lor< td=""><td></td><td></td><td></td><td></td><td></td></lor<>					
Sulfonated Compounds Furnigants	0.5	-		-	-	-	<0.01	<0.01	4.0.01																							
Furnigants Halogenated Aliphatic Compounds	0.5 5			-			<0.01	<0.01	<0.01	<0.01																	<lor< td=""><td></td><td></td><td></td><td></td><td></td></lor<>					
Fumigants		-		-	-																											

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

Page 2 of 2

TABLE LR2 Soil Analytical Results for Drainage Lines and Dams

Sample Identification							D1	D2	D3	D5	D6	D7	D8	D8-BASE	D9	D10	D11	D11-1	D12	D12-1
Sample Depth (m)	PQL	HIL D ^A	HSL D ^B	EII 0//C	Management	FOL OUE	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		HIL D	HSL D	EIL C/I ^C	Limits ^D	ESL C/I ^E	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 Hydr	ocarbons	(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	1-1			1-1	-	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	1-1			1-1	-	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	<u>85.6</u>	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)

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

^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 meg/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 Drainage Lines and Dams

Sample Identification							COMPOSITE 1	COMPOSITE 2	COMPOSITE 3	COMPOSITE 4	ND4-BASE	ND7-BASE
Sample Depth (m)	PQL	HIL D ^A	HSL D ^B	EIL C/I ^C	Management	ESL C/I ^E					0.25-0.35	0.1-0.15
Date		HIL D	HSL D	EIL C/I	Limits ^D	ESL C/I	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 Hydr	ocarbons	(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)

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

<LOR = Less than the Limit of Reporting

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

TABLE LR4 Groundwater Analytica	l Resul	ts																		
Sample Identification	PQL		Guideline		MW06	MW01	MW01	MW03	MW03	MW04	MW04	MW05	MW05	MW07	MW08	MW09	MW10	MW11	MW12	MW13
Date	PQL	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	1	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 Nickel	1	1.4 11	200 200	1000 1000	<10 22	<10 <10	5 58	<10 488	3 420	<10 938	600	3 15	3 15	10 30	<1 2	2 16	1 19	5	88 110	2
Lead	1	3.4	2000	1000	<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			1								<8	<4	<4	<8	7
Total Cyanide	4	NA			<4			<u> </u>	l	l	l	l	l	l		<8	<4	13	<8	40
Total Petroleum Hydrocarbons (TPH) TPH C6-C9	20		1				1	T						<20	<20	1				
TPH C10-C14	50		 	†	 		 	 						<50	<50	 			 	
TPH C15-C28	10		İ	<u> </u>										<100	330					
TPH C29-C36	50													<50	<50					
TPH C6-C36		7	LOR	LOR										<50	330					
Polycyclic Aromatic Hydrocarbons (PA			•				1	1												
3-Methylcholanthrene	0.1				<0.1			-						<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
2-Methylnaphthalene 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	<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 Benzo(b)fluoranthene	0.05	0.2			<0.05 <0.1			-						<0.05 <0.1	<0.05 <0.1	0.58 1.4	<0.05 <0.1	<0.05 <0.1	0.4	6.46 8.1
Benzo(e)pyrene	0.1				<0.1									<0.1	<0.1	0.7	<0.1	<0.1	0.8	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 Fluorene	0.1	1.4			<0.1 <0.1									<0.1 <0.1	<0.1 <0.1	0.2 <0.1	<0.1 <0.1	<0.1 <0.1	0.3 <0.1	4.8 <0.1
Indeno(1.2.3.cd)pyrene	0.1	-	 	<u> </u>	<0.1		1	†						<0.1	<0.1	0.2	<0.1	<0.1	0.2	3
N-2-Fluorenyl Acetamide	0.1		İ	<u> </u>	<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		ļ							<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.9
Pyrene Semivolatile Organic Compounds (SVC	0.1				<0.1		<u> </u>							<0.1	<0.1	0.2	<0.1	<0.1	0.3	5
Organochlorine Pesticides (OCP)	<i>,</i> (5)																			
alpha-BHC	2			1	<2	<2		<2		<2		<2				<2	<2		T	
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 Chlordane	2	0.08		 	<2 <2	<2 <2	 	<2 <2		<2 <2		<2 <2				<2 <2	<2 <2		 	
Endosulfan	2	0.08	 	†	<2	<2	 	<2		<2		<2				<2	<2		 	
Dieldrin	2	0.01	i	1	<2	<2	1	<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 DDT	4	0.01		1	<2 <4	<2 <4	 	<2 <4		<2 <4		<2 <4				<2 <4	<2 <4		 	
וטט	4	0.01	1	1	<4	<4	ı	<4		<4		<4				<4	<4			

TABLE LR4 Groundwater Analytic	al Resul	ts																		
Sample Identification	PQL		Guideline		MW06	MW01	MW01	MW03	MW03	MW04	MW04	MW05	MW05	MW07	MW08	MW09	MW10	MW11	MW12	MW13
Date	PUL	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
21500																				
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		•	1	1	_						•		1	•						
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			<u> </u>
Bromophos-ethyl	2				<2	<2		<2		<2		<2				<2	<2			<u> </u>
Chlorfenvinphos	2				<2	<2		<2		<2		<2				<2	<2			
Prothiofos	2				<2	<2		<2		<2		<2				<2	<2		<u> </u>	
Ethion	2				<2	<2		<2		<2		<2			l	<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							1	
Phenanthrene	2					<2		<2		<2		<2								
Anthracene	2					<2		<2		<2		<2								
Fluoranthene	2					<2		<2		<2		<2							1	
Pyrene	2					<2		<2		<2		<2							1	
N-2-Fluorenyl Acetamide	2					<2		<2		<2		<2								
Benz(a)anthracene	2					<2		<2		<2		<2							1	
Chrysene	2					<2		<2		<2		<2							1	
Benzo(b) & Benzo(k)fluoranthene	4					<4		<4		<4		<4								
7.12-Dimethylbenz(a)anthracene	2					<2		<2		<2		<2							1	
Benzo(a)pyrene	2					<2		<2		<2		<2							1	
3-Methylcholanthrene	2					<2		<2		<2		<2							1	
Indeno(1.2.3.cd)pyrene	2					<2		<2		<2		<2							1	
Dibenz(a.h)anthracene	2					<2		<2		<2		<2							T	
Benzo(g.h.i)perylene	2					<2	1	<2		<2		<2							T T	
Phenols																				
Total Phenolics	4	320			<4	<4		<4		<4		<4				<4	<4		Т	
Phthalate Esthers																				
Dimethylphthalate	2	3700			<2	<2		<2		<2		<2				<2	<2			
Diethylephthalate	2	1000			<2	<2		<2		<2		<2				<2	<2		Т	
Nitrosamines																				
Total Nitrosamines	2				<2	<2		<2		<2		<2				<2	<2		T	
Nitroaromatics and Ketones																				
Total Nitroaromatics and Ketones	2				<2	<2		<2		<2		<2				<2	<2		T	
Haloethers								•												
Total Haloethers	2				<2	<2	1	<2		<2		<2			1	<2	<2		τ	
Chlorinated Hydrocarbons																				
Total Chlorinated Hydrocarbons	2		ı		<2	<2	T	<2	ı	<2		<2			ı	<2	<2		$\overline{}$	
Anilines and Benzidines												_ ~					<u> </u>			
Total Anilines and Benzidines	2		ı		<2	<2	T	<2	ı	<2		<2			ı	<2	<2		$\overline{}$	
Miscellaneous Compounds					_ ~_			_ ~_												
Total Misscellaneous Compounds	2		1		<2	<2	1	<2	1	<2		<2			1	<2	<2		$\overline{}$	
Total Missociia recus Compounds		1			\Z	~2	1	\Z		\Z	1	\Z		1		\Z	\Z			

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

Sample Identification	cal Resul	Ī	Guideline		MW14	MW15	MW16	MW17	MW18	S3A	S3B	SUMP	MW19	MW20	MW21
Date	PQL	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
		3378 I Testi	iiiigatioii	Otook											
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 <1	0.2	<0.1	<0.1	<0.1	0.3	<1 1	3			<0.1
Chromium Copper	1	1.4	100 200	1000 1000	7	<1 2	4	<1 10	3 2	<1 4	2	<1 5		-	<10 <10
Nickel	+ 1	11	200	1000	10	7	6	14	3	6	1	8			62
Lead	1	3.4	2000	1000	<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							1	1	1	1					
TPH C6-C9	20	1						l	l				<20	<20	-
TPH C10-C14 TPH C15-C28	50 10	-			-		 	 	 	 			<50 <100	<50 <100	
TPH C15-C28 TPH C29-C36	50	1			 								<50	<50	-
TPH C6-C36	30	7	LOR	LOR	l		 	 	 	 			<50	<50	
Polycyclic Aromatic Hydrocarbons (PAH)		LOIX	LOIL									200	100	
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	0.0			<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<u> </u>
Benzo(a)pyrene Benzo(b)fluoranthene	0.05	0.2			0.06	<0.05 <0.1	0.22	<0.05 <0.1	0.06 <0.1	0.14 0.2	0.08 <0.1	<0.05 <0.1	<0.05 <0.1	<0.05 <0.1	
Benzo(e)pyrene	0.1				<0.1	<0.1	0.2	<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	16			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
Naphthalene Perylene	0.1	16			<0.1 <0.1	<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	<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	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Semivolatile Organic Compounds (S		•				30.1			30.1	30.1					
Organochlorine Pesticides (OCP)															
alpha-BHC	2														<2
HCB	2														<2
delta-BHC	2														<2
Heptachlor	2	0.09												 	<2
Aldrin	2	0.001												<u> </u>	<2
Heptachlor epoxide	2	0.00						l	l					1	<2
Chlordane	2	0.08			!		 	 	 	 					<2
Endosulfan Dieldrin	2	0.2			-		 	 	 	 				-	<2 <2
DDE	2	0.01		-	-		 	 	 	 				 	<2 <2
Endrin	2	0.03					 	 	 	 				 	<2
DDD	2	0.02			i		1	1	1	1				 	<2
Endrin aldehyde	2	1			1		1	1	1	1					<2
Endosulfan sulfate	2														<2
DDT	4	0.01		1	1		t	†	†	t				1	<4

TABLE LR4 Groundwater A	Analytical	Results
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TABLE LR4 Groundwater Analytical		.5	Guideline		1.004/4.4	101/45	101/40	100/47	100/40	004	000	OLIMA	100/40	1.01400	1.004/04
Sample Identification	PQL			011	MW14	MW15	MW16	MW17	MW18	S3A	S3B	SUMP	MW19	MW20	MW21
Date	l	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							
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	l						<u> </u>						<2
Nitrosamines															
Total Nitrosamines	2														<2
Nitroaromatics and Ketones															
Total Nitroaromatics and Ketones	2														<2
Haloethers															
Total Haloethers	2		l						<u> </u>						<2
Chlorinated Hydrocarbons															
Total Chlorinated Hydrocarbons	2														<2
Anilines and Benzidines									_						
Total Anilines and Benzidines	2				l										<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



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

NIALL JOHNSTON

Manager Contaminated Sites

Mul 18/10/2012

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)

TABLE LR1 Soil Analytica	al Results t	for AEC 2 And	de Waste Pil	e (mg/kg)													
Sample Identification					MW12	MW12	MW13	SB103	SB103	SB104	SB104	SB105	SB105	MW103	MW103	MW104	MW104
Sample Depth (m)	PQL	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		HIL D	EIL C/I	LOL C/I	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										
Sample collected by					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 Hydroca	arbons (PAF	1)															
Naphthalene	0.5	1-	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	1-	-	-	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	1-	-	-	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	<u>160</u>	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	1-	-	-	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

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

Results shown in underline are in excess of the ecological criteria

Page 1 of 1 Environ

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.

<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				,	SB17	SB18	MW19	MW19	SB111	SB111	SB112	SB112	SB112	SB113	SB113	SB114	SB114
Sample Depth (m)	PQL				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	1 42	HIL D ^A	EIL C/I ^B	ESL C/I	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
OI- Dfil-				1	FILL	FILL		FILL	Eu l	F., 1	T ===	F# 1	FILL	F	F# 1	FILE	F
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 Hydroca	rhons (PAH	1)															
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	<u>101</u>	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.

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

^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

TABLE LR3 Soil Analytical Results for AEC 8 Carbon Plant

		/ ALO 0 00	irbon Piant																	
Sample Identification					SB11	SB12	SB13	MW14	MW15	MW16	MW16	MW17	MW17	MW18	MW18	SB108	SB109	SB110	MW105	MW105
Sample Depth (m)	PQL	HIL D ^A	EIL C/IB	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		HILD	EIL C/I	LSL C/I	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															
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 Hydrocar	bons (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

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

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.

^{*} 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

TABLE LR3 Soll Analytical	i iveaulta iv	ALC U CE	ii boii i iaiit															
Sample Identification					MW106	MW107	HA106	HA106	HA107	HA107	HA108	HA109	HA109	HA110	HA110	HA111	HA111	HA112
Sample Depth (m)	PQL	HIL D ^A	EIL C/IB	ESL C/I	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		HIL D	EIL C/I	LSL C/I	30-Jun-14	30-Jun-14	25-Jun-14											
	•	•			-	-	-	-	-	-	-	-	•	-	-	-	-	-
Sample Profile					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													
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 Hydrocar	rbons (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	<u>98</u>	<u>180</u>	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

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

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 conc

^{*} 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		Guide	eline	SB9	SB9	MW11	SB101	SB101
Sample Depth (m)	PQL	LIII DA	EU O//B	0.3-0.4	0.6-0.8	0-0.2	0.0-0.1	0.3-0.4
Date		HIL D ^A	EIL C/IB	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	-	-

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</p>
- * 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

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

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

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

Sample Identification				SB1	SB2	SB3	SB4	SB115	SB116	SB116	SB117	SB117	SB118	SB118	SB119	SB119	SB120	SB121
Sample Depth (m)	PQL	LIII DA	EIL C/IB	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		HIL D ^A	EIL C/I	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	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers	Dry Scrubbers					
Sample collected by				FR	FR	FR	FR	KG	KG	KG	KG							
Metals																		
Aluminium	50	NL*	-	53300	139000	138000	41700	-	1	-	-	-	-	-	-	-	-	-
Arsenic	1	3000	160	4.5	28.9	8.8	14.6	-	1	-	-	-	-	-	-	-	-	-
Cadmium	0.1	900	-	0.7	1.8	1.4	0.8	-	1	-	-	-	-	-	-	-	-	-
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	-	1	-	-	-	-	-	-	-	-	-
Lead	2	1500	1800	25	430	28.7	247	-	1	-	-	-	-	-	-	-	-	-
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	-	-	-	-	-	-	-	-	-	-	-

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

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

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

^{*} 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				SB121	SB122	SB123	SB123	SB124	SB125	SB126	SB127	SB127	SB127	SB128	SB129	SB129	SB129	SB131
Sample Depth (m)	PQL	LIII DA	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		HIL D ^A	EIL C/I	01-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14									
•			-	-														
Sample Profile				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														
		•				•				•				•			•	
Metals																		
Aluminium	50	NL*	-	-	-	-	-	-	•	-	-	-	-		-		-	-
Arsenic	1	3000	160	-	-	-	-	-	ı	-	-	-	ı	ı	-	ı	-	-
Cadmium	0.1	900	-	-	-	-	-	-	ı	-	-	-	ı	ı	-	ı	-	-
Chromium	1	3600	320**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	2	240000	210**	-	-	-	-	-	•	-	-	-	-		-		-	-
Nickel	1	6000	140**	-	-	-	-	-	1	-	-	-	ı	ı	-	ı	-	-
Lead	2	1500	1800	-	-	-	-	-	1	-	-	-	ı	ı	-	ı	-	-
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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

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

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

 $^{^\}star$ Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening L

 $^{^{\}star\star}$ EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and T $^{\prime\star}$

TABLE LR5 Soil Analytical Results for AEC 12 Pot Line

Sample Identification				SB131	SB132	SB133	SB133	SB134	SB135	SB135	HA101	HA101	HA101	HA102	HA102	HA102	HA103	HA103	HA104
Sample Depth (m)	PQL	LIII. DA	EU O#B	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		HIL D ^A	EIL C/I ^B	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	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AU 1/ 1 1/ 1																			

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

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

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

 $^{^\}star$ Site-specific fluoride (soluble) soil criteria derived from 'Preliminary Screening L

 $^{^{\}star\star}$ EIL values calculated using site-specific CEC (7.26 meq/100g), pH (5.5) and T $^{\prime\star}$

TABLE LR5 Soil Analytical Results for AEC 12 Pot Line

Sample Identification				HA104	HA105	HA105	HA105
Sample Depth (m)	PQL	LIII DA	EIL C/IB	0.1	Surface	0.1	0.2
Date		HIL D ^A	EIL C/I	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.

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

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

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

 $^{^\}star$ 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 TI

TABLE LR6 Soil Analytical Results for PAEC 26 Ring furnace Scrubber

TABLE LING SOIL ATTAINTING	ui itesuits	01 1 ALG 20 1	King rumace	OCIUDDEI																
Sample Identification	_				HA113	HA113	HA114	HA115	HA115	HA116	HA116	HA117	HA117	HA119	HA119	HA120	HA121	HA122	HA122	SB106
Sample Depth (m)	PQL	HIL D ^A	EIL C/IB	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		HIL D	EIL C/I	ESL C/I	27-Jun-14	30-Jun-14														
Sample Profile					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	KG														
Metals																				
Fluoride (soluble)	40	17000*		-	40	130	29	7.9	-	28	-	13	-	76	130	13	17	39	68	38
Polycyclic Aromatic Hydroca	arbons (PAI	1)																		
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	8.0	<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	8.0	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.

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

^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

^{*} 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

Sample Depth (m)	PQL	HIL D ^A	HSL D ^B	EIL C/IC	Management	ESL C/I ^E	0.2	0-0.2	0.5	0-0.3	0.4-0.5	0.4-0.5	0.1-0.3
Date		HIL D	HSL D	EIL C/I	Limits ^D	ESL C/I	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						
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	<u>590</u>
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	<u>5600</u>
Fluoride (soluble)	0.5	17000*		-			45	16	19	22	<0.5	2.1	31
Polycyclic Aromatic Hydroca	arbons (PAH	l)											
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

TP101

< 0.5

0.35

<25

<50

<100

<100

<25

<50

<0.2

< 0.5

<2

<1

< 0.5

0.69

<25

<50

<100

<100

<25

<50

<0.2

<0.5

<2

<1

<0.5

NIL (+)VE

<25

<50

<100

<100

<25

<50

<0.2

<0.5

<2

<1

< 0.5

NIL (+)VE

<25

<50

<100

<100

<25

<50

<0.2

<0.5

<2

<1

<0.5

NIL (+)VE

<25

<50

<100

<100

<25

<50

<0.2

<0.5

<2

<1

<0.5

NIL (+)VE

<25

<50

<100

<100

<25

<50

<0.2

< 0.5

<2

<1

<0.5

NIL (+)VE

<25

<50

<100

<100

<25

<50

<0.2

< 0.5

<2

<1

TP104

TP107

TP111

TP113

TP115

TP116

All results are in units of mg/kg.

Benzo(a) pyrene TEQ

Sum of reported PAH

TRH C6-C10

TRH >C10-C16

TRH >C16-C34

TRH >C34-C40

Benzene

Toluene

Xvlenes

Ethylbenzene

TRH C6-C10 - BTEX (F1)

TRH >C10-C36 - Naph (F2)

Total Petroleum Hydrocarbons (TPH)

Benzene, Toluene, Ethyl benene, Xylene (BTEX)

0.5

25

50

100

100

25

50

0.2

0.5

40

4000

800

1000

5000

10000

170

2500

6600

215

75

135

165

180

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

260

NL

3

NL

NL

230

^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

^{*} 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

Cample Identification	i itesuits it	01 1 ALO 23 A	ilea Last Oi i	laying i lei	us		TP117	TD440	TD110	TD420	TP122	TD100	TP124	TP125	TP126	TP127
Sample Identification	PQL		HSL D ^B		Managament			TP118	TP119	TP120	0.5	TP123 0.5	0.5	0.5	0.5	
Sample Depth (m)	PQL	HIL D ^A		EIL C/I ^C	Management Limits ^D	ESL C/I ^E	0.5	0.5	0.5	0.5						0.5
Date					Limits		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
Sample collected by							KW	KW	KVV	KW	KVV	KW	KW	KW	NW	KVV
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**	İ		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 Hydrocar	bons (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	8.0	0.4	0.3
Benzo(a) pyrene	0.05					72 ^F	<u>220</u>	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 Hydrocarbon					,											
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		1	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 bene		(BTEX)			1					2.2	2.2	2.2	2.2	2.2	0.0	
Benzene	0.2		3		1	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		1	135	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	2		NL		1	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

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

^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)

TABLE LR9 Soil Analytical Results for PAEC 31 Storage Area west of Pot Line 3

Sample Identification							TP128	TP128	TP129	TP130	TP130	TP131	TP132	TP132	TP133	TP134	TP135	TP135	TP136	TP137	TP137
Sample Depth (m)	PQL		1		Management	1	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
	- FQL	HIL D ^A	HSL D ^B	EIL C/IC	Limits	ESL C/I ^E	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
Date			l	l	LIIIIIIS		25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14	25-Juli-14
Sample Profile							FILL														
PAEC Sampled							SAPL3														
Sample collected by							KW														
Campic collected by														1.00							
Metals																					
Arsenic	4	3000	l	160	l		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 Hydroca	bons (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 Hydrocarbor																					
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 benz		(BTEX)		1	1																
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

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

^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

<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

TABLE LR9 Soil Analytical Sample Identification	Troounto re		.c.ago /oa				TP138	TP139	TP140
Sample Depth (m)	PQL		_		Management	-	0.2	0.1	0.1
Date Date		HIL D ^A	HSL D ^B	EIL C/I ^C	Limits ^D	ESL C/I ^E	25-Jun-14	25-Jun-14	25-Jun-14
Dato	-		1						
Sample Profile							FILL	FILL	FILL
PAEC Sampled							SAPL3	SAPL3	SAPL3
Sample collected by							KW	ĸw	KW
,								ı	
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 Hydrocai	bons (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 Hydrocarbon									
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 benz		(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	L	_l l	180	<1	<1	<1

PQL = Practical Quantitation Limit.

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^{**} 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'.

Sample Identification Date	PQL	Q5% Eroch A	Guide Recreational		Stock	MW06	MW06	MW101 9/7/14	MW102	MW07	MW07 9/7/14	MW08	MW08 9/7/14	MW09 30/4/12	MW09	MW10 30/4/12	MW10 9/7/14	MW11	MW11 9/7/14	MW12 30/4/12	MW12 9/7/14	MW13	MW13	MW103	
		95% Fresn	Recleational	inigation	SIUCK	Background	Background		Refuelling	Refuelling		Refuelling	Refuelling	FLS	FLS	FLS	5///14 FLS	Washhay	Washhay	AWP	AWP	AWP	AWP	AWP	AWP
PAEC Sampled Sample Appearance						Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Cloudy	Clear	Turbid	Clear	Washbay 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 16	<10	2,150		7,700	1,300
Arsenic Cadmium	0.1	24	100 20	100 10	500 10	<10 <1	<0.1	<0.1	<0.1	13 0.2	6 <0.1	3 <1	<1 <0.1	<0.1	<0.1	2 <0.1	3 <0.1	18 <0.1	<0.1	2.1	<1 <0.1	<0.1	<1 <0.1	0.2	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 Lead	1 1	97* 87*	200 100	200 2000	1000	22 <10	20 <1	9 <1	2 <1	30 <1	2 <1	2 <1	<1 <1	16 <1	14 <1	19 <1	24	5 <1	6 <1	110	15 <1	2 <1	<1 <1	18 <1	5 <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	< 0.0
Fluoride	100		1500	1000	2000	1000	220	460	3200	1300	1400	4900	6700	1000	560	1200	2100	3900	8300	1700	220	43000	40000	12000	1300
Non Metallic Inorganics Free Cyanide	4	7	800		1	<4								-8		<4		<4		<8		7			
Total Cyanide	4	NA.	000			<4								<8 <8		<4		13		<8		40			
Total Petroleum Hydrocarbons (TPH)																									
TPH C6-C9 TPH C10-C14	20 50							<10 <50	18 <50	<20 <50	<10 <50	<20 <50	<10 <50												
TPH C15-C28	100				1		l	<100	<100	<100	<100	330	<100			l								†	
TPH C29-C36	100							<100	<100	<50	<100	<50	<100												
TPH C6-C36 Polycyclic Aromatic Hydrocarbons (P.	(H)	LOR		LOR	LOR			<100	18	<50	<100	330	<100												
Polycyclic Aromatic Hydrocarbons (Pa 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	10	 	l	1	<0.1	l		l	<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				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				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 Benzo(b)&(k)fluoranthene	0.1					<0.1				<0.1		<0.1		0.6		<0.1		<0.1		0.2	<0.1	3.6 10.8	<0.1	<0.1	0.1
Benzo(a) pyrene	0.05	0.2				< 0.2				<0.2		<0.2		1.8 <0.05		<0.2		<0.2		0.8	<0.2	6.46	< 0.2	<0.2	<0.2
Indeno(1,2,3-c,d)pyrene	0.1					<0.03				<0.03		<0.1		0.2		<0.03		<0.1		0.2	<0.03	3	<0.03	<0.03	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 (S)	/OCs)							•																•	
Organochlorine Pesticides (OCP) alpha-BHC	2		<u> </u>		T	<2		1						<2		<2								1	_
HCB	2					<2								<2		<2									
delta-BHC	2					<2								<2		<2									
Heptachlor Aldrin	2	0.09 0.001				<2								<2 <2		<2 <2									
Heptachlor epoxide	2	0.001				<2 <2								<2 <2		<2									
Chlordane	2	0.08				<2								<2		<2									
Endosulfan	2	0.2				<2								<2		<2									
Dieldrin DDE		0.04			+	^								^											
	2	0.01				<2								<2		<2									
Endrin	2	0.01 0.03 0.02				<2 <2 <2								<2 <2		<2 <2 <2									
Endrin DDD	2 2 2	0.03				<2 <2 <2								<2 <2 <2		<2 <2 <2									
Endrin DDD Endrin aldehyde	2 2 2 2	0.03				<2 <2 <2 <2								<2 <2 <2 <2		<2 <2 <2 <2									
Endrin DDD	2 2 2	0.03 0.02				<2 <2 <2 <2 <2 <2								<2 <2 <2		<2 <2 <2									
Endrin DDD Endrin aldehyde Endosulfan sulfate DDT Organophosphorous Pesticides (OPI	2 2 2 2 2 2 4	0.03				<2 <2 <2 <2 <2 <2 <2 <4								<2 <2 <2 <2 <2 <2 <4		<2 <2 <2 <2 <2 <2 <2 <4									
Endrin DDD Endrin aldehyde Endosulfan sulfate DDT Organophosphorous Pesticides (OPI Dichlorvos	2 2 2 2 2 2 4	0.03				<2 <2 <2 <2 <2 <2 <4								<2 <2 <2 <2 <2 <2 <4		<2 <2 <2 <2 <2 <2 <4									
Endrin DDD Endrin aldehyde Endosulfan sulfate DDT Organophosphorous Pesticides (OPI	2 2 2 2 2 4	0.03 0.02 0.01				<2 <2 <2 <2 <2 <2 <2 <4								<2 <2 <2 <2 <2 <2 <4 <4		<2 <2 <2 <2 <2 <2 <2 <4									
Endrin DDD Endrin aldehyde Endosulfan sulfate DDT Organophosphorous Pesticides (OPI Dichloros Dimethoate Diazinon Chlorpyrifos-methy	2 2 2 2 4 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01				<2 <2 <2 <2 <2 <4 <4 <4 <4 <2 <2 <2 <2 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4								<2 <2 <2 <2 <4 <4 <4 <2 <2 <2 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4		<2 <2 <2 <2 <2 <4 <4 <4 <4 <2 <2 <2 <2 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4									
Endrin DDD Endrin aldehyde Endosulfan sulfate DDT Grganophosphorous Pesticides (OPI Dichloros Dimethoate Diazinon Chloryrifos-methy Malathior	2 2 2 2 2 4 4 2 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.15 0.01				<2 <2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2								<2 <2 <2 <2 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4		<2 <2 <2 <2 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4 <4									
Endrin DDD Endrin aldehyde Endosulfan sulfate DDT Organophosphorous Pesticides (OPI Dichlorvos Dimethoats Diazinon Chlorpyrifos-methy Malathior Fenthion	2 2 2 2 2 2 4 3 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01				<2 <2 <2 <2 <2 <4 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2								<2 <2 <2 <2 <4 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2		<2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2									
Endrin DDD Endrin aldehyde Endosulfan sulfate DDT Organophosphorous Pesticides (OPI Dichloros Dimethoats Diazinon Chloryrifos Bomophoseshy	2 2 2 2 2 2 4 4 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.15 0.01				<2 <2 <2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2								<2 <2 <2 <2 <4 <4 <2 <2 <2 <4 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2		<2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2									
Endrin DDD Endrin aldehyde Endrin aldehyde Endrin sulfate DDT Organoshosphorous Pesticides (OPI Dehloros Domethodst Organoshosphorous Pesticides (OPI Dehloros Demethodst Organoshosphorous Pesticides (OPI Dehloroshosphorous Pesticides (OPI Dehloroshosphorous Pesticides (OPI Dehloroshosphorous Pesticides (OPI Endreminion Chloroprifics Bomophoseethy Chlorderwinghos	2 2 2 2 4 4 4 9 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.15 0.01				<2 <2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2								<2 <2 <2 <2 <2 <4 <4 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2		<2 <2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2									
Endrin DDD Endrin alidehyde Endrin alidehyde Endrin alidehyde Endrin sullate DDT Organophosphorous Pesticides (OPI Dichlorvos Dimethoate Diazinon Chlorpyrifos-methy Malathior Fenthion Chlorpyrifos Bromophos-ethy Chlorderwiphos Prothiotos	2 2 2 2 4 4 4 9 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.15 0.01				2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2								<2 <2 <2 <2 <2 <4 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2											
Endrin DDD DDD Endrin aldehyde Endrin aldehyde Endrin aldehyde Endrin aldehyde DDT Organophosphorous Pesticides (OPI Dichlorvos Dimethoste Dolazinon Diazinon Diazinon Chicopyrios-methy Endrinon Chloryprios-methy Endrinon Chloryprios Bromophos-ethy Chlordervinghos Bromophos-ethy Prothiolos Ethion	2 2 2 2 2 2 4 4 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.15 0.01				<2 <2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2								<2 <2 <2 <2 <2 <4 <4 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2		<2 <2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2									
Endrin DDD DDD Endrin aldehyde Endrin aldehyde Endrin aldehyde Endrosulfan sulfate DDT Organophsphorous Pesticides (OPI Dichlorvos Dimethoate Dazinon Clatopyrifos-methy Malathior Forthlocifos Boronsphos-ethy Clotlorlarvingtos Boronsphos-ethy Clotlorlarvingtos Frothlocios Ethion Frothlocios Ethion Frothlocios	2 2 2 2 4 4 4 9 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.15 0.01 0.05 0.2				2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2								<2 <2 <2 <2 <2 <4 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2											
Endrin DDD Endrin aldehyde Endosulfan sulfate DDT Organophosphorous Pesticides (OPI Dichlorvos Dimethoate Dazinon Chlorpyrifos-methy Malathior Fenthion Chlorpyrifos Bromophos-ethy Chlordenvinphos Prothiolos Ethion Total Phenolics Phehalate Total Phenolics Phythalate Esthers	2 2 2 2 2 4 4 2 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.05 0.05 0.2				2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2								<2 <2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2<											
Endrin DDD Endrin aldehyde Endrin aldehyde Endrin sulfate DDT Organophosphorous Pesticides (OPI Dichlorovs Dimethoate Diazinco Chicorpyrides-methy Malathior Ferethion Chicorpyrides Bormophos-phosphorous Portinical Services Por	2 2 2 2 2 2 4 4 4 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.05 0.2 320				2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2								<2 <2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2<		22 22 22 24 44 22 22 22 22 22 22 22 22 2									
Endrin DDD Endrin aldehyde Endrous auflate DDT Granophosphorous Pesticides (OPI Dichlorovs Dimethoate Diazinon Chicipyrilos-methy Malathior Forthion Chicipyrilos Diodicolos Endrous Chicipyrilos Postrous Chicipyrilos Postrous Chicipyrilos Postrous Chicipyrilos Postrous Chicipyrilos Postrous Chicipyrilos Postrous Chicipyrilos Protinicolos Enthon Phenois Total Phenois Total Phenoics Phthalate Esthers Dimethylerhalate Diethylepthalate Nitrosamines	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.05 0.2 320				2 2 2 2 2 4 4 4 2 2 2 2 2 2 2 2 2 2 2 2										2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2									
Endrin DDD Endrin aldehyde Endrin aldehyde Endrosulfan sulfate DDT Granophosphorous Pesticides (OPI Dehoroes Demethods Chicayorifos-methy Malathior Fenthion Chloryrifos-methy Malathior Fenthion Chloryrifos-methy Bromophos-ethy Chlorfervirphos Prothiofos Ethion Phenolis Dimethydphhalate Dimethydphhalate Dimethydphhalate Dimethydphhalate Dimethydphhalate Dimethydphhalate Nitrosamines Total Nitrosamines	2 2 2 2 2 2 4 4 4 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.05 0.2 320				2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2								<2 <2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2<		22 22 22 24 44 22 22 22 22 22 22 22 22 2									
Endrin DDD Endrin aldehyde Endrin aldehyde Endrosulfan sulfate DDT Granophosphorous Pesticides (OPI Dichlorovs Dimethoate Diazinon Chicipyrifos-methy Malathior Fertilion Chicipyrifos-ethy Chicropyrifos Bermophos-ethy Chicropyrifos Endrosulfan Chicipyrifos Bermophos-ethy Chicropyrifos Diazinon Chicipyrifos Bermophos-ethy Chicropyrifos Diazinon	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.05 0.2 320				2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2								<2 <2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2<		22 22 22 22 24 44 22 22 22 22 22 22 22 2									
Endrin DDD Endrin aldehyde Endrin aldehyde Endrosulfan sulfate DDT Granophosphorous Pesticides (OPI Dehoroes Demethods Chicayorifos-methy Malathior Fenthion Chloryrifos-methy Malathior Fenthion Chloryrifos-methy Bromophos-ethy Chlorfervirphos Prothiofos Ethion Phenolis Dimethydphhalate Dimethydphhalate Dimethydphhalate Dimethydphhalate Dimethydphhalate Dimethydphhalate Nitrosamines Total Nitrosamines	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.05 0.2 320				2 2 2 2 2 4 4 4 2 2 2 2 2 2 2 2 2 2 2 2										2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2									
Endrin DDD Endrin aldehyde Endrous villate DDT Granophosphorous Pesticides (OPI Dichlorous Dimethoste Domethoste 2	0.03 0.02 0.01 0.01 0.05 0.2 320				2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2								<2 <2 <2 <2 <2 <4 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2 <2<		22 22 22 22 24 44 22 22 22 22 22 22 22 2										
Endrin DDD Endrin aldehyde Endrin aldehyde Endrosulfan sulfate DDT Granophosphorous Pesticides (OPI Dichloros Dimethoate Dazinon Chiorpyrilos Harbinos Endrosulfan Chiorpyrilos Endrosulfan Chiorpyrilos Endrosulfan Chiorpyrilos Endrosulfan Chiorpyrilos Endrosulfan Endrosu	2 2 2 2 2 4 4 8 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.05 0.2 320				2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2										2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2									
Endrin DDD Endrin aldehyde Endrin aldehyde Endrin aldehyde Endrosulfate DDT Granoshosphorous Pesticides (OPI Dichloros) Demethoate Cheromethoate Chicomethoate 2 2 2 2 4 4 2 2 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.05 0.2 320				2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2										2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2										
Endrin DDD DDD Endrin aldehyde Endrin aldehyde Endrosulfan sulfate DDT Granophsphorous Pesticides (OPI Dichloros Dimethoate Dazinon Chiorpyrina Malathior Fenthion Chiorpyrina Stomophose-ethy Chiofreviruphos Prothiotos Total Phenoiles Prothiotos Total Phenoiles Prothiotos Total Phenoiles Prothiotos Total Phenoiles Prothiotos Total Principal Stomophose Total Principal S	2 2 2 2 2 4 4 8 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.05 0.2 320				2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2										2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2									
Endrin DDD Endrin aldehyde Endrin aldehyde Endrin aldehyde Endrosulfare sulfate DDT Dichlorous Dimethods Diazinon Chioryprifo-methy Malathior Fenthion Chioryprifos Bromophos-ethy Chiorherwiphos Prothiotos Enlon Strong Strong Strong Strong Bromophos-ethy Chiorherwiphos Prothiotos Enlon Total Phenolics Phenolics Phenolics Phenolics Diethydphalate Diethydphalate Diethydphalate Diethydphalate Diethydphalate Total Phenolics Phenolics Phenolics Total Phenolics Tot	2 2 2 2 4 4 8 2 2 2 2 2 2 2 2 2 2 2 2 2	0.03 0.02 0.01 0.01 0.05 0.2 320				2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2										2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2									

Sample Identification Date	PQL	95% Fresh A	Guideli Recreational		Stock	MW14 1/5/12	MW14 9/7/14	MW15 3/5/12	MW15 11/7/14	MW16 3/5/12	MW16 10/7/14	MW17 3/5/12	MW17 10/7/14	MW18 3/5/12	MW18 10/7/14	MW105 10/7/14	MW106 10/7/14	MW107 11/7/14	S3A 3/5/12	S3A 10/7/14	S3B 3/5/12	S3B 10/7/14	SUMP 3/5/12		MW19 10/7/14		MW20 10/7/14	
AEC Sampled		0070110011				Corbon Bloot	Carbon Plant	Corbon Bloot	Corbon Bloot	Corbon Bloot	Corbon Bloot	Corbon Blont	Corbon Blont	Carbon Plant	Corbon Blont	Carbon Plant	Corbon Blood	Carbon Plant	Carbon Plant	Corbon Bloot	Carbon Plant	Carbon Plant	Corbon Bloot	DSA	DSA	DSA	DSA	PRA
Sample Appearance						Yellow		Yellow	Clear Clear	Clear Clear	Clear	Cloudy	Clear Clear	Clear	Clear	Clear	Clear Clear	Clear Clear	Clear Clear	Clear Clear	Clear Clear	Clear Clear	Clear Clear	Milky		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 Cadmium	0.1	24 2*	100 20	100	500 10	0.3	2 <0.1	<1 0.2	2 <0.1	4 <0.1	<1 <0.1	12 <0.1	12 <0.1	2 <0.1	<1 <0.1	1 <0.1	2 <0.1	<1 <0.1	5 0.3	0.2	2 <1	0.2	4		<0.1	-	2 <0.1	<1 <0.1
Chromium	1	27*	500	100	1000	v.3 <1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1 4	3	<1	2	<0.1 5	2	v.3 <1	1	1	2	3 <1		<1	- :	2	<10.1
Copper	1	12*	20,000	200	500	7	3	2	<1	4	2	10	i	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* 70*	100	2000	100	<1	<1	<1 37	<1	<1 57	<1	34 40	1 0	<1	<1 4	<1 4	<1 15	<1	<1	1	<1	<1	<1		<1	-	<1	<10 70
Zinc Mercury	5 0.1	0.6	30,000 10	2000	20,000	32 <0.1	<0.05	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	50 <0.1	<0.05	< 0.05	<0.05	<0.05	31 <0.1	64 <0.05	24 <0.1	<0.05	38 <0.1		< 0.05		6 <0.05	<0.1
Fluoride	100	0.0	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																												
ree Cyanide	4	7 NA	800			<4 4		<4 <4		<8 <8		<8 <8		<4 <4					<4 <4		<4 <4		<4 <4					
Fotal Cyanid∈ Fotal Petroleum Hydrocarbons (TPF		NA				4	-	<4		<8		<8		<4					<4		<4		<4					
TPH C6-C9	20										<10					240								<20	1	<20		
TPH C10-C14	50										<50					180								<50		<50		
TPH C15-C28	100										<100					1400								<100		<100		
TPH C29-C36 TPH C6-C36	100	LOR		LOR	LOR						<100 <100					<100 1820								<50 <50		<50 <50		
Polycyclic Aromatic Hydrocarbons (F	PAH)	LON		LOIX	LOIX						×100					1020								<30		230		
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 Benzo(a) pyrene	0.05	0.2				0.1		<0.2		0.3	< 0.2	<0.2 <0.05	<0.2	<0.2	<0.2		< 0.2		0.2		<0.2		< 0.2	<0.2		< 0.2		
Indeno(1,2,3-c,d)pyrene	0.05	0.2				<0.1	-	<0.05		0.22 <0.1	<0.05	<0.05	<0.05	<0.1	<0.05		<0.05		<0.14		<0.1		<0.05	<0.05		<0.05		
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(a.h.i)pervlene	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 (S			1			40.1		40.1		0.1	40.1	40.1	40.1	40.1	40.1		40.1		40.1		40.1		40.1	40.1		40.1		
Organochlorine Pesticides (OCP)																												
alpha-BHC	2																											<2
HCB delta-BHC	2																											<2
Heptachlor	2	0.09																										<2 <2 <2
Aldrin	2	0.001																										<2
Heptachlor epoxide	2	0.08																										<2
Chlordane Endosulfan	2	0.06																										<2 <2 <2 <2
Dieldrin	2	0.01																										
DDE	2	0.03																										<2
Endrin	2	0.02																										<2 <2
DDD Endrin aldehyde																												<2
																												<2
Endosulfan sulfate	2																											<2
DDT	2 2 4	0.01																										<2 <2
DDT Organophosphorous Pesticides (OF	2 2 4																											<2 <2 <2 <2 <2 <2 <2 <4
DDT Organophosphorous Pesticides (OF Dichlorvos	2 2 4 PP[2	0.01																										<2 <2 <2 <2 <2 <2 <4 <4
DDT Organophosphorous Pesticides (OF Dichlorvos Dimethoate Diazinon	2 2 4 PPP 2 2 2 2																											<2 <2 <2 <2 <2 <2 <4 <4
DDT Organophosphorous Pesticides (OF Dichlorvos Dimethoate Diazinon Chlorpyrifos-methy	2 2 4 PPP 2 2 2 2 2 2 2	0.01 0.15 0.01																										<2 <2 <2 <2 <2 <2 <4 <4
DDT Organophosphorous Pesticides (OF Dichlorvos Dimethoate Diazinon Chlorpyrifos-methy Malathior	2 2 4 PPP 2 2 2 2 2 2 2	0.01 0.15 0.01 0.05																										<2 <2 <2 <2 <2 <2 <4 <4
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DDT Organophosphorous Pesticides (OF Dichlorvos Dinethoras Diazinon Chlorpyrifos-methy Malathior Fenthion Chlorpyrifos Bromophos-ethy Chlorenviphos Prothiolos	2 2 4 PPP' 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	0.01 0.15 0.01 0.05																										22 22 22 24 44 22 22 22 22 22 22 22 22 2
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DDT Organonhosphorous Pesticides (OF Dichlorovs Direthorous Diazhoro Diazhoro Chlorpyrifos-methy Malathior Ferthion Chlorpyrifos Bromophos-eithy Districtory Bromophos-eithy Districtory Bromophos-eithy Districtory Bromophos Bromophos Chlorpyrifos Bromophos Bromophos Chlorpyrifos Bromophos Chlorpyrifos Bromophos Chlorpyrifos Bromophos Chlorpyrifos Bromophos Chlorpyrifos Bromophos Chlorpyrifos Bromophos Districtory Districtor	2 2 4 4 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	0.01 0.15 0.01 0.05 0.2																										22 22 22 22 24 44 22 22 22 22 22 22 22 2
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TABLE LR11 Groundwater Analytical Results for VOCs and SVOCs

Sample Identification	PQL		Guideline		MW06	MW09	MW10	MW105	MW107	MW21
Date	FUL	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
					1.00	1.00	1.00	1.00	1.00	1.00
Volatile Organic Compounds (VOCs) an	d Semiv	olatile Organi	c 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
L										

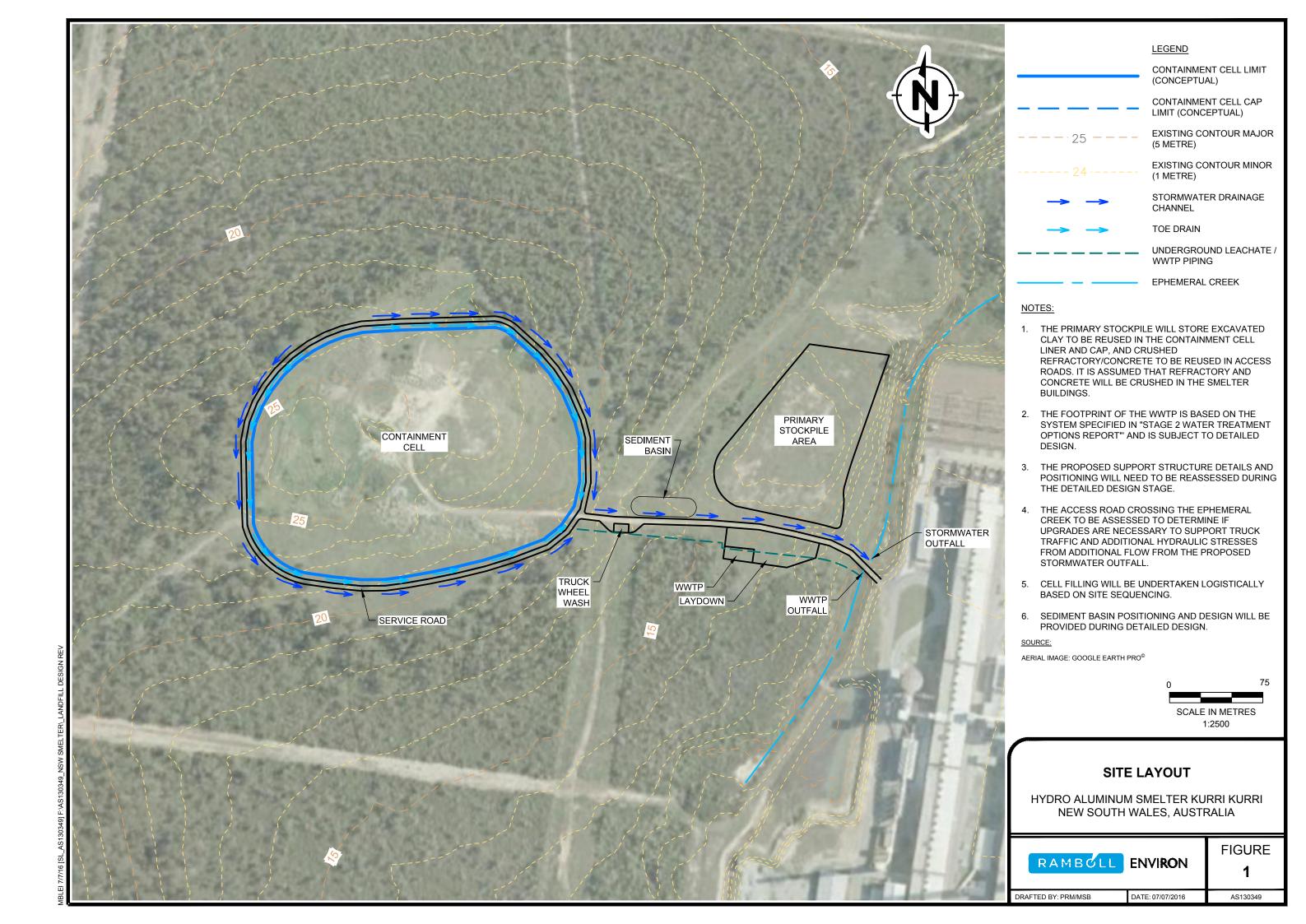
All results in µg/L
PQL = Practical Quantitation Limit.

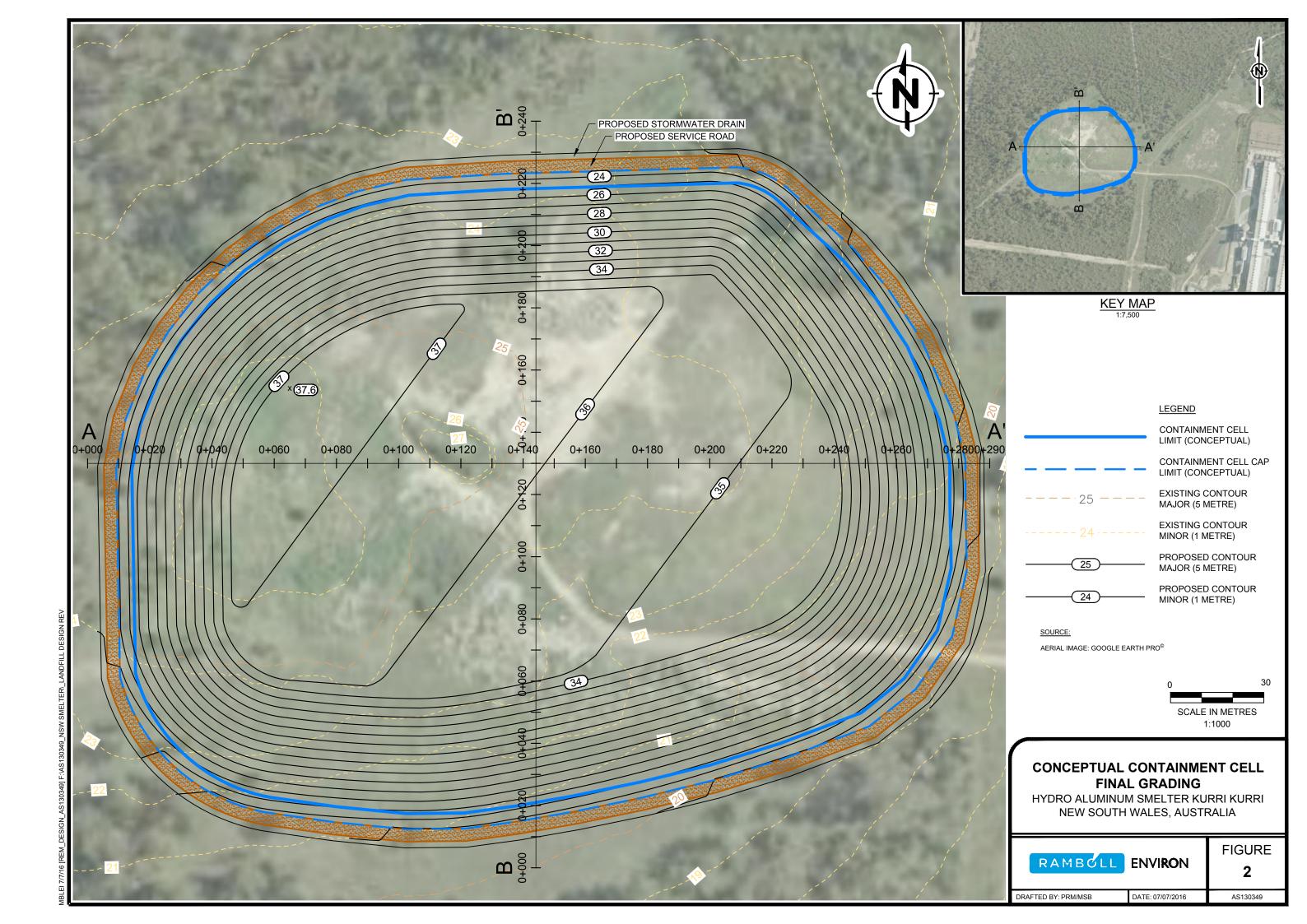
^ ANZECC 2000 95% Protection Level for Receiving Water Type
Guidelines in *italics* are low level reliability guidelines

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





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.
- 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.

PROPOSED PRE-LINER EXCAVATION GRADE

0+120

CROSS SECTION B-B'

HORZ: 1:1000

VERT: 1:500

0+140

(VERTICAL EXAGGERATION OF 2)

0+100

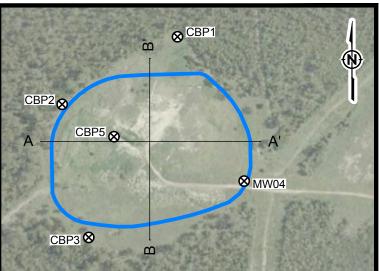
0+080

0+060

0+020

0+040

- 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.
- CELL FILLING WILL BE UNDERTAKEN LOGISTICALLY BASED ON SITE SEQUENCING.



NEW SOUTH WALES, AUSTRALIA

DATE: 07/07/2016

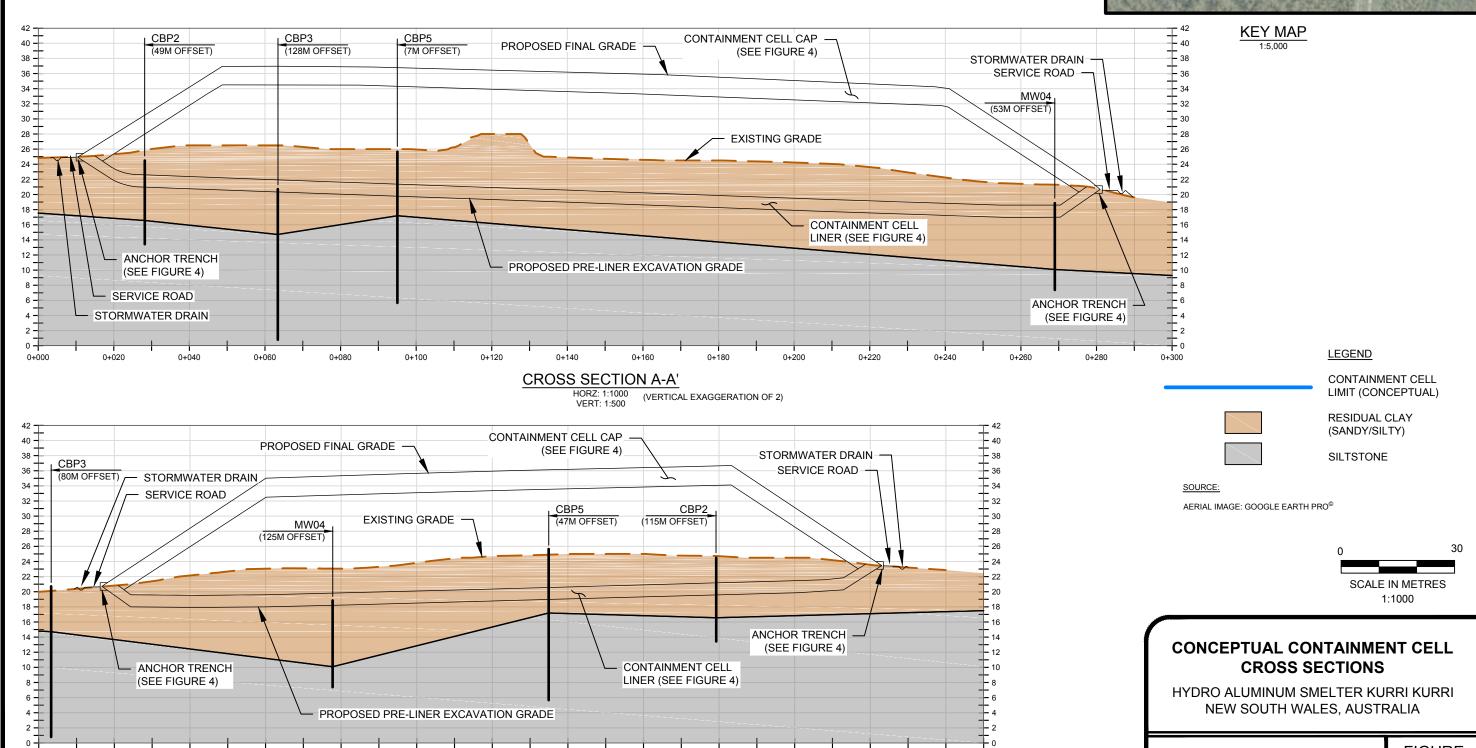
RAMBOLL ENVIRON

DRAFTED BY: PRM/MSB

FIGURE

3

AS130349



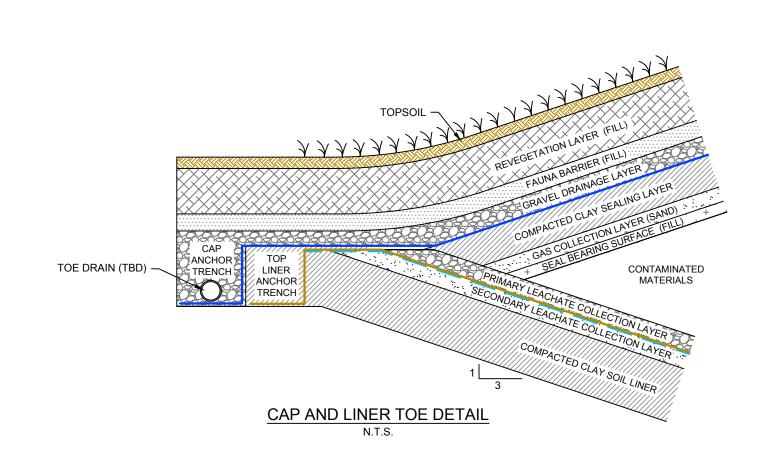
0 + 180

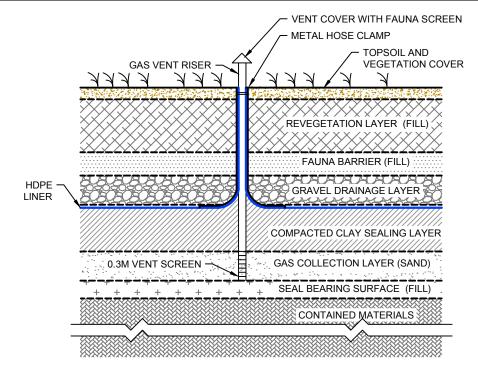
0+200

0+220

0+240

0+250





TYPICAL GAS VENT PENETRATION THROUGH CAP DETAIL

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.
- 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**
- THE LINER AND CAP DETAILS ARE SUBJECT TO CHANGE BASED ON ECONOMIC OR FUNCTIONAL CONSIDERATIONS DURING DETAILED DESIGN.
- GRAVEL DRAINAGE LAYER IS TO COMPRISE ROUNDED GRAVEL OR ALTERNATE GEOSYNTHETIC MATERIAL COULD BE CONSIDERED, EG/ GEONET OR

CONCEPTUAL CONTAINMENT CELL DETAIL CAP AND LINER

HYDRO ALUMINUM SMELTER KURRI KURRI NEW SOUTH WALES, AUSTRALIA

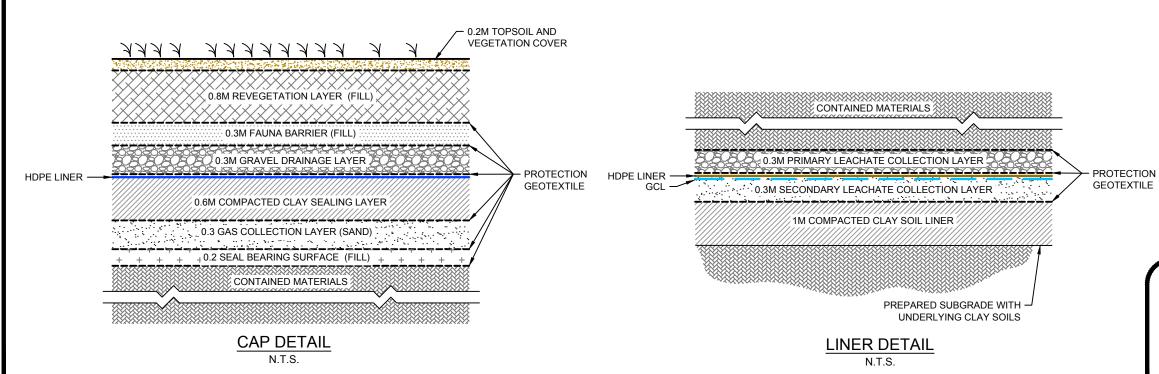


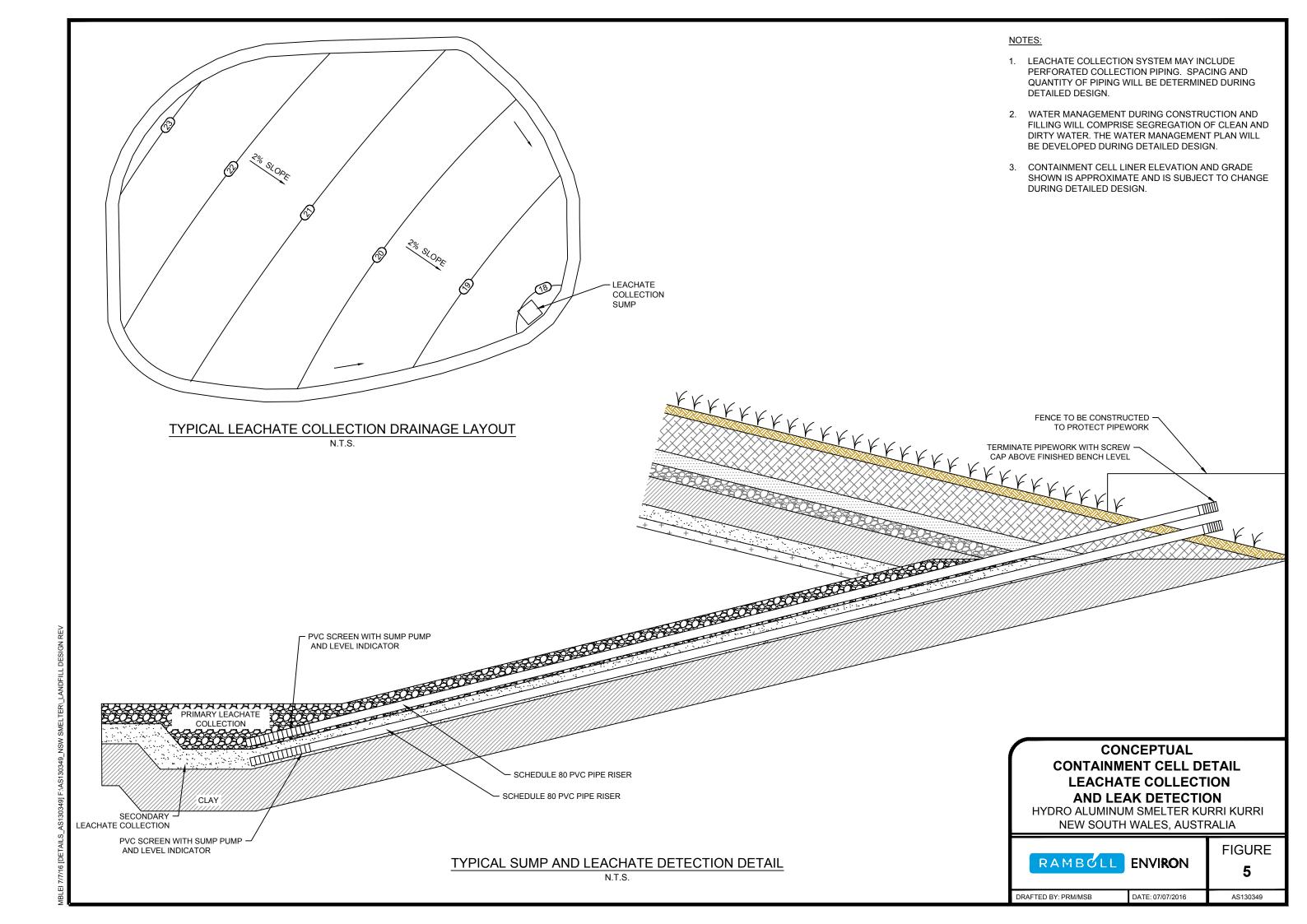
FIGURE

AS130349

DRAFTED BY: PRM/MSB

DATE: 07/07/2016





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

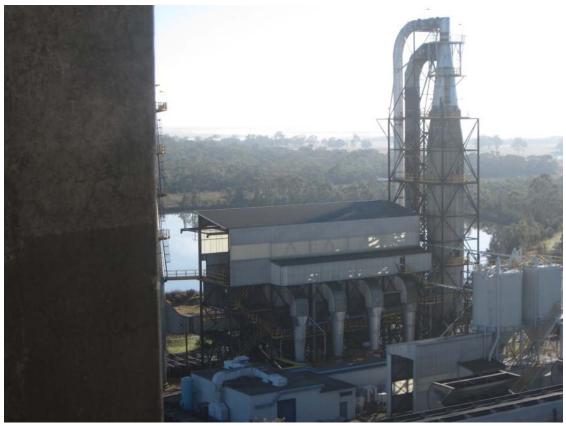


Plate 8: Bake Furnace Scrubber



Plate 9: Bake Furnace Scrubber



Plate 10: Area East of Playing Fields

APPENDIX 6 LETTER REPORT ON 2018 GROUNDWATER MONITORING



ENVIRONMENT & HEALTH

20 April 2018

Hydro Aluminium Hart Road Loxford NSW 2326

RE: Addendum to Remedial Action Plan

Ramboll Level 2, Suite 18 50 Glebe Road PO Box 435 The Junction NSW 2291

T +61 2 4962 5444 www.ramboll.com

Ref 318000445

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:
 - o Two field duplicates— analysed for all parameters
 - o One field triplicate analysed for all parameters
 - o 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 6μ S/cm. Review of the calculated relative percent difference (RPD) found all sample concentrations within the RPD criteria of $\pm 30\%$, 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.

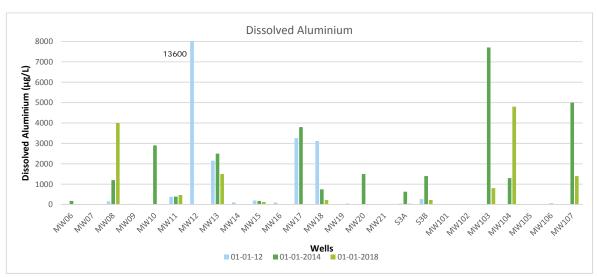


Figure 1: Dissolved Aluminium trends from 2012, 2014 and 2018 groundwater sampling rounds

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.

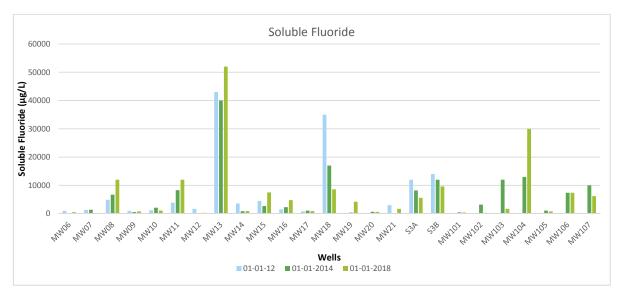


Figure 2: Soluble Fluodie trends from 2012, 2014 and 2018 groundwater sampling rounds i

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

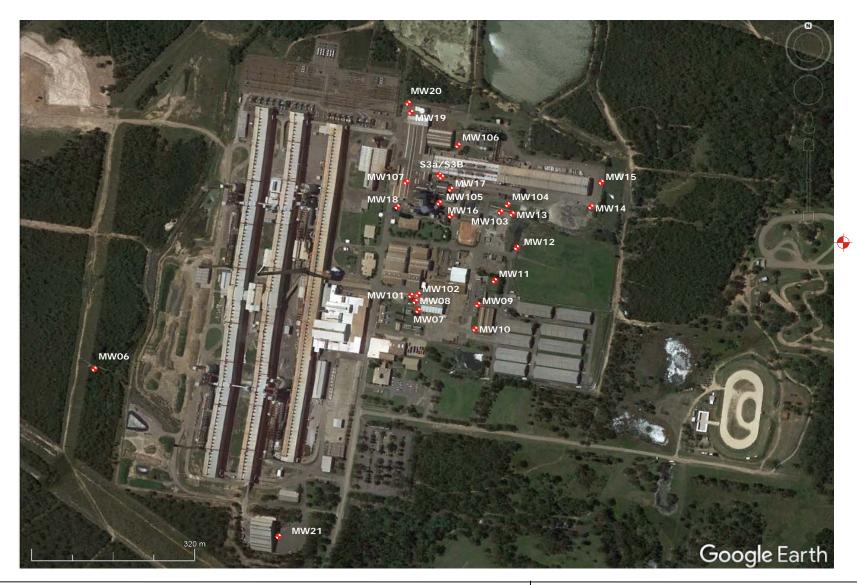
Ramboll completed a groundwater sampling event at the Hydro Smelter Site. The objective of the groundwater sampling was to provide concentrations of key contaminants of concern (aluminium and fluoride) in groundwater for inputs into the human health and ecological risk assessments.

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



Site Groundwater Monitoring Well Location

Site Groundwater Monitoring Wells

RAMBOLL

Hydro Aluminium Kurri Kurri: Addendum to RAP

JOB NO: 318000445 DATE: April 2018 FIGURE 1

APPENDIX 2 SUMMARY OF RESULTS



Well ID / Surface Water ID	Date	SWL (mbtoc)	Temperature (°C)	Spec Cond. (mS/cm)	1000	рН	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

 μ S/cm = milliSiemens per centimetre

mV = milli Volts



Sample Identification	PQL	Units		Guidel	ine		MW06	MW07	MW08	MW09	MW10	MW11	MW12	MW13	MW14	MW15	MW16	MW17	MW18	MW19	MW20
Date	PQL	Units	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/brow n, turbid, no odour	turbid, grey, brown, no odour	brown no	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 particulate s, 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 Par	ramete	rs																			
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 Inorgan	ics																				
Free Cyanide	4	μq/L	7	800			< 4		< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4

PQL = Practical Quantitation Limit.

B NHMRC Australian Drinking Water Guidelines, 2011
Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC (2011)

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



Sample Identification				Guidel	ine		MW21	S3A	S3B	MW101	MW102	MW103	MW104	MW105	MW106	MW107	QA101	QA103	QC102	QC101
Date	PQL	Units	95% Fresh A	Recreational	Irrigation	Stock	11-04-18	11-04-18	11-04-18	11-04-18	10-04-18		10-04-18	11-04-18	10-04-18	11-04-18	10-04-18		10-11/4/18	
			73 70 TTC3IT	rtooroutionar	migation	Otour	11 01 10	11 01 10	11 01 10	11 01 10	10 01 10	10 01 10	10 01 10	11 01 10	10 01 10	11 01 10	10 01 10	10 117 17 10	10 117 17 10	10 11/1/10
PAEC Sampled																				
Sample Appearance							turbid, pale grey	clear, no odour	clear, no odour	clear, no odour	clear, no odour	clear, tiny orange particulate s, 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 Pa	ramete	rs																		
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 Inorgan	ics																			
Free Cyanide	4	μq/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)

Hydro Aluminium Groundwater Sampling Smelter Site 3180004445 19-04-18



TABLE LR10 Groundwater Analytical Results (ug/L)

TABLE LKTU Groundwater Analytic	ai Resu	its (ug/L)																					
Sample Identification	PQL			Guideli			MW06	MW06	MW06	MW07	MW07	MW07	80WM	MW08	MW08	MW09	MW09	MW09	MW10	MW10	MW10	MW11	MW11
Date	FQL	95% Fr	esh A I	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/brow n, 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		
pH EC									12000						350			3100			8400		
Metals		<u>'</u>		*		•		•	•		•		•	•		•	<u> </u>			•			
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	

Free Cyanide

All results in upt.

POL - Practical Quantitation Limit.

POL - Practical Quantitation Limit.

POL - Practical Quantitation Limit.

PALZECC 2000 95% Protection Level for Receiving Water Type
Guidelines in Raics are flow level reliability guidelines

In HHMRC Australian Drinking Water Guidelines, 2011

In Hardness Mordider Trigger Values for Cd, Cr (II), Cu, Ni, Pb, Zn

NHMRC arsenic guidelines are based on total arsenic

NHMRC guidelines for Phorenia are based on Cr (Vi)

Total Phenolics guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

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

Results for TRr have been compared to TPH guidelines.

Results for TRr 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)

TABLE LK TO Groundwater Analy	licai Res	iiis (ug/L)																				
Sample Identification	PQI			deline		MW11	MW12	MW12	MW12	MW13	MW13	MW13	MW14	MW14	MW14	MW15	MW15	MW15	MW16	MW16	MW16	MW17
Date	FQI	95% Fres	sh A Recreation	al 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 Cvanide	4	7	800			<4	<8		<4	7		<4	<4		<4	<4		<4	<8		<4	<8

Free Cyanide

All results in upt.

POL - Practical Quantitation Limit.

POL - Practical Quantitation Limit.

POL - Practical Quantitation Limit.

*ANZECC 2000 95% Protection Level for Receiving Water Type
Guidelines in Raics are flow level reliability guidelines

*In HIMRIC Australian Drinking Water Guidelines, 2011

*I Hardness Mordider Trigger Values for Cd, Cr (II), Cu, Ni, Pb, Zn

NHMRC arsenic guidelines are based on total arsenic

NHMRC guidelines for Protromia are based on Cr (Vi)

Total Phenolics guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

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

Results for TRr have been compared to TPH guidelines.

Results for TRr 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)

TABLE LK TO Groundwater Arian	yılcal Resi	iits (ug/L)																					
Sample Identification	PQL		Guidel	ine		MW 17	MW17	MW18	MW18	MW18	MW19	MW19	MW19	MW20	MW20	MW20	MW21	MW21	S3A	S3A	S3A	S3B	S3B
Date	PQL	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 particulate s, 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		i
EC							760			200			940			1500		20000			340		ĺ
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 ugil.
POL = Practical Quantitation Limit.
^ANZECC 2000 95% Protection Level for Receiving Water Type
Guidelines in italics are low level reliability guidelines
**NHMRC Australian Drinking Water Quidelines, 2011
**Hardness Modified Trigger Values for Cd. Cr (III), Cu, Ni, Pb, Zn

* Hardness Modified Trigger Values for Cd, Cf (II), Cu, Ni, Pb, Zn
NHMRC arsenic guidelines are based on total arsenic
NHMRC guidelines for chromium are based on Cf (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 for TRH have been compared to TPH guidelines.

Hydro Aluminium Groundwater Sampling Smelter Site 3180004445 19-04-18



TABLE LR10 Groundwater Analytical Results (ug/L)

Caracla Identification		. (. 0, ,	Cuidal	lina.		COD	B 80 87 4 0 4	MW 101	B 41 A / 4 O O	1.0044.00	B 818/400	1.00/4.00	101/404	B 40 8 / 4 O 4	A BALLA OF	1.014.0F	A 8 8 / 4 0 0	1.004/400	100/407	MW107	OLIMAE
Sample Identification	PQL	Guideline			,	S3B	MW101		MW102	MW102	MW103	MW103	MW104	MW104	MW105	MW105	MW106	MW106	MW107		SUMF
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 particulate s, 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	440
Non Metallic Inorganics								•													
Free Cyanide	4	7	800			<4		<4		<4		<4		<4		<4		<4		<4	<4

Free Cyanide

All results in upt.

POL - Practical Quantitation Limit.

POL - Practical Quantitation Limit.

POL - Practical Quantitation Limit.

*ANZECC 2000 95% Protection Level for Receiving Water Type
Guidelines in Raics are flow level reliability guidelines

*In HIMRIC Australian Drinking Water Guidelines, 2011

*I Hardness Mordider Trigger Values for Cd, Cr (II), Cu, Ni, Pb, Zn

NHMRC arsenic guidelines are based on total arsenic

NHMRC guidelines for Protromia are based on Cr (Vi)

Total Phenolics guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

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

Results for TRr have been compared to TPH guidelines.

Results for TRr have been compared to TPH guidelines.

Results shaded grey are in excess of the primary acceptance criteria: ANZECC 95%, NHMRC (2011)

19-04-18



TABLE LR10 Groundwater Analytical Results (ug/L)

TABLE ENTO Groundwater Analytical Nesdits (45/1)													
Sample Identification	MW09 QA101			MW09	QA102		MW06	QA103		QC102	QC101		
Sample Type	Intralaboratory			Triplicate		RPD %	Triplicate		RPD %	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		RPD %	turbid, grey, brown, no odour			clear, slight sulphide odour						
Sample collected by	NG			N	G		(CG		NG	CG		

Physico-chemical Parameters													
рН	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



Envirolab Services Pty Ltd

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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			
NATA Accreditation Number 2901. This document shall not be reproduced except in full.				
Accredited for compliance with ISC	Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *			

Results Approved By

Diego Bigolin, Team Leader, Inorganics Jaimie Loa-Kum-Cheung, Senior Chemist **Authorised By**

Jacinta Hurst, Laboratory Manager



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
рН	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
рН	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
рН	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		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	-	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
рН	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		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	-	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
рН	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		189291-26	189291-27	189291-28
Your Reference	UNITS	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
рН	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		189291-26	189291-27	189291-28
Your Reference	UNITS	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.

Envirolab Reference: 189291 Page | 6 of 11 Revision No: R00

QUALITY COI	NTROL: Mis	cellaneou		Du		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
рН	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 CO	NTROL: Mis	cellaneou		Du	plicate	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
рН	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 COI	NTROL: Mis	cellaneou		Du		Spike Recovery %				
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	21	12/04/2018	12/04/2018			[NT]
Date analysed	-			[NT]	21	12/04/2018	12/04/2018			[NT]
рН	pH Units		Inorg-001	[NT]	21	7.7	7.7	0		[NT]
Electrical Conductivity	μS/cm	1	Inorg-002	[NT]	21	840	840	0		[NT]
Fluoride, F	mg/L	0.1	Inorg-026	[NT]	21	7.4	7.4	0		[NT]
Free Cyanide in Water	mg/L	0.004	Inorg-014	[NT]	21	<0.004	<0.004	0		[NT]

QUALITY CON	TROL: All mo	etals in w		Du	plicate	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 CON	TROL: All m	etals in w	Du	plicate	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 CON	TROL: All m	etals in w		Du	Spike Recovery %					
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	23	13/04/2018	13/04/2018			[NT]
Date analysed	-			[NT]	23	13/04/2018	13/04/2018			[NT]
Aluminium-Dissolved	μg/L	10	Metals-022	[NT]	23	40	40	0		[NT]

Result Definiti	ons
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	ol 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

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.

Envirolab Reference: 189291 Page | 10 of 11
Revision No: R00

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.

ENVIROLAB
GROUP.

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

		B GROUP -	Natio n	aı pn	ione r	umb	er 130	10 42 43	44			Perth Lab - MPL Caboratories 16-18 Hayden Crt Myaree, WA 6154								
Client: Ramb	poli				Clien	t Proje	ct Nar	ne:/ N	ımber ,	/ Site etc (ie report	title):		Ph 08 9317 2505 / lab@mpl.com.au						
Contact Pers	on: Natalie Gilbert		-		1					itoring / 3] ,	Aelhourne	e Lab - Envi	rolah Serv	iras		
Project Mgr:	Natalie Gilbert				PO No.: P1082							1A Dalmore Drive Scoresby VIC 3179								
Sampler: Na	talie Gilbert/ Craig Goodb	ody			Envirolab Quote No.: Quotation – 18SY036]	h 03 9763	3 2500 / me	lbourne@	envirolab.com.au				
Address:					Date	result	s requi	red:								ffice - Envi				
•	Level 2, suite 19, 50 (Glebe Road,	The Junc	tion 	Or choose: standard / same day / 1 day / 2 day / 3 day Note: Inform lab in advance if urgent turnaround is required - surcharges apply								P	h 07 3266	Depot St, E 9532 / bri Office - Envi	sbane@e	nvirolab.com.au			
Phone:		Mob:		43218430	1 Repo	rt forn	nat: es	dat / e	quis /] 7	a The Par	ade, Norwo	od, SA 50	67		
mail: ngilbert@ramboll.com							ents:	Ple	99 ed	F	- mei	roug	Say	rleg	n 0406 35	0706/ad	elaide@ei	nvirolab.com.au		
Sample Information											Tests Re	quired	l:.					Comments		
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	됩	EC	soluble fluoride	dissolved aluminium	cyanide (free)									Provide as much information about the sample as you can		
MVIU6,			W	_	Х	х	x	х	х											
MW06		<u> </u>		11/4/18	X	х	х	х	х									Enthalt Sources		
¥ ₩07 ø	dry	<u> </u>		\\\'-_\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	X	х	x	x	х								CHINIKE CHINIKE	Chatewood NSW 2007		
MW08 ◀	2		Ш	10/4/19	Х	х	х	х	х									Ph: (02) 9910 620a		
MW09 -	3		\sqcup	1./1/	X	х	х	х	x	<u> </u>							א מכה	1.89291		
MW10 🔧	4		Ш		Х	x	x	x	х								Date R	Carrod 12/4/2018		
MW11 ,	<i>_5_</i>			<u> </u>	x	х	x	х	X									ceived: 10.15		
MW12 •	6		 		X	х	x	x _	х								Receive	Hay: P2		
MW13 ➤	7				X	х	х	x	х					••				pol/mbient		
MW14 ,	8	ļ			X	х	х	x	x									celikepack 10-2		
MW15 ∞	9	<u> </u>		<u> </u>	Х	×	_x	×	х								Conty	Intacti srcken/None		
MW16	10			11/,4/18	Х	х	х	x	x											
ЧW17 .			<u> </u>	10/41/18-	Х	х	x	х	х											
Relinquished	by (Company):	Ramboll			Recei	ved by	/ (Com	pany):	E/2					Lab us	se only:					
Print Name:		N-Gilbert	C- (spelboely		Name			PK					Sampl	les Rece	ived: Coo	or Ami	olent (circle oné)		
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Sydney Lab - Envirolab Services

12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

|--|

S3B

Print Name:

Date & Time:

Signature:

24

Ramboll

06-04-18

N.Gilbert

Relinquished by (Company):

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

X X

Print Name:

Date & Time:

Signature:

Received by (Company):

Client: Ramboll							Client Project Name / Number / Site etc (ie report title):									Ph 08 9317 2505 / lab@mpl.com.au					
Contact Pers	on: Natalie Gilbert					Sm	elter S	ite GW	Monit	oring /	3180	00 / H	ydro		Melbourne Lab - Envirolab Services 1A Dalmore Drive Scoresby VIC 3179						
Project Mgr:	Natalie Gilbert				PO N	o.: P10	82		•												
Sampler: Nat	talie Gilbert/ Craig Goodb	ody			Envir	olab Q	uote N	o. :		Qu	otation	- 18SY	036	Ì	Ph 03 9763 2500 / melbourne@envirolab.com.au						
Address:					Date results required:										Brisbane Office - Envirolab Services						
	Level 2, suite 19, 50 G	ilebe Road,	The Junction		Or choose: standard / same day / 1 day / 2 day / 3 day Note: Inform lab in advance if urgent turnaround is required - surcharges apply										20a, 10-20 Depot St, Banyo, QLD 4014 Ph 07 3266 9532 / 'brisbane@envirolab.com.au Adelaide Office - Envirolab Services						
Phone:		Mob:		432184301	Repo	rt form	at: esc	dat / e	quis /										, SA 506		
Email: ngilbert@ramboll.com							nts:								,	n 0406 3	350 706	/ adela	lde@en	virolab.com.au 	
Sample information							A-7-	7,5	21 S. T.		Test	s Requ	uired				•		7	Comments	
Envirolab Sample ID	Client Sample ID or Information	Depth	Date sampled	Type of sample	Hd	EC	soluble fluoride	dissolved	cyanide (free)											Provide as much information about the sample as you can	
MW18 a	12		W	10/4/18	Х	х	х	х	х												
MW19 •	13		1	10/4/19	Х	x	х	х	x										<u> </u>		
MW20	14			11/4/18	Х	х	х	х	x					_				<u> </u>			
MW21	15			11/4/19	Х	х	x	x	х			·				_					
MW101	16			11/4/18	Х	x	x	х	х	_											
MW102 9	17			10/4/18	Х	x	x	x	x								,				
MW103 °	18			10/4/18	Х	x	x	x	х												
MW104 •	.19			10/4/18	Х	х	х	х	x												
MW105	30			11/4/19	Х	x	x	x	х												
MW106 •	ય			10/4,718	Х	х	х	х	X												
MW107	22			11/4/18	Х	х	x	x	х												
S3A	23			4/4/19	Х	х	х	х	х												

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Lab use only:

Temperature Received at:

Samples Received: Cool or Ambient (circle one)

Transported by: Hand delivered / courier

Sydney Lab - Envirolab Services

<u>Perth Lab</u> - MPL Laboratories 16-18 Hayden Crt Myaree, WA 6154

12 Ashley St, Chatswood, NSW 2067 Ph 02 9910 6200 / sydney@envirolab.com.au

Page No: 20 / 3

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Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	돐	ដ	soluble fluoride	dissolved aluminium	cyanide (free)											Pi infoi sa	rovide as much rmation about the mple as you can	Fup to ALS for onalysis	٠.
QA101	25		10/4/18	3	Х	х	х	х	х]	
QA102	ALS		10/4/18	}	Х	х	х	х	х]	
QA103	FF 26		11/4/18		Х	х	х	x	х														
QALOS			1		Х	х	х	х.	x]	
QC101 N			10/4/18		Х	х	x	x	х	<u> </u>													
QC102	27	n.	11/4/18		X	х	х	х	x												<u>. </u>	4	
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Signature:

Signature:

189291

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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:



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 ID	Hd	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 ' \checkmark ' 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.



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



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

Page : 2 of 2 Work Order : ES1810554

Client : RAMBOLL AUSTRALIA PTY LTD
Project : Smelter Site GW Monitoring 318000



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 Client sample ID		QA102										
(Matrix: WATER)												
	Client sampling date / time											
Compound	CAS Number	LOR	Unit	ES1810554-001								
				Result								
EA005P: pH by PC Titrator	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 A	nalyser											
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



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

Page : 2 of 3 Work Order : ES1810554

Client : RAMBOLL AUSTRALIA PTY LTD
Project : Smelter Site GW Monitoring 318000



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 D	Ouplicate (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 T	itrator (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: Conductivit	y by PC Titrator (QC Lot: 1	563821)							
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 N	Metals by ICP-MS (QC Lot: 1	564577)							
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 b	y Segmented Flow Analyse	r (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: 15638	17)							
ES1810363-003	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	1.3	1.3	0.00	0% - 50%

Page : 3 of 3 ES1810554 Work Order

RAMBOLL AUSTRALIA PTY LTD Client Smelter Site GW Monitoring 318000 Project



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)	Laboratory Control Spike (LCS) Report					
				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 (QCL	ot: 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.

	Matrix Spike (MS) Report										
			Spike	SpikeRecovery(%)	Recovery L	imits (%)					
Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High					
EK025SF: Free CN by Segmented Flow Analyser (QCLot: 1568324)											
QA102	EK025SF: Free Cyanide		0.2 mg/L	77.2	70	130					
EK040P: Fluoride by PC Titrator (QCLot: 1563817)											
Anonymous	EK040P: Fluoride	16984-48-8	5 mg/L	121	70	130					
	by Segmented Flow Analyser (QCLot: 1568324) QA102	by Segmented Flow Analyser (QCLot: 1568324) QA102 PC Titrator (QCLot: 1563817) EK025SF: Free Cyanide	by Segmented Flow Analyser (QCLot: 1568324) QA102	Spike Client sample ID Method: Compound CAS Number Concentration by Segmented Flow Analyser (QCLot: 1568324) QA102 EK025SF: Free Cyanide 0.2 mg/L y PC Titrator (QCLot: 1563817)	Spike SpikeRecovery(%)	Spike SpikeRecovery(%) Recovery L					



QA/QC Compliance Assessment to assist with Quality Review

: 17-Apr-2018

: ES1810554 **Work Order** Page : 1 of 4

: Environmental Division Sydney Client : RAMBOLL AUSTRALIA PTY LTD Laboratory

: MS NATALIE GILBERT Telephone : +61-2-8784 8555 Contact **Project** : Smelter Site GW Monitoring 318000 **Date Samples Received** : 12-Apr-2018 Issue Date

Site : Hydro

: Natalie Gilbert/ Craig Goodbody Sampler 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.

Page : 2 of 4
Work Order : ES1810554

Client : RAMBOLL AUSTRALIA PTY LTD
Project : Smelter Site GW Monitoring 318000



Outliers: Analysis Holding Time Compliance

Matrix: WATER

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	Date extracted	Due for extraction	Days	Date analysed	Due for analysis	Days
			overdue			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	Co	Count		e (%)	Quality Control Specification
Method	QC	Regular	Actual	Expected	
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 <u>VOC in soils</u> 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.

Watth. Water				Lvaluation	Tiolding time	breach, • - within	A Holding time
Method	Sample Date	Ex	traction / Preparation			Analysis	
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	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	✓

Page : 3 of 4 Work Order ES1810554

Client RAMBOLL AUSTRALIA PTY LTD Smelter Site GW Monitoring 318000 Project



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	n: × = Quality Co	ntrol frequency r	not within specification; ✓ = Quality Control frequency within specification.
Quality Control Sample Type		Co	unt		Rate (%)		Quality Control Specification
Analytical Methods	Method	OC	Reaular	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

Page : 4 of 4 Work Order : ES1810554

Client : RAMBOLL AUSTRALIA PTY LTD
Project : Smelter Site GW Monitoring 318000



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)

及80/1854

The to the As for Sydney Work Order Reference ES1810554 Environmental Division Telephone : +61-2-8784 8555 White - Lab copy / Blue - Client copy / Pink - Retain in Book Page No: 20 f o lagse Provide as much information about the sample as you can Comments IA 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 <u>Adelaide Office -</u> Envirolab Services 7a The Parade, Norwood, SA 5067 Ph 0406 350 706 / adelaide@envirolab.com.au Ph 02 9910 6200 / sydney@envirolab.com.au Samples Received: Cool or Ambient (circle one) Perth <u>Lab</u> - MPL Laboratories 16-18 Hayden Crt Myaree, WA 6154 Ph 08 9317 2505 / lab@mpl.com.au 12 Ashley St, Chatswood, NSW 2067 Melbourne Lab - Envirolab Services 8/18 Sydney Lab - Envirolab Services A Inkelab Triplicak Habe Phonosas Lab use only; Client Project Name / Number / Site etc (le report title): Smelter Site GW Monitoring / 318000 / Hydro Or choose: standard / same day / 1. day (2 day) / 3 day Note: Inform lab in advance if urgent tumaround.is-fequired -Quotation - 18SY036 Tests Required ENVIROLAB GROUP - National phone number 1300 42 43 44 12/4/2018 10:15 CHAIN OF CUSTODY - Client 432184301 Report format: esdat / equis / Cyanide (free) Received by (Company), EL Envirolab Quote No. : Date results required: PO No.: P1082 soluble fluoride EC Date & Time: Reason All is In 118 1651 SG Print Name: Signature: Ηđ × × Type of sample THE EMALEN 3 Level 2, suite 19, 50 Glebe Road, The Junction Date Sampled 8//4/01 ngilbert@ramboll.com 12.4.18 1/0 Sample information Depth N.Gilbert ĕ 06-04-18 Ramboli Sampler: Natalie Gilbert/ Craig Goodbody Client Sample ID or information Contact Person: Natalie Gilbert Project Mgr: Natalie Gilbert 36 77 Relinquished by (Company): į FB extra. Client: Ramboll ENVIROURB Envirolab Sample ID QC101 K QA102 Date & Time: Print Name: Phone: Email: QA103 QA101 Signature: QC102 (

162681

APPENDIX 4 FIELD SHEETS

	umber:	0.00				Da	le:	0	14/18			
Projec		6100				We	II Numb	er:	MW104			
Locatio	on:	Hyd	0			Sar	Sampler(s):					
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	c vapour				ppr	n Me	asuremei	nt d	evice:			
	to Groun	dwater:	1.6.	9	r	n Me	asuremei	nt D	evice:			
Correct			+0-6	15		m						
	dwater Ele					m						
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		niscible Laye			r	n						
Well De			4.5	0.	r	n						
Thickne	ss to Gro	undwater C	Column:		r	n						
Well Sa	mpling											
Method	d:	☐ Micro-Pu	ırge		頭	Peristal	lic		☐ Bailer			
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Sample	Appear	ance:				1		i i				
	TELAD	SPEC.					mmt	1.7				
TIME	TEMP (°C)	COND. (µS/cm or	рН		(mg/L pm)	Redox (mV)	TBS (mg		Comments (appearance, odour, etc)			
		205/5m)		J. P.		(,	Огррп	''	(appearance, odobí, etc)			
305	26.5	3.37	7.21	0.3	35		763		copy brown no oder			
300	265	3.36	7.00	0 -	21	192.	763.	3	:(1			
07	26.6	3.32	6.91	0	17	202.	763.	3				
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Ref. N	umber:				Date	(0)	14/18					
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Locati	on:	Hydra) ,		Sam	pler(s):	Nς					
Field A	Aeasure i	ments				15000						
	c vapour			ppr	n Mea	surement c	device:					
	to Groun	dwater:	(12	- 1	n Mea	Measurement Device:						
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Well De				3 · 80 n	n							
Thickne	ess to Gro	undwater (Column:	n	<u> </u>							
	ampling		LE PORT	ESTER								
Method		☐ Micro-Pu	Jrge	75%	Peristalti		□ Bailer					
	ımpling:				End Sa	mpling:						
Sample	Appear	spec.		1		mm Ha						
TIME	TEMP	COND.	nU	DO (mg/L	Redox	TD3 (mg/)	Comments					
TIVIL	(°c)	(µS/cm or	рН	्राविका	(mV)	o r ppm)	(appearance, odour, etc)					
3.28	25-3	4.74	6.48	0-61	-79.2	763.6	light brown, no a	olz				
	25.2	4.73	6.48	0.28	-85=1	763.6	11					
3-30	25-3	4.73	6.51	0.55	-902	763-6	6,0					
								-				
Miscelle	aneous F	ield Comr	nents	J-5 (-)	10 TW			TICEN				
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[riplicate	∋:											
Rinsate:												
Samples	Filtered											
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Other:												

Ref. Nu	ımber:				Dat	e: (<i>(</i>	14/18
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	dwater Ele			r	n		
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		iscible Laye			n		
Well De			9,00	6 . n	n		
Thickne	ss to Gro	undwater C	column:	n	1		
	mpling						
Method		☐ Micro-Pu			Peristalt		□ Bailer
Start Sa			3.4	45	End So	ampling:	
Sample	Appeard					11.	
	TEMP	SPEC, COND.		DO (mg/L	Redox	TDS (mg)	Comments
TIME	(°c)	(µS/cm or	рН	OCDDD)	(mV)	o r ppm)	(appearance, odour, etc)
3-41181	1249	1.74	4.64	0.97	137-2	7636	
3.48	25-0	1.73	4.61	1-03	(40-3	- 0	
3.49	25.0	1.72	4.54	1.12	144.	1	
3 50	25.6	1.72	4.21	1.14		763-7	
0 00		1 /2	() (, , ,	1 (0)	7007	
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Miscello	neous F	ield Comn	nents			A STATE OF THE STA	
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riplicate		NA					
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Other:		10		- "			
							

	umber:				Dat	e: 10	0/4/18				
Projec	-	61085			We	l Number	MWIO				
Locat	ion:	jovo			San	Sampler(s): NG					
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		rs in well:		pp	m Med	surement	device: 1 Pds 0 P3/	-			
	to Grour	ndwater:	3.41		m Med	surement	(/ V				
Correc			+0.7		m						
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Well De					m						
Thickne	ess to Gro	oundwater (Column:		n	i.	7				
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	mpling										
Method		☐ Micro-P			^C Peristalti		□ Bailer	٦			
	mpling:		23		End Sc	ımpling:	733				
ample	Appear	T	10		1	mm Ha					
TIME	TEMP	SPEC. COND.		DO (mg/L	Redox	TDS (mg/L	Comments				
111412	(°C)	(µS/cm or	pН	or ppm)	(mV)	or ppm)	(appearance, odour, etc)				
7-26	21-8	6-73	6.58	1.19	113.1	764.8	light brown turbid no				
7.27	22-0	8-68	6.50	1.07	107.3	744.8	11	1			
7.2×	22.1	8.58	6.48	1.06	104.9	764.8	11	1			
7.29	22.1	8.55	6.47		1037		//	1			
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Ref. N	lumber:				Dat	e:	10/4/	18			
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TIME	TEMP	COND.	На	DO (mg/L	Redox	TDS (mg/		Comments			
	(°c)	(µS/cm or	Pr.	or Kow	(mV)	orppm	(appe	arance, odour, etc)			
\$ 55	24.8	3.69	7.67	3-48	96.5	765.0	cleas	no odan			
7.56	247	3.77	7.66	3.66	95.1	765.0	twhich	-	1		
7.57	24.7	Bn 2683	7.56	2.72	95.4	765-0	11	gray www.	1_		
7.58	24.7	3-71									
v vaa	77'/	3.71	7.51	2.55	95-3	765.0	"				
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iscella	Inacije E	ield Comn	antr		30 -2/3 -	United to	The State of the S		4		
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	to Groun	idwater:		36	m Me	asurement	Device:				
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		niscible Layer.			m Me	asurement	Device:				
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Well Sc	ampling			I LEVEL OF	5-240						
Method		☐ Micro-Pu	Jrge	Æ	P eristal	ltic	□ Bailer				
	ımpling:		8.34	•	End S	ampling:					
Sample	Appear										
TIME	TEMP (°C)	SPEC. COND. (µS/cm or	рН	DO (mg/L or peri	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)				
40	26.0	0.460	7.94	4.13	101-2	765.0	rd/brown to hid.				
1-41	25.8	0.456	7.15	4.07			be coming clear				
1.42	26.2	0.450	-	3.10	108:3		clear no odour				
.43	21.2	0451	6.63	3.11	1 0						
.44	26.7		-	2 2 7	108-5		grey brown twhen no				
	76-1	0.450	6.48	3.27	108.9	765.0	7				
1.45	26.2	0450	6.38	3-35	109-3		(1				
.46	26.3	0.450	6-31	3-44	108	77650	Y				
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RAMBOLL

	lumber:					Dat	e:	10/4/18.
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/letho		☐ Micro-P	urge	7	Peris	stalti	C	□ Bailer
tart Sc	ampling:	9	12.0				mpling:	_ bollot
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	75.15	SPEC.					munity	
TIME	TEMP (°C)	COND.	Hq	DO (mg/L		dox 1V)	TDS (mg/L	Comments
40	-	#DS/Crbi)	0.11	or pom			or-ppm)	(appearance, odour, etc)
09	266	0.54	8.11	0.78	_		765.1	clear, try orange
10	26.6	0.64	7.54	0.63		7	B65.1	particulates no ode
-11	26-8	0.54	6.92	0-23	-8	-9	765.11	<i>L</i> 1
-12	26.9	0.52	6.81	0.48	-9	.9	765.1	4
1.13.	26.9	0.52	6.76	0.46	- (1-	3	765.1	n
	26.9	0.52	6.64	0.46			765.1	/1
15	27.0	0.52	6.56		-14		765.1	1)
-16	27.0	0.51		0.42	-16		765.3	·
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(.06	21.8	2.58	6-03	0.66	-26.9		4		
.07	21-8	2.57	6.03	0.59	-29.0				
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	lumber:				Dat	e:	10/4			
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	dwater El				m					
		cible Layer:			m Mea	surement [Device:			
		niscible Lay			m					
Well De		undwater (15.0		m					
MICKNE	ess 10 Gro	unawater C	Jolumn:		m					
Wall C	ampling	KAUTO VOSE	TO BE STORY							
Method		☐ Micro-Pu	ırge	K	hD o ried and it	C *				
	ımpling:	LI MICIO-PU		30	Peristalti		☐ Bailer			
	Appear	ance.		30	Eng 50	impling:	N. Comments			
· · · · · · · ·	, ,ppcar	SPEC.			1	multa	- Wa			
TIME	TEMP (°C)	COND.	На	DO (mg/L	Redox	IDS (mg/L	Comments			
	(°C)	(µS/cm or res/em)		or ppm)	(mV)	o r pp m)	(appearance, odour, etc)			
1.34	23.0	12-84	6.38		469.5	765.2	very tubid, grey pul			
1.35	22.9	(3.()	6.27	_	68-1	765.2	of light bobby			
1-36	22.9	13.41	6.20	_	67.3	765.1	no odow			
1.37	22.8	13-70	6.16		(5.7	765.2	11			
	00 7	13.97	6.15				1,			
1.38	A4.	13 17	0.17		63.5	3.5 765.2 "				
							4			
			*							
	+						46.			
							1.4			
	•	p.								
		4.	100							
	9		- 9							
			16							
iscella	neous Fi	eld Comm	ents	0	Tolle P		Carrier of the Carrie			
	d Integrit	y: L	eac	of al	Acs	sann	olina - 7.57			
uplicate		NA		0			1			
plicate	: /	NA					4			
nsate:		NA.	1 1		٥					
mples I		m	etell	2	,	*	Talking.			
	Condition	n: Ov	eca	ot,	hun	nd	i i			
her:				(C)						

	lumber:	P108	12			Dat		10/4/18.		
Projec		// /				Well Number: MWI7				
Locat		Hydro	•			San	npler(s):	NG		
	Measure	7 . 132 . 35		700						
	to Grour	irs in well:	1 7	pp	om		surement			
Correc		iawater:	1.6	-5	m	Med	surement	Device:		
		levation :	- 0	09	m					
		cible Layer			m	A4				
		niscible Lay			m	Measurement Device:				
Well De		mociore Edy	5.	12	m					
		oundwater (m m					
		7011011101	001011111.		111					
Well So	ampling				1997		RING SK	STATE OF THE SAME		
Method	d:	☐ Micro-P	urge	,è	Per	istalti	c	☐ Bailer		
	ımpling:		12-	. ((Er	nd Sc	mpling:			
Sample	Appear				-		11.			
	TEMP	SPEC. COND.		DO (mg/L			wim the			
TIME	(°c)	(µS/cm or	PH	or Koy)		edox nV)	or ppm)	Comm (appearance,		
012		res/cda)	-							
12-13	11/-									
	26.0	1.00	7.44	0.87	-2	.9	765.0	light brown	small or	
2.15	25-9	0.98	7.12	0.60	-8	.4	765-0	paticulate	nooder	
2.16	25-9	0.97	7.03				765.0	/ h		
2-17	25.8	0.97	6.96	0.54	-1	1.8	765.0			
	25.8	0.97	6.93	0.51						
V. (0	23 0	0.3(7	0,17	0.3 1	-12	0	1650	1/		
-						-				
		leld Comn	nents		100					
	d Integrit									
uplicate										
	. ~	A								
	/V	11	ala							
		n. cla	. d.	1	-					
	CONTINU	(0)	ruy,	rupu	1.1					
nsate: imples l	N	1 A net	ots.	hupid	,					

	umber:	2//10	7		Date: 10/4/18 -					
Projec		6108				l Number:				
Locati		Hyd	CO.		San	npler(s):	Na			
	Aeasure	No. of the last of	THE SHAPE							
	c vapou		,	pp	m Med	Measurement device:				
	to Groun	dwater:	48	2	m Med	Measurement Device:				
Correc			+0-5	55	m					
	dwater Ele				m					
		cible Layer:			m Med	Measurement Device:				
		niscible Lay			m					
Well De	<u> </u>		6-0	14	m					
inickne	ess to Gro	undwater (Column:		m					
Well Sc	mpling			ARCE IN						
Method		☐ Micro-Pu	Jrge	Ìx	Peristalti	C	☐ Bailer	WAS IE I		
	mpling:		1.5.			mpling:				
	Appear	ance:	1 -0 2	S 10 4	2.70	- /				
		SPEC.				mmlles				
TIME	TIME TEMP COND. pH DO (mg/L Redox (ω) (ω) (μ) (mv) (mv)		TDS (mg/L	Comments						
		ms/cm)	_			or ppm)	(appearance, odou			
.53	24.9	[-1(7.33	3.77		763.8	light brown to	shid n		
.54	24.9	1-10	7.24		-27-2	763.8	C)			
.22	24-9	1.09		4.19	-27-9	763-8	11			
.76	24-9	(-08			-27-4	763-8	(1			
-57	24-9	1-06	7.07	4.80	-26.8	7638	lı			
	-									
la a = 11 .		-140	No. of the last		II)					
		eld Comm		-1				Alb Pil		
ell Head oplicate	d Integrity		ad e	end	- 5	21				
plicate:		NA								
sate:		14								
	-iltered	neta	4							
	Condition	melon	unna							
· 10:::0:	Solidillo	Er)	will							

Ref. N	umber:				D	Date: (0/4/18,					
Projec	et:	P108	2		W	Well Number: MW 18					
Locati	ion:	tryo	UO.		Sc	ımpler(s):	Ne.				
	Measure										
	ic vapou			рр		easurement :					
	to Groun	dwater:			m Me	Measurement Device:					
Correc			+ (3.74	m						
	dwater El				m						
		cible Layer:			m Me	easurement l	Device:				
		niscible Laye	er:	. / -	m						
Well De	<u> </u>	7-1	047		m						
Inickne	ess to Gro	undwater C	olumn:		m						
Well Sc	ampling			The Real							
Method		☐ Micro-Pu	ırge	×	Peristo	altic	☐ Bailer	AND DESCRIPTION OF THE PARTY OF			
Start So	mpling:	KE	12-6	17.	End	Sampling:					
Sample	Appear	ance:									
	TEMP	SPEC.		201 11		mm (fg		6			
TIME	TEMP (°C)	COND. (µS/cm or	Hq	DO (mg/L	Redo (mV)		Comments (appearance, odou	ır. etc)			
2 60	25.7	(ms/am)	7.51								
	257	0.269	7-51	0.12	-15%	0764.5	light grey/clear	36pre			
	25.6	0 268	7.18				brange partice	Mares			
	25.7	0.267	7.04			.6764.5		-			
	25-8	0.266	\$6.91	0-41		0764.4	11				
12.54	26.0	0.266	6-78	0.38	-169	6764.4	C)				
12.55	26-1	0.267	6-69	0.38	-171.	9764.4	11				
12.56	26.0	0.267	6.63	0.36	-173	57644	11				
Aiscello	neous F	ield Comm	ents								
	ad Integrit	y:	000 6	Der	d =	2	13				
ouplicat	- 10	A	-								
riplicate): N	A									
insate:	\sim	IA.	/ A								
amples		me	tals.		- 1	11-1					
/eather)ther:	Conditio	n: jw	nny	run	md	/ het.					
mer:											

Ref. N	lumber:				D	ate: / 6	14/18	
Projec	et:	Pla	82.		W	ell Number:	nw	19
Locat	ion:					ampler(s):	NG	
	Neasure						French Land	
		rs in well:		рр	m M	easurement c	device:	
	to Groun	ndwater:	20		m M	easurement [Device:	
Correc			-0-	09	m			
		levation :			m			
		cible Layer niscible Lay			_	easurement [evice:	
Well De		niscible Lay	er:		m			
		oundwater (m			
MICKING	233 10 010	ondwater	201011111.	- 1	m			
Well So	mpling		SE-SIZ VA		10000		i li (chi lovi li la x	
Method		□ Micro-P	urae	D	Peristo	altic	□ Bail	or
Start So	mpling:		12	7.		Sampling:	Li Dali	<u> </u>
	Appear	ance:		, ,		1/		
	TELAD	SPEC.				month		
TIME	TEMP (°C)	COND. (µS/cm or	Hq	DO (mg/L or pam)	Redo. (mV)		(apped	Comments grance, odour, etc)
1.20	26-6	(1.27	7.05		-18-3	764.1	clear	no odor
1-29	26.5	1.22	6.68		-19.		aver 11	no wow
1.30	26.5	1-22	6.46	-		8 764.1	"	
1-31	26.6	1-21	6.35	0.70	-31.		(1	
1-32	26.7	1.26	625	0.68	-41-		4	
1.33	268	1.19	6.25	0.68	-44.	764.2	11	
·								
					4.			
		ield Comn						
	d Integrit	Υ <u>'</u>	read	Q 6	ind	= 3.	2	
uplicate	1.0	VA					1.	
plicate		1 A						
nsate:	C114 1	NA	1 0 0					
imples		- W	etal	7				
eather her:	Conditio	n: {	unne	1.				
ner:								

Ref. Nu	ımber:				Date	:	10/4/18	
Projec	t:	P108	2		Well	Number:	MWIS	
Location	on:	Hadra	ઝ ∙		Samı	pler(s):	NG	
. 400 . 400	Neasuren			- Lynd				
	c vapours			ppr		urement d		
	o Ground	dwater:	1.5	9 r	n Meas	urement D	evice:	
Correct			-0.	(r	n			
Ground	lwater Ele	evation :		r	n			
		ible Layer:		r	n Meas	urement D	evice:	
		iscible Laye			n			
Well De			52	<i>O</i> n	n			
Thickne	ss to Grou	undwater C	olumn:	n	n			
Wall Sa	une n line		I CALL		7827			
Method Method	mpling	☐ Micro-Pu	rge	X	Peristaltia		□ Bailer	
Start Sa		LI MICIO-FU				mpling:	Li bullet	
	Appeard	ince.	2-1	3	Ena sa	mpling.		
sample	Appear	SPEC.		Ĭ	Ι	mm Ha		
TIME	TEMP	COND.	Hq	DO (mg/L	Redox	TOS Img/L	Comments	
THE	(°c)	(µS/cm or	Pii	or kaoury	(mV)	o r ppm)	(appearance, odour, etc)	
2.19	27-3	1-5-4	7-83	0.79	-47-2	763.8	light brown, tucked us	aq
2.20	27-19	1-58	7.68	080	-51-5	763-6	4	
2.21	27.0	1.28	7.55	0.76	-56.4	763.6	ч	
2.21	27-0	1-57	7.43	0.70	-59.8		4	
2.23	27.0	1-57	7-41	0-70	-60.4		U	
					-			
								_
								-
Miscello	aneous F	ield Comn	nents	SY E		of the		
	ad Integri			and-	- 1	.99	i	
Duplicat		A		~			· · · · · · · · · · · · · · · · · · ·	
Triplicate		A						
Rinsate:	N	A .	1					
	Filtered	meta	W					
	r Conditio		nny.					
Other:			1					\neg

	umber:				Do	ate: 10	14/18			
Projec			<u>-</u>		W	ell Number:	Mh	114		
Locati	on:	Hydr	e)		Sa	mpler(s):	NG.			
	Aeasure							THE E		
	c vapou		0/1	ppr		easurement c				
	to Groun	dwater:	2 68	1	m Me	easurement [Device:			
Correc			10.7	73	m					
	dwater El				m					
		cible Layer: niscible Laye			_	Measurement Device:				
Well De		iscible Laye	-	~	m					
		undwater (- American		n					
MICKIE	,33 10 010	onawaier	201011111.		n					
Well Sc	mpling		1 1 3	FIET TO V	M 77 "57"					
Method		☐ Micro-Pi	Jrae	kı	Peristo	ıltic	□ Ba	ilor		
	mpling:		2.3			Sampling:				
Sample	Appear	ance:		4 *		//				
	TELAD	SPEC.				mm Hg				
TIME	TEMP (°C)	COND.	рH	DO (mg/L	Redo.	1 02	(appe	Commer arance, o		
2 1,1	03.6	ms/cm)	1:18							
2-41	23-8	6.01	6.68	0.84	-22		clear	Ne	oclour	
2.42	23.6	6-02	6.55	0-74	-29-	7763.5	11			
243	23.6	5.83	6.39	0.64	-41	6 763.5	1/			
2.44	23.8	5.54	631	0 66	-45-	7763.5	/1			
2.45	23.8	5.47	6 29	0.67	-47.	17634	//			
2.46	23.7	5.40	6.26	0-69	49.	6763.5	11			
		9 - 4				0 770 9 3				
				1						
					-					
Miscello	meous !	ield Comr	nante	resiliate.	MILEST.					
	ad Integri		licili3	37	+,	- elle		-1		
Duplicat				2 2	> w	- SAL	5 sci.	nge	7.	
Triplicate						1		- V		
Rinsate:										
Samples	Filtered									
	Conditio	n:								
Other:										

Ref. Number: 318000XX(P1082)	Date: 11/4/18					
Project: Hydro GW	Well Number: MW2 1					
ocation:	Sampler(s):					
ield Measurements						
Organic vapours in well: ppm	Measurement device:					
Depth to Groundwater: 2 105 m	Measurement Device;					
Correction: — 0-06 m Groundwater Elevation: m						
Name the description of the desc	15					
historia de la companya de la compan	Measurement Device:					
Joll Doubles 12 / 0						
ointenants Our and I O I						
nickness to Groundwater Column: m						
Veli Sampling						
	eristaltic 🗆 Bailer					
	End Sampling:					
ample Appearance:	End dampling.					
SPEC. DO (mg/L or ppm) TIME TEMP COND. pH Or ppm) Or ppm) TIME TEMP COND. pH Or ppm) Or	Redox TDS (mg/L Comments (appearance, odour, etc)					
	27-4 - clear, no odow					
	1-2 - n n					
24 23-0 13-99 6-72 0-72 -	-9.4 - a a					
: 25 23.0 14-68 6-72 0-66 -	-20.2 - a u					
:27 23.1 15-36 6-72 0-64 -	-31.7 - WL 3.65 drawing of					
:28 23.1 15-54 6-72 0-67 -	34.5 - dear no odow.					
29 23.1 15-82 6.71 6-67 -	38.5 - ~					
scellaneous Field Comments						
ell Head Integrity:						
pplicate:						
olicate:						
nsate:						
mples Filtered						
eather Condition: her:						
IICI.						

(D > Mw21 @ 8:30 11/4/18

(NField Sheets\GroundwaterSampling-field_par_form_v2.doc RAMBULL)

H:\Hunter\Audits\Contaminated land\Field Sheets\GroundwaterSampling-field_par_form_v2.doc

Dof N	υmber:	PIN	2)				11/1/10				
Projec		1/00	1 6	elkesi	Date		11/9/18				
Locati			314			Number: oler(s):	MW06				
		west	0/ (23	Sum		CG				
The State of the Land	Measure	Se Made N		E WEST							
	ic vapour		1 == 2	ppr		urement o					
	to Groun	dwater:	2.2.	2 r	n Meas	Measurement Device:					
Correc		70	1.74	1	m						
	dwater Ele				m						
		cible Layer:		r	n Meas	Measurement Device:					
		niscible Laye	er:	r	n						
Well De		undwater C	6-75		n						
HICKHE	355 10 G10	unawater C	olumn;	n	n						
Wall C.		Take I ha									
Method	ampling	D Micro Pu	IFO.O.		David - III -						
	a: ampling:	☐ Micro-Pu	nge	Ц	Peristaltic		□ Bailer				
	Appear	ance.			End Sar	npling:					
Jampie	Appear	SPEC.									
TIME	TEMP (°C)	COND. (µS/cm or mS/cm)	рН	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)				
9:13	21.5	15-11 ms	7-08	0.74	-92.4	_	dear, slight Sulphido				
9:16	21.5	14.88	697	0-66	-103-3		, sugar sugar				
9-1-		4.	-	1	10		14/1 - 7:50				
1.15	21.5	14.48		0.62	-115.4		WU - 2 00 anbroc				
9:17	21-5	14.34	6-76	0.58	-122.	2 -	clea.				
9318	21.5	14.21	6-70	0.52	-124.6	-	•				
9:19	21-5	14.16	6.66	0.51	-126.1	_	v u				
		1-110			120 4	(
		ield Comn	nents								
	ad Integri	1-	1								
Duplicat		QA103) (#)							
riplicate	e: (
Rinsate:	Cillana -1										
	Filtered	.n.									
veathe Other:	r Conditio	on:									
		10	1		and -	01-					
WL	Often	MIZG 1	nun	nt lon	west	race	11/4/18				
	MIA	106	QA/	03	a	9:20	114/18				
							DAMBOLL				
. A IOTHER (A)	odiis (Coriidi)	inated land (Field	oneers/Groun	iawaieisampling	g-neia_par_rorr	n_vz.qoc	RAMBOLL				

Ref. No	umber:	PIO	82	te:	11	14/18				
Projec		yoro G	W Sm	reles	ik We	ii Nun	nber:	MW	20	
Locati	on: ou	Bille S.	metter	SiteA	/ Sai	mpler((s):	(6		
	Aeasure i									8
	c vapour			ppr	_			device:		
	to Groun	dwater:	2.60	-		asurer	nent [Device:		
Correc	iion: dwater Ele		0.65		m					
		cible Layer:			m m Me	acuron	aont F	evice:		
		niscible Layer.			n	asoren	HEIII L	revice.		
Well De		6-	18		n					
Thickne	ss to Gro	undwater C	olumn:	r	n					
Well Sampling										
Method: ☐ Micro-Purge ☐ Peristaltic ☐ Bailer										
Start Sa					End S	amplir	ng:			
sample	Appear	ance: SPEC.						T .		
TIME	TEMP (°C)	COND. (µS/cm or mS/cm)	рН	DO (mg/L or ppm)	Redox (mV)		(mg/L opm)	(app	Comments earance, odour, etc)	
10:40	23.7	1-89ms	7.09	1:10	-39.1	-		hobid,	pale grey.	
10:41	23.6	1-89	6-63	0.97	-37.	6 -		L.	u	
10:42	23.6	1.88	6.34	0.85	-38.8	3 -	-	~	فد	
10:43	23.6	1.86	6-14	0.79.	-41-6	<u> </u>	-	a	~	
10:44	23.6	1-85	6.07	0.76	-44.	2 -	_	13	м	
10:45	23-6	1-85	6-03	0.76	-45.	44		EA.	•	
			0 0 3	0 / 0						
						+				
						-				
		ield Comn	nents				T-			
	ıd Integri	ty:								
Duplicat Triplicate										
Rinsate:		102	A							
Samples	Filtered	102								
	Conditio	n:								
Other:										\neg
									1	

Sample 1D MW20 @ 10:50 11/4/18

Ref. N	Ref. Number: P1082 Date: 11/4/18										
Projec	12	yelo 1	GW S	molters	Wel	l Number:	MWIOZ				
Locati		carbon	plan	H?)		npler(s):	CG				
The state of the s	Aeasure	and the same of th									
	c vapou		1 10 -	ppr	_	surement c					
	to Groun	dwater:	1.185	r	n Med	surement [Device:				
Correc	tion: dwater Ele	<u> </u>	- 095		m						
		cible Layer:			m						
		niscible Layer:	or:			isurement D	Pevice:				
Well De		iiscible Luye	3.65		n						
	<u> </u>	undwater C		n							
		011011010	201011111,								
Well Sc	mpling										
Method		☐ Micro-Pu	Jrae	П	Peristalti	ic	□ Bailer				
Start Sampling: End Sampling:											
	Appear	ance:			1 = 1.10.00	pg.					
TIME	TEMP (°C)	SPEC. COND. (µS/cm or mS/cm)	рН	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	Comments (appearance, odour, etc)				
11=20	23.0	0.74	6-03	103	-20-7	-	dea, no odan				
11:21	22-9	0-73	5-78	0.89.	26-8		the Co				
11:22	23.0	0-73	5.67	0-83	- 33-	0 -	N U				
11-23	23-0	0.72	5.66	0.81	-35-	2 —	th u				
11:24	22.9	0-72	5-67	0.79	-37-	-	CA C				
		1									
		1									
		7									
	1										
Miscello	ineous F	ield Comm	nents			A STATE OF THE					
Vell Hea	ıd Integrit	y:									
Duplicat											
riplicate	:										
insate:											
amples Filtered											
	Conditio	n:									
Other:											

Sample 10 MW107

Ref. N	umber:	P108	2		Da	e: /	1/4/18	ų.			
Projec	t: /ty	NO G	W Sm	thes	₩e	Well Number: MWE 1338 M					
Locati	on: V	orbon	plant		Sar	npler(s):	Co				
1000 - 100	Aeasure i										
	c vapour			ppn	n Me	asurement o	device:				
	to Groun	dwater:	1.255	r	n Med	asurement [Device:				
Correc		(1-055	r	n						
	dwater Ele			r	n						
		cible Layer:		n	n Med	asurement [Device:				
		niscible Laye	er:	n	n						
Well De		5.	13	n	n						
Thickne	ess to Gro	undwater C	Column:	n	า 📗						
MI-II C-											
Method	mpling	DAG- D			<i>_</i>		38 48 48 11				
		☐ Micro-Pu	urge	₩.	Peristal		☐ Bailer				
Start Sa	Appear	· · · · · · · · · · · · · · · · · · ·			End S	ampling:					
Sumple	Appear	SPEC.									
TIME	TEMP (°C)	COND. (µS/cm or mS/cm)	На	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)		nments :e, odour, etc)			
11-49	26.3	1-10 ms	640	1.73	-26.	7 —	dea,	no odow.			
11:50	25-7	1.11	6-28	0.75	-46	9 -	~	₩			
11:51	25.7	1.11	6-28	0-69	-49-	4 -	u	L.			
11:52	257	1-11	6.28	0.67	-52	2 -	ц	~			
11:53	25-8	1-11	6-29	0.63	-56.	10 -	W	e.			
11:54	25.7	1-10	6-30	0.60	-59.	7 -	v-	c.			
,						<u></u>					
								18.			
		ield Comn	nents			1					
Well Hec	ad Integrit	у:				15	coupled i	recor			
Duplicat						/	10				
Triplicate	e:					/	angle				
Rinsate:					/		discord	lod			
Samples						·	u) CV				
	Conditio	n:	/	(A)							
Other:											
56	morpl	e 1D	M	WB7	1 (9 1	1:55 11/	4/18			

 $\label{thm:linear} H:\ Hunter\ Audits\ Contaminated\ I and\ Field\ Sheets\ Groundwater\ Sampling-field_par_form_v2. doc$

RAMBOLL

Def N		PIACE					to to					
	ımber:	1082	-	1 - 05	_	Date: 11/4/18						
Projec			smel		-	Il Number	53A/M	WA				
Location	on:	V cerb	an	plant	Sai	mpler(s):	Co					
100	l easurer	to see an an an an an an an an an an an an an										
	c vapour			ppr	n Me	asurement d	evice:					
	to Ground	dwater:	73	r	n Me	asurement D	evice:					
Correc			+0-9	7	m							
	dwater Ele			1	m							
		cible Layer:		r	n Me	asurement D	evice:					
		iscible Laye		r	n							
Well De			11.00	r	n							
Thickne	ss to Gro	undwater C	olumn:	n	n							
	mpling			HT. CO	/							
Method		☐ Micro-Pu	ırge		Peristal	ltic	□ Bailer					
Start Sa					End S	ampling:						
Sample	Appear											
TIME	TEMP (°C)	SPEC. COND. (µS/cm or mS/cm)	рН	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)		ments e, odour, etc)				
12:22	28.4	0.455	7-19	5.52	0-7		dee	no odan				
12:23	24.3	0-451	6.98	4-23	72-9	5 —	u	C.				
12:25	24.2	0.450	6.91	3.76	-7.6	_	a	c				
12:26	24-1	0450	6.94	3-70	-11-5		en	Ne.				
12:27	24-1	0-450	6-96	3-64	-13-	7 -	CA	u				
12=28	24.0	0450	6-99	3.58	-15-	8 -	~	~				
Miscello	neous F	ield Comn	nents									
Well Hed	ad Integri	ty:										
Duplicat	e:											
Triplicate) :											
Rinsate:												
Samples												
	Conditio	n:										
Other:												
	3.4	1	21/4				1					

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	umber:	11082	- 11	112	Date		11/4/18/	
Projec Locati		your s	Smell	Site		Number:	S3B/	MWB
		cerbon	~ PI	ant	Sam	pler(s):	(G-	
	Measure:		/	की भी क्षेत्रक				Harris State
	c vapour to Groun		170	ppi		surement d		
Correc		awaler.	9.70		_	surement D	evice:	
	dwater Ele	evation:	0 17		m			
		cible Layer:			n Maa	auramant D.		
		niscible Layer.			n Mea	surement De	evice:	
/ell De		//	1.52		n			
		undwater (~		n			
				<u> </u>				
/ell Sa	mpling							No Text
lethoc	1:	☐ Micro-Pu	urge		Peristalti	С	□ Bailer	
art Sa	mpling:				End Sa	mpling:		
ample	Appear							
TIME	TEMP (°C)	SPEC. COND. (µS/cm or mS/cm)	рН	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)		nments ce, odour, etc)
2:38	24.0	1.06	6 - 62	1.41	-7.2	_	dea	no oda
-39	23-9	1.07	6-51	0-88	-12-7	_	e e	~
140	23.9	1.06	6.44	0.72	- 18-2	_	и	4
1:41	23.9	1-06	6-40	0-69	-22.2	_	И	4
2=42	24.0	1.06	6-37	0.68	-24.1	_	£ ^	ч
2343	24.0	1-06	6-35	0-66	_ 25-	9 -	W	C
						-		
		eld Comn	nents					
	d Integrit	у:						
plicate								
licate	<u>. </u>							
sate:	Fill - 1							
	Filtered							
eatner ner:	Conditio	n:						
101.							- P	

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RAMBOLL

Ref. No	umber:	P1082			Date	: /	14118	
Projec		NO GW	Smell	le Site		Number:	MWIO	5
Location		0 0	J U	7,110		pler(s):	CG	
Field N	Measurer	nents			OS JUNE	a va juke ni		
Organi	c vapour	s in well:		ppn	n Meas	surement c	device:	
Depth :	to Groun	dwater:	0-64	-(n	n Meas	surement [Device:	
Correc	tion:	-	0-13	n	n			
Ground	dwater Ele	evation :		n	n			
		cible Layer:		n	n Meas	surement D	evice:	
		niscible Lay	er:	n	1			
Well De		3	-82	n	1			
Thickne	ess to Gro	undwater (Column:	m	1			
Andreas III	mpling		100			DE LITTLE	A LIFE TO SERVICE	
Method		☐ Micro-P	urge		Peristalti		□ Bailer	
	mpling:				End Sa	mpling:		
Sample	Appear							
TIME	TEMP	SPEC. COND.	11	DO (mg/L	Redox	TD\$ (mg/L	Comi	ments
TIME	(°C)	(µS/cm or	рН	or ppm)	(mV)	or ppm)		e, odour, etc)
13:09	26.0	ms/cm)	7-29	0.51	-124.	-	dea	no odar
13:10	26-0	1-12	7.0%	0.61	-127-	5 -	slightly br	own hydroca
18211	26.0	1.11	7.90	0./1	-129.	,	en	J o do
62		7.11	0.70	041			u	પ
13312	26-0	1.11	6.85	0-39	-130-5		u	L L
13:13	2640	1.11	6-76	0-35-	-132.5		Cr	U.
13:14	26-1	1-11	6-73	0-36	-133-0) —	W	<u> </u>
					1). 4			
					į.			
								<u> </u>
		ield Com	ments					
	ad Integri	ty: dav	raged	bolt	_ Ope	neda	its han	seev.
Duplicat					/			
Triplicate	e:							
Rinsate:								
	Filtered							
	r Conditio			all			,	
Other:	Oll	1 worte	MIMI	1ell ca	191	pune	d out w	TITL RETIN

Organic Depth to Correcti Ground	Hyp	o GW	1/4	ersite			14/10	7						
Field Monday Organic Depth to Correcti Ground	easuren				1161	NULLUEL.		Well Number: MW/6						
Organic Depth to Correcti Ground)	Sam	pler(s):	06	0						
Depth to Correcti Ground	vapours	nents	E ST F THE		ALPHA									
Correcti Ground		in well:		ppn	n Meas	urement c	levice:							
Ground	o Ground	dwater:	0.31	n	n Meas	urement D	evice:							
	ion:	- (1.085	r	n									
Depth to	water Ele	evation :		r	n									
	o Immisc	ible Layer:		n	n Meas	urement D	evice:							
Thicknes	ss to Imm	iscible Laye	r:	n	n									
Well Dep		2 -	19	n	า									
Thicknes	ss to Grou	undwater C	olumn:	r	1									
Well Sai		Elekson.		WH-1-8				The sealth and						
Method:		☐ Micro-Pu	rge	Y	Peristaltio		☐ Baile	er						
Start San			1 - 1		End Sai	mpling:								
Sample ,	Appeard		of bro	rwn	ish of	1 thy	Fubrd-							
TIME	TEMP (°C)	SPEC. COND. (µS/cm or mS/cm)	рН	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	I '	Comments rance, odour, etc)						
13:34	28.2	0.60	8-36	5-21	-140-7		slightly	yellow no on						
13:35	27-5	0.57	7.70	0-56	-144-4		u							
10	27.6	0.55	7.53	0 - 41	-140.	9	e a	<u> </u>						
	27.8	0.54	7-31	0-37	-/35	9-	ex	u						
13:38	27-9	054	7-19	0-41	- /3/	6 -	ca	<u> </u>						
	27-9	0.54	7.12	0-39	-1300			<u>.</u>						
1001	2"	0 34	+-12	0-01	-100									
			-											
Miscella	ineous F	ield Comn	nents	J-14 118			HATTI BART							
Well Hea														
Duplicate		• ^												
Triplicate:														
Rinsate:														
Samples I	Filtered													
Weather		n:												
Other:														

5 carple 1 MW/6 @ 13:40 11/4/18

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Ref. No	umber:	PI	082		Date	: //	14/18				
Projec	t: 12	NO G	W Sm	eller 5/2	Well	Well Number: MW101					
Location	on: adj	to dies		I pup.	Sam	pler(s):	CG	,			
Field N	Neasurer	nents	e incom				Mr. Light				
	c vapour			ppm	Meas	urement c	device:				
	to Ground	dwater:	1.92	m	Meas	urement D	evice:				
Correc			0-08	n	n			V			
	dwater Ele			n							
		cible Layer:		m	_	urement D	evice:				
		iscible Laye		m	_						
Well De		undwater C	1-92	m							
HIICKIIE	:33 10 G10	Jilawaiei C	olumn.	m							
Wall Sc	monling		21-111								
Method	mpling	☐ Micro-Pu	ırae		eristaltic		□ Bai	lor.			
Start Sa		LI IVIICIO-I C	nge	82		mpling:		<u> </u>			
	Appear	ance:			I Lina da	inpiing.					
1		SPEC.									
TIME	TEMP (°C)	COND. (µS/cm or mS/cm)	рН	DO (mg/L or ppm)	Redox (mV)	TDS (mg/L or ppm)	(appe	Comments arance, odour, etc)			
14:04	27-2	0.55	6.93	0-89	-28+	-	dea,	noodon			
14:05	27-1	0-55	6.75	0.50	_30.6		u	ex.			
14:06	27.1	0.55	6-61	0-57	-32.3	-	u	u			
14:07	27.1	0.55	6.53	0-44	-34-2		u	~			
14:08	27-2	0-55	6-45	0.42	-37	7 -	U	u			
14:09	22-1	0.55	6.37	0.39	-41.	3 —	u	4			
14:10	27.2	0.54	6-30	0-37	-45	5 -	u	٧,			
A											
	a neous F ad Integri	ield Comn	nents								
Duplicat		ry.									
Triplicate											
Rinsate:											
Samples											
	r Conditio	n:									
Other:											
<u> </u>	- [.	(D)	101/	nl		1/.	2 15	11/4/18			

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RAMBOLL

APPENDIX 7 LABORATORY REPORT AND EIL CALCULATION SPREADSHEETS

ENVIROLAB
GROUP

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

Client:						Client Project Name / Number / Site etc (ie report title):								16-18 Hayden Crt Myaree, WA 6154 Ph 08 9317 2505 / lab@mpl.com.au				
Contact Per			<u>w</u>	<u> </u>	<u> </u>		<u> 19072</u>	<u>8</u> 2	<u> 180</u>	<u>003</u>	<u>44 </u>			Malhau	rne Lab -	Emuinale	- L Comil	
Project Mgr	-				PO N	0.:								1A Dalm	ore Driv	e Scores	by VIC 3	3179
Sampler:	<u>, h v</u>	<u> </u>					<u>uote N</u>		<u>854</u>	<u>036</u>				Ph 03 97	63 2500	/ melbo	urne@e	envirolab.com.au
Address:	Sure 18 level	12			Date	result	s requi	red:						Brisbane	Office -	Envirola	ab Servi	ces
	50 Glebe Rd.											/ / 3 day			20 Depot			
	Suite 18, Level 50 Glebe Rd. The Junch	M NS	W 27.91	1		Inform Traes a		dvance	if urgent	t turnaro	und is re	quired =		Ph 07 32	66 9532	/ brisba	ne@en	virolab.com.au
Phone: 4	9625444	Mob: (3)	107 140	4176			<i>i<u>ppiv</u> n</i> át: es:	lat /ˈéɾ	uis /			·		Adelaide	e Office -	Envirola	ab Servi	ces · .
Email: Kgreen field@ramboll					omme			,	ŧ.					arade, N 350 706			57 virolab.com.au	
	t F	information					-				Tests R	equired						Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Hd	EC	% Organic	10 clay	5 5 5 7 7 8									Provide as much information about the sample as you can
1	44020 SOIL1	SWEGG	0418	SOLV	X	×	\searrow	<i>></i>						1				
2	HYDRO SOIL 2		1	1	区			×										_
3	HYDROSOIL 3				\sim		X	\sim	. —						 			Р -
4	HYDROSDIL4	4 -	4	4	区			X										Endreich Services
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									-					 				Chatswood NSW 2087 Ph: (02) 9910 6200
							_	1			\top			 		<u>Jr</u>	<u>ਹ ਵਿਚ.</u>	189258
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												+		†			$\overline{4}$	
Rèlinquished	by (Company): RAM	BOLL			Receiv	ved by	(Comp	anv):	En				Lab	ise only	<u> </u>	ı		
Print Name:		ONFIE	W		Print I		_	,	PRe					-		Cool o	r Ambi	ient (circle oné)
Date & Time:					Date 8	_		10/4	1201		10-15				e Recei			(if applicable)
Signature:	Theel				Signal			- 	11		त्र	_	_					l / courier
									Whi	te - Lai	b copy	/ Blue - Cli	ent copy	/ Pink	- Reta	ain in .	Book	Page No:

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories



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 ISC	D/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.

Envirolab Reference: 189258 Page | 5 of 9

Revision No: R00

QU	ALITY CONT	ROL: CE	EC .			Du	plicate		Spike Re	covery %
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]

QUALIT	CONTROL	Misc Ino	rg - Soil			Du	plicate		Spike Re	covery %
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	
Date analysed	-			16/04/2018	1	16/04/2018	16/04/2018		16/04/2018	
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	6.1	[NT]		102	
Total Organic Carbon (Walkley Black)	mg/kg	1000	Inorg-036	<1000	1	59000	59000	0	98	

Result Definiti	ons
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	Contro	ol 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.
Б	Ouplicate	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.
Mati	rix 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.
•	boratory 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.
Surroga	ate 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.

Envirolab Reference: 189258 Page | 9 of 9

Revision No: R00

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)
or for fresh ABCs only Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration
or for fresh ABCs only Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate
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 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
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)

Out	puts	
Land use	Cu soil-sp	ecific 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



Imputo
Inputs Select contaminant from list below
Cr III
Below needed to calculate fresh and aged
ACLs
Enter 0/ play (values from 0 to 4000/)
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

Out	puts	
Land use	Cr III soil-s	pecific 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 ACLs	needed to calculate fresh and aged
	estion evolunge conseity (silver
	cation exchange capacity (silver ea method) (values from 0 to 100
	(kg dwt)
	3 . ,
	11.8
	needed to calculate fresh and aged
Below ABCs	needed to calculate fresh and aged
ABCs	-
ABCs Measu	red background concentration
ABCs Measu	red background concentration
Measu (mg/kç	red background concentration g). Leave blank if no measured value
Measu (mg/kg	red background concentration g). Leave blank if no measured value fresh ABCs only
Measu (mg/kg	red background concentration g). Leave blank if no measured value fresh ABCs only iron content (aqua regia method)
Measu (mg/kg or for t Enter i	red background concentration g). Leave blank if no measured value fresh ABCs only iron content (aqua regia method) s from 0 to 50%) to obtain estimate
Measu (mg/kg or for t Enter i	red background concentration g). Leave blank if no measured value fresh ABCs only iron content (aqua regia method)
Measu (mg/kg or for Enter i (value of bac	fresh ABCs only iron content (aqua regia method) s from 0 to 50%) to obtain estimate kground concentration
Measu (mg/kg or for Enter i (value of bac	red background concentration g). Leave blank if no measured value fresh ABCs only iron content (aqua regia method) s from 0 to 50%) to obtain estimate kground concentration
Measu (mg/kg or for t Enter i (value of bac	fresh ABCs only iron content (aqua regia method) s from 0 to 50%) to obtain estimate kground concentration
Measu (mg/kg or for t Enter i (value of bac	freed background concentration g). Leave blank if no measured value fresh ABCs only fron content (aqua regia method) s from 0 to 50%) to obtain estimate kground concentration 7 aged ABCs only
Measu (mg/kg or for Enter i (value of bac or for Enter i	fresh ABCs only iron content (aqua regia method) s from 0 to 50%) to obtain estimate kground concentration 7 aged ABCs only State (or closest State) NSW
Measu (mg/kg or for Enter i (value of bac or for Enter i	fresh ABCs only iron content (aqua regia method) s from 0 to 50%) to obtain estimate kground concentration 7 aged ABCs only State (or closest State)

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 age	d	
Below needed to calculate fresh and age ABCs Measured background concentration (mg/kg). Leave blank if no measured valu		
ABCs Measured background concentration		
Measured background concentration (mg/kg). Leave blank if no measured valuor for fresh ABCs only Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration	ıe	
Measured background concentration (mg/kg). Leave blank if no measured valuor for fresh ABCs only Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate	ıe	
Measured background concentration (mg/kg). Leave blank if no measured valuor for fresh ABCs only Enter iron content (aqua regia method) (values from 0 to 50%) to obtain estimate of background concentration	ıe	
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	ıe	
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	ıe	
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)	ıe	

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	

Contaminated Soils Management Plan

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

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. Ramboll

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CONTENTS

Executive	Summary	ii
1.	Introduction	3
1.1	Background	3
1.2	Objective	3
1.3	Scope of Work	3
1.4	Regulatory Framework and Guidelines	4
2.	Site Identification	5
2.1	Site Location	5
2.2	Site Boundaries	5
2.3	Future Land use	5
3.	Site Conditions	6
3.1	Topography	6
3.2	Geology	6
3.3	Regional Hydrogeology	6
3.4	Local Hydrology	7
3.5	Site Sensitivity	7
4.	Summary of PREVIOUS INVESTIGATIONS	8
4.1	Phase 2 Environmental Site Assessment of Dickson Road Site	8
4.2	Tier 2 Ecological Risk Assessment	9
4.3	Stage 2 Aquatic Assessment - Ecological Risk Assessment	11
4.4	Annual Cattle Monitoring Reports	11
4.5	Phase 1 Environmental Site Assessment	11
4.6	Phase 2 Environmental Site Assessment of Parcel 16	12
5.	Assessment Criteria	14
5.1	Contaminants of Concern	14
5.2	Soil	14
5.3	Surface Water and Groundwater	16
5.3.1	Appropriate Criteria for Groundwater and Surface Water	17
6.	Site Characterisation	19
6.1	Assessment of Contamination	19
6.2	Soil Results	20
6.3	Groundwater Results	22
6.4	Surface Water Results	23
6.5	Conceptual Site Model	23
6.6	Statement of Suitability for Existing and Proposed Site Use	27
7.	Remedial Action Plan	28
7.1	Remediation Goal	28
7.2	Extent of Remediation Required	28
7.3	Remediation Options	28
7.4	Rationale for the Selection of the Recommended Remedial Option	29
7.5	Contingency if the Remediation Strategy Fails	30
7.6	Interim Site Management Plan	30
8.	Remedial Action Works Plan	31
8.1	Hold Point	31
8.2	Site Establishment	31
8.3	Survey	31
8.4	Remedial Methodology	31
8.4.1	Excavation	32

8.4.2	Sorting	32
8.4.3	Spoil Management	32
8.4.4	Materials Tracking	32
8.4.5	Groundwater Remediation	33
8.4.6	Validation of Remediation	33
8.4.7	Reshaping and Final Landform	33
8.4.8	Smelter Site Stockpile Area	33
8.4.9	Demobilisation	34
9.	Validation Sampling and Analysis Quality Plan	35
9.1	Validation Data Quality Objectives	35
9.1.1	Step 3: Identify Inputs to the Decision	35
9.1.2	Step 5: Development of Decision Rules	36
9.2	Design for Obtaining Validation Data	36
9.3	Data Quality Indicators	38
9.4	Remediation Acceptance Criteria	40
9.5	Validation Reporting	40
10.	Construction Environmental Management Plan	41
10.1	Construction Environmental Management Plan	41
10.2	Site Access	41
10.3	Hours of Operation	41
10.4	Air Controls	41
10.4.1	Dust Control	41
10.4.2	Odour	41
10.5	Noise Control	42
10.6	Erosion and Sediment Control	42
10.7	Surface Water and Groundwater Control	42
10.7.1	Surface water	42
10.7.2	Groundwater	43
10.8	Traffic Control	43
10.9	Spill Response	43
10.10	Hazardous Materials	43
10.11	Waste Materials	44
10.12	Flora and Fauna	44
11.	Health and Safety	45
12.	Remediation Schedule	46
13.	Environmental Controls Contingency Plan	47
13.1	Asbestos Management Protocol	47
13.1.1	Asbestos Related Permits and Approvals	47
13.1.2	Management of Unexpected ACM Finds	48
14.	Regulatory Compliance Requirements	49
15.	Key Personnel	51
16.	Community Relations Plan	52
17.	Long Term Management	53
18.	References	54
19.	Limitations	55
19.1	User Reliance	55

APPENDICES

Appendix 1

Figures

Appendix 2

NEPM EIL Calculations

Appendix 3

Site Photographs

Appendix 4

Test Pit and Borehole Logs

Appendix 5

Laboratory Tables

Appendix 6

Laboratory Reports

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 BTEX	Below Ground Surface Renzone Teluana Ethylhanzana & Vulanas (Managyalia Aramatis Hydrocarbana)
	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
P9/ L	rind ogranis per Liue

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 32°47.652′ S, Longitude 151°29.283′ 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 $14,150~\text{m}^3$ or approximately 21,225 tonnes. This was based on an estimation of the areal extent from aerial imagery and a bulk density of $1.5~\text{kg/m}^3$ 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 semipermanent 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
 - o A site walkover to evaluate other potential locations of buried waste or illegal dumping
 - o 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	70³ CrIII 1% clay
Copper	6000	65³
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	-

- 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.

The applicable assessment criteria for petroleum hydrocarbons in soil are presented in **Table 5-3**.

Table 5-3: ESLs and Management Limits¹ for Petroleum Hydrocarbons in Soil

	Soil texture	ESLs (mg/kg dry soil)	Management Limits ¹ (mg/kg dry soil)
TPH fraction		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.

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

³ To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.

⁴To obtain F2 subtract naphthalene from the >C10-C16 fraction.

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.

 $^{^{}m 4}$ To obtain F1, subtract the sum of BTEX from C6-C10 fraction.

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 $626\mu S/cm$ to $1520\mu S/cm$. 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 $7\mu g/L$. 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 CaCO₃). 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	11	100	500
Cadmium	0.842	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	31.22	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.

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.

 $^{^2}$ 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.

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	31.21
Mercury	3	<0.05	0	
Fluoride	3	10,000	1/1	1000²/ 2000³
Total Cyanide	3	61	1	74
Polycyclic Aromatic Hydrocarbons	3	<lor< td=""><td>0</td><td></td></lor<>	0	
PhenoIs	3	<lor< td=""><td>0</td><td></td></lor<>	0	
Other SVOCs	3	<lor< td=""><td>0</td><td></td></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 μ g/L exceeded the trigger levels for irrigation and stock watering or 1000 μ g/L and 2000 μ g/L respectively. The total cyanide concentration was 61 μ g/L. There is no guideline for total cyanide, however the guideline for protection of 95% of fresh water species for free cyanide is 7 μ g/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	11
Cadmium	3	0.6	0	
Chromium	3	5	3	11
Copper	3	20	2	5.46 ¹
Lead	3	10	0	
Nickel	3	67	1	42.91
Zinc	3	210	3	31.21
Mercury	3	0.4	2	0.06^{1}
Fluoride	3	3600	3	1000
Total Cyanide	3	<4	0	
Organochlorine Pesticides	3	<lor< td=""><td>0</td><td></td></lor<>	0	
Organophosphorous Pesticides	3	<lor< td=""><td>0</td><td></td></lor<>	0	
Polycyclic Aromatic Hydrocarbons	3	<lor< td=""><td>0</td><td></td></lor<>	0	
PhenoIs	3	<lor< td=""><td>0</td><td></td></lor<>	0	
Other SVOCs	3	<lor< td=""><td>0</td><td></td></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
Incidental ingestion of impacted soil	No	Potential	No	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
Dust inhalation	No	No	NA	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.
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
Incidental ingestion of impacted surface water	No	NA	NA	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
Root uptake	NA	Yes	Yes	and ecological receptors of Swamp Creek.
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.
Root uptake	NA	Yes	Yes	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.

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.

Volume estimates (m3) Mass estimates (T) Туре Bulk Range Density Range (T/m³)Estimate Low High High Low Smelter derived 8,490 8,490 16,980 1.5 12,735 25,470 wastes Contaminated soils 5,660 5,660 11,320 1.8 10,188 20,376

Table 7-1: Fill Quantity Estimates

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 <u>coarse</u>, <u>high-level</u> 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-ofsite 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
	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:
Step 5: Development of Decision Rules	 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?
	Acceptable limits and the manner of addressing possible decision errors are outlined in the sections below:
Step 6: Specific Limits of Decision Error	 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:

- 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
- 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	ТВА
Contractor Procurement	4 – 6 weeks	ТВА
Preliminaries (documentation)	3 weeks	ТВА
Site establishment and mobilisation	1 week	ТВА
Site works	6 - 8 weeks	ТВА
Demobilisation	1 week	ТВА
Groundwater sampling following remediation	6 months	ТВА
Validation reporting	2 weeks following groundwater sampling	ТВА

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
	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:
State Environmental Planning Policy 55 – Remediation of Land (SEPP 55)	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.
	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.
Contaminated Land Management Act 1997 (CLM Act)	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.
	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.
Environmental Planning and Assessment Act 1979 (EP&A Act)	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	ТВА	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	ТВА	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 <i>Contaminated Land Management Act</i> 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
	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/
Information and Feedback Mechanisms	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.
	Hydro established the Community Reference Group in 2014. The group is comprised of local community representatives with the following aims:
	 Create a forum for discussion and exchange of information on topics related to the Project.
Community Reference Group	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.
	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.
	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:
Community Information Notices and Fact Sheets	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.

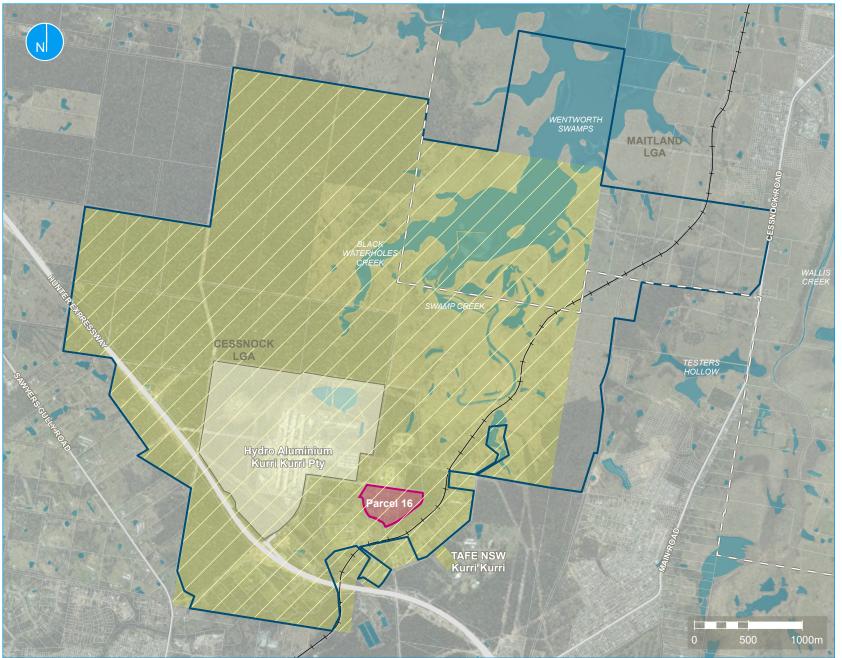
Ramboll did not independently verify all of the written or oral information provided to Ramboll during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided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



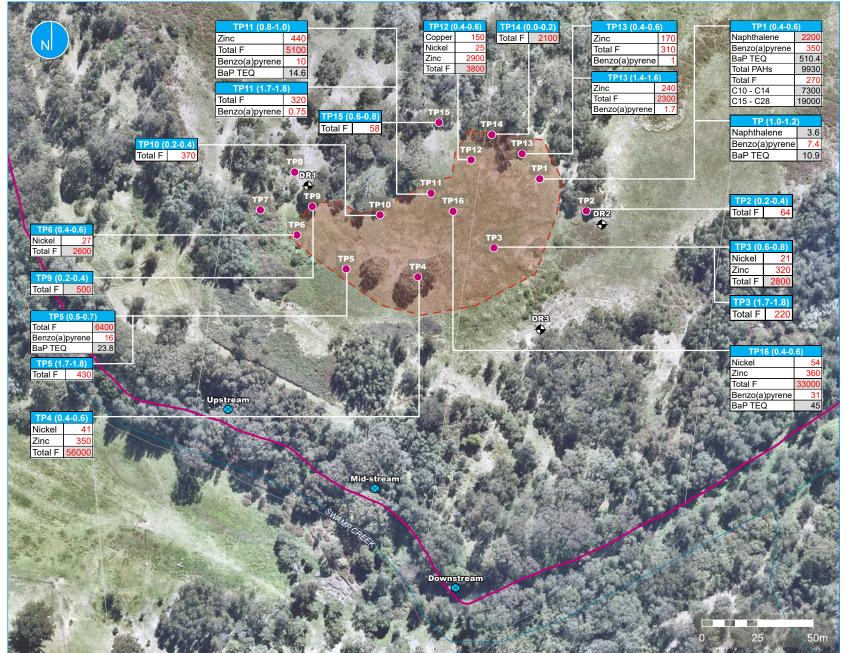
Legend





Imagery © Department Finance, Services and Innovation 2020

A4 1:35,000



Legend

Parcel boundary



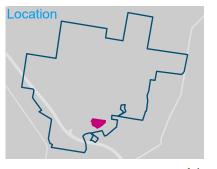
Extent of waste and extent of remediation required

- Groundwater well
- Test pit
- Surface water

Exceedance criteria

_//						
Analyte (mg/kg)	EIL/ESL for Areas of Ecological Significance	HIL/HSL for Residential use	Managemen 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) ElLs derived using NEPM (2013) ElL 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



A4 1:1,700

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
			AVEKAGE	0.04245	1.22/2/3	7.225

Inputs
Select contaminant from list below
Cr_III
Below needed to calculate fresh and aged ACLs
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)
Enter State (or closest State)
NSW
Enter traffic volume (high or 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
_
ABCs Measured background concentration
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
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
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

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)
3
7.2
1.2
Below needed to calculate fresh and aged
ABCs
Measured background concentration
(mg/kg). Leave blank if no measured value
(g.n.g). Louis Diame in the model of tande
an fan fan ah ADOs an ha
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)

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)

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

DA ⁻	TE :	STARTED					COMPLETED 16/8/12	R.L. SURFACE	DATUM	
								SLOPE 90°		
ΕQI	UIP	MENT S	olid A	Auger				HOLE LOCATION Next	o TP8	
								LOGGED BY SC		CHECKED BY KG
NO.	TES	<u> </u>		<u> </u>	<u> </u>		T		1	T
Method	Water		RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material l	Description	Samples Tests Remarks	Additional Observations
M IDA		eta isa de la company		(m) 1 1 1 2 1 3 1 1 1 1 1 1 1 1		5.60	SAND; brown, fine to medium grain brown. Varying amounts of silt (5 -	h plasticity, some fine sand, moist		

BOREHOLE NUMBER DR2

						COMPLETED st			
Ю	LE S	SIZE							
ON	TES								
Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material D	Description	Samples Tests Remarks	Additional Observations
ADI						SAND with some silt, brown, fine gra	ained, moist.		
				1					
				2					
	ge▼			3					
	Seepage					<u> </u>			
	√ 05					becoming SAND/Clayey SAND, ligh moist/wet at 3.5 - 4.0m depth	t brown, medium plasticity fines,		
	SWL 3.8m 12/8/12 14:20			4					
	VL 3.8m 1:								
	S			<u>5</u>					
				- (x) - (x) - (x)					
		<u> </u>		-		Borehole DR2 terminated at 5.5m			
				6					

BOREHOLE / TEST PIT AS130309C HYDRO KURRI KURRI.GPJ GINT STD AUSTRALIA.GDT 30/5/16

BOREHOLE NUMBER DR3

DATI DRIL EQU HOL	DATE STARTED 16/8/12 DRILLING CONTRACTOR TerraTest EQUIPMENT Solid Auger							R.L. SURFACE SLOPE 90° HOLE LOCATION South of TP4 on Riv LOGGED BY SC		DATUM BEARING er terrace
ō	Water	Well Details		Depth (m)	Graphic Log	Classification Symbol	Material Desc	cription	Samples Tests Remarks	Additional Observations
ADT	SWL at 0.53m 21/08/12 10:10 ▼			1,0 - 1,0 - 1,5 - 2,0 - 3,5 - 4,0 - 4,5 		OH	Silty SAND; brown to light brown, fine gmoist. Moist/wet and 0.5m, becoming sontent decreases with depth.			

BOREHOLE NUMBER Pump

PR	ROJE	CT NUM	BER					_ PROJECT LOCATION _K	urri Kurri	
DA	ATE S	STARTE	D _16	6/8/12			COMPLETED 16/8/12	R.L. SURFACE		DATUM
1								SLOPE 90°		
1										
								_ LOGGED BY SC		CHECKED BY KJG
NC	JIES	<u> </u>								
Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material De	·	Samples Tests Remarks	Additional Observations
				_	\bowtie	SPG	FILL; Silty sandy GRAVEL; tan, brick	fragments to 150mm, moist		
				_	\bowtie					
				0 <u>,5</u>		SP-SM	SAND; white/cream, fine, medium gramaterial, moist.	ined, trace of carbonaceous		
	1 21			1, <u>0</u>		SP-SM	Becoming SAND/SAND with some SI grained, silty fines (non plastic), moist	LT; light brown, fine-medium		
ADT	22/8/2012			- - 1, <u>5</u>						
				2 <u>,0</u>						
				2 <u>,5</u>						
				3 <u>,0</u>						
				_						
				3 <u>,5</u>						
				_						
				4 <u>,0</u>						
				4 <u>,5</u>						
				_ _ _						

TEST PIT NUMBER TP01

DATE STARTED _ 26/712	DAT							Kurri Kurri		
TEST PIT ISIZE LOGGED BY KJG CHECKED BY FR NOTES Material Description Material Description Material Description Material Description Material Description Material Description Samples Remarks Additional Closervæ Fill.: sand, coarse grained, yellow/brown with metal pipe, plastic bags, wood, a resolution of control of the con										
Test PIT SIZE LOGGED BY KJG CHECKED BY FR Material Description Samples Tests Remarks Additional Observer Surples Tests Remarks Additional Observer Remarks Fig. 1, 2, 3, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,										
Notes Page										
Depth Part							LOGGED BY KJG		CHECKED BY FR	
FILL sand, carere grained, yellowhrown with metal pipe, plastic bags, wood, a showle, clyided or unknown material, part of 44 gallon druin, drun of old ramming compound (no longer used) - very odourous and sampled, pitch odour 50% waster50% soil. 1.0.	NO	IES								
shovet, cylinder of unknown material, part of 44 gallori drum, drum of old mamming compound (no briger used) - very odourous and sampled, pitch odour 50% waster 50% soil.	Method	Water		Graphic Log	Classification Symbol			Tests	Additional Observations	
Borenoie 1P01 terminated at 1.7m			- 0,5 - 1,0 			shovel, cylinder of unknown material, part of ramming compound (no longer used) - very of 50% waste/50% soil.	44 gallon drum, drum of old			
		-				Borehole TP01 terminated at 1.7m			EOH @ 1.7m - Refusal	
	+			I				1	1	
			_							
			_							

RAMBOLL ENVIRON **TEST PIT NUMBER TP02** PAGE 1 OF 1 PROJECT NAME Dickson Road CLIENT Hydro Aluminium Kurri Kurri 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 LOGGED BY KJG CHECKED BY FR TEST PIT SIZE NOTES Classification Symbol Graphic Log Samples Material Description Additional Observations Tests Remarks RL Depth (m) SAND; fine grained, brown, with some rootlets. SAND; fine grained, yellow Borehole TP02 terminated at 0.9m EOH @ 0.9m 1,0 1,5

BOREHOLE / TEST PIT AS130309C HYDRO KURRI KURRI GPJ GINT STD AUSTRALIA.GDT 30/5/16

TEST PIT NUMBER TP03

				40	COMPLETED COSTAG	DI CUPEACE		DATUM		
					COMPLETED _26/7/12					
			Backhoe							
	TES									
Method	Water	RL (m)	(m) htdad	Classification Symbol	Material Descri		Samples Tests Remarks	Additional Observations		
			0,5 - 1,0		SAND; yellow, fine grained, wet Borehole TP03 terminated at 1.8m	netal pipe, plastic pipe, brick, rical conduit, wiring, concrete, reo		EOH @ 1.8m		
					Borehole TP03 terminated at 1.8m			EOH @ 1.8m		
		1	1 1	I	İ			1		

TEST PIT NUMBER TP04

			COMPLETED _26/7/12				
TEST PIT SIZENOTES				LOGGED B1 _KJG		CHECKED BT TR	
Water (B)	(m) utded Graphic Log	Classification Symbol	Material Descr	•	Samples Tests Remarks	Additional Observations	
	0.5		FILL; clay, brown, low plasticity with 2 bulker tyre, 20-30% waste	pags, brick, wood, metal, plastic,	DUPA		
						EOH @ 1 8m	
			Borehole TP04 terminated at 1.8m			EOH @ 1.8m	
						EOH @ 1.8m	

TEST PIT NUMBER TP05

						rri Kurri			
DA EX	ATE (CA)	STAR [*]	TED 26	6/7/12 RAC	2 TOR	COMPLETED 26/7/12	R.L. SURFACE		DATUMBEARING
TE	STI	PIT SIZ	ZE						
NO	OTES	<u> </u>							
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Descripti		Samples Tests Remarks	Additional Observations
DONETHOLE / TEST TIL AS 1908/98/ TILDRO NOTATION OF THE STOTAL AND TO SUPPLIE OF THE STOTAL AND TO SUPPLIE OF THE STOTAL AND T			1, <u>0</u>			SAND; brown, fine grained, wet Borehole TP05 terminated at 1.8m	g, plastic strapping, air hoses,		EOH @ 1.8m

BOREHOLE / TEST PIT AS130309C HYDRO KURRI KURRI.GPJ GINT STD AUSTRALIA.GDT 30/5/16

TEST PIT NUMBER TP06

CLI	ENT	Г <u>Ну</u>	dro A	lumini	um Ku	ırri Kurri			
PR	ΟJΕ	CT NI	JMBE	R			PROJECT LOCATION _K	Curri Kurri	
DA ⁻	ΓE S	TAR	ΓED _	26/7/	12	COMPLETED 26/7/12	R.L. SURFACE		DATUM
EXC	CAV	ATIO	N COI	NTRAG	CTOR		SLOPE		BEARING
TES	ST P	IT SIZ	ZE				LOGGED BY KJG		CHECKED BY FR
NO.	TES								
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	n	Samples Tests Remarks	Additional Observations
\neg						FILL; sand, yellow, fine grained			
			- - 0, <u>5</u> - - 1, <u>0</u>			FILL; gravelly clayey sand, fine grained, timber, b sock, wiring, steel strapping, rubber mud flap, larg size, plastic, 50% waste.	rick, thermos exhaust damper ge piece of concrete - unknown		
			_	<u> </u>		Borehole TP06 terminated at 1.3m			
			1 <u>,5</u>						
			_						
			- -						

TEST PIT NUMBER TP07

					COMPLETED _26/7/12			
			Backhoe					
	T P TES		<u></u>			LOGGED BY KJG		CHECKED BY FR
NO	IES	<u> </u>						
Method	Water	RL (m)	Oraphic Log	Classification Symbol	Material Desc		Samples Tests Remarks	Additional Observations
			1/ . 1/2		TOPSOIL; clayey sand, brown, fine grained	with some rootlets		
			- <u>\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\</u>	<u>.</u>				
			1/2 \(\frac{1}{2}\)					
			1.1/		SAND; yellow, fine grained			
				•				
			-					
				•				
			0,5					
				•				
							Ь	
			1,0		Borehole TP07 terminated at 1m		\perp	
			1 <u>,5</u>					
			"					
			2,0				1	

BOREHOLE / TEST PIT AS130309C HYDRO KURRI KURRI.GPJ GINT STD AUSTRALIA.GDT 30/5/16

TEST PIT NUMBER TP08

						ırri Kurri			
						COMPLETED _26/7/12			
EX	CAV	ATIO	N COI	NTRAC	CTOR		SLOPE		BEARING
EQ	UIP	MENT	Bac	ckhoe			TEST PIT LOCATION _Tra	ack on Northerr	n side
			IZE LOGGED B			LOGGED BY KJG		CHECKED BY FR	
NO.	TES								
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Descriptio	on.	Samples Tests Remarks	Additional Observations
				7/1/2		TOPSOIL; clayey sand, brown, fine grained			
						SAND; fine grained, yellow, moist			
			- 1,5 -			Borehole TP08 terminated at 1.1m			

RAMBOLL ENVIRON **TEST PIT NUMBER TP09** PAGE 1 OF 1 PROJECT NAME Dickson Road CLIENT Hydro Aluminium Kurri Kurri PROJECT NUMBER PROJECT LOCATION Kurri Kurri EXCAVATION CONTRACTOR _____ SLOPE _--- BEARING _---EQUIPMENT Backhoe TEST PIT LOCATION North of TP6 LOGGED BY KJG CHECKED BY FR TEST PIT SIZE _ NOTES Classification Symbol Graphic Log Samples Material Description Additional Observations Tests Remarks RL Depth (m) FILL?; sand, dark brown, fine grained with 1 large log SAND; fine grained, yellow/grey 0,5 BOREHOLE / TEST PIT AS130309C HYDRO KURRI KURRI GPJ GINT STD AUSTRALIA.GDT 30/5/16 Borehole TP09 terminated at 1.2m 1,5

TEST PIT NUMBER TP10

						COMPLETED 2017/42			
						COMPLETED _26/7/12			
NOT							<u> </u>		
					_				
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Descripti	on	Samples Tests Remarks	Additional Observations
			0, <u>5</u>					DUPB/B1	
			1,0			FILL; sand, brown, fine grained with some clay, cearthware pipe, baghouse sock, 20% waste SAND; yellow, fine grained Borehole TP10 terminated at 1.6m	concrete, timber dunnage,		
			_						

TEST PIT NUMBER TP11

					COMPLETED 26/7/12				
					COMPLETED _20///12				
				LOGGED BY KJG CHECKED BY FR					
	TES								
Method	Water	RL (m)	(m) htded Graphic Log	Classification Symbol	Material Descr		Samples Tests Remarks	Additional Observations	
			1,0		FILL; sand, dark brown, fine grained with som strapping, timber, steel shelving, drums, plast concrete, PVC piping, plastic, 80% waste SAND; fine grained, dark brown, wet Borehole TP11 terminated at 1.8m	e clay/gravel and bricks, hose, ic, electric wiring, cable tray,			

TEST PIT NUMBER TP12

						ırri Kurri			
DA EX	ATE :	STAR [®]	TED _	26/7/ NTRAC	12 CTOR	COMPLETED _26/7/12	R.L. SURFACE		DATUM
TE	EST F	PIT SIZ	ZE						
NC	OTES	<u> </u>							
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Descript		Samples Tests Remarks	Additional Observations
BURETULE/ I EST PIT AS JOUGUSC RITURO NURRI GITA GINT STD AUST RALLA, GDT 30/9/10			1,0 - 1,5 - 2,0			SAND; grey, fine grained SAND; grey, fine grained Borehole TP12 terminated at 1.5m	ipe, packing paper, 30% waste		* Large piece 60cm x 40cm + smaller pieces

TEST PIT NUMBER TP13

1					ırri Kurri					
DA	ATE S	STAR	TED _26/7/	12	COMPLETED 26/7/12	R.L. SURFACE		DATUM		
1						_ LOGGED BY KJG		CHECKED BY FR		
NC	TES	<u> </u>	I I							
Method	Water	RL (m)	(m) htdead Graphic Log	Classification Symbol	Material Descrip	otion	Samples Tests Remarks	Additional Observations		
W	w ▶	(m)	0,5 1,0	0.8	FILL; sand, dark brown, fine grained with some strapping, electrical conduit, fence posts (steel plastic, Kao Wool*, carbon fluxing tubes, brick bricks and the strapping of the), wiring, large lumps of steel,	DUP C	* small piece 5cm x 3cm EOH @ 1.6 Refusal on Concrete		

TEST PIT NUMBER TP14

					COMPLETED _26/7/12			DATUM
			ZE			LOGGED BY KJG		CHECKED BY FR
TOP	ES			T				
Method	Water	RL (m)	Debth Graphic Log	Classification Symbol	Material Descript		Samples Tests Remarks	Additional Observations
			0,5 1,0		FILL; sand, dark brown, fine grained with some timber, strapping, rubber hose, electrical conduit bags, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, PVC pipe, steel pipe, carbon, days, aluminium, pVC pipe, steel pipe, carbon, days, aluminium, pVC pipe, steel pipe, carbon, days, aluminium, pVC pipe, steel pipe, carbon, days, aluminium, pVC pipe, steel pipe, carbon, days, aluminium, pVC pipe, steel pipe, carbon, days, aluminium, pVC pipe, steel pipe, carbon, days, aluminium, pVC pipe, steel pipe, carbon, days, aluminium, days	, bricks, packing foam, bulker		
- 1	- 1		1 1	1	[

TEST PIT NUMBER TP15

PR	OJE	CT N	UMBER _			PROJECT LOCATION	Kurri Kurri	Kurri				
					COMPLETED _26/7/12							
	ST P TES		ZE			LOGGED BY KJG		_ CHECKED BY FR				
INC	ILS	<u> </u>										
Method	Water	RL (m)	(m) Ographic Log	Classification Symbol	Material Descri SAND; grey, fine grained	ption	Samples Tests Remarks	Additional Observations				
			_									
			0,5				DUP D/D1					
			-		Borehole TP15 terminated at 1m							
			-									
			1 <u>,5</u>									
			_									
			2,0									

BOREHOLE / TEST PIT AS130309C HYDRO KURRI KURRI.GPJ GINT STD AUSTRALIA.GDT 30/5/16

TEST PIT NUMBER TP16

						rri Kurri			
						COMPLETED _26/7/12			
	TES								
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	n	Samples Tests Remarks	Additional Observations
						SAND; grey, fine grained, moist SAND; grey, fine grained, moist Borehole TP16 terminated at 1.6m	ags, concrete slab, bricks,		
			_						

APPENDIX 5 LABORATORY TABLES

Job No: AS130419

Project Name: Dickson Road Remedial Action Plan



June 2020					Sample typ	۱ ا	Soil	Soil	Soil	Soil	Soil
					Sample ID:		TP1	TP1	TP2	TP3	TP3
			NEPM 2013	NEDM 2012			0.4-0.6	1.0-1.2	0.2-0.4	0.6-0.8	1.7-1.8
			ESLs/ Site	NEPM 2013	Sample dep		26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12
	NEPM 2013 HIL	NEPM 2013 Soil		Management Limits	Project nan		Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road
	A Residential	HSLs for Vapour	Specific EIL for		Project man	iie.	RAWP	RAWP	RAWP	RAWP	RAWP
	A Residentiai	Intrusion HSL A		Residential, Park	Site:		Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road
			Ecological	Land and Open	Site.		Landfill	Landfill	Landfill	Landfill	Landfill
	Significance Space Sam		Sample pro	file:	FILL	FILL	SAND	FILL	SAND		
				-	Sample coll		KJG				
					Sample Con	lected by.	KJG	KJG	KJG	KJG	KJG
Analyte grouping / Analyte					Units	LOR					
Analyte grouping/Analyte					Units	LUK					
Miscellaneous Inorganics	<u> </u>	1		T T	 	T		Т	ı	ı	<u> </u>
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 1	5800		2800	13000	2300
Arsenic	100,000		100		mg/kg	4	<4	-	<4	13000	<4
Cadmium	20		100		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		- 03		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
					1 3 1						
Polynuclear Aromatic Hydrocarbons	<u> </u>	1 2	10	T T		0.4				ı	<u> </u>
Naphthalene		3	10		mg/kg	<0.1	2200	3.6	-	-	-
Acenaphthylene					mg/kg	<0.1	360	1	-	-	-
Acenaphthene Fluorene					mg/kg	<0.1	84 580	0.8	-	-	-
					mg/kg	<0.1 <0.1	1800	2.9 13	-	-	-
Phenanthrene Anthracene					mg/kg 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			<u> </u>		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				<u> </u>	1 1119/119		7,550	75.0			
C6 - C9 Fraction (NEPM 2013 F1)		45	125	700	mg/kg	25	<25	<25	_	_	_
	1						723		-		
		l 110 l	25	I 1000 I	l ma/ka l	5() I	/300	I <50	-	-	_
C10 - C14 Fraction (NEPM 2013 F2) C15 - C28 Fraction (NEPM 2013 F3)		110	25	1000 2500	mg/kg mg/kg	50 100	7300 19000	<50 <100	-	-	-

Blank Cell indicates no criterion available

LOR = Limit of Reporting

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

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

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.

⁻ means not analysed

^{*}Site-specific recreational fluoride value calculated in the Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)

^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.

 $^{^{\}rm D}\!$ Direct Contact are applied to surface soils or soils that could result in immediate contact.

Job No: AS130419

Project Name: Dickson Road Remedial Action Plan



June 2020										
					Soil	Soil	Soil	Soil	Soil	Soil
					TP4	TP5	TP5	TP6	TP9	TP10
			NEPM 2013	NEPM 2013	0.4-0.6	0.5-0.7	1.7-1.8	0.4-0.6	0.2-0.4	0.2-0.4
		NEDM 2042 C 'I	ESLs/ Site	Management	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12
	NEPM 2013 HIL	NEPM 2013 Soil	Specific EIL for	Limits	Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road
	A Residential	HSLs for Vapour	Areas of	Residential, Park	RAWP	RAWP	RAWP	RAWP	RAWP	RAWP
		Intrusion HSL A	Ecological	Land and Open	Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road
			Significance	Space	Landfill	Landfill	Landfill	Landfill	Landfill	Landfill
			Significance	Space	FILL	FILL	SAND	FILL	SAND	FILL
					KJG	KJG	KJG	KJG	KJG	KJG
					1.50	1.00	1.00	1.55	1.50	1.00
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		100		<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		<u> </u>	10		-	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< td=""><td>-</td><td>-</td><td>-</td></lor<>	-	-	-
Total PAHs	300				_	159.5	<lor< td=""><td>_</td><td>-</td><td>_</td></lor<>	_	-	_
Total Petroleum Hydrocarbons		<u> </u>	<u> </u>			133.3	1 12011	<u> </u>	<u> </u>	
C6 - C9 Fraction (NEPM 2013 F1)	T	45	125	700	-	<25	<25	_	_	_
C10 - C14 Fraction (NEPM 2013 F2)		110	25	1000	_	<50	<50	_	_	_
C15 - C28 Fraction (NEPM 2013 F3)		110		2500	_	240	<100	_	-	-
C29 - C36 Fraction (NEPM 2013 F4)		1		10,000	-	290	<100	-	_	-
		 		,		 	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	 		

Blank Cell indicates no criterion available

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Concentration in ${\bf red}$ exceed the adopted Site Specific EIL

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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

⁻ means not analysed

^{*}Site-specific recreational fluoride value calculated in the Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)

^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 be applied after consideration of relevant ESLs and HSLs.

 $^{^{\}rm D}$ Direct Contact are applied to surface soils or soils that could result in immediate contact.

To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.

To obtain F2 subtract naphthalene from the >C10-C16 fraction.

Job No: AS130419

Project Name: Dickson Road Remedial Action Plan



June 2020										
					Soil	Soil	Soil	Soil	Soil	Soil
					TP11	TP11	TP12	TP13	TP13	TP14
			NEPM 2013	NEPM 2013	0.8-1.0	1.7-1.8	0.4-0.6	0.4-0.6	1.4-1.6	0.0-0.2
			FSI c / Sita	Management	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12	26/Jul/12
	NEPM 2013 HIL	NEPM 2013 Soil	Specific EIL for		Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road
	A Residential	HSLs for Vapour	Areas of	Residential, Park	RAWP	RAWP	RAWP	RAWP	RAWP	RAWP
	A Residential	Intrusion HSL A			Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road
			Ecological	Land and Open	Landfill	Landfill	Landfill	Landfill	Landfill	Landfill
			Significance	Space	FILL	SAND	FILL	FILL	FILL	FILL
						<u> </u>				
					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	+	2100	320	3000	210	2300	2100
	1 440		4.5			1				
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							l	l		
Naphthalene		3	10		2.7	<0.1	_	<0.1	< 0.1	_
Acenaphthylene			10		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 10	0.75	-	1	1.7	<u> </u>
Indeno(1,2,3-c,d)pyrene			0.7		6.5	0.4	-	0.7	1.2	
Dibenzo(a,h)anthracene					1.3	0.4	-	0.7	0.3	-
Benzo(g,h,i)perylene		<u> </u>			6.2	0.1	-	0.2	1.3	-
	3				14.6	1.1	-	1.6	2.7	-
Carcinogenic PAHs (as BaP TEQ)										
Total PAHs	300				106.6	5.9	-	8.4	15.8	-
Total Petroleum Hydrocarbons	<u> </u>	45	125	700	.25	-25	<u> </u>	.05	:25	
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	-

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Concentration in ${\bf red}$ exceed the adopted Site Specific EIL

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To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.

To obtain F2 subtract naphthalene from the >C10-C16 fraction.

⁻ means not analysed

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 $^{^{\}rm D}$ Direct Contact are applied to surface soils or soils that could result in immediate contact.

Job No: AS130419

Project Name: Dickson Road Remedial Action Plan



					Soil	Soil	Soil	Soil	Soil	Soil
				-	TP15	TP16	EMP3-SF1	EMP3-SF2	EMP3-SF3	EMP3-SF4
			NEPM 2013	NEPM 2013	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
		NEPM 2013 Soil	ESLs/ Site	Management	Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road	Dickson Road
	NEPM 2013 HIL	HSLs for Vapour	Specific FIL for	Limits	RAWP	RAWP	RAWP	RAWP	RAWP	RAWP
	A Residential	Intrusion HSL A		Residential, Park	Dickson Road	Dickson Road	IVAWE	IVAVVI	IVAVIE	IVAVVE
			Ecological	Land and Open	Landfill	Landfill	Phase 2 ESA	Phase 2 ESA	Phase 2 ESA	Phase 2 ESA
			Significance	Space			i			
					FILL	FILL	Topsoil	Topsoil	Topsoil	Topsoil
					KJG	KJG	SC	SC	SC	SC
Analyte grouping/Analyte										
Miscellaneous Inorganics										
Moisture					13	8.2	_	_	_	_
	240									
Total Cyanide	240		4.5		<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			İ	<0.5	<0.5	-	-	-	-
Chromium	100		70		<1	32	-	-	-	-
Copper	6000		65		<1	45	-	-	-	-
Lead	300			İ	<1	24	-	-	-	-
Mercury	40				<0.1	0.1	-	-	-	-
Nickel	400		20	İ	2	54	-	-	-	-
Zinc	7400		140		1	360	-	-	-	_
Polynuclear Aromatic Hydrocarbons										
Naphthalene	T	3	10		_	0.9	-	-	_	_
Acenaphthylene			10		_	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			0.7			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		.05	1	1		<u> </u>
un - ug Fraction (MFPM 7013 FT)		45	125	700	-	<25	-	-	-	-
		440	2.5	1000						
C10 - C14 Fraction (NEPM 2013 F2)		110	25	1000	-	<50	-	-	-	-
		110	25	1000 2500 10,000	-	<50 450 610	-	-	-	-

Blank Cell indicates no criterion available

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Concentration in ${\bf red}$ exceed the adopted Site Specific EIL

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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

⁻ means not analysed

^{*}Site-specific recreational fluoride value calculated in the Preliminary Screening Level Health Risk Assessment for Fluoride and Aluminium (ENVIRON 2013)

^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 be applied after consideration of relevant ESLs and HSLs.

 $^{^{\}rm D}$ Direct Contact are applied to surface soils or soils that could result in immediate contact.

To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.

To obtain F2 subtract naphthalene from the >C10-C16 fraction.



Analyte grouping/Analyte Miscellaneous Inorganics OH Electrical Conductivity Total Cyanide Total Fluoride	Aquatic Ecosystems ^c	Water ^G		Project Name		Dickson Road	28/08/12 Dickson Road				
Miscellaneous Inorganics OH Electrical Conductivity Total Cyanide Total Fluoride				Sample appe	arance:	RAWP Clear SC	RAWP Clear SC	RAWP Clear SC	RAWP Clear SC	RAWP Clear SC	RAWP Clear SC
DH Electrical Conductivity Fotal Cyanide Fotal Fluoride				Units	LOR	30	30	30	J 3C	30	
Total Cyanide Total Fluoride				pH Units µS/cm	1	5.1 2000	6 1900	6.5 3400	6.2 230	6.5	6.6 240
	7	1000	2000	μg/L μg/L	4 100	<4 180	<4 140	61 10000	<4 2400	<4 3600	<4 2700
Dissolved Metals in Water Arsenic Cadmium	1	100	500	μg/L	1	1	<1 <0.1	1	-	-	-
Chromium Copper	0.84 1 5.46	10 100 200	10 1000 1000	μg/L μg/L μg/L	0.1 1 1	0.6 <1 <1	<1 <1	<0.1 <1 5	- - -	- - -	- - -
Lead Mercury Nickel	25.84 0.06 42.9	2000 2 200	100 2 1000	μg/L μg/L μg/L	1 0.05 1	<1 <0.05 120	<1 <0.05 9	<1 <0.05 20	-	-	-
Zinc Total Metals in Water	31.2	2000	20000	µg/L	1	170	57	18	- 3	-	-
Arsenic Cadmium Chromium	0.84	100 10 100	500 10 1000	μg/L μg/L μg/L	0.1	- - -	- - -		<0.1 2	0.3 5	15 0.6 4
Copper Lead Mercury	5.46 25.84 0.06	200 2000 2	1000 100 2	μg/L μg/L μg/L	1 1 0.05	- - -	- - -	- - -	3 4 <0.05	10 9 0.4	20 10 0.2
Nickel Zinc	42.9 31.2	200 2000	1000 20000	μg/L μg/L	1	-	-	-	19 74	38 160	67 210
Calcium - Dissolved Potassium - Dissolved				mg/L mg/L	0.5 0.5	5.6 7.5	14 5.3	24 4.9			- -
Sodium - Dissolved Magnesium - Dissolved Hydroxide Alkalinity (OH-) as CaCO ₃				mg/L mg/L	0.5 0.5 5	310 34 <5	320 15 <5	710 36 <5	-		-
Bicarbonate Alkalinity as CaCO ₃ Carbonate Alkalinity as CaCO ₃				mg/L mg/L mg/L	5	8 <5	56 <5	530 <5	- - -	- - -	-
Fotal Alkalinity as CaCO ₃ Sulphate, SO4				mg/L mg/L	5 1	8 120 530	56 210	530 650 330	-	-	-
Chloride, Cl Conic Balance PAHs in Water				mg/L %	1	-2.5	400 -2.3	2.2	-	-	-
Naphthalene ^J Acenaphthylene	16			μg/L μg/L	1 1	<1 <1	<1 <1	<1 <1	<1 <1	<1 <1	<1 <1
Acenaphthene Fluorene Phenanthrene ^K	2			μg/L μg/L μg/L	1 1 1	<1 <1 <1	<1 <1 <1	<1 <1 <1	<1 <1 <1	<1 <1 <1	<1 <1 <1
Anthracene ^K Fluoranthene ^K	0.4			μg/L μg/L	1 1	<1 <1	<1 <1	<1 <1	<1 <1	<1 <1	<1 <1
Pyrene Benzo(a)anthracene Chrysene				μg/L μg/L μg/L	1 1 1	<1 <1 <1	<1 <1 <1	<1 <1 <1	<1 <1 <1	<1 <1 <1	<1 <1 <1
Benzo(b+k)fluoranthene Benzo(a)pyrene ^K Indeno(1,2,3-c,d)pyrene	0.2			μg/L μg/L μg/L	2 1 1	<2 <1 <1	<2 <1 <1	<2 <1 <1	<2 <1 <1	<2 <1 <1	<2 <1 <1
Dibenzo(a,h)anthracene Benzo(g,h,i)perylene				μg/L μg/L μg/L	1 1	<1 <1	<1 <1 <1	<1 <1	<1 <1 <1	<1 <1 <1	<1 <1
SVOC's in Water Phenol Bis (2-chloroethyl) ether	320			μg/L μg/L	10 10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10
2-Chlorophenol ³ 1,3-Dichlorobenzene 1,4-Dichlorobenzene	490			μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
2-Methylphenol 1,2-Dichlorobenzene Dis-(2-Chloroisopropyl) ether				μg/L μg/L μg/L μg/L	10 10 10 10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10
3/4-Methylphenol N-nitrosodi-n-propylamine				μg/L μg/L	20 10	<20 <10	<20 <10	<20 <10	<20 <10	<20 <10	<20 <10
Hexachloroethane Nitrobenzene Esophorone				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
2,4-Dimethylphenol 2-Nitrophenol Dis (2-Chloroethoxy) methane	2 2			μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
2,4-Dichlorophenol 1,2,4-Trichlorobenzene Naphthalene	160			µg/L µg/L µg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
1-Chloroaniline Hexachlorobutadiene 2-Methylnaphthalene				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
Hexachlorocyclopentadiene 2.4.6-Trichlorophenol ^J	20			μg/L μg/L	10 10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10
2.4.5-Trichlorophenol 2-Chloronaphthalene 2-Nitroaniline	0.5			μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
Dimethyl phthalate 2,6-Dinitrotoluene Acenaphthylene				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
3-Nitroaniline Acenaphthene 2,4-Dinitrophenol				μg/L μg/L μg/L	10 10 100	<10 <10 <100	<10 <10 <100	<10 <10 <100	<10 <10 <100	<10 <10 <100	<10 <10 <100
4-Nitrophenol Dibenzofuran Diethylphthalate				μg/L μg/L μg/L	100 10 10	<100 <10 <10	<100 <10 <10	<100 <10 <10	<100 <10 <10	<100 <10 <10	<100 <10 <10
1-Chlorophenylphenylether 1-Nitroaniline Fluorene				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
2-methyl-4,6-dinitrophenol Azobenzene 4-Bromophenylphenylether				μg/L μg/L μg/L	100 10 10	<100 <100 <10 <10	<100 <100 <10 <10	<100 <100 <10 <10	<100 <100 <10 <10	<100 <100 <10 <10	<100 <100 <10 <10
Hexachlorobenzene Pentachlorophenol ^J	0.1 10			μg/L μg/L	10 100	<10 <100	<10 <100	<10 <100	<10 <100	<10 <100	<10 <100
Phenanthrene Anthracene Carbazole				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
Di-n-butylphthalate Fluoranthene Pyrene				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
Butylbenzylphthalate Bis(2-ethylhexyl) phthalate Benzo(a)anthracene				μg/L μg/L μg/L	10 10 10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10
Chrysene Di-n-octylphthalate Benzo(b)fluoranthene				μg/L μg/L μg/L μg/L	10 10 10 10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10
Benzo(k)fluoranthene Benzo(a)pyrene				μg/L μg/L	10 10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10
Indeno(1,2,3-c,d)pyrene Dibenzo(a,h)anthracene Benzo(g,h,i)perylene				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
Ethylmethanesulfonate Aniline Pentachloroethane				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
Benzyl alcohol Acetophenone N-nitrosomorpholine				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
N-nitrosopiperidine 2,6-Dichlorophenol Hexachloropropene-1	34			μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
N-nitroso-n-butylamine Safrole 1,2,4,5-Tetrachlorobenzene				μg/L μg/L μg/L	10 10 10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10
Trans-iso-safrole 1,3-Dinitrobenzene Pentachlorobenzene				μg/L μg/L	10 10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10
L-Naphthylamine 2,3,4,6-Tetrachlorophenol				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
2-Naphthylamine 5-Nitro-o-toluidine Diphenylamine				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
Phenacetin Pentachloronitrobenzene Dinoseb				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
Methapyrilene o-Dimethylaminoazobenzene 2-Acetylaminofluorene				μg/L μg/L μg/L	10 10 10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10
7,12-Dimethylbenz(a)anthracene 3-Methylcholanthrene				μg/L μg/L	10 10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10
a-BHC o-BHC g-BHC				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
d-BHC Heptachlor Aldrin	0.09 0.001			μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
Heptachlor Epoxide g-Chlordane a-Chlordane				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10
Endosulfan I D,p'-DDE Dieldrin				μg/L μg/L μg/L	10 10 10	<10 <10 <10	<10 <10 <10 <10	<10 <10 <10	<10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10
Endrin Dielarin Diplomation Diplomation Diplomation Dielarin Diela	0.02			μg/L μg/L	10 10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10
Endosulfan II Endrin Aldehyde o,p'-DDT Endosulfan Sulphate	0.2			μg/L μg/L μg/L μg/L	10 10 10 10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <10 <10 <10	<10 <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)

General The long-term trigger value (LTV) is the maximum concentration (mg/L) of contaminant in the irrigation water which can be tolerated assumptions described in ANZECC Volume 3, Section 9.2.5. The short-term trigger value (STV) is the maximum concentration (mg/L) of contaminant in the irrigation (mg/L) of contaminant in the irrigation water which can be tolerated assumptions described in ANZECC Volume 3, Section 9.2.5. The short-term trigger value (STV) is the maximum concentration (mg/L) of contaminant in the irrigation water which can be tolerated assumptions described in ANZECC Volume 3, Section 9.2.5. The short-term trigger value (STV) is the maximum concentration (mg/L) of contaminant in the irrigation water which can be tolerated assumptions described in ANZECC Volume 3, Section 9.2.5.

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)

¹ Figure may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance. KChemical 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 Australia Screening criteria supported by OEH Contaminants and Risk, Environment Protection Science Branch (as of 20/04/2 PFAS National Environmental Management Plan collaborative from the Heads of EPAs Australia and New Zealand (HEPA) and Australia Government of the Environment of Health (2017) derived guidance values for drinking water and recreational water using Food Standards Australia 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% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid limit <50% and fine with liquid lim * 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

<u>Underlined</u> 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.

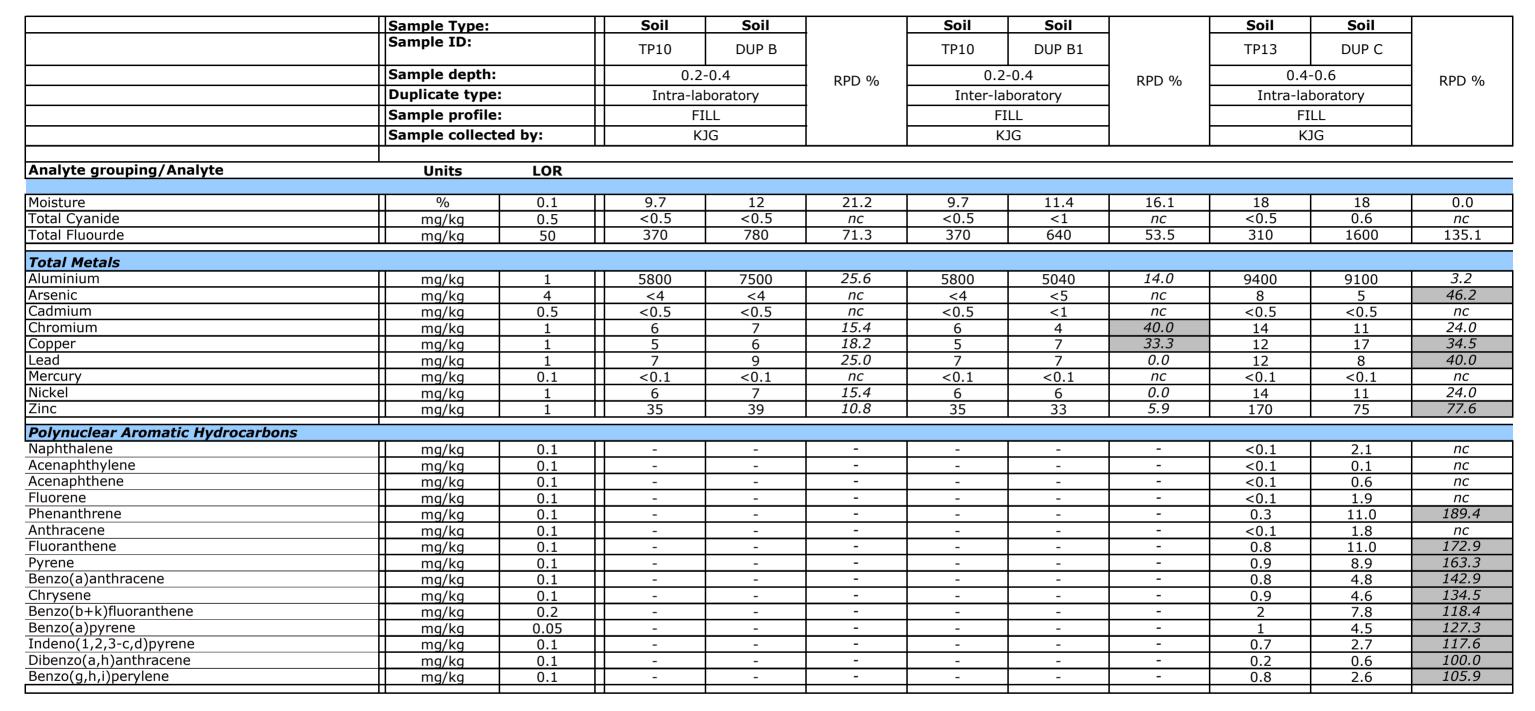
NHMRC arsenic guidelines are based on total arsenic ANZECC, NEPM and NHMRC guidelines for chromium are based on Cr (VI)

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 Table 3: Soil QA Results

Job No: AS130419

Project Name: Remedial Action Plan

18/06/2020



Note all units in mg/kg

Shaded cells exceed RPD >30%



<value = Less than the laboratory Limit of Reporting (LOR)

nc = not calculated as one or more results are below the LOR.

Guidelines	Sample type Sample ID: Sample dept Sample date Project Nam Sample appe Sample colle Duplicate type	h: : e: earance: ected by:	Water DR2 N/A 28/08/12 Dickson Road RAWP Clear SC Intra-lal	Water QC01 N/A 28/08/12 Dickson Road RAWP Clear SC	RPD %
Analyte grouping/Analyte	Units	LOR			
Miscellaneous Inorganics					
oH Electrical Conductivity	pH Units μS/cm	1	6 1900	6 1900	0.0 0.0
otal Cyanide	μg/L	4	<4	<4	nc
otal Fluoride Dissolved Metals in Water	μg/L	100	140	150	6.9
Arsenic	μg/L	1	<1	<1	nc
Cadmium Chromium	μg/L μg/L	0.1	<0.1 <1	<0.1 <1	nc nc
Copper Lead	μg/L μg/L	1	<1 <1	<1 <1	nc nc
1ercury	μg/L	0.05	< 0.05	<0.05	nc
lickel Zinc	μg/L μg/L	1 1	9 57	9 44	0.0 25.7
PAHs in Water					
Naphthalene Nacenaphthylene	μg/L μg/L	1 1	<1 <1	<1 <1	nc nc
Acenaphthene Tuorene	μg/L μg/L	1	<1 <1	<1 <1	nc nc
Phenanthrene Anthracene	μg/L	1	<1	<1	nc
luoranthene	μg/L μg/L	1 1	<1 <1	<1 <1	nc nc
Pyrene Benzo(a)anthracene	μg/L μg/L	1	<1 <1	<1 <1	nc nc
Chrysene	μg/L	1	<1	<1	nc
Benzo(b+k)fluoranthene Benzo(a)pyrene	μg/L μg/L	2	<2 <1	<2 <1	nc nc
ndeno(1,2,3-c,d)pyrene Dibenzo(a,h)anthracene	μg/L μg/L	1 1	<1 <1	<1 <1	nc nc
Benzo(g,h,i)perylene	μg/L 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 nc
-Chlorophenol ,3-Dichlorobenzene	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
,4-Dichlorobenzene -Methylphenol	рд/- µg/L µg/L	10 10	<10 <10	<10 <10	nc nc
,2-Dichlorobenzene	µg/L	10	<10	<10	nc
is-(2-Chloroisopropyl) ether /4-Methylphenol	μg/L μg/L	10 20	<10 <20	<10 <20	nc nc
l-nitrosodi-n-propylamine lexachloroethane	µg/L µg/L	10 10	<10 <10	<10 <10	nc
litrobenzene	μg/L	10	<10	<10	nc nc
sophorone ,4-Dimethylphenol	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
-Nitrophenol is (2-Chloroethoxy) methane	µg/L µg/L	10 10	<10 <10	<10 <10	nc nc
,4-Dichlorophenol	µg/L	10	<10	<10	nc
,2,4-Trichlorobenzene laphthalene	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
-Chloroaniline lexachlorobutadiene	μg/L	10	<10 <10	<10 <10	nc
-Methylnaphthalene	μg/L μg/L	10 10	<10	<10	nc nc
exachlorocyclopentadiene ,4,6-Trichlorophenol	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
,4,5-Trichlorophenol -Chloronaphthalene	μg/L	10 10	<10 <10	<10 <10	nc
-Nitroaniline	μg/L μg/L	10	<10	<10	nc nc
Dimethyl phthalate 2,6-Dinitrotoluene	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
cenaphthylene B-Nitroaniline	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
Acenaphthene	μg/L	10	<10	<10	nc
2,4-Dinitrophenol Nitrophenol	μg/L μg/L	100 100	<100 <100	<100 <100	nc nc
Dibenzofuran Diethylphthalate	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
-Chlorophenylphenylether -Nitroaniline	μg/L	10	<10 <10	<10 <10	nc
luorene	μg/L μg/L	10 10	<10	<10	nc nc
-methyl-4,6-dinitrophenol zobenzene	μg/L μg/L	100 10	<100 <10	<100 <10	nc nc
-Bromophenylphenylether lexachlorobenzene	μg/L	10 10	<10 <10	<10 <10	nc
entachlorophenol	μg/L μg/L	100	<100	<100	nc nc
henanthrene .nthracene	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
arbazole Di-n-butylphthalate	μg/L	10	<10 <10	<10 <10	nc
luoranthene	μg/L μg/L	10 10	<10	<10	nc nc
yrene utylbenzylphthalate	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
is(2-ethylhexyl) phthalate	μg/L	10	<10	<10 <10	nc
enzo(a)anthracene hrysene	μg/L μg/L	10 10	<10 <10	<10	nc nc
vi-n-octylphthalate enzo(b)fluoranthene	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
enzo(a)pyrene	μg/L	10	<10 <10 <10	<10 <10	nc
ndeno(1,2,3-c,d)pyrene	μg/L μg/L	10 10	<10	<10	nc nc
Dibenzo(a,h)anthracene Benzo(g,h,i)perylene	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
thylmethanesulfonate niline	µg/L µg/L	10 10	<10 <10	<10 <10	nc
entachloroethane	μg/L	10	<10	<10	nc nc
enzyl alcohol cetophenone	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
-nitrosomorpholine -nitrosopiperidine	µg/L µg/L	10 10	<10 <10	<10 <10	nc
,6-Dichlorophenol	μg/L	10	<10	<10	nc nc
exachloropropene-1 -nitroso-n-butylamine	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
afrole ,2,4,5-Tetrachlorobenzene	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
rans-iso-safrole	μg/L	10	<10	<10	nc
,3-Dinitrobenzene entachlorobenzene	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
-Naphthylamine ,3,4,6-Tetrachlorophenol	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
-Naphthylamine -Nitro-o-toluidine	μg/L	10	<10 <10 <10	<10 <10 <10	nc
iphenylamine	μg/L μg/L	10 10	<10	<10	nc nc
henacetin entachloronitrobenzene	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
inoseb	μg/L	10	<10	<10	nc
lethapyrilene -Dimethylaminoazobenzene	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
-Acetylaminofluorene ,12-Dimethylbenz(a)anthracene	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
-Methylcholanthrene	μg/L	10	<10	<10	nc
-BHC -BHC	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
-BHC -BHC	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
leptachlor Idrin	μg/L	10	<10 <10 <10	<10 <10 <10	nc
leptachlor Epoxide	μg/L μg/L	10 10	<10	<10	nc nc
-Chlordane -Chlordane	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
	μg/L	10 10 10	<10 <10 <10	<10 <10 <10	nc
	!! "	. 10	. (11)	. < 10	nc
,p'-DDE Dieldrin	μg/L μg/L	10	<10	<10	nc
,p'-DDE Dieldrin ndrin	μg/L μg/L	10 10	<10 <10	<10 <10	nc nc
indosulfan I ,p'-DDE Dieldrin indrin ,p'-DDD indosulfan II indrin Aldehyde	μg/L	10	<10	<10	nc

APPENDIX 6 LABORATORY REPORTS

CHAIN OF CUSTODY - Client



ENVIROLAB GROUP

Client: Contact pers	ENVIRON on: KIRSTY GR	EENE								c (ie report		Envirolab Services 12 Ashley St, Chatswood, NSW 2067						
Project Mgr:		<u> </u>		PO No					<u> </u>			Phone	e: 02 9	910 62	00	Fax :02 9910 6201		
Sampler:				Enviro	lab Qu	ote No	. :					E-mai	il: ahie	@envir	olabse	rvices.com.au		
Address:				Date r	esults	require	ed:					Conta	ict: Aile	een Hie				
			· ·				\					Envir	rolab S	ervice	s WA 1	:/a MPL		
				Or cho	ose: g	tandar	/1 / 1 c	lay / 2	2 day / :	3 day		16-18 Hayden Crt, Myaree WA 6154						
Phone:							nce if urg	ent turr	naround is	required - sur	charge applies	Phone: 08 9317 2505 Fax :08 9317 4163						
Fax:				Lab co	mmen	ts:						E-mail: lab@mpl.com.au Contact: Shuk Li						
Email:			<u> </u>	ļ								Conta	act: Shi	uk Li				
	Sample inform	nation		Tests Required								, , ,		1	· · ·	Comments		
Envirolab Sample ID	Client Sample ID or information	Date sampled	Type of sample	AUMINIUM	Fundance	CYANICE	РАН	TPH	PERIOR 8						Hou	Provide as much information about the sample as you can		
1	TP1:0.4-0.6	26/7/12	SOIL	<u>IX</u>	\geq	\geq	\geq	\times	\geq			1 1			\bot			
ン	TP1:1.0-1.2		<u> </u>	<u> </u>	<u> </u>		X	\geq	<u>ار</u> _ إ			1			24 1005	- 2//20		
7	TP2: 0.2-0.4			\cong	\geq	\times			$ \times $	<u>-</u>	<u> </u>				THE STATE OF THE S	76609		
Ψ	TPZ: 0.8-0.5	1 1		\vdash	-	~ /					 	+			$+\times$	(oce) red		
	7P3: 0.6-0.8			K	+	\Rightarrow	<u> </u>		$ \langle \rangle $			 				22/2/12		
6	M2 1.7-18	 		\leftarrow			<u> </u>		\Diamond			+			-	V7 17 10		
7	184:0.4-0.6	 		ļ×	 ×						 			<u> </u>	+			
8 9	174.1.7-1.8	 		 	1			~_	\forall	 	<u> </u>	++	-		1	10		
	TP5: 0-5-0.7 TPS:1-7-1.8	 	<u> </u>	\bowtie		l ⇔			Θ		 	+		-	 			
.0		<u> </u>		₽					\mathbf{K}	<u> </u>		+						
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	187:08-1.0	+		╫┈	 			 -		- 	+	1						
Relinquished by (company):				Received by (company): 24 \$						Sampl	es Recei	ved: Cool	or Amhi	ent (circle one)				
Print Name:				Print Name:						Samples Received: Cool or Ambient (circle one) Temperature Recieved at: (if applicable)								
Date & Time:				Date & Time: 31/7					Transported by: Hand delivered / courier									
Signature:			Signature:				7	•	-		Page No:							
	Form: 302 - Chain of Custody-Client, Issued 16/03/10, Version 4, Page																	

CHAIN OF CUSTODY - Client



ENVIROLAB GROUP

Client: Contact pers	ENVIRON on: KIRSTY GY	ZEENF	120	AS	1303	t Name 309	e / Nur	nber /	Site el	tc (le rep N R	oort title): OAD	Enviro 12 Ash Phone	iley St,	Chats	wood,	NSW 2067 Fax :02 9910 6201
Project Mgr:				PO No			*****					- 4				
Sampler:	V W.				lab Qu							-4		_		rvices.com.au
Address:				Date r	esults	require	ea:						t: Aile			
																t/a MPL
									2 day /			l l	16-18 Hayden Crt, Myaree WA 6154 Phone: 08 9317 2505 Fax :08 9317 416 E-mail: lab@mpl.com.au			
Phone:							nce if urg	ent lun	naround k	s required -	- surcharge applies	_				rax :08 9317 4163
Fax:				Lab ∝	men	ts:						1				
Email:												Contac	ct: Shu	k Li		
	Sample inforn	nation	and the State							Tests	Required	Comments				Comments
Envirolab Sample ID	Client Sample ID or information	Date sampled	Type of sample	ALUMINIUM	Amorabe	CYANIDE	рын	TPH	HEAVE METALS 8						Hous	Provide as much information about the sample as you can
14	TP8:0.4-0.6	26/7/12	5016	1											\times	
75	TP9: 0.2-0.4	1		X	$\overline{\mathbb{X}}$	\times			\times							
16	TP4: 1-0-1-2			T											\searrow	
17	700:0.2-0.4			\supset	\mathbf{X}	X		[·	\bowtie							
(8	1910:15-16			1											$\perp \!$	
18	TP1: 08-10			$\mathbf{I} \times$		$\overline{}$	1X	\mathbf{X}	$\overline{\mathbf{X}}$	T -						
70	Dell: 1-7-1-18			攵	1	X	X	\boxtimes	IX					i		
21	TP12:0.4-0.6			ts					X						1 .	*
22	1217:1-4-1-5			1	1	T]							1	\sim	
$\frac{\nu}{\nu^3}$	1913:0.4-0.6			$1 \times$	$1 \times$	マ	$1 \times$	$1 \times$	$1 \times$	1 1						
24	1913:1-4-1-6			$f \propto$		Ĭ		$1 \leq$	<i>1</i>							
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76		 	+ 4	╁╱	 			†	1 3						X	
	d by (company):	1. 7		Rece	ived by	(com	nany):	1-10	7 /			Sample	s Receiv	ed: Coo	l or Amb	ient (circle one)
Print Name				1	Name:		1/	35				7	rature Ro			(if applicable)
Date & Time					& Time		31	12				Transp	orted by:	: Hand	delivere	d / courier
Signature:	77.5		-		ature:			,					·			Page No:
Form	: 302 - Chain of Custody-Client	t, Issued 16/03	3/10, Version 4, Page			-					*					

CHAIN OF CUSTODY - Client



ENVIROLAB GROUP

Client: Contact pers Project Mgr: Sampler: Address: Phone: Fax: Email:			ELO	PO No. Enviro Date r	:: lab Qu esults	ote No require	.: ed:	D)(_)	Site et	3 day	d - surch	arge applies	Phone E-ma Contain Envi	shley S e: 02 9 iil: ahid act: Ail rolab 9 8 Hayd e: 08 9	910 62 e@envir een Hie Service len Crt, 9317 25 @mpl.c	swood, 1 00 rolabsei s WA t Myaree	NSW 2067 Fax :02 9910 6201 rvices.com.au /a MPL WA 6154 Fax :08 9317 4163
	Sample inform	nation							,	Test	s Requ	ired			·		Comments
Envirolab Sample ID	Client Sample ID or information	Date sampled	Type of sample	ALLIMINICIA	fundance	CYANIDE	Pari	JPH.	FORMS 8							OnoH	Provide as much information about the sample as you can
2.7	795:0.6-08	26/7/12	SOLL	\mathbb{X}	\times	X			X							M	
28	TP16:04-0.6	1	1	\mathbb{X}	\geq		\geq	\times	$ \times $								
29	1916:1.5-1.6			1			<u> </u>								<u>. </u>	\rightarrow	
30	DUPA						ļ <u> </u>						_			- 24	
31	DUP B			\bowtie	${race}$	↓≥ <	1	ļ	إججإ								De languaged for
32	DUP B1			$1 \times$	\bowtie	\geq	ļ		X								PIS forward to
33	DUP C			\times	$ \times $	$1\times$	1,X	\searrow				 		 		MC	1100
34	DUP D				Ĺ	<u>Ľ</u>	<u> </u>	<u> </u>				ļ					
35	pup D1	3	7	<u> </u>	<u> </u>	 		<u> </u>			<u> </u>						
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				1	<u> </u>	<u> </u>	ļ	 			<u> </u>						
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				1				<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	_	<u> </u>			
Relinguishe	d by (company):			Rece	ved by	y (com			<u> </u>	.			Samp	les Rece	eived: Coo	of Amb	lent (circle one)
Print Name				Print	Name	:		<u>55</u>					Temperature Recieved at: (if applicable)				
Date & Tim	e:			Date	& Tim	e:	3	17					Transported by: Hand delivered / courier				
Signature:					ture:		4	<u> </u>					L				Page No:
Form	: 302 - Chain of Custody-Clien	, Issued 16/03	1/10, Version 4, Page	1 of 1.													



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

NATA accreditation number 2901. This document shall not be reproduced except in full.

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

Results Approved By:

Rhian Morgan

Reporting Supervisor Inorganics Supervisor

Client Reference: AS130309C Dickson Rd

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
vTRHC6 - C9	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
vTRHC6 - C9	mg/kg	<25	<25	<25	<25	<25
Surrogate aaa-Trifluorotoluene	%	86	94	104	84	93

Client Reference: AS130309C Dickson Rd

sTRHin 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
TRHC10 - C14	mg/kg	7,300	<50	<50	<50	<50
TRHC 15 - C28	mg/kg	19,000	<100	240	<100	140
TRHC29 - C36	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
TRHC10 - C14	mg/kg	<50	<50	<50	<50	<50
TRHC 15 - C28	mg/kg	<100	<100	<100	450	100
TRHC29 - C36	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	76609-1
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	26/07/20
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/201
Date analysed	-	01/08/2012	01/08/2012	01/08/2012	01/08/2012	01/08/201
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

Client Reference: AS130309C Dickson Rd

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
	<u> </u>	T	T		T	T
Acid Extractable metals in soil	LINITO	70000 0	70000 46	70000 47	70000 45	70000 47
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 Sampled Type of sample		26/07/2012 Soil	26/07/2012 Soil	26/07/2012 Soil	26/07/2012 Soil	26/07/2012 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-	TP16-
		Triplicate	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
Missallanasus lasur sail						
Miscellaneous Inorg - soil Our Reference:	UNITS	76609-9	76609-10	76609-11	76609-15	76609-17
Your Reference	UNITO	76609-9 TP5	76609-10 TP5	76609-11 TP6	76609-15 TP9	76609-17 TP10
Depth		0.5-0.7	1.7-1.8	0.4-0.6	0.2-0.4	0.2-0.4
Depth Date Sampled		26/07/2012	26/07/2012	26/07/2012	26/07/2012	0.2-0.4 26/07/2012
Type of sample		26/07/2012 Soil	Soil	26/07/2012 Soil	26/07/2012 Soil	26/07/2012 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
	mg/kg	2,100	58	33,000	780	1,600
Total Fluoride	mg/kg	2,100	30	33,000	700	1,000

Moisture Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS	76609-1 TP1 0.4-0.6 26/07/2012 Soil	76609-2 TP1 1.0-1.2 26/07/2012 Soil	76609-3 TP2 0.2-0.4 26/07/2012 Soil	76609-5 TP3 0.6-0.8 26/07/2012 Soil	76609-6 TP3 1.7-1.8 26/07/2012 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
Worstone	70	5.7	11	10	17	10
Moisture Our Reference: Your Reference	UNITS	76609-7 TP4	76609-9 TP5	76609-10 TP5	76609-11 TP6	76609-15 TP9
Depth		0.4-0.6	0.5-0.7	1.7-1.8	0.4-0.6	0.2-0.4
Date Sampled Type of sample		26/07/2012 Soil	26/07/2012 Soil	26/07/2012 Soil	26/07/2012 Soil	26/07/2012 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: Your Reference Depth Date Sampled Type of sample	UNITS	76609-17 TP10 0.2-0.4 26/07/2012 Soil	76609-19 TP11 0.8-1.0 26/07/2012 Soil	76609-20 TP11 1.7-1.8 26/07/2012 Soil	76609-21 TP12 0.4-0.6 26/07/2012 Soil	76609-23 TP13 0.4-0.6 26/07/2012 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
ivioistare	76	9.7	16	16	17	10
Moisture Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS	76609-24 TP13 1.4-1.6 26/07/2012 Soil	76609-25 TP14 0.0-0.2 26/07/2012 Soil	76609-27 TP15 0.6-0.8 26/07/2012 Soil	76609-28 TP16 0.4-0.6 26/07/2012 Soil	76609-31 DUPB - 26/07/2012 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
			_	L		
Moisture Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS	76609-33 DUPC - 26/07/2012 Soil				
Date prepared	-	01/08/12	1			
Date analysed	-	02/08/12				
Moisture	%	18				
· · · · ·	1	· -	1			

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.

AS130309C Dickson Rd **Client Reference:** QUALITYCONTROL UNITS PQL **METHOD** Blank Duplicate **Duplicate results** Spike Sm# Spike % Sm# Recovery TRH in Soil (C6-C9) Base II Duplicate II % RPD Date extracted 01/08/2 76609-1 01/08/2012 | 01/08/2012 LCS-2 01/08/2012 012 01/08/2 01/08/2012 || 01/08/2012 Date analysed 76609-1 LCS-2 01/08/2012 012 vTRHC6 - C9 25 Org-016 <25 76609-1 <25||<25 LCS-2 121% mg/kg 76609-1 % Org-016 103 93 || 93 || RPD: 0 LCS-2 114% Surrogate aaa-Trifluorotoluene QUALITYCONTROL PQL Blank UNITS **METHOD** Duplicate Spike % **Duplicate results** Spike Sm# Sm# Recovery sTRH in Soil (C10-C36) Base II Duplicate II % RPD Date extracted 01/08/2 76609-1 01/08/2012 | 01/08/2012 LCS-2 01/08/2012 012 01/08/2 76609-1 01/08/2012 | 01/08/2012 LCS-2 01/08/2012 Date analysed 012 TRHC₁₀ - C₁₄ 50 Org-003 <50 76609-1 7300 | 15000 | RPD: 69 LCS-2 98% mg/kg Org-003 19000 | 37000 | RPD: 64 LCS-2 TRHC₁₅ - C₂₈ mg/kg 100 <100 76609-1 102% 5300 | 12000 | RPD: 77 LCS-2 TRHC29 - C36 mg/kg 100 Org-003 <100 76609-1 84% 76609-1 LCS-2 Surrogate o-Terphenyl % Org-003 82 # || # 95% QUALITYCONTROL UNITS Blank PQL METHOD Duplicate Spike Sm# Spike % **Duplicate results** Recovery PAHs in Soil Base II Duplicate II % RPD Date extracted 01/08/2 76609-1 01/08/2012 | 01/08/2012 LCS-2 01/08/2012 012 01/08/2 76609-1 01/08/2012 | 01/08/2012 LCS-2 01/08/2012 Date analysed 012 Org-012 2200 | 3900 | RPD: 56 LCS-2 97% Naphthalene mg/kg 0.1 <0.1 76609-1 subset Org-012 76609-1 360 | 750 | RPD: 70 Acenaphthylene mg/kg 0.1 <0.1 [NR] [NR] subset Org-012 76609-1 84 || 190 || RPD: 77 [NR] Acenaphthene 0.1 < 0.1 [NR] mg/kg subset Org-012 Fluorene mg/kg 0.1 <0.1 76609-1 580 | 1200 | RPD: 70 LCS-2 98% subset Org-012 1800 | 3300 | RPD: 59 Phenanthrene mg/kg 0.1 <0.1 76609-1 LCS-2 110% subset Anthracene Org-012 76609-1 490 || 1000 || RPD: 68 [NR] [NR] mg/kg 0.1 < 0.1 subset Org-012 Fluoranthene mg/kg 0.1 <0.1 76609-1 1300 | 2400 | RPD: 59 LCS-2 113% subset Org-012 Pyrene 0.1 <0.1 76609-1 1000 | 1900 | RPD: 62 LCS-2 119% mg/kg subset Org-012 76609-1 450 || 950 || RPD: 71 Benzo(a)anthracene <0.1 [NR] [NR] mg/kg 0.1

subset

Org-012

subset

Org-012

subset

Org-012

subset

Org-012

subset

<0.1

<0.2

< 0.05

<0.1

76609-1

76609-1

76609-1

76609-1

360||750||RPD:70

560 || 1300 || RPD: 80

350 | 790 | RPD: 77

180 | 410 | RPD: 78

Envirolab Reference: 76609 Revision No: R 00

mg/kg

mg/kg

mg/kg

mg/kg

0.2

0.05

0.1

Chrysene

Benzo(b+k)fluoranthene

Benzo(a)pyrene

Indeno(1,2,3-c,d)pyrene

102%

[NR]

96%

[NR]

LCS-2

[NR]

LCS-2

[NR]

Client Reference: AS130309C Dickson Rd								
QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	76609-1	36 85 RPD: 81	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	subset 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%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Acid Extractable metals in soil						Base II Duplicate II %RPD		,
Date digested	-			01/08/2 012	76609-1	01/08/2012 01/08/2012	LCS-1	01/08/2012
Date analysed	-			01/08/2 012	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%

Client Reference: AS130309C Dickson Rd QUALITYCONTROL UNITS PQL METHOD Spike % Blank Duplicate **Duplicate results** Spike Sm# Sm# Recovery Miscellaneous Inorg - soil Base II Duplicate II % RPD 31/07/2 Date prepared [NT] [NT] LCS-1 31/07/2012 012 Date analysed 31/07/2 LCS-1 31/07/2012 [NT] [NT] 012 NEPM-404 Total Fluoride [NT] [NT] LCS-1 105% mg/kg 50 <50 Total Cyanide 0.5 Inorg-013 <0.5 [NT] [NT] LCS-1 117% mg/kg QUALITYCONTROL UNITS PQL METHOD Blank Moisture Date prepared [NT] Date analysed [NT] Moisture 0.1 Inorg-008 [NT] % QUALITYCONTROL UNITS Dup. Sm# Spike % Recovery Duplicate Spike Sm# TRH in Soil (C6-C9) Base + Duplicate + %RPD 01/08/2012 || 01/08/2012 Date extracted 76609-28 76609-2 01/08/2012 01/08/2012 || 01/08/2012 Date analysed 76609-28 76609-2 01/08/2012 vTRHC6 - C9 76609-28 <25||<25 76609-2 101% mg/kg 84||94||RPD:11 108% % 76609-28 76609-2 Surrogate aaa-Trifluorotoluene QUALITYCONTROL UNITS Spike % Recovery Dup. Sm# Duplicate Spike Sm# sTRH in Soil (C10-C36) Base + Duplicate + %RPD Date extracted 76609-28 01/08/2012 | 01/08/2012 01/08/2012 76609-2

Date extracted	-	76609-26	01/06/2012 01/06/2012	76609-2	01/06/2012
Date analysed	-	76609-28	01/08/2012 01/08/2012	76609-2	01/08/2012
TRHC10 - C14	mg/kg	76609-28	<50 <50	76609-2	96%
TRHC 15 - C28	mg/kg	76609-28	450 390 RPD:14	76609-2	107%
TRHC29 - C36	mg/kg	76609-28	610 680 RPD:11	76609-2	94%
Surrogate o-Terphenyl	%	76609-28	82 81 RPD:1	76609-2	102%
QUALITYCONTROL	UNITS	Dup.Sm#	Duplicate	Spike Sm#	Spike % Recovery
PAHs in Soil			Base + Duplicate + %RPD		
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]

		Client Referenc	e: AS130309C Dicks	on Rd	
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-	%	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%
QUALITYCONTROL 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	#

QUALITYCONTROL Miscellaneous Inorg - soil	UNITS	Dup.Sm#	Duplicate Base + Duplicate + %RPD
- Wilscellaneous morg - soil			Base + Duplicate + %KFD
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
QUALITYCONTROL	UNITS	Dup. Sm#	Duplicate
Miscellaneous Inorg - soil			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:

Asbestos ID was authorised by Approved Signatory:

Not applicable for this job

Not applicable for this job

INS: Insufficient sample for this test PQL: Practical Quantitation Limit NT: Not tested

NA: Test not required RPD: Relative Percent Difference NA: Test not required

<: Less than >: Greater than LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike: A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample): This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in 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.

Envirolab Reference: 76609 Page 16 of 16

Revision No: R 00

Aileen Hie

From: Sent: Kirsty Greenfield [kgreenfield@environcorp.com] Friday, 10 August 2012 11:38 AM Aileen Hie

Subject: ö Request for TCLP analysis for Batch 76609

Hi Aileen,

I'd like to arrange for TCLP analysis for Batch 76609 for the following samples:

TP1: 0.4-0.6 - BaP and Fluoride

TP1: 1.0-1.2 - BaP

TP4: 0.4-0.6 - Fluoride

R TP5: 0.5-0.7 - BaP, Fluoride

TP11: 0.8-1.0 - BaP, Fluoride

TP16: 0.4-0.6 - BaP, Fluoride

Thanks,

ENVIRON

kgreenfield@environcorp.com Eastpoint Complex | Suite 19B, Level 2 50 Glebe Road | The Junction, NSW 2291 Kirsty Greenfield | Environmental Consultant ENVIRON Australia Pty Ltd T: 02 4962 5444| F: 02 4962 5888 | M: 0407 149 176

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ENVINO Dre: 17/8/12 ALT PAS



Envirolab Services Pty Ltd
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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:

No. of samples:

Date samples received / completed instructions received

AS130309C Dickson Rd
Additional Testing on 6 Soils

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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Results Approved By:

Nick Sarlamis
Inorganics Supervisor



PAHs in TCLP (USEPA 1311)						
Our Reference:	UNITS	76609-A-1	76609-A-2	76609-A-7	76609-A-9	76609-A-19
Your Reference		TP1	TP1	TP4	TP5	TP11
Depth		0.4-0.6	1.0-1.2	0.4-0.6	0.5-0.7	0.8-1.0
Date Sampled Type of sample		26/07/2012 Soil	26/07/2012 Soil	26/07/2012 Soil	26/07/2012 Soil	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

	Ī	Γ
PAHs in TCLP (USEPA 1311)		
Our Reference:	UNITS	76609-A-28
Your Reference		TP16
Depth		0.4-0.6
Date Sampled Type of sample		26/07/2012 Soil
Туре от заттре		3011
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
FluoreneinTCLP	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.

Client Reference: AS130309C Dickson Rd												
QUALITY CONTROL PAHs in TCLP (USEPA	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery				
1311)						Base ii Bapiloate ii 701(1 B						
Date extracted	-			13/08/2 012	[NT]	[NT]	LCS-W1	13/08/2012				
Date analysed	-			14/08/2 012	[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	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery			
Miscellaneous Inorganics						Base II Duplicate II %RPD					
Date prepared	-			15/08/2 012	[NT]	[NT]	LCS-W1	15/08/2012			
Date analysed	-			15/08/2 012	[NT]	[NT]	LCS-W1	15/08/2012			
Fluoride, Fin TCLP	mg/L	0.1	Inorg-026	<0.1	[NT]	[NT]	LCS-W1	90%			

Report Comments:

Asbestos ID was analysed by Approved Identifier:

Asbestos ID was authorised by Approved Signatory:

Not applicable for this job

Not applicable for this job

INS: Insufficient sample for this test PQL: Practical Quantitation Limit NT: Not tested

NA: Test not required RPD: Relative Percent Difference NA: Test not required

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.

Envirolab Reference: 76609-A Page 8 of 8

Revision No: R 00

CHAIN OF CUSTODY - Client



ENVIROLAB GROUP

Client: EN	VIRON AUSTRAHA	Pty/to		Client	Projec	t Name	e / Nur	nber /	Site et	tc (ie rep	ort title	e):	Envirolab Services 12 Ashley St, Chatswood, NSW 2067			· · ·				
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Project Mgr:				PO No								·	4			6200			2 9910 6	201
Sampler:	Steve Cadm	an				ote No						 	4		_		abser	vices.	com.au	
Address:	LVI Z, Suite 19B		<u>.</u>	Date r	esults	require	ed:							act: A						
	50 Giebe Rd		x 435)															/a MP		
1	The Junction NSW	2291	•	Or cho										-		_	_	WA 61		4.60
Phone:	4962 5444						nce if urg	ent turn	around is	is required	- surcharg	e applies	4	Phone: 08 9317 2505 Fax :08 9317 4163 E-mail: lab@mpl.com.au				163		
Fax:	4962 5888 /			Lab co	mmen	ıts:									_	•	ı.au			
Email:	karcenfield Gen	viloncal	p-fom	3									Contact: Shuk Li							
	Sample inform			Ŕ						Tests	Require	d							Comments	1
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6	Midstream - 24/8/12	750	15		X	X	X	X	X		X								t ₎	Ď
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Form	: 302 - Chain of Custody-Client	, Issued 16/03	3/10, Version 4, Page	1 of 1.																

Geoff Weir

From: Sent:

Aileen Hie Thursday, 30 August 2012 10:55 AM Simon Song; Geoff Weir FW: Water samples arriving today

Subject:

Regards,

Aileen Hie | Customer Service Coordinator | Envirolab Services

Great Chemistry. Great Service

12 Ashley St Chatswood NSW 2067

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 bottles). DR1 to DR3. Also, our job reference number is AS130309C (which is on the COC) not AS130314 (which is on the

Thanks,



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

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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

78151

CERTIFICATE OF ANALYSIS

Client:

Environ

PO Box 560 North Sydney NSW 2060

Attention: Kirsty Greenfield, Steve Cadman

Sample log in details:

AS130309C, Dickson Rd Your Reference:

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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Results Approved By:

Nancy Zhang

Chemist

Reporting Supervisor

Inorganics Supervisor



	1	T	T	T		1
PAHs in Water						
Our Reference:	UNITS	78151-1	78151-2	78151-3	78151-4	78151-5
Your Reference		DR1	DR2	DR3	QC01	UPSTREAM
Date Sampled		28/08/2012	28/08/2012	28/08/2012	28/08/2012	29/08/2012
Type of sample		Water	Water	Water	Water	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-d14	%	80	79	69	83	91

PAHs in Water			
Our Reference:	UNITS	78151-6	78151-7
Your Reference		MIDSTREAM	DOWNSTREA
Data Caranta d		00/00/0040	M
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
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-d14	%	84	90

0.4001			I			
SVOC's in water Our Reference:	UNITS	78151-1	78151-2	78151-3	78151-4	78151-5
Your Reference		DR1	78131-2 DR2	DR3	QC01	UPSTREAM
Date Sampled		28/08/2012	28/08/2012	28/08/2012	28/08/2012	29/08/2012
Type of sample		Water	Water	Water	Water	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			T		T	
Our Reference:	UNITS	78151-1	78151-2	78151-3	78151-4	78151-5
Your Reference		DR1	DR2	DR3	QC01	UPSTREAM
Date Sampled		28/08/2012	28/08/2012	28/08/2012	28/08/2012	29/08/2012
Type of sample		Water	Water	Water	Water	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:	UNITS	78151-1	78151-2	78151-3	78151-4	78151-5
Your Reference		DR1	DR2	DR3	QC01	UPSTREAM
Date Sampled		28/08/2012	28/08/2012	28/08/2012	28/08/2012	29/08/2012
Type of sample		Water	Water	Water	Water	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-de	%	48	43	31	42	46
Surrogate Nitrobenzene-ds	%	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

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SVOC's in water Our Reference:	UNITS	70151 6	70454 7
Your Reference	UNITS	78151-6 MIDSTREAM	78151-7 DOWNSTREA
Tour residions		IVIIDOTT CONTROL	M
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

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SVOC's in water Our Reference:	UNITS	78151-6	78151-7
Your Reference	ONITS	MIDSTREAM	DOWNSTREA
Tour resonance		WILD GITTED TO	M
Date Sampled		29/08/2012	29/08/2012
Type of sample		Water	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:	UNITS	78151-6	78151-7
Your Reference		MIDSTREAM	DOWNSTREA
Data Carania d		29/08/2012	M 29/08/2012
Date Sampled Type of sample		29/06/2012 Water	29/06/2012 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-de	%	47	48
Surrogate Nitrobenzene-ds	%	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:	UNITS	78151-1	78151-2	78151-3	78151-4
Your Reference		DR1	DR2	DR3	QC01
Date Sampled		28/08/2012	28/08/2012	28/08/2012	28/08/2012
Type of sample		Water	Water	Water	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:	UNITS	78151-1	78151-2	78151-3	78151-4	78151-5
Your Reference		DR1	DR2	DR3	QC01	UPSTREAM
Date Sampled		28/08/2012	28/08/2012	28/08/2012	28/08/2012	29/08/2012
Type of sample		Water	Water	Water	Water	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
рН	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:	UNITS	78151-6	78151-7
Your Reference		MIDSTREAM	DOWNSTREA
			M
Date Sampled		29/08/2012	29/08/2012
Type of sample		Water	Water
Date prepared	-	30/08/2012	30/08/2012
Date analysed	-	30/08/2012	30/08/2012
рН	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:	UNITS	78151-5	78151-6	78151-7
Your Reference		UPSTREAM	MIDSTREAM	DOWNSTREA
				М
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	UNITS	78151-1 DR1 28/08/2012 Water	78151-2 DR2 28/08/2012 Water	78151-3 DR3 28/08/2012
Type of sample				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 CaCO3	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.

Client Reference: AS130309C, Dickson Rd									
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery	
PAHs in Water						Base II Duplicate II % RPD			
Date extracted	-			04/09/2 012	[NT]	[NT]	LCS-W1	04/09/2012	
Date analysed	-			05/09/2 012	[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-	%		Org-012 subset	84	[NT]	[NT]	LCS-W1	105%	

Client Reference: AS130309C, Dickson Rd PQL QUALITYCONTROL UNITS METHOD Blank Duplicate **Duplicate results** Spike Sm# Spike % Sm# Recovery Base || Duplicate || %RPD SVOC's in water Date extracted 04/09/2 [NT] LCS-W1 04/09/2012 [NT] 012 05/09/2 LCS-W1 05/09/2012 Date analysed [NT] [NT] 012 43% Phenol μg/L 10 Org-012 <10 [NT] [NT] LCS-W1 Org-012 [NR] Bis (2-chloroethyl) ether 10 <10 [NT] [NT] [NR] μg/L Org-012 [NT] LCS-W1 97% 2-Chlorophenol μg/L 10 <10 [NT] Org-012 1,3-Dichlorobenzene μg/L 10 <10 [NT] [NT] [NR] [NR] 1,4-Dichlorobenzene 10 Org-012 <10 [NT] [NT] LCS-W1 103% μg/L Org-012 [NR] [NR] 2-Methylphenol μg/L 10 <10 [NT] [NT] Org-012 1,2-Dichlorobenzene μg/L 10 <10 [NT] [NT] [NR] [NR] bis-(2-Chloroisopropyl) μg/L 10 Org-012 <10 [NT] [NT] [NR] [NR] ether 3/4-Methylphenol 20 Org-012 <20 [NT] [NT] [NR] [NR] μg/L N-nitrosodi-n-10 Org-012 <10 [NT] [NT] [NR] [NR] μg/L propylamine Hexachloroethane 10 Org-012 <10 [NT] [NT] [NR] [NR] μg/L Org-012 Nitrobenzene 10 <10 [NT] [NT] [NR] [NR] μg/L Isophorone 10 Org-012 <10 [NT] [NT] [NR] [NR] μg/L 2,4-Dimethylphenol 10 Org-012 <10 [NT] [NT] [NR] [NR] μg/L Org-012 <10 [NT] [NR] [NR] 2-Nitrophenol μg/L 10 [NT] bis (2-Chloroethoxy) Org-012 [NT] [NT] [NR] [NR] μg/L 10 <10 methane [NR] 10 Org-012 [NT] [NT] [NR] 2,4-Dichlorophenol μg/L <10 1,2,4-Trichlorobenzene Org-012 [NR] μg/L 10 <10 [NT] [NT] [NR] Naphthalene 10 Org-012 [NT] [NT] [NR] [NR] μg/L <10 4-Chloroaniline μg/L Org-012 [NT] [NR] [NR] 10 <10 [NT] Org-012 [NR] Hexachlorobutadiene μg/L 10 <10 [NT] [NT] [NR] 2-Methylnaphthalene Org-012 [NT] [NT] [NR] [NR] μg/L 10 <10 Org-012 [NR] Hexachlorocyclopentadi 10 <10 [NT] [NT] [NR] μg/L ene 2,4,6-Trichlorophenol μg/L 10 Org-012 <10 [NT] [NT] [NR] [NR] 2,4,5-Trichlorophenol Org-012 [NR] μg/L 10 <10 [NT] [NT] [NR] Org-012 2-Chloronaphthalene 10 [NT] [NT] [NR] [NR] μg/L <10 Org-012 2-Nitroaniline μg/L 10 <10 [NT] [NT] [NR] [NR] Org-012 LCS-W1 Dimethyl phthalate μg/L 10 <10 [NT] [NT] 111% [NR] 2,6-Dinitrotoluene 10 Org-012 [NT] [NT] [NR] μg/L <10 Org-012 Acenaphthylene μg/L 10 <10 [NT] [NT] [NR] [NR] Org-012 3-Nitroaniline μg/L 10 <10 [NT] [NT] [NR] [NR] Acenaphthene 10 Org-012 [NT] LCS-W1 105% μg/L <10 [NT] 2,4-Dinitrophenol μg/L 100 Org-012 <100 [NT] [NT] [NR] [NR] Org-012 LCS-W1 4-Nitrophenol μg/L 100 <100 [NT] [NT] 53% 10 Org-012 [NR] [NR] Dibenzofuran μg/L <10 [NT] [NT] Diethylphthalate μg/L 10 Org-012 <10 [NT] [NT] LCS-W1 104% 10 Org-012 <10 [NT] [NT] [NR] [NR] μg/L

<10

Org-012

[NT]

[NT]

Envirolab Reference: 78151 Revision No: R 00

µg/L

10

Chlorophenylphenylether
4-Nitroaniline

[NR]

[NR]

Client Reference: AS130309C, Dickson Rd PQL QUALITYCONTROL UNITS METHOD Blank Duplicate **Duplicate results** Spike Sm# Spike % Sm# Recovery SVOC's in water Base || Duplicate || %RPD Org-012 Fluorene [NT] μg/L 10 <10 [NT] [NR] [NR] 100 [NR] 2-methyl-4,6μg/L Org-012 <100 [NT] [NT] [NR] dinitrophenol Org-012 Azobenzene μg/L 10 <10 [NT] [NT] [NR] [NR] μg/L Org-012 10 <10 [NT] [NT] [NR] [NR] Bromophenylphenylether [NR] Hexachlorobenzene μg/L 10 Org-012 <10 [NT] [NT] [NR] Org-012 Pentachlorophenol μg/L 100 <100 [NT] [NT] [NR] [NR] Phenanthrene 10 Org-012 <10 [NT] [NT] [NR] [NR] μg/L Org-012 [NR] Anthracene μg/L 10 <10 [NT] [NT] [NR] Org-012 Carbazole μg/L 10 <10 [NT] [NT] [NR] [NR] Di-n-butylphthalate μg/L 10 Org-012 <10 [NT] [NT] [NR] [NR] Org-012 [NR] Fluoranthene 10 <10 [NT] [NT] [NR] µg/L Pyrene 10 Org-012 <10 [NT] [NT] LCS-W1 100% μg/L Butylbenzylphthalate 10 Org-012 <10 [NT] [NT] [NR] [NR] μg/L Bis(2-ethylhexyl) 10 Org-012 <10 [NT] [NT] [NR] [NR] μg/L phthalate Benzo(a)anthracene 10 Org-012 <10 [NT] [NT] [NR] [NR] μg/L 10 Org-012 <10 [NT] [NT] [NR] [NR] Chrysene μg/L Di-n-octylphthalate Org-012 <10 [NT] [NT] [NR] [NR] μg/L 10 Benzo(b)fluoranthene μg/L 10 Org-012 <10 [NT] [NT] [NR] [NR] Benzo(k)fluoranthene 10 Org-012 [NT] [NT] [NR] [NR] μg/L <10 Org-012 [NR] [NR] Benzo(a)pyrene μg/L 10 <10 [NT] [NT] Indeno(1,2,3-c,d)pyrene 10 Org-012 [NT] [NT] [NR] [NR] μg/L <10 [NR] 10 Org-012 [NT] [NT] [NR] Dibenzo(a,h)anthracene <10 μg/L Org-012 [NR] Benzo(g,h,i)perylene μg/L 10 <10 [NT] [NT] [NR] Ethylmethanesulfonate Org-012 [NT] [NR] μg/L 10 <10 [NT] [NR] Aniline Org-012 [NR] 10 <10 [NT] [NT] [NR] μg/L Pentachloroethane μg/L 10 Org-012 <10 [NT] [NT] [NR] [NR] Benzyl alcohol Org-012 μg/L 10 <10 [NT] [NT] [NR] [NR] Org-012 Acetophenone 10 <10 [NT] [NT] [NR] [NR] μg/L Org-012 N-nitrosomorpholine μg/L 10 <10 [NT] [NT] [NR] [NR] Org-012 N-nitrosopiperidine μg/L 10 <10 [NT] [NT] [NR] [NR] 2,6-Dichlorophenol [NR] 10 Org-012 [NT] [NT] [NR] μg/L <10 Org-012 Hexachloropropene-1 µg/L 10 <10 [NT] [NT] [NR] [NR] N-nitroso-n-butylamine Org-012 μg/L 10 <10 [NT] [NT] [NR] [NR] Safrole 10 Org-012 [NT] [NT] [NR] [NR] μg/L <10 Org-012 1,2,4,5µg/L 10 <10 [NT] [NT] [NR] [NR] Tetrachlorobenzene μg/L Trans-iso-safrole 10 Org-012 <10 [NT] [NT] [NR] [NR] 1,3-Dinitrobenzene Org-012 [NT] [NT] [NR] [NR] μg/L 10 <10 Pentachlorobenzene μg/L 10 Org-012 <10 [NT] [NT] [NR] [NR] Org-012 1-Naphthylamine μg/L 10 <10 [NT] [NT] [NR] [NR] 2,3,4,6-Org-012 [NR] [NR] µg/L 10 <10 [NT] [NT] Tetrachlorophenol 2-Naphthylamine μg/L 10 Org-012 <10 [NT] [NT] [NR] [NR]

Envirolab Reference: 78151 Revision No: R 00

μg/L

10

Org-012

<10

[NT]

[NT]

5-Nitro-o-toluidine

[NR]

[NR]

			nt Referenc	e: A	S130309C, D	ickson Rd	_	
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
SVOC's in water						Base II Duplicate II % RPD		
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- Dimethylaminoazobenze ne	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-de	%		Org-012	43	[NT]	[NT]	LCS-W1	50%
Surrogate Nitrobenzene-ds	%		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%

Envirolab Reference: 78151 Revision No: R 00

Client Reference: AS130309C, Dickson Rd

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UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
					Base II Duplicate II %RPD		
-			31/08/2 012	[NT]	[NT]	LCS-W1	31/08/2012
-			03/09/2 012	[NT]	[NT]	LCS-W1	03/09/2012
μg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	107%
μg/L	0.1	Metals-022 ICP-MS	<0.1	[NT]	[NT]	LCS-W1	109%
μg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	105%
μg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	108%
μg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	104%
μg/L	0.05	Metals-021 CV-AAS	<0.050	[NT]	[NT]	LCS-W1	100%
μg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	108%
μg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	108%
UNITS	PQL	METHOD	Blank	Duplicate	Duplicate results	Spike Sm#	Spike % Recovery
				GHIII	Base II Duplicate II %RPD		recovery
-			[NT]	78151-1	30/08/2012 30/08/2012	LCS-W1	30/08/2012
-			[NT]	78151-1	30/08/2012 30/08/2012	LCS-W1	30/08/2012
pH Units		Inorg-001	[NT]	78151-1	5.1 [N/T]	LCS-W1	101%
μS/cm	1	Inorg-002	<1	78151-1	2000 [N/T]	LCS-W1	104%
· ·	0.004	_	<0.004	78151-1		LCS-W1	106%
-		_	<0.1				91%
		.					Spike %
				Sm#		'	Recovery
					Base II Duplicate II %RPD		
-			31/08/2 012	78151-5	31/08/2012 31/08/2012	LCS-W1	31/08/2012
-			03/09/2 012	78151-5	03/09/2012 03/09/2012	LCS-W1	03/09/2012
μg/L	1	Metals-022 ICP-MS	<1	78151-5	3 3 RPD:0	LCS-W1	104%
μg/L	0.1	Metals-022 ICP-MS	<0.1	78151-5	<0.1 <0.1	LCS-W1	107%
μg/L	1	Metals-022 ICP-MS	<1	78151-5	2 2 RPD:0	LCS-W1	101%
μg/L	1	Metals-022 ICP-MS	<1	78151-5	3 3 RPD:0	LCS-W1	98%
μg/L	1	Metals-022 ICP-MS	<1	78151-5	4 4 RPD:0	LCS-W1	106%
μg/L	0.05	Metals-021 CV-AAS	<0.05	78151-5	<0.05 [N/T]	LCS-W1	104%
μg/L	1	Metals-022 ICP-MS	<1	78151-5	19 19 RPD:0	LCS-W1	98%
	- - - - - - - - - - - - -	UNITS PQL -	UNITS PQL METHOD -	UNITS POL METHOD Blank -	UNITS POL METHOD Blank Duplicate Sm# - 31/08/2 [NT] - 03/09/2 [NT] - 012 - 03/09/2 [NT] - 012 - 011 - [NT] - [NT] - [NT] - [NT] - 0.05 Metals-022 - 0.1 [NT] -	UNITS	UNITS PQL METHOD Blank Duplicate Sni# Base II Duplicate II %RPD LCS-W1

Envirolab Reference: 78151 Revision No: R 00

Client Reference: AS130309C, Dickson Rd PQL QUALITYCONTROL UNITS METHOD Blank Duplicate **Duplicate results** Spike Sm# Spike % Sm# Recovery Base II Duplicate II % RPD HM in water - total Zinc-Total Metals-022 78151-5 74 || 95 || RPD: 25 LCS-W1 103% μg/L <1 ICP-MS QUALITYCONTROL UNITS PQL METHOD Blank **Duplicate Duplicate results** Spike Sm# Spike % Sm# Recovery Ion Balance Base II Duplicate II %RPD 30/08/2012 | 30/08/2012 LCS-W1 Date prepared [NT] 78151-1 30/08/2012 Date analysed [NT] 78151-1 30/08/2012 | 30/08/2012 LCS-W1 30/08/2012 Calcium - Dissolved mg/L Metals-020 78151-1 LCS-W1 97% 0.5 < 0.5 5.6 || [N/T] ICP-AES Potassium - Dissolved Metals-020 LCS-W1 mg/L 0.5 < 0.5 78151-1 7.5 || [N/T] 102% **ICP-AES** Sodium - Dissolved Metals-020 78151-1 310 || [N/T] LCS-W1 105% mg/L 0.5 < 0.5 **ICP-AES** Metals-020 LCS-W1 Magnesium - Dissolved mg/L 0.5 < 0.5 78151-1 34 || [N/T] 93% **ICP-AES** Hydroxide Alkalinity Inorg-006 mg/L 5 <5 78151-1 <5 || [N/T] [NR] [NR] (OH⁻) as CaCO₃ Bicarbonate Alkalinity as mg/L 5 Inorg-006 <5 78151-1 8 || [N/T] [NR] [NR] CaCO₃ Carbonate Alkalinity as Inorg-006 78151-1 [NR] [NR] mg/L 5 <5 <5 || [N/T] CaCO₃ Total Alkalinity as mg/L 5 Inorg-006 <5 78151-1 8 || [N/T] LCS-W1 105% CaCO₃ LCS-W1 103% Sulphate, SO4 mg/L 1 Inorg-081 <1 78151-1 120 || 120 || RPD: 0 530||520||RPD:2 LCS-W1 Chloride, Cl Inorg-081 78151-1 95% mg/L 1 <1 Ionic Balance Inorg-041 [NT] 78151-1 -2.5 || [N/T] [NR] [NR] QUALITYCONTROL **UNITS** Dup. Sm# Duplicate Spike Sm# Spike % Recovery Miscellaneous Inorganics Base + Duplicate + %RPD Date prepared [NT] [NT] 78151-2 30/08/2012 [NT] [NT] 78151-2 30/08/2012 Date analysed рΗ pH Units [NT] [NT] [NR] [NR] **Electrical Conductivity** µS/cm [NT] [NT] [NR] [NR] Total Cyanide [NT] [NT] 78151-2 102% mg/L Fluoride, F mg/L [NT] [NT] 78151-2 91% QUALITYCONTROL **UNITS** Dup. Sm# **Duplicate** Spike Sm# Spike % Recovery HM in water - total Base + Duplicate + %RPD Date prepared [NT] [NT] 78151-6 31/08/2012 Date analysed [NT] [NT] 78151-6 03/09/2012 Arsenic-Total [NT] 78151-6 110% [NT] μg/L Cadmium-Total 78151-6 104% [NT] μg/L [NT] Chromium-Total μg/L [NT] [NT] 78151-6 98% Copper-Total [NT] [NT] 78151-6 90% μg/L Lead-Total [NT] [NT] 78151-6 96% µg/L Mercury-Total [NT] [NT] [NR] [NR] μg/L Nickel-Total 88% µg/L [NT] [NT] 78151-6

Envirolab Reference: 78151 Revision No: R 00

μg/L

[NT]

[NT]

78151-6

Zinc-Total

#

Client Reference: AS130309C, Dickson Rd

		Chefft Kelefelic	e. A01303030, Dicks	on ita	
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 CaCO3	mg/L	[NT]	[NT]	[NR]	[NR]
Carbonate Alkalinity as CaCO3	mg/L	[NT]	[NT]	[NR]	[NR]
Total Alkalinity as CaCO3	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]

Envirolab Reference: 78151 Revision No: R 00 Client Reference: AS130309C, Dickson Rd

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:

Asbestos ID was authorised by Approved Signatory:

Not applicable for this job

Not applicable for this job

INS: Insufficient sample for this test PQL: Practical Quantitation Limit NT: Not tested

NA: Test not required RPD: Relative Percent Difference NA: Test not required

<: Less than >: Greater than LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike: A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample): This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in 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.

Envirolab Reference: 78151
Revision No: R 00





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 Address : 277-289 Woodpark Road Smithfield NSW Australia 2164

MAITLAND NSW, AUSTRALIA 2320

Facsimile : +61 02 49344354 Felephone : +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 : ----

 C-O-C number
 : -- Date Samples Received
 : 01-AUG-2012

 Sampler
 : sue 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.

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.

Position	Accreditation Category
Senior Spectroscopist	Sydney Inorganics
Laboratory Supervisor	Newcastle
Senior Inorganic Chemist	Sydney Inorganics
	Laboratory Supervisor

Address 277-289 Woodpark Road Smithfield NSW Australia 2164 PHONE +61-2-8784 8555 Facsimile +61-2-8784 8500 Environmental Division Sydney ABN 84 009 936 029 Part of the ALS Group A Campbell Brothers Limited Company



Page : 2 of 3 Work Order : ES1218770

Client : ENVIRON AUSTRALIA PTY LTD
Project : AS130309C DICKSON ROAD



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.

Page : 3 of 3 Work Order : ES1218770

Client : ENVIRON AUSTRALIA PTY LTD
Project : AS130309C DICKSON ROAD



Analytical Results

Sub-Matrix: SOIL		Clie	ent sample ID	DUPB1	 	
	Cli	ent samplii	ng 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 Ana	lyser					
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** Page : 1 of 5

Client : ENVIRON AUSTRALIA PTY LTD Laboratory : Environmental Division Sydney

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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 : ----

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

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



NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out 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

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Page : 2 of 5 Work Order : ES1218770

Client : ENVIRON AUSTRALIA PTY LTD
Project : AS130309C DICKSON ROAD



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

Page : 3 of 5 Work Order : ES1218770

Client : ENVIRON AUSTRALIA PTY LTD
Project : AS130309C DICKSON ROAD



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 Co	ntent (QC Lot: 243295	1)							
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 Meta	Is 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 Reco	overable Mercury by FII	MS (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 Cyar	nide By Discrete Analys	er (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 To	otal (QC Lot: 2440049)								
ES1218770-001	DUPB1	EK040T: Fluoride	16984-48-8	40	mg/kg	640	660	2.9	0% - 50%

Page : 4 of 5 Work Order : ES1218770

Client : ENVIRON AUSTRALIA PTY LTD
Project : AS130309C DICKSON ROAD



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)	Laboratory Control Spike (LCS) Report					
				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: 2434	574)									
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	85.5				
EK026G: Total Cyanide By Discrete Analyser (QCLot: 2431)	293)									
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.

ub-Matrix: SOIL					Matrix Spike (MS) Report		
				Spike	Spike Recovery (%)	Recovery I	Limits (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
G005T: Total Metal	s by ICP-AES (QCLot: 2434573	3)					
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
	I	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	250 mg/kg 103 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
G035T: Total Reco	overable Mercury by FIMS (QCI	Lot: 2434574)					
ES1218353-004	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	71.9	70	130
EK026G: Total Cyan	ide By Discrete Analyser (QCL	_ot: 2431293)					

Page : 5 of 5 Work Order : ES1218770

Client : ENVIRON AUSTRALIA PTY LTD
Project : AS130309C DICKSON ROAD



Sub-Matrix: SOIL	Matrix: SOIL				Matrix Spike (MS) Report					
					Spike Recovery (%)	Recovery Li	imits (%)			
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High			
EK026G: Total Cyani	de By Discrete Analyser (QCLot: 2431293)	- continued								
ES1218326-001	Anonymous	EK026G: Total Cyanide	57-12-5	25 mg/kg	96.0	70	130			
EK040T: Fluoride To	tal (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 Spi	ke (MS) and Matrix Spi	ke Duplicate	(MSD) Repor	t	
				Spike	Spike Rec	overy (%)	Recovery	Limits (%)	RPD	9s (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EK026G: Total Cyanic	le By Discrete Analyser (QCLo	ot: 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 Recov	erable Mercury by FIMS (QCL	ot: 2434574)								
ES1218353-004	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	71.9		70	130		
EK040T: Fluoride Tota	al (QCLot: 2440049)									
ES1218770-001	DUPB1	EK040T: Fluoride	16984-48-8	400 mg/kg	108		70	130		





: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Environmental Division

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

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Project : AS130309C DICKSON ROAD QC Level

Site : ----

 C-O-C number
 : --- Date Samples Received
 : 01-AUG-2012

 Sampler
 : ssue 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

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Page : 2 of 5 Work Order : ES1218770

Client : ENVIRON AUSTRALIA PTY LTD
Project : AS130309C DICKSON ROAD



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.

Wath. Gol				Evaluation.	riolaning time	brodon, vitam	ii nolaling tilin
Method	Sample Date	Ex	traction / Preparation	Analysis			
Container / Client Sample ID(s)		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	1	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	1	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	1	03-AUG-2012	16-AUG-2012	✓
EK040T: Fluoride Total							
Pulp Bag (EK040T) DUPB1	26-JUL-2012	02-AUG-2012	02-AUG-2012	1	08-AUG-2012	02-AUG-2012	sc .

Page : 3 of 5 Work Order : ES1218770

Client : ENVIRON AUSTRALIA PTY LTD
Project : AS130309C DICKSON ROAD



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

Matrix: SOIL				Evaluation	i. A - Quality Col	illoi irequericy i	not within specification; \checkmark = Quality Control frequency within specification.
Quality Control Sample Type		Co	ount		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

Page : 4 of 5 Work Order : ES1218770

Client : ENVIRON AUSTRALIA PTY LTD
Project : AS130309C DICKSON ROAD



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)

Page : 5 of 5 Work Order : ES1218770

Client : ENVIRON AUSTRALIA PTY LTD
Project : AS130309C DICKSON ROAD



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	Ex	traction / Preparation			Analysis	
Container / Client Sample ID(s)	Date extracted	Due for extraction	Days	Date analysed	Due for analysis	Days
			overdue			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.

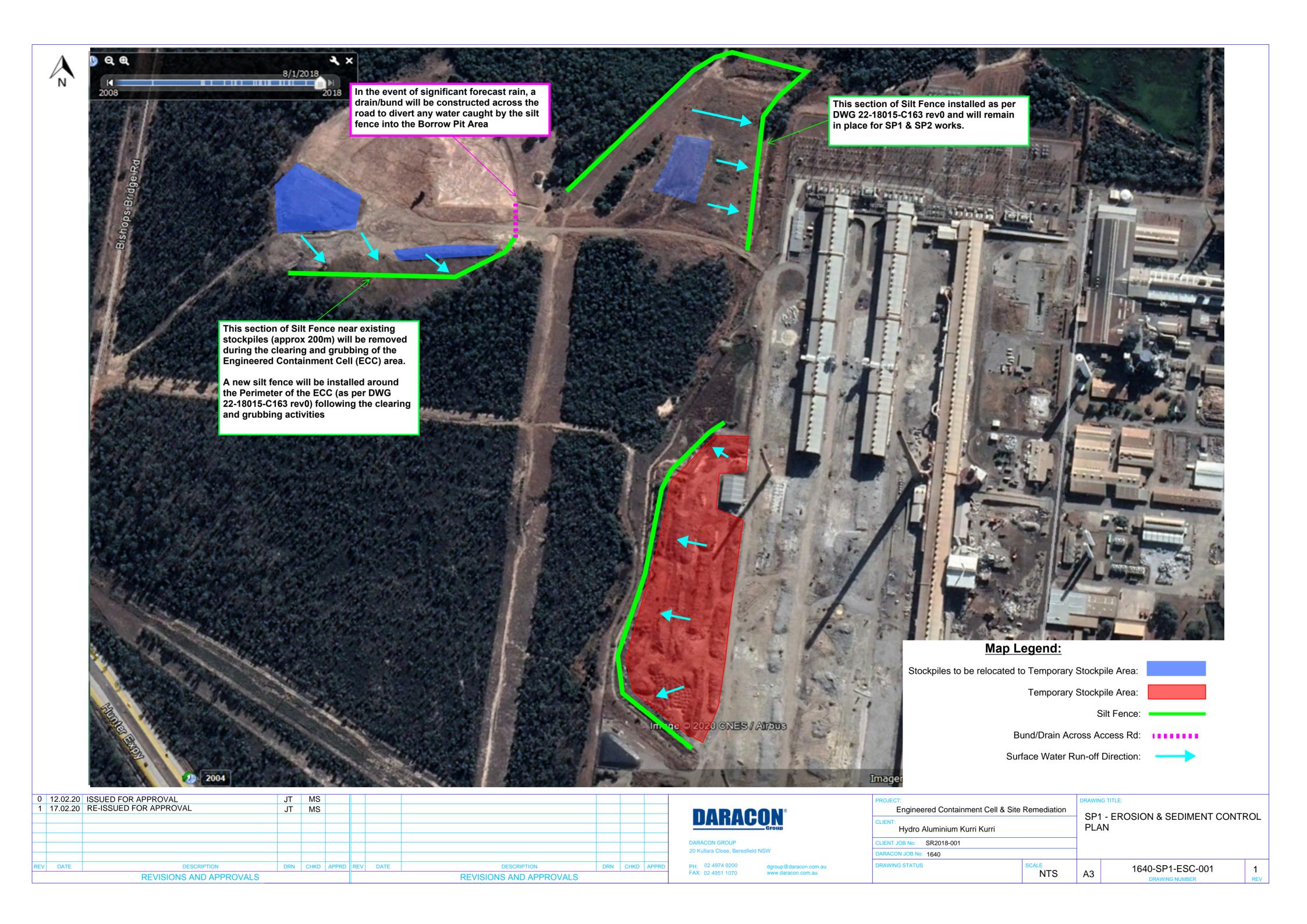
No Quality Control Sample Frequency Outliers exist.

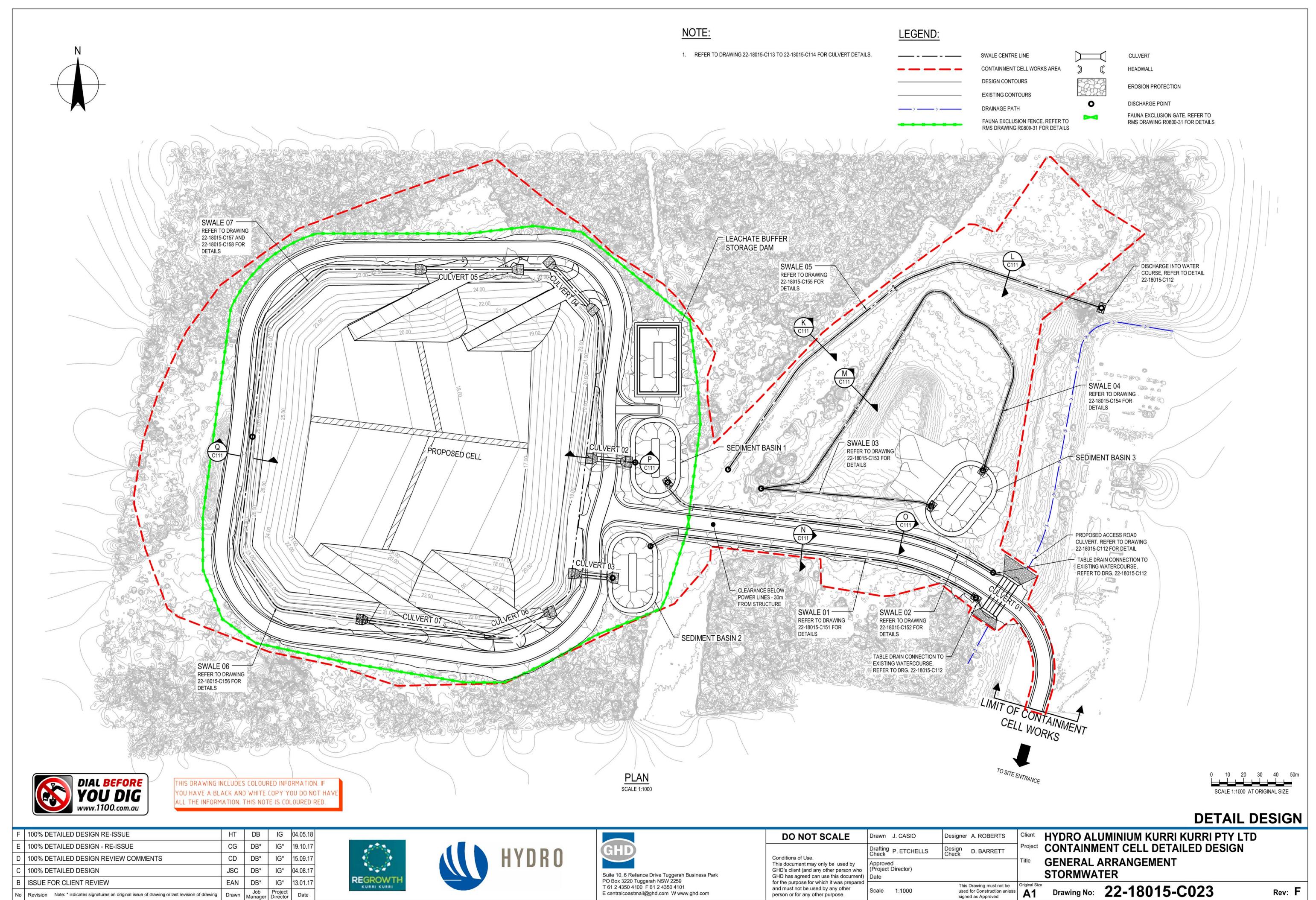
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Project Mgr:				PO No.:			-			Phone:	Phone: 02 9910 6200	Fa	Fax :02 9910 6201
Sampler:				Envirolab (Quote No. :	,				E-mail:	E-mail: ahie@envirolabservices.com.au	abservi	ices.com.au
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APPENDIX 3
INITIAL REMEDIATION EROSION AND SEDIMENT CONTROL PLAN





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NOTES:

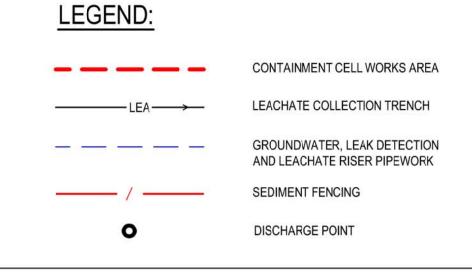
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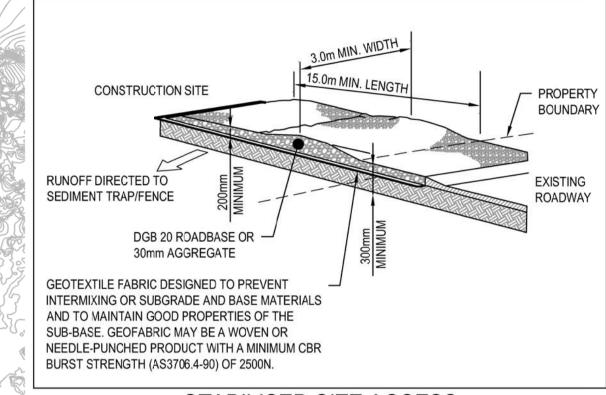
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- 1. ALL STOCKPILE LOCATIONS LOCATED OUTSIDE OF CONTAINMENT CELL WORKS AREA. FINAL LOCATIONS TO BE AGREED WITH HYDRO WITHIN MAIN SITE AREA.
- 2. THE SEDIMENT & EROSION CONTROL PLAN PRESENTS CONCEPTS ONLY. CONTRACTOR SHALL AT ALL TIMES BE RESPONSIBLE FOR THE ESTABLISHMENT & MANAGEMENT OF A DETAILED SCHEME MEETING COUNCILS DESIGN, OTHER REGULATORY AUTHORITY REQUIREMENTS AND MAKE GOOD PAYMENTS OF ALL FEES.
- 3. THE CONTRACTOR SHALL INSTIGATE ALL SEDIMENT AND EROSION CONTROL MEASURES IN ACCORDANCE WITH STATUTORY REQUIREMENTS AND IN PARTICULAR THE 'BLUE BOOK' (MANAGING URBAN STORMWATER SOILS AND CONSTRUCTION), PRODUCED BY THE DEPARTMENT OF HOUSING AND COUNCILS POLICIES. THESE MEASURES ARE TO BE INSPECTED AND MAINTAINED ON A DAILY BASIS.
- 4. THE CONTRACTOR SHALL INFORM ALL SUB CONTRACTOR OF THEIR RESPONSIBILITIES IN MINIMISING THE POTENTIAL FOR SOIL EROSION AND POLLUTION TO DOWNSLOPE LANDS AND WATERWAYS.
- 5. WHERE PRACTICAL, THE SOIL EROSION HAZED ON THE SITE SHALL BE KEPT AS LOW AS POSSIBLE TO THIS END, WORKS SHOULD BE UNDERTAKEN IN THE FOLLOWING SEQUENCE.
- 5.1 CONSTRUCT TEMPORARY STABILISED SITE ACCESS INCLUSIVE OF SHAKE DOWN /
- 5.2 INSTALL ALL TEMPORARY SEDIMENT FENCES AND BARRIER FENCES WHERE FENCES ADJACENT EACH OTHER, THE SEDIMENT FENCE CAN BE INCORPORATED INTO THE
- 5.3 INSTALL SEDIMENT CONTROL MEASURE AS OUTLINED ON THE APPROVED PLANS.

- 6. AT ALL TIMES AND IN PARTICULAR DURING WINDY AND DRY WEATHER. LARGE UNPROTECTED AREAS WILL BE KEPT MOIST (NOT WET) BY SPRINKLING WITH WATER TO KEEP DUST UNDER CONTROL ENSURING CONFORMITY TO REGULATORY AUTHORITY REQUIREMENTS.
- 7. WATER SHALL BE PREVENTED FROM ENTERING THE PERMANENT DRAINAGE SYSTEM UNLESS THE CATCHMENT AREA HAS BEEN STABILISED AND/OR ANY LIKELY SEDIMENT BEEN FILTERED
- 8. TEMPORARY SOIL AND WATER MANAGEMENT STRUCTURES SHALL BE REMOVED ONLY AFTER THE LANDS THEY ARE PROTECTING ARE STABILISED / REHABILITATED.
- 9. ALLOW FOR GRASS STABILISATION OF EXPOSED AREAS, OPEN CHANNELS AND ROCK BATTERS DURING ALL PHASES OF CONSTRUCTION.
- 10. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED TO ENSURE THAT THEY OPERATE EFFECTIVELY. REPAIRS AND/OR MAINTENANCE SHALL BE UNDERTAKEN REGULARLY AND AS REQUIRED, PARTICULARLY FOLLOWING RAIN EVENTS.

SEDIMENT BASIN 3





STABILISED SITE ACCESS

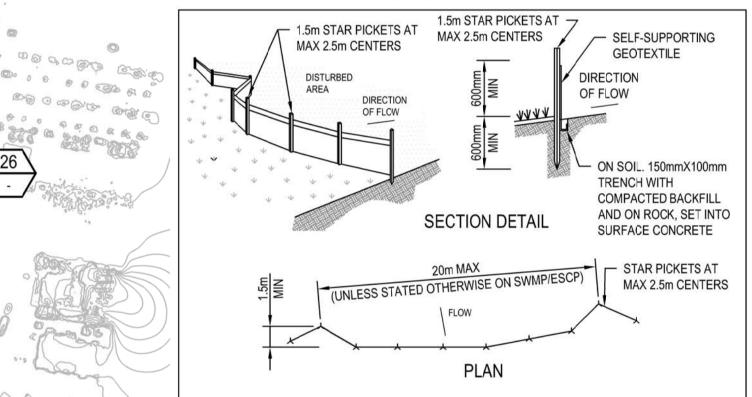


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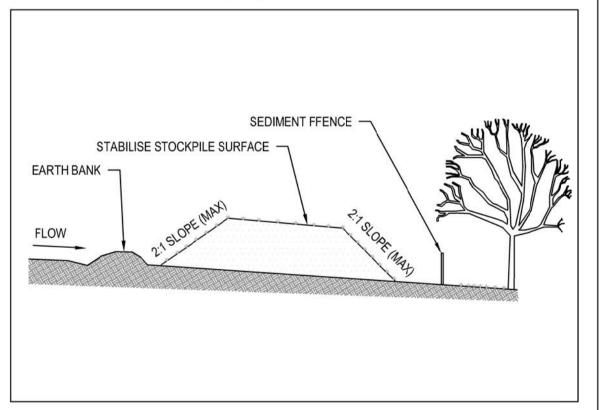
STABILISED SITE ACCESS

SCALE 1:1000 AT ORIGINAL SIZE

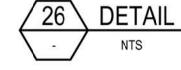
signed as Approved



SEDIMENT FENCE



STOCKPILES



DETAIL DESIGN

B 100% DETAILED DESIGN RE-ISSUE IG 04.05.18 A 100% DETAILED DESIGN JSC DB* IG* 04.08.17 Revision Note: * indicates signatures on original issue of drawing or last revision of drawing

Plot Date: 4 May 2018 - 11:38 AM





PLAN

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SEDIMENT BASIN 2

DO NOT SCALE Drawn J. CASIO Designer A. ROBERTS Drafting P. ETCHELLS Design D. MORRISON Conditions of Use. This document may only be used by GHD's client (and any other person who Approved (Project Director) GHD has agreed can use this document) for the purpose for which it was prepared This Drawing must not be Original Size and must not be used by any other used for Construction unless

person or for any other purpose.

TO SITE ENTRANCE

HYDRO ALUMINIUM KURRI KURRI PTY LTD CONTAINMENT CELL DETAILED DESIGN **EROSION AND SEDIMENT CONTROL PLANS AND DETAILS**

Drawing No: 22-18015-C163

Rev: B