AshtonCoal
PART OF THE YANCOAL AUSTRALIA GROUP

Ashton Coal Operations Pty Limited
Annual Environmental Management Report

2011/2012

Name of Mine:	Ashton Coal Mine
Titles/Mining Leases:	ML1529 and ML1533
MOP Commencement Date:	1 November 2007
MOP Completion Date:	31 December 2012
AEMR Commencement Date:	2 September 2011
AEMR Completion Date:	31 December 2012
Name of Leaseholder:	White Mining NSW Limited & ICRA (Ashton) Pty Ltd
Name of Operator (if different):	Ashton Coal Operations Pty Ltd
Reporting Officer:	Brian Wesley
Title:	General Manager

Signature Brian Wesley **Date** 12/6/13

EXECUTIVE SUMMARY

The Ashton Coal Project (ACP) is located approximately 14km north-west of Singleton near the village of Camberwell.

This report covers the period 2 September 2011 to 31 December 2012. During the period of this Annual Environmental Management Report (AEMR), both the Open Cut and Underground mines have been in production, however the North East Open Cut ceased coal production operations in late September 2011.

Ashton Coal produced 3.14 million tonnes run of mine coal during the reporting period, against an approved run of mine production rate of 5.45 million tonnes per annum.

Environmental performance is reported in Section 3 of the AEMR. Overall environmental management was effective, and generally complied with development consent conditions. Results of an internal audit against development consent conditions are presented as Table 3.

NEOC Closure and Rehabilitation

Following the closure of the North East Open Cut (NEOC) in September 2011, all available overburden dumps were rehabilitated, with a total of 18.21ha rehabilitation carried out during the reporting period. Underground production is expected to continue until approximately 2023.

Air Quality

During the reporting period, all annual average community monitoring sites were within the development consent limits. There were 23 exceedances of daily limits at the community monitors, and 52 exceedances of the daily limits at the background monitoring stations. The exceedances which occurred from August 2012 through to December 2012 were not attributed to ACOL as the NEOC was no longer operating and the entire available overburden dump had been reshaped and rehabilitated by the end of May 2012.

Surface Water Monitoring

Water quality in Glennies Creek, Bowmans Creek, and the Hunter River are monitored on a monthly basis. Results have generally indicated minimal impacts from mining, with trends correlating to local weather conditions. A minor non-compliance was recorded in October 2012, when total suspended particulates were not analysed by the laboratory. This was reported to the relevant departments upon receipt of the laboratory report.

Groundwater

The groundwater monitoring network was expanded to target the Glennies Creek Alluvium and the Hunter River Alluvium.

Groundwater monitoring frequency was increased in key monitoring bores during the early and final stages of LW7B, LW8 and LW101 panel extractions. This provided a high level of monitoring for impacts of subsidence on the Bowmans Creek Alluvium.

No impacts have been observed in the Glennies Creek, Bowmans Creek or Hunter River Alluvium as a result of underground mining.

Biodiversity

Management of the Southern Woodland has removed impacts such as grazing and this, combined with two good seasons, has improved conditions for woodland bird species over the last two years. There was a marked difference in the diversity and abundance of ground foraging woodland birds

in the Southern Woodland compared to that of areas which still have grazing or have yet to recover from historical activities.

Results of monitoring re-identified all threatened species that have been previously recorded as well as some additional threatened species. Populations of significant fauna groups (i.e. woodland birds) remain healthy and noticeable differences in the assemblage and abundance of these birds can be seen between sites managed by Ashton and unmanaged sites (managed sites had noticeable improved results), suggesting that the management program is effective and should be continued.

Aquatic ecology monitoring undertaken during the reporting period had mixed results, with diversity results varying over the seasons, generally in response to creek flows prior to and during the surveys.

Subsidence

During the reporting period the Underground mine continued first and secondary workings in the Pikes Gully and Upper Liddell Seam respectively. Subsidence monitoring is undertaken regularly. During the reporting period, subsidence monitoring indicated no unplanned impacts on the Narama Dam or the powerline easement.

During this reporting period, PG Longwall 7B and 8 and ULD LW101 were remediated in some areas post mining of each panel. Key infrastructure including Telstra cables, powerlines and water pipelines were not adversely impacted by subsidence over the period, and did not require remediation.

In general, the maximum subsidence movements detected were less than those predicted in the SMP. There is no indication of any significant lateral movement of the steep slope adjacent to Glennies Creek or of the New England Highway road cutting.

Community Relations

A total of 12 complaints were received during the 2011-2012 reporting period. Four of these complaints were received directly by ACOL and then a further eight complaints were received through the EPA. Complaints were predominantly associated with noise, followed by dust, blasting and other. A full listing can be found in Appendix 2.

Bowmans Creek Diversion

During the reporting period, the Bowmans Creek Eastern and Western Diversions were constructed and commissioned. Rehabilitation works commenced at the end of construction works, and will continue over the following years.

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List of Abbreviations

AEMR	Annual Environmental Management Report
ACOL	Ashton Coal Operations Pty Limited
ACP	Ashton Coal Project
ACHMP	Aboriginal Cultural Heritage Management Plan
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AQMP	Air Quality Management Plan
BMP	Bushfire Management Plan
BVMP	Blasting and Vibration Management Plan
CA	Conservation Area
$CaCO_3$	Total Hardness
CCC	Community Consultative Committee
CL	Centre Line
CHPP	Coal Handling Preparation Plant
CO2e	Carbon Dioxide equivalence
DA	Development Application
DSC	Dams Safety Committee
DoP&I	Department of Planning and Infrastructure
dB(A)	Decibel
DRE	Department of Resources and Energy
EA	Environmental Assessment
EC	Electrical Conductivity
EEA	Eastern Emplacement Area
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EPL	Environmental Protection Licence
GS	General Security
$g/m^2/month$	grams per square metre per month
ha	Hectare
hr	Hour
HS	High Security
HVAS	High Volume Air Samplers
kg	Kilogram
km/hr	Kilometre per hour
kt	Kilo Tonne
kV	Kilovolt
L	Litre
LFA	Landscape Function Analyses
LHD	Load Haul Dump
LW	Longwall
MIC	Maximum Instantaneous Charge
ML	Mega Litre
m	Metre
m/s	Metres per second
mg/L	milligrams per litre
mm	Millimetre
Mt	Million tonne
Mod	Modification
MOP	Mining Operations Plan
µS/cm	microsiemens per centimetre
$\mu g/m^3$	micrograms per cubic metre
NA	Non-Applicable
NEOC	North East Open Cut
NMP	Noise Management Plan
NOW	NSW Office of Water
NS	Not Sampled
OEH	Office of Environment and Heritage
O&G	Oil and Grease
OC	Open Cut
POEO	Protection Of Environment Operations
PG	Pikes Gully
PM_{10}	Particulate Matter under ten microns
PWD	Process Water Dam
REMP	Rehabilitation and Environmental Management Plan
RFS	Rural Fire Service
RL	Radiation Licence
ROM	Run Of Mine

ROW	Right of Way	ULD	Upper Liddell Seam
SEOC	South East Open Cut	UG	Underground
SMP	Subsidence Management Plan	UHMD	Upper Hunter Mining Dialogue
SWMP	Site Water Management Plan	WAL	Water Access Licence
t	Tonne	WD	Wind Direction
TDS	Total Dissolved Solids	WMO	Waste Management Officer
TSP	Total Suspended Particulates	WS	Wind Speed
TSS	Total Suspended Solids	XL	Cross Line

1.0 INTRODUCTION

Ashton Coal is owned by Yancoal Australia Limited (90%) and Itochu Corporation (10%) and operated by Ashton Coal Operations Pty Limited (ACOL). The Ashton Coal Project (ACP) is located approximately 14km north-west of Singleton near the village of Camberwell.

The project currently consists of an open cut truck and shovel mine, underground longwall mine, associated Coal Handling Preparation Plant (CHPP), stockpiling, administration buildings, workshops, stores, bathhouse facilities and car parking.

This report covers the period 2 September 2011 to 31 December 2012. During the period of this Annual Environmental Management Report (AEMR), both the Open Cut and Underground mines have been in production, however the North East Open Cut ceased coal production operations in late September 2011.

This report has been developed in accordance with Condition 9.3 of the ACOL Development Consent DA 309-11-2001-I. The structure of this report is based on the document "*Guidelines and Format for Preparation of Annual Environmental Management Report*", Department of Mineral Resources, Document No. EDG03 MREMP Guide V3 dated January 2006.

In accordance with Condition 9.3 of the Development Consent, Ashton has consulted with the Director-General of the Department of Planning and Infrastructure (DoP&I) and the NSW Office of Water (NOW) in relation to the preparation of this report.

1.1 CONSENTS, LEASE AND LICENCES

A combined Site MOP which incorporates both the Open Cut and Underground operations was approved on the 1 September 2008. The Site MOP covers the period 1 November 2007 to 31 December 2012.

A new MOP is due to be submitted early in 2013 after an extension was granted to the submission deadline.

ACOL received approval of three separate development consent modifications during the reporting period:

- On 28 February 2012 ACOL received approval of development consent modification 309-11-2001-i (M8) from the DoP&I. The approval as granted with conditions allowed for a minor modification to condition 1.20 to Schedule 2 relating to gas well locations;
- On 5 June 2012 ACOL received approval of development consent modification 309-11-2001-i (M9) from the DoP&I. The approval as granted with conditions allowed for the establishment of upcast ventilation shaft above the underground mine;
- On 12 December 2012 ACOL received approval of development consent modification 309-11-2001-i (M10) from the DoP&I. The approval as granted with conditions allowed for the establishment of a central gas drainage plant and associated surface infrastructure.

The following table (**Table 1**) provides a summary of the status of all leases, licences and approvals relevant to environmental management obtained by ACOL.

Copies of all licences and approvals where required have been provided to government agencies and Singleton Council and are available for inspection at the ACOL site office

Table 1. CONSENTS, LEASES AND LICENCES

Approval Number	Description	Issue Date	Expiry Date
Approvals			
DA 309-11-2001-i	Development Consent for the ACP	11/10/2002	11/10/2023
DA 309-11-2001-i (MOD 1)	Modification to Development Consent (allows EPA to specify noise criteria in Table 10)	15/10/2003	11/10/2023
DA 309-11-2001-i (MOD 2)	Modification to Development Consent (permits 10 m increase in height of Eastern Emplacement Area (EEA) and the removal of the western emplacement)	27/01/2005	11/10/2023
DA 309-11-2001-i (MOD 3)	Modification to Development Consent (for the construction and operations of tailings pipelines between the mine and the former Ravensworth Mine)	19/02/2007	11/10/2023
DA 309-11-2001-i (MOD 4)	Modification to Development Consent (for the mining of an additional longwall panel and an increase in run-of-mine (ROM) production from 5.2 to 5.8 Million tonnes per annum (Mtpa)	26/03/2010	11/10/2023
DA 309-11-2001-i (MOD 6)	Modification to Development Consent (Bowmans Creek Diversion)	24/12/2010	11/10/2023
DA 309-11-2001-i (MOD 7)	Modification to Development Consent (North East Open Cut (NEOC) Hebden seam extraction and Development of Gas Drainage Wells)	15/06/2011	11/10/2023
DA 309-11-2001-i (MOD 8)	Modification to Development Consent (Minor modifications to condition 1.20 to Schedule 2)	28/02/2012	11/10/2023
DA 309-11-2001-i (MOD 9)	Modification to Development Consent (Establishment of upcast ventilation shaft above the underground mine)	05/06/2012	11/10/2023
Mining Authorisations			
ML 1533	Mining Lease	26/02/2003	26/02/2024
ML1529	Mining Lease	17/09/2003	11/11/2012 Renewal application confirmation received 9/11/2011
ML 1623	Mining Lease	30/10/08	30/10/2029
EL 5860	Exploration Licence (EL)	21/05/2012 renewal application lodged	
EL 4918	Exploration Licence	17/12/2010 renewal application lodged	

Licence / Permit No.	Description	Expiry Date
EPL 11879	Environmental Protection Licence (EPL) NEOC Area and processing facilities	Superseded
Variation to EPL 11879	Established Construction Noise Criteria	Superseded
Variation to EPL 11879	Modified dust sampling requirements	Superseded
Variation to EPL 11879	Incorporation of UG mine	NA
Dangerous Goods Notification	Issued - 28/03/2013	14/03/2014
Radiation Licences		
License #29720 RL 28485	Radiation Licence (RL) Licence to Sell/Possess Radioactive Substances	18/06/2015
Radiation Registration 12903	CHPP - module 2 thickener underflow Issued - 17/01/2010	16/01/2014
Radiation Registration 12905	CHPP - module 1 thickener underflow Issued - 17/01/2010	16/01/2014
Radiation Registration 12906	CHPP - module 2 dense medium Issued - 17/01/2010	16/01/2014
Radiation Registration 21160	CHPP- combined thickeners tailings sump Issued - 10/12/2009	9/12/2013
Radiation Registration 22922	CHPP-module 1 dense medium feed Issued - 16/01/2012	15/01/2014
Crown Lands Permits		
Crown Lands LI354487	Pipeline permit Issued - 18/09/2003	Annually - 15th January
Crown Lands LI363792	Pipeline permit Issued - 16/01/2004	Annually - 5th November
Crown Lands LI370218	Pipeline permit	Annually - 16th April
Crown Lands LI386385	Pipeline permit Issued - 16/09/2008	Annually - 6th September
Crown Lands LI408628	Pipeline permit Issued - 04/07/2008	Annually - 4th July
Crown Lands LI450779	Licence Permit	Annually - 24th December
Crown Lands LI454691	Licence Permit	Annually - 30th July

Licence No.	Type	Renewal Date
Surface Water Licences		
WAL1358 Glennies Creek Supplementary 4ML	Water Access Licence	Perpetuity
WAL15583 Glennies Creek General Security 354ML	Water Access Licence	Perpetuity
WAL8404 Glennies Creek High Security 80ML	Water Access Licence	Perpetuity
WAL997 Glennies Creek High Security 11ML	Water Access Licence	NA
WAL1120 Hunter River High Security 3ML	Water Access Licence	Perpetuity
WAL1121 Hunter River General Security 335ML	Water Access Licence	Perpetuity
WAL6346 Hunter River Supplementary 15.5ML	Water Access Licence	Perpetuity
WAL23912 Bowmans Creek 14ML	Water Access Licence	Perpetuity
WAL29565 Bowmans Creek 266ML	Water Access Licence	Perpetuity
WAL654 / 20AL200480 Stock & Domestic 8ML	Water Access Licence	Perpetuity
WAL660 Stock & Domestic 6ML	Water Access Licence	Perpetuity
WAL665 Stock & Domestic 3ML	Water Access Licence	Perpetuity
WAL738 Stock & Domestic 3ML	Water Access Licence	Perpetuity
WAL811 Stock & Domestic 3ML	Water Access Licence	Perpetuity
WAL872 Glennies Creek General Security 12ML	Water Access Licence	Perpetuity
WAL873 Stock & Domestic 8ML	Water Access Licence	Perpetuity
WAL896 Stock & Domestic 3ML	Water Access Licence	Perpetuity
WAL984 Glennies Creek General Security 9ML	Water Access Licence	Perpetuity
WAL985 / 20AL201283 Stock & Domestic 8ML	Water Access Licence	Perpetuity
WAL1095 / 20AL201564 Glennies Creek General Security 122ML	Water Access Licence	Perpetuity
WAL1157 Stock & Domestic 3ML	Water Access Licence	Perpetuity
WAL1190 Stock & Domestic 1ML	Water Access Licence	Perpetuity
WAL9515 Stock & Domestic 12ML	Water Access Licence	Perpetuity
WAL10532 Stock & Domestic 3ML	Water Access Licence	Perpetuity
Groundwater Licences		
WAL29566 Alluvial (aquifer) 358ML	Water Access Licence	Perpetuity
20BL136766 Stock Domestic	Bore	Perpetuity
20BL168848 Test Bore	Bore	Perpetuity
20BL168849 Test Bore	Bore	Perpetuity
20BL169508 Mining (dewatering) 100ML	Bore	14/03/15
20BL169937 Mining (dewatering) 230ML (in conjunction with 20BL171364)	Bore	04/04/12
20BL170596 Monitoring	Bore	Perpetuity

Licence No.	Type	Renewal Date
20BL171364 Mining (dewatering) 230ML (in conjunction with 20BL169937)	Bore	16/05/12
20BL172142 Test Bore	Bore	Perpetuity
20BL172143 Test Bore	Bore	Perpetuity
20BL172757 Test Bore	Bore	Perpetuity
20BL173193 Test Bore	Bore	Perpetuity
20BL172144 Test Bore	Bore	Perpetuity
Work Approvals		
20CA201565 Glennies Creek	Combined water supply works / water use approval	11/03/19
20WA203882 Glennies Creek	Combined water supply works / water use approval	13/12/17
20CA201626 Hunter River	Combined water supply works / water use approval	07/04/19
Permit No.	**Location Description**	**Expiry Date**
AHIMS Permit No 1591	To collect Aboriginal artefacts to north of the New England Highway under s90 of the NPW Act	21/07/08
AHIMS Permit No 2783	To collect Aboriginal Artefacts LW 1-4 area under s90 of the NPW Act	2009
Part 3A Permit No P1819	To install two power poles near Bowmans Creek	05/12/04
Section 90 Consent Permits AHIP 1131017 AHIMS Permit ID 3436	Longwalls 1-4: Salvage excavations. Community collection. Harm to certain Aboriginal objects through proposed works. Certain Aboriginal objects must not be harmed	23/12/21
Section 90 Consents Permits AHIP 1130976 archaeologist registered	Longwalls 5-8: Movement only of certain Aboriginal objects. Test excavations. Salvage excavations. Community collection. Harm to certain Aboriginal objects through proposed works. Certain Aboriginal objects must not be harmed	26/08/31
Permit no CW802609	To construct levee bank on Bowmans Creek	07/09/08
Clause 88(1) approval	For safe operations and stability of workings and resource recovery longwall	01/06/11

Licence No.	Type	Renewal Date
	mining (LW 1-4)	
Clause 88(1) approval	For safe operations and stability of workings and resource recovery longwall mining (LW 5-6)	01/12/09
Clause 88(1) approval	For safe operations and stability of workings and resource recovery longwall mining (LW 6B, 7A, 7B & 8)	03/03/11
Clause 88(1) approval	For safe operations and stability of workings and resource recovery longwall mining (ULD LW 101-103)	19/04/12
Clause 88(1) approval	For safe operations and stability of workings and resource recovery longwall mining (LW 6B variation)	Application submitted

Approval	Approval Date	Expiry Date
S126 Approvals for emplacement of carbonaceous materials Ashton NEOC	08/04/04	NA
S126 Approvals for emplacement of carbonaceous materials Ravensworth Void 4	17/01/07	NA
S100 Approval for emplacement of coarse rejects materials in the NEOC void	01/03/12	NA

1.2 MINE CONTACTS

Positions of responsibility for operations and environment for the period are detailed hereunder:

Table 2. **KEY MINE CONTACTS**

Area of Responsibility	Name	Title	Contact Number(s)
General Manager	B. Wesley	General Manager	(02) 6570 9104
Open Cut Mine	B. Chilcott	Open Cut Mine Manager	(02) 6570 9128
Underground Mine	D. Gibson	Underground Mine Manager	(02) 6570 9260
CHPP	I. McTaggart	CHPP Manager	(02) 6570 9148
Environment	L. Richards	Environment and Community Relations Manager	(02) 6570 9219
Environmental Contact Line			1800 657 639

Brian Wesley has overall responsibility for the operational and development phases of the project. Lisa Richards is responsible for day-to-day environmental management and community relations and is the nominated Environmental Manager for the project.

1.3 ENVIRONMENTAL MANAGEMENT PLAN UPDATE

During the reporting period the following Environmental Management Plans were reviewed, updated and approved by the DoP&I:

- Archaeology and Cultural Heritage Management Plan
- Flora and Fauna Management Plan
- Site Water Management Plan

In the first half of 2013 the following management plans will be completed and submitted to the relevant stakeholders:

- Mining Operations Plan (MOP) 2013-2017 – incorporating the Landscape and Revegetation Management Plan; Land Management Plan; Final Void Management Plan; and Rehabilitation Management Plan required under the development consent.
- Noise Management Plan (NMP)
- Air Quality Management Plan (AQMP)
- Bushfire Management Plan (BMP)

1.4 ENVIRONMENTAL COMMITMENTS

ACOL undertakes an internal audit of the performance of the project against conditions of the consent and other statutory approvals. A 3 year external compliance audit was undertaken in 2010 and reported in the 2009-2010 AEMR. During the 2013 reporting period the next 3 year external compliance audit will be undertaken.

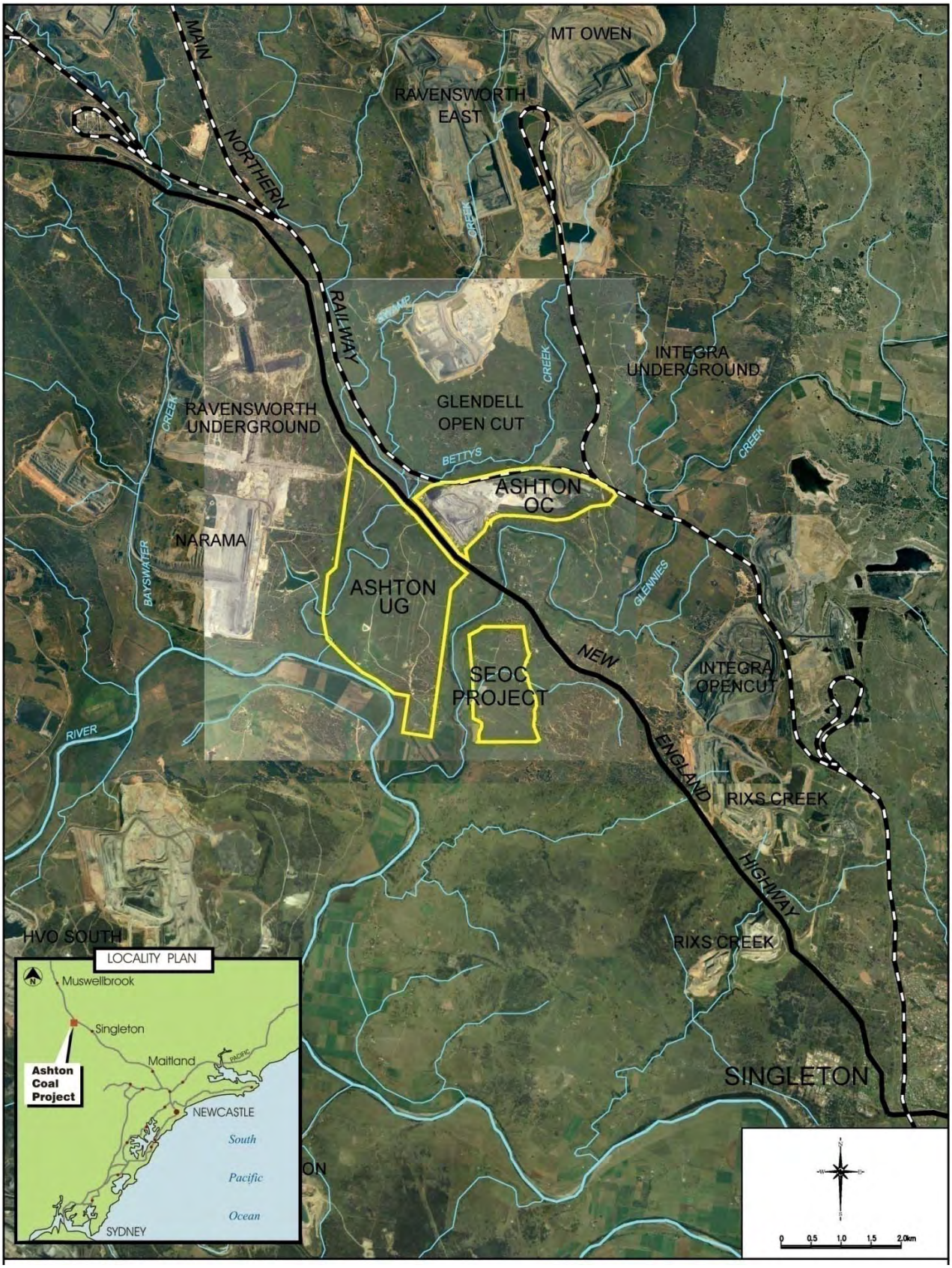
Table 3. **INTERNAL ENVIRONMENTAL AUDIT – NON-COMPLIANCES**

Environmental performance condition	Compliance with Project Approval conditions & MOP	Comments
Land & Site Environmental Management including subsidence management– Management Plans	1.3	In consultation with the DoP&I and DRE the MOP 2013-17; NMP; AQMP; & BMP will be submitted to the relevant stakeholders during the first half of 2013.
Hazardous Materials, Waste & Overburden Management	2.6, 2.9 & 3.14	
Meteorological Monitoring	3.1.2	
Air Quality	3.1.3	
Erosion & Sediment Control	3.2	
Surface Water	3.3.2.1	Monthly TSS samples for October 2012 were collected and sent for analysis, however were not analysed by NATA accredited laboratory.
Ground Water	3.4	
Flora & Fauna	3.6 & 3.7	
Blasting & Vibration	3.9	
Noise	3.10	
Aboriginal Heritage	3.12	
Natural / European Heritage	3.13	
Bushfire	3.15	

Table 3. INTERNAL ENVIRONMENTAL AUDIT – NON-COMPLIANCES		
Environmental performance condition	**Compliance with Project Approval conditions & MOP**	**Comments**
Subsidence Management	3.16	
Greenhouse Gas Emissions	3.18	
Transport & Utilities	3.19	
Rehabilitation	5.0	

*Legend

Compliant	
Condition/impact criteria non-compliance	
Administrative non-compliance	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NORTHERN
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SWAMP
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INTEGRA
UNDERGROUND
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UNDERGROUND
CREEK
GLENDELL
OPEN CUT
BETTYS
CREEK
ASHTON
OC
NARAMA
BAYSWATER
ASHTON
UG
GLENNIES
NEW
SEOC
PROJECT
INTEGRA
OPENCUT
RIVER
ENGLAND
RIXS CREEK
HIGHWAY
HVO SOUTH
RIXS CREEK
LOCALITY PLAN
Muswellbrook
Singleton
Maitland
Ashton
Coal
Project
NEWCASTLE
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SYDNEY
SINGLETON
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2.0 OPERATIONS DURING THE REPORTING PERIOD

2.1 EXPLORATION

Table 4. EXPLORATION

Mining lease	Mining method	Planned exploration
ML 1533	Open cut	No exploration activities were undertaken
ML 1533	Underground	6 holes (5 cored holes and 1 piezometer)
Exploration Licences 4918	Open Cut	3 holes (1 cored hole and 2 piezometers)
Exploration Licences 5860	Open Cut	No exploration activities were undertaken

2.2 LAND PREPARATION

There was minor clearing of vegetation for the preparation for underground surface infrastructure facilities including pads for surface goaf drainage holes, ventilation air shafts and borehole pump.

2.3 CONSTRUCTION

During the reporting period ACOL drilled two surface goaf drainage holes above Longwall 8 Pikes Gully (PG) seam and one hole above Longwall 101 Upper Liddell (ULD) seam. The holes were drilled, lined with steel casing to the base of the Lemington seams and open holed to within approximately 20m of the PG and ULD seams. To drain the goaf gas from the seam, a mobile surface gas drainage plant was used which draws mostly methane from the goaf and releases it, without flaring, into the atmosphere. Of the three holes drilled, only two were required to be commissioned and operated. All boreholes have been fitted with a rated gate valve and sealing system which remains bolted to the borehole pre, during and post goaf drainage. The purpose of the goaf gas drainage system is to reduce longwall tailgate gas concentrations by 'pulling' the gas further back into the goaf due to the pressure differential.

Along with the construction of the goaf gas drainage hole, a surface pad was constructed which allowed a suitable foundation for the mobile plant and associated monitoring equipment and compressor. Each borehole when constructed was fenced to prevent stock and unauthorised personnel interaction.

During the reporting period, ACOL raisebored two upcast air shafts for the ULD Seam; one 5.5m diameter shaft at the outbye end of ULD seam Longwall 101 and one 2m diameter at the inbye end of ULD seam Longwall 102. During 2013 these shafts will be fitted with purpose designed ventilation fans which will provide greater ventilation capacity to ensure the safe working conditions of underground mine employees and facilitate Life of Mine access to the remaining coal reserves beyond the PG seam. Both shafts were excavated by contractor Raisebore Australia using conventional raiseboring technique, with the raisebore rig located on the surface. Excavation cuttings were removed from the shafts and then removed from the mine via the conveyor system or Load Haul Dump (LHD) vehicles.

The 5.5m diameter shaft was supported by shotcrete in accordance with the recommendations from geotechnical studies. The shaft was also remotely inspected by camera, to visually assess the need for any additional support. Location of the 2m diameter fan shaft considered the need of the mine and the environmental requirements to minimise impact in the Conservation Area (CA). Upon completion of excavation, both shafts were sealed with steel caps, fenced and signposted.

One submersible pump borehole was drilled for the ULD seam at the inbye end of ULD LW101 panel during this reporting period. The borehole was sealed, fenced and signposted after the casing and grouting of the bore were completed, ready for pump and discharge line in 2013.

Figure 2. Typical layout of the goaf drainage plant

No construction was undertaken in the CHPP or the Open Cut during the reporting period.

2.4 MINING

2.4.1 Estimated Mine Life

The North East Open Cut Mine ceased mining operations in the reporting period, with the last of the Hebden seam mined on the 24th September 2011.

The expected mine life for the underground mine is until 2025.

2.4.2 Mine Production and Mining Constraints

2.4.2.1 Open Cut

Mining Operations

The Ashton North East Open Cut ceased mining operations in late September 2011. The Open Cut operated a fleet of hydraulic excavators and associated haul trucks along with support equipment consisting of watercarts, dozers and graders. Overburden was drilled and blasted prior to removal by the excavators. Overburden between seams is typically 15 – 20 m thick. Coal was usually free-dug by excavator or windrowed by dozers prior to loading. During the three months of this reporting period that the NEOC operated, mining focussed on the Hebden seam.

The Open Cut mine was designed and developed to minimise environmental impacts on Camberwell village, particularly in relation to impacts from blasting vibration, dust and noise. The original mine plan with north-south strips and pit progressing from east to west was progressively changed to east-west strips and mining from north to south. This concentrated the mining activity initially in the north-west corner of the pit, furthest from the village, and has the effect of creating a buffer as the mining operations deepen. Mining with this modified orientation minimised hauling of overburden along the southern boundary of the pit and concentrated most of the mining and hauling at levels below the environmental bund for longer periods. The remaining void at the southern end of the operation is being progressively filled with coarse reject from the continuing Underground operation.

At the closure of the mining operations in the NEOC, all available overburden dumps were bulk shaped and then rehabilitated during autumn 2012. A total of 18.21ha of rehabilitation was carried out in the reporting period; where pasture seed was applied at 45kg/ha with fertiliser at 200 kg/ha. Compost was applied to all areas at 100t/ha. A further 2.34ha of overburden face of the emplacement area which was unable to be reshaped was temporarily seeded with the same seed mix used for the pasture areas.

Sufficient overburden has been stockpiled to enable the rehabilitation of ACOL's disturbance area, including Underground and CHPP areas following cessation of mining.

Permanent workshop, office and refuelling facilities are located at the northern limit of the open cut and in the vicinity of the Clean Coal Stockpile and Train Loading Infrastructure. These facilities are operational and service equipment associated with the CHPP and rejects emplacement.

2.4.2.2 Underground

At the end of June 2012, the Underground Mine had Reserve of 43.1Mt, of which 14Mt was proved and 29.1Mt was probable. At the end of December 2012, the Reserve was approximately 41.6Mt. The mining plan includes sequential mining of the Pikes Gully, Upper Liddell, Upper Lower Liddell and the Lower Barrett coal seams. Underground development commenced in the Pikes Gully Seam in December 2005 with Longwall coal extraction commencing in 2007.

The Subsidence Management Plan and Extraction Plan for Upper Liddell Seam Longwalls 101 to 104 were approved in July 2012. ACOL will seek further approval for Longwalls 105 to 108 at a subsequent date.

Longwall extraction within this reporting period included PG seam Longwall 7B panel, PG seam Longwall 8 and half of ULD seam Longwall 101 panel.

- Longwall 7B began extraction on the 4 October 2011 and completed longwall mining on 17 January 2012
- Longwall 8 extracted from the 27 February 2012 to the 5 June 2012.
- ULD Longwall 101 panel began extraction on 3 August 2012 at chainage 2,470m. To the end of 2012, Longwall 101 was extracted to 1,034m chainage which equates to 1,436m of extraction.

Development undertaken in the Upper Liddell seam included the:

- completion of Tailgate 101,
- completion of Maingate 101 and
- part of Maingate 102 and
- longwall faceline for Longwall 101.

Ashton Underground Mine has approval and operates 24hrs a day 7 days a week. Underground equipment is listed in **Table 5**.

Table 5. **UNDERGROUND EQUIPMENT**

Number	Development	Number	Production
4	Joy 12Continous Miner 12B	1	Eickhoff SL750 DERDS Longwall Shearer
4	Joy Shuttle Car	120	Caterpillar 2 leg shield
8	Joy FX240 roof bolting miner mounted rigs	1	Caterpillar face conveyer (AFC)
2	Stamler Breaker Feeders	1	Caterpillar stage loader
2	Boot Ends	1	Caterpillar coal crusher
1	QDS platform roof/rib bolter	2	Contract Eimco LHD's
Number	**Ancillary**	**Number**	**Ancillary**
10	PJB Mk4.5 Man transports	1	Ballast trailer
7	Jug-A-O LHD's	5	Rambor portable roof bolters
1	Airtrak - Coalroc	1	QDS platform rib bolter - Coalroc
2	Flaktwoods 315kW centrifugal fans	4	21m^3/s auxiliary ventilation fans
1	1600mm stacker conveyor (single VVVF drive)	1	Dieci 7t forklift
2	1600mm conveyors (two VVVF drives each)	2	1400mm conveyors (two VVVF drives each)
2	1050 Temporary conveyors (jiffy belt)		

2.4.3 Production and Waste Summary

Operations in the reporting period and predictions for the next reporting period are detailed in **Table 6**.

Table 6. **PRODUCTION AND WASTE SUMMARY**

	CUMULATIVE PRODUCTION		
	Start of this Reporting Period	**At end of this Reporting Period**	**Est. end of next Reporting Period**
Topsoil Stripped (m^3)	158,200	158,200	158,200
Topsoil used/spread (m^3)	115,288	129,628	129,628
Overburden (bcm)	71,123,023	71,266,788	71,266,788
Open Cut ROM Coal (t)	13,206,302	13,245,331	13,245,331
Underground ROM Coal (t)	11,491,515	14,596,604	17,936,655
Total ROM Coal (t)	24,697,815	27,841,933	31,181,984
Processing Waste (t)	9,523,687	11,150,097	12,845,727
Open Cut Product Coal (t)	8,057,750	8,088,164	8,088,164
Underground Product Coal (t)	6,661,892	8,149,186	9,793,607
Total Product Coal (t)	14,719,642	16,237,350	17,881,771

2.4.4 Changes in Mining Equipment or Method

On the 24th September 2011 the open cut ceased operations. With the closure of the open cut ACOL progressed to a solely underground mining operation.

2.5 MINERAL PROCESSING

The CHPP incorporates two modules (400tph and 600tph) which are operated independently to produce the total designed throughput of 1000tph. The associated materials handling is designed for 1000tph and includes two rotary breakers on the ROM coal side, one feeding Open Cut coal and the other Underground, and a skyline conveyor on the product coal side. Product coal is recovered through a series of coal valves and conveyed to a Train Loading Station mounted over a dedicated rail siding.

The CHPP is operated by ACOL and manned on a 24 hours a day 5 days per week basis. However if required the CHPP has the ability to operate 24 hours a day 7 days a week. Train loading may operate 7 days a week and is dependent on the rail schedule.

The CHPP processed 3.138Mt ROM coal during the reporting period to produce 1.063Mt of semi-soft product coal and a trial of 16.9Kt of thermal coal. Coal was transported by rail to the Port of Newcastle for sale on the export market. Some semi soft coking coal was sold to domestic steel mills.

Figure 3. Coal Handling Preparation Plant

2.6 WASTE MANAGEMENT

Coarse rejects are transferred to a rejects bin, loaded on to ACOL trucks and transported to the Tailings Emplacement Facility for disposal. A total of 976Kt of coarse reject material were disposed of in this manner during the reporting period.

Fine rejects are pumped to the Mac Gen Void 4 tailings dam. A total of 651Kt of fine reject material was pumped to the Mac Gen tailings dam during the period.

2.6.1 Monitoring and Maintenance of Containment Facilities

All coarse reject material is disposed of within the Eastern Emplacement Area.

Emplacement of all tailings occurs in the Ravensworth Void 4 tailings dam. The Tailings Emplacement Operations Plan defines the management of the Void 4 tailings facility.

Monitoring includes;

- Continuous Flow Monitoring,
- Twice a week inspections,
- Monthly inspections,
- Subsidence Monitoring, and
- Emplacement Surveillance Report

2.6.2 Sewage Treatment/Disposal

ACOL operates three (3) on-site sewerage management systems, these being:

1. Underground mine bathhouse and administration building combined. The sewage treatment system is a two stage Biolytix type with tertiary bromide dosing. Treated effluent is disposed of by spray irrigation. A buffer tank and controlled release pumping system is installed to alleviate surges in bathhouse water being delivered to the Biolytix system during shift change.
2. CHPP facilities and open cut bathhouse combined. The sewage treatment system is an Envirocycle type with disposal of the treated effluent by spray irrigation.
3. Open cut mine workshop. The sewage treatment system is an Envirocycle type with disposal of the treated effluent by spray irrigation.

2.6.3 Total Site Waste Management Program

Ashton Coal has contracted Transpacific Industries to operate a total waste management program. To date the following changes have been implemented as part of the program:

- Increase in paper and cardboard recycling bins including under desk baskets, wheelie bins and skip bins across site.
- Timber recycling skip bins have been placed at each of the surface areas (UG surface, CHPP and OC workshop).
- Batteries are now recycled where possible.
- Used printer cartridges are now fully recycled through the ‘Cartridges 4 Planet Ark’ program.

A Transpacific Waste Management Officer (WMO) inspects ACOL's waste streams on a weekly basis. During these inspections the WMO identifies contamination of waste streams, and where efficiencies and improvements can be made to the system. All of this information is provided in a monthly report where any abnormalities are discussed in Occupational Health, Safety and Environment meetings. Where heavy contamination is identified, the WMO, appropriate Ashton Manager or Environmental Coordinator will provide a toolbox talk to the relevant employees to increase awareness of the problem.

Waste tracking is completed by Transpacific with data provided to ACOL in monthly reports.

2.6.4 Waste Stream Volumes

The waste stream volumes are shown in **Table 7** below and **Figure 4** presents percentage makeup of waste end use for the period.

Waste streams are separated into five end uses. These being:

- Disposal – general waste and contaminated rags.
- Energy Recovery – waste oil.
- Recycling – timber, oil filters, batteries, paper and cardboard and scrap metal.
- Reuse – refurbished air filters.
- Treatment – effluent.

Table 7. **WASTE STREAM WEIGHTS (KG) SEPTEMBER 2011 – DECEMBER 2012**

Waste Stream	Volume (kg)^
General Waste (kg)	378,303
Contaminated Rags – Hydrocarbons (kg)	722
Effluent (kg)	98,100
Scrap Metal (kg)	103,360
Waste Oil (kg)	43,200
Oil Filters (kg)	1,232
Timber (kg)	70,940
Paper & Cardboard (kg)	7,418
Batteries - Lead Acid (kg)	2,420
Printer cartridges recycled to 'Cartridges 4 Planet Ark' program (kg)	20

^ Volume for some wastes is estimated from bin collections. This method is a conservative approach and potentially overestimates the actual waste produced.

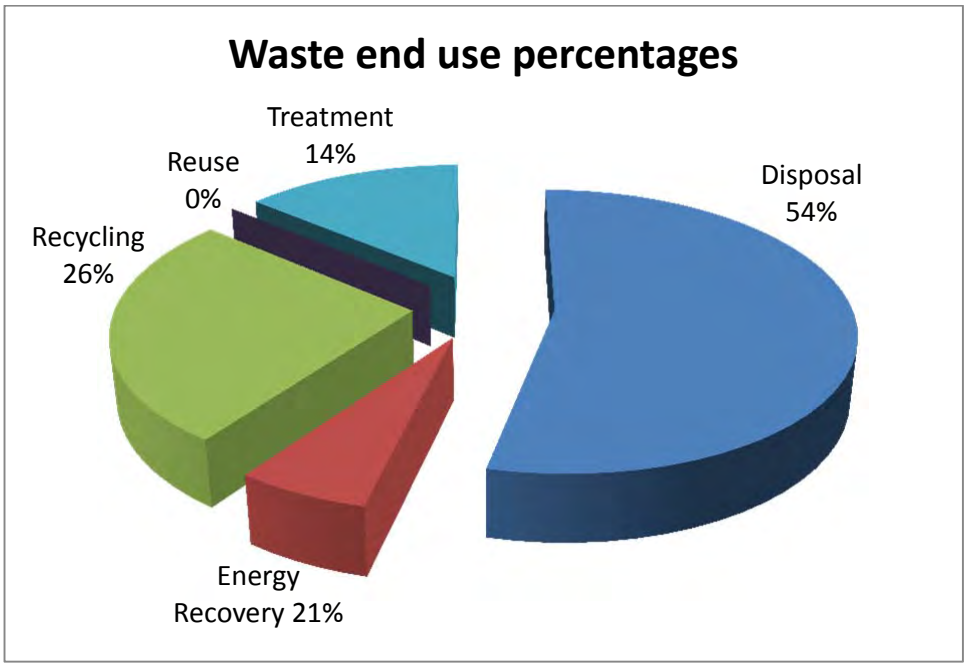

Figure 4. Waste end use percentages

2.7 ROM Coal and Coal Product Stockpiles

Both ROM coal and product coal are stockpiled adjacent to the CHPP. The ROM coal pad for the Underground has a capacity for about a 200Kt stockpile. The capacity of the product coal stockpile is approximately 400Kt. All product coal was transported off site by rail during the reporting period.

2.8 Water Management

Ashton is a nil discharge site and split water into three distinct water categories, Clean Water, Runoff Water and Mine Water.

Clean Water Management

Clean water is used only where there exists a need for water of that quality or there is a shortfall of Mine Water for reuse. Clean water is currently sourced from:

- Glennies Creek; and
- the Hunter River.

This water is used untreated as raw water in the Underground; treated in an on-site water treatment plant for use in the office and bath house facilities; or used as raw top up water to the process water dam for use in the CHPP, wash down and dust suppression.

Runoff Water Management

Runoff water from some of the rehabilitation areas is directed to sediment control structures prior to runoff from site. These areas are minimised and the water is harvested back onto site for reuse as a priority.

Mine Water Management

All water contaminated by contact with carbonaceous material or collected from the general mining area catchment is classed as Mine Water and is collected on site in storage dams. This mine water is utilised in the mining process for dust suppression and in the CHPP. Where the quality is suitable this water may also be used to irrigate rehabilitated areas. There has been no irrigation of rehabilitation areas within the open cut undertaken during the reporting period.

There is an agreement in place to use excess underground water from Glennies Creek Underground Coal Mine (Integra Coal). This water supply is used to top up process water levels and for dust suppression.

2.8.1 Water Supply and Demand

Licences are held by ACOL to pump water from Glennies Creek and the Hunter River for use on the mine site (refer to **Table 1**). Full allocation of Water Access Licences (WAL) was made available for the 2011-12 water year and the current portion of the 2012-13 water year.

Table 8 and **Table 9** show the balance of water draw from Glennies Creek and the Hunter River respectively over the reporting period. The Glennies Creek water draw includes pumped volume as well as an underground seepage calculation to balance approved draw down in the Glennies Creek alluvium due to the underground operations. **Section 3.4** discusses in more detail the Underground alluvium impacts.

An extensive metering network and water balance model is in place across site to enable detailed monitoring of all water movements. Site water balances are presented in **Table 10**, **Table 11** and **Table 12** for the reporting period.

Table 8. BALANCE OF LICENSED WATER DRAW FROM GLENNIES CREEK

Month	Total Volume Pumped ML	Underground Seepage ML	Total Volume Extracted (Total Volume + Underground seepage)	Cumulative Total ML	Available Water Determination	Total Licensed ML	Drawdown from Total Licensed ML
A	B	C	D	E	F	G	H
			= B + C	= cum D			= G - E
2011-12 Water Year							
Jul-11	23.0	4.9	28.0	28.0	100% GS & HS	480.4	452.4
Aug-11	9.1	1.8	10.9	38.9	100% GS & HS	480.4	441.5
Sep-11	6.1	1.7	7.8	46.7	100% GS & HS	480.4	433.7
Oct-11	16.0	2.0	18.0	64.7	100% GS & HS	480.4	415.7
Nov-11	14.6	1.8	16.4	81.1	100% GS & HS	480.4	399.3
Dec-11	12.1	1.6	13.8	94.9	100% GS & HS	480.4	385.5
Jan-12	8.4	1.9	10.4	105.2	100% GS & HS	480.4	375.2
Feb-12	9.6	1.9	11.6	116.8	100% GS & HS	480.4	363.6
Mar-12	15.5	1.9	17.4	134.2	100% GS & HS	480.4	346.2
Apr-12	13.3	1.7	14.9	149.2	100% GS & HS	480.4	331.3
May-12	14.0	1.4	15.4	164.6	100% GS & HS	480.4	315.8
Jun-12	9.6	2.3	11.9	176.5	100% GS & HS	480.4	303.9
Total at end of Water Year	**151.4**	**25.1**	**176.5**	**176.5**		**480.4**	**303.9**
2012-13 Water Year							
Jul-12	6.5	1.9	8.3	8.3	100% GS & HS	480.4	472.1
Aug-12	15.0	1.9	17.0	25.3	100% GS & HS	480.4	455.1
Sep-12	11.3	1.7	13.0	38.3	100% GS & HS	480.4	442.1
Oct-12	25.7	1.9	27.6	65.8	100% GS & HS	480.4	414.6
Nov-12	56.4	1.9	58.3	124.2	100% GS & HS	480.4	356.2
Dec-12	20.4	1.7	22.1	146.3	100% GS & HS	480.4	334.1

GS – General Security
HS – High Security

Table 9. **BALANCE OF LICENSED WATER DRAW FROM HUNTER RIVER**

Month	Total Volume Pumped	Cumulative Total	Available Water Determination	Total Licensed ML	Drawdown from Total Licensed ML
2011-12 Water Year					
Jul-11	2.8	2.8	100% GS & HS	371.5	368.7
Aug-11	4.3	7.1	100% GS & HS	371.5	364.4
Sep-11	4.5	11.6	100% GS & HS	371.5	359.9
Oct-11	3.3	14.9	100% GS & HS	371.5	356.6
Nov-11	9.1	24.0	100% GS & HS	371.5	347.5
Dec-11	0.0	24.0	100% GS & HS	371.5	347.5
Jan-12	0.0	24.0	100% GS & HS	371.5	347.5
Feb-12	0.0	24.0	100% GS & HS	371.5	347.5
Mar-12	0.0	24.0	100% GS & HS	371.5	347.5
Apr-12	0.0	24.0	100% GS & HS	371.5	347.5
May-12	0.0	24.0	100% GS & HS	371.5	347.5
Jun-12	0.0	24.0	100% GS & HS	371.5	347.5
Total at end of Water Year	**24.0**	**24.0**		**371.5**	**347.5**
2012-13 Water Year					
Jul-12	0.0	0.0	100% GS & HS	371.5	371.5
Aug-12	0.0	0.0	100% GS & HS	371.5	371.5
Sep-12	2.1	2.1	100% GS & HS	371.5	369.4
Oct-12	27.0	29.0	100% GS & HS	371.5	344.5
Nov-12	43.2	72.2	100% GS & HS	371.5	301.3
Dec-12	5.7	77.9	100% GS & HS	371.5	295.7

GS – General Security
HS – High Security

Table 10. WATER BALANCE RESULTS FROM 1 SEPTEMBER 11 TO 29 FEBRUARY 12		
Rainfall Over Period (ACOL operated rain gauge)	568 mm	
Stored Water at Start of Period (Surveyed)	137 ML	
Stored Water at End of period (Estimated)	169 ML	
Change in Storage	+32 ML	
Water Movements	**Total Flow Over Period (ML)**	**Average Daily Flow (ML/day)**
Water Inflows		
• Rainfall Runoff (estimated)	210	1.16
• Hunter River Extraction (measured)	17	0.09
• Glennies Creek Extraction (measured)	67	0.37
• Inflow from Glennies Creek Mine (measured)	61	0.33
• Pump out from open cut (estimated)	0	0.00
• Net Water make from underground operation (measured)	181	0.99
Total Inflows	**536**	**2.94**
Water Outflows		
• Dust Suppression (estimated)	148	0.81
• CHPP (measured)	221	1.21
• CHPP Misc (metered)	94	0.52
• Export to NEWPAC (metered)	0	0.00
• Irrigation of Rehabilitation (estimated)	0	0.00
• Evaporation Losses (estimated)	42	0.23
• Site Overflows (estimated)	0	0.00
Total Outflows	**504**	**2.77**
Inflows – Outflows	**+32**	**+0.17**

Table 11. WATER BALANCE RESULTS FROM 1 MARCH 12 TO 31 AUGUST 12		
Rainfall Over Period (ACOL operated rain gauge)	215mm	
Stored Water at Start of Period (Estimated)	169 ML	
Stored Water at End of period (Estimated)	134 ML	
Change in Storage	-35 ML	
Water Movements	**Total Flow Over Period (ML)**	**Average Daily Flow (ML/day)**
Water Inflows		
• Rainfall Runoff (estimated)	56	0.30
• Hunter River Extraction (measured)	0	0.00
• Glennies Creek Extraction (measured)	73	0.39
• Inflow from Glennies Creek Mine (measured)	0	0.00
• Pump out from open cut (estimated)	0	0.00
• Net Water make from underground operation (measured)	235	1.28
Total Inflows	**364**	**1.98**
Water Outflows		
• Dust Suppression (estimated)	48	0.26
• CHPP (measured)	241	1.31
• CHPP Misc (metered)	88	0.48
• Export to NEWPAC (metered)	0	0.00
• Irrigation of Rehabilitation (estimated)	0	0.00
• Evaporation Losses (estimated)	22	0.12
• Site Overflows (estimated)	0	0.00
Total Outflows	**399**	**2.17**
Inflows – Outflows	**-35**	**-0.19**

Table 12. WATER BALANCE RESULTS FROM 1 SEPTEMBER 12 TO 31 DECEMBER 12		
Rainfall Over Period (ACOL operated rain gauge)	89mm	
Stored Water at Start of Period (Estimated)	134 ML	
Stored Water at End of period (Estimated)	158 ML	
Change in Storage	+24 ML	
Water Movements	**Total Flow Over Period (ML)**	**Average Daily Flow (ML/day)**
Water Inflows		
• Rainfall Runoff (estimated)	6	0.05
• Hunter River Extraction (measured)	80	0.66
• Glennies Creek Extraction (measured)	114	0.93
• Inflow from Glennies Creek Mine (measured)	86	0.71
• Pump out from open cut (estimated)	32	0.26
• Net Water make from underground operation (measured)	85	0.69
Total Inflows	**402**	**3.30**
Water Outflows		
• Dust Suppression (estimated)	15	0.13
• CHPP (measured)	231	1.89
• CHPP Misc (metered)	90	0.74
• Export to NEWPAC (metered)	0	0.00
• Irrigation of Rehabilitation (estimated)	21	0.17
• Evaporation Losses (estimated)	21	0.17
• Site Overflows (estimated)	0	0.00
Total Outflows	**378**	**3.10**
Inflows – Outflows	**+24**	**0.20**

2.9 HAZARDOUS MATERIAL MANAGEMENT

The open cut workshop and fuel storage facilities have a dedicated bunded area for both fuel and oil storage. No changes have been made to these facilities during the reporting period.

Only small volumes of specialised lubricants are stored at the CHPP. These are stored in a dedicated bunded area.

There have been no incidents or non-compliances in relation to hazardous materials onsite during the reporting period.

3.0 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

3.1 AIR QUALITY

3.1.1 Air Quality Management

Ashton Coal has an approved Air Quality Management Plan. Controls have been put in place in accordance with this plan to control potential causes of air pollution. These controls are considered to have been adequate for the reporting period, and are described below.

Planning Controls

ACOL has implemented the following planning controls:

- A network of real time environmental monitoring stations has been established on site;
- During the operation of the OC, ACOL had developed protocols involving specific operational controls when the wind was emanating from the northwest sector to minimise the effect of emissions on the village of Camberwell. The trigger to stop operations is generated by real-time monitoring.
- Large earth berms and tree plantations between the operations and the village have been constructed and planted;
- At the closure of the mining operations in the NEOC, all available overburden dumps were bulk shaped and then rehabilitated during autumn 2012.

Engineering Controls

Engineering controls are implemented on the ACOL site during mining operations. These include but are not necessarily limited to:

- Water carts utilised around the site to keep trafficked areas in a damp condition;
- All stockpiles are kept damp by the use of fixed or mobile water sprays under dry and windy conditions;
- Roads are regularly graded to ensure that loose dust-generating surface material is kept to the lowest level practicable;
- Speed limits on mine roads are restricted to 60 km/hr. Speed limits will be reduced if required to maintain dust emission at minimum levels;
- Roads are clearly delineated to minimise trafficked areas and to ensure that traffic is kept to watered areas;
- Drills are fitted with dust control equipment and graded rock will be used to stem blast holes. Drill rigs use water injection for drilling and drill areas are wet down prior to drilling during dry and windy conditions;
- Haul trucks and other earthmoving equipment with upwardly directed exhausts are used on site to minimise the generation of dust by exhaust emissions; and
- All diesel equipment used on site is maintained properly and fitted with appropriate pollution control devices.

Operational Controls

Active controls involve the continuous management of dust generating activities to ensure that dust emissions do not affect nearby sensitive receptors. During the OC operations high priority

was given to the real time air quality and weather data measured within the village and surrounds in accordance with set protocols. Other controls included day-to-day planning of mining activities and taking account of forecast weather and actual weather conditions.
Specific Operational controls include:

- There will be no dumping on high levels of emplacement areas when ten minute average wind speeds exceed 10 m/s and the wind is emanating from the northwest sector;
- Dumping, dozing, loading and haulage operations will be managed to minimise the amount of visible dust exiting the “lease” area;
- Blasting is to be undertaken using procedures that will involve an assessment of meteorological conditions and will be designed to prevent dust and other emissions causing exceedances, or air quality goals or nuisance effects. Such controls are detailed in the Blasting and Vibration Management Plan; and
- Four water carts are used onsite at Ashton Coal. Two of these operate permanently during open cut operations with the remainder being utilised when the conditions necessitate.

Changes and Improvements during the Reporting Period
Improvements made during the reporting period to reduce the potential for the generation of dust from site activities include;

- A further 18.21ha of the Eastern Emplacement Area was rehabilitated; and
- 2.34ha of the unshaped overburden face of the emplacement area has been temporarily seeded.

3.1.2 Meteorological Monitoring

Ashton established two meteorological monitoring stations prior to the commencement of construction and operation activities on site. These are located at Monitoring Location 1 (see **Figure 11**) in the village of Camberwell and at the Repeater Station on the ridge in between the village and the NEOC. The repeater station is the primary meteorological station from which wind direction and speed are assessed for mine operation purposes, whilst Location 1 is used in combination with the repeater station to measure temperature inversions. These weather stations are calibrated annually.

Rainfall
Rainfall data for the reporting period is displayed in **Table 13**. The total rainfall for the period was below the long term median for Singleton NSW. During the first half of the reporting period the area received 166.4mm over the average rainfall for that period. A drier period was experienced throughout the remainder of the reporting period with just over half of the average rainfall received.

The 2012 calendar year recorded a total of 493.0mm which was well below the long term median rainfall and 2011 calendar year totals of 666.7mm and 856.6mm respectively.

Table 13. RAINFALL DATA FOR REPORTING PERIOD 2011-2012

Month	Rainfall (mm)	Long Term Median Rainfall *(mm)
Sep-11	79.4	50.4
Oct-11	101.6	34.5
Nov-11	155.2	64.6
Dec-11	43.4	83.4
Jan-12	45.8	69.6
Feb-12	142.6	94.7
Mar-12	76.6	68.5
Apr-12	28.8	41.3
May-12	12.2	43.6
Jun-12	55.8	43.8
Jul-12	35.2	40.8
Aug-12	7.2	31.5
Sep-12	4.8	50.4
Oct-12	3.2	34.5
Nov-12	27.4	64.6
Dec-12	53.4	83.4

Wind Speed and Direction

Seasonal windroses are shown in **Figure 5, Figure 6, Figure 7, Figure 8** and **Figure 9.**
Winds generally followed a consistent trend to the long term climatic conditions experienced in the Hunter Valley with a dominance of north westerlies from mid-autumn through to mid-spring and southerlies through October to April.

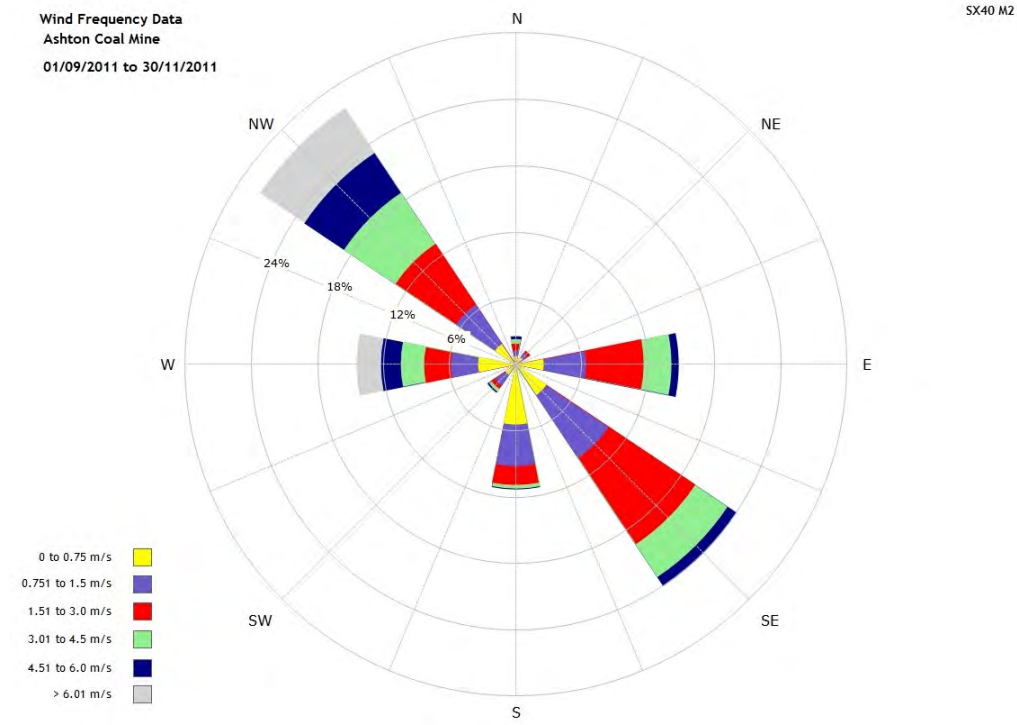

Figure 5. 1/9/2011 to 30/11/2011 Windrose

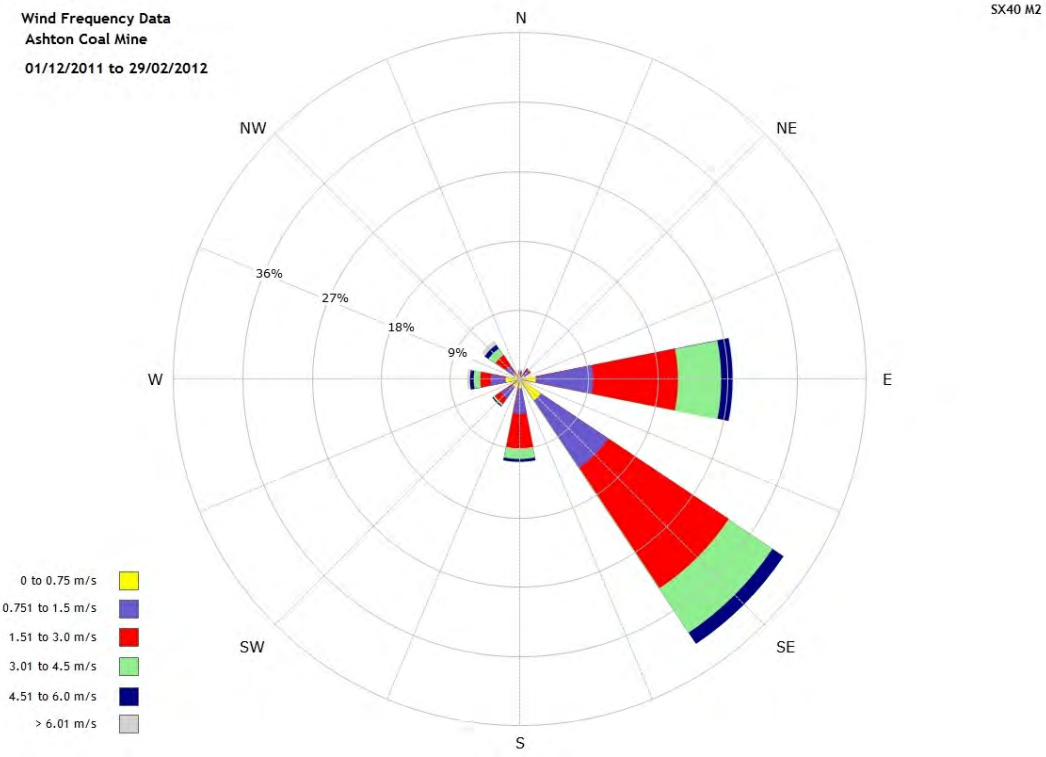

Figure 6. 1/12/2011 to 29/2/2012 Windrose

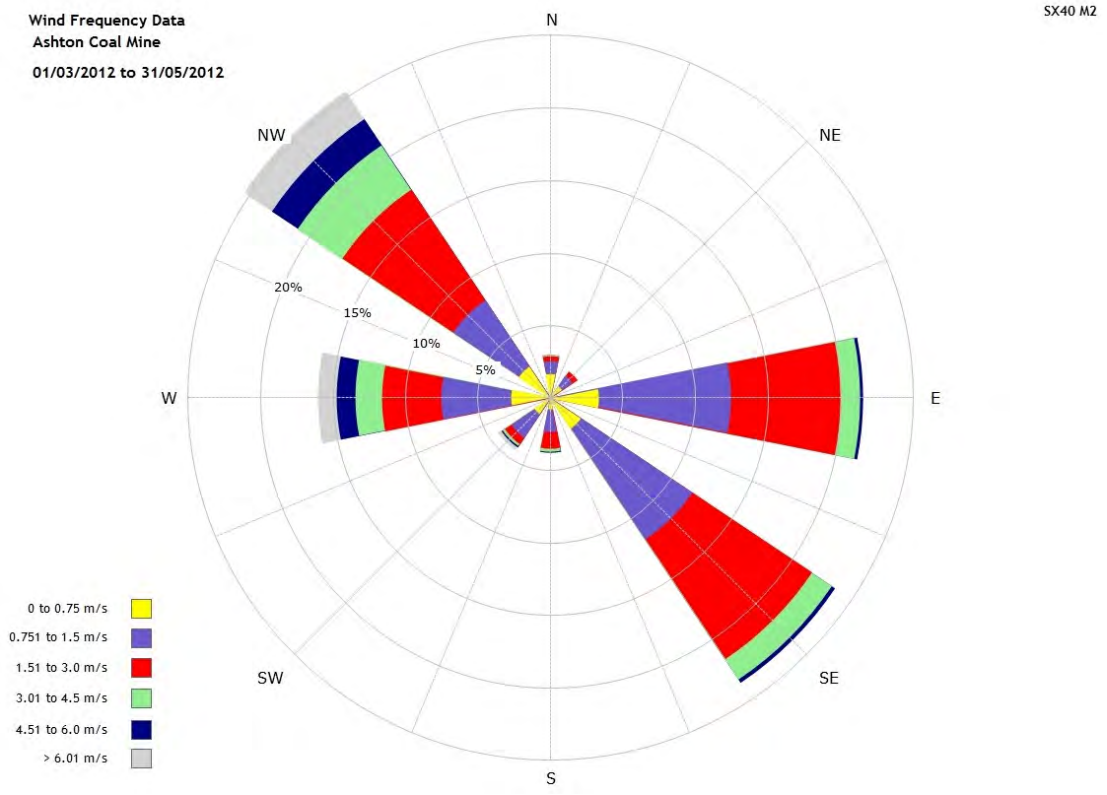

Figure 7. 1/3/2012 to 31/5/2012 Windrose

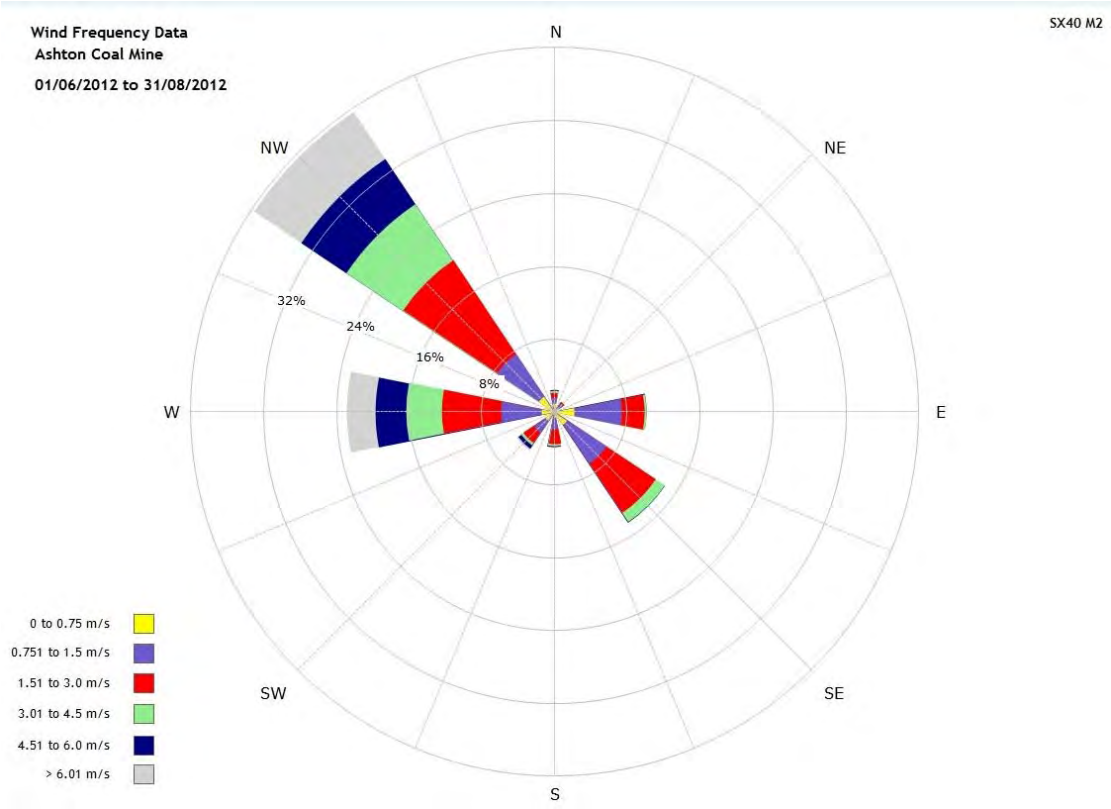

Figure 8. 1/6/2012 to 31/8/2012 Windrose

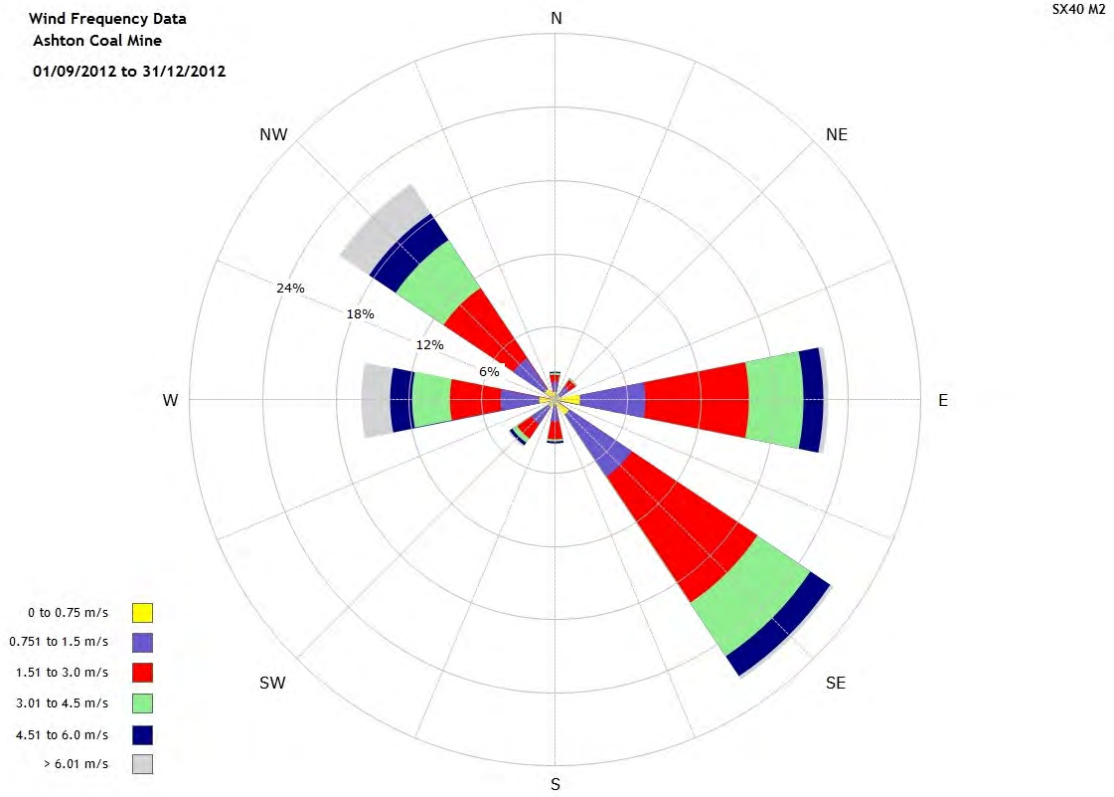

Figure 9. 1/9/2012 to 31/12/2012 Windrose

3.1.3 Air Quality Criteria and Monitoring

A network of real-time environmental monitoring stations was installed prior to the commencement of operations and is utilised to ensure continued compliance with the criteria established in the Development Consent and the EPL, assist in management decisions, and respond to community complaints and enquiries.

3.1.3.1 Particulate Matter < 10µg (PM_{10})

During the previous reporting period MOD7 of DA No. 309-11-2001-i was approved by the DoP&I. From this MOD approval a major change to Air Quality criteria occurred, where in DC's *Table 5: Short term criterion for particulate matter*, the maximum cumulative 24 hour average changed from 150µg/m^3 to 50µg/m^3.

The criteria for particulate matter less than 10µm (PM_{10}) is as follows:

- Annual mean less than 30µg/m^3 on a cumulative basis; and
- Maximum cumulative 24 hour average not to exceed 50µg/m^3.

Locations of PM_{10} monitoring stations are detailed on **Figure 11** and **Table 14**.

Table 14. LOCATION OF PM_{10} MONITORING STATIONS

Monitoring Station No	Monitor Purpose	Location
1	Community Site	Camberwell village (north)
2	Community Site	Camberwell village (south)
3	Community Site	Property east of Camberwell village
4	Background (upwind) Site	Onsite near Dam 56
7	Background (upwind) Site	Onsite at north-western end of rail siding
8	Community Site	Camberwell village (east)

Monitoring Locations 4 and 7 are situated to the north of mining operations, immediately south of the Main Northern Railway and are intended to monitor the incoming concentrations of PM_{10} dust when the prevailing winds are from the northwest, which is the wind direction that presents the greatest risk of Ashton mine impacting the village of Camberwell.

The Ashton contribution to the concentration of PM_{10} at community sites is calculated by subtracting the incoming dust concentration (the lowest level recorded at sites 4 or 7 is used for this calculation) from the ambient level of dust concentration at the four community sites. This is a very conservative calculation.

PM_{10} data for the reporting period is presented below. The monitoring results indicate that;

- The annual cumulative average at all 4 Community sites (1, 2, 3 and 8) was below the annual criteria of 30µg/m³ for the period; and
- There were 23 occasions where the 24 hour cumulative average criteria of 50µg/m³ was exceeded at the community sites (1, 2, 3 and 8), however at the two background sites (4 and 7) there were 52 occasions of exceedances.
- Of the exceedances which occurred during September 2011 when the NEOC was operating the wind direction was from the north-west and the background sites (Site 4 & 7) had higher dust levels than the community sites indicating that the NEOC did not contribute to the dust exceedances.
- The exceedances which occurred from August 2012 through to December 2012 were not attributed to ACOL as the NEOC was no longer operating and all of the available overburden dump had been reshaped and rehabilitated by the end of May 2012.

Only minor PM_{10} data loss events occurred during the reporting period, which were generally caused by equipment failure or power outage.

Historic Trends

Historic pre ACOL PM_{10} results from 1996 to 2001 are available for a monitoring location in close proximity to ACOL's Site 1. These results are shown below. It is difficult to undertake a direct comparison of these results with the the ACOL monitoring results as the historic results are based on the operation of a HVAS PM_{10} operated every 6 days and the ACOL monitoring system is a realtime monitoring system operating 24 hours a day 7 days a week . The results however do give an indication of the historic PM_{10} levels within the Village of Camberwell prior to the commencment of the ACOL operations. As seen in the graph below there are several periods in time where the historic annual average is above the cummulative annual average criteria of 30µg/m^3.

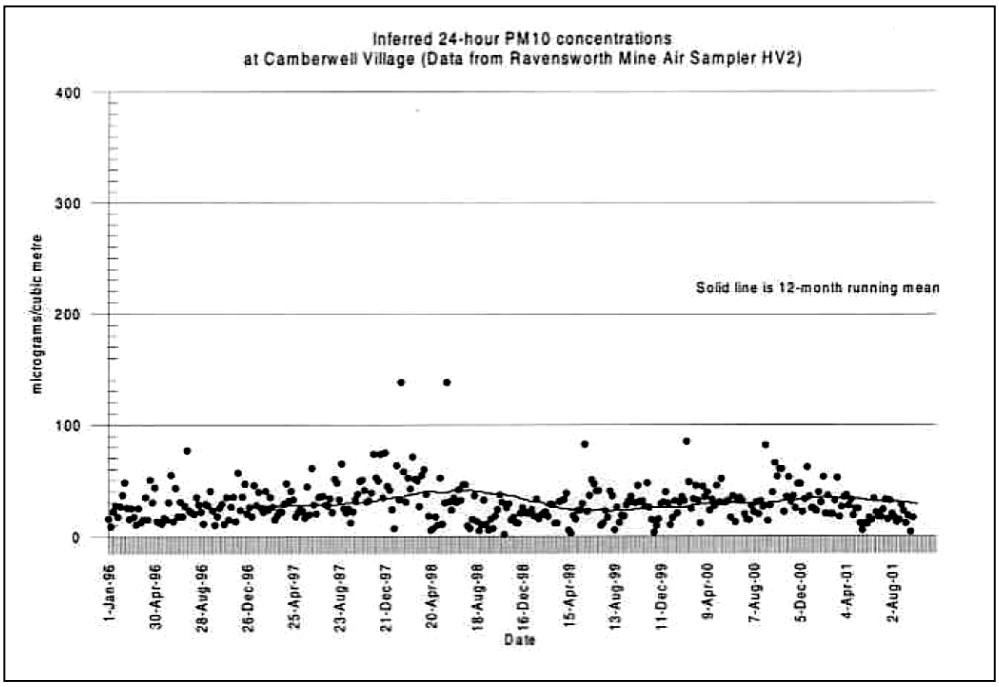

Figure 10. Historic Pre ACOL 24-hr PM_{10} Data

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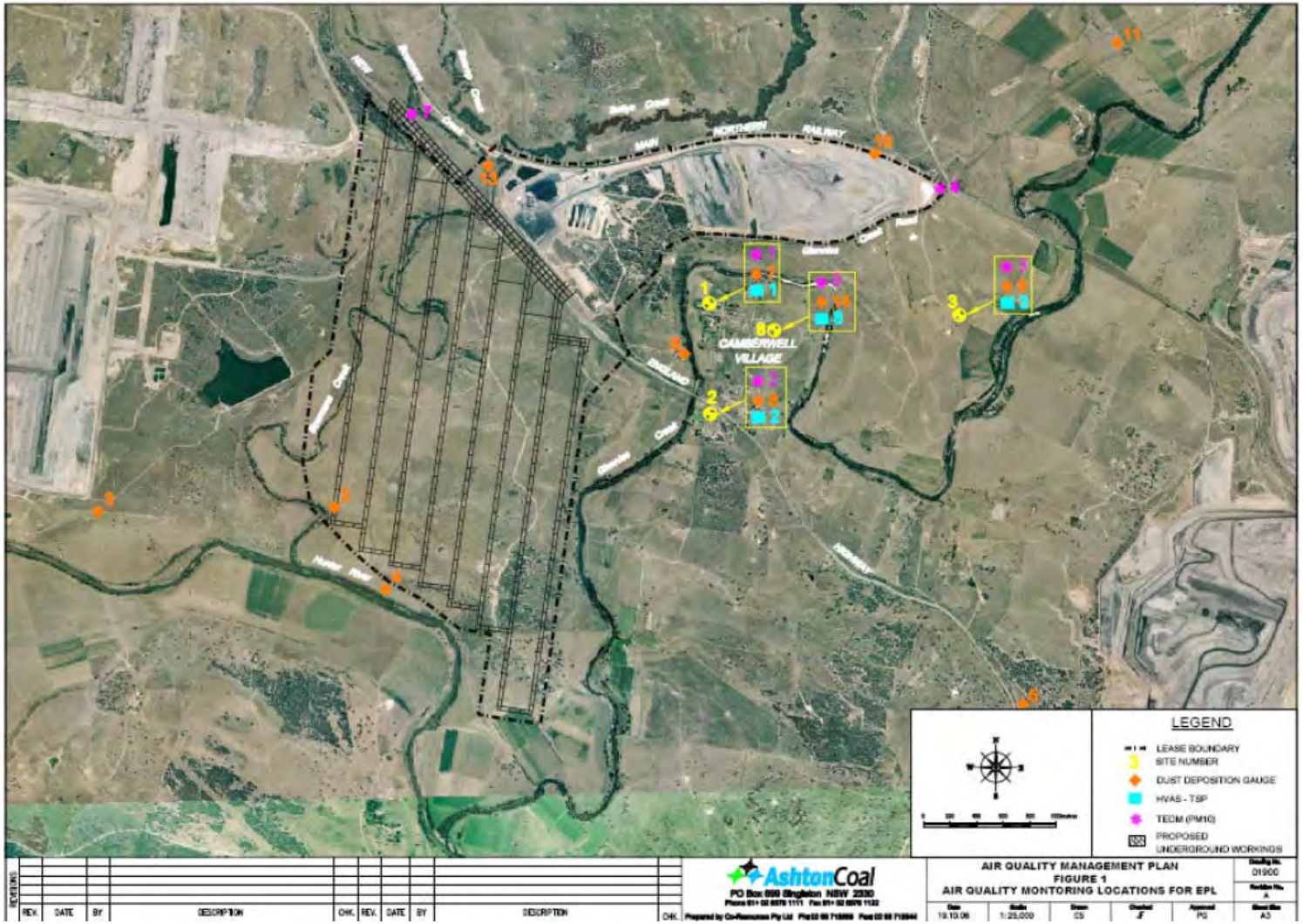

Figure 11. Air Quality Monitoring Locations

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Site 1 TEOM (Community Site)

For the reporting period 98.2% of Site 1 available data was captured, data losses were due to electrical maintenance and power outages. The rolling average PM_{10} results for Site 1 (22µg/m^3) demonstrate compliance with the annual goal of 30µg/m^3 (**Figure 12**). There were 13 days where Site 1 exceeded the maximum 24hr Criteria of 50µg/m^3.

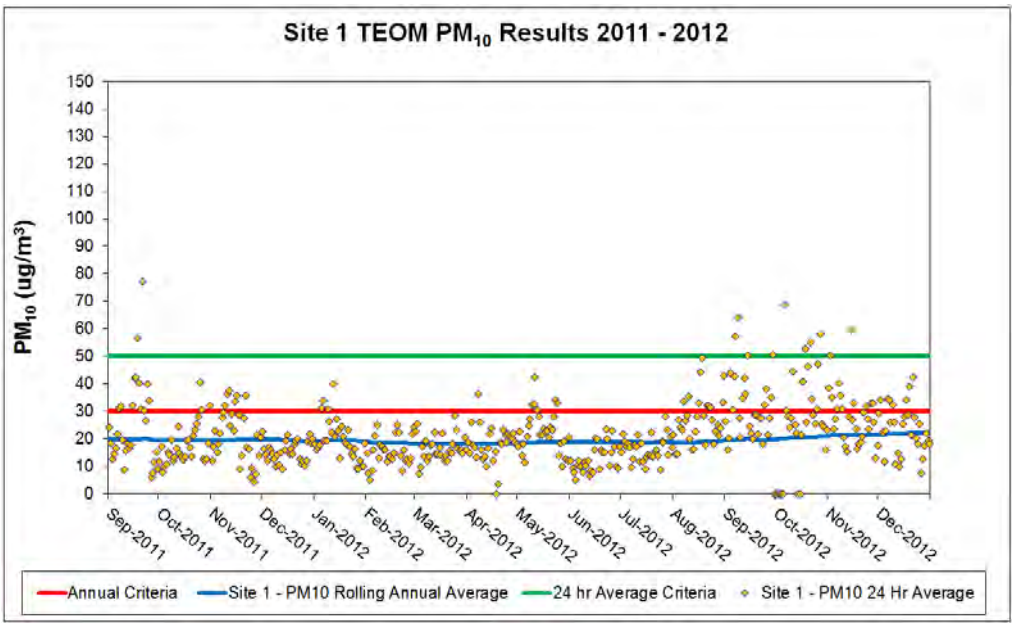

Figure 12. TEOM PM_{10} results for Site 1 - 2011-12 reporting period

Site 2 TEOM (Community Site)

For the reporting period 99.0% of Site 2 available data was captured, data losses were due to power outages. The rolling average PM_{10} results for Site 2 (17µg/m^3) demonstrate compliance with the annual goal of 30µg/m^3 (**Figure 13**). There were 2 days where Site 2 exceeded the maximum 24hr Criteria of 50µg/m^3.

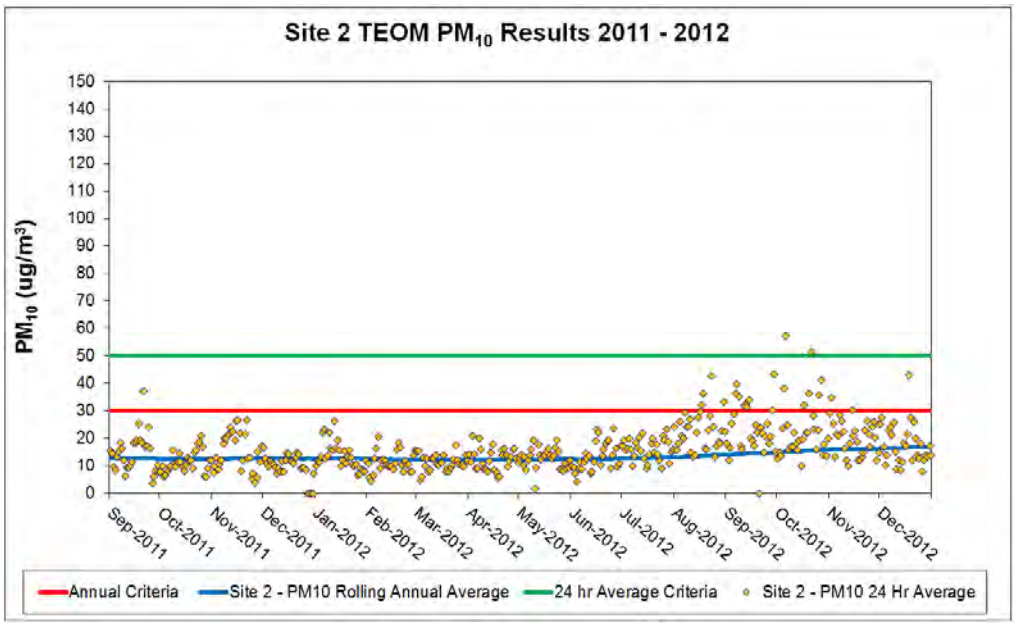

Figure 13. TEOM PM_{10} results for Site 2 - 2011-12 reporting period

Site 3 TEOM (Community Site)

Site 3 is located on a farming property to the east of the Eastern Emplacement Area (OC overburden dump). For the reporting period 96.3% of Site 3 available data was captured, the data loss was due to an air conditioner failure. The rolling average PM_{10} results for Site 3 (25 µg/m^3) demonstrate compliance with the annual criteria of 30µg/m^3 (**Figure 14**). There were 20 days where Site 3 exceeded the maximum 24hr Criteria of 50µg/m^3.

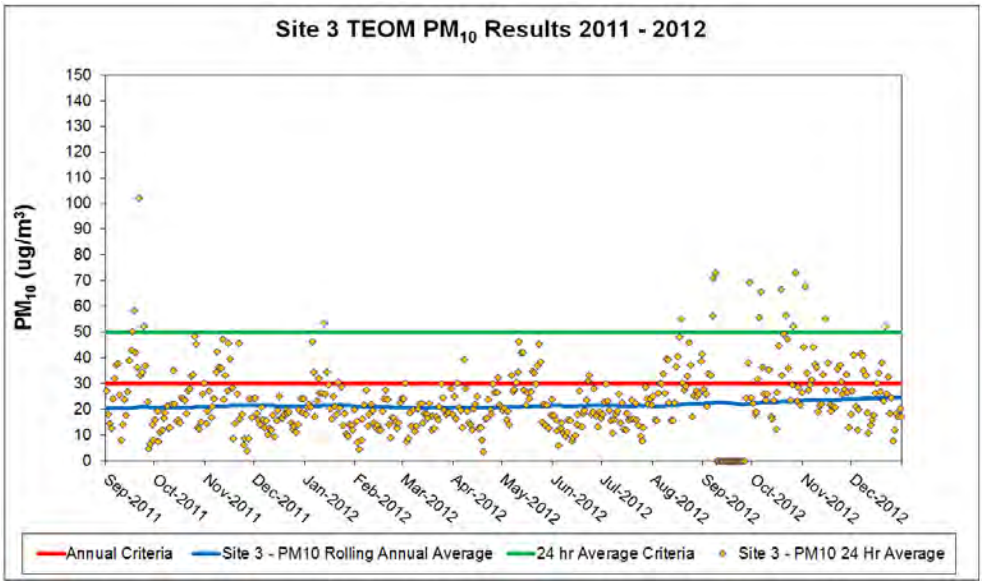

Figure 14. TEOM PM_{10} results for Site 3 - 2010-11 reporting period

Site 8 TEOM (Community Site)

Site 8 is located on the eastern side of Camberwell Village. The site recorded a 99.8% data recovery rate; the loss of data was due to a power outage. Site 8 (23µg/m^3) showed compliance with the annual criteria of 30µg/m^3 (**Figure 15**). There were 15 days where Site 8 exceeded the maximum 24hr Criteria of 50µg/m^3.

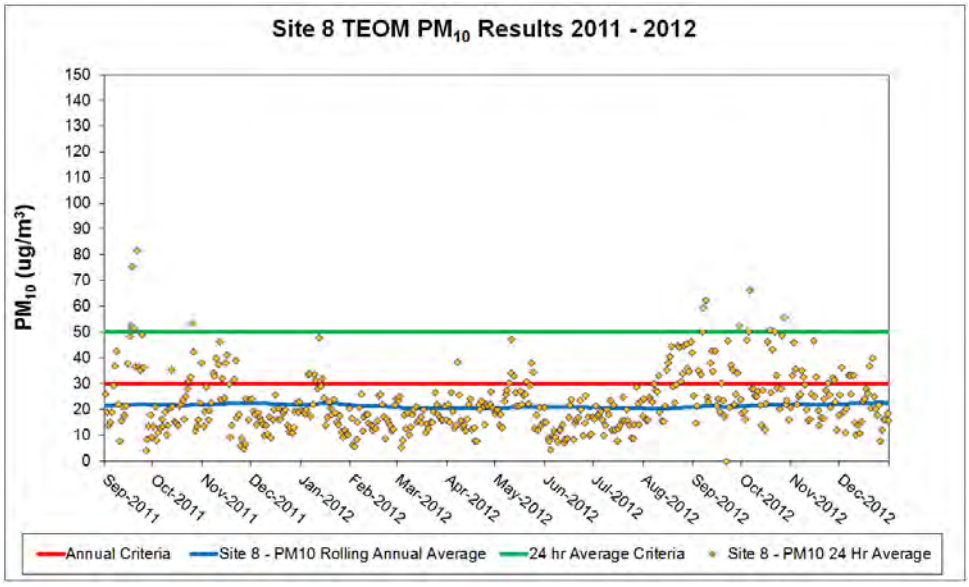

Figure 15. TEOM PM_{10} results for Site 8 during the 2011-12 reporting period

Site 4 / 7 TEOMs (Onsite – Background, Upwind Sites)

The annual criterion of 30µg/m^3 is not expected to apply to onsite TEOMs however the annual criterion was still achieved at Site 4 and 7. Comparison of Site 4 and 7 results show why Site 7 is selected for most calculations of Ashton's Contribution. It is generally the lowest of the background TEOMs.

Site 4 (30µg/m^3) is located on the eastern tip of the eastern emplacement area, next to Dam 56. For the reporting period 96.3% of Site 4 available data was captured, the data losses were due to an air conditioner failure and power outages. There were 49 days where Site 4 exceeded the maximum 24hr Criteria of 50µg/m^3.

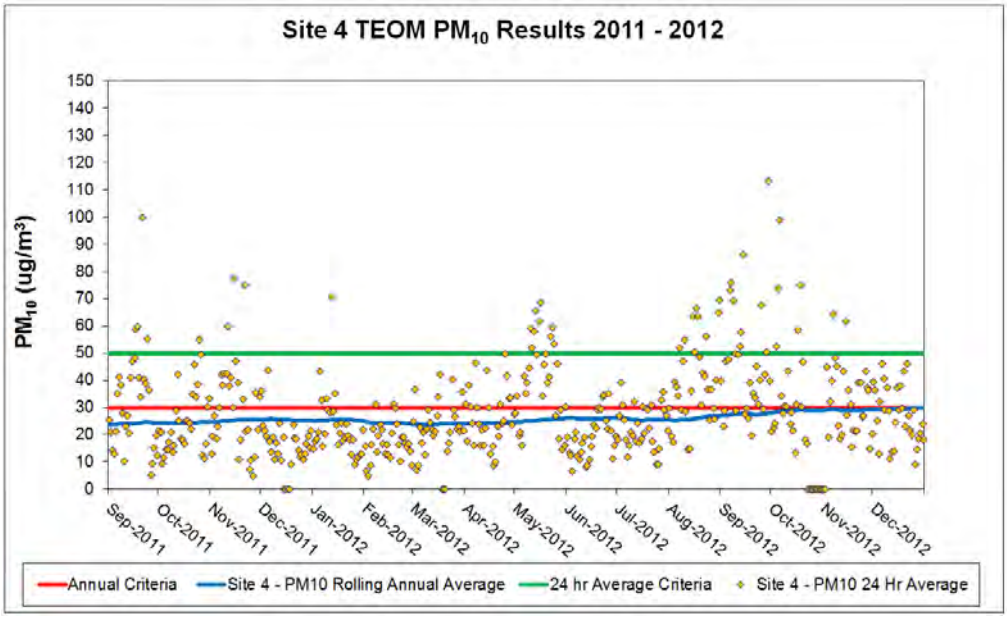

Figure 16. TEOM PM_{10} results for Site 4 during the 2011-12 reporting period

Site 7 (24µg/m^3) is more remote from mining operations. 99.8% of the data was recovered from this site during the monitoring period; the loss of data was due to a pump unit failure. There were 17 days where Site 7 exceeded the maximum 24hr Criteria of 50µg/m^3.

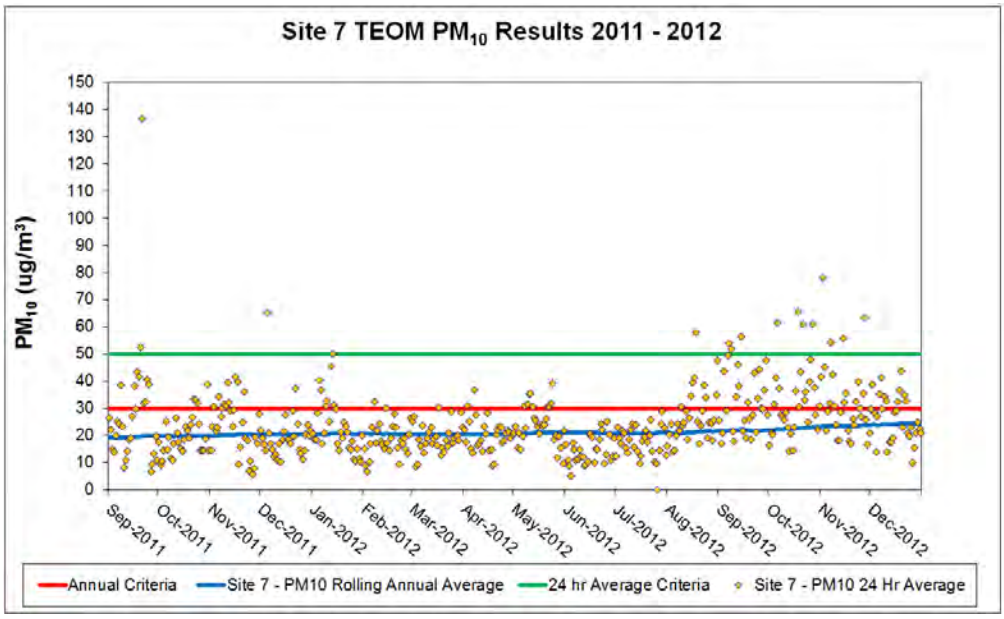

Figure 17. TEOM PM_{10} results for Site 7 during the 2011-12 reporting period

3.1.3.2 Total Suspended Particulate Matter

The High Volume Air Samplers (HVAS) operate for a 24 hour period on every sixth day (specified OEH schedule). HVAS measure cumulative dust levels from all sources. The criterion applicable to these gauges is an annual average of 90µg/m^3. 100% of data was recovered at all sites. There is no 24 hour criterion for Total Suspended Particulates (TSP).

The locations of High Volume Air Samplers to monitor TSP are shown in **Figure 11** above and detailed in **Table 15**.

Table 15. LOCATION OF TSP MONITORING STATIONS

Monitoring Station No	Location
1	Camberwell village (north)
2	Camberwell village (south)
3	Property east of Camberwell village
8	Camberwell village (east)

Historic Trends

Historic TSP results are available for a location close to Site 1 in Camberwell Village. The results for this site are shown below. They show historically prior to the commencement of the ACOL operations the annual average has exceeded the 90µg/m^3 (annual mean) criteria at various times.

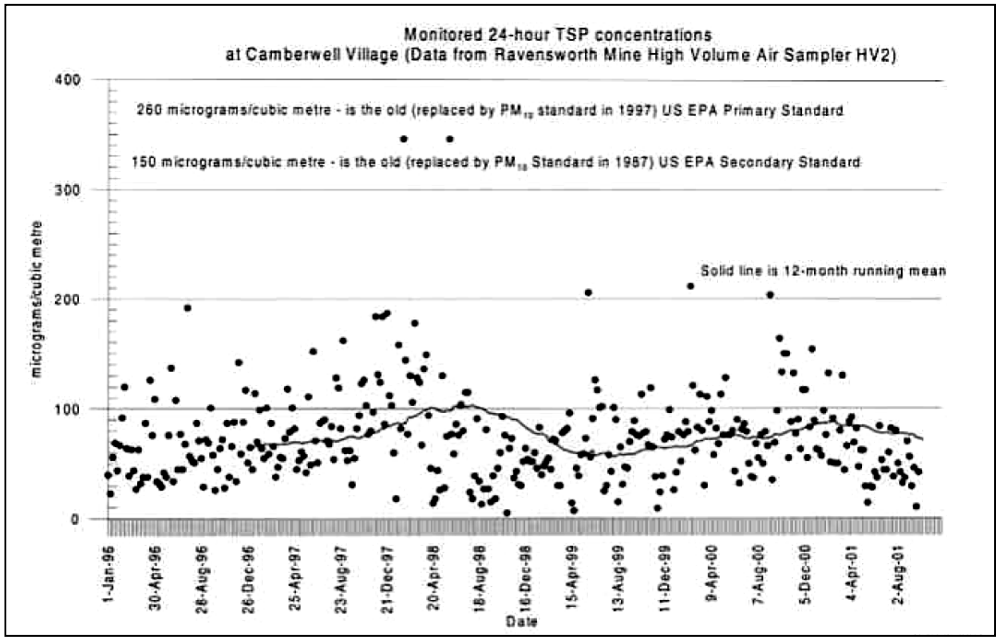

Figure 18. Historical TSP Data

HVAS TSP Rolling Annual Average

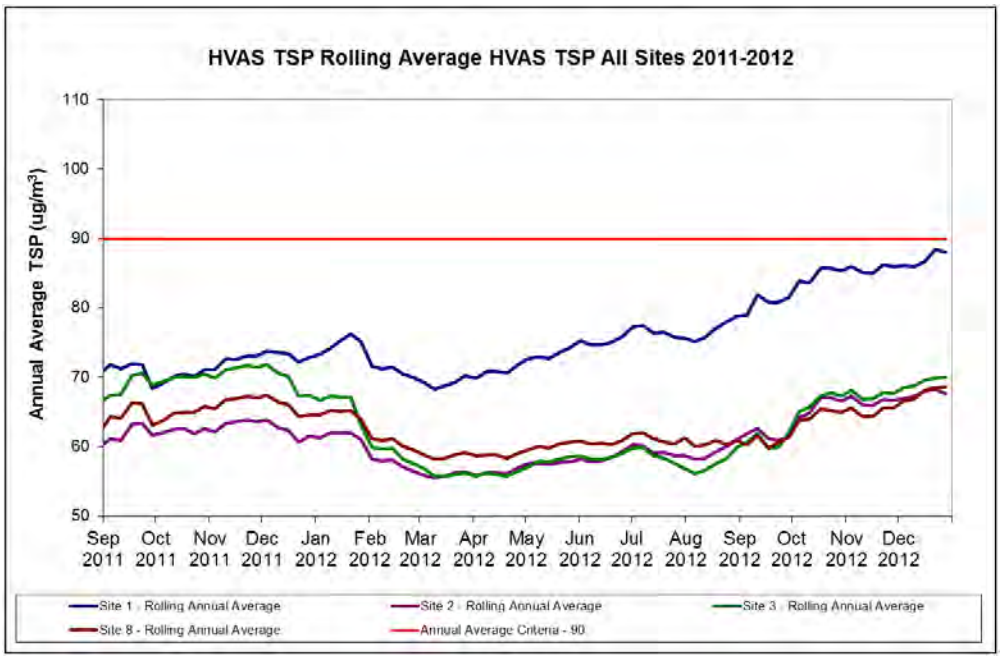

Figure 19. HVAS Total Suspended Particulates for all sites during 2011-12

All four HVAS TSP monitors complied with the annual average criteria of 90µg/m^3. Site 1 had a slightly increasing trend over the reporting period, whereas sites 2, 3 and 8 all had a steady trend over the reporting period (**Figure 19**).

Site 1 HVAS

The cumulative rolling annual average for TSP at Site 1 (88µg/m^3) demonstrated compliance with the annual average criteria of 90µg/m^3. (**Figure 20**)

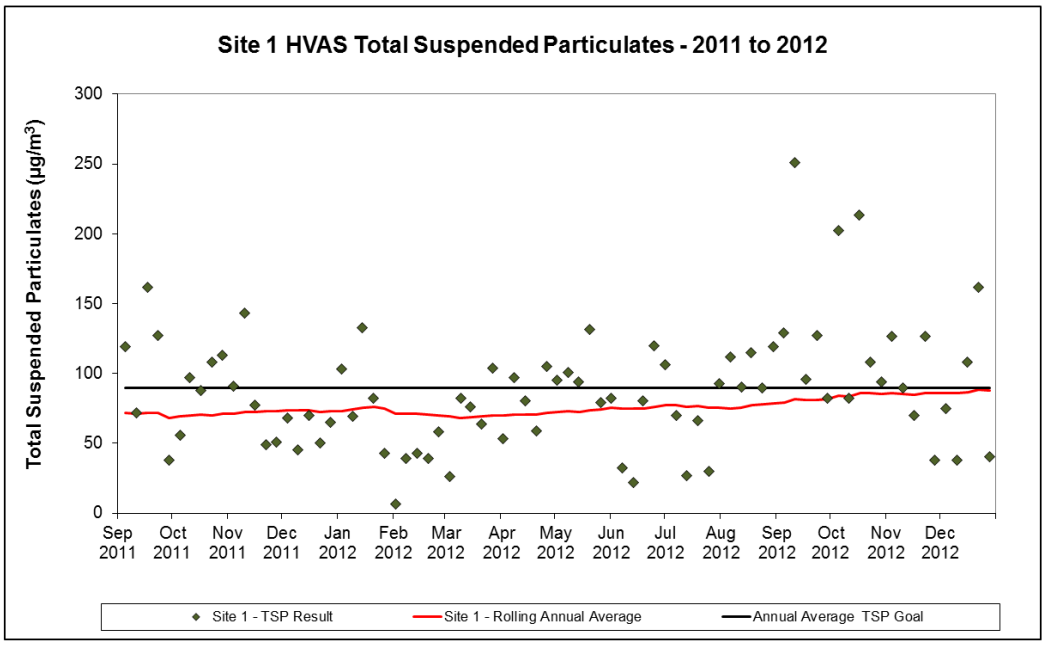

Figure 20. HVAS TSP for Site 1 during the 2011-12 reporting period

Site 2 HVAS

The cumulative rolling average TSP results for Site 2 (68µg/m^3) complied with the annual average TSP goal of 90µg/m^3 for the reporting period. (**Figure 21**)

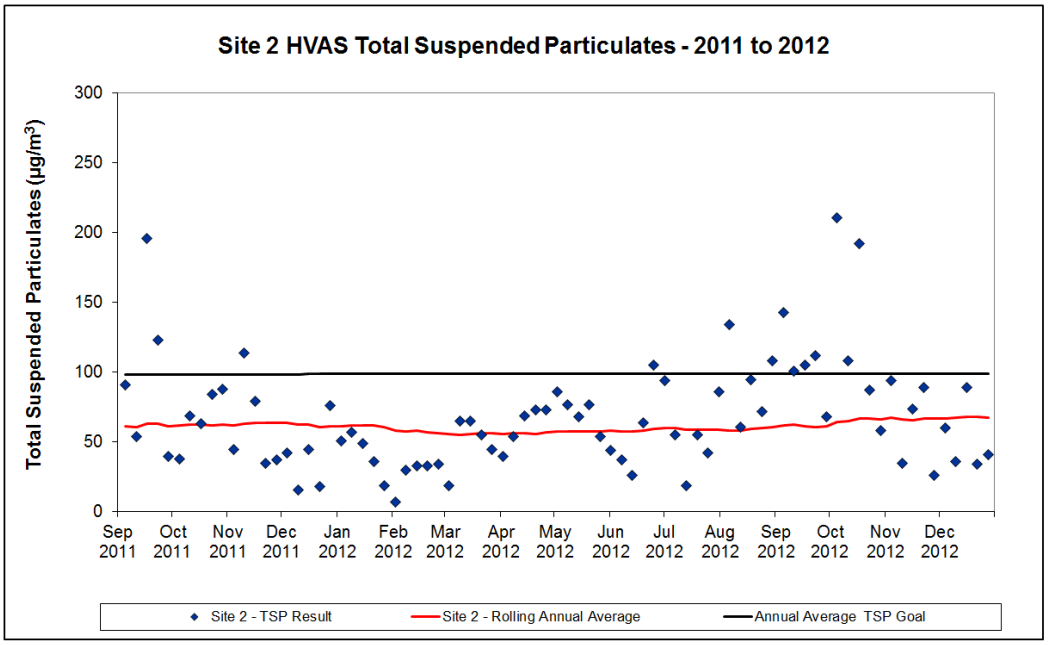

Figure 21. HVAS TSP for Site 2 during the 2011-12 reporting period

Site 3 HVAS

The cumulative rolling average TSP results for Site 3 (70µg/m^3) complied with the annual average TSP goal of 90µg/m^3 for the reporting period (**Figure 22).**

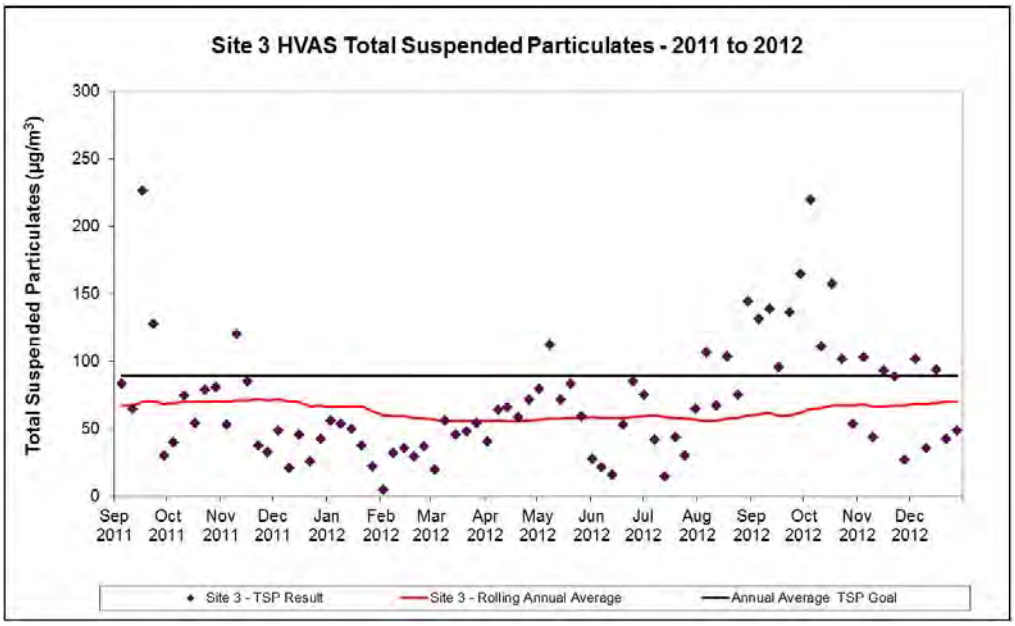

Figure 22. HVAS TSP for Site 3 during the 2011-12 reporting period

Site 8 HVAS

The cumulative rolling average TSP results for Site 8 (69µg/m^3) complied with the annual average TSP goal of 90µg/m^3 for the reporting period (**Figure 23**).

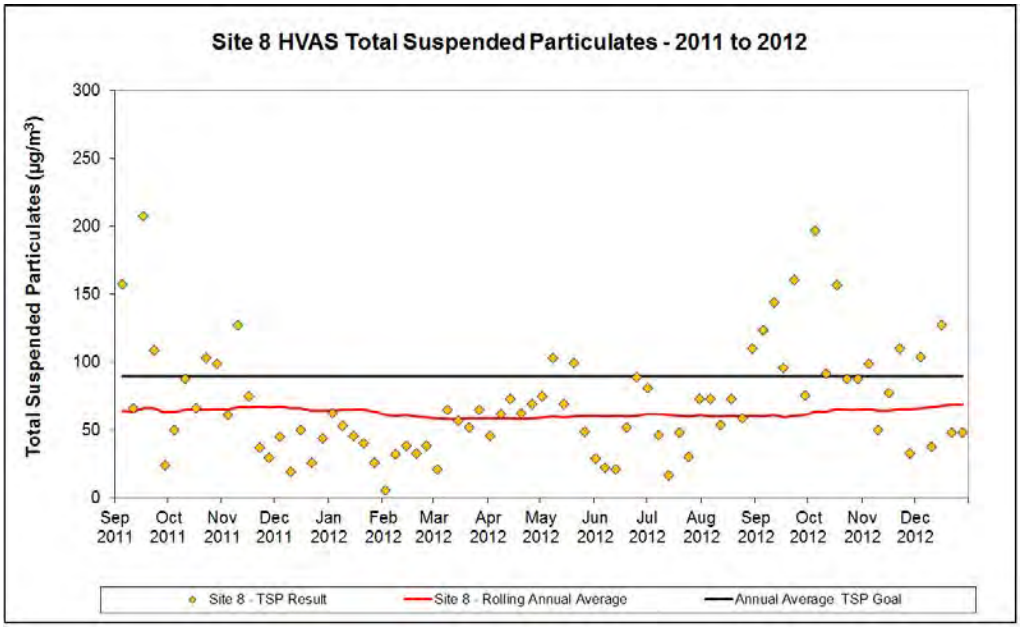

Figure 23. HVAS TSP for Site 8 during the 2011-12 reporting period

3.1.3.3 Dust Deposition Gauges

The locations of Dust Deposition gauges are shown in **Figure 11** and detailed in **Table 16**.

Table 16. **DEPOSITIONAL DUST GAUGE LOCATIONS**

Monitoring Station No	Location
2	Ravensworth property west of open cut
4	Ashton property near Hunter River
5	New England Highway SE of Camberwell village
6	St Clements Church
7	TEOM site 1 – Camberwell Village
8	TEOM site 2 – Camberwell Village
9	TEOM site 3 – Property east of Camberwell
10	Onsite - TEOM site 4 (near Dam 56)
11	Northeast of Eastern Emplacement Area on Glennies Creek Rd
13	Onsite – TEOM site 7
14	TEOM site 8 – Camberwell Village

Data recovery for all depositional dust gauges are shown in **Table 17.**

Table 17. **DUST DEPOSITION GAUGES – DATA RECOVERY**

Gauge Number	Data Availability (%)
D2	100%
D4	100%
D5	100%
D6	100%
D7	100%
D8	100%
D9	100%
D10	100%
D11	100%
D13	100%
D14	100%

Table 18 and **Figure 24** show the annual average insoluble solids for each gauge over the 2011 – 2012 reporting period. Gauges D2, D4, D5 and D10 exceeded the annual average of 4g/m²/month for the reporting period. Gauge D10 is an onsite gauge to which criteria is not expected to apply. D2, D4 and D5 are all located along ACOL's southern boundary of the Mining Lease, along with the Open Cut ceasing mining operations in September 2011 it is likely that these exceedances are not due to ACOL's operations.

Table 18. INSOLUBLE SOLIDS ANNUAL AVERAGE RESULTS (EXCLUDING CONTAMINATED GAUGES)		
Dust Gauge	**Annual Average EIS Background Values (g/m^2.month)**	**Rolling Annual Average 2012 (g/m^2/month)**
D2	3.5	4.73
D4	1.6	5.40
D5	2.0	4.78
D6	1.5	3.20
D7	NA	3.16
D8	NA	2.88
D9	NA	3.24
D10 (onsite)	NA	4.39
D11	NA	3.76
D13 (onsite)	NA	3.75
D14	NA	2.87

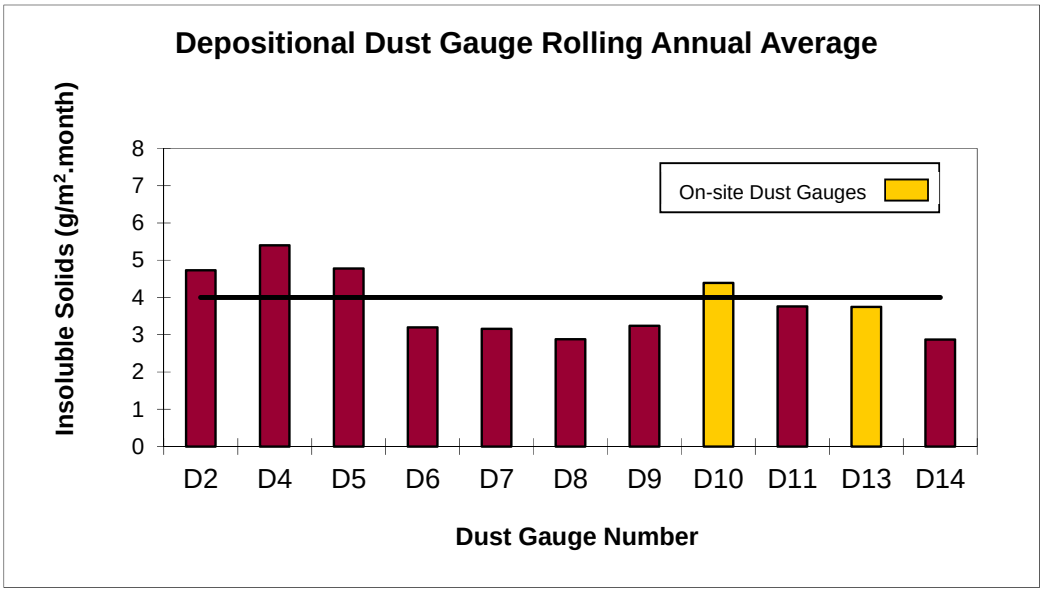

Figure 24. Depositional Dust Rolling Annual Average 2012

3.2 EROSION AND SEDIMENT

3.2.1 Erosion and Sediment Management

All runoff from disturbed areas is collected in a series of sedimentation and settling dams established in accordance with the Site Water Management Plan (SWMP). Monitoring indicates that these dams have been working effectively in controlling sediment flow.

Major runoff storage dams are located in the following areas:

- On the north-west side of the CHPP (Process Water Dam and Settling Dam);
- On the eastern side of the Eastern Emplacement Area (Dam 56); and

In addition, there are a number of minor runoff capture dams that intercept runoff water before it departs site.

3.2.2 Erosion and Sediment Monitoring

Visual inspections are undertaken on a regular basis and stream water quality results are presented in the following section.

3.3 SURFACE WATER

3.3.1 Surface Water Management

ACOL has an approved Site Water Management Plan. Controls have been put in place in accordance with this plan to control potential causes of water pollution. These controls are considered to have been adequate for the reporting period.

3.3.2 Surface Water Monitoring

The water monitoring locations are shown in **Figure 25** and detailed in **Table 19**.

Table 19. **SURFACE WATER MONITORING LOCATIONS**

Monitoring Station	Stream	Location
SM 1	Bettys Creek	Glendell land upstream of Ashton
SM 2	Bettys Creek	Just upstream of confluence with Bowmans Creek
SM 3	Bowmans Creek	Water pool at north west corner of mine lease
SM 4	Bowmans Creek	Water pool immediately downstream of New England Highway
SM 5	Bowmans Creek	Halfway down Ashton property
SM 6	Bowmans Creek	Just upstream of confluence with Hunter River
SM 7	Glennies Creek	Upstream of Ashton Mine
SM 8	Glennies Creek	Halfway down Ashton property
SM 9	Hunter River	Upstream of confluence with Bowmans Creek
SM 10	Hunter River	Downstream of confluence with Bowmans Creek
SM 11	Glennies Creek	Upstream of confluence with Hunter River
SM 12	Hunter River	Downstream of confluence with Glennies Creek
SM 13	Hunter River	Upstream of confluence with Glennies Creek midway between Bowmans Creek and Glennies Creek
SM 14	Hunter River	Directly upstream of confluence with Glennies Creek

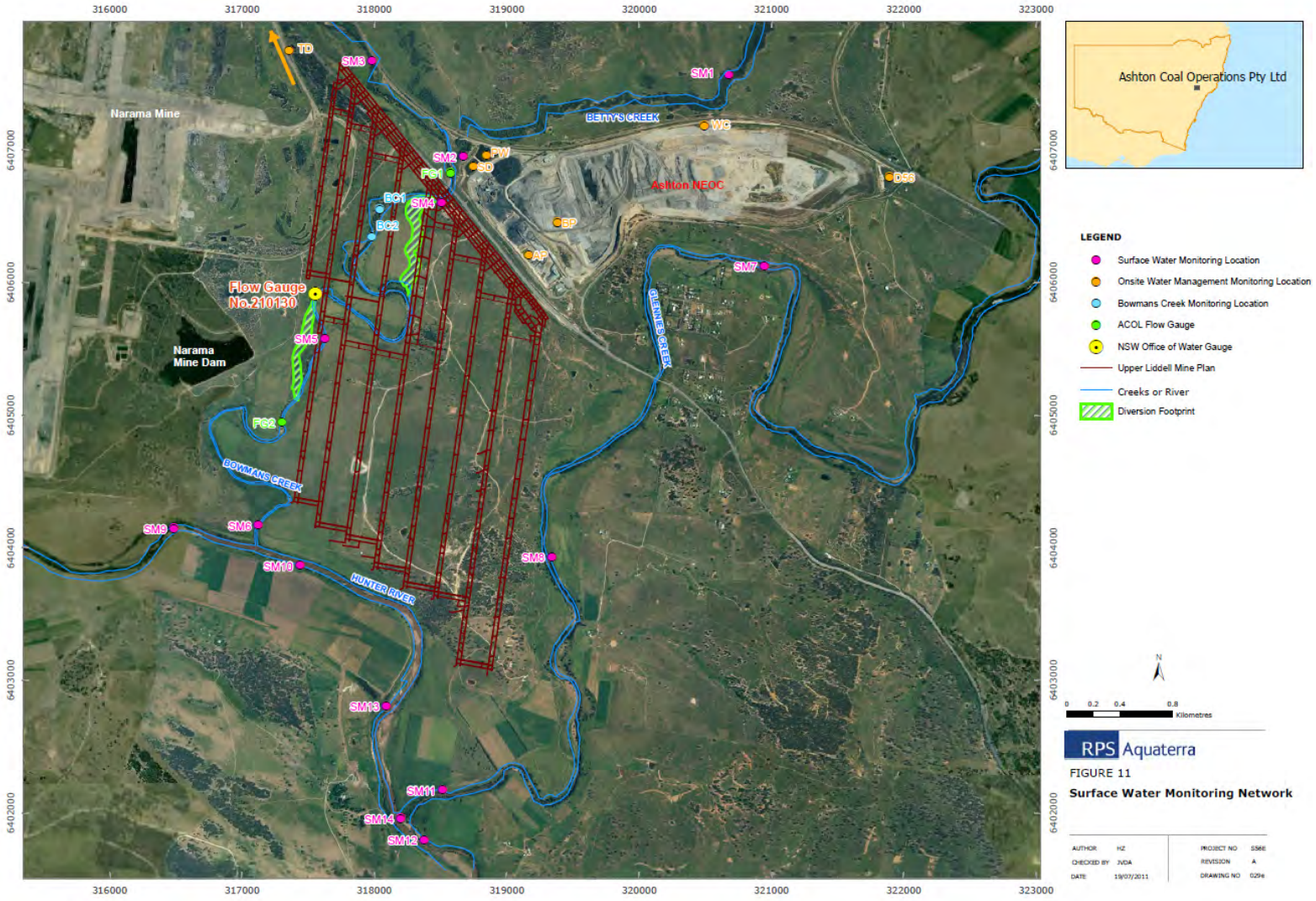

Figure 25. Water Quality Monitoring Location

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3.3.2.1 Monthly Water Quality Monitoring Results

Monthly water samples were collected and analysed during the reporting period for pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Suspended Solids (TSS) Total Hardness ($CaCO_3$), and Oil and Grease (O&G).

Most of the time monitoring locations SM1 and SM2 in Betty's Creek were dry. At different times monitoring locations SM6, SM9 and SM12 were unable to be sampled due to access issues with flooding during the months of December 2011, February and March 2012 as shown in following results table, these results are indicated as 'NS' not sampled.

During October 2012 the laboratory contracted to undertake the water sample analysis for ACOL missed analysing the samples for TSS resulting in a no result, as seen in **Table 23**.

pH

Results of monthly water quality monitoring in Bowmans Creek, Glennies Creek and the Hunter River (**Table 20**) indicate that pH levels throughout the reporting period were consistently neutral to slightly alkaline (7.2 - 8.6).

Table 20. **pH RESULTS 2011 - 2012**

pH	SM 1	SM 2	SM 3	SM 4	SM 5	SM 6	SM 7	SM 8	SM 9	SM 10	SM 11	SM 12	SM 13	SM 14
Sep-11	Dry	Dry	7.9	7.9	7.9	8.0	8.0	8.0	8.2	8.2	7.9	8.1	8.2	8.2
Oct-11	7.8	7.6	8.2	7.7	8.0	8.0	8.0	7.9	8.2	7.9	7.9	8.1	8.2	8.2
Nov-11	Dry	Dry	8.1	8.1	8.1	8.1	8.0	8.0	8.3	8.3	7.9	8.3	8.3	8.3
Dec-11	Dry	Dry	8.1	8.0	8.0	NS	7.9	7.8	NS	8.0	7.8	NS	8.0	8.1
Jan-12	Dry	Dry	8.1	8.2	8.2	8.1	8.1	8.1	8.5	8.6	8.2	8.5	8.5	8.6
Feb-12	7.2	7.2	7.9	7.7	7.8	7.8	7.7	7.8	NS	7.8	7.8	7.8	7.9	8.1
Mar-12	8.2	8.0	8.1	8.1	8.1	8.2	8.0	8.0	8.3	8.3	8.0	NS	8.3	8.3
Apr-12	Dry	Dry	8.1	8.1	8.0	8.1	8.0	8.0	8.3	8.3	8.1	8.2	8.3	8.1
May-12	Dry	Dry	7.8	7.9	8.0	8.1	8.0	8.1	8.3	8.3	8.1	8.2	8.3	8.3
Jun-12	Dry	Dry	8.1	8.2	8.0	8.1	8.0	8.1	8.4	8.4	8.1	8.4	8.5	8.4
Jul-12	7.6	7.6	8.1	8.1	8.1	8.1	8.0	8.0	8.2	8.2	8.0	8.1	8.2	8.2
Aug-12	Dry	Dry	8.0	8.1	8.1	8.2	8.1	8.1	8.1	7.9	8.1	7.6	8.4	8.5
Sep-12	Dry	Dry	7.8	8.0	8.2	8.1	8.0	8.0	8.4	8.4	8.0	8.4	8.4	8.4
Oct-12	Dry	Dry	7.7	8.2	8.1	8	8.0	8.0	8.4	8.4	8.1	8.2	8.3	8.4
Nov-12	Dry	Dry	7.5	8.1	8.2	7.9	7.8	7.8	8.4	8.4	7.9	8.2	8.3	8.4
Dec-12	Dry	Dry	7.8	8.1	8.2	8.0	8.0	8.0	8.4	8.4	8.1	8.1	8.3	8.3
Minimum	7.2	7.2	7.5	7.7	7.8	7.8	7.7	7.8	8.1	7.8	7.8	7.6	7.9	8.1
Average	7.7	7.6	8.0	8.0	8.1	8.1	8.0	8.0	8.3	8.2	8.0	8.2	8.3	8.3
Maximum	8.2	8.0	8.2	8.2	8.2	8.2	8.1	8.1	8.5	8.6	8.2	8.5	8.5	8.6

pH levels in Bowmans Creek (SM3, SM4, SM5 and SM6) were slightly alkaline (ranging from 7.5 to 8.2) and remained within the acceptable pH range (**Figure 26**).

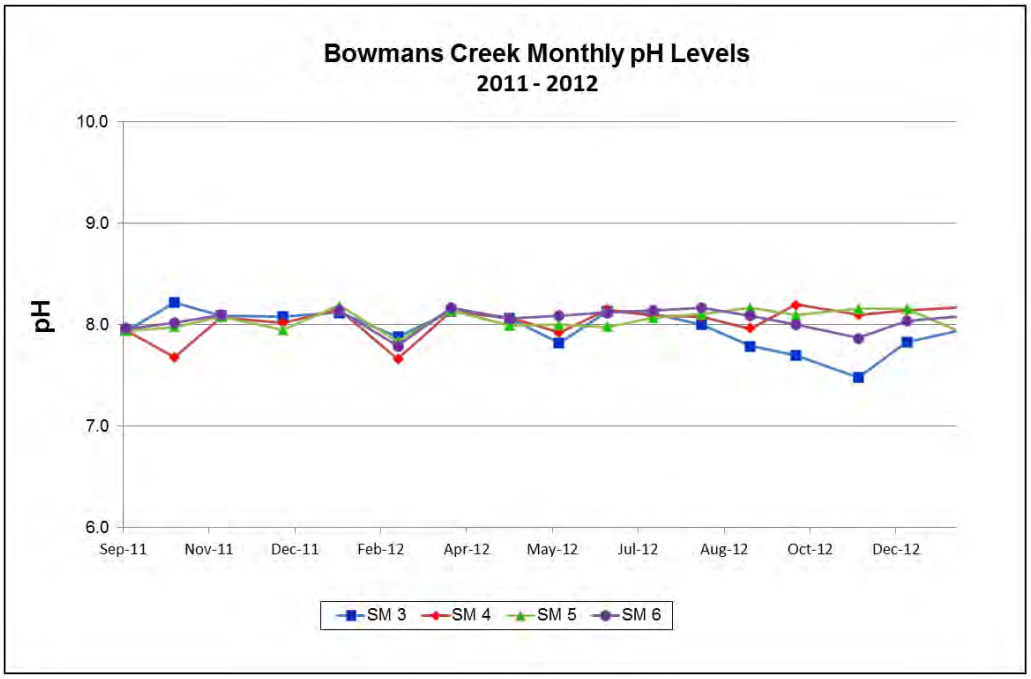

Figure 26. Monthly pH levels at Bowmans Creek sites 2011-12

Glennies Creek (SM7, SM8 and SM11) pH levels were slightly alkaline (ranging from 7.7 to 8.2) with little variation between sites for most of the year (**Figure 27**). The pH levels remained within the acceptable recommended pH range.

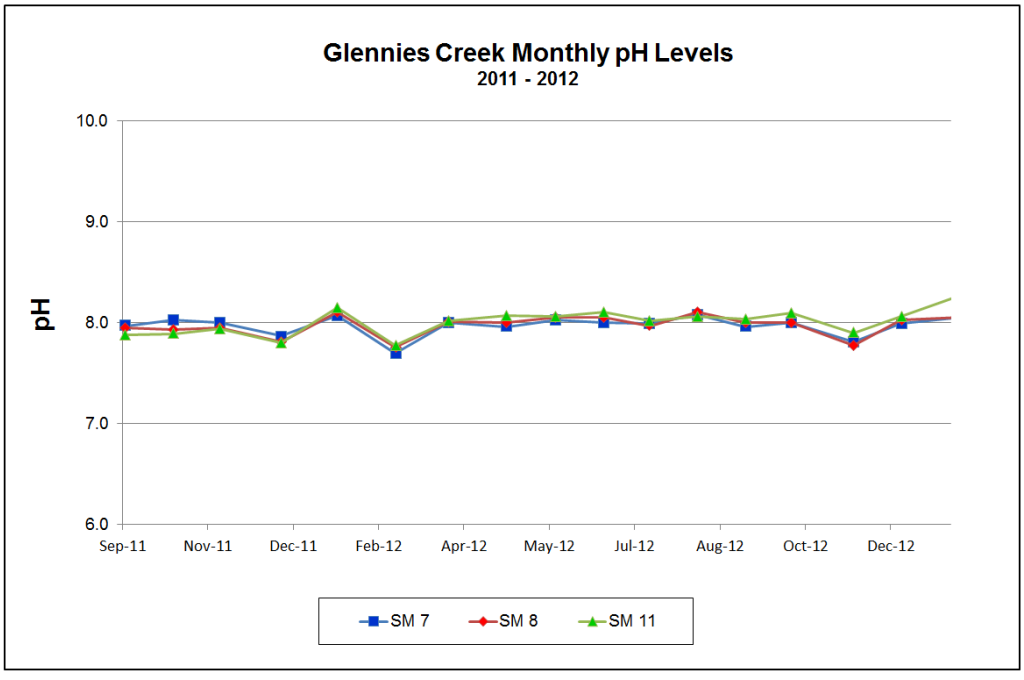

Figure 27. Monthly pH levels at Glennies Creek sites 2011-12

pH levels in the Hunter River (SM9, SM10, SM12, SM13 and SM14) were neutral to slightly alkaline (ranging from 7.6 to 8.6) with minimal variation between sites, and remained within the acceptable recommended pH range (**Figure 28**). Similar to Glennies Creek slight pH fluctuations throughout the reporting period followed a very similar pattern across all sites, this is due to both the Hunter River and Glennies Creek having regulated flows.

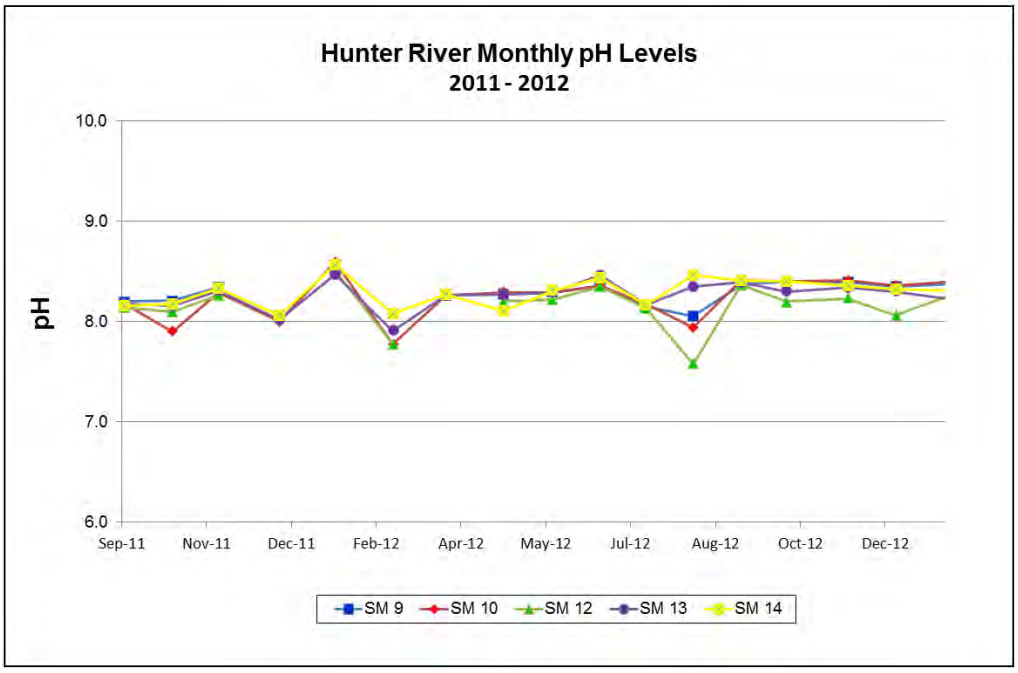

Figure 28. Monthly pH levels at Hunter River sites 2011-2012

Electrical Conductivity (EC)

Results from monthly readings indicate an EC range from 139-3020 µS/cm. Bowmans Creek sites (SM3, SM4, SM5 and SM6) generally experienced higher EC compared to other sites. This is due to an inflow of saline ground water which forms most of the flow during dry months and low surface flow periods, resulting in increased EC levels.

Monthly EC results measured in µS/cm are displayed in **Table 21**.

Table 21. **ELECTRICAL CONDUCTIVITY RESULTS 2011 - 2012**

EC (µS/cm)	SM 1	SM 2	SM 3	SM 4	SM 5	SM 6	SM 7	SM 8	SM 9	SM 10	SM 11	SM 12	SM 13	SM 14
Sep-11	Dry	Dry	852	864	889	888	814	829	789	789	428	432	424	446
Oct-11	510	366	630	604	613	610	453	433	667	665	439	612	592	660
Nov-11	Dry	Dry	847	845	839	853	562	540	1000	968	562	947	981	981
Dec-11	Dry	Dry	511	510	507	NS	378	338	NS	516	345	NS	605	604
Jan-12	Dry	Dry	951	982	939	1010	403	416	840	845	441	783	846	847
Feb-12	140	139	365	329	362	391	312	315	NS	396	322	378	421	448
Mar-12	2950	3020	915	915	893	913	306	310	561	586	320	NS	572	580
Apr-12	Dry	Dry	990	995	962	992	452	458	893	902	472	794	897	881
May-12	Dry	Dry	940	987	923	1020	414	413	978	977	432	848	973	977
Jun-12	Dry	Dry	847	861	858	861	293	297	691	705	298	556	701	701
Jul-12	472	509	632	631	629	891	278	282	576	691	279	444	614	616
Aug-12	Dry	Dry	950	965	944	990	496	522	663	676	554	656	663	669
Sep-12	Dry	Dry	996	1200	972	1280	450	463	1030	1040	476	965	1040	1040
Oct-12	Dry	Dry	962	1760	954	1520	277	281	1160	1150	279	782	1150	1150
Nov-12	Dry	Dry	978	2650	1000	1870	245	246	1210	1210	246	557	1230	1230
Dec-12	Dry	Dry	951	3010	1010	1740	235	234	958	960	244	468	955	960
Minimum	140	139	365	329	362	391	235	234	561	396	244	378	421	446
Average	1018	1009	832	1132	831	1055	398	399	858	817	384	659	792	799
Maximum	2950	3020	996	3010	1010	1870	814	829	1210	1210	562	965	1230	1230

Electrical Conductivity (EC) levels in Bowmans Creek fluctuated between 329 µS/cm and 3010 µS/cm (**Figure 29**). Elevated levels in EC at SM4 have been observed previously and result from natural saline groundwater inflows to the pool. During periods of low flow in Bowmans Creek, the saline groundwater discharge becomes the dominant supply of water to the pool resulting in increasingly elevated EC levels. EC levels greater than 10,000 µS/cm have been historically observed at the site.

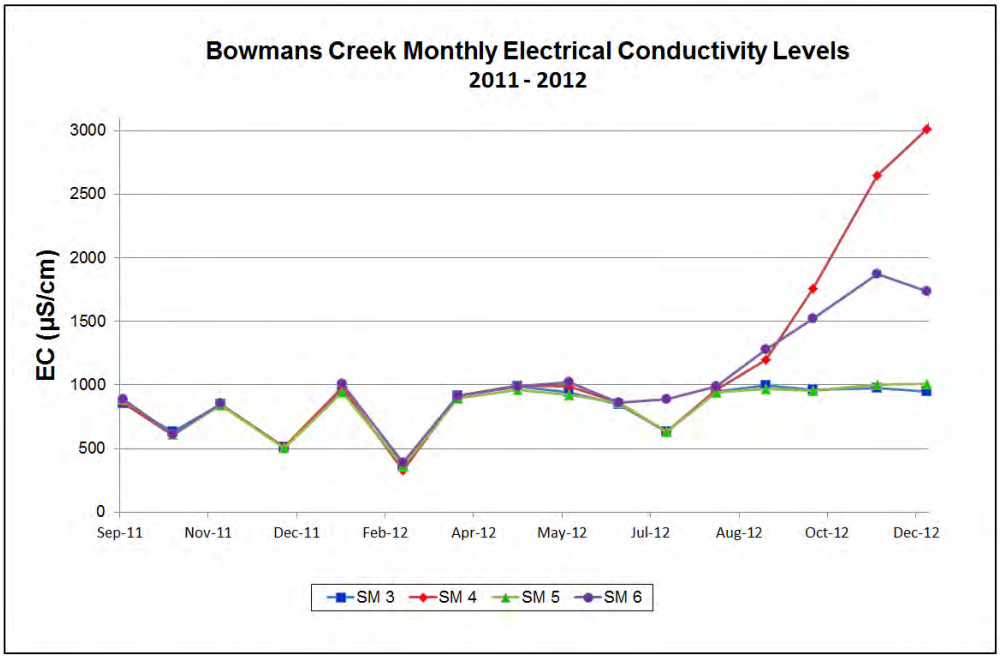

Figure 29. Monthly EC levels at Bowmans Creek sites 2011-2012

Electrical Conductivity (EC) levels in Glennies Creek (SM7, SM8 and SM11) remained consistently low throughout the year, fluctuating between 234 µS/cm and 829 µS/cm.

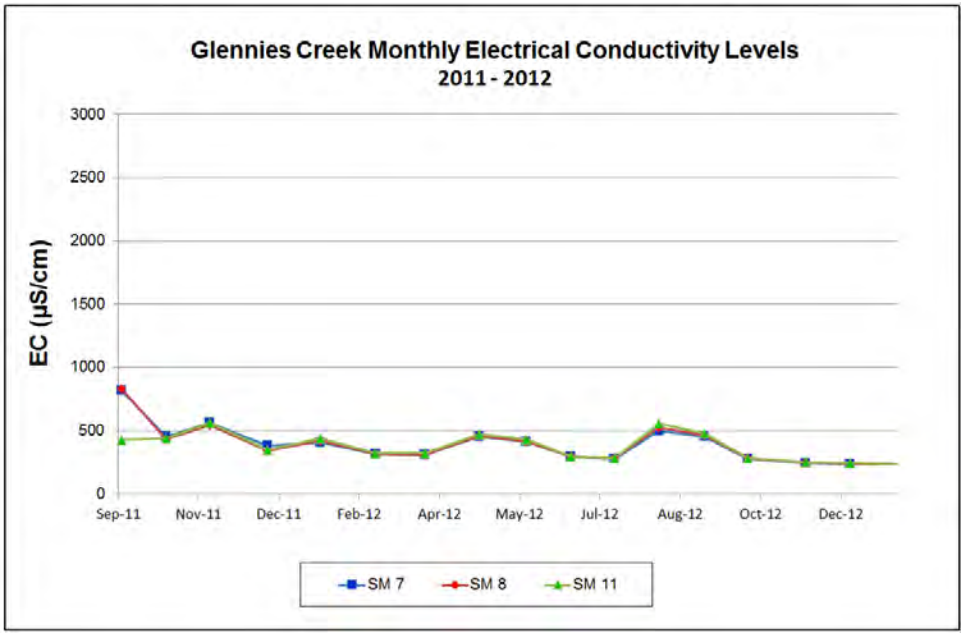

Figure 30. Monthly EC levels at Glennies Creek sites 2011-2012

Electrical Conductivity (EC) levels in Hunter River (SM9, SM10, SM12, SM13 and SM14) were generally low throughout the year. An exception to this was from September 2012 onwards where SM12 exhibited lower EC readings compared to other monitoring locations. SM12 is downstream of the confluence with Glennies Creek and therefore receives the regulated flow from Lake St Clair during dry times.

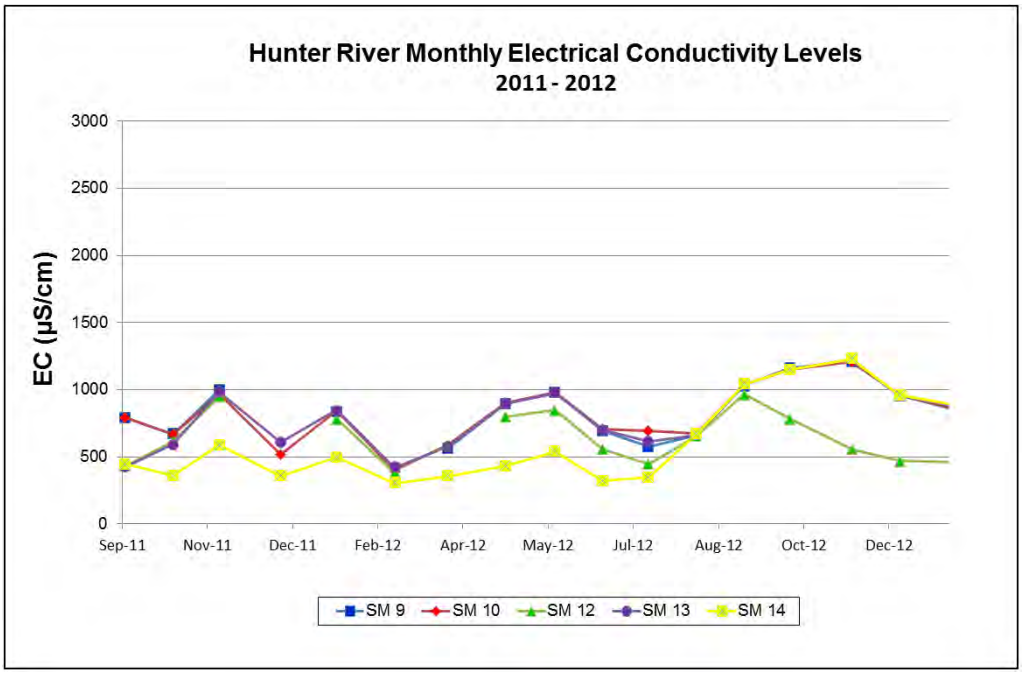

Figure 31. Monthly EC levels at Hunter River sites 2011-2012

Total Dissolved Solids (TDS)

Monthly TDS results measured in mg/L are displayed in **Table 22**

Table 22. **TOTAL DISSOLVED SOLIDS RESULTS 2011 - 2012**

TDS (mg/L)	SM 1	SM 2	SM 3	SM 4	SM 5	SM 6	SM 7	SM 8	SM 9	SM 10	SM 11	SM 12	SM 13	SM 14
Sep-11	Dry	Dry	500	496	498	476	424	440	438	446	428	432	424	446
Oct-11	426	380	366	352	360	348	270	290	376	376	302	356	362	360
Nov-11	Dry	Dry	568	584	558	582	408	390	658	648	384	640	654	590
Dec-11	Dry	Dry	300	316	294	NS	246	222	NS	320	224	NS	354	356
Jan-12	Dry	Dry	564	558	532	550	244	238	486	476	260	440	492	494
Feb-12	536	380	266	270	256	292	216	262	NS	308	240	298	288	304
Mar-12	2020	1970	512	532	518	518	158	202	340	340	191	NS	328	354
Apr-12	Dry	Dry	524	542	486	504	238	242	450	492	238	428	462	432
May-12	Dry	Dry	570	592	548	590	234	236	582	570	250	542	556	538
Jun-12	Dry	Dry	464	472	514	536	170	182	366	406	154	314	364	322
Jul-12	556	580	392	396	354	532	162	161	340	400	151	280	368	350
Aug-12	Dry	Dry	504	524	508	538	230	280	324	336	286	338	352	310
Sep-12	Dry	Dry	542	656	528	728	268	260	590	552	266	494	590	594
Oct-12	Dry	Dry	532	968	556	864	192	131	668	610	168	434	662	630
Nov-12	Dry	Dry	496	1360	524	994	128	128	634	632	122	270	650	560
Dec-12	Dry	Dry	530	1670	556	1030	130	155	562	530	145	252	564	560
Minimum	426	380	266	270	256	292	128	128	324	308	122	252	288	304
Average	885	828	477	643	474	605	232	239	487	465	238	394	467	450
Maximum	2020	1970	570	1670	558	1030	424	440	668	648	428	640	662	630

The spike in TDS at SM4 correlates with the EC result for the same time period (**Figure 32**). This trend can be explained by the low flow conditions in Bowmans Creek resulting in natural saline groundwater recharge dominating water supply to the site.

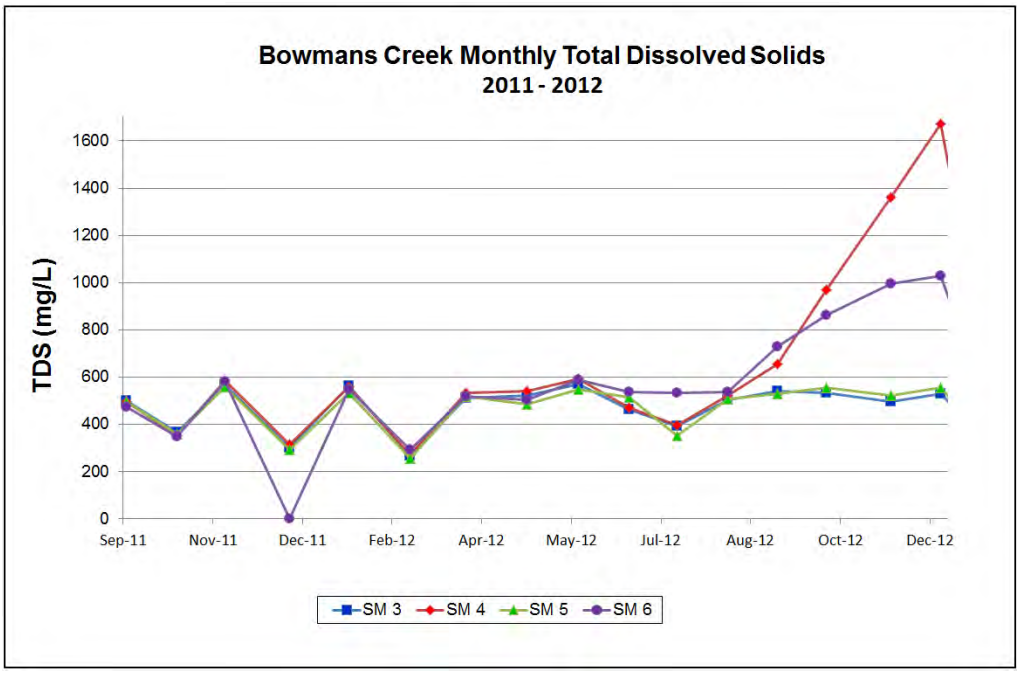

Figure 32. Monthly TDS levels at Bowmans Creek sites 2011-2012

Levels of TDS in Glennies Creek were consistently low over the monitoring period with minimal variance across the three sites (**Figure 33**).

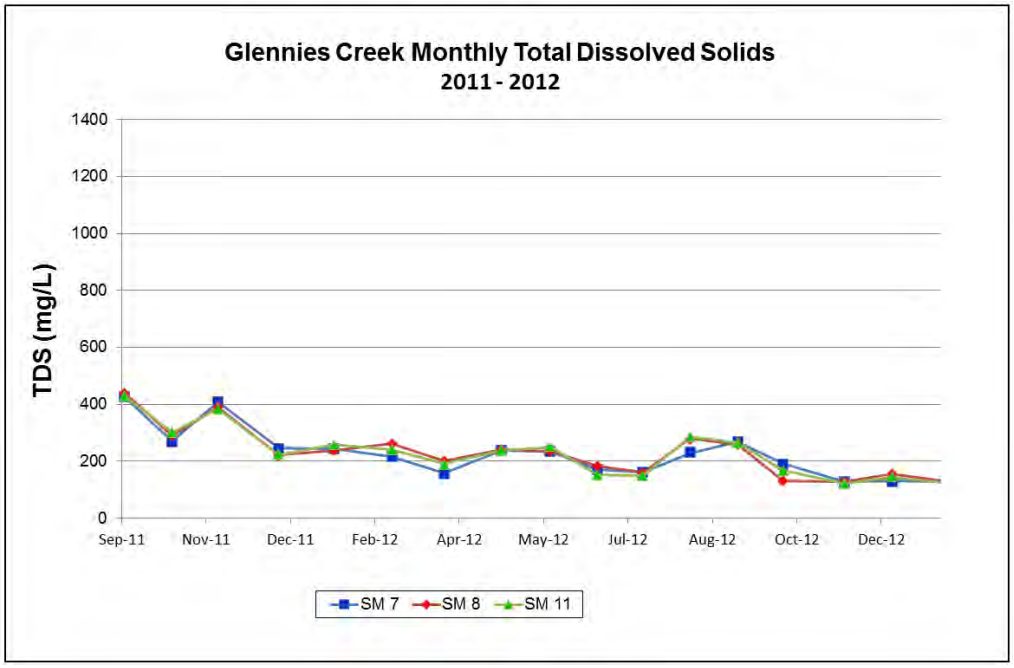

Figure 33. Monthly TDS levels at Glennies Creek sites 2011-2012

Levels of TDS in the Hunter River were consistently low over the monitoring period with small variance between the sites (**Figure 34**). SM12 was influenced by the inflows of Glennies Creek during the latter part of 2012 due to dry weather.

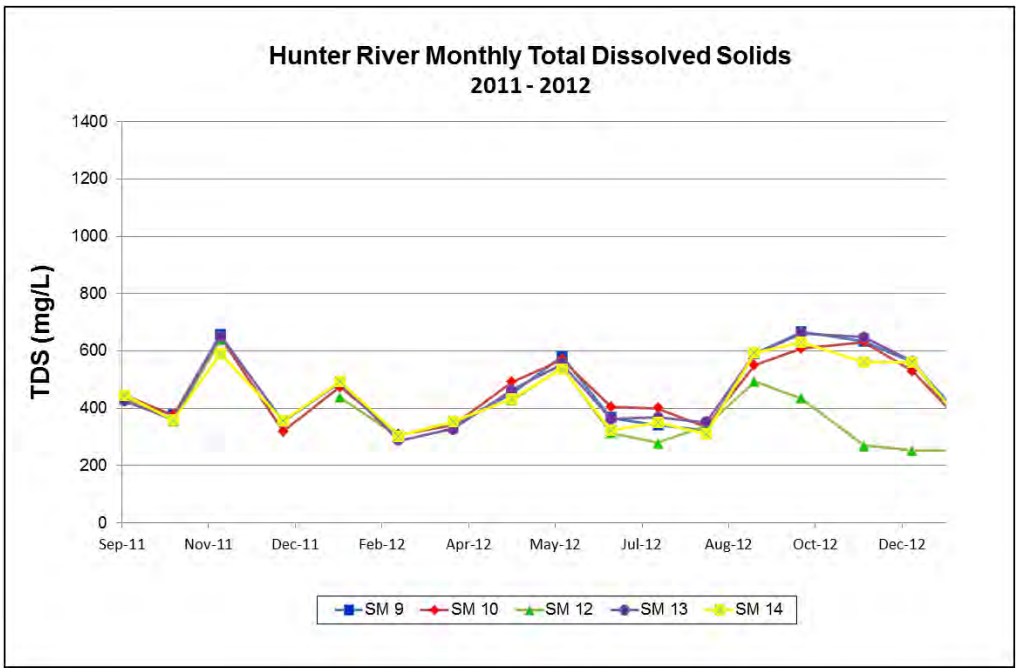

Figure 34. Monthly TDS levels at Hunter River sites 2011-2012

Total Suspended Solids (TSS)

Monthly TSS results measured in mg/L are displayed in **Table 23**.

It was identified that the NATA accredited laboratory used for analysis of water samples had not carried out the required testing for October 2012's water samples (Total Suspended Particulates were not analysed). The investigation undertaken has identified that all processes and paper work completed by ACOL staff and sample collection contractors were completed correctly. A formal complaint was lodged with the laboratory, who has provided a written response confirming that it was a human error on their part. The samples were not retained by the laboratory, so analysis was not able to be undertaken.

Table 23. TOTAL SUSPENDED SOLIDS RESULTS 2011 - 2012

TSS (mg/L)	SM 1	SM 2	SM 3	SM 4	SM 5	SM 6	SM 7	SM 8	SM 9	SM 10	SM 11	SM 12	SM 13	SM 14
Sep-11	Dry	Dry	5	6	6	9	9	5	20	18	11	24	20	20
Oct-11	38	36	14	12	8	20	24	24	24	24	14	11	10	20
Nov-11	Dry	Dry	24	23	26	22	29	16	32	24	18	24	29	30
Dec-11	Dry	Dry	20	21	26	NS	24	44	NS	106	26	NS	214	209
Jan-12	Dry	Dry	26	10	23	20	18	14	24	40	19	46	54	54
Feb-12	1030	683	251	172	286	425	114	147	NS	348	108	232	304	267
Mar-12	16	10	20	16	26	142	18	12	34	20	15	NS	34	32
Apr-12	Dry	Dry	10	12	10	11	10	<5	18	8	12	38	20	20
May-12	Dry	Dry	<5	<5	<5	<5	<5	<5	8	7	<5	6	<5	<5
Jun-12	Dry	Dry	12	12	14	23	12	7	16	16	14	15	10	24
Jul-12	136	150	8	16	12	16	8	12	40	34	14	29	35	32
Aug-12	Dry	Dry	8	8	9	12	8	13	10	12	7	8	12	9
Sep-12	Dry	Dry	10	12	12	9	12	14	18	22	12	18	18	22
Oct-12	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nov-12	Dry	Dry	13	16	30	19	6	12	26	28	14	24	26	20
Dec-12	Dry	Dry	10	15	20	30	12	11	28	28	85	40	28	30
Minimum	16	10	5	6	6	9	6	5	8	7	7	6	10	9
Average	305	220	31	25	36	58	22	25	23	49	26	40	58	56
Maximum	1030	683	251	172	286	425	114	147	40	348	108	232	304	267

Levels of TSS in Bowmans Creek were consistently low during the monitoring period with the exception of a large spike for all sites in February 2012, which was due to the heavy rain in February in the head waters of Bowmans and Glennies Creek catchments (**Figure 35).**

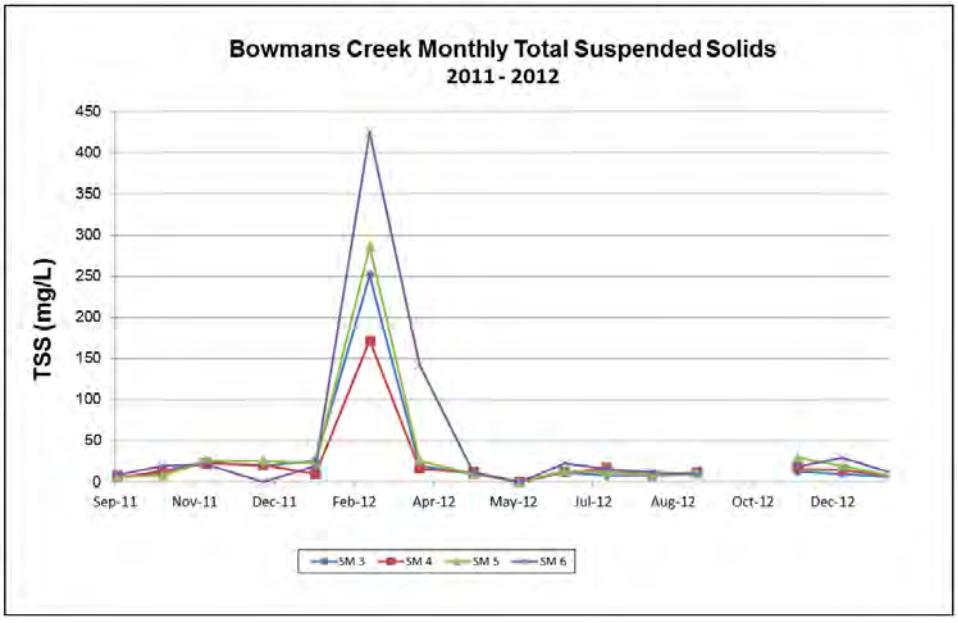

Figure 35. Monthly TSS levels at Bowmans Creek sites 2011-2012

Levels of TSS in Glennies Creek were consistently low during the monitoring period with the exception of a spike for all sites in February 2012, which was due to the heavy rain in February (**Figure 36**). The spike in SM11 during December 2012 is an isolated event. SM11 is located near the confluence with the Hunter River and is downstream of SM7 and SM8. Due to its location and the surrounding results, it is unlikely that SM11's results in December 2012 would be attributed to ACOL activities.

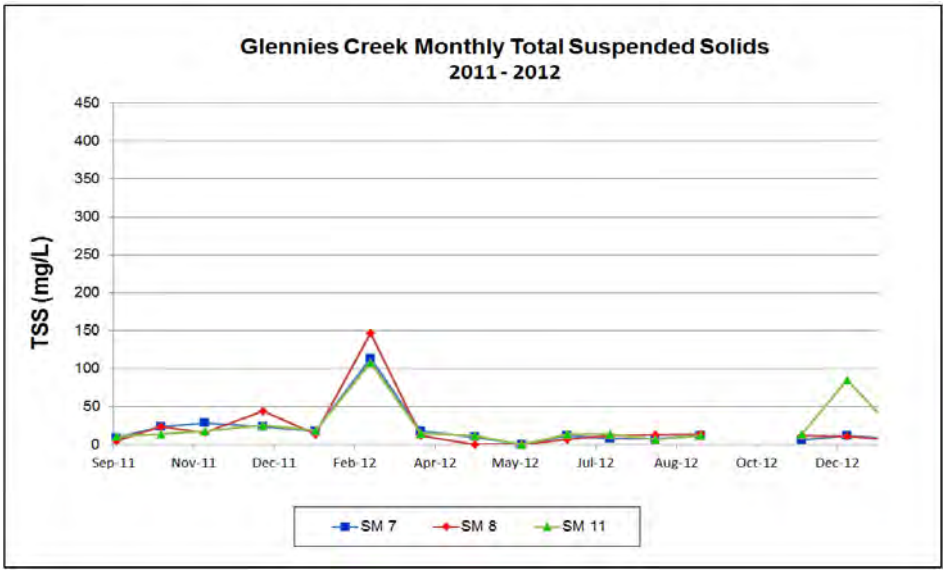

Figure 36. Monthly TSS levels at Glennies Creek sites 2011-2012

Hunter River monitoring locations displayed the identical spike in TSS during February 2012 as seen in Bowmans Creek, and to a lesser extent Glennies Creek. (**Figure 37**). Of particular note is SM9 which is a monitoring location upstream of Bowmans Creek and Glennies Creek which was not affected by the waters coming from these creeks, the high results were due to the heavy rain in February in the head waters of Bowmans and Glennies Creek catchments. The spike in December 2011 in the Hunter River sites was due to the storms in December.

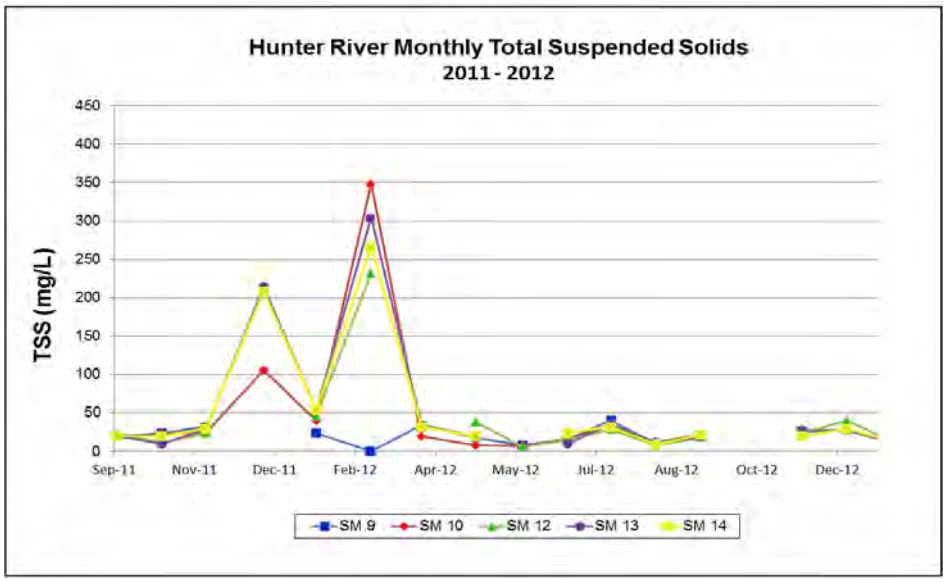

Figure 37. Monthly TSS levels at Hunter River sites 2011-2012

Total Hardness

Monthly Total Hardness results measured in mg/L of $CaCO_3$ are displayed in **Table 24**.

Table 24. **TOTAL HARDNESS RESULTS 2011 - 2012**

$CaCO_3$ (mg/L)	SM 1	SM 2	SM 3	SM 4	SM 5	SM 6	SM 7	SM 8	SM 9	SM 10	SM 11	SM 12	SM 13	SM 14
Sep-11	Dry	Dry	181	172	179	188	169	173	218	214	180	214	211	207
Oct-11	64	61	127	129	129	127	104	104	209	196	102	179	183	203
Nov-11	Dry	Dry	175	167	167	170	122	122	310	277	129	273	290	295
Dec-11	Dry	Dry	116	116	102	NS	91	68	NS	119	75	NS	160	158
Jan-12	Dry	Dry	217	220	192	209	113	109	266	285	118	246	292	288
Feb-12	20	20	77	77	77	84	70	68	NS	81	73	84	122	128
Mar-12	Dry	Dry	217	201	217	219	94	91	205	205	82	NS	183	183
Apr-12	Dry	Dry	213	213	194	194	104	104	280	261	107	225	271	278
May-12	Dry	Dry	215	224	204	212	109	118	335	324	116	271	308	315
Jun-12	Dry	Dry	236	224	224	222	84	84	249	254	84	181	242	245
Jul-12	65	69	155	168	141	145	78	78	187	179	78	139	196	198
Aug-12	Dry	Dry	214	214	208	221	118	126	224	220	126	207	222	211
Sep-12	Dry	Dry	196	238	169	236	106	108	321	305	112	288	308	308
Oct-12	Dry	Dry	206	306	176	320	70	73	353	353	73	225	353	353
Nov-12	Dry	Dry	207	460	188	364	62	62	365	365	69	157	370	383
Dec-12	Dry	Dry	200	534	187	314	60	66	292	305	64	135	292	296
Minimum	20	20	77	77	77	84	60	62	187	81	64	84	122	128
Average	50	50	185	240	172	215	97	97	272	246	99	202	250	253
Maximum	65	69	236	534	224	364	169	173	365	365	180	288	370	383

Oil and Grease

For the reporting period the Oil and Grease results were consistently measured under 5mg/L at all monitoring sites**.**

3.3.2.2 Weekly Water Quality Monitoring Results

Weekly water samples were collected and analysed during the reporting period for pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Suspended Solids (TSS) Total Hardness ($CaCO_3$) and Oil and Grease (O&G). The purpose of this monitoring is a proactive approach to determine if the process water dam (PWD) is leaking dirty water into the creek system. Sites SM3 and SM4 are located adjacent to Betty's and Bowmans Creek and are up and down stream of the PWD. The results of this monitoring indicate that there were no discharges during the monitoring period.

Elevated levels in EC, TDS and Hardness recorded at SM4 resulted from saline groundwater discharge into the pool at SM4, during the dry period of the end of 2012. During periods of low flow in Bowmans Creek, the groundwater discharge dominates the water supply to the pool. The spikes in TSS levels in November 2011 and February 2012 were due to high rainfall during those weeks.

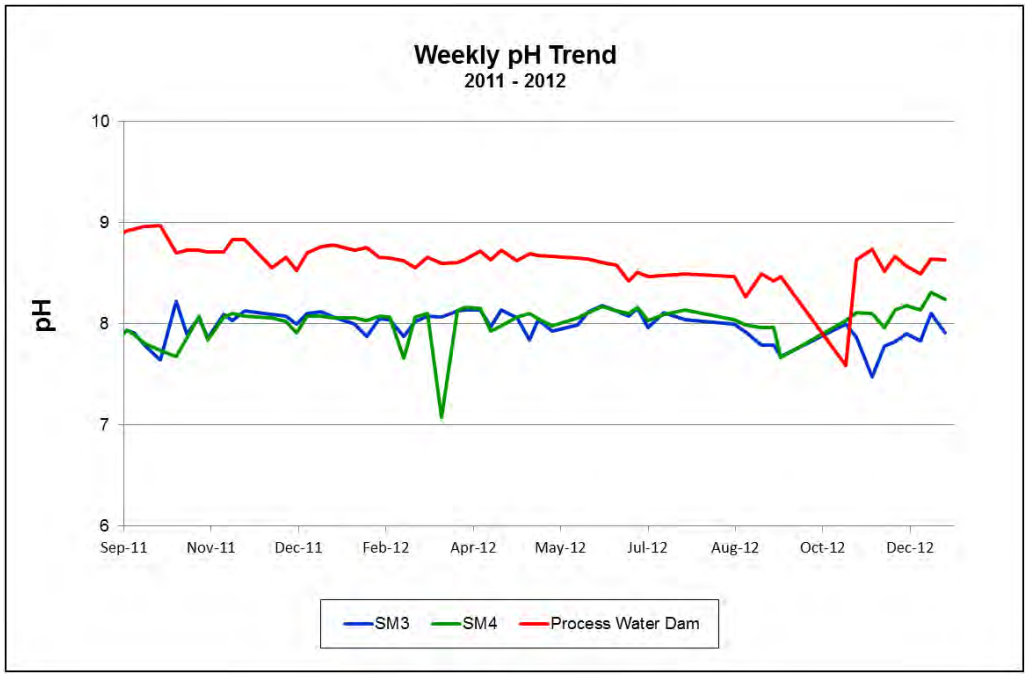

Figure 38. Weekly pH levels during 2011-2012 for sites SM3, SM4 and Process Water Dam (PWD)

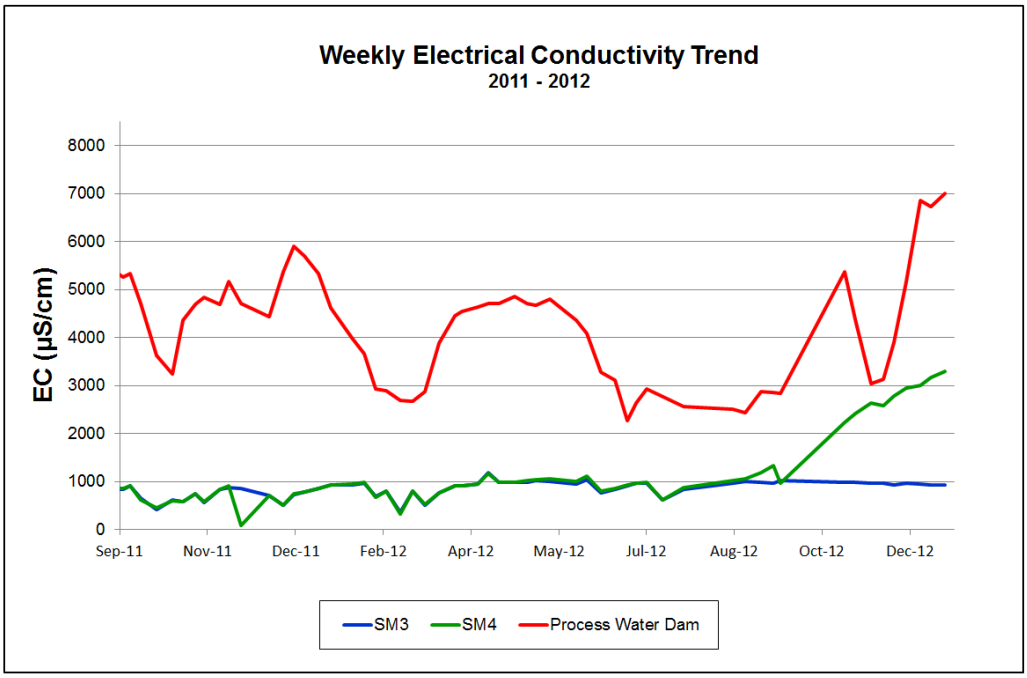

Figure 39. Weekly EC levels during 2011-2012 for sites SM3, SM4 and PWD

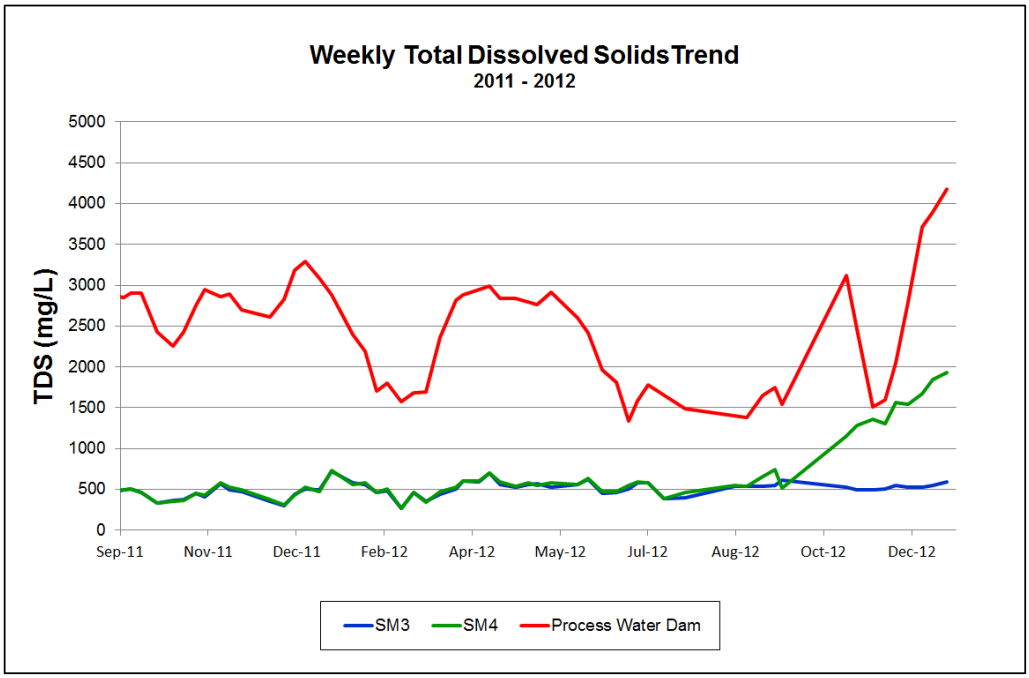

Figure 40. Weekly TDS levels during 2011-2012 for sites SM3, SM4 and PWD

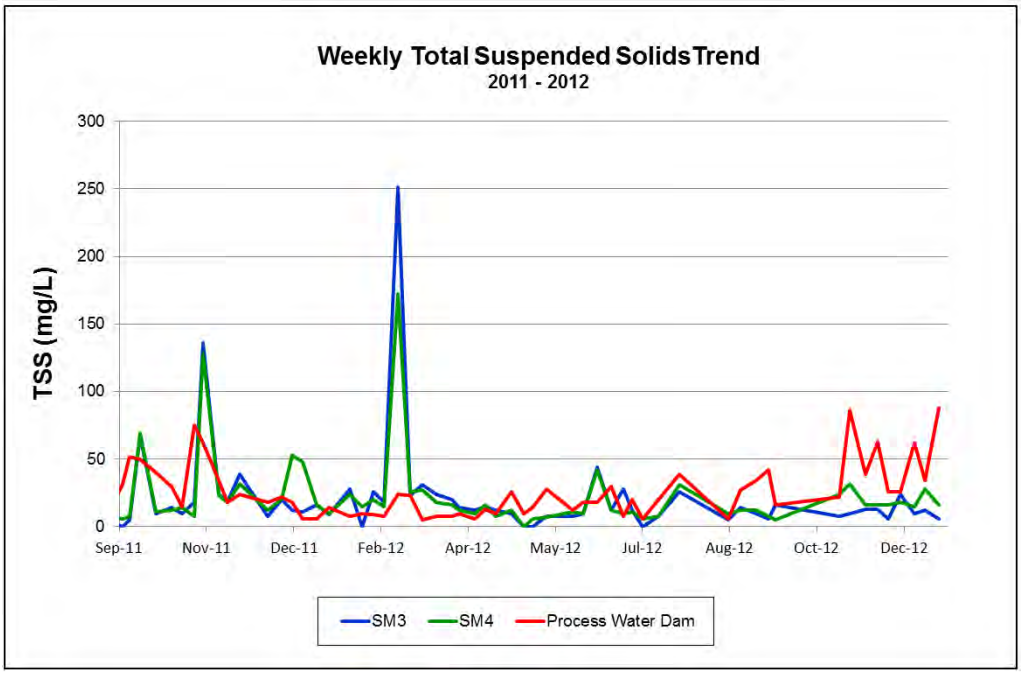

Figure 41. Weekly TSS levels during 2011-2012 for sites SM3, SM4 and PWD

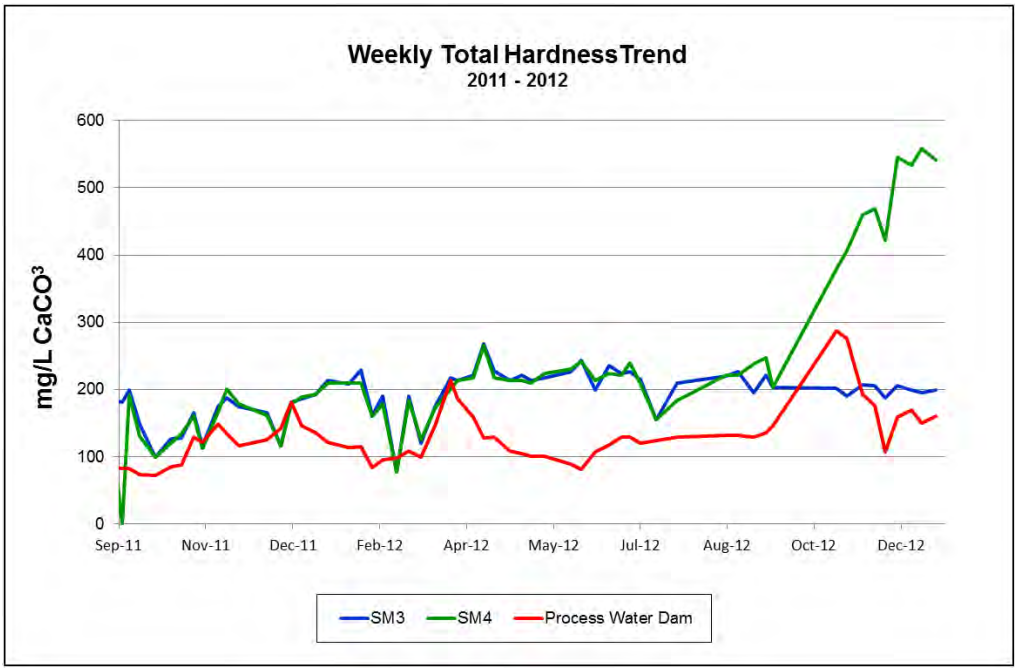

Figure 42. Weekly Total Hardness levels during 2011-2012 for sites SM3, SM4 and PWD

3.4 GROUND WATER

As required by Consent Condition 9.2 (d), a groundwater report has been prepared by an independent expert covering the reporting period 1 September 2011 to 31 December 2012. This report has been included in **Appendix 1**.

3.4.1 Summary

The groundwater report included in **Appendix 1** details the monitoring and other work carried out as part of the groundwater management activities for the period. The results of all groundwater monitoring are presented, together with analysis of trends. Over the review period, the actual groundwater related impacts, derived from the analysis of this data were below the levels predicted in the groundwater assessment reports for the Upper Liddell Seam Extraction Plan Groundwater Impact Assessment (RPS Aquaterra, 2012). The monitoring program has been carried out in accordance with the Ashton Water Management Plan (2012 WMP) and the requirements detailed in the Consent Conditions.

The main outcomes over the 2011-12 reporting period:

- Underground coal extraction was completed at Pikes Gully seam longwall panels LW7B and LW8.
- The development headings for Upper Liddell LW101 were driven and completed during the review period with partial extraction of LW101 also completed.
- The groundwater monitoring network was expanded which included three vibrating wire piezometers monitoring the coal measures near LW101 as well as the installation of one standpipe piezometer targeting the Glennies Creek Alluvium and another two targeting the Hunter River Alluvium.
- Groundwater monitoring frequency was increased in key monitoring bores during the early and final stages of LW7B, LW8 and LW101 panel extractions. This provided a high level of monitoring for impacts of subsidence on the Bowmans Creek Alluvium. This was undertaken in accordance with Consent Condition 3.9, which requires confirmation that the subsidence impacts or environmental consequences are less than those predicted in the Ashton Coal Bowmans Creek Diversion EA.
- No impacts have been observed in the Glennies Creek, Bowmans Creek or Hunter River Alluvium as a result of underground mining.
- Mining of LW7B and LW8 occurred beneath sections of the Bowmans Creek Alluvium. No reduction in alluvium storage of groundwater was observed.
- A gradual trend of declining groundwater levels was observed in the northern and southern sections of the Bowmans Creek Alluvium over the reporting period. This trend is attributed to a recovery following above average water levels associated with above average rainfall in late 2011 and early 2012.

- Underground inflows were shown to increase above predictions in January 2012 and again in July 2012 however, both events were short lived with the averaged groundwater inflows over the reporting period below both the 2001 EIS and current model predictions.

In summary, the groundwater monitoring during the reporting period has been completed in full compliance with Consent Condition 9.2 (d) of the ACOL Approval. With the exception of temporary pumping at above predicted inflow rates the groundwater-related impacts from underground mining during the review period were below the levels predicted in the 2001 EIS, 2012 WMP and the Upper Liddell Seam Extraction Plan Impact Assessment.

3.5 Contaminated and Polluted Land

There were no discharges to land during the reporting period.

3.6 Flora and Fauna Management

Fauna monitoring was conducted in summer 2012 and winter 2012 as part of the Flora and Fauna Management Plan. These monitoring surveys continually assess habitat value, species abundance and diversity within ACOL lands and monitor any changes to allow for an appropriate action towards a healthier ecosystem.

Following a request from OEH after the 2010/2011 AEMR; an OEH monitoring form will be completed annually for the Ashton Coal Conservation Area and will be included in the AEMR. Ashton Coal commissioned Pacific Environmental Associates to undertake this work during January 2012. The OEH monitoring form is located in **Appendix 4.**

The main focus of the monitoring is the Southern Woodland, also known as the Conservation Area which consists of open grassy woodland dominated by *Allocasuarina luehmannii*. Sub-dominant species include *Eucalyptus crebra* (narrow-leaved ironbark), *Eucalyptus melliodora* (yellow box) and *Eucalyptus fibrosa* (broad-leaved red ironbark).

Monitoring sites are illustrated in **Figure 43.**

Analogue sites (Blue lines)	1-Southern Woodland (SW)
	2- Northern Woodland (NW)
	3- South East Open Cut Area 1 (SEOC1)
Impact Sites (Red line)	4- Open Cut regeneration area (OC)
	5- South East Open Cut Area 2 (SEOC2)
	6- Underground Subsidence Zone (UG).

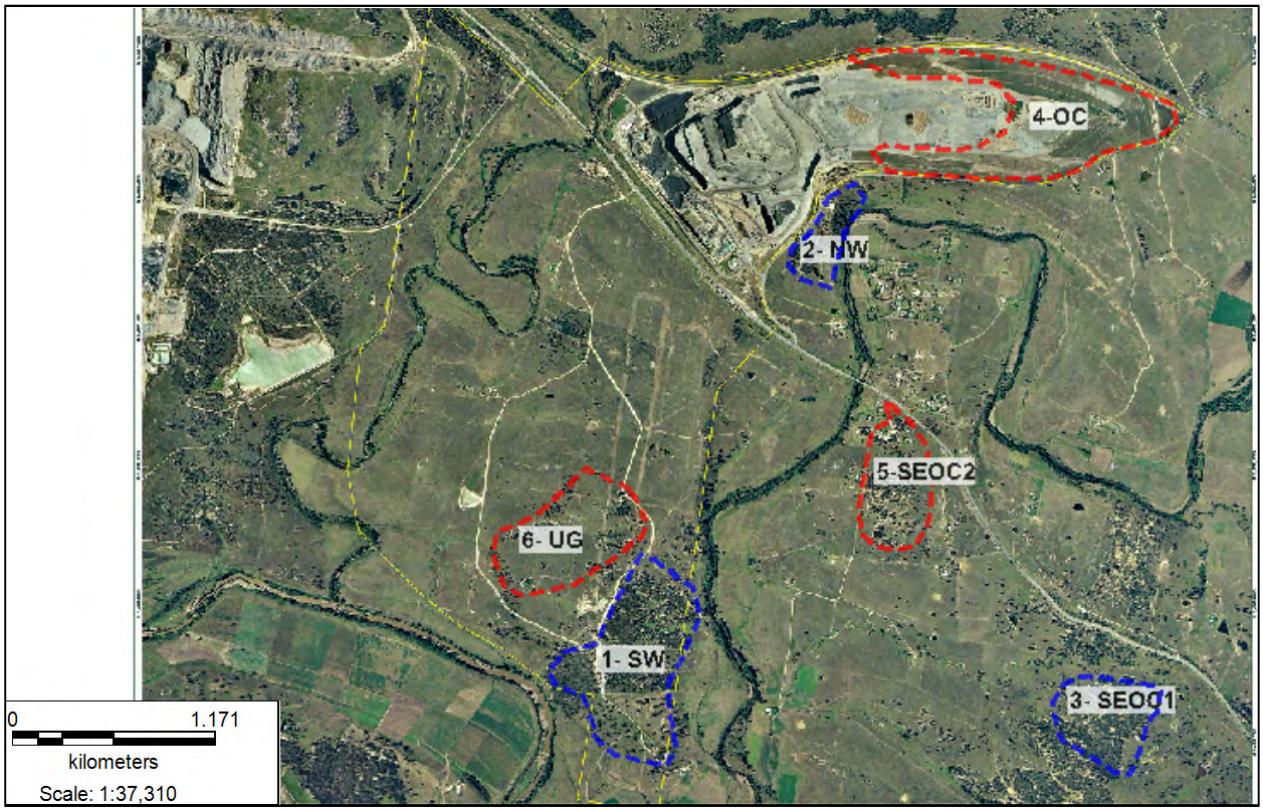

Figure 43. Monitoring locations for summer 2012 and winter 2012 ecological surveys

The surveys were conducted by PEA Consulting. Fauna and Flora monitoring comprises of the following surveys and techniques:

- Bird survey
- Arboreal and ground fauna cage trapping
- Pit fall trapping
- Frog survey
- Reptile survey
- Ant diversity survey
- Micro-bat Anabat and harp trap surveys
- Nocturnal surveys
- River Red Gum heath assessment
- Landscape Functions Analysis

Fauna results of this survey indicate that the southern woodland and South East Open Cut Area 1 and 2 provide a greater range of habitats for a more significant range of species. Tests of significance show that the Southern Woodland has greater diversity and abundance of birds and mammals than all other sites. Exploratory data methods also indicate that these sites differ from the other sites in terms of frog and reptile diversity. The seasonal variation of fauna assemblages is relatively consistent across the sample sites. When compared to complexity, area to edge ratio

and distance to water bodies the Southern Woodland has similar trends in diversity and abundance as better quality sample sites in the Hunter Valley.

There has been a general trend of increasing diversity across all groups with a flattening of the trends occurring within the last year of survey period. Significance tests show that a great deal of difference between sites can be attributed to the diversity and abundance in the Southern Woodland sample sites.

Management of the Southern Woodland has removed impacts such as grazing and this, combined with two good seasons, has improved conditions for woodland bird species over the last two years. There was a marked difference in the diversity and abundance of ground foraging woodland birds in the Southern Woodland compared to that of areas which still have grazing or have yet to recover from historical activities. Woodland bird species are considered one of the most important indicators for woodland quality in rural NSW and therefore can be viewed as highlighting the qualities of this site.

Future management of the South East Open Cut Area 1 and South East Open Cut Area 2 will likely see improvements in habitats such as structural diversity, nutrient cycling and infiltration that enhance avian diversity.

The poor habitat values of the open cut site provides an opportunity to measure the status of this area against the established sites. This will allow for the long term assessment of the success of regeneration against benchmarks and permit the comparison of faunal diversity with regeneration success.

Results of monitoring re-identified all threatened species that have been previously recorded as well as some additional threatened species. Populations of significant fauna groups (i.e. woodland birds) remain healthy and noticeable differences in the assemblage and abundance of these birds can be seen between sites managed by Ashton and unmanaged sites (managed sites had noticeable improved results), suggesting that the management program is effective and should be continued.

3.7 AQUATIC ECOLOGY MONITORING - BOWMANS AND GLENNIES CREEK

As required by Consent Conditions 3.19 and 3.20 under Development Application DA No 309-11-2001-i issued by the Minister for Planning, aquatic ecological monitoring was undertaken during the reporting period. Monitoring conducted during the period builds on sampling studies conducted between 2006 and 2011 and the initial benchmarking conducted during the EIS phase in 2001. Monitoring was conducted in spring 2011, autumn 2012 and spring 2012 in Bowmans Creek and Glennies Creek. Monitoring locations are shown in **Figure 44**.

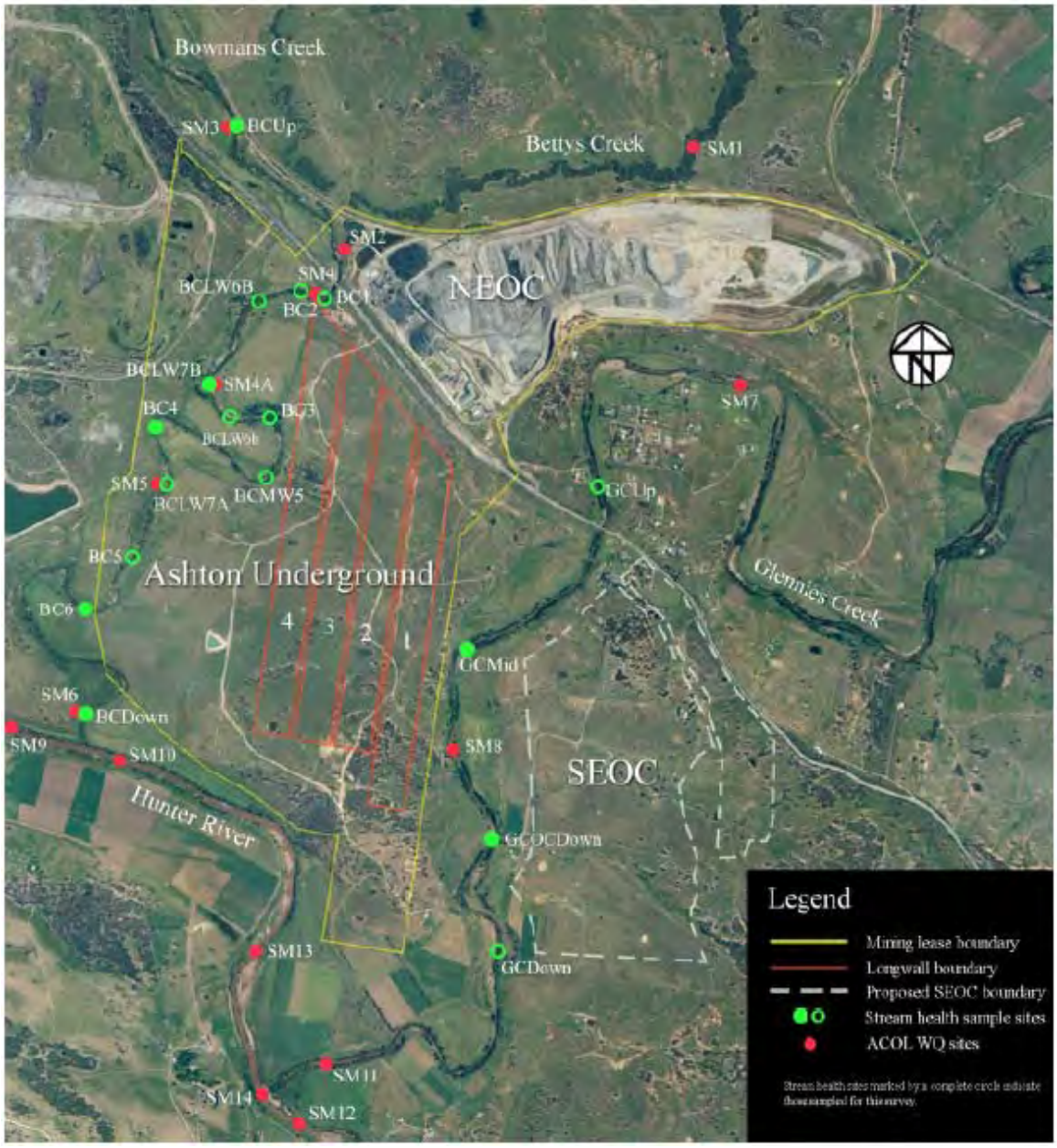

Figure 44. Aquatic Monitoring Location

The Aquatic Ecology Monitoring study endeavours to answer the following questions:

- Are there measurable differences in aquatic ecological or riparian attributes between creek pools upstream, alongside and downstream of mining operations?
- Are observed differences directly attributable to mining impacts or can differences be attributed to spatial (between-site) and/or temporal (between-survey) differences?
- Do the creeks provide (and continue to provide) suitable aquatic habitat?
- Do the creeks continue to provide suitable fish passage?

To be able to answer these questions and generate a holistic picture of the stream health numerous monitoring approaches were undertaken including:

- Water quality profiling
- Fish trapping
- Aquatic macroinvertebrate assemblage analysis
- Aquatic habitat assessment

3.7.1 Sampling Methods

The adopted sampling methods are based on existing methods being utilised for monitoring long-term aquatic ecological change in the Illawarra and Hunter coal mining catchments. The study follows the National River Process and Management Program River Bio-assessment Manual methods (NRPMP 1994) as adapted for the National River Health Program (now referred to as the AusRivAS method (Turak *et al* 1999).

The AusRivAS protocol recommends that, wherever possible, two habitats (riffles and edges) be sampled at each site. However, given the location of a number of the study sites in reaches of creeks where there are predicted to be periods of little or no connecting flow between pools or where there are predicted to be no riffle sections available for sampling, it was decided that only pool 'edge' samples would be sampled, as riffle samples could not be guaranteed for all (or possibly even for most) sites at all sample times.

The following AusRivAS definitions are relevant and sampling has conformed to these definitions:

- A site is "a stream reach with a length of 100 m or 10 times the stream width, whichever is the greater"
- A riffle habitat is "an area of broken water with rapid current that has some cobble or boulder substratum". However, "sampling riffles where the substratum consists predominantly of large boulders may be difficult and may not produce reliable results".
- Edge habitat is "an area along the creek with little or no current".

Since the spring 2008 survey the monitoring locations were reviewed and altered due to changes in the mine plan as well as the nearing commencement of the Bowmans Creek Diversion. There are 13 monitoring sites located on Bowmans Creek another 4 sites on the diversion channels (2 each), will would be brought into the monitoring program once the construction of the diversion is completed. Glennies Creek sites were cut down to 3 and are deemed sufficient enough for this

study. Not all sites are being sampled for the full stream health monitoring program but are being sampled for fish passage and/or field water quality as necessary.

The number of sites utilised was as follows:

Table 25. **SITES UTILISED DURING AQUATIC MONITORING**

Indices	Bowmans Ck Spring 2011	Bowmans Ck Autumn 2012	Bowmans Ck Spring 2012	Glennies Ck Spring 2011	Glennies Ck Autumn 2012	Glennies Ck Spring 2012
Water quality profiling	6	5	7	3	3	3
Over-night fish trapping	4	2	3	1	1	0
Macroinvertebrate sampling plus aquatic habitat assessment	5	5	7	3	3	3

This study design enables the direct assessment of mining impacts on individual pools as mining proceeds and also facilitates the interpretation of long-term monitoring results. As for previous surveys the particular reach selected for sampling within each of the sample locations was selected on the basis of it being;

(i) a reach with high drought resistance (generally based on pool size, depth and riparian cover) and

(ii) a reach with high aquatic habitat diversity; ideally deep pools connected by gentle riffles, abundance of stream bed litter, presence of snags, presence of aquatic vegetation and good extent of cover of overhanging riparian vegetation.

3.7.2 Monitoring Results

3.7.2.1 Bowmans Creek

The study received consistent high rainfall in the weeks prior to and during sampling. Four weeks before the spring 2011 survey commenced, a 105mm rain event over nine rainfall days caused a minor flood event which peaked at a flow of 1210ML/day in the Bowmans Creek study area. At two sites high flows took creek levels up 1.5m above the spring 2011 water levels, as indicated by debris lines in the riparian vegetation.

After two months of low rainfall and relatively low and stable flows (less than 50ML/day), there was a short spike in creek flow rates preceding the autumn 2012 survey, and mean daily flow rates then fell from 133.8ML/day on the 13th June to 81.7ML/day on the 15th.

The three months leading into the spring 2012 survey were very dry, with only 15.2mm rainfall recorded over the period. As a result the creek flows within Bowmans Creek study area were low, with the majority of the creek having receded into a series of disconnected pools. Surface flows were present at BCUp, BC4 and BCLW7A only, and at site BCLW7B surface water had receded to a small pool.

During the spring 2011 survey a total of 35 macroinvertebrate taxa were identified from the five study sites, with individual site macroinvertebrate diversity ranging between 17 at BC6 and 22 at BCUp. The site mean taxa diversity results have remained relatively consistent over the most recent three surveys.

There were five species of fish recorded from the Bowmans Creek study area including three native species and two introduced species. The native species were Australian smelt, flathead gudgeons and mullet, and the introduced species included carp and plague minnow. Juvenile individuals of a native gudgeon were recorded at BCUp and are most likely to be the commonly encountered species, flathead gudgeon. Tadpoles were recorded at BC4 and a juvenile long-necked turtle was recorded at BCDown.

For autumn 2012 there were 39 macroinvertebrate taxa recorded from the five study sites. Individual site diversity ranged between 17 taxa at BCDown to 26 taxa at BCUp, and the site mean taxa diversity was the highest to date at 22.2 ± 1.8 taxa per site.

There were three species of fish recorded from the Bowmans Creek study sites. Plague minnow were recorded from all sites and a single Australian smelt was recorded from BCLW7B. Firetail gudgeons were recorded from BCDown. This species has not been recorded over the previous ten surveys, however unconfirmed juvenile gudgeon specimens recorded frequently over most surveys may have been firetail gudgeons. There were no carp observed during the autumn 2012 survey, possibly due to a combination of the (relatively) high water levels and low water clarity. There were no carp recorded for other higher flow surveys conducted in autumn and spring 2007 and spring 2010.

Macroinvertebrate taxa continued to increase in the spring 2012 survey. There were 52 macroinvertebrate taxa recorded from the seven study sites, with individual site diversity ranging from 17 taxa at BCLW7B to 35 taxa at both BCUp and BCLW7B. The Bowmans Creek site mean diversity was by far the highest to date at 26.7 ± 2.6, which is comparable to the previous highest mean diversity recorded during the autumn 2012 survey. Four out of the seven sites (BCUp, BC1, BCLW7A and BC6) recorded their highest diversity results over all surveys and all site diversities except Site BCLW7B were above their respective ranges of long-term mean ± standard deviation values.

There were at least six species of fish recorded from the Bowmans Creek study sites in spring 2012, one of which (the small native western carp gudgeon) had not previously been recorded from the Bowmans Creek study sites. This species is known and expected in waterways within the region.

Table 5 Bowmans Creek Macroinvertebrate Summary Data

Season	No. of sites	Total No. of Taxa	Mean Site No. of Taxa	SE Site No. of Taxa	Creek SIGNAL Score	Mean Site SIG	SE Site SIG
Au07	4	25	14.0	2.5	2.95	2.92	0.26
Sp07	4	30	17.0	1.9	3.64	3.69	0.22
Au08	4	32	18.8	1.1	4.00	4.02	0.11
Sp08	4	37	18.8	1.8	3.93	3.92	0.06
Au09	6	44	19.8	1.9	3.75	3.74	0.07
Sp09	6	46	21.2	2.6	3.55	3.54	0.11
Au10	6	40	17.5	2.4	3.61	3.58	0.18
Sp10	6	39	19.2	2.0	3.58	3.59	0.07
Au11	5	33	20.0	0.6	3.58	3.57	0.05
Sp11	5	37	19.8	0.9	3.79	3.80	0.13
Au12	5	39	22.2	1.8	3.55	3.53	0.09
Sp12	7	52	26.7	2.6	3.82	3.83	0.07

Figure 45. Bowmans Creek Seasonal Site Total Taxa Macroinvertebrate

Table 6 Bowmans Creek Seasonal Site Diversity Data

Site	BC Up	BC1	BC LW7B	BC MW5	BC4	BC LW7A	BC6	BC Down
Au07	12			14		21		9
Sp07	21			12		18		17
Au08	20			18		21		16
Sp08	24	12	18	22		21		16
Au09	23	12	24	17		21		22
Sp09		15	12			29		25
Au10		12	14			26		22
Sp10	18		19		24		22	12
Au11	20		19		21		18	21
Sp11	22		21		20		17	19
Au12	26		19		25		24	17
This Survey								
Sp12	35	22	17		24	35	31	23
Long-Term Mean & Standard Deviation								
Mean	20.7	12.8	18.3	16.6	22.5	22.4	20.3	17.8
StdDev	4.0	1.5	3.8	3.8	2.4	3.7	3.3	4.7
X-SD	16.64	11.25	14.48	12.75	20.12	18.69	16.95	13.15
X+SD	24.70	14.25	22.02	20.45	24.88	26.16	23.55	22.48

Figure 46. Bowmans Creek Seasonal Site Macroinvertebrate Diversity

3.7.2.2 Glennies Creek

During spring 2011 the Glennies Creek study area sites were sampled during relatively low flow conditions, three weeks on from a moderate flow event which reached 1,816ML/day. Flow rates over the sample period varied between 26.2ML/day and 34.6ML/day.

The autumn 2012 survey was undertaken during a brief rise in creek flow rates following a three month period of low rainfall and relatively low and stable flows (mostly less than 65ML/day). Mean daily flow rates rose from 390.0ML/day on the 13th June to 406.4ML/day on the 14th June, followed by a decrease on the 15th June to 309.3ML/day.

The spring 2012 survey was undertaken during a period of relatively stable flow, which had fluctuated between 180 and 270 ML/day for around eight weeks prior to the spring 2012 sample date. There was surface flow at all sites and site water levels were around 20cm lower than the previous autumn 2012 survey.

For the spring 2011 survey, a total of 35 macroinvertebrate taxa were identified from the three Glennies Creek sites. Individual site diversity varied between 20 taxa at GCUp and 27 taxa at GCMid.

Four species of fish were recorded from the Glennies Creek sites for spring 2011. Eeltailed catfish have only been recorded previously from GCMid (spring 2009), and for this survey were found at GCOCDown. The other native species was Australian smelt, from GCMid and GCOCDown. Carp were recorded at all Glennies Creek sites and plague minnow were recorded from GCUp and GCOCDown. A number of adult dwarf tree frogs were present at GCUp.

During the autumn 2012 survey a total of 26 macroinvertebrate taxa were recorded from the three study sites, with individual site diversity ranging between 14 taxa at GCUp and 18 taxa at GCOCDown. For each of the higher flow surveys to date there have been individual or multiple sites that supported higher diversities of macroinvertebrates. However, for this survey, all sites recorded low diversities and the total creek diversity (26 taxa) plus the overall mean site diversity (16.3 ± 1.2 taxa) are the lowest records to date. These figures are much lower than the previous lowest total diversity (33 taxa in spring 2009) and previous lowest mean site diversity recorded - in the original autumn 2007 post-flood survey. This may be attributable to high flows prior to the survey, which has a negative impact on the presence of macroinvertebrates.

Native firetail gudgeon and plague minnow were the only two species of fish recorded for this survey. Both species were recorded at GCUp and GCMid. There were no tadpoles recorded in Glennies Creek this survey.

During spring 2012 the site macroinvertebrate diversity figures were comparatively high for all sites. A total of 41 macroinvertebrate taxa were recorded over the three sample sites, with individual site diversity ranging between 24 and 28 taxa and an overall mean site diversity of 26.0 ± 2.0, which is the highest to date. This is a stark contrast to the autumn 2012 survey that was undertaken during higher flow conditions and for which the mean site diversity was the lowest to date.

There were five species of fish recorded from Glennies Creek for spring 2012, including one species (Coxs gudgeon, found at GCup) that had not been recorded from the Glennies Creek study area sites previously. Coxs gudgeon is a small native gudgeon that is commonly encountered in coastal drainages in NSW and is known in the study region. The other native species included Australian smelt and the firetail gudgeon. The two introduced species plague minnow and carp are found for most surveys to date, and for this survey plague minnow were found at all sites with carp recorded from site GCMid only.

Table 11 Glennies Creek Macroinvertebrate Summary Data

Season	No. of sites	Total No. of Taxa	Mean Site No. of Taxa	SE Site No. of Taxa	Creek SIGNAL Score	Mean Site SIG	SE Site SIG
Au07	3	34	19.0	3.6	3.71	3.70	0.07
Sp07	5	42	22.6	1.0	3.80	3.79	0.12
Au08	5	42	24.2	0.5	3.90	3.89	0.11
Sp08	5	34	20.8	0.4	3.74	3.74	0.10
Au09	5	41	24.0	0.8	3.95	3.96	0.07
Sp09	3	33	21.0	0.6	3.71	3.70	0.11
Au10	3	36	22.0	2.1	3.98	3.98	0.16
Sp10	3	34	20.3	6.1	3.53	3.46	0.12
Au11	2	34	25.0	2.0	3.78	3.78	0.04
Sp11	3	35	23.0	2.1	3.97	3.98	0.09
Au12	3	26	16.3	1.2	3.57	3.58	0.07
Sp12	3	41	26.0	2.0	4.05	4.07	0.22

Figure 47. Glennies Creek Seasonal Site Total Taxa Macroinvertebrate

Table 12 Glennies Creek Seasonal Site Diversity Data

Site	GCUp	GCOC Up	GC Mid	GCOC Down	GC Down
Au07	26		17		14
Sp07	22	26	22	23	20
Au08	26	24	24	24	23
Sp08	21	20	21	22	20
Au09	22	24	23	27	24
Sp09	21		20		22
Au10	18		25		23
Sp10	9		30	22	
Au11			27	23	
Sp11	20		27	22	
Au12	14		17	18	
This Survey					
Sp12	26		28	24	
Long-Term Mean & Standard Deviation					
Mean	20.5	23.5	23.4	22.8	20.9
SE	5.3	2.5	4.2	2.4	3.4
X-SD	15.19	20.98	19.21	20.39	17.47
X+SD	25.72	26.02	27.63	25.16	24.24

Figure 48. Glennies Creek Seasonal Site Macroinvertebrate Diversity

3.8 WEED AND PEST CONTROL

3.8.1 Weed Management

Weed works conducted during the period are shown in **Figure 50** and **Figure 51** and focused on the following species:

Table 26. **WEED MANAGEMENT**

Species	Classification	Area treated (ha)
African Boxthorn	Class 4 noxious weed	186.31ha
Galenia	Environmental weed	16.85ha in the NEOC rehabilitation
St John's Wort	Class 4 noxious weed	205.77ha in 2011 and 103.46ha in 2012
Mother of Millions	Class 3 noxious weed	5.88ha
Scotch & Black Thistles	Environmental weed	3.07ha in the NEOC rehabilitation
Coolatai Grass	Class 3 noxious weed	25.27ha
African Olive	Environmental weed	18.56ha

3.8.2 Pest Control

Ashton Coal has a vertebrate pest program in place. In December 2012 a campaign under this program was undertaken by Enright Land Management Pty Ltd on behalf of Ashton Coal. 1080 baits were used to target wild dogs and foxes on Ashton Coal land. There were a total of 26 bait stations (**Figure 52**) that were used to present the 1080 baits to the target species. Each station is checked on four separate occasions over a two week period with all baits not taken removed on the fourth and final check. The remaining baits are buried onsite as per the Pesticide Control Order 2008. 30 of the 104 presented baits were positively identified as being taken by foxes and one bait taken by a Wild Dog, with another seven baits being taken however the mounds were disturbed by cattle and vehicles making it hard to determine what had taken the baits, but with such a high population of foxes in the area it is highly likely that these baits had been picked up by foxes.

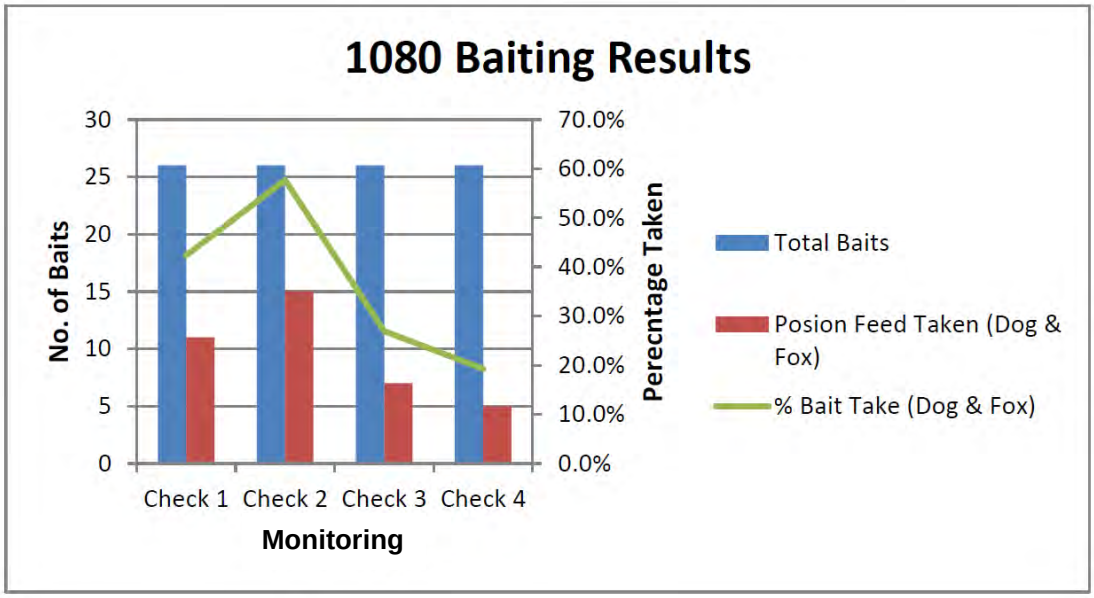

Figure 49. December 2012 1080 baiting results

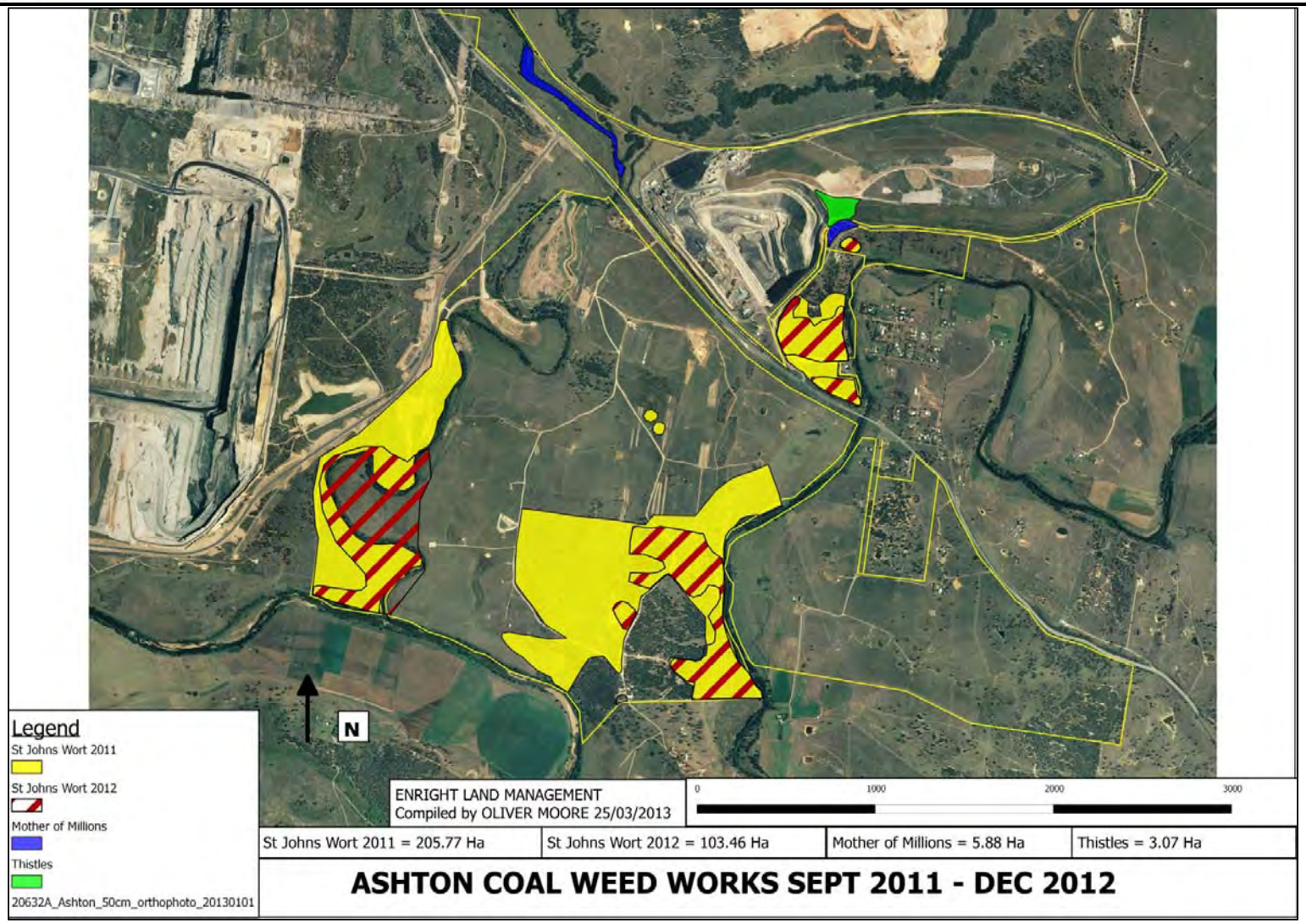

Figure 50. Overview of weed control works September 2011 to December 2012 part A

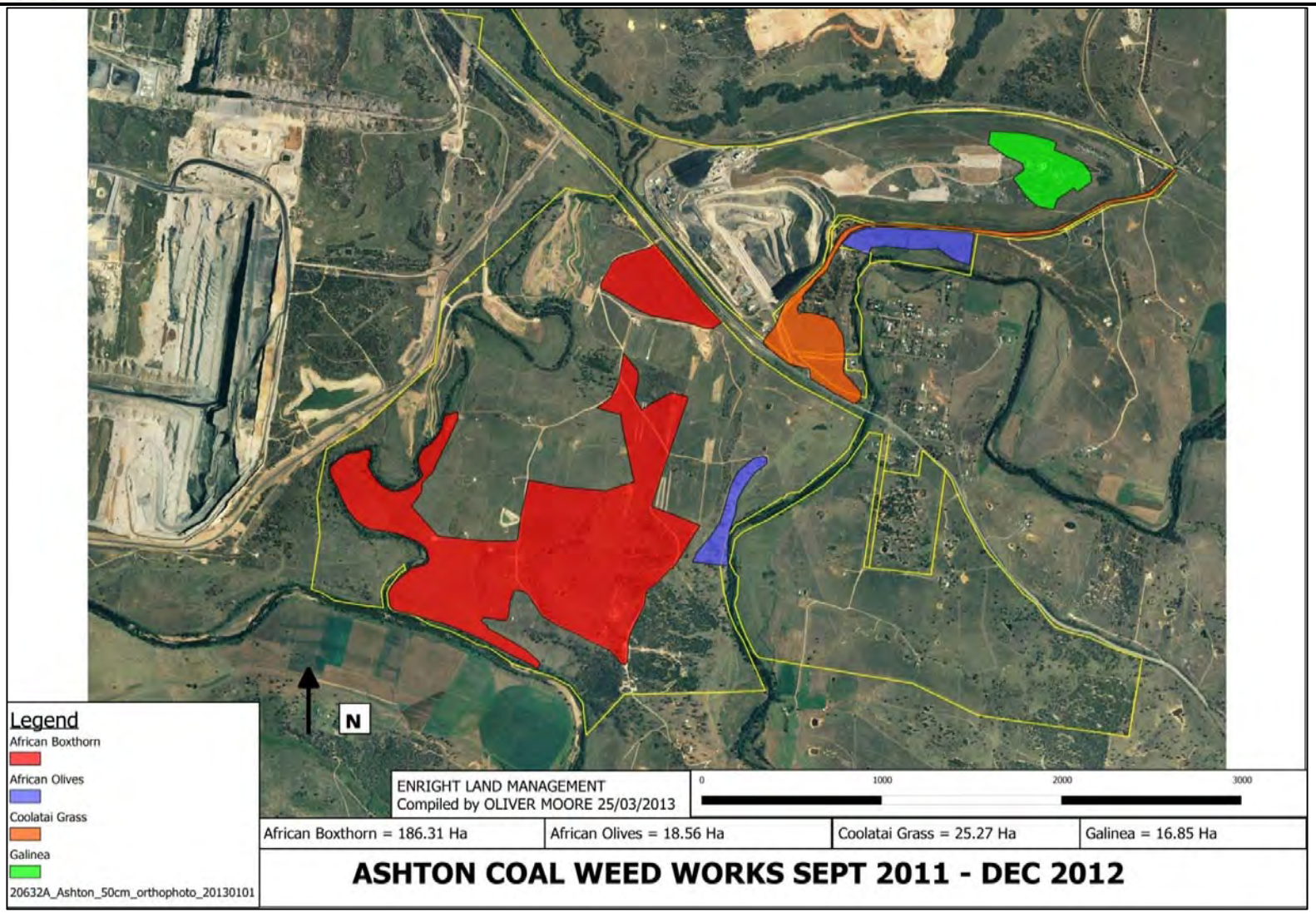

Figure 51. Overview of weed control works September 2011 to December 2012 part B

Figure 52. Pest Control – 1080 Ground Baiting Locations December 2012

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3.9 BLASTING

3.9.1 Blast Management

Blasting ceased with the closure of the NEOC in September 2011, and is not expected to resume until the future South East Open Cut (SEOC) pit is developed. Due to the proximity of the Main Northern Railway, Glennies Creek Road and the village of Camberwell to the mining operations area, the Blasting and Vibration Management Plan (BVMP) was in place to ensure that blasts conformed to the criteria defined in the Development Consent and the EPL.

Blasting times are limited to the hours of 9am to 5pm Monday to Saturday inclusive by the Development Consent, However the EPL states that blasting cannot occur on Sundays or public holidays without prior approval. During the reporting period no blasts were conducted on Sundays or Public Holidays.

To ensure that ground vibration does not exceed criteria at receptor locations, the Maximum Instantaneous Charge (MIC) is calculated for each blast at the design stage. Procedures are also in place to ensure that sufficient depth of crushed stemming material is placed in the collar of each blast hole to minimise the likelihood of excessive air blast (air overpressure).

The BVMP also requires the completion of a Blasting Environmental Checklist prior to each blast. This checklist ensures that meteorological conditions are appropriate for the blast to occur. There is also a checklist for Community Notifications.

The private residents of Camberwell village and all occupiers of buildings within 2 kilometres of blasting locations were provided advance notice of planned blasting events on the Ashton website (www.ashtoncoal.com.au) and excepting where they have requested to be removed from the contact list, at least one hour prior to each blasting event, by telephone.

3.9.2 Blast Criteria and Monitoring

The Development Consent defines the following criteria:

"The Airblast overpressure level from blasting operations carried out in or on the premises must not exceed:

(a) 115dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period; and

(b) 120dB (Lin Peak) at any time

At any residence or other noise sensitive receiver such as the St Clements Anglican Church and Camberwell Community Hall

The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed:

(a) 2mm/s for more than 5% of the total number of blasts carried out in or on the premises during each reporting period; and

(b) Exceed 10mm/s at any time

At any residence or other noise sensitive receiver such as the St Clements Anglican Church and Camberwell Community Hall."

One blast took place during the reporting period. A summary of the results is provided below.

Table 27. LOCATION OF BLAST MONITORING STATIONS	
Monitoring Station No	**Location**
1	Camberwell village (north)
2	St Clements Church

Table 28. SUMMARY BLAST MONITORING RESULTS				
	St Clements Church		**Camberwell Village**	
	Vibration	**Overpressure**	**Vibration**	**Overpressure**
Results Captured	1	1	1	1
Data Recovery (%)	100%	100%	100%	100%
Results >2mm/s	0		0	
Results >2mm/s (%)	0%		0%	
Results >10mm/s	0		0	
Results > 115dB		0		0
Results > 115dB (%)		0%		0%
Results > 120bB		0		0

The single blast during the reporting period was within all criteria at both the St Clements Church and Camberwell Village locations.

3.10 OPERATIONAL NOISE

3.10.1 Noise Management

The Noise Management Plan of Ashton Coal's mining operations has been approved by the Department of Planning and Infrastructure. As part of this plan a set of proactive and reactive mitigation measures have been identified to assist in reducing the noise impact from ACOL on the neighbouring residence. A real time noise monitoring station is located in Camberwell Village as a management tool when determining noise sources for responding to complaints. During the reporting period there were no noise exceedances of the EPL and Development Consent criteria recorded during the noise surveys.

3.10.2 Noise Criteria and Monitoring

Noise generated by the Ashton Coal Project must not exceed the limits specified in Condition 6.34 (Table 5) of the development consent and condition L2.1 of the EPL, detailed in **Table 29**.

Table 29. (DC TABLE 5) NOISE LIMITS (DB(A))				
Location	**Day**	**Evening**	**Night**	
	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(1\ minute)}$
Any residence not owned by the Applicant or not subject to an agreement between the Applicant and the residence owner as to an alternate noise limit	38	38	36	46

The above criteria do not apply when wind speeds are greater than 3m/s and/or there is an inversion in place of greater than 3°C/100m.

Quarterly Noise Monitoring

Condition 6.44 of the Development Consent requires noise monitoring surveys at potentially affected residences on a 3-monthly basis. All monitoring was performed by Spectrum Acoustics, utilising manned monitoring methods as specified in the EIS.

Quarterly noise monitoring results are detailed in tables below. There were no noise exceedances of the EPL and Development Consent criteria recorded during the five surveys conducted during this reporting period.

Table 30. **NOISE RESULTS NOVEMBER 2011 (15 NOVEMBER 2011):**

ACOL Noise Monitoring Results – 15 November 2011 – Day							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	3:30 pm	39	Inaudible	Birds (39), other mines (30), ACOL inaudible	3.6/96	Nil	Nil
Stapleton	4:18 pm	47	Inaudible	Traffic (46), birds (40), ACOL inaudible	4.0/130	Nil	Nil
Clark	4:01 pm	46	Inaudible	Birds & insects (44), traffic (42), ACOL inaudible	4.0/110	Nil	Nil
Horadam	4:35 pm	52	Inaudible	Traffic (52), ACOL inaudible	4.4/122	Nil	Nil
Moss	4:55 pm	64	Inaudible	Traffic (64), ACOL inaudible	5.0/102	Nil	Nil
ACOL Noise Monitoring Results – 15 November 2011 – Evening							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	7:37 pm	44	Inaudible	Birds & insects (42), train (38), cows (36), ACOL inaudible	3.2/98	>3	Nil
Stapleton	8:30 pm	46	Inaudible	Birds & insects (44), traffic (42), ACOL inaudible	1.9/113	>3	Nil
Clark	8:10 pm	41	Inaudible	Birds (38), traffic (37), insects (34), ACOL inaudible	2.2/111	>3	Nil
Horadam	8:55 pm	44	Inaudible	Traffic (44), ACOL inaudible	1.9/107	>3	Nil
Moss	9:13 pm	63	Inaudible	Traffic (63), ACOL inaudible	1.7/138	>3	Nil
ACOL Noise Monitoring Results – 15 November 2011 – Night							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	10:01 pm	42	Inaudible	Birds & insects (40), train (36), cows (35), ACOL inaudible	1.6/139	>3	Nil
Stapleton	10:40 pm	45	Inaudible	Traffic (45), insects (30), ACOL inaudible	1.9/131	>3	Nil
Clark	10:23 pm	44	Inaudible	Traffic (43), insects (36), train (35), ACOL inaudible	1.7/149	>3	Nil
Horadam	11:00 pm	46	Inaudible	Traffic (46), insects (30), ACOL inaudible	1.1/124	>3	Nil
Moss	11:20 pm	60	Inaudible	Traffic (60), insects (32), ACOL inaudible	0.7/106	>3	Nil

* Comments outline the primary noise sources and noise levels from each source in dB(A)

During the day, evening and night monitoring periods winds were light to gentle shifting from the east south east to the south east. The weather station data indicated there was a mild temperature inversion (>3 °C/ 100m) from early in the evening. There were no noise exceedances recorded during the survey.

Table 31. **NOISE RESULTS FEBRUARY 2012 (15 FEBRUARY 2012):**

ACOL Noise Monitoring Results – 15 February 2012 – Day							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	5:17 pm	51	Inaudible	Tractor (49), birds (44), mines (42), ACOL inaudible	3.7 / 117	Nil	Nil
Stapleton	4:28 pm	47	Inaudible	Traffic (45), mower (42), ACOL inaudible	3.5 / 57	Nil	Nil
Clark	4:08 pm	46	Inaudible	Traffic (46), Birds & insects (34), ACOL inaudible	3.2 / 83	Nil	Nil
Horadam	4:49 pm	51	Inaudible	Traffic (51), ACOL inaudible	3.1 / 122	Nil	Nil
Moss	3:48 pm	68	Inaudible	Traffic (68), ACOL inaudible	3.3 / 109	Nil	Nil
ACOL Noise Monitoring Results – 15 February 2012 – Evening							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	9:13 pm	51	Inaudible	Insects (49), bats (43), mines (41), ACOL inaudible	2.3 / 112	< 3	Nil
Stapleton	8:27 pm	51	Inaudible	Birds & insects (48), traffic (46), ACOL inaudible	2.8 / 130	< 3	Nil
Clark	8:11 pm	48	Inaudible	Traffic (45), dog (45), ACOL inaudible	2.5 / 121	< 3	Nil
Horadam	8:46 pm	52	Inaudible	Traffic (52), wind (41), ACOL inaudible	2.8 / 117	< 3	Nil
Moss	7:51 pm	65	Inaudible	Traffic (65), ACOL inaudible	2.8 / 133	< 3	Nil
ACOL Noise Monitoring Results – 15 February 2012 – Night							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	11:18 pm	49	Inaudible	Birds & insects (47), mines (42), ACOL inaudible	1.7 / 114	< 3	Nil
Stapleton	10:38 pm	46	Inaudible	Traffic (43), insects (42), ACOL inaudible	2.2 / 109	< 3	Nil
Clark	10:19 pm	50	Inaudible	Traffic (49), insects (43), mines (34), ACOL inaudible	2.6 / 100	< 3	Nil
Horadam	10:56 pm	53	Inaudible	Insects (50), traffic (49), ACOL inaudible	2.0 / 109	< 3	Nil
Moss	10:01 pm	65	Inaudible	Traffic (65), insects (42), ACOL inaudible	1.9 / 130	< 3	Nil

* Comments outline the primary noise sources and noise levels from each source in dB(A)

During the three monitoring periods winds were light to gentle shifting from the south east. The weather station data indicated there may have been a mild temperature inversion (<3 ^{O}C/ 100m) from early in the evening. There were no noise exceedances recorded during the survey.

Table 32. **NOISE RESULTS MAY 2011 (31 MAY 2012):**

ACOL Noise Monitoring Results – 31 May 2012 – Day							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	4:30 pm	51	Inaudible	Birds (50), mines (39), ACOL inaudible	1.8 / 111	3.6	Nil
Stapleton	3:48 pm	50	Inaudible	Traffic (48), mower (42), wind (41), ACOL inaudible	1.8 / 108	2.7	Nil
Clark	3:30 pm	56	Inaudible	Mower (55), traffic (42), wind (40), ACOL inaudible	2.9 / 112	2.5	Nil
Horadam	4:09 pm	56	Inaudible	Traffic (56), wind (39), ACOL inaudible	2.3 / 112	3.3	Nil
Moss	3:11 pm	69	Inaudible	Traffic (69), wind (45), ACOL inaudible	1.9 / 105	2.5	Nil
ACOL Noise Monitoring Results – 31 May 2012 – Evening							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	8:36 pm	44	Inaudible	Car (40), mines (40), insects (35), ACOL inaudible	1.3 / 102	9.1	Nil
Stapleton	7:56 pm	50	Inaudible	Traffic (49), Birds & insects (42), ACOL inaudible	1.7 / 126	8.5	Nil
Clark	7:39 pm	46	Inaudible	Traffic (46), birds (32), mines (30), ACOL inaudible	2.2 / 131	8.0	Nil
Horadam	8:16 pm	55	Inaudible	Traffic (55), insects (38), ACOL inaudible	1.3 / 141	9.0	Nil
Moss	7:21 pm	68	Inaudible	Traffic (68), ACOL inaudible	1.7 / 184	8.3	Nil
ACOL Noise Monitoring Results – 31 May 2012 – Night							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	10:38 pm	47	Inaudible	Train (43), mines (42), insects (36), ACOL inaudible	1.2 / 106	7.7	Nil
Stapleton	11:33 pm	47	Inaudible	Traffic (46), insects (33), mines (31), ACOL inaudible	0.3 / 120	9.4	Nil
Clark	11:15 pm	43	Inaudible	Traffic (40), mines (38), insects (32), ACOL inaudible	0.9 / 121	9.2	Nil
Horadam	10:58 pm	51	Inaudible	Traffic (51), Insects (35), ACOL inaudible	1.0 / 119	8.6	Nil
Moss	11:51 pm	64	Inaudible	Traffic (64), insects (33), ACOL inaudible	0.7 / 146	9.9	Nil

* Comments outline the primary noise sources and noise levels from each source in dB(A)

During the three monitoring periods winds were light to gentle shifting from the south east. The weather station data indicated there was a mild (<4 ^{O}C/ 100m) temperature inversion late in the afternoon and a strong (>4 ^{O}C/ 100m) temperature inversion from early in the evening. There were no exceedances of noise criteria recorded.

Table 33. **NOISE RESULTS AUGUST 2012 (27 AUGUST 2012):**

ACOL Noise Monitoring Results – 27 August 2012 – Day							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	4:03 pm	52	Inaudible	Turkeys (50), train (36), mines (36), ACOL inaudible	1.4 / 83	3.0	Nil
Stapleton	5:05 pm	50	Inaudible	Traffic (49), wind (40), birds (36), ACOL inaudible	2.0 / 97	1.8	Nil
Clark	4:46 pm	43	Inaudible	Birds (40), traffic (36), mine (30), ACOL inaudible	1.9 / 117	2.4	Nil
Horadam	4:27 pm	53	Inaudible	Traffic (53), ACOL inaudible	1.4 / 126	2.6	Nil
Moss	5:23 pm	70	Inaudible	Traffic (70), ACOL inaudible	1.4 / 168	2.9	Nil
ACOL Noise Monitoring Results – 27 August 2012 – Evening							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	8:51 pm	39	Inaudible	Mine (36), traffic (34), insects (31), ACOL inaudible	1.9 / 146	9.0	Nil
Stapleton	8:10 pm	47	Inaudible	Traffic (46), Birds (39), mine (35), ACOL inaudible	1.6 / 111	8.7	Nil
Clark	7:53 pm	44	Inaudible	Traffic (41), birds (37), mine (36), ACOL inaudible	1.6 / 111	7.8	Nil
Horadam	8:29 pm	46	Inaudible	Traffic (46), ACOL inaudible	1.5 / 153	8.9	Nil
Moss	7:37 pm	67	Inaudible	Traffic (67), ACOL inaudible	1.8 / 112	7.8	Nil
ACOL Noise Monitoring Results – 27 August 2012 – Night							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	10:41 pm	47	Inaudible	Train (45), traffic (39), mines (37), ACOL inaudible	1.9 / 143	>9	Nil
Stapleton	11:41 pm	48	Inaudible	Traffic (47), insects (41), ACOL inaudible	0.3 / 86	>9	Nil
Clark	11:29 pm	46	Inaudible	Traffic (45), insects (36), mines (34), ACOL inaudible	0.5 / 86	>9	Nil
Horadam	11:07 pm	55	Inaudible	Traffic (55), Insects (36), ACOL inaudible	0.3 / 87	>9	Nil
Moss	11:59 pm	63	Inaudible	Traffic (63), insects (36), ACOL inaudible	1.4 / 288	>9	Nil

* Comments outline the primary noise sources and noise levels from each source in dB(A)

During the three monitoring periods winds were light to gentle shifting from the south east. The weather station data indicated there was a mild (<4 °C/ 100m) temperature inversion late in the afternoon and a strong (>4 °C/ 100m) temperature inversion from early in the evening. There were no exceedances of noise criteria recorded.

Table 34. **NOISE RESULTS NOVEMBER 2012 (21 NOVEMBER 2012):**

ACOL Noise Monitoring Results – 21 November 2012 – Day							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	5:30 pm	35	Inaudible	Mines (32), farm animals (30), birds (28), ACOL inaudible	1.0/87	3.1	Nil
Stapleton	4:19 pm	45	Inaudible	Traffic (45), birds (33), ACOL inaudible	1.1/183	3.0	Nil
Clark	3:58 pm	46	Inaudible	Traffic (46), birds (32), ACOL inaudible	1.0/145	3.3	Nil
Horadam	4:40 pm	38	Inaudible	Traffic (38), birds (27), ACOL inaudible	0.8/191	2.8	Nil
Moss	4:58 pm	69	Inaudible	Traffic (68), ACOL inaudible	0.9/254	2.5	Nil
ACOL Noise Monitoring Results – 21 November 2012 – Evening							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	7:13 pm	35	Inaudible	Mine (33), birds (29), traffic (28), ACOL inaudible	1.0/114	6.1	Nil
Stapleton	8:05 pm	46	Inaudible	Traffic (45), birds & insects (40), ACOL inaudible	0.9/115	8.1	Nil
Clark	7:44 pm	43	Inaudible	Traffic (42), birds & insects (38), ACOL inaudible	2.5/85	6.9	Nil
Horadam	8:53 pm	44	Inaudible	Traffic (43), insects (36), ACOL inaudible	1.3/107	12.1	Nil
Moss	8:27 pm	68	Inaudible	Traffic (68), birds (32), mines (30), ACOL inaudible	2.6/92	10.6	Nil
ACOL Noise Monitoring Results – 21 November 2012 – Night							
Location	Time	dB(A) Leq	ACOL dB(A)	Comments *	WS (m/s)/ WD (°)	Inversion °C/ 100m	ACP Noise Sources
Richards	10:00 pm	40	Inaudible	Birds & insects (37), farm noise (35), mines (33), ACOL inaudible	2.1/176	8.1	Nil
Stapleton	10:46 pm	49	Inaudible	Traffic (48), insects (39), dog (30), ACOL inaudible	1.6/147	8.6	Nil
Clark	10:27 pm	47	Inaudible	Traffic (47), insects (37), ACOL inaudible	1.9/154	8.1	Nil
Horadam	11:30 pm	40	Inaudible	Traffic (39), Insects (32), ACOL inaudible	0.7/126	11.1	Nil
Moss	11:05 pm	63	Inaudible	Traffic (63), insects (30), ACOL inaudible	1.4/134	9.9	Nil

* Comments outline the primary noise sources and noise levels from each source in dB(A)

During the beginning of the day time monitoring period the wind was gentle from the south. In the evening the winds were generally easterly and turning southeast to south at night. There were no exceedances of noise criteria recorded.

3.11 VISUAL

Fixed lighting is utilised to illuminate the areas around the underground surface facilities, CHPP and open cut workshop. During the reporting period an earth bund was constructed and tree screen planted as a visual screen for main fans that are being constructed at the northern end on LW1 and LW101.

3.12 ABORIGINAL HERITAGE

Consultation with the Indigenous Community

Consultation with Indigenous community was undertaken throughout the reporting period on various topics related to cultural heritage management. These included Aboriginal Heritage Impact Permit (AHIP) 1131017, Aboriginal Cultural Heritage Management Plan (ACHMP) and development consent modifications 9 and 10. Full details of the consultation can be found in **Appendix 5**.

Pre-disturbance inspections for minor surface works within underground surface areas continued throughout the year. Each of the ACOL Registered Aboriginal Parties participate in the inspections on a rostered basis. These inspections are part of ACOL's environmental management processes. Details of these works, including dates and names of participants, can be found in the full correspondence log in **Appendix 5**. Areas that had archaeological clearance and salvage works completed during the reporting period included:

- Bowmans Creek Diversion
- Longwalls 1 & 2 Predicted Subsidence Zones
- 5.5m Vent Shaft Site
- Backroad Vent Shaft Site
- Borehole 3 Site

3.13 NATURAL HERITAGE

One item of natural or European heritage was identified during the reporting period. A Shepherds hut was identified above the underground workings in the vicinity of LW8. Best practice non ground disturbing techniques were used to identify the extent of the site which was not impacted by the mining operations.

The Diocese is still reviewing its plans for St Clements Church however Ashton Coal will continue to support the building in its current and future forms for the sustainability of Camberwell Village.

3.14 SPONTANEOUS COMBUSTION

A Spontaneous Combustion Management Plan has been prepared and implemented on site.

ACOL have taken on the responsibility of an area of Macquarie Generations Ravensworth Void 4 area for the disposal of Tailings. This area has had significant spontaneous combustion instances and is managed under the Tailings Emplacement Operations Plan. Part of this management includes regular monitoring by CHPP personnel and detailed surveys of the area to record the location and severity of spontaneous combustion points. Photographic records of each area are also recorded. Monitoring during this period has shown a decrease in instances of spontaneous combustion.

3.15 BUSHFIRE

The review of the Bushfire Management Plan (BMP) is currently being undertaken and will be completed during 2013.
During this reporting period there was a small grass fire located on ACOL owned land on the southern side of the New England highway and in between Glennies Creek and Glennies Street on the evening of 11th January 2012. The Rural Fire Service (RFS) attended and had the fire extinguished within a couple of hours. The following day they again attended the site to conduct an investigation. The RFS was unable to determine what had caused the fire.

3.16 MINE SUBSIDENCE

During the reporting period the Underground mine continued first and secondary workings in the Pikes Gully and Upper Liddell Seam respectively. Mining of first workings have been geotechnically assessed as being long term stable, thus no subsidence was experienced in these areas. The mined height was generally 2.6m to 2.8m for 1st workings development while the longwall targeted a 2.3 to 2.5m section to minimise extraction of excess roof and floor stone. The seam dips to the southwest at a grade of up to 1 in 10. The PG seam overburden ranges in thickness from 129m at the end of Longwall 7B to 180m at the start of Longwall 8. Longwall 7B and Longwall 8 panels are narrower compared to the rest of the blocks. The final extraction voids for Longwall 7B and Longwall 8 are 198m and 134m respectively which includes gate road development. The ULD seam Longwall 101 overburden ranges in thickness from 155m near the start of the longwall panel to 80m at the take-off end. Chain pillar dimensions for both PG seam and ULD seam are a minimum of 25m rib-to-rib at a maximum of 150m cut-through centres.

Longwall operations commenced in February 2007. To date mining of PG seam except Longwall 6B are complete and longwall equipment has been relocated into ULD seam longwall 101 to continue extraction to lower seams. The progress of longwall extraction is shown in **Figure 53.**

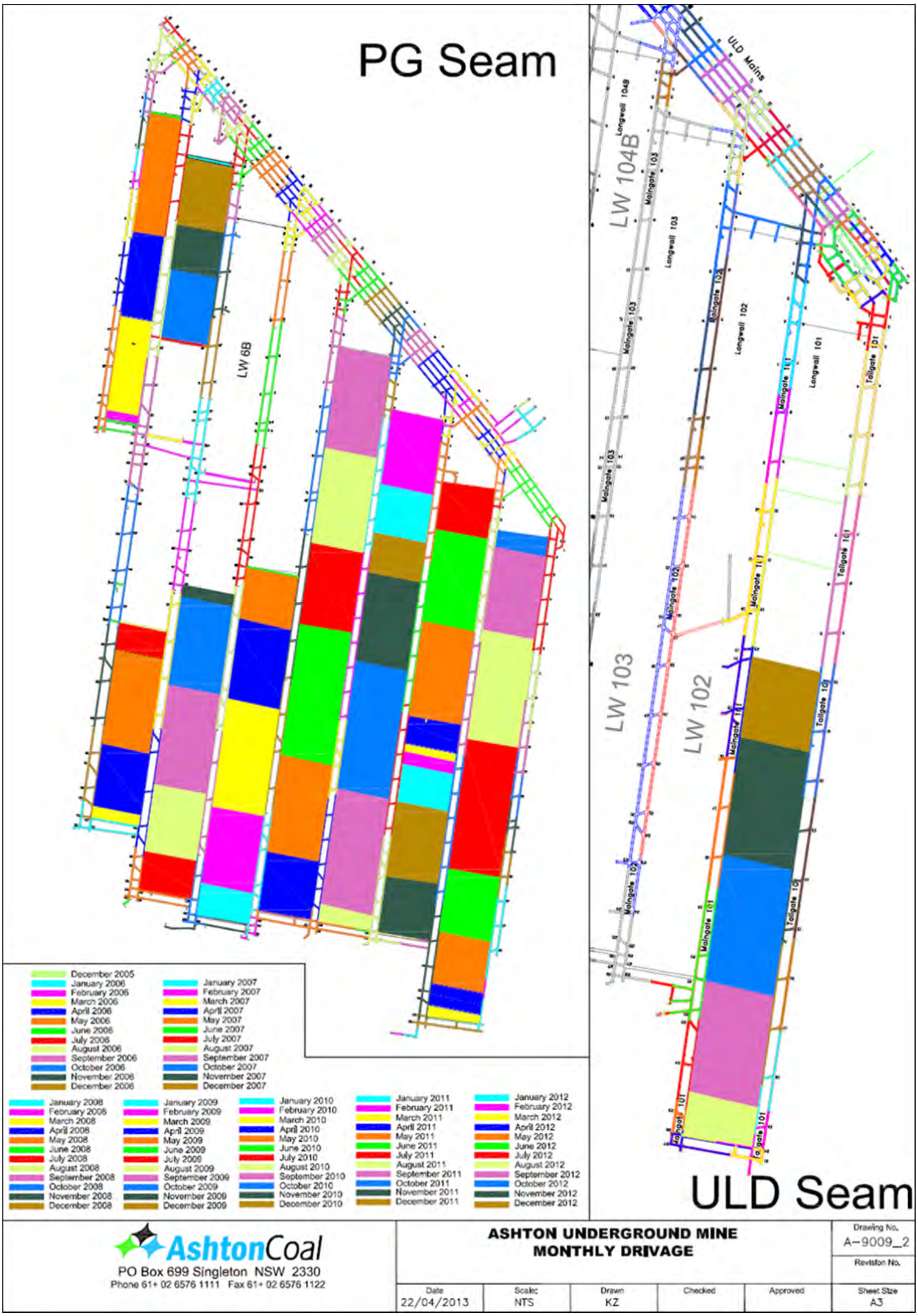

Figure 53. Progression of Longwall Extraction

3.16.1 Subsidence Monitoring

Ashton Coal has monitored the subsidence movement on the surface during the extraction of Longwalls 1 to 8 using longitudinal subsidence lines. These are located over the start and finish of each panel, a main cross line (XL) extending over all seven southern panels and a dedicated cross line (XL) extending over Longwall 7B and 8. All panels have monitoring data from each start and end lines and various cross lines relevant to the panel, surface features or strata features.

The ULD seam Longwall 101 utilises panel centre lines (CL), the PG LW1 panel centre lines and the cross block survey monitoring lines that were used for the PG longwalls. The subsidence monitoring lines relevant to ULD LW101 to the end of this reporting period are CL1 and XL1 to XL5. A plan showing the location of the subsidence monitoring centre lines and cross lines are included in Appendix 3.

Table 35 outlines the maximum subsidence recorded during regular survey of subsidence lines throughout the mine life as the longwall passed each location.

Visual and survey monitoring of existing single pole 33kV power structures over PG seam Longwall 7 and Longwall 8 were undertaken regularly. The 33kV poles have been referenced as PP30 to PP32, PP36 to PP38 (pole number referenced from north to south). The 33kV powerline was surveyed prior to and post undermining and visually inspected during/post undermining to ensure adequate clearance and safety. Signage has been erected to indicate maximum load heights under the 33kV powerline prior to commencement of LW8. Survey data from the 33kV power lines was recorded and supplied to the Principal Subsidence Engineer as per the Ashton Mine Subsidence Monitoring Program Longwall 6B-8.

During mining of PG seam Longwall 7B and Longwall 8, monthly surveys were completed on Narama Dam due to extraction taking place within the notification area. Narama Dam is a prescribed dam under the Dam Safety Act 1978. Monitoring information was sent to the Dams Safety Committee weekly as required under DSC ASHTON-2 Approval: Mining in the Narama Notification Area. Measurements show there was no perceptible effect on the dam from Longwall 7B and Longwall 8 extraction.

Table 35. **SUBSIDENCE LEVELS PG SEAM**

	Maximum Predicted EIS	Maximum Predicted SMP	Maximum Measured			
North End of LW1			**CL2**	**XL8**		
Subsidence (mm)	1430	1800	1550	1550		
Tilt (mm/m)	122	244	100	125		
Horizontal Movement (mm)	-	>500	530	535		
Tensile Strain (mm/m)	16	73	36	20		
Compressive Strain (mm/m)	25	98	40	30		
Remainder of LW1			**CL1**	**XL5**		
Subsidence (mm)	1690	1700	1381	1429		
Tilt (mm/m)	60	141	61	100		
Horizontal Movement (mm)	-	300-500	502	428		
Tensile Strain (mm/m)	8	42	49	22		
Compressive Strain (mm/m)	12	56	23	19		
Longwall 2			**CL1**	**CL2**	**XL5**	
Subsidence (mm)	1690	1600	1332	1566	1286	
Tilt (mm/m)	91	102	40	94	63	
Horizontal Movement (mm)	-	300-500	501	298	425	
Tensile Strain (mm/m)	12	30	17	42	28	
Compressive Strain (mm/m)	18	41	17	19	11	
Longwall 3			**CL1**	**CL2**	**XL5**	
Subsidence (mm)	1500	1600	1443	1451	1480	
Tilt (mm/m)	65	78	41	59	99	
Horizontal Movement (mm)	-	300-500	430	360	450	
Tensile Strain (mm/m)	9	23	10	40	22	
Compressive Strain (mm/m)	13	31	7	29	25	
Longwall 4			**CL1**	**CL2**	**XL5**	**XL10**
Subsidence (mm)	1430	1600	1421	1235	1491	1288
Tilt (mm/m)	46	78	36	40	55	34
Horizontal Movement (mm)	-	300-500	252	584	373	267[1]
Tensile Strain (mm/m)	6	23	10	31	10	10
Compressive Strain (mm/m)	9	31	9	67	9	6
Longwall 5			**CL1**	**CL2**	**XL5**	
Subsidence (mm)	1430	1600	1305	1374	1429	
Tilt (mm/m)	29	78	23	30	35	
Horizontal Movement (mm)	-	300-500	413	362[2]	402	
Tensile Strain (mm/m)	4	23	22	6	15	
Compressive Strain (mm/m)	5	31	9	8	6	
Longwall 6A			**CL1**	**CL2**	**XL5**	
Subsidence (mm)	1430	1600	1415	1332	1410	
Tilt (mm/m)	29	57	19	25	39	
Horizontal Movement (mm)	-	300-500	290	262	333	

Table 35. SUBSIDENCE LEVELS PG SEAM						
	Maximum Predicted EIS	**Maximum Predicted SMP**	**Maximum Measured**			
Tensile Strain (mm/m)	4	17	7	10	9	
Compressive Strain (mm/m)	5	23	7	10	8	
Longwall 7A			**CL1**	**CL2**	**XL5**	
Subsidence (mm)	1430	1600	1452	>1010	1334	
Tilt (mm/m)	29	57	24	16	24	
Horizontal Movement (mm)	-	300-500	355	145	426	
Tensile Strain (mm/m)	4	17	8	>4	12	
Compressive Strain (mm/m)	5	23	10	>5	10	
Longwall 7B			**CL3**	**CL4**	**XL13**	
Subsidence (mm)	1430	1600	1400	1258	1500[3]	
Tilt (mm/m)	29	57	30	22	30[3]	
Horizontal Movement (mm)	-	300-500	321	180	415	
Horizontal Movement (mm)	-	300-500	321	180	415	
Tensile Strain (mm/m)	4	17	10	6	12	
Compressive Strain (mm/m)	5	23	8	10	6	
Longwall 8			**CL1**	**CL2**	**XL13**	**XL14**
Subsidence (mm)	1430	1200	548[4]	739[5]	569	869[6]
Tilt (mm/m)	29	50	8	11	12	21
Horizontal Movement (mm)	-	300-500	90	88	218	243
Tensile Strain (mm/m)	4	15	0.8	2.6	6.1	6.4
Compressive Strain (mm/m)	5	20	1.0	2.5	10.6	12.7

[1] XL10 was installed after some horizontal movement associated with the previous longwall may have occurred so not all horizontal movements were measured.
[2] Maximum measured at end line.
[3] Estimated from the shape of the profile because subsidence line did not extend across the area of greatest subsidence.
[4] Maximum measured at end of line, construction activities prevented the monitoring points extending further into the panel.
[5] Maximum measured at the end of the line, monitoring line did not extend past the adjacent LW7B recovery point.
[6] Maximum measured at the end of the line, monitoring line installed to monitor subsidence effects outside the panel edge towards Ravensworth Underground Shaft 5 only.

The following table (**Table 36)** outlines the maximum subsidence parameters predicted and recorded during regular survey of subsidence lines as the ULD Longwall 101 passed each location measured up until 7 January 2013.

Subsidence monitoring over ULD seam Longwall 101 to the end of December 2012 consisted of regular surveys of LW101 CL1 andXL1 to XL5. XL2 and XL3 do not extend over the extraction area of LW101, however monitoring was conducted to observe subsidence impacts outside of the panel towards Glennies Creek. XL4 was extended west over the LW101 panel after PG LW1 extraction. Previous to this XL4 extended to the panel edge of PG LW1. Therefore the monitoring on XL4 only shows cumulative results up to the edge of PG LW1 and does not represent the multi seam cumulative subsidence beyond this point. The results west of PG LW1 panel edge are only

the effects of ULD LW101. Subsidence monitoring and recording is undertaken in accordance with "*Ashton Mine Subsidence Monitoring Program Longwall 101 to 104".* This information is being supplied to the Principal Subsidence Engineer as per the "*Ashton Mine Subsidence Monitoring Program Longwall 101"*. See the ULD and Pikes Gully Seam Layouts Proposed and Existing Subsidence Monitoring plan in **Appendix 3** for the subsidence cross lines.

Visual and survey monitoring of existing 132kV power structures over ULD Longwall 101 was undertaken regularly. The 132kV poles have been referenced as SET21, SET22 and SET23. The 132kV powerline was surveyed prior to, during and post undermining. Survey data from the 132kV power lines was recorded and supplied to the Principal Subsidence Engineer as per the "*Ashton Mine Subsidence Monitoring Program Longwall 101".* Maximum subsidence measured on power poles (SET21, SET22, and SET23) during ULD Longwall 101 mining was: 0.115m, 2.065m and 0.036m respectively.

Table 36. **SUBSIDENCE LEVELS ULD SEAM**

	Maximum Predicted EIS	Maximum Predicted SMP	Maximum Measured as at 07/01/2013					
Longwall 101			**CL1**	**XL1**	**XL2[1]**	**XL3[2]**	**XL4[3]**	**XL5**
Subsidence (mm)	3700	4400	2715	2494	32	200	1822	2964
Tilt (mm/m)	150	235	5.8	41.8	3.7	31.3	48.9	100.5
Tensile Strain (mm/m)	70	94	4.5	22.6	1.3	13.2	11.5	26.2

[1] XL2 does not extend over ULD LW101 area.
[2] XL3 does not extend over ULD LW101 area.
[3] XL4 was extended to the west post PG LW1 mining and prior to ULD LW101 mining therefore the data past PG LW1 relates to ULD LW101 effects only

3.16.2 Impacts

Surface subsidence cracks generally developed along each gate edge of the Longwall panels. These generally run parallel to the gate road within the longwall block. Where required these cracks are remediated. The method and extent of remediation required is dependent on the extent of cracking and the environmental and other surface features present in the vicinity of the crack zone. During this reporting period, PG Longwall 7B and 8 and ULD LW101 were remediated in some areas post mining of each panel.

Remediation of cracking above Longwall 7B and 8 involved grading the Macquarie Generation access road, as most of the identified subsidence occurred on this road. Due to the limited width of cracking it posed minimal risk of injury to personnel, equipment or wildlife. The cracking which exists on the Macquarie Generation access road is face cracking: it opens up during undermining and in most cases closes again as the longwall continues to retreat. No subsidence cracking has been identified since the Macquarie Generation access road was graded.

Longwall 7B and 8 undermined areas of alluvium with heavy grass growth. These two factors resulted in limited visible cracking (similar to that experienced in Longwall 6A and 7A mining). Brunkers Lane at the time of undermining was in the process of being upgraded by Ravensworth North to become Lemington Road. The roadworks being undertaken continually involved drainage and other earthworks thus restricted access for both survey and visual monitoring. The extent of subsidence remediation at the goaf edge is outlined in **Figure 55.**

Subsidence above Longwalls 7B and 8 was typical of the subsidence behaviour observed in previous panels. No cracking has been observed to date around the start line of Longwall 7B or 8. Gateroad cracking was slow to develop due to the alluvial soil being undermined and moderate rainfall, allowing the ground surface to behave plastically with subsidence. The measured subsidence is within SMP predictions for Longwalls 7B and 8.

Cracks over ULD LW101 to the end of December 2012 are particularly evident on the up-hill side of the panel. Some cracks and compression lines have occurred parallel to the retreating face. Where this has occurred the features have usually started from a parallel pillar edge crack and continued around to align with the face. Rehabilitation of the surface cracks has been occurring as extraction continues. The work has been completed with a small excavator smoothing over surface cracks. Affected surface roads have only required treatment with a grader to smooth compression humps and minor cracks. The maximum subsidence movements detected over ULD LW101 are less than SMP predictions

During this reporting period, a section of primary access road to Property 130 within Ashton property was closed prior to ULD LW101 undermining. The alternate access road was adopted during the closure period. Relevant road users were notified prior to the road closure. Road closed signs and detour signs were in place. Powerline clearance signs within the alternate access road have been updated to ensure the safe movement of plant and equipment under and in the vicinity of these overhead lines. Subsidence remediation works were completed using a grader to maintain the undermined access road in a serviceable condition. The extent of subsidence remediation at the goaf edge is outlined in **Figure 56**. No new cracks have been identified since the remediation work.

Buried Telstra cables that run over PG LW 7 and 8 and ULD LW101 were undermined with no negative impacts. This line remained in service during the impact period. Overhead 132kV and 33kV electricity transmission lines were also undermined without damage. Prior to undermining, the affected powerlines were placed in rollers to prevent overstressing of the line as the poles moved with the subsidence.

An Xstrata Coal owned buried water pipeline was undermined by Longwalls 7 and 8 with no subsidence induced issues occurring. Prior to undermining, ACOL notified Ravensworth Operations and requested that 'broken pipeline' procedures were in place so that water loss due to a pipe split could be minimised (by means of flow rate monitoring and pump shut-down). This was implemented by Ravensworth Operations. Longwall 7 and 8 also undermined an ACOL owned tailings pipeline with no adverse impacts. This pipeline was exposed within a 'spoon drain' and had 'broken pipeline' monitoring in place.

Undermined farm sheds remained stable and usable during and post longwall extraction.

No damage was observed to farm gates, grids or fences during the reporting period.

Ponding has become evident in some subsided areas, typically in those areas which were flat pre-mining. The ponding which exists does not present any increased safety or environmental issues however it will need to be pumped out or have drainage re-established to prevent continual filling and holding of water. This is planned as future remediation, in consideration of the currently approved multi seam mining which will see the same area undermined for a further three seams. Presently the ponding is not severe and serves as a water source for stock which graze over the lease.

In general, the maximum subsidence movements detected were less than those predicted in the SMP. There is no indication of any significant lateral movement of the steep slope adjacent to Glennies Creek or of the New England Highway road cutting.

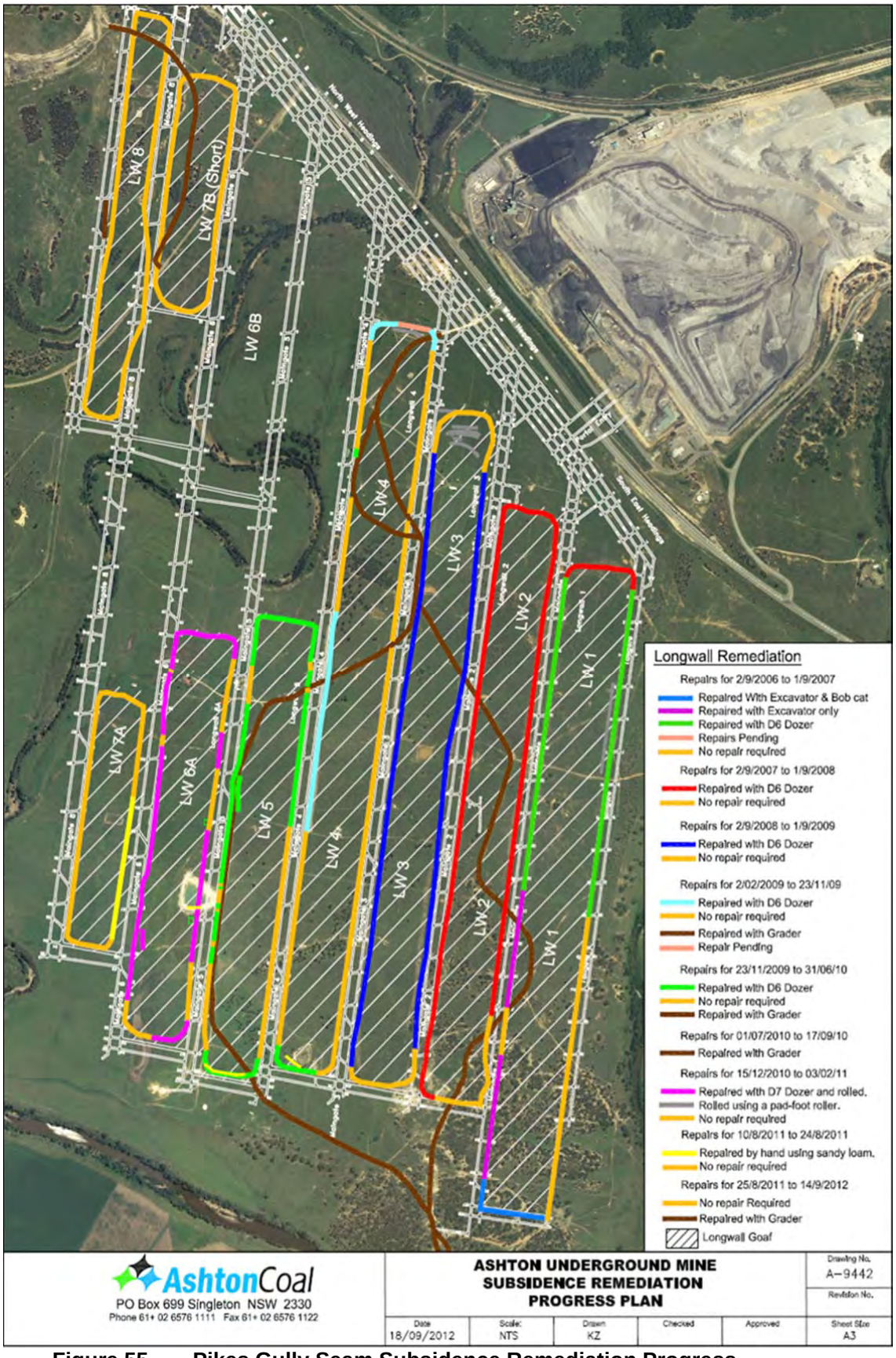

Figure 55. Pikes Gully Seam Subsidence Remediation Progress

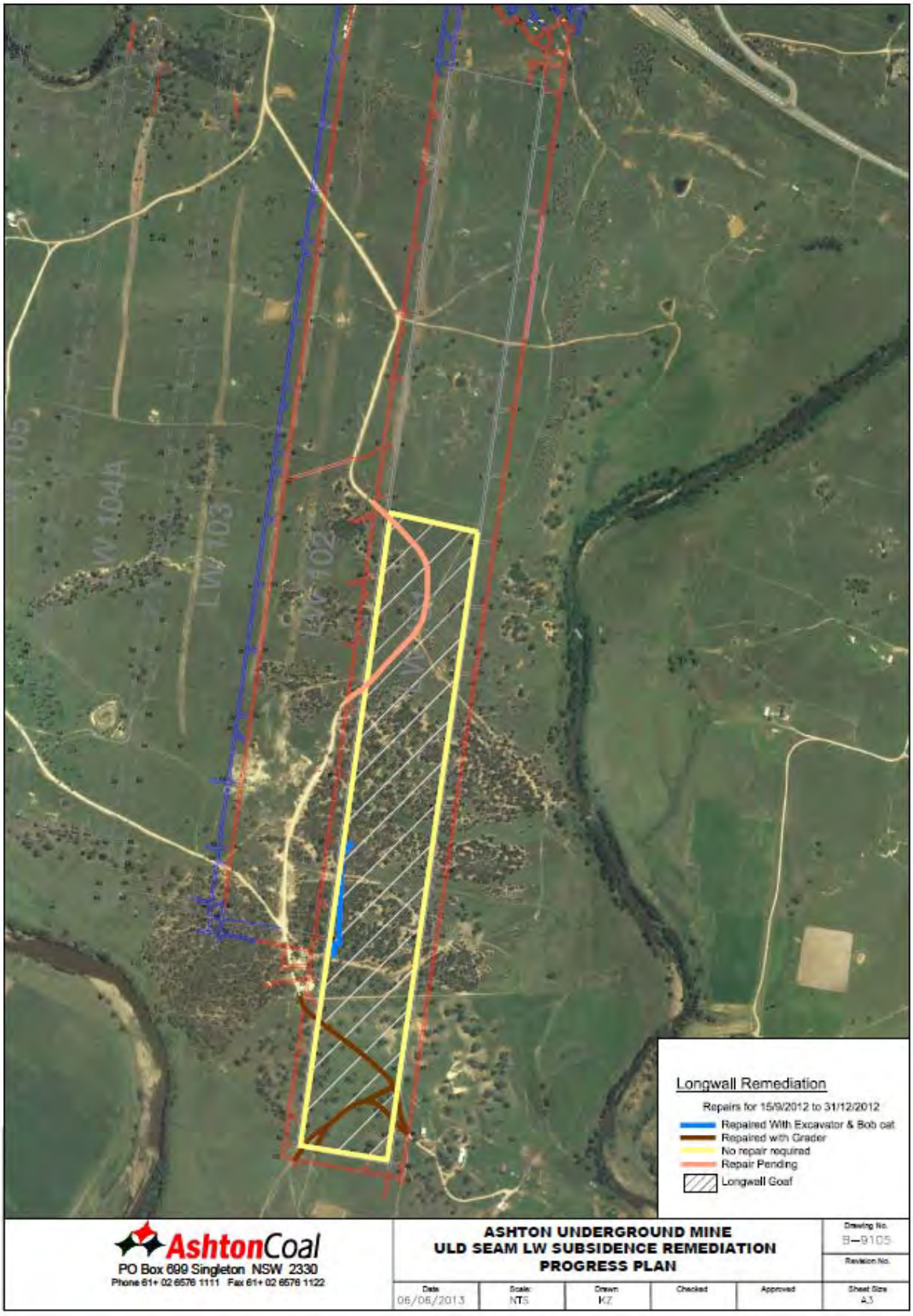

Figure 56. ULD Seam Subsidence Remediation Progress

3.17 HYDROCARBON CONTAMINATION

Minor hydrocarbon spills occurred on hardstand areas during the reporting period. All spills were contained and promptly collected with appropriate absorbent products prior to any hydrocarbons moving out of the immediate work areas.

3.18 METHANE DRAINAGE/VENTILATION

Mine ventilation began in May 2006 and has continued throughout the period. The ventilation quantity is currently approximately 225 cubic metres per second through the main fans at the portal and approximately 28 cubic metres per second through the backroad ventilation fan on the surface adjacent to Longwall 1. Use of this backroad fan was discontinued in September 2012 because the back road was sealed up.

Methane drainage occurred through surface gas drainage wells utilising a venturi effect to draw gas to the surface. Methane drainage activities occurred during the reporting period for LW8 and LW101. There were a total of 3 holes drilled however only 2 were used. The gas wells were in use from March to June 2012 and then October to November 2012.

Total emissions for the reporting period from the underground ventilation were:

- Main Fans Total Emissions – 336,485 Co2-e tonnes;
- Backroad fan Total Emissions – 57,452 Co2-e tonnes; and
- Gas Drainage Total Emissions – 45,708 Co2-e tonnes.

During 2013 the construction of the centralised Gas Drainage Plant will commence. The plant will allow for the currently vented methane to be flared and create potential to utilise the gas captured as a beneficial energy source.

3.19 PUBLIC SAFETY

A boundary fence surrounds the open cut operations with warning signs indicating the area is subject to mining. Only one access road to the site is in general use and all visitors are directed to the ACOL office for further directions on the roads that they are permitted to access. All other vehicle access points are locked. A boom gate system that remains closed outside normal office hours has been installed to prevent ad hoc public access.

The safety of public travelling along the New England Highway and Glennies Creek Road has been of major consideration when blasting within 500m. Road closures are designed to impact on motorists for a maximum of 2 to 3 minutes. There were no road closures during the reporting period.

Since the commencement of subsidence over the longwall area signage has been erected on the Right of Way (ROW) leading to property 130 on Ashton Property. An alternate access road has been established and road closure signs are placed when possible subsidence impact may be experienced on the ROW. As detailed in the approved SMP, Road Management Plan and Property 130 Management Plan, the tenants and owner of Property 130 are notified when any such impacts are expected to be experienced.

4.0 COMMUNITY RELATIONS

4.1 ENVIRONMENTAL COMPLAINTS

Each complaint received is recorded in the complaints register, and a detailed complaints record sheet is also completed for each individual complaint. A toll-free telephone number (1800 657 639) is maintained as the complaints line. Complaints are directed to a dedicated call centre which forwards information of the complaint directly to the Site Supervisor, the Environment and Community Relations Manager and Environmental Co-ordinator at the time of the complaint. Out of business hours complaints are addressed immediately by the Site Supervisor and responded to by either the Environment and Community Relations Manager or the Environment and Community Relations Co-ordinator on the next business day. All complaints received during the working week are responded to within 24 hours of being received and are discussed at morning planning meetings for action where required. Complaints received via the EPA are generally not reported to Ashton until several days after the potential event, due to this there are generally no inspection or operational changes possible for EPA complaints.

A total of 12 complaints were received during the 2011-2012 reporting period. Four of these complaints were received directly by ACOL and then a further eight complaints were received through the EPA. This can be observed in **Figure 57** and **Figure 58** below.

A full list of complaints is provided in **Appendix 2**.

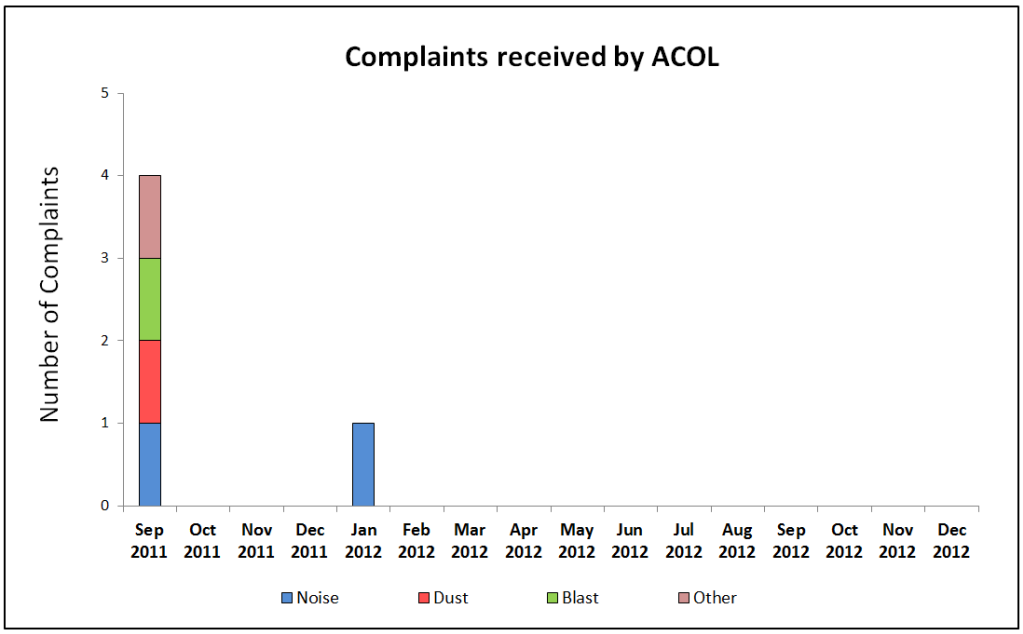

Figure 57. Complaints received directly to ACOL*

*The total number of Community complaints to Ashton Coal was 4 however there was one complaint which had multiple issues resulting in a total of 5 issues.

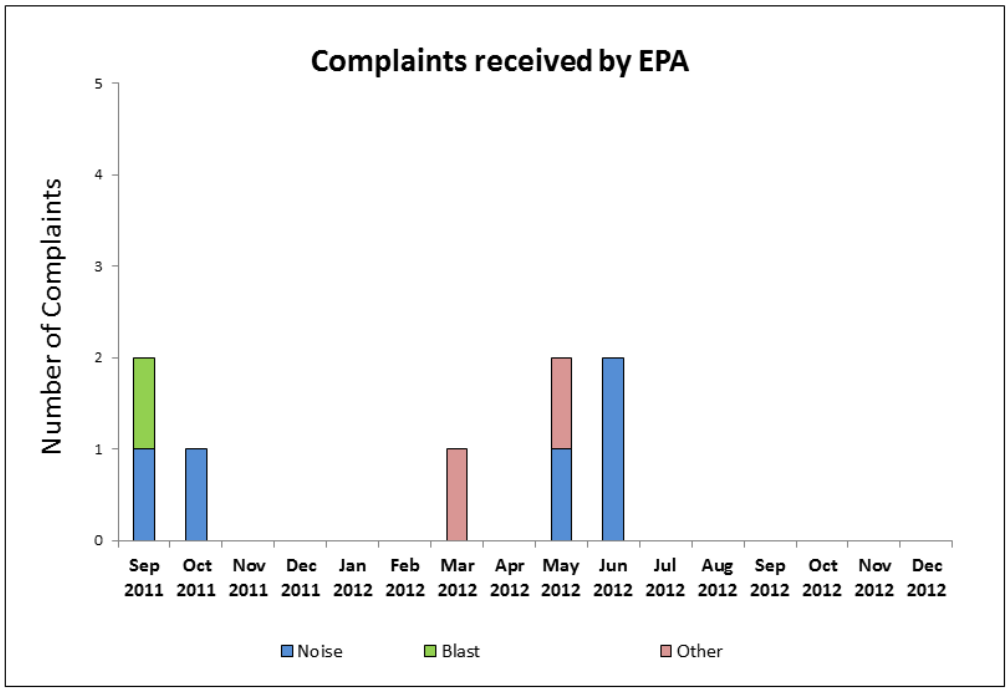

Figure 58. Complaints received via the EPA

A breakdown of complaint issues is shown below. The majority of complaints received by ACOL were concerning noise (40%). Dust (20%), blasting (20%) and other (20%) made up the rest of the complaints.

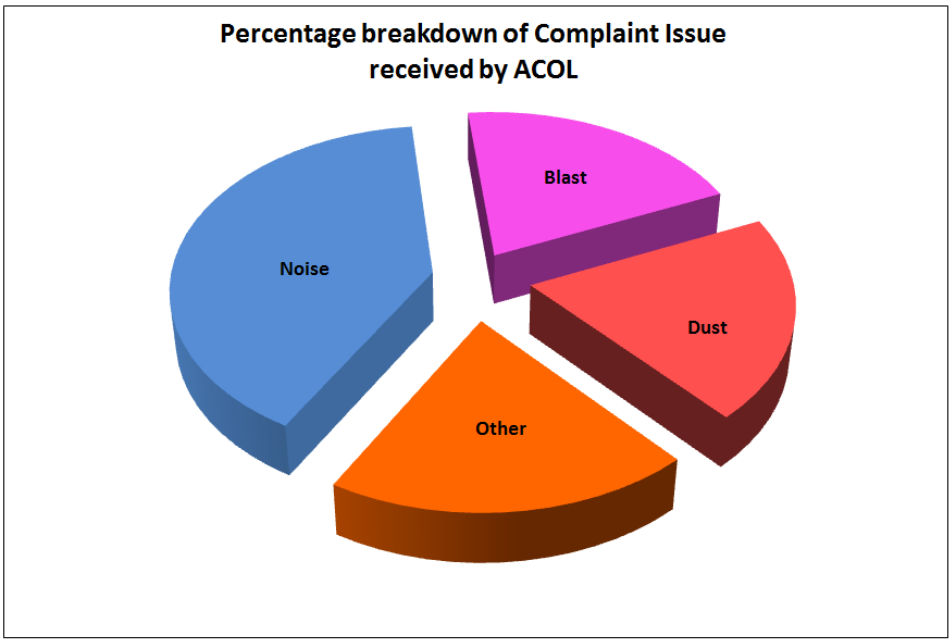

Figure 59. Percentage Breakdown of Complaint Issue received by ACOL

Similarly, the complaints received by the EPA, as seen in **Figure 60**, were mostly relating to noise (62%), other (25%) and blasting (13%) made up the remainder.

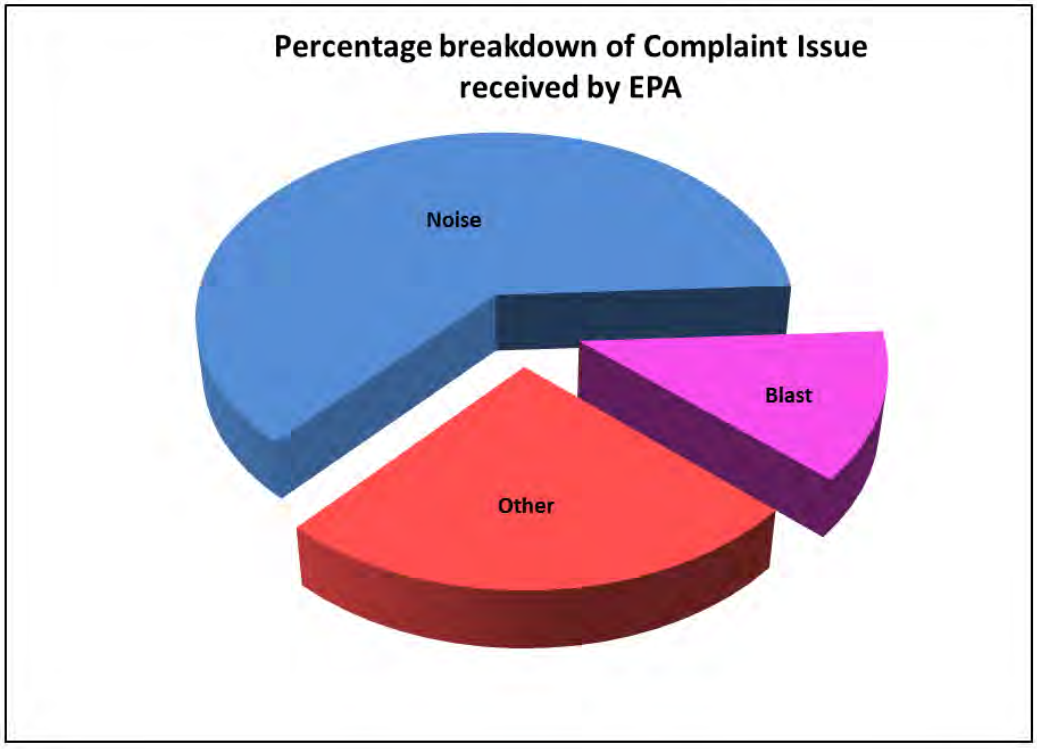

Figure 60. Percentage Breakdown of Complaint Issue received by EPA

The majority of complaints are received by the EPA rather than directly to ACOL as **Figure 61** shows.

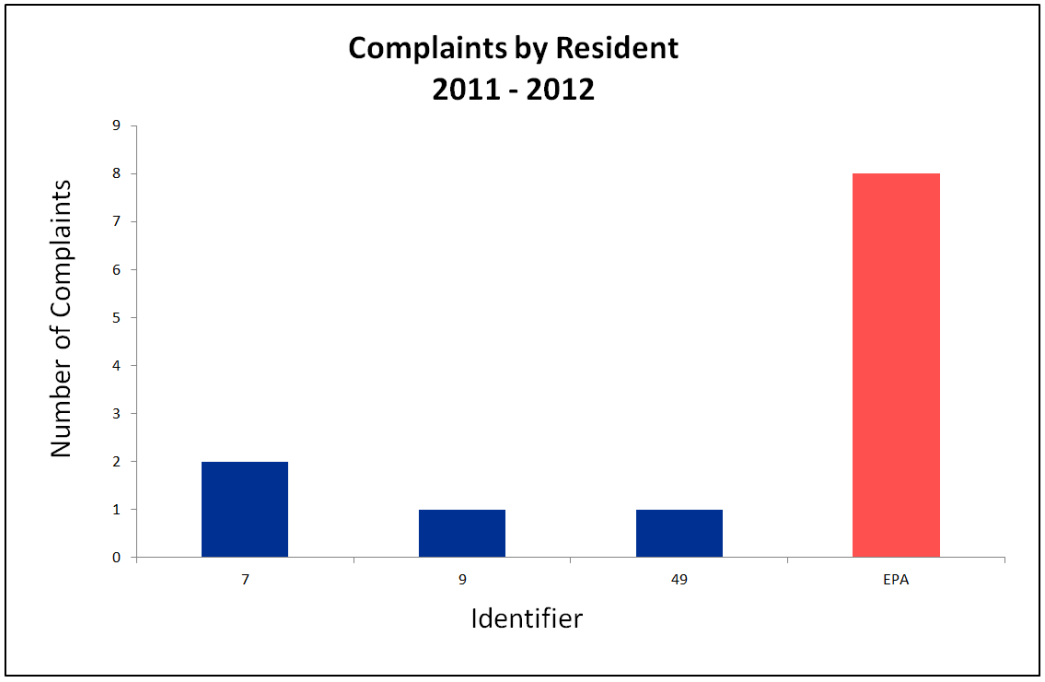

Figure 61. Complaints by Resident 2011 - 2012

This reporting period demonstrated the least amount of complaints received in ACOL's history, as seen in **Figure 62**. It's also the first time ACOL has not received directly from the community any complaints in the winter/second half of the reporting period. This is considered to be attributable to

a combination of the reduced intensity and eventual closure during the period of the open cut operations; a strong environmental focus; and the negotiation of agreements and acquisition of privately owned residences.

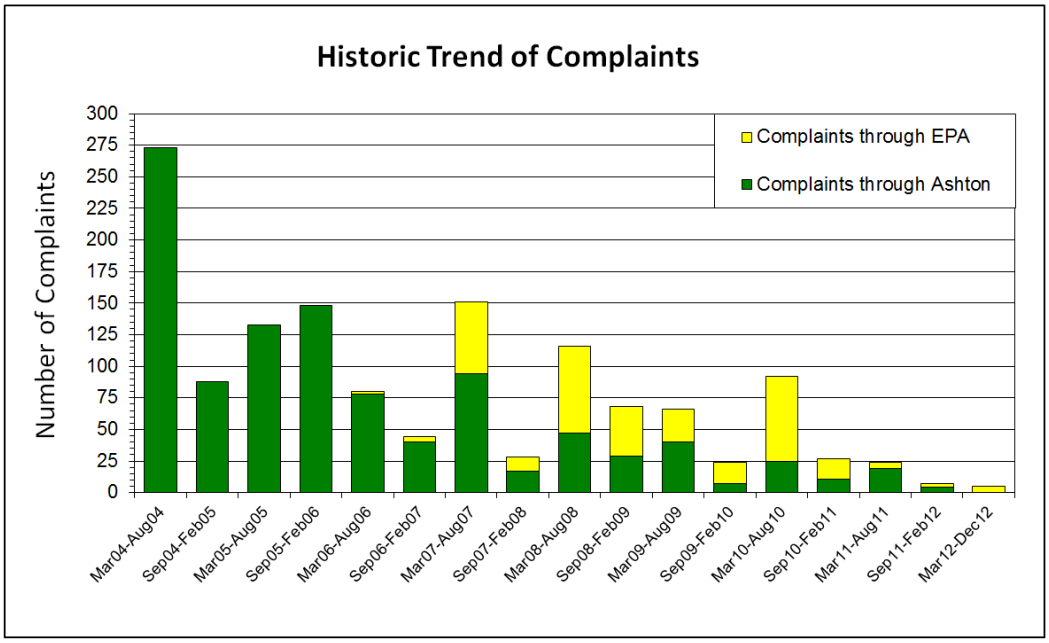

Figure 62. Historic Trend of Complaints

4.2 COMMUNITY LIAISON

ACOL has committed to a community program that provides a budget for undertaking activities that aim to reduce the impact of mining on the residents of Camberwell. Continuing from the work completed in previous years ACOL conducted water tank cleaning on household water tanks for residents in Camberwell. This involved cleaning the sludge layer that builds up on the bottom of all tanks from plant matter and dust. Rainwater tank guidelines suggest that all tanks regardless of the area should be cleaned on a regular basis, generally every two years. ACOL also continued to install a number of whole house filters on water tanks to provide clearer drinking water.

4.2.1 Community Consultative Committee

Community Consultative Committee (CCC) meetings were conducted quarterly during the reporting period. CCC members were provided with information on the project as well as updates on environmental monitoring and future projects.

The CCC has been actively involved in questioning ACOL's commitment to the village as well as asking questions on the South East Open Cut Project Approval, Bowman's Creek Diversion Project, rehabilitation and the section 94 project. It is noted that during the reporting period as part of ACOL's s94 contribution project the entry signs to Camberwell Village were constructed with active involvement and consultation with the CCC and Singleton Council. All records of CCC meetings can be found on the Ashton Coal website.

4.2.2 Community Support

During the reporting period ACOL gave support to:

- Aboriginal Rugby League Knockout Competition;
- Local Children suffering serious and chronic illnesses ("Pitch for Mitch", “Simply Loving Taylor” & “Donations for Ted”);
- Children's Cancer Institute Australia;
- Community Carols at Singleton Heights;
- Cystic Fibrosis Association;
- Hunter Medical Research Institute;
- King Street Public School, Singleton - All Schools State Rugby League Carnival;
- Singleton Council Mayoral Scholarship;
- Sponsorship for Dance Around the World;
- Special Children's Christmas Party;
- Uniting Care Singleton Disability Respite Services;
- Wanaruah Art Show;
- Westpac Rescue Helicopter Service; and
- World Youth Organisation.

ACOL also participated in the continual development of the Upper Hunter Air Quality Monitoring network, providing funding and also in kind support through participation in the Technical Working group.

4.2.3 Educational Support

During the reporting period ACOL have had various people come to site to view our rehabilitation and learn more about the use of Solid Municipal Waste Compost (compost) on rehabilitation. Solid Municipal Waste Compost is composted organic product derived from general household waste. The compost is produced to a strict quality standard set by the NSW EPA, through their Mixed Waste Exemption 2011. Ashton has been using the compost in rehabilitation for five years now and has some of the oldest rehabilitation in the hunter valley in which compost was been used as a major soil ameliorant. Visiting groups included:

- mining environmental officers; and
- 2 site visits of 25 Chinese Ministry of Land and Resources delegation on a rehabilitation technical site visit as part of their Sydney University Environmental Sustainability course.

4.2.4 ACOL Website Upgrade

During the reporting period Ashton Coal’s website was upgraded (www.ashtoncoal.com.au). The upgrade to the Website was initiated to better facilitate public access to ACOL documents, information and communication with the wider community. During the upgrade period the Department of Planning also undertook a review of Mine site websites and produced a guidance note for the development of mining operation websites. The new ACOL website has been reviewed against this guidance note and found to be generally consistent with this. Upgrades to the website were also carried out to satisfy the POEO Act amendment guidelines; including all EPL monitoring data and the Pollution Incident Response Management Plan to be publicly available on the website.

5.0 REHABILITATION

5.1 OPEN CUT

A total of 18.21 hectares (ha) of the EEA was rehabilitated during the reporting period. 14.34 ha was sown to pasture at a rate of 40kg/ha with fertilizer and a further 3.87ha was direct seeded to native trees at a rate of 5kg/ha of tree seed mixed with 90kg/ha of a bulking agent. Compost was spread across all new rehabilitation areas at 100t/ha. 2.34ha of unshaped overburden face of the emplacement area was temporarily seeded with the same seed mix used for the pasture areas.

5.2 REHABILITATION TRIALS AND RESEARCH

SITA in conjunction with Ashton started a trial with varying microbial sprays on compost to investigate possible improvements to soil health, pasture coverage and diversity, . The trial was conducted on the autumn 2012 pasture rehabilitation. The trial consists of the following plots:

- **Control**: A horizon top soil + 100t/ha compost
- **Treatment Area 1**: B horizon top soil + 100t/ha compost + *1L/ha evergreen* + *1L/ha digester* + *1L/ha green manure*
- **Treatment area 2A**: A horizon top soil + 100t/ha compost + *1L/ha of green manure*
- **Treatment Area 3A**: A horizon top soil + 100t/ha compost + *2L/ha digester* + *1L/ha green manure*
- **Treatment area 3B**: A horizon top soil + 100t/ha of compost + *750g/ha BDX* + *1L/ha green manure*

Figure 63. 2012 Pasture rehabilitation in trial plot 3A with 2009 native woodland in background.

5.3 REHABILITATION SUMMARY

Table 37. **REHABILITATION SUMMARY 2011– 2012**

	Area Affected / Rehabilitated (hectares)		
	End of this reporting period (ha)	**Last Report (ha)**	**Next Report (estimated) (ha)**
A: MINE LEASE AREA			
Mine Lease 1529	128.7	128.7	128.7
Mine Lease 1533 (part overlies ML 1529)	883.4	883.4	883.4
Mine Lease 1623	26.2	26.2	26.2
B: DISTURBED AREAS			
B1 Infrastructure area	49.8	45.7	49.8
B2 Active Mining Area (Excluding B3 – B5)	0.0	3.4	0.0
B3 Waste Emplacement (Active / unshaped)	34.1 (includes 2.3ha of Temporary rehabilitation)	41.8	34.1 (includes 2.3ha of Temporary rehabilitation)
B4 Tailings emplacements (active / uncapped)	13.0	13.0	13.0
B5 Shaped waste emplacement (awaits final vegetation)	0.0	7.7	0.0
B6 Ravensworth Void 4 area of responsibility (Active / unshaped / partially rehabilitated)	41.0	41.0	41.0
ALL DISTURBED AREAS	124.9	139.6	124.9
C. REHABILITATION PROGRESS			
C1 Total Rehabilitated Area (except for maintenance)	141.6	128.0	141.6
D. REHABILITATION ON SLOPES			
D1 10 to 18 degrees	104	99.0	104
D2 Greater than 18 degrees	0.0	0.0	0.0
E. SURFACE OF REHABILITATED LAND			
E1 Pasture and grasses	90.4	82.0	90.4
E2 Native woodland / ecosystems	46.0	39.8	46.0
E3 Plantations and crops	0.0	0.0	0.0
E4 Other (includes non-vegetative outcomes)	5.2 (total) 4.6 (Dams and drainage) 0.6 (Topsoil stockpile)	5.0 (Dams and drainage)	5.2

Table 38. MAINTENANCE ACTIVITIES ON REHABILITATED LAND

NATURE OF TREATMENT	Area Treated (ha)		Comment / control strategies / treatment detail
	Report Period	Next Period	
Additional erosion control works (drains re-contouring, rock protection)	0.0	0.0	
Re-covering (detail – further topsoil, subsoil sealing, etc)	0.0	0.0	No areas were re-covered during the period.
Soil treatment (detail – fertiliser, lime, gypsum, compost, etc)	0.0	0.0	
Treatment / Management (detail – grazing, cropping, slashing, etc)	0.0	15.0	Some pasture areas on top of the EEA are planned to be slashed to improve pasture growth.
Re-seeding / Replanting (detail – species density, season, etc)	0.0	0.0	
Adversely Affected by Weeds (detail – type and treatment)	16.9	10.0	A spraying program targeting galenia was implemented starting at the eastern end of the EEA (Figure 62).
Feral animal control (detail – additional fencing, trapping, baiting, etc)	0.0	0.0	No feral animal control within rehabilitation areas was undertaken during the reporting period.

5.4 Rehabilitation Monitoring

Due to this reporting period being conducted over 16 months there were two rehabilitation monitoring surveys and reports conducted during December 2011 and December 2012.

The rehabilitation monitoring reports were undertaken by Carbon Based Environmental on behalf of Ashton Coal Operations Pty Ltd. The purpose of these reports is to present the results of an ongoing annual rehabilitation monitoring program, commenced in 2008, which compares the progress of a number of rehabilitation sites against a set of completion criteria obtained from measurements made in areas of remnant woodland and grassland communities in the local area. It also aims to comply and be consistent with conditions specified within a range of approval documents and associated Management Plans and align with the Rehabilitation and Environmental Management Plan (REMP) Guidelines (DRE 2010).

ACOL's agreed post mining land use aims to incorporate a combination of habitat conservation and managed cattle grazing. Two main vegetation communities form the basis of the rehabilitation objectives and these include woodland (scattered trees with grassy understorey) and perennial pastures (native or exotic grassland). As a result, three native woodland and three native grassland reference sites were established in 2008 (DnA Environmental and Carbon Based Environmental 2009a). Locations of rehabilitation monitoring sites in relation to reference sites are shown in **Figure 68.**

The rehabilitation monitoring sites were selected for their final landuse, vegetation community type and year of establishment and were considered to be representative of the rehabilitation area as a whole or were similar to and representative of other smaller areas of rehabilitation. The rehabilitation sites are situated on the main waste emplacement and consist of two main vegetation communities: "native woodland" and "exotic pasture". The sites vary in age of establishment and were revegetated between 2005 and 2009. Between 2008 and 2010 there were a total of four "woodland" and four "exotic pasture" rehabilitation sites incorporated into the annual rehabilitation monitoring program. In 2012, four new "exotic pasture" sites were added to the annual rehabilitation monitoring program. The four new sites varied in age of establishment and were revegetated between 2010 and 2012.

As part of the ongoing rehabilitation maintenance program, weed control was undertaken across a number of monitoring sites during the reporting period. A small area incorporating the monitoring site M200801was treated by scraping and re-seeding with quick establishing exotic pasture in order to effectively eradicate Galenia in this area. As a result of this treatment, the monitoring site was reclassified as an exotic pasture site, and is progressing well towards meeting completion criteria.

The methodology used in 2011 and 2012 for undertaking the monitoring was consistent with that used in past years. The monitoring methodologies used a combination of Landscape Function Analyses (LFA), comprehensive soil analyses and an assessment of ecosystem characteristics using an adaptation of methodologies derived by the Biometric Model used in the Property Vegetation Planning Process (Gibbons *et al* 2008). It is not expected for the rehabilitation sites to meet criteria immediately as it will take time for the rehabilitation to mature and therefore meet the completion criteria. The ecological assessment provides quantitative data that measures changes in:

- Floristic diversity including species area curves and growth forms;
- Ground cover diversity and abundance;
- Vegetation structure and habitat characteristics (including ground cover, cryptogams, logs, rocks, litter, projected foliage cover at various height increments);
- Understorey density and growth (including established shrubs, direct seeding and tubestock plantings and tree regeneration);
- Overstorey characteristics including tree density, health and survival; and
- Other habitat attributes such as the presence of hollows, mistletoe and the production of buds, flowers and fruit.

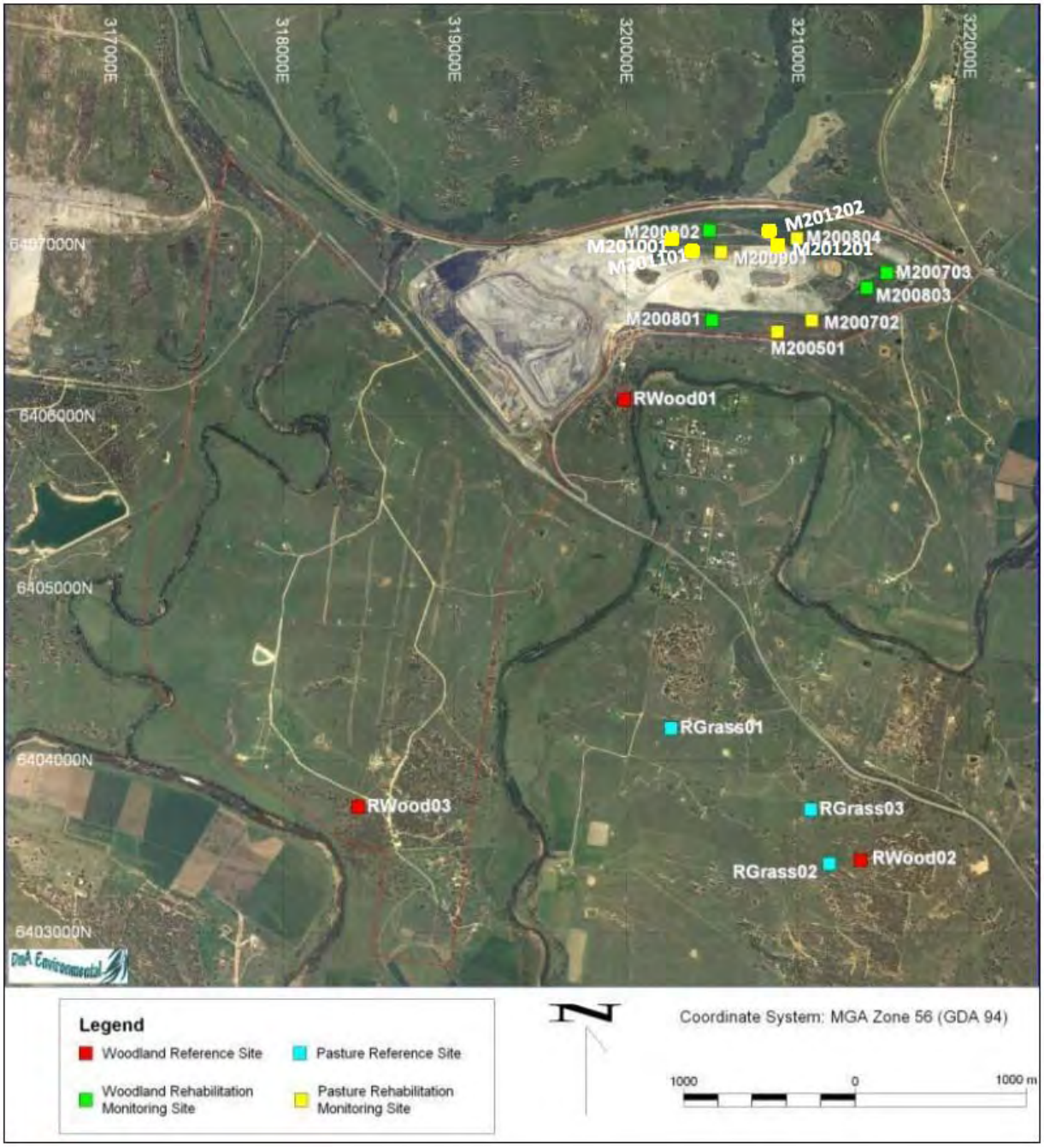

Figure 68. Locations of rehabilitation monitoring sites in relation to reference sites

Permanent transects and photo-points are established to record changes in these attributes over time. Data obtained from the reference sites provide a range of values from representative examples of similar vegetation communities and rehabilitation areas will be compared to reference sites that best represent the final land use vegetation community and management conditions they will be subjected to. Selected performance indicators will be expected to equal or exceed values obtained from the reference site under the same set of conditions or demonstrate a positive trend over time towards target values. 2012 was a particularly dry year with results reflective in the rehabilitation sites. Reference sites were monitored under the same conditions to ensure true comparisons of the results.

5.4.1 Summary of results

It is not expected for the rehabilitation sites to meet criteria immediately as it will take time for the rehabilitation to mature and therefore meet the completion criteria. The monitoring is being undertaken to inform ongoing maintenance rehabilitation works and recommend maintenance programs across the site.

5.4.1.1 Woodland sites

There are three woodland rehabilitation sites on the EEA being monitored (M200703, M200802 and M200803).

Of the three woodland rehabilitation sites, two sites (M200703 and M200803) are currently moving towards meeting completion criteria when compared to the woodland reference sites. Scheduled rehabilitation maintenance activities have been undertaken on Site M200802 including weed spraying to allow improvement against completion criteria in the coming years.

Site M200703 (5 year old rehabilitation)

In 2012, M200703 had a high density of juvenile trees that were dominated by the species *Acacia pycantha* and *Acacia salingna* with good populations of *Corymbia maculata* and *Acacia linearifolia*. Values for shrub and juvenile tree density and species diversity exceed completion targets. Native species richness and the number of local endemic species established increased in 2012 to meet completion targets. Eight healthy trees were recorded at M200703 that continue to establish well.

M200703 is a woodland site that was tree seeded into overburden treated with compost in 2007.
In 2012, the LFA indices are still progressing towards the completion criteria. Soil analysis results indicated pH levels were moderately alkaline. Phosphorous and organic matter levels were within the target range and may be considered to meet completion criteria.

Protective groundcover and total groundcover increased in 2012 as a result of an increased litter layer, and are progressing towards completion targets. The health and abundance of understory declined in 2012, indicating rehabilitation maintenance work may be required on this site. Maintenance activities will concentrate on the establishment of understory and ground cover species, working towards reducing bare patch area and stabilising rills.

Site M200802 (4 year old rehabilitation)
M200802 is a woodland rehabilitation site that was tree seeded, sown with a cover crop and treated with biosolids in 2008. In 2012, this site was sprayed to treat Galenia.

The LFA indices for stability, infiltration and nutrient recycling are yet to reach the completion criteria. Soil analysis for M200802 indicated that organic matter levels require further improvements over time, although pH and phosphorus were within the appropriate range to meet completion criteria.

There were no trees or shrubs recorded in site M200802 in 2012. Total ground cover and perennial plant cover had declined from 2011, probably as a result of the treated Galenia dying off and no longer providing cover. Native understory diversity and abundance results were lower than expected as Galenia had outcompeted and dominated other species. Future rehabilitation monitoring at this site will provide more information on whether the site may require reseeding with native trees and shrubs following the successful treatment of Galenia.

Site M200803 (4 year old rehabilitation)
M200803 is a rehabilitation woodland site that was tree seeded into overburden treated with compost and sown with a Ryecorn (*Secale cereale*) cover crop in 2008. In 2011, the monitoring site was moved 10m down the LFA transect, such that the majority of the monitoring area reflected woodland rehabilitation, rather than a pasture like area dominated by exotic species.

In 2012, the LFA indices for stability, nutrient recycling and landscape organisation are progressing towards completion targets. Soil analyses results indicated pH and phosphorous levels are yet to reach the target ranges. pH remained similar to previous monitoring and was considered strongly alkaline. Completion criteria were met for organic matter recorded at M200803.
Site M200803 is close to meeting completion targets for total native richness and diversity. Positive trends were recorded in plant cover with completion targets met for total and perennial plant cover. The exotic and native understorey abundance was comparable to the local remnant woodland vegetation.

Juvenile trees were well established in site M200803 with Forest Red Gum (*Eucalyptus tereticornis*) and Grey Box (*Eucalyptus moluccana*) abundant. This year three new species of juvenile eucalypts were identified including Blakelys Red Gum (*Eucalyptus blakelyi*) and Red Ironbark (*Eucalyptus fibrosa*). This woodland site met or exceeded all completion criteria targets for tree diversity, density and local endemic species establishment. Targets for initial shrub and juvenile tree establishment and low foliage cover have been met.

Site M200803 shows positive trends for most completion targets. It is expected that in time as trees further establish, that those criteria for mature and established trees will be achieved.

5.4.1.2 Pasture sites

For the 2012 monitoring year, nine rehabilitation sites were compared to the pasture reference sites. In addition to the original four pasture rehabilitations sites (M200501, M200702, M200804 and M200901), a site which had previously been a woodland rehabilitation site but which has since been re-seeded to exotic pasture (M200801) is now included as a pasture rehabilitation site. This

year there were also four new pasture rehabilitation sites (M201001, M201101, M201201 and M201202) added to the monitoring program.

Of the nine pasture rehabilitation sites, five appear to be moving towards achieving completion targets (M200501, M200702, M200801, M201001 and M201101). Two of the other sites (M201201 and M201202) were only sown in 2012 and in time are expected to further establish, and should move towards achieving final completion targets. The remaining two sites (M200804 and M200901) have recently been sprayed to treat Galenia and as a result are not yet improving against completion targets.

Site M200501 (7 year old rehabilitation)
M200501 is an exotic pasture rehabilitation site situated on the main waste emplacement sown with exotic pasture and tubestock in 2005. In 2012, M200501 remained an exotic pasture site with Rhodes grass, Annual ryegrass and Acacias abundant. Galenia remained common in patches across the site.

In 2012, the LFA indices for this site met the completion criteria for stability, nutrient recycling and infiltration. A similar trend was evident for soil analysis results with completion targets achieved for percent organic matter and phosphorus levels. Although the pH was not within the target range it has remained steady and near neutral since 2008.

Site M200501 met or exceeded criteria for ecosystem establishment with species diversity targets met for grasses and herbs. This pasture site was dominated by the exotic grass species Wimmera Ryegrass (*Lolium rigidum*) and Rhodes Grass (*Chloris gayana*). Dry seasonal conditions have created an increase in native grasses browning off and an increased litter layer. This in turn decreased perennial ground cover to below completion targets. Exotic understory abundance however continues to meet required completion levels.

Site M200702 (5 year old rehabilitation)
M200702 is an exotic pasture rehabilitation site situated at the southern side of the eastern end of the main waste emplacement sown with exotic pasture in 2007. In 2012, Kikuyu was dominant with Ryegrass (*Lolium sp*) common to the site.

In this monitoring period, the LFA indices for stability, nutrient recycling and infiltration remained steady and this year were able to satisfy the levels set out in the completion criteria. Active rills previously recorded at this pasture site were now stable with no active rills recorded in 2012. The composition of the soil at M200702 are yet to meet the completion criteria for pH, organic matter and phosphorous; the pH is considered to be moderately alkaline.

Site M200702 met or exceeded completion criteria for ecosystem establishment and habitat complexity. With this site dominated by exotic pasture species completion criteria were met for grass species diversity and total ground cover. Perennial ground cover and exotic understory abundance also met completion levels as required. However, species diversity at this site is low with the number of herb species falling below the targets set by the pasture reference sites. Galenia continued to be absent from M200702.

Site M200801 (4 year old rehabilitation)

M200801 was originally treated with compost, tree seeded and sown with a cover crop in 2008. In 2010, the site was completely dominated by a dense cover of Galenia. In early 2011, M200801 was scalped to remove the Galenia and re-seeded to an exotic pasture. This year, the re-seeded exotic pasture has become well established with high ground cover.

In 2012, the LFA indices for nutrient recycling and infiltration increased to meet completion targets. Stability slightly decreased and remains below the target range required. The soil analysis for this pasture site is yet to meet completion criteria for pH, organic matter and phosphorous levels however pH fell within desirable levels. The pH of this site has decreased from 2010 and is now classified as neutral.

Although this site was re-seeded to pasture in 2011, positive trends were observed in ecosystem establishment. Completion criteria are being met for exotic understory abundance and herb species diversity. M200801 also met targets for total perennial plant cover, with the site dominated by Ryegrass and Rhodes Grass.

In time it is expected that this site will further establish, and should move towards achieving final completion targets.

Site M200804 (4 year old rehabilitation)

M200804 is an exotic pasture rehabilitation site situated on the north facing slope of the main waste emplacement. It was treated with compost and sown with Rhodes Grass and Lucerne (*Medicago sativa*) in 2008. In 2012, this site had recently had a spray treatment applied to treat the invasion of Galenia.

LFA indices recorded for 2012, at M200804 all declined. Completion criteria have not yet been met for stability, nutrient recycling and infiltration. Organic matter in the soil was reflective of that recorded in the pasture reference sites. pH increased, with the soils now classified as moderately alkaline.

The impact on other species as a result of Galenia dominating this site and the subsequent spray treatment applied was evident in ecosystem establishment and protective ground cover scores. This pasture site fell below the completion target range for species diversity especially for herb and grass species. The diversity of the exotic understorey per square metre was also below those recorded in the reference sites. The protective groundcover had significantly reduced this year as a result of the dying Galenia.

The Galenia infestation that previously affected M200804 has been treated in 2012. The impact of the spray treatment upon the Galenia and other species will have to be further assessed in the next monitoring period. Consideration may need to be given to reseeding the site with an exotic pasture mix.

Site M200901 (3 year old rehabilitation)

M200901 is an exotic pasture rehabilitation site situated on the north facing slope on the main waste emplacement. This site was treated with compost and sown with Ryegrass, Lucerne and Ryecorn in 2009. In 2012, this site had recently been sprayed to treat the Galenia infestation that was dominating M200901.

In 2012, the LFA indices recorded at this site for stability, infiltration and nutrient recycling were yet to meet completion targets. The completion target for soil pH and phosphorous is yet to be met. pH remained steady and was considered to be strongly alkaline. Phosphorous levels have been traditionally high at this pasture site and remain above the completion target range. Organic matter exceeded the target range and was considered to be within desirable levels hence meeting this completion criterion.

The Galenia infestation that previously affected M200901 has been treated in 2012. The impact and success of the spray treatment applied to the Galenia will be further assessed in the next monitoring period. Consideration may need to be given to reseeding the site with an exotic pasture mix. Treatment applied this year to the Galenia has also impacted upon species diversity and abundance at this site. The diversity of the exotic understorey per square metre was below those recorded in the reference sites. Protective groundcover and perennial plant cover decreased this year as the Galenia began to die off and create an increased litter layer.

Site M201001 (2 year old rehabilitation)

M201001 is an exotic pasture rehabilitation site situated on the north facing slope of the main waste emplacement sown with an exotic pasture in 2010. In 2012, this site was a well-established exotic pasture with 100% ground cover. This site was dominated by a thick layer of litter and Kikuyu and Rhodes grass.

In this monitoring period the LFA indices recorded for stability, infiltration and nutrient recycling were within the target ranges, hence meeting completion criteria. Soil analysis results indicated pH, organic matter and phosphorous levels did not fall within the target range. Organic matter levels were however within desirable levels and may be considered to meet completion criteria. The pH of the soils recorded at M201001 was considered to be moderately alkaline.

Site M201001 had varying levels of success in meeting the completion criteria for ecosystem establishment and habitat complexity. The successful establishment of a pasture community has provided ground cover percentages that meet and exceed completion criteria targets. However, species diversity at this site is low with the number of herb and grass species and the abundance of exotics in the understory falling below the targets set by the pasture reference sites.

Site M201101 (1 year old rehabilitation)

M201101 is an exotic pasture rehabilitation site situated on the south facing slope of the main waste emplacement sown with an exotic pasture in 2011. In 2012, this site was a well-established exotic pasture dominated by Kikuyu (*Pennisetum clandestine*) and Couch (*Cynodon dactylon*).

In this monitoring period the LFA indices recorded for infiltration and nutrient recycling were within the target ranges, hence meeting completion criteria. The LFA indices for stability are yet to meet the completion levels as required. Soil analysis results indicated pH, organic matter and phosphorous levels did not fall within the target range. Organic matter levels were within desirable levels and may be considered to meet completion targets. The soils pH recorded at M201101 was considered to be moderately alkaline.

Site M201101 had varying levels of success in meeting the completion criteria for ecosystem establishment and habitat complexity. The successful establishment of a pasture community has provided ground cover percentages that meet and exceed completion criteria targets. However,

species diversity at this site is low with the number of herb and grass species and the abundance of exotics in the understory falling just below the targets set by the pasture reference sites.

Site M201201 (6 month old rehabilitation)

M201201 is an exotic pasture rehabilitation site situated on top of the main emplacement. This site was treated with compost and sown with Ryegrass, Lucerne and Ryecorn in mid-2012. By December 2012 the pasture was well established in the rip lines and the compost was still evident across the site. Wimmera rye grass was common across the site. A number of plants were stressed due to the dry conditions.

In 2012, the LFA indices recorded at this site for stability, infiltration and nutrient recycling did not yet meet completion criteria. Soil analyses results indicated pH, organic matter and phosphorous levels did not fall within the target range. Organic matter levels were however within desirable levels and may be considered to meet completion targets. The soils pH recorded at M201201 was considered to be moderately alkaline.

Although this site was only sown in mid-2012, positive trends were observed in ecosystem establishment. Completion criteria are being met for exotic understory abundance and the number of herbs and grass species recorded just falls short of meeting the target ranges. As this site has only been recently sown, perennial plant cover and total ground cover are yet to reach the completion criteria levels. In time it is expected that this site will further establish, and should move towards achieving final completion targets.

Site M201202 (6 month old rehabilitation)

M201202 is an exotic pasture rehabilitation site situated on top of the main emplacement. This site was treated with compost and sown with Ryegrass, Lucerne and Ryecorn in mid-2012. By December the pasture was well established in the rip lines and the compost was still evident across the site. Peppercress (*Lepidium africanum*) and Wimmera rye grass (*Lolium rigidum*) were common across the site. A number of plants were very stressed due to the dry conditions.

In 2012, the LFA indices recorded at this site for stability, infiltration and nutrient recycling had not yet met completion criteria. Soil analysis results indicated pH and phosphorous levels did not fall within the target range. The soils pH recorded at M201202 was considered to be slightly alkaline. Organic matter levels were however within target range and therefore were within completion levels.

Although this site was only sown in mid-2012, positive trends were observed in ecosystem establishment. Completion criteria are being met for exotic understory abundance and the number of herbs and grass species recorded just falls short of the completion criterion. As this site has only recently been sown, perennial plant cover and total ground cover are yet to reach the completion criteria levels. In time it is expected that this site will further establish, and should move towards achieving final completion targets.

6.0 MAJOR PROJECTS

6.1 BOWMANS CREEK DIVERSION CONSTRUCTION

The Bowmans Creek Diversion Project, which was approved in December 2010, was designed to allow optimal extraction of coal from ACOL's Underground Mine.

Hyder Consulting was engaged to produce conceptual engineering plans for the Diversions. The designs were to be based on the adjacent section of the existing creek in terms of variable channel cross section and the variability in bed level, including ecological features such as resting pools and riffle systems to allow the ongoing fish passage through the Bowmans Creek system. A key feature of the design is that a geosynthetic clay liner has been placed under the channel to minimise leakage from the creek and to preserve the transmission of flows in these sections of channel following impacts from underground mining. There were two distinct diversions:

Eastern Diversion
This diversion extended for about 800m approximately along the eastern edge of the alluvial floodplain before reconnecting with the existing creek. This diversion involved the excavation of a meandering channel within existing cobble and alluvial material that mirrored the geomorphic features of the adjacent Bowmans Creek with variable bed levels to create pools and riffles.

Western Diversion
This diversion extended for approximately 780m, and also mirrored the geomorphic characteristics of the Bowmans Creek which is typically about 7m deep, featuring variable bed levels to create pools and riffles. The excavation of the channel was in some areas within existing cobble and alluvial material, moving to areas of clay and hard conglomerate sandstone.

Hardy Bros. Mining was engaged to undertake the construction of the Project, work commenced in December 2011. Throughout the construction period, monthly Environmental Construction Compliance Audits were undertaken by Minespex, including assessment of adherence to commitments in the Construction Environmental Plan; their final report concluded that compliance requirements had been satisfied.

In August 2012, Environmental Rehabilitation work started, with fertilization, grass seeding and tree planting commencing. This rehabilitation work extended throughout the project, and will continue under the guidance of ACOL's Environmental Department. Completion of the construction phase of the Project was achieved mid-November 2012, this included initial back stabilisation works (such as hydro mulching, turf laying and hay bale barriers). Water was diverted into the creek immediately following finalisation of the construction in November 2012.

6.2 DEVELOPMENT CONSENT MODIFICATION – INCREASED UNDERGROUND PRODUCTION & SOUTH EAST OPEN CUT INTEGRATION

ACOL has an existing application to modify DA 309-11-2001 (Mod 5) which seeks to increase underground production limits of the CHPP from 2.95Mtpa to 5Mtpa. The modification application also seeks to integrate the South East Open Cut project with the CHPP. ACOL expects this modification to be finalised by first quarter 2014.

7.0 ACTIVITIES PROPOSED IN THE NEXT AEMR PERIOD

7.1 EXPLORATION

Table 39. ANTICIPATED EXPLORATION FOR PERIOD TO DECEMBER 2013

Mining lease	Mining method	Planned exploration
ML 1533	Open cut	No activity planned
ML 1533	Underground	It is expected that approximately four holes are likely to be drilled for gas drainage and another six exploration holes.
Exploration Licences 4918	Open Cut	Exploration will be dependent on outcome of SEOC appeal
Exploration Licences 5860	Open Cut	Exploration will be dependent on outcome of SEOC appeal

7.2 ENVIRONMENTAL MANAGEMENT PLAN UPDATE

In the first half of 2013 the following management and operations plans will be completed and submitted to the relevant stakeholders:

- Mining Operations Plan 2013-2017 – incorporating the Landscape and Revegetation Management Plan; Land Management Plan; Final Void Management Plan; and Rehabilitation Management Plan.
- Noise Management Plan
- Air Quality Management Plan
- Bushfire Management Plan

7.3 REHABILITATION

Maintenance on the NEOC rehabilitation will continue during the 2013 reporting period with the Galenia spraying program continuing to be implemented.

7.4 BUFFER LAND

It is proposed to undertake more weed works within the crown land lease areas. A continued campaign is planned for St Johns Wort spraying during November 2013 to January 2014 across all the land managed by Ashton Coal. Further continued campaigns during 2013 will target Coolatai grass, African Boxthorn and Green Cestrum.

7.5 CONSTRUCTION

Construction works will continue on the commissioning of the ventilation air shafts, goaf drainage plant system and submersible borehole pump.

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Annual Environmental Management Report 2011 - 2012

7 June 2013

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APPENDIX 1

GROUNDWATER REPORT

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ASHTON COAL MINE 2011–2012 AEMR GROUNDWATER MANAGEMENT REPORT

ASHTON COAL MINE 2011–2012 AEMR GROUNDWATER MANAGEMENT REPORT

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Revision A	21/02/2013	Initial draft for client review
Revision B	21/05/2013	Final report incorporating client review

	Name	Position	Signature	Date
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Disclaimer

EXECUTIVE SUMMARY

This report has been prepared in accordance with Consent Condition 9.2 (d) of the Ashton Coal Project Approval and covers the review period 1 September 2011 to 31 December 2013. This report has been prepared as a supporting document for the Ashton Coal Operations Ltd 2011-12 Annual Environmental Management Report.

This report details the monitoring and other work carried out as part of the groundwater management activities for the project. The results of all groundwater monitoring are presented, together with analysis of trends. Over the review period, the actual groundwater related impacts, derived from the analysis of this data were below the levels predicted in the groundwater assessment reports for the Upper Liddell Seam Extraction Plan Groundwater Impact Assessment (RPS Aquaterra, 2012)

The monitoring program has been carried out in accordance with the Ashton Water Management Plan (2012 WMP) and the requirements detailed in the Consent Conditions.

The main outcomes over the 2011-12 review period review are summarised in Table E1.

Table E1: Comparison of Observed Impacts against the 2012 ULD Extraction Plan

Impact Description	Impact observed over the review period (Sep 2011-January 2013 including LW7B, LW8 and LW101	Predicted Groundwater Related Impacts for the Review Period	
		PG + ULD*	ULD only*
Groundwater drawdown to the Glennies Creek Alluvium (south of ULD LW101)	None observed	0.11m	0.06m
Groundwater drawdown to the Glennies Creek Alluvium (east of ULD LW101)	None observed	0.18m	0.04m
Groundwater drawdown to the Bowmans Creek Alluvium (at the oxbow)	None observed	0.45m	0.13m
Groundwater drawdown to the Hunter River Alluvium (south of ULD LWs 5 to 7)	None observed	0.01m	0.01m
Underground Inflows -Average Monthly	0.3 – 1.8ML/d (3 – 21L/s)	1.4ML/d (16L/s)	1-10L/s

*Reference: Ashton Coal, 2012 and RPS Aquaterra, 2012a

Over the review period:

- Underground coal extraction was completed at Pikes Gully seam longwall panels LW7B and LW8.
- The development headings for Upper Liddell LW101 were driven and completed during the review period with partial extraction of LW101 also completed.
- The groundwater monitoring network was expanded which included three vibrating wire piezometers monitoring the coal measures near LW101 as well as the installation of one standpipe piezometer targeting the Glennies Creek Alluvium and another two targeting the Hunter River Alluvium.
- Groundwater monitoring frequency was increased in key monitoring bores during the early and final stages of LW7B, LW8 and LW101 panel extractions. This provided a high level of monitoring for impacts of subsidence on the Bowmans Creek Alluvium. This was undertaken in accordance with Consent Condition 3.9, which requires confirmation that the subsidence impacts or environmental consequences are less than those predicted in the Ashton Coal Bowmans Creek Diversion EA.
- No impacts have been observed in the Glennies Creek, Bowmans Creek or Hunter River Alluvium as a result of underground mining.
- Mining of LW7B and LW8 occurred beneath sections of the Bowmans Creek Alluvium. No reduction in alluvium storage of groundwater was observed.

- A gradual trend of declining groundwater levels was observed in the northern and southern sections of the Bowmans Creek Alluvium over the reporting period. This trend is attributed to a recovery following above average water levels associated with above average rainfall in late 2011 and early 2012.
- Underground inflows were shown to increase above predictions in January 2012 and again in July 2012 however, both events were short lived with the averaged groundwater inflows over the reporting period below both the 2001 EIS and current model predictions.

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APPENDICES

1. INTRODUCTION

Ashton Coal Operations Pty Limited (ACOL) operates the Ashton Coal Project (ACP), located 14 kilometres (km) west of Singleton in the Hunter Valley region of New South Wales. ACOL is a wholly owned subsidiary of Yancoal Australia Limited (Yancoal), which is the majority (90%) joint venture owner of the mine.

The ACP comprises an open cut mine, an underground mine, a coal handling and preparation plant, rail loading facilities, run-of-mine and product coals stockpiles, and various surface support infrastructure and facilities. Development consent (DA 309-11-2001) for the ACP was granted by the Minister for Planning in October 2002. The ACP is approved to produce up to 5.45Mtpa of ROM coal until February 2024.

Open cut mining operations commenced at the North East Open Cut (NEOC) in 2004 extracting coal from several seams of varying thickness. Mining at the NEOC was completed in 2011 (Figure 1).

Underground mining operations extract coal via longwall mining and the ACP has approval to mine the Pikes Gully (PG), Upper Liddell (ULD), Upper Lower Liddell (ULLD) and Lower Barrett (LB) coal seams. The approved plan includes a diversion of Bowmans Creek via two diversion channels, which have re-routed the creek to areas not undermined by proposed longwall panels (Figure 1). To date coal has been extracted from the PG and the ULD seam.

- Coal from the PG seam is mined via eight approved longwall panels mine plan (LW1 to LW8). Mining operations commenced in the PG seam in July 2006 and with the exception of LW6B mining of the PG seam is largely completed.
- Coal from the underlying ULD seam is mined via eight approved longwall panels (LW101 to LW108). Mining of the ULD seam commenced at LW101 in August 2012. At the time of writing this report mining of LW101 is partially completed.

1.1 Scope of this Report

This report comprises a Groundwater Management Report for the review period 1 September 2011 to 31 December 2012 (the review period). The report has been prepared for inclusion into the Annual Environmental Management Report (AEMR) for ACOL.

Condition 9.2 (d) of DA 309-11-2001 requires that the AEMR include (inter alia):

> d) a Groundwater Management Report prepared by an independent expert to the satisfaction of NoW, addressing:
>
> i) work done under and the level of compliance with, the groundwater management measures defined in the Groundwater Management Plan; and
>
> ii) identification of trends in groundwater monitoring data and comparison with predictions, in documents referred to in condition 1.2 and any previous SMPs, over the life of mining operations.

This report addresses Condition 9.2 (d) by presenting a detailed review of the groundwater management work undertaken over the review period and the level of compliance with the Development Consent conditions and approved Water Management Plan (2012 WMP).

A detailed analysis of the monitoring data is presented. Trends displayed by the monitoring data have been compared to the predictions that were made in the groundwater impact assessment reports for the Environmental Impact Statement produced by HLA Envirosciences (2001 EIS), the Water Management Plan produced by Ashton Coal and RPS Aquaterra (2012 WMP) and the ULD Seam Extraction Plan Impact Assessment (RPS Aquaterra, 2012).

During the review period the following significant activities took place:

- Coal extraction in the PG seam at LW7B (3/10/2011 to 17/01/2012) and LW8 (27/02/2012 to 05/06/2012).
- Coal extraction in the ULD seam at LW101 (03/08/2012 - ongoing).

- Completion of Mining in the NEOC
- Rehabilitation works at the NEOC.
- The construction of the Western and Eastern Bowmans Creek Diversions (BCDs).

2. GROUNDWATER MONITORING PROGRAMME

2.1 Monitoring Network

An extensive network of groundwater monitoring bores provides comprehensive groundwater monitoring across the ACP (Figures 1, 2 and 3). The network is designed to monitor baseline groundwater trends and identify any groundwater impacts resulting from the mining operations.

The monitoring network targets all identified hydrogeological units in the area. These units include saturated Quaternary alluvium, Permian sandstone, and Permian coal seams. Targeted monitoring of individual units is achieved through the use of standpipe piezometers with discrete sealed screened intervals and fully grouted, multi-level vibrating wire piezometers (VWPs).

The monitoring network is spatially distributed across the underground mining area to provide detailed and representative coverage. More intensive monitoring coverage is focussed in areas of saturated alluvium, environmentally sensitive locations and current mining activity.

A summary of all underground monitoring bores and VWPs are listed with targeted aquifers in Tables 1 to 5 of Appendix A.

2.1.1 Additions to the Monitoring Network

During the review period the monitoring network was expanded in the LW101 area with the addition of following monitoring bores:

- VWP WMLC333 installed to monitor the Lemington (Lem) 15, Lem 19, Arties, ULD, Upper Lower Liddell, Upper Barrett and Lower Barrett seams.
- VWP WMLC334 installed to monitor the Lem 10, Lem 15, Lem 19, Arties, ULD, Upper Lower Liddell, Upper Barrett and Lower Barrett seams.
- VWP WMLC335 installed to monitor the Lem 15A, Lem 17, Upper Pikes Gully, Arties, ULD, Upper Lower Liddell, Upper Barrett and Lower Barrett seams.
- Standpipe piezometer WMLP336 installed to monitor the Glennies Creek Alluvium (GCA).
- Standpipe piezometers WMLP337 and WMLP338 installed to monitor the Hunter River Alluvium.

All of the new monitoring bores and VWPs (listed above) were installed on allotment 3 of DP1114623 under licence 20BL170596. They were drilled and completed by Hunter Drilling Pty Ltd in accordance with the minimum construction requirements for boreholes in Australia with completion reports (Form As) provided to the NSW Office of Water.

Groundwater level monitoring was conducted over the review period in accordance with the monitoring frequencies specified in the 2012 WMP.

2.2 Groundwater Monitoring

Water level and water quality field parameters are monitored monthly across the network in accordance with the 2012 WMP.

Key monitoring bores were targeted during longwall mining and heading development for intensified monitoring. These monitoring sites were selected based on the identified potential impacts from mining (RPS Aquaterra 2012a). During the review period, the monitoring was intensified at selected monitoring points to a fortnightly frequency throughout LW7B, LW8 and LW101 extraction periods.

Monitoring bore selection was based on proximity to the advancing longwall face and the aquifer monitored. The aim of fortnightly monitoring was to provide timely identification of any adverse impacts from mining operations. Figure 2 presents key monitoring sites during the mining of longwall panels LW7B and LW8 and Figure 3 during the mining of LW101.

Groundwater Level

In addition to routine monthly monitoring and fortnightly monitoring, key monitoring bores were equipped with automatic data loggers recording piezometric pressures at 6-hourly intervals (Figure 3). The data loggers were relocated as mining progressed to provide early identification of mining related impacts and the ability to relate any impacts to the exact position of the longwall face.

High frequency monitoring was also implemented with data loggers during the construction of the Bowmans Creek diversions. Data loggers were installed in the following selected monitoring bores:

- WMLP320, WMLP316 and in the southern end of the Western Diversion.
- WMLP311, 323, 325, 326, WMLP308, and Ashton Well for the Eastern section of the diversion.

Groundwater Quality

Field water quality screening parameters of electrical conductivity (EC) and pH were monitored monthly in key monitoring bores over the review period and fortnightly at selected bores during longwall mining (refer Tables 3.2 and 3.3 respectively).

Selected monitoring bores were also sampled for comprehensive laboratory analysis providing EC, pH, major ions, total dissolved solids (TDS), total suspended solids (TSS), dissolved metals, nutrients, cyanide, fluoride and turbidity (Appendix B).

Monitoring Frequencies

Table 2.1 provides a summary of the monitoring frequencies for the review period. Table 2.1 also includes recommendations for the upcoming review period (1 January 2013 to 31 December 2013).

Table 2.1: Ashton Coal Project – Key Piezometer Monitoring Frequency

Area	Piezometers	Monitoring Frequency (Review Period)	Proposed Monitoring Frequency
	(refer to Tables 1-5 Appendix A)	(2011 – 2012)	(2012 – 2013)
NEOC	GM1*	M, Q, A	M, Q, A
	GM3A and GM3B	Q, A	Q, A
	WML172-174	M, Q, A	M, Q, A
LW1 – 8 Area	RM02, 03, 05, 06, 07, 08 and 09	F, M, Q, A	M, Q, A
	RSGM1, PB1	M, Q, A	M, Q, A
	WML106, 107,108, 110C,111B,112B,112C, 113A, 113B,113C, 115A*, 115B, 115C	F, M, Q, A	M, Q, A
	WML189, 191 and 213	F, M, Q, A	M, Q, A
	RA 8,12,10,15,14,16,18, 27, 30 WMLP 275, 276, 308, 311, 312*, 314*, 315, 316, 320,323*, 324, 325, 326, 327	F, M, Q, A	F, M, Q, A
	T1-P*, T2-A, T2-P, T3-A, T3-P, T4-A, T5, T6, T7, T9*, T10	F, M, Q, A	F, M, Q, A
LW101 - 108	WMLC333, 334, 335, 336, 337, 338	F, M, Q, A	M, Q, A
Hunter River	WML277, 278, 279 280, RA27	F, M, Q, A	M, Q, A
Glennies Creek	WML239, 240*, 241*, 243*, 245, 247*, 249*,252*, 253*, 256, AP243, 245 WML144 and WMLC245 and 248	M, Q, A	M, Q, A

Area	Piezometers	Monitoring Frequency (Review Period)	Proposed Monitoring Frequency
	(refer to Tables 1-5 Appendix A)	(2011 – 2012)	(2012 – 2013)
Barrier between Glennies Creek and LW1	WML119, 120A, 120B, and 129	F, M, Q, A	M, Q, A
	WML181, 182, 183, 184,185, 186, 187,189,191	F, M, Q, A	M, Q, A
	WML248, 261, 262*, WMLP301,L302, 248	F, M, Q, A	M, Q, A

*Piezometer mined out or provided incomplete data set for the review period

*Fortnightly (F), Monthly (M), Quarterly (Q), Annually (A)

*Fortnightly monitoring is dependent on the progress of the active longwall

2.3 Underground Monitoring

Monitoring of groundwater inflows is conducted routinely by adopting a water balance approach. This routine monitoring forms part of the ongoing groundwater monitoring program as outlined in section 9.3.1 of the 2012 WMP.

Underground monitoring of groundwater inflows undertaken during the review period included:

- Groundwater inflow rates (metering on the dewatering pipelines).
- Water supply to the underground mine (cumulative flow metering on the dewatering pipelines).
- Inflows from the eastern rib of the LW1 tailgate in the PG seam, which is conveyed by pipeline to the LW1 backroad sump (no longer accessible).
- Metering of total water volumes pumped from the mine to the dam beside the mine portal in Arties pit, or directly into the mine water management system.
- Water quality monitoring (EC).
- Water quality monitoring at various in-mine sumps, and total water pumped out of the mine.

The calculated total inflow figures are considered to be conservative in that they include a component of recycled water derived from seepage losses back into the North West Mains from the storage dam in Arties Dam.

2.3.1 Review Period

Over the review period water was removed from the underground mine via two pathways. A borehole pump (Sump Bore no.2) located south of LW5 that pumps directly to the CHPP mine water dams, and pipelines along the gate-roads that eventually pump to the Arties Dam (near the mine portal).

Over the review period the discharge was monitored weekly at flow meters installed on:

- The underground pipeline at the portal (flow meter 28).
- Borehole number 2 at the outflow point to the CHPP dams and at the borehole (flow meters 32 and 33).
- The underground water supply pipeline (flow meter 26).

2.4 Rainfall Monitoring

Monthly rainfall data measured at the Ashton weather station is compared against the monthly total and the long-term median (LTM) for the Singleton area. The Bureau of Meteorology Singleton STP Station (number 061397) is used for long-term rainfall data.

3. MONITORING RESULTS

3.1 Rainfall

During the review period the total rainfall was 766.4mm, this is 22.9mm above the long-term median total for the same period (Table 3.1).

The first half of the review period (1 September 2011 to 31 March 2012) experienced the majority of rainfall with a total of 575mm. This was due to very wet months in December and February 2012. The latter half of the review period (April 2012 to December 2012) experienced significantly reduced rainfall with a total of 256mm.

Table 3.1: Ashton Monthly Rainfall

Month	Rainfall (mm)*	Monthly Total (mm)	Long Term Median (mm)
Sep-11	55.6	71.6	50.4
Oct-11	101.6	63.6	34.5
Nov-11	155.2	156.1	64.6
Dec-11	43.0	69.8	83.4
Jan-12	45.0	50.4	64.3
Feb-12	98.0	163.9	49.6
Mar-12	76.6	91.5	47
Apr-12	28.8	30.2	32.3
May-12	12.2	12.1	29.9
Jun-12	0.6	70.3	31.2
Jul-12	29.8	35.7	35.4
Aug-12	47.8	10.6	30.6
Sep-12	20.8	9	34
Oct-12	33.8	2.6	49.2
Nov-12	6.4	27.4	50.1
Dec-12	11.2	58	57

*Data obtained from the Bureau of Meteorology Singleton STP Station number 061397

The long-term median provides a robust measure of typical seasonal rainfall, it is less affected by the high variability of rainfall data. An extreme rainfall event will have less affect on the median than it will have on the arithmetic mean

The long-term median monthly rainfall is plotted on all hydrographs (Figures 4 to 22) and salinity plots (Figures 23 to 32) to help interpret the trends observed in groundwater level and EC in the Bowmans Creek, Glennies Creek and Hunter River Alluvium (Section 2.4.2).

3.2 Groundwater Level

3.2.1 Glennies Creek Alluvium

The water level trends observed in the GCA are presented in Figure 4. Water levels in the GCA remained within or above the baseline range observed over the review period with no significant long-term impacts attributable to mining activities.

Fluctuations observed over the review period demonstrate natural seasonal variations. Monitoring bores show a notable increase to high rainfall events in late 2011, following this increase a steady decline to the baseline range is observed (Figure 4).

Mining activities LW7B and LW8 did not occur in the vicinity of the GCA and no impacts to the alluvium were identified during the extraction of these longwalls.

LW101 is adjacent to the GCA, bores WML129, WML239 and WML240 provide monitoring of the GCA water level within close proximity to the longwall panel. Minor declines in these bores were observed during August and September 2012, which coincided both with coal extraction at LW101 and with a period of low rainfall (Figure 4).

Water level declines observed at WML129, WML239 and WML240 are consistent with similar trends observed at GCA bores that are not located in the vicinity of LW101 (Figure 4). Therefore the water level decline is likely a response to decreased recharge (rainfall) during the period. This is further supported by complete recovery observed in all GCA monitoring bores following recharge events.

Groundwater levels within the GCA during the reporting period were within the trigger levels outlined in the 2012 WMP. The approved incremental groundwater level drawdown due to ULD coal extraction is 0.06 meters (m) east of the southern portion of LW101 and 0.04 east of the central portion of LW101. The observed drawdown due to mining in all GCA bores was nil with full recovery from seasonal fluctuations to pre mining levels by the end of the reporting period (Figure 4).

3.2.2 Bowmans Creek Alluvium

Bowmans Creek Alluvium (Northern Underground Area)

During the review period the extraction of LW7B caused part of the Bowmans Creek Alluvium (BCA) to subside. The subsided section of the alluvium is situated above the southern half of LW7B (Figure 2).

The water level in the northern BCA, which is in the vicinity of longwall panels LW7B and LW8, is presented in Figure 5. Following full subsidence the base of the BCA is approximately 57mAHD. The BCA therefore remains partially saturated with water levels within the baseline range following the completion of the two longwall panels.

A gradual declining water level trend is noted in the northern BCA bores throughout most of 2012, becoming more pronounced in the latter half of the review period (Figure 5). It is noted that prior to this decline water levels were elevated due to a particularly high rainfall, first during March to June 2011, and then again in October and November 2011. A similar decline was observed in the 2009 to 2010 period, with a groundwater recharge event followed by a period of reduced rainfall. The maximum decline in water levels ranged from 1.24m (WMLP312) to 1.88m (T5 and WMLP308). The observed decline is attributed to a natural water level regression following a period of high recharge. However, ongoing observation of monitoring data is recommended to ensure that this decline is not a result of mining activity.

Ashton Well shows a sharp increase in the water level within the review period and minor increases are also observed in WMLP308, WMLP311 and WMLP323. These responses coincide with construction activities at the Eastern BCD and a period of increased rainfall which caused the diversion channel to become inundated as the dewatering system struggled to keep up with the rainfall runoff. The observed water level increase shows the associated water losses from the BCD into the surrounding alluvium (BCA). The increase is only temporary with a subsequent and rapid decline to background levels following the completion of the BCD and a reduction in rainfall.

Bowmans Creek Alluvium (Central Underground Area)

Water level trends from a representative selection of BCA bores in the central area of the ACP underground mine area are presented in Figure 6. A slight declining trend over the review period is observed at RA18, T2-A and WMLP320.

WMLP316 shows intermittent water level decline during the period of dewatering conducted for the Western BCD in the second and third quarter of 2012 (Figure 6). Following the completion of the construction the water levels are shown to rapidly recover to baseline conditions during the fourth quarter of 2012.

Bowmans Creek Alluvium (Southern Underground Area)

Water level trends from a representative selection of BCA bores in the southern area of the ACP underground are presented in Figure 7. A gradual declining trend of the water level is observed in all bores from March 2012, following a period of increasing water levels during the start of the review period. The maximum decline in water levels ranged from 1.02m (RA14) to 1.18m (WMLC113C)

The observed declining trend coincides with the similar trend observed in the northern BCA (Figure 5). The southern BCA bores were not in the vicinity of any active longwall panels over the review period so the observed decline is not attributable to mining related impacts. The response is therefore inferred to be due to water level regression following a large recharge event during the previous review period and the start of the current review period.

3.2.3 Hunter River Alluvium

Water level trends in the Hunter River Alluvium are presented in Figure 8. No responses attributable to mining activities are observed over the review period. This is consistent with the groundwater model predictions and the approved impacts in the 2012 WMP.

A general declining trend was observed at all HRA monitoring bores show over the review period attributed to the reduced recharge in the latter half of the review period (Figure 8).

Monitoring bores WMLP336, WMLP337 and WMLP338 were installed during the review period and therefore no data exists at these locations to assist with interpretation (Figure 8). A gradual decrease in water levels is observed, this is consistent with trends observed in other alluvial bores over the period of reduced recharge.

A rapid and sudden increase in water levels is observed in RA27 in the last quarter of 2011 and in all bores during the first quarter of 2012. This increase is consistent with increased flows in the Hunter River associated with high rainfall events.

3.2.4 Bowmans Creek Colluvium and Regolith

Piezometers monitoring the Bowmans Creek colluvium and regolith are presented in Figure 9. All piezometers have shown stable water level trends over the review period with no impacts attributed to underground mining operations. This indicates limited connection between the colluvium/regolith and the underlying coal measures.

3.2.5 Permian Coal Measures

Figures 10 to 22 present hydrographs of all PG Seam and Permian overburden monitoring bores.

Coal Measures Overburden

Figures 10 to 12 present standpipe piezometers monitoring the weathered overburden in the Bowmans Creek floodplain area. All monitoring bores are shown to be relatively stable within seasonal fluctuations with the exception of WML115B.

A dewatering effect was observed in the coal measures overburden at WML115B (Figure 10). This response is expected and shows a partial to complete depressurisation in the overlying Permian as coal is extracted from the PG seam at LW7B.

Figure 32 presents the ACP paired monitoring sites that providing a local comparison of the water levels in the Permian and the alluvium. Each site has a shallow standpipe piezometer screened in the in the overlying BCA (T1-A, T2-A, T3-A, T4-A, WMLP323 and WMLP311) and a slightly offset deeper standpipe piezometer in uppermost water-bearing horizon in the Permian (T1-P, T2-P, T3-P, T4-P, WML324 and WMLP325).

At all sites, differences in water level were found to exist between the alluvium and shallow Permian. Prior to coal extraction at the ACP, the Permian groundwater level was higher than the alluvium groundwater level. Following mining (in the PG and ULD) and over the review period this upwards gradient from the Permian has been reversed. The water level in the alluvial bores is now higher than in the Permian at all paired sites (Figure 32).

Groundwater levels in the piezometers which monitor the upper most water bearing horizon of the Permian coal measures beneath the Bowmans Creek flood plain area have declined in response to coal extraction in the PG seam while the alluvium piezometers have not shown a response attributable to mining (Figure 32).

During the extraction of LW7B, the water level responses to mining were most notable at the following sites:

- WMLP324, located near eastern BCD displayed drawdown of 1.8m during LW7B extraction, whilst WMLP323 which monitors the overlaying BCA at the same location did not show a discernible response to mining.
- T2-P, located to the south above LW7A displayed a drawdown of 1.5m during the first quarter of 2012, which is attributed to the extraction of LW7B. The water level at T2-A was observed to increase over the same period.
- No paired sites were shown to respond to the coal extraction at LW101 in the ULD seam.

The responses in the above Permian are related to changes in storage due to bed separation effects. Such a response is identified as a rapid decline in groundwater levels as the longwall passes due to an increase in aquifer storage. As the surrounding rock mass settles, the storage can decrease back towards previous levels and groundwater flows in from the surrounding aquifer resulting in subsequent groundwater level recovery once the longwall has passed. This is distinguishable from dewatering effects, which are denoted by a more continuous declining trend in groundwater levels.

- The water level in the overburden showed an overall rise throughout the period of LW7B extraction, attributed to above average rainfall over the extraction period. The water level in most bores shows a slight decline at the beginning of 2012 which coincides a period of declining rainfall levels.
- With the exception of WML115B there has been no response attributable to coal extraction at LW8. As previously discussed, the water level declines during the reporting period in the vicinity of LW8, as presented in Figure 5, are attributed to groundwater levels returning to background levels following above average rainfall throughout 2011.
- A general gradual decline is seen in water levels in the Permian and alluvium during coal extraction in the ULD seam at LW101. This declining trend is attributed to reduced rainfall recharge and in most cases is more prevalent in the alluvium as could be expected.

Bayswater Seams

Figure 13 presents hydrographs of the standpipe piezometers monitoring the Bayswater Seam towards the south of Bowmans Creek.

Piezometers which monitor the Bayswater Seam are located to the south and south east of longwall panels 6A to 7A and are therefore considered to be outside the influence of LW7B and LW8 extraction. As such, no response was observed during LW7B or LW8 (Figure 13). Water levels in bores RSGM1, WML112B and WML213 have remained largely stable throughout the monitoring period with a slight declining trend during 2012, which is most likely a response to the lower than average rainfall during that year.

Figure 13 shows that water levels in WML113A have recovered by approximately 5m during the reporting period and since August 2012 have stabilised at approximately 47 to 48mAHD (pre mining levels). This rapid recovery is assumed to be a response to the utilisation of the LW7A goaf for water storage during underground operations.

Lemington Seams

Figures 14 and 15 present VWPs installed within the Lemington seams. All piezometers which monitor the Lemington seams have now shown some depressurisation throughout the review period in response to mining of LW7B, LW8 and LW101.

Generally, drawdown occurs over a relatively broad area in the Pikes Gully Seam in response to the development headings, whereas in the overburden, responses are only seen once longwall extraction occurs and then only within the area of subsided strata or the immediately adjacent areas. Hence, the magnitude of response in each overburden piezometer has varied according to the proximity of the piezometer to the nearest active or extracted longwall.

Whilst most piezometers had already responded during mining of LW1 to 5 in the Pikes Gully Seam, further pressure responses were detected during the review period. The horizons that showed recognisable drawdowns in response to coal extraction over the review period were:

- WML115 – Lem 3-4, Lem 15 (above LW7B).
- WMLC334 – Lem 10, Lem 15 and Lem 19 (south west of LW101).
- WML269 – Lem 19 (within main gate pillars, south of LW5).
- WML213 – Lem 15 (south west of LW7A).

Pressure responses in WML115A, monitoring the Lem 4 to 15 seams above LW7B indicate that there was significant disturbance of the strata in November 2011 as all of the WML115A vibrating wire piezometers were lost, presumably due to ground movements severing the communication cables. All piezometers were still pressurised at the time they ceased recording.

It can be seen from Figures 14 and 15 that prior to the WML115A being lost, the groundwater responses show dewatering in the deeper coal measures (Pikes Gully, Lem 15 & 19 seams), but not in the uppermost section of the coal measures (Lem 7-9 Seams and CM overburden). This suggests that any connective cracking from the underground workings only extends to the Lem 15 seam. It also indicates that there is no hydraulic connection from the goaf to the base of the BCA within this panel.

The significant groundwater responses in the Lemington seams over the review period are summarised as follows:

- The uppermost section of the coal measure overburden (WML115B) shows a pressure response to coal extraction at LW7B (Figure 14). The saturated thickness levels at WML115B stabilised at 2.3m to 2.5m of water above the base of the screened interval. This demonstrates continued saturation in the upper Permian following the advancement of LW7B past this location.
- The underlying Lem 9 seam showed a gradual decrease in pressure over the review period at WML113A and WML133A (Figure 14). The gradual decreasing trend is shown to stabilise towards the end of the review period.
- The lower Lem 15 and 19 seams exhibited a rapid depressurisation response following the commencement of LW7B extraction (October 2011) in WML269 (Figure 15). This rapid depressurisation followed by partial saturation is typical of bed separation effects.
- The Lem 15 and 19 seams exhibited a rapid depressurisation response to LW101 extraction in WMLC334 (Figure 15). This pressure again is typical of the rapid depressurisation effects in response bed separation effects.

All other piezometers which monitor the Lemington seams around the southern end of the underground area (WML213, WML107A, WML113A and WML269) revealed a continuation of trends which were first established in previous review periods and demonstrate that the Permian strata has remained saturated and only partially depressurised in these areas.

Pikes Gully (east of LW1 and LW101)

Figure 16 presents PG seam standpipe piezometers to the east of LW1 (WML119, WML120A, and WML181-WML186).

Piezometers between LW1 and Glennies Creek are considered to be outside of the influence of coal extraction at LW7B and LW8 and they have not shown any response (Figure 16). With the exception of WML182, the PG water level in the area exhibits a stable trend over the LW7B and LW8 extraction period.

The water level WML182 exhibits a sharp increase towards the end of 2011 followed by a decline in water levels since April 2012. The water level observed in this bore is shown to respond relatively rapidly to rainfall events. The PG seam in this area is close to the surface perhaps explaining the rapid response to recharge events. WML182 also responds to the coal extraction at LW101 and the subsequent extraction of LW101 however remains saturated over the review period.

The groundwater level in all monitoring holes (except WML182) shows a recovering trend from June 2010 (Figure 16). The observed trend suggests a steady reduction in the hydraulic conductivity of the PG Seam within the barrier. This is possibly a delayed response to the in-seam grouting carried out in 2007 and/or the progressive infilling of fractures with fines (from the floodplain alluvium).

Pikes Gully Seam (mine footprint)

Hydrographs for the PG seam standpipe/vibrating wire piezometers distributed across the ACP underground area are displayed in Figure 17.

No responses were observed in the piezometers monitoring the PG seam in the longwall chain pillars over the review period (Figure 17). Observed responses to the LW1 development heading extraction were identified at these piezometers and a continuation of these established trends was observed over the review period.

Piezometers located inside the LW1 to LW8 area are now fully depressurised (WML191-100m and WML189-93m). Piezometers located outside the LW1 to LW8 area (WML213-205.5m and WML106-84m) show gradual and partial depressurisation effects.

The significant groundwater responses observed over the review period in the PG seam in the underground are summarised as follows:

- WML115A was destroyed by subsidence during coal extraction at LW7B.
- WMLC335-67m was installed to the south of ULD LW101 on 2 April 2012. The measured pressure in the PG Seam following LW7B was around 48mAHD and the seam is around 21.5mAHD. This piezometer along with WML213 show the PG Seam has remained saturated with only partial depressurisation outside the mined area.

Arties, Liddell and Barrett Coal Seams

Hydrographs for monitoring bores in the Arties seam over the reporting period are presented in Figure 18. Generally a stable water level trend is exhibited with a slight reducing trend in the final quarter of the review period (LW101).

WMLP301, WMLC333, WMLC334 and WMLC335 all show a minor decreasing water level trend in the Arties seam following coal extraction at LW101 (Figure 18). This reducing trend is attributed to a decreasing pressure head caused by dewatering in the overlying ULD seam.

Liddell and Barrett Seams

A series of VWPs are installed within the ULD, Lower Liddell and Lower Barrett coal seams with the associated hydrographs presented in Figures 19 to 22.

Gradual depressurisation responses have been observed in the ULD Seam with the most pronounced responses observed in WML191 and WMLC334 (Figure 19). WMLP191 shows a drawdown in the ULD seam of approximately 20m since May 2012 and WMLC334 shows a drawdown of approximately 10m over the same time period.

Piezometers WMLC334, WML262, WMLC333 and WMLC335 have also exhibited depressurisation responses in the ULD seam (Figures 19 and 20). The ULD seam piezometer in WMLC144 on the eastern side of Glennies Creek did not show a response to coal extraction at LW101.

Observed pressure responses in the ULD seam intensify as the longwall extraction progresses past each monitoring locations. The intensity of these groundwater level responses is generally related to the proximity of the monitoring piezometer to the coal extraction. Following longwall progression past piezometer locations the pressures were observed to stabilise.

Fluctuating pressures are observed in the Upper and Lower Barrett in WML191 and WMLC335 (Figure 22). These responses reflect pressure variations caused by LW101 coal extraction in the overlying ULD seam.

3.3 Groundwater Quality Monitoring Results

The monitoring of groundwater quality has highlighted some variation from the baseline trend of low salinity in the Alluvium and high salinity in the Permian. The main variances are as follows:

3.3.1 Electrical Conductivity

Bowmans Creek Alluvium

Groundwater salinities of monitoring bores in the Bowmans Creek Alluvium (BCA) are presented on Figure 23. The monitoring bores presented either overly or are within close proximity to the LW7B and LW8 goafs. The following observations are noted:

- Salinity levels ranged from 790 to 1,344µS/cm EC and averaged of 1,014µS/cm (Table 3.2).
- A gradual long term decline in EC levels is observed. This is in part attributed to the elimination of upward leakage of saline groundwater from the underlying Permian coal measures.
- A small spike in EC levels occurred in some bores during early 2012 following a period of high rainfall (above the long term median). This spike is attributed to the sudden flushing of salts from the unsaturated zone towards to water table which accumulate during periods of low rainfall.

EC levels in key BCA bores over the reporting period are all within the baseline range (722-9920µS/cm) provided in the 2012 WMP. The observed EC levels indicate that no connective cracking to the underlying seams has been caused by mining operations.

Glennies Creek Alluvium

Groundwater salinities of monitoring bores in the Glennies Creek Alluvium (GCA) are presented on Figures 24 and 25. The following observations are noted:

- The EC level in the GCA is slightly higher than the EC levels of surface flow in Glennies Creek (200 to 900µS/cm) during the review period (Figure 31).
- Over the review period the salinity levels in the GCA ranged from 269 to 1507µS/cm with an average of 659µS/cm. Historically the GCA has reported variable salinity with EC levels ranging from 348 to 2,610µS/cm.
- Piezometers WML240 and WML129 monitor the GCA in the barrier to the west of Glennies Creek (Figure 24). They show a steady EC levels over the review period.
- The EC level at WML120B is shown to fluctuate over the review period (Figure 24). The EC level remains within the baseline range and is observed to vary with recharge events.
- Relatively steady groundwater EC levels were observed at piezometers that monitor the GCA close to the eastern side of Glennies Creek (e.g. WML253) (Figure 25).

EC levels observed in the GCA over the review period are within the baseline range (722-9920µS/cm) provided in the 2012 WMP. No observed trends in the data indicate an impact caused by mining operations in the underlying seams.

Hunter River Alluvium

Groundwater salinities in the recently installed monitoring bores in the HRA are presented on Figure 26. The following observations are noted:

- Groundwater EC levels ranging from 1,007 to 2,820µS/cm. This is higher than the Hunter River surface flow (240 to 1290µS/cm), but is within historical limits.

EC levels in the HRA are generally within the baseline range (1375-2540µS/cm) provided in the 2012 WMP over the review period.

Coal Measures Overburden

Groundwater salinities in the coal measures overburden are presented on Figure 27. The following observations are noted:

- Standpipe piezometers (WML115B, WMLP324 and WMLP325) which were completed within the Coal Measures Overburden (Figure 27) near LW7B and LW8, revealed groundwater salinities in the range 383 to 5410µS/cm.
- A gradual increase in EC levels was observed in the coal measures overburden during the review period. EC levels however remain within the baseline levels

EC levels in the coal measures overburden are within the baseline range (320-18200µS/cm) provided in the 2012 WMP over the review period.

Coal Seams

Groundwater salinities in the coal seams above LW101 are presented on Figure 28. The following observations are noted:

- Salinity of groundwater in the near surface coal seams ranged from 106 to 6580µS/cm EC.
- The EC remained relatively steady in most of the boreholes prior to the commencement of coal extraction at LW101.
- An increase in EC level was evident following the commencement of LW101 extraction at WML181, WML185, WML301 and WMLP302 (Figure 28). These EC levels have become stable following the progression of the longwall and begun to decrease to pre-extraction levels.

Upper Liddell Seam

Groundwater salinities in the ULD seams are presented on Figure 28. The following observations are noted:

- The groundwater EC levels in the ULD Seam ranged from 126 to 7390µS/cm.
- A lower EC was observed in WML261, this may reflect partial connection with the fresher groundwater in the overlying alluvium.

Underground Inflows

Groundwater salinities of the underground inflows are presented on Figure 30. Following the completion of mining in the PG seam, only limited monitoring data is available due to accessibility. The following observations are noted:

- The EC levels of the underground inflows are shown to remain relatively stable over the first half of the review period. One key exception is the strongly increasing salinity observed at MG03 (backroad seal).
- A gradual declining EC trend is apparent at the NW mains (14C/T), however values are still above the historical minimum.
- An apparent declining trend (from two data points) is observed at MG09 (13 C/T). With the lowest values observed during the current review period.
- The underground inflow EC range is observed to be relatively high with a similar range to that of the coal measures (approximately 2000 to 9000µS/cm).

No significant reduction of the inflows EC was observed over the review period providing an indication that the inflows are sourced from the Permian and not the fresher alluvium aquifers.

Table 3.2: Salinity Measured as Electrical Conductivity (µS/cm)

Key Monitoring Bores	Monitoring Date														Statistics		
	01-Dec-11	08-Dec-11	06-Jun-12	08-Jun-12	12-Jun-12	22-Aug-12	05-Sep-12	18-Sep-12	04-Oct-12	16-Oct-12	31-Oct-12	12-Nov-12	11-Dec-12	28-Dec-12	Min	Max	Average
Bowmans Creek																	
RA30	-	1136	-	1,344	-	-	-	-	-	-	-	-	-	-	1136	1344	1240
T5	-	1087	-	955	-	-	-	-	-	-	-	-	-	-	955	1087	1021
T6	-	1043	-	952	-	-	-	-	-	-	-	-	-	-	952	1043	998
WMLP311	1000	-	790	-	-	-	-	-	-	-	-	-	-	-	790	1000	895
WMLP323	964	-	871	-	-	-	-	-	-	-	-	-	-	-	871	964	918
															790	**1344**	**1014**
Glennies Creek																	
WML120B	737	-	830	-	-	743	757	624	732	724	721	744	800	785	624	830	745
WML129	365	-	465	-	445	360	377	327	351	357	430	310	284	269	269	465	362
WML239	-	-	-	355	-	904	826	686	799	792	803	839	858	847	355	904	771
WML240	993	-	-	564	-	529	696	606	737	741	786	879	974	1010	529	1010	774
WML241	488	-	-		497	-	-	-	-	-	-	-	-	-	488	497	493
WML253	359	-	-	355	-	-	-	-	-	-	-	-	-	-	355	359	357
AP243	1507	-	-	977	-	-	-	-	-	-	-	-	-	-	977	1507	1242
															269	**1507**	**659**
Hunter River Alluvium																	
WMLP336	-	-	-	-	-	-	1669	1359	1383	1186	1296	1063	1007	1008	1007	1669	1246
WMLP337	-	-	-	-	-	1969	2062	1940	2240	2320	2750	2820	2800	2790	1940	2820	2410
WMLP338	-	-	-	-	-	1547	1647	1343	1527	1473	1730	1690	1671	1653	1343	1730	1587
															1007	**2820**	**1767**
Coal Measures Overburden																	
WML115B	-	4550	-	5,410	-	-	-	-	-	-	-	-	-	-	4550	5410	4980
WMLP324	383	-	598	-	-	-	-	-	-	-	-	-	-	-	383	598	491
WMLP325	809	-	1,307	-	-	-	-	-	-	-	-	-	-	-	809	1307	1058
															383	**5410**	**2176**

Key Monitoring Bores	Monitoring Date														Statistics		
	01-Dec-11	08-Dec-11	06-Jun-12	08-Jun-12	12-Jun-12	22-Aug-12	05-Sep-12	18-Sep-12	04-Oct-12	16-Oct-12	31-Oct-12	12-Nov-12	11-Dec-12	28-Dec-12	Min	Max	Average
Coal Measures																	
WML119	106	-	178	-	208	147.5	204	166	259	334	707	1217	1610	1913	106	1913	587
WML120A	596	-	655	-	-	585	632	531	611	596	593	561	542	500	500	655	582
WML181	3170	-	3,850	-	3870	2950	3150	2600	3070	3020	3520	3540	3380	3540	2600	3870	3305
WML182	5090	-	4220	-	4230	3930	4180	3450	4160	4180	4600	4900	4720	4790	3450	5090	4371
WML183	4760	-	4780	-	5100	4620	4840	3830	4490	4480	4880	5140	4880	4690	3830	5140	4708
WML184	974	-	1073	-	-	3120	4010	2540	2820	3620	2990	4910	4630	1353	974	4910	2913
WML185	1182	-	1,168	-	1220	1392	1428	1795	1962	2056	2234	2244	2119	-	1168	2244	1709
WMLP301	6320	-	6540	-	6580	5190	5510	4560	5360	5310	5900	6040	5800	5910	4560	6580	5752
WMLP302	876	-	913	-	-	701	819	688	809	799	810	858	891	890	688	913	823
															106	**6580**	**2798**
Upper Liddell																	
WML261	126	-	-	-	-	142	155.2	132	162.3	166.6	175	237	2380	232	126	2380	391
WML262	7370	-	7280	-	7390	6410	6760	5520	6570	6480	7030	7370	7230	7220	5520	7390	6886
															126	**7390**	**3841**

3.3.2 pH

The pH of the groundwater in the alluvium ranges from 6.16 to 7.76 (Table 3.3). Likewise the coal measures groundwater is generally near-neutral, with most pH values lying within a similar range over the review period (5.86 to 8.14).

All piezometers located within the alluvium reported pH values within guideline limits for freshwater ecosystems (6.5 to 8). A summary of the findings over the reporting period is as follows:

Bowmans Creek Alluvium

The pH of monitoring bores located in the Bowmans Alluvium showed the following:

- pH ranged from 6.7 to 7.4 EC and averaged 6.97 over the reporting period.
- All piezometers located in the Bowmans Creek Alluvium reported pH values within the guideline limits for freshwater ecosystems.

Glennies Creek Alluvium

The pH of monitoring bores located in the Glennies Creek Alluvium showed the following:

- pH ranged from 6.37 to 7.76 EC and averaged 6.89 over the reporting period.
- All piezometers located in the Glennies Creek Alluvium reported pH values within the guideline limits for freshwater ecosystems.

Hunter River Alluvium

The pH of monitoring bores located in the Hunter River Alluvium showed the following:

- pH ranged from 6.16 to 7.42 and averaged 6.95 over the reporting period .
- All piezometers located in the Glennies Creek Alluvium reported pH values within the guideline limits for freshwater ecosystems.

Coal Measures Overburden

The pH of monitoring bores located in the Coal Measures Overburden showed the following:

- pH ranged from 6.70 to 7.4 and averaged 7.05 over the reporting period .

Coal Measures

The pH of monitoring bores located in the Coal Measures showed the following:

- pH ranged from 5.86 to 8.14 and averaged 7.06 over the reporting period .

Upper Liddell Seam

The pH of monitoring bores located in the Coal Measures showed the following:

- pH ranged from 6.23 to 8.10 and averaged 7.12 over the reporting period.

Table 3.3: pH

Key Monitoring Bores	Monitoring Date														Statistics		
	01-Dec-11	08-Dec-11	06-Jun-12	08-Jun-12	12-Jun-12	22-Aug-12	05-Sep-12	18-Sep-12	04-Oct-12	16-Oct-12	31-Oct-12	12-Nov-12	11-Dec-12	28-Dec-12	Min	Max	Average
Bowmans Creek																	
RA30	-	6.7	-	6.7	-	-	-	-	-	-	-	-	-	-	6.70	6.70	6.70
T5	-	7	-	6.9	-	-	-	-	-	-	-	-	-	-	6.90	7.00	6.95
T6	-	6.9	-	6.9	-	-	-	-	-	-	-	-	-	-	6.90	6.90	6.90
WMLP311	7.1	-	7	-	-	-	-	-	-	-	-	-	-	-	7.00	7.10	7.05
WMLP323	7.4	-	7.1	-	-	-	-	-	-	-	-	-	-	-	7.10	7.40	7.25
															6.70	**7.40**	**6.97**
Glennies Creek																	
WML120B	6.8	-	6.7	-	-	6.93	6.59	6.55	6.49	6.68	6.77	6.64	7.12	7.02	6.49	7.12	6.75
WML129	6.9	-	7	-	7.51	7.37	7.07	7.23	7.05	7	6.97	7.23	7.57	7.76	6.97	7.76	7.25
WML239	6.9	-	-	6.9	-	6.88	6.56	6.37	6.94	6.86	6.83	6.79	7	7.07	6.37	7.07	6.82
WML240	6.6	-	-	6.7	-	6.87	6.77	6.66	6.95	6.6	6.64	6.51	6.72	7.04	6.51	7.04	6.73
WML241	7	-	-	7.0	-	-	-	-	-	-	-	-	-	-	7.00	7.00	7.00
WML253	6.7	-	-	6.7	-	-	-	-	-	-	-	-	-	-	6.70	6.70	6.70
AP243	6.9	-	-	7.0	-	-	-	-	-	-	-	-	-	-	6.90	7.00	6.95
															6.37	**7.76**	**6.89**
Hunter River Alluvium																	
WMLP336	-	-	-	-	-	-	6.96	6.83	6.95	6.89	6.97	6.84	7.11	7.07	6.83	7.11	6.95
WMLP337	-	-	-	-	-	7.2	6.78	7.42	6.81	6.98	6.97	6.96	7.04	7.02	6.78	7.42	7.02
WMLP338	-	-	-	-	-	7.39	6.98	6.16	6.91	6.93	6.87	6.68	6.88	6.99	6.16	7.39	6.87
															6.16	**7.42**	**6.95**

Key Monitoring Bores	Monitoring Date														Statistics		
	01-Dec-11	08-Dec-11	06-Jun-12	08-Jun-12	12-Jun-12	22-Aug-12	05-Sep-12	18-Sep-12	04-Oct-12	16-Oct-12	31-Oct-12	12-Nov-12	11-Dec-12	28-Dec-12	Min	Max	Average
Coal Measures Overburden																	
WML115B	-	7	-	6.9	-	-	-	-	-	-	-	-	-	-	6.90	7.00	6.95
WMLP324	7.1	-	7.2	-	-	-	-	-	-	-	-	-	-	-	7.10	7.20	7.15
WMLP325	7.4	-	6.7	-	-	-	-	-	-	-	-	-	-	-	6.70	7.40	7.05
															6.70	**7.40**	**7.05**
Coal Measures																	
WML119	6.8	-	6.2	-	6.81	6.61	7.21	7.33	6.87	6.58	6.9	7.01	7.28	7.39	6.20	7.39	6.92
WML120A	7.2	-	7.4	-	7.91	7.25	7.3	7.49	7.24	7.05	7.19	6.91	7.05	7.12	6.91	7.91	7.26
WML181	7.1	-	7.4	-	7.91	7.25	7.3	7.49	7.24	7.05	7.19	6.91	7.05	7.12	6.91	7.91	7.25
WML182	7.1	-	7.0	-	7.62	7.01	6.95	7.27	7.15	6.93	7.03	6.83	7.01	7.04	6.83	7.62	7.08
WML183	7.4	-	7.2	7.85	-	7.25	7.32	7.14	7.02	6.84	6.96	6.87	6.9	6.88	6.84	7.85	7.14
WML184	6.8	-	6.7	-	-	6.83	7.06	7.15	6.93	7.01	7.14	7.05	7.11	6.68	6.68	7.15	6.95
WML185	6.8	-	6.8	-	7.46		7.08	6.59	6.59	6.79	6.81	6.7	6.79	6.76	6.59	7.46	6.83
WMLP301	7.7	-	7.7	-	8.14	7.79	7.26	6.73	7.7	7.59	7.65	7.61	7.69	7.91	6.73	8.14	7.62
WMLP302	6.5	-	6.4	-	-	6.85	6.25	6.43	5.86	6.36	6.41	6.3	6.5	6.64	5.86	6.85	6.41
															5.86	**8.14**	**7.06**
Upper Liddell																	
WML261	6.3	-	-	-	-	6.92	6.62	6.23	6.28	6.47	6.65	6.39	7.12	7.39	6.23	7.39	6.64
WML262	7.9	7.8	7.8	-	8.1	7.39	6.54	7.63	6.76	7.76	7.77	7.73	7.82	7.8	6.54	8.10	7.60
															6.23	**8.10**	**7.12**

3.4 Mine Inflows

North East Open Cut

Mining from the NEOC was completed prior to the review period, during the review period the pit was utilised only for backfilling purposes.

The abstracted water was made up of rainfall captured by the mine catchment, including rainfall infiltration to the in-pit waste, as well as groundwater inflows. Groundwater inflows to the open cut are estimated to be a small proportion of the total, they are conservatively estimated at less than 25% (0.13ML/d) of the total abstraction volume.

Underground Mine

Calculated monthly groundwater inflows to the underground mine are presented in Figure 33 with the current groundwater model prediction.

The following observations are noted over the review period:

- From 1 September 2011 to 29 December 2011 groundwater inflows were below the approved prediction from the groundwater model.
- From 29 December 2011 to 30 January 2012 during the end of LW7B and start of LW8 extraction, high inflows were observed, at times above the model predictions. This triggered an investigation into the likely cause of the increased volume (RPS Aquaterra, 2012b). The investigation ruled out leakage from the overlying alluvial aquifer through water quality interpretation. Inflows have since reduced to below predicted rates.
- The monthly average groundwater inflows ranged from 3.2L/s (0.2ML/d) to 21.17L/s (1.8ML/d) over the reporting period. With the exception of the short duration peak inflow rates, inflows are shown to remain below predicted rates.
- Total inflows for the review period are approximately 535ML over the 490 day reporting period at an average of 13L/s (1.1ML/d). This is below the predicted EIS inflow of 570ML/yr (18L/s) but is reasonably consistent with current model predictions.

Groundwater inflows are calculated using a water balance method, i.e. total inflows are equal to the sum of the water abstracted from the underground mine, minus the sum of the water supplied for operational purposes.

Over 2012 the portal discharge water meter was reading incorrectly due to air being pumped into the line. This was confirmed by testing the flow capability of the discharge pump and the meter recordings. Measurements made on the water make in the PG seam backr oad and the LW7B and LW8 area show that underground inflows have been consistently making 11L/s total for the mine.

The inflow calculation does not take into consideration underground operational factors such as the temporary storage of water within the mine and changes in this storage. This can lead to a misrepresentation of inflows rates. Specifically, actual inflows can be exaggerated during periods of active water abstraction where water is also being pumped from storage and understated during periods where inflows are diverted to storage areas.

To minimise this error inflows are presented in Figure 33 as a monthly average. However, the peak inflows (approximately 20L/s) and minor inflows (approximately 3L/s) plotted in Figure 33 are still likely to be skewed by the storage and release of water underground. The most accurate representation of inflows is the average inflow for the review period of 13L/s.

3.5 Groundwater Dependant Ecosystems

It is considered unlikely that there would be any impact on groundwater dependant ecosystems in the vicinity of longwall mining at ACOL. This is because of the following observations:

- No impacts on flows in Bowmans Creek, the Hunter River and Glennies Creek were observed over the reporting period.

- No significant impacts on the groundwater levels within alluvial aquifers from mining of the PG seam or ULD seam are noted within the review period.
- No groundwater related impacts were observed in the identified River Red Gum area over the review period. The identified River Red Gum area is located next to the creek between the southern end of the western diversion and the Hunter River.

4. GROUNDWATER MODEL REVIEW

In accordance with Consent Condition 9.2, the performance of the groundwater system in response to mining operations was compared with predicted impacts that were made in the 2012 WMP. The actual impacts were also compared with impacts predicted in the groundwater Upper Liddell Seam Extraction Plan Impact Assessment (RPS Aquaterra 2012a).

The groundwater model used for the 2009 Bowmans Creek Development Consent Modification Application (MOD6) has been updated to allow better definition of subsidence related impacts of underground mining. The updates include re-definition of model layers, in particular assignment of separate model layers for the main coal seams and the interburdens (previously each seam and its overburden were treated as a single layer), and the subdivision of the Pikes Gully seam overburden into several layers (previously the Pikes Gully seam and its overburden constituted a single layer).

5. SUMMARY AND RECOMMENDATIONS

5.1 Summary

During the review period coal extraction occurred at LW7B, LW8 and LW101 in addition the Bowmans Creek diversions were constructed and commissioned. Groundwater monitoring over the review period was concentrated on the potential impacts from these operations.

The following conclusions are noted from interpretation of the monitoring data over the review period:

- No significant impacts were observed in the HRA or GCA.
- A declining trend of the northern and southern BCA water levels is noted over the review period. While it is believed that the decline is consistent with historical water levels, and is not an impact from mining activities, ongoing monitoring and assessment is required to confirm this finding.
- No water level decline was observed to the central BCA at the oxbow
- No significant groundwater quality impacts have been observed.
- No significant impacts to GDEs or other groundwater users in the area have occured.
- Average groundwater inflows to the underground (13L/s / 1.1ML/d)) were below inflow rates predicted in the 2001 EIS (18.5L/s / 1.6ML/d) and 2012 WMP (14.4L/s / 1.2ML/d).
- Short-term inflow peaks observed over the review period are attributed to underground mine water management and operational pumping requirements. Total inflows over the review period are below predicted rates (section 10.4.4 of 2012 WMP).

The impacts observed are compared against the predicted impacts in Table 5.1.

Table 5.1: Comparison of Observed Impacts against the 2012 ULD Extraction Plan

Impact Description	Impact Observed over the Review Period (Sep 2011-January 2013 including LW7B, LW8 and LW101	Predicted Groundwater Related Impacts for the Review Period	
		PG + ULD*	ULD Only*
Groundwater drawdown to the Glennies Creek Alluvium (south of ULD LW101)	None observed	0.11m	0.06m
Groundwater drawdown to the Glennies Creek Alluvium (east of ULD LW101)	None observed	0.18m	0.04m
Groundwater drawdown to the Bowmans Creek Alluvium (at the oxbow)	None observed – further observation required to confirm	0.45m	0.13m
Groundwater drawdown to the Hunter River Alluvium (south of ULD LWs 5 to 7)	None observed	0.01m	0.01m
Underground Inflows - Average Monthly	0.3 – 1.8ML/d (3 – 21L/s)	1.4ML/d (16L/s)	1-10L/s

*Reference: Ashton Coal, 2012 and RPS Aquaterra, 2012a

The groundwater monitoring during the review period has been completed in full compliance with Consent Condition 9.2 (d) of the ACP Approval.

With the exception of temporary pumping at above predicted inflow rates the groundwater-related impacts from underground mining during the review period were below the levels predicted in the 2001 EIS, 2012 WMP and the Upper Liddell Seam Extraction Plan Impact Assessment (RPS Aquaterra, 2012a).

5.2 Recommendations

The following recommends are made for the 2013-2014 review period based on analysis of the groundwater monitoring data collected over the current review period.

- Continuation of the monitoring program as outlined in the 2012 WMP.

- Increased monitoring of the water level in the BCA. The monitoring would determine if the declining trend noted over the review period is correctly attributed to natural effects or if it is an impact from mining activities.
- In order to be able to better define actual mine inflows, the underground mine water management needs to be streamlined. Increased underground monitoring of flow rate, water transfer to and from storage, water quality, and accurate determination of total inflow volume is required.

6. REFERENCES

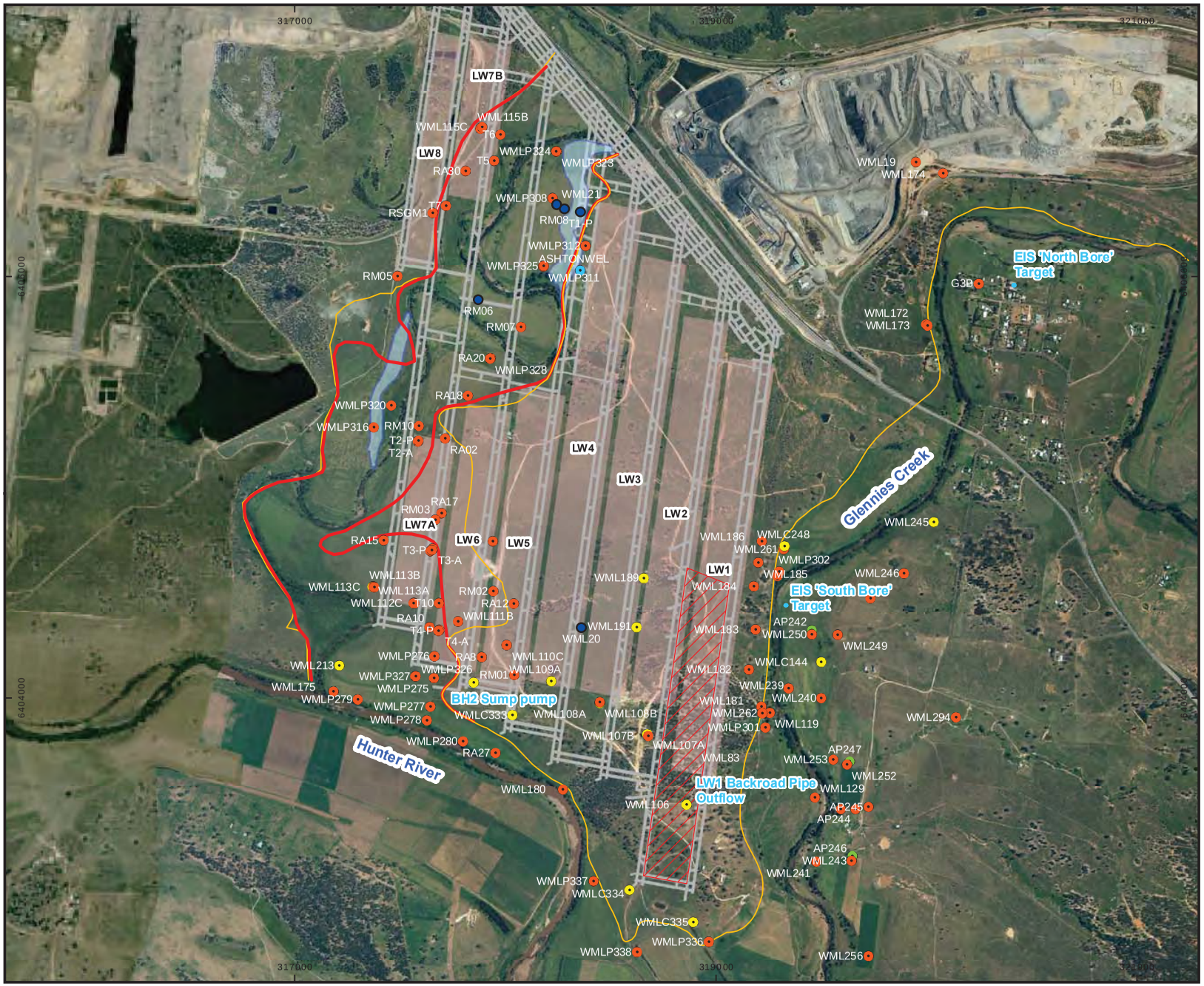
Ashton Coal Operations Pty Limited, 2012. *Water Management Plan MP 3.4.1.8*, Revision E, July 2012.

RPS Aquaterra, 2012a. *Upper Liddell Seam Extraction Plan Impact Assessment*, Revision F. Report to Ashton Coal, February 2012

RPS Aquaterra, 2012b. *Groundwater Inflow Investigation – Pikes Gully LW7B*. Report to Ashton Coal, September 2012

HLA-Envirosciences, 2001, *Environmental Impact Statement, Ashton Coal Project, (Appendix H of Groundwater Hydrology and Impact Report, and Appendix I – Soil and Land Capability Assessment Report)*.

FIGURES



LEGEND

Monitoring Bores

Type

- Stand pipe
- Test bore
- Vibrating wire
- Well
- Decommissioned
- Upper Liddell Seam Extraction
- Alluvium boundary
- Saturated alluvium boundary
- Bowmans Creek Diversion
- Pikes Gully Seam Extraction
- Upper Liddell Mine Plan

N

200 0 200 400
Metres

APPROX SCALE 1:25,000 @ A4

GDA 1994 MGA Zone 56

RPS Aquaterra

FIGURE 1

Ashton Coal
Groundwater Monitoring Network

S56_047d Rev: A Produced: HZ Reviewed: SC Date: 24/01/2013

LEGEND

- Decommisioned_Piezometers
- Decommisioned_Piezometers

Monitoring Bores

Type

- Stand pipe
- Test bore
- Vibrating wire
- Well
- Decommissioned piezometer
- Brunkers Lane
- Subsidence Cross Section Line
- Alluvium boundary
- Saturated alluvium boundary
- Bowmans Creek Diversion
- Upper Liddell Mine Plan

N

200 0 200 400

Metres

APPROX SCALE 1:15,000 @ A4

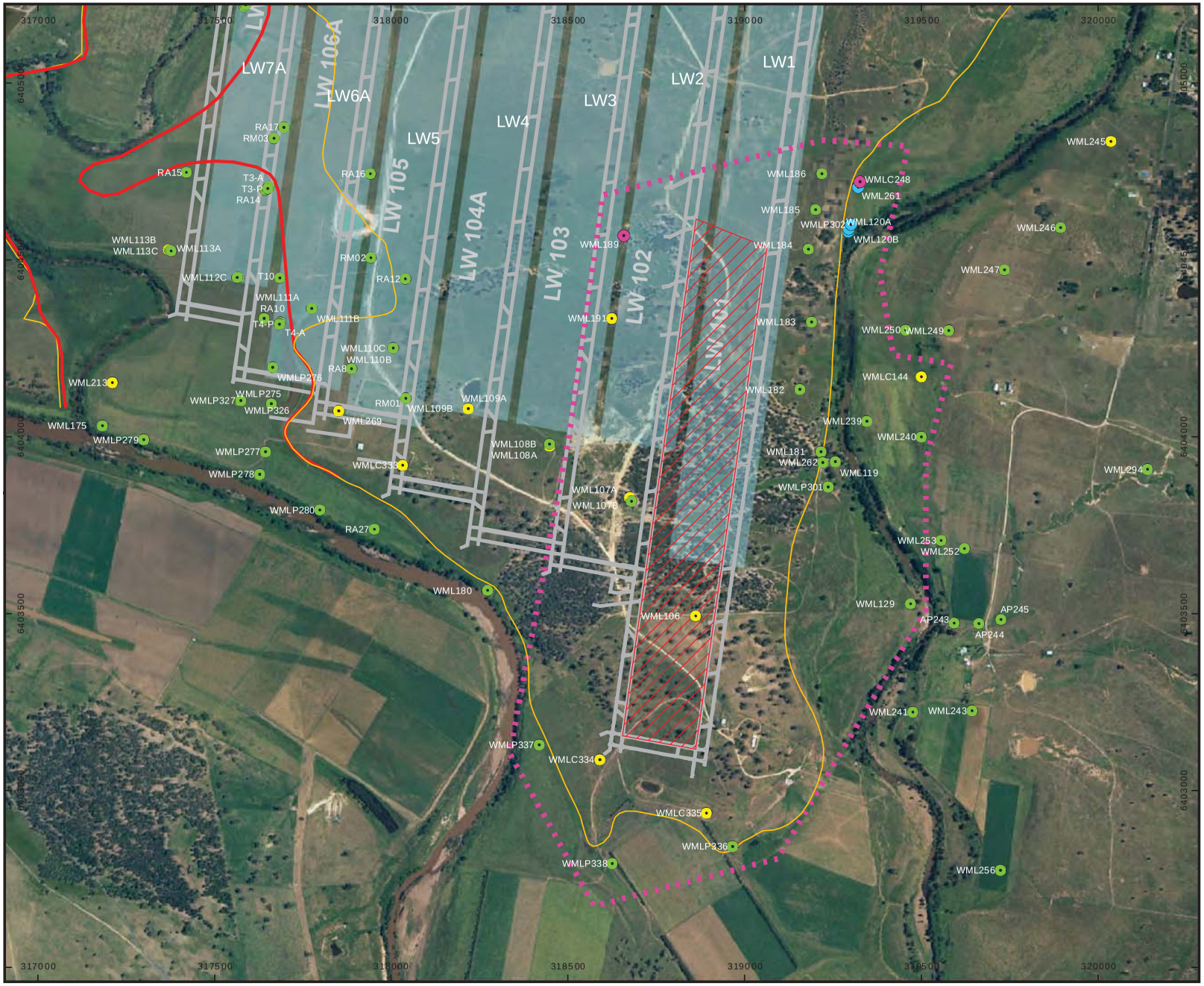
GDA 1994 MGA Zone 56

RPS Aquaterra

FIGURE 2

Groundwater Monitoring Network (Pikes Gully LW7B & LW8)

S56_048c Rev: A Produced: HZ Reviewed: SC Date: 24/01/2013



LEGEND

Monitoring Bores

Type

- Stand Pipe Piezometer
- Stand Pipe Piezometer with Data Logger
- Vibrating Wire Piezometer
- Vibrating Wire Piezometer with Data Logger
- Upper Liddell Seam Extraction
- Pikes Gully Seam Extraction
- Alluvium boundary
- Saturated alluvium boundary
- Upper Liddell Seam Mine Plan
- Bores to Monitor for ULD LW101

N

200 0 200 400

Metres

APPROX SCALE 1:15,000 @ A4

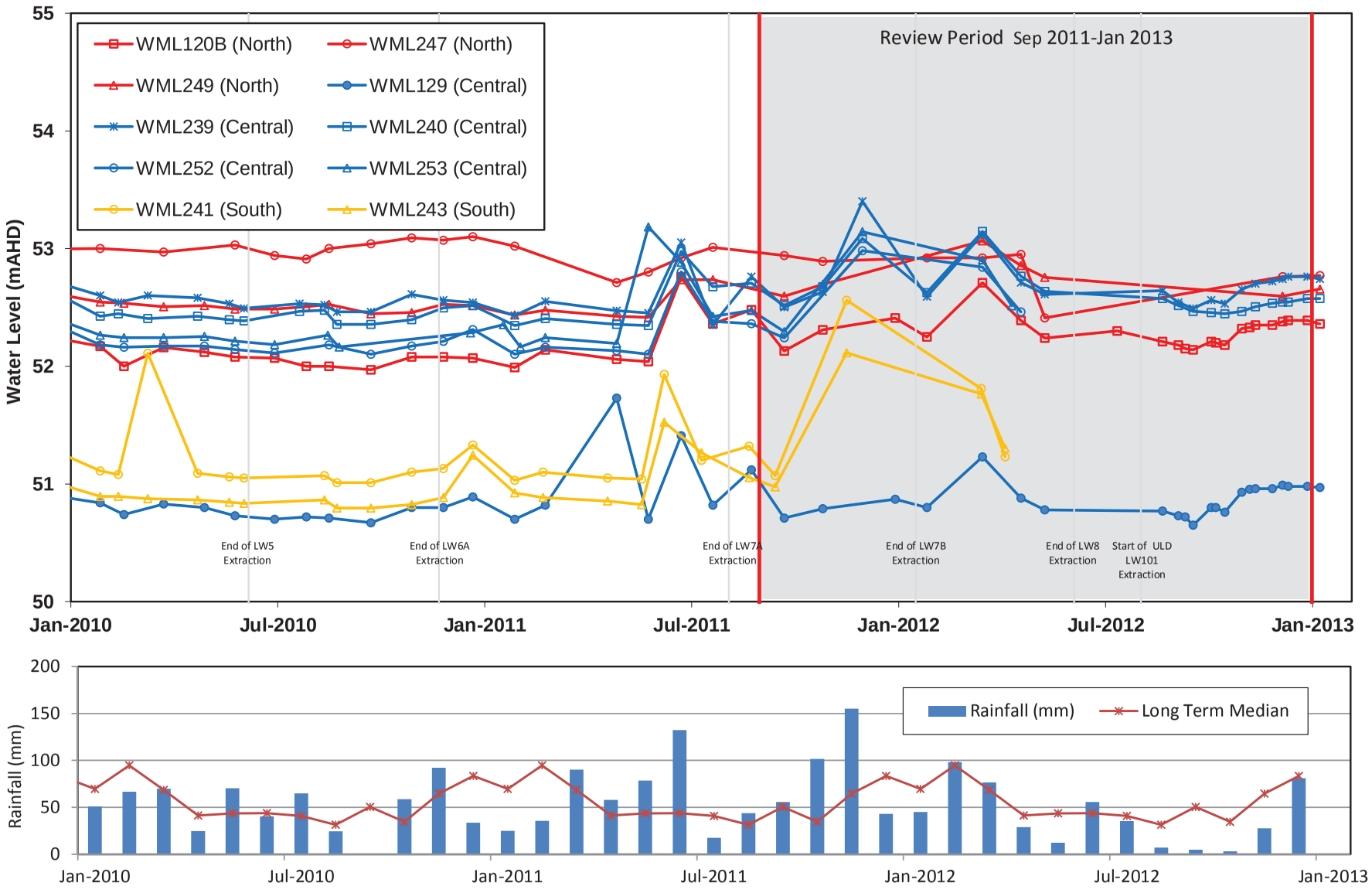
GDA 1994 MGA Zone 56

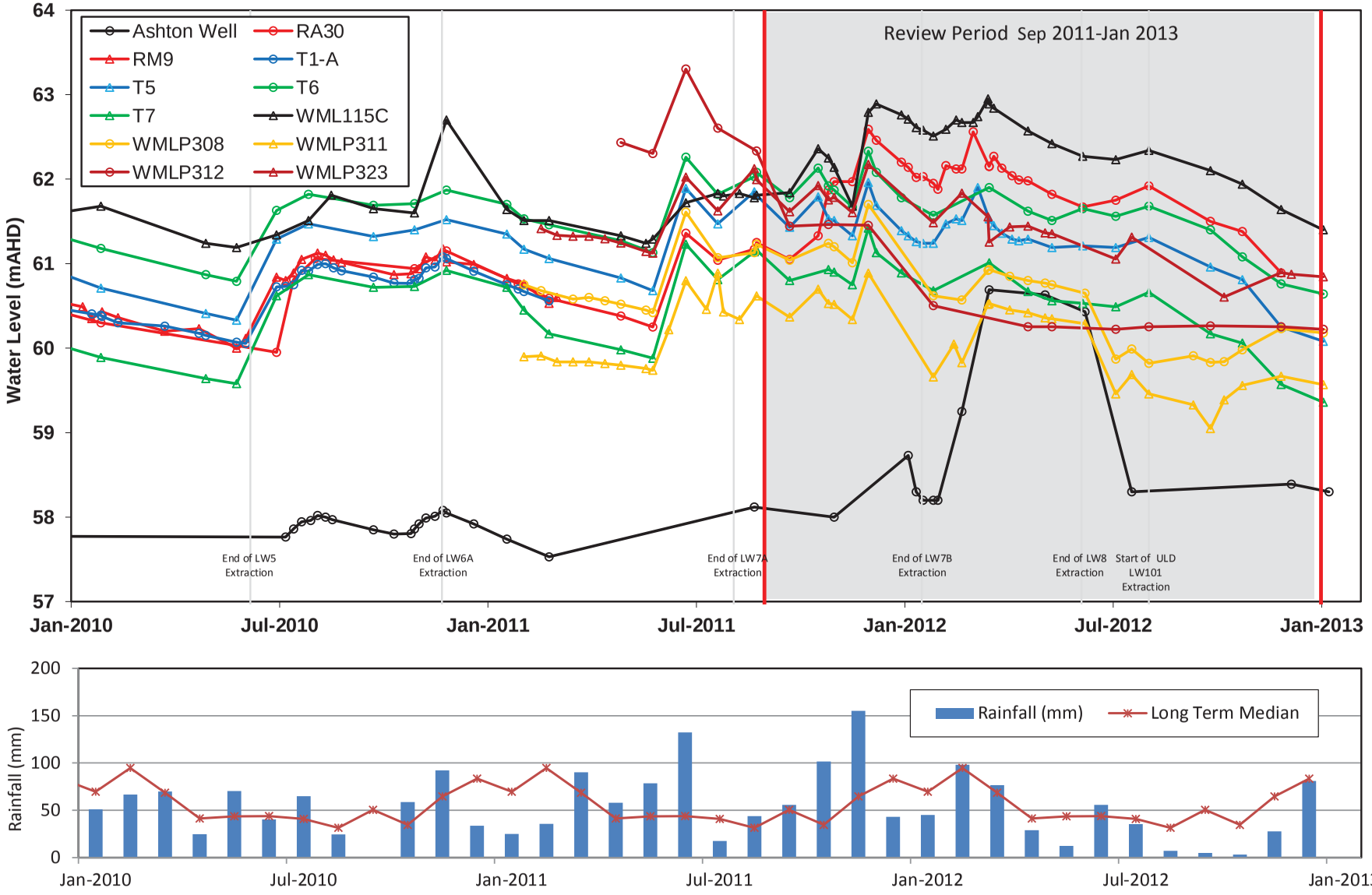
RPS Aquaterra

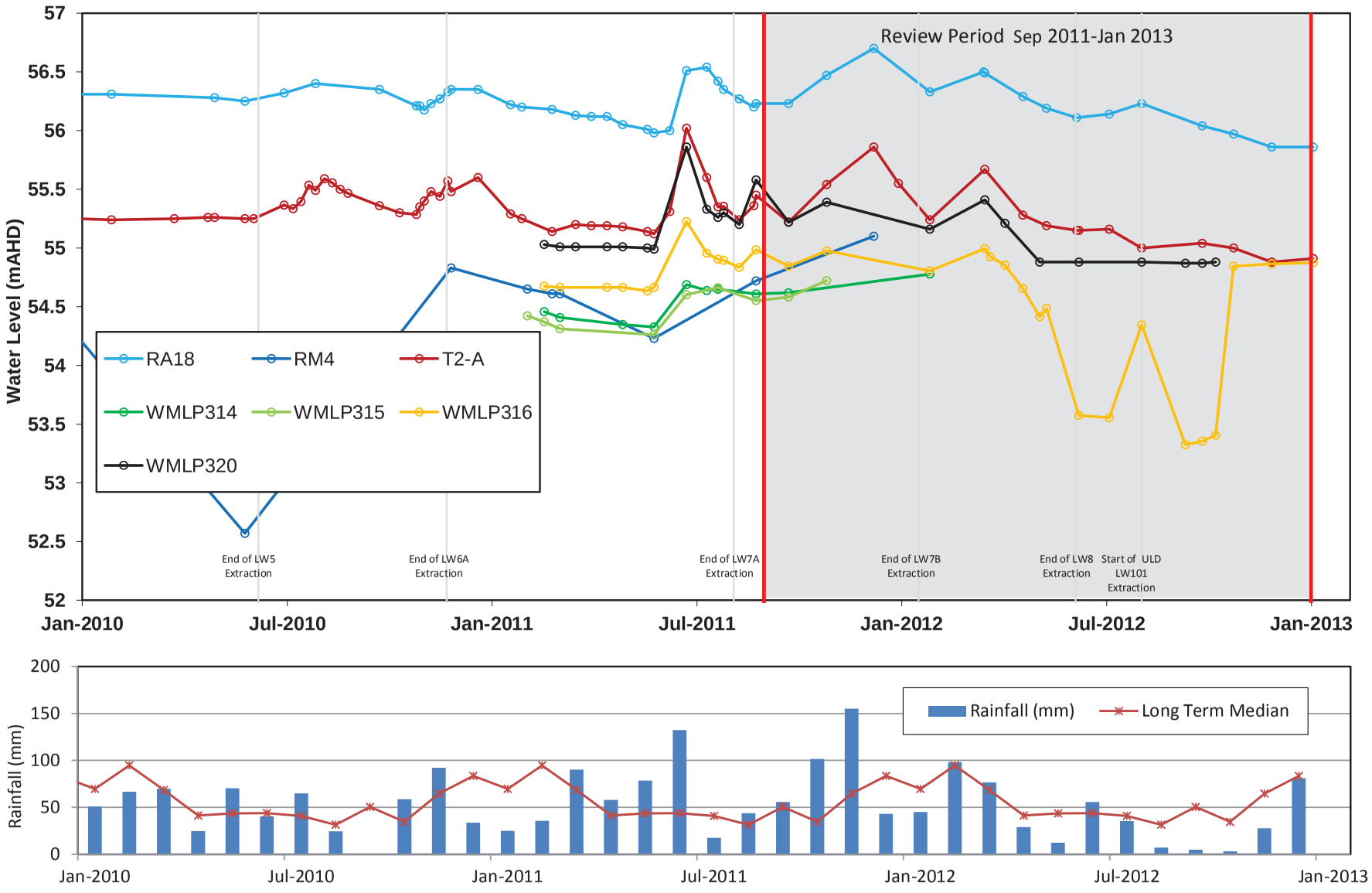
FIGURE 3

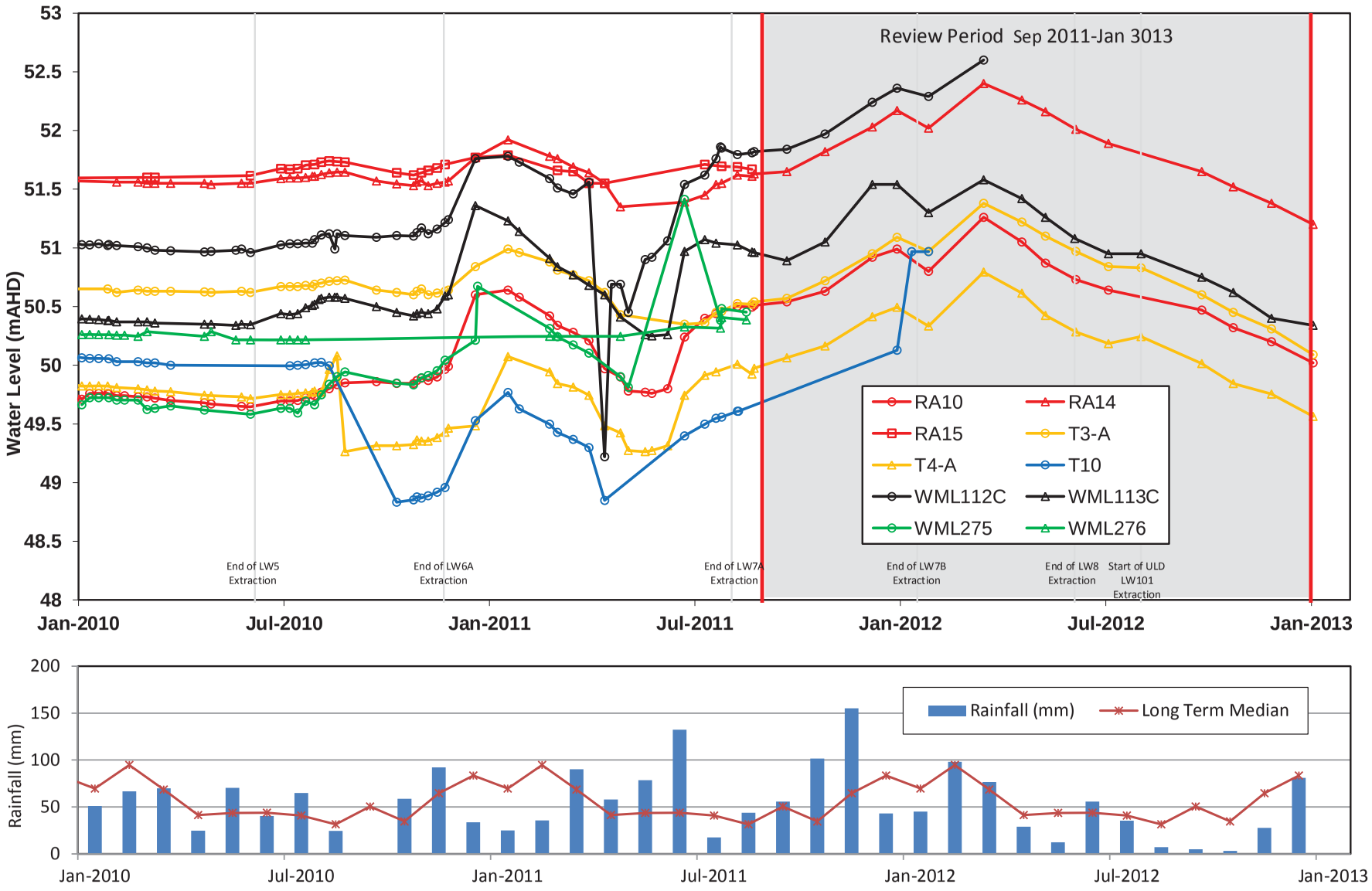
Ashton Coal
ULD LW101 Monitoring Network

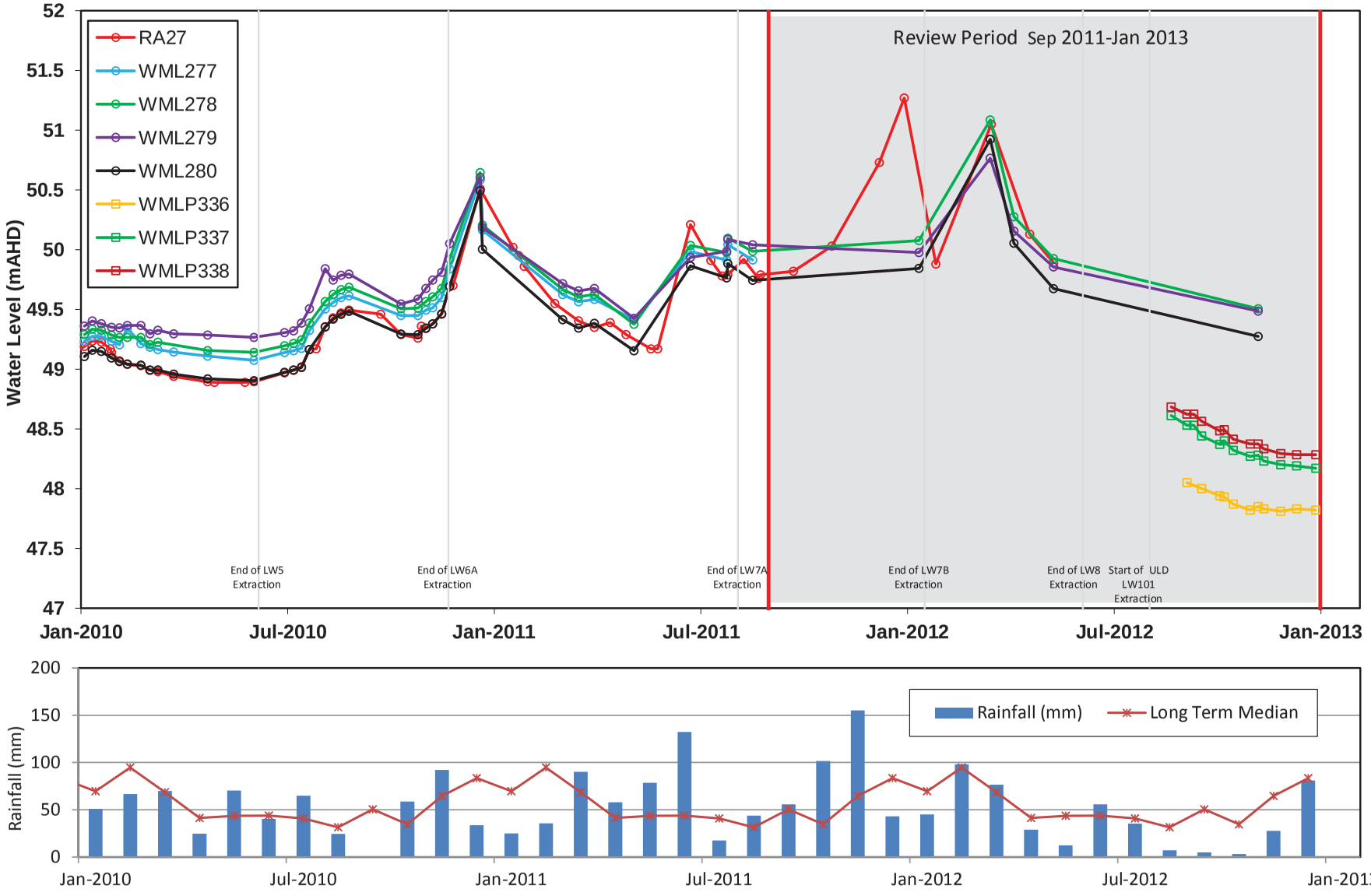
S56_059e Rev: e Produced: HZ Reviewed: SC Date: 24/01/2013

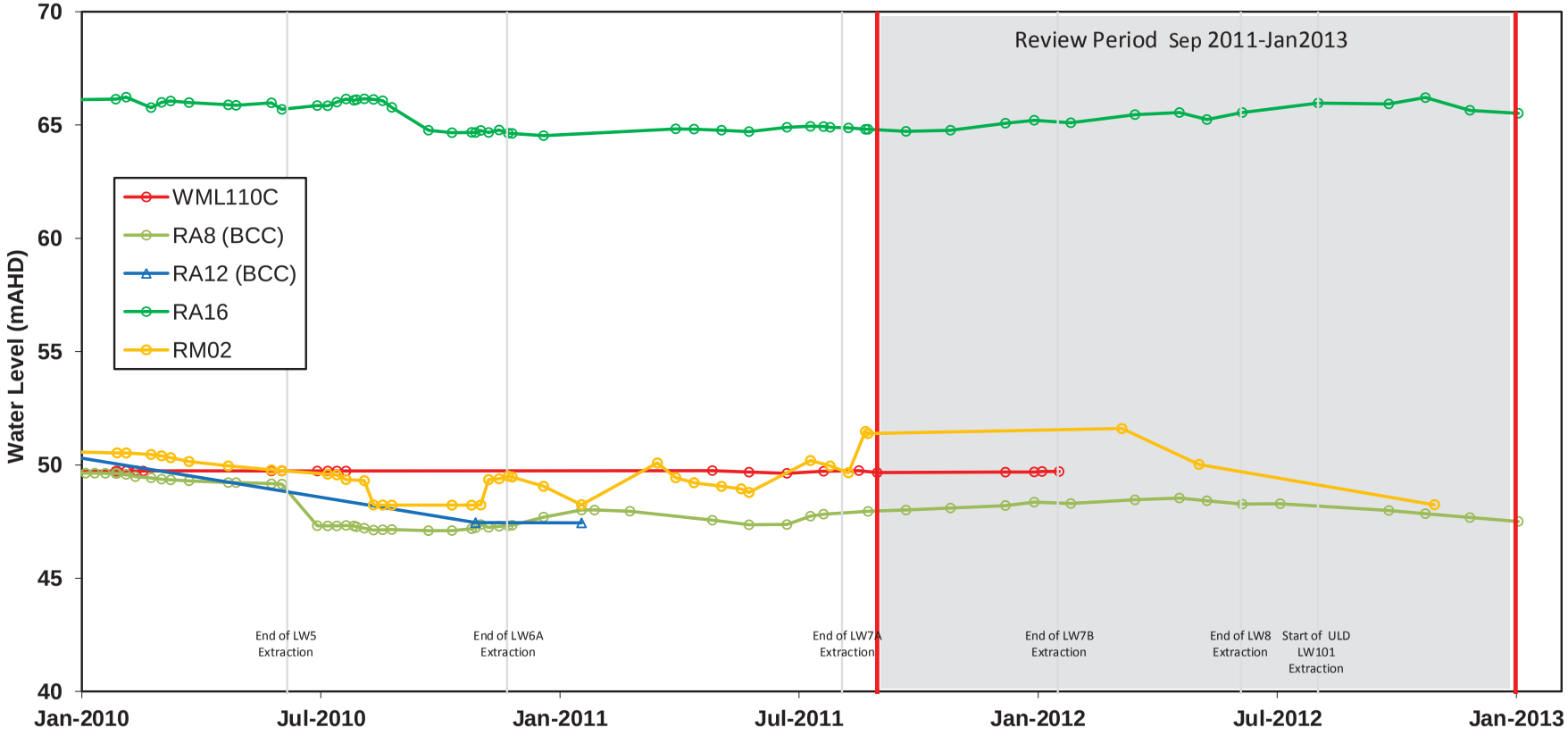

WML120B (North)
WML247 (North)
WML249 (North)
WML129 (Central)
WML239 (Central)
WML240 (Central)
WML252 (Central)
WML253 (Central)
WML241 (South)
WML243 (South)
Review Period Sep 2011-Jan 2013
Water Level (mAHD)
55
54
53
52
51
50
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0

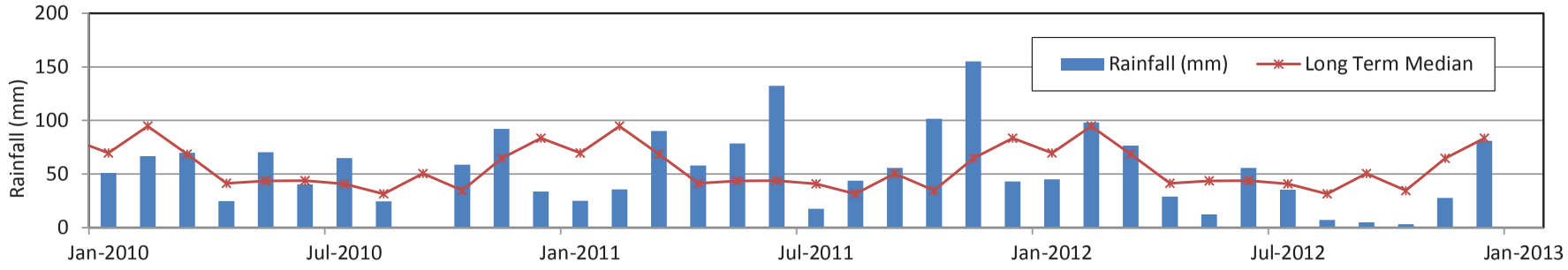

Ashton Well
RA30
RM9
T1-A
T5
T6
T7
WML115C
WMLP308
WMLP311
WMLP312
WMLP323
Review Period Sep 2011-Jan 2013
Water Level (mAHD)
64
63
62
61
60
59
58
57
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0

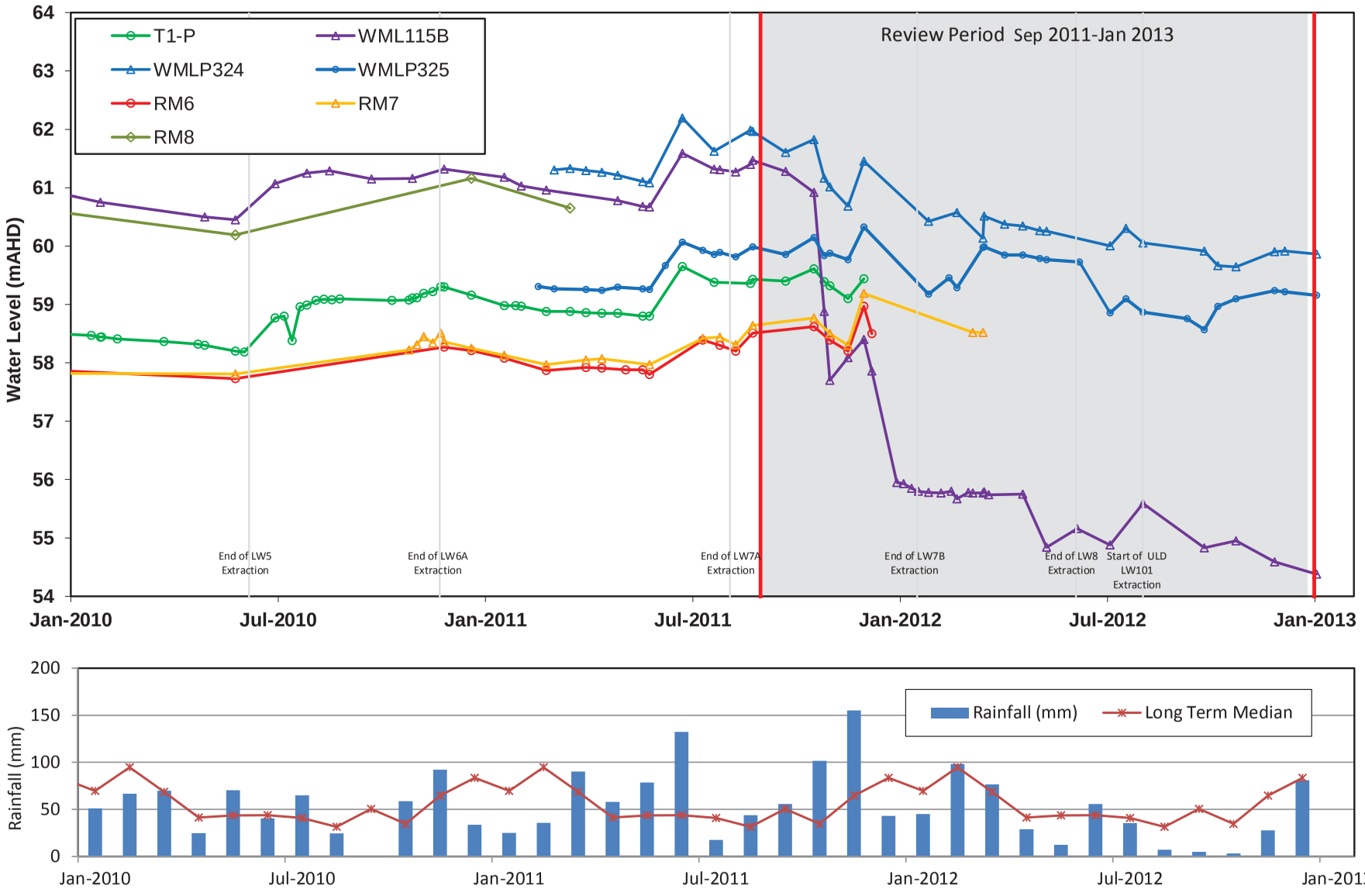

Review Period Sep 2011-Jan 2013
Water Level (mAHD)
57
56.5
56
55.5
55
54.5
54
53.5
53
52.5
52
RA18
RM4
T2-A
WMLP314
WMLP315
WMLP316
WMLP320
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
200
150
100
50
0
Rainfall (mm)
Long Term Median
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013


Review Period Sep 2011-Jan 3013
Water Level (mAHD)
53
52.5
52
51.5
51
50.5
50
49.5
49
48.5
48
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
RA10
RA14
RA15
T3-A
T4-A
T10
WML112C
WML113C
WML275
WML276
Rainfall (mm)
200
150
100
50
0
Rainfall (mm)
Long Term Median


RA27
WML277
WML278
WML279
WML280
WMLP336
WMLP337
WMLP338
Review Period Sep 2011-Jan 2013
Water Level (mAHD)
52
51.5
51
50.5
50
49.5
49
48.5
48
47.5
47
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0


Review Period Sep 2011-Jan2013
WML110C
RA8 (BCC)
RA12 (BCC)
RA16
RM02
Water Level (mAHD)
70
65
60
55
50
45
40
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013


Rainfall (mm)
Long Term Median
Rainfall (mm)
200
150
100
50
0
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013



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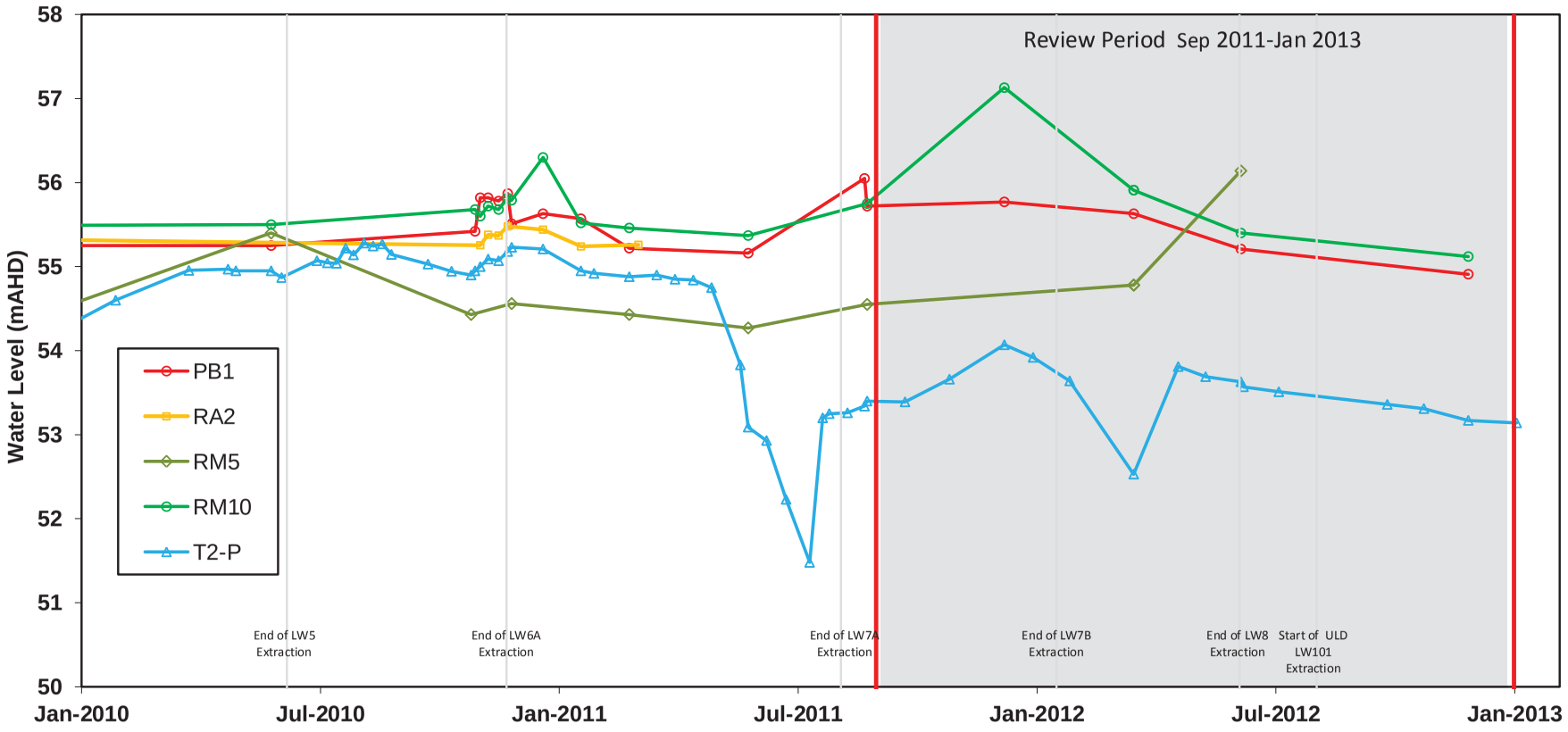
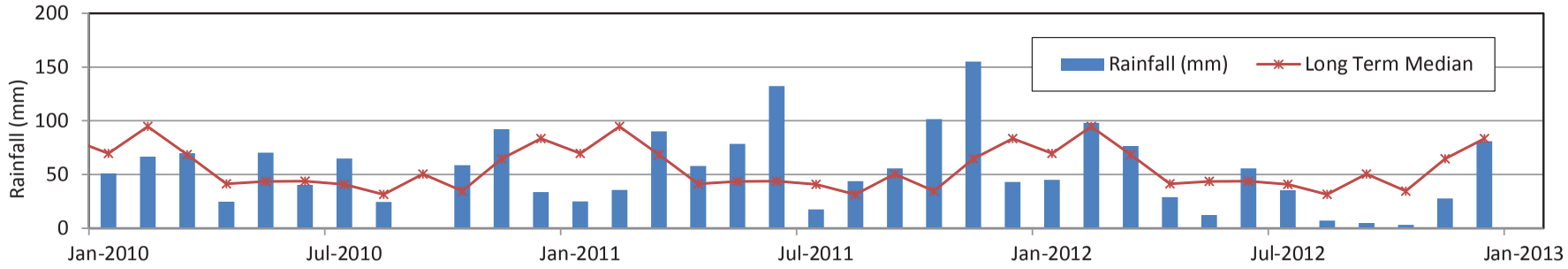
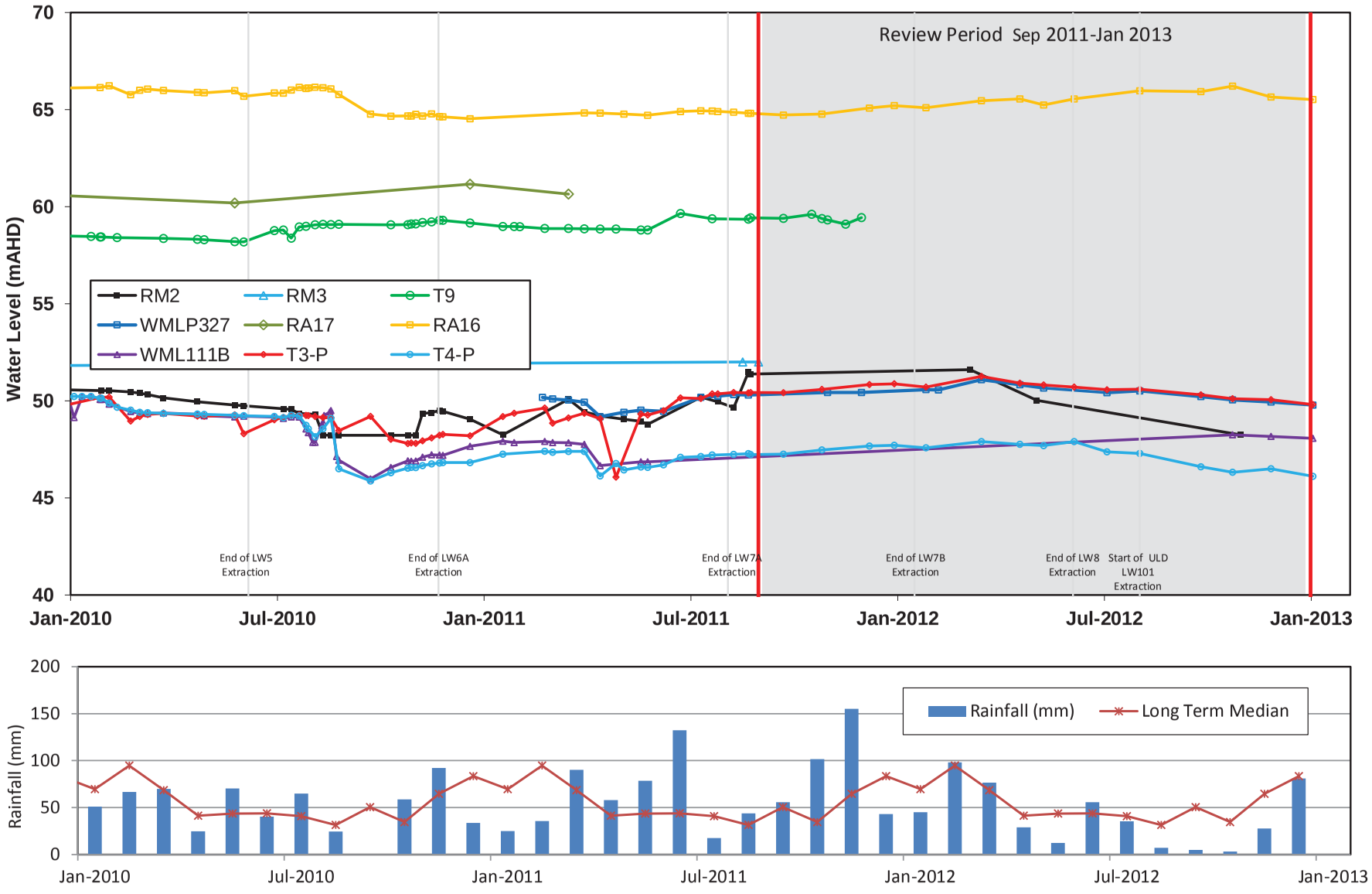
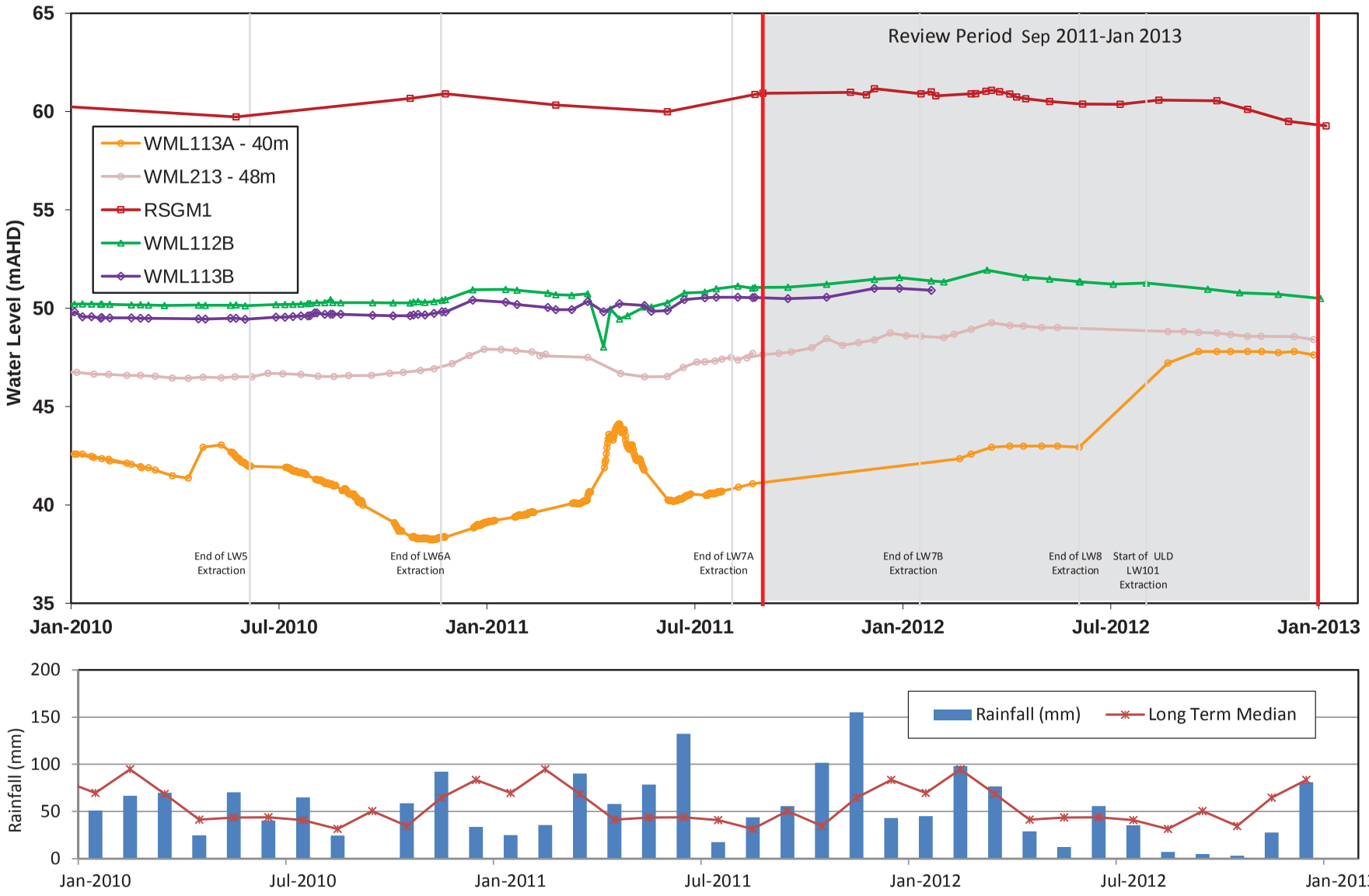
Ashton Coal Operations Pty Ltd

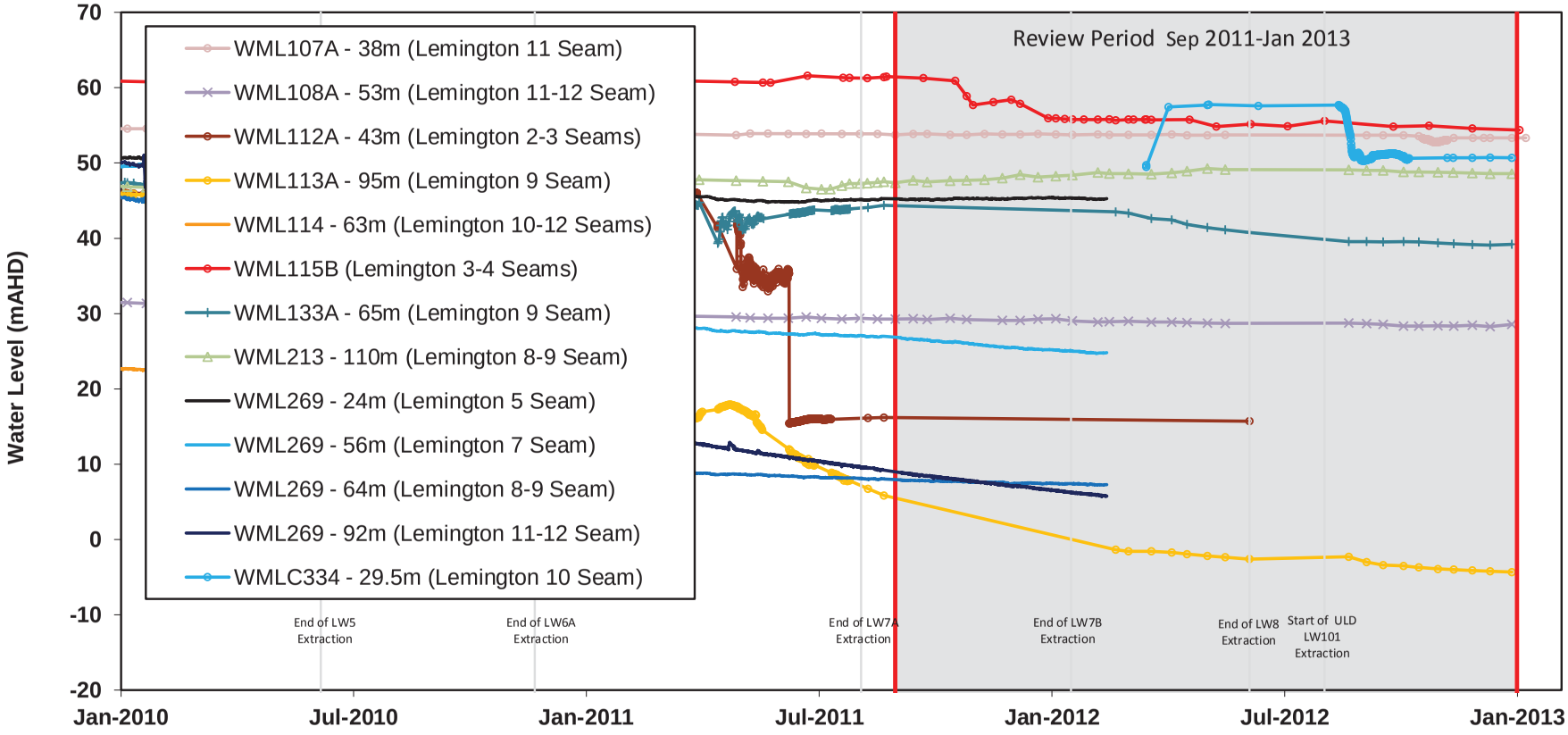
GROUNDWATER LEVEL HYDROGRAPHS - COAL MEASURES OVERBURDEN ALONG BOWMANS CREEK (NORTH) Figure 10

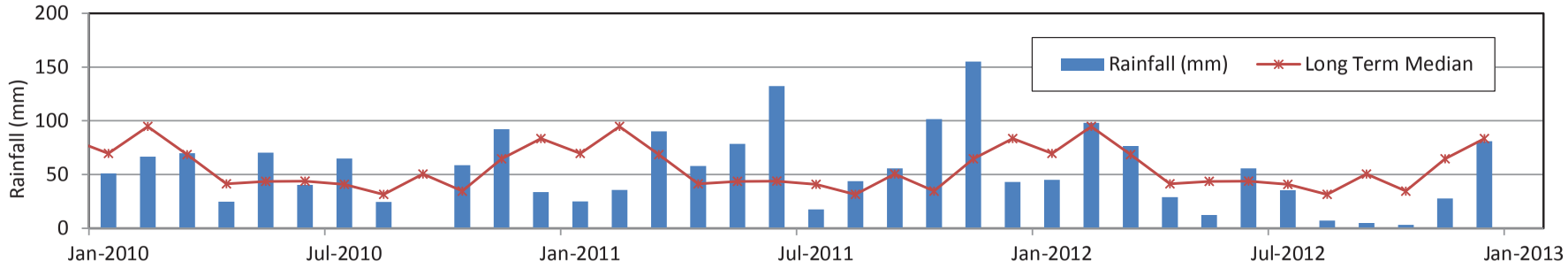

Review Period Sep 2011-Jan 2013
Water Level (mAHD)
58
57
56
55
54
53
52
51
50
PB1
RA2
RM5
RM10
T2-P
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013

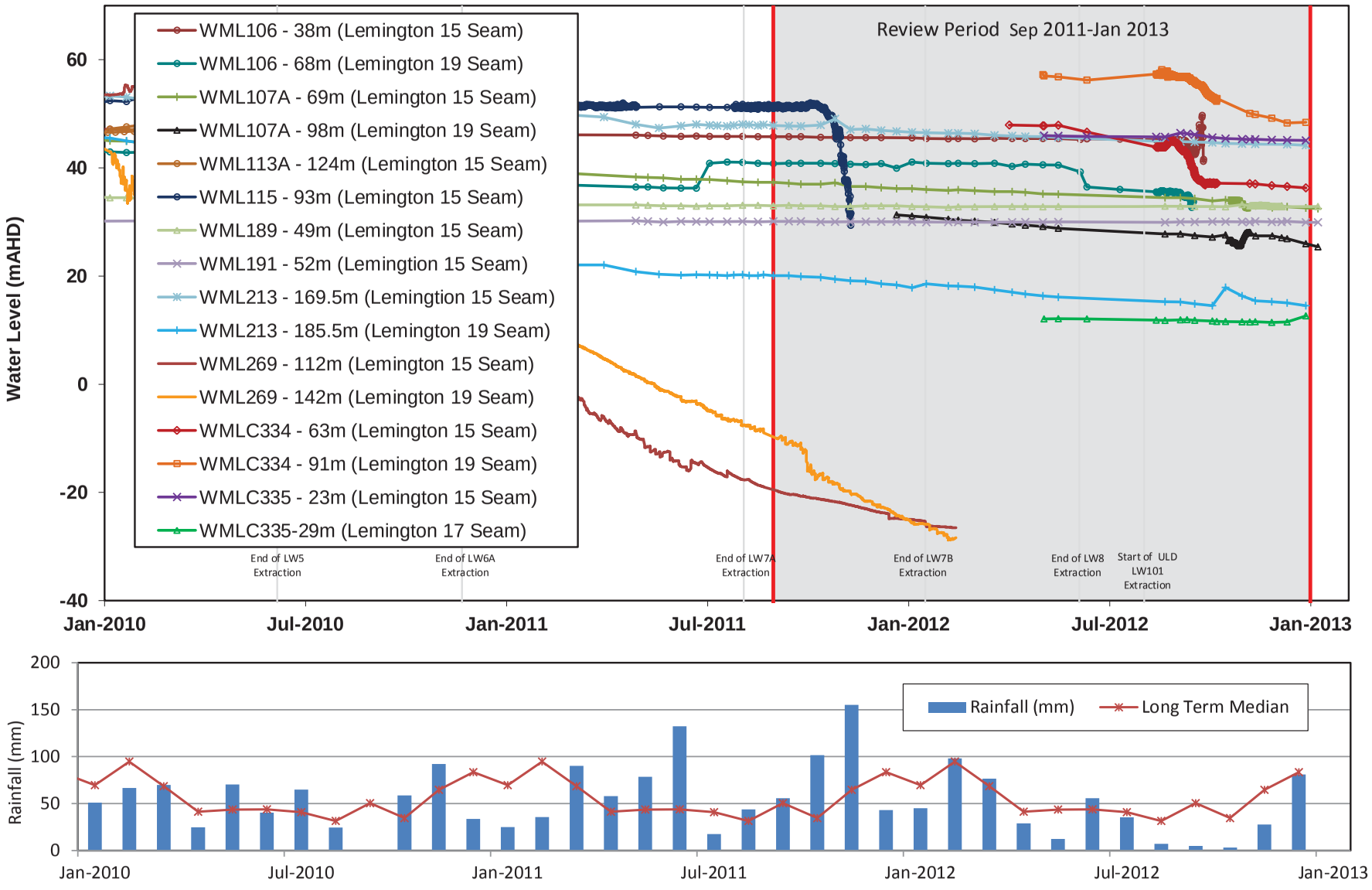

Rainfall (mm)
200
150
100
50
0
Rainfall (mm)
Long Term Median
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013

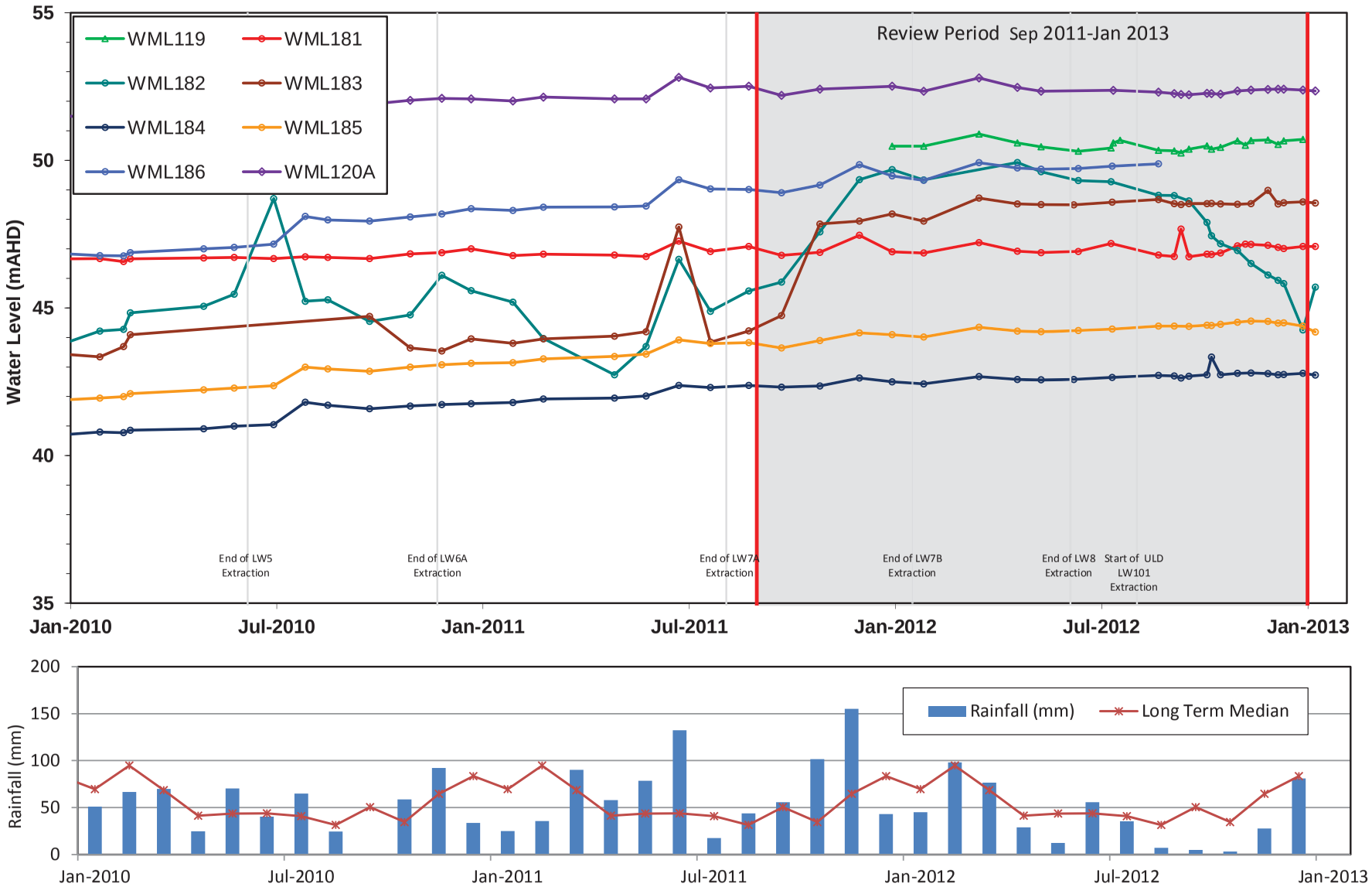

Review Period Sep 2011-Jan 2013
Water Level (mAHD)
70
65
60
55
50
45
40
RM2
RM3
T9
WMLP327
RA17
RA16
WML111B
T3-P
T4-P
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
200
150
100
50
0
Rainfall (mm)
Long Term Median

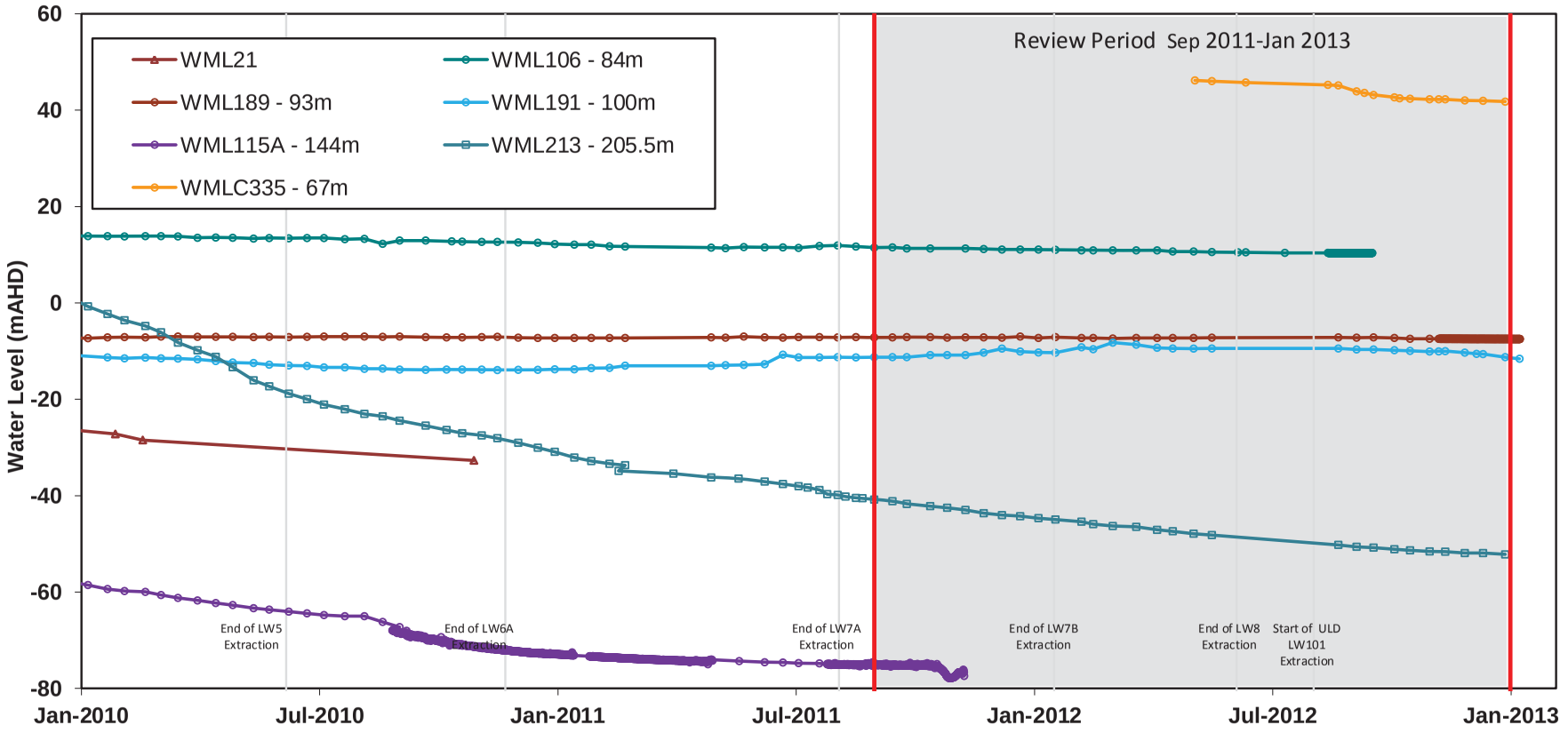

Review Period Sep 2011-Jan 2013
WML113A - 40m
WML213 - 48m
RSGM1
WML112B
WML113B
Water Level (mAHD)
65
60
55
50
45
40
35
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0

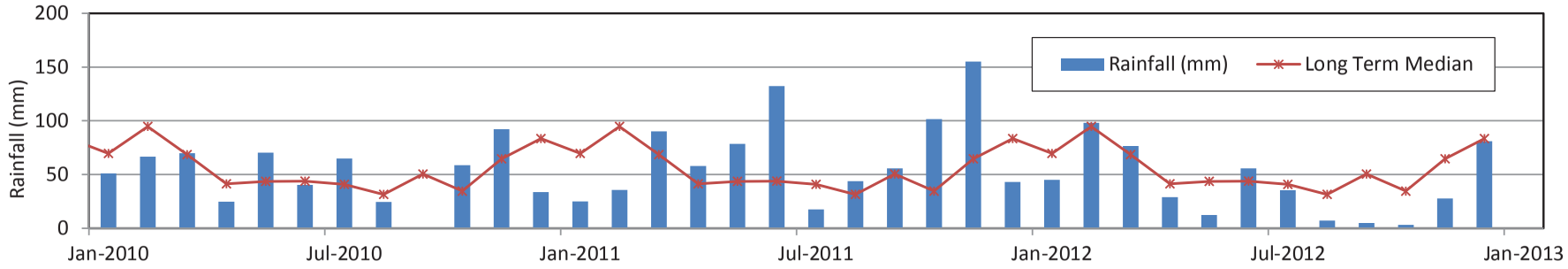

Water Level (mAHD)
70
60
50
40
30
20
10
0
-10
-20
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Review Period Sep 2011-Jan 2013
WML107A - 38m (Lemington 11 Seam)
WML108A - 53m (Lemington 11-12 Seam)
WML112A - 43m (Lemington 2-3 Seams)
WML113A - 95m (Lemington 9 Seam)
WML114 - 63m (Lemington 10-12 Seams)
WML115B (Lemington 3-4 Seams)
WML133A - 65m (Lemington 9 Seam)
WML213 - 110m (Lemington 8-9 Seam)
WML269 - 24m (Lemington 5 Seam)
WML269 - 56m (Lemington 7 Seam)
WML269 - 64m (Lemington 8-9 Seam)
WML269 - 92m (Lemington 11-12 Seam)
WMLC334 - 29.5m (Lemington 10 Seam)
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction

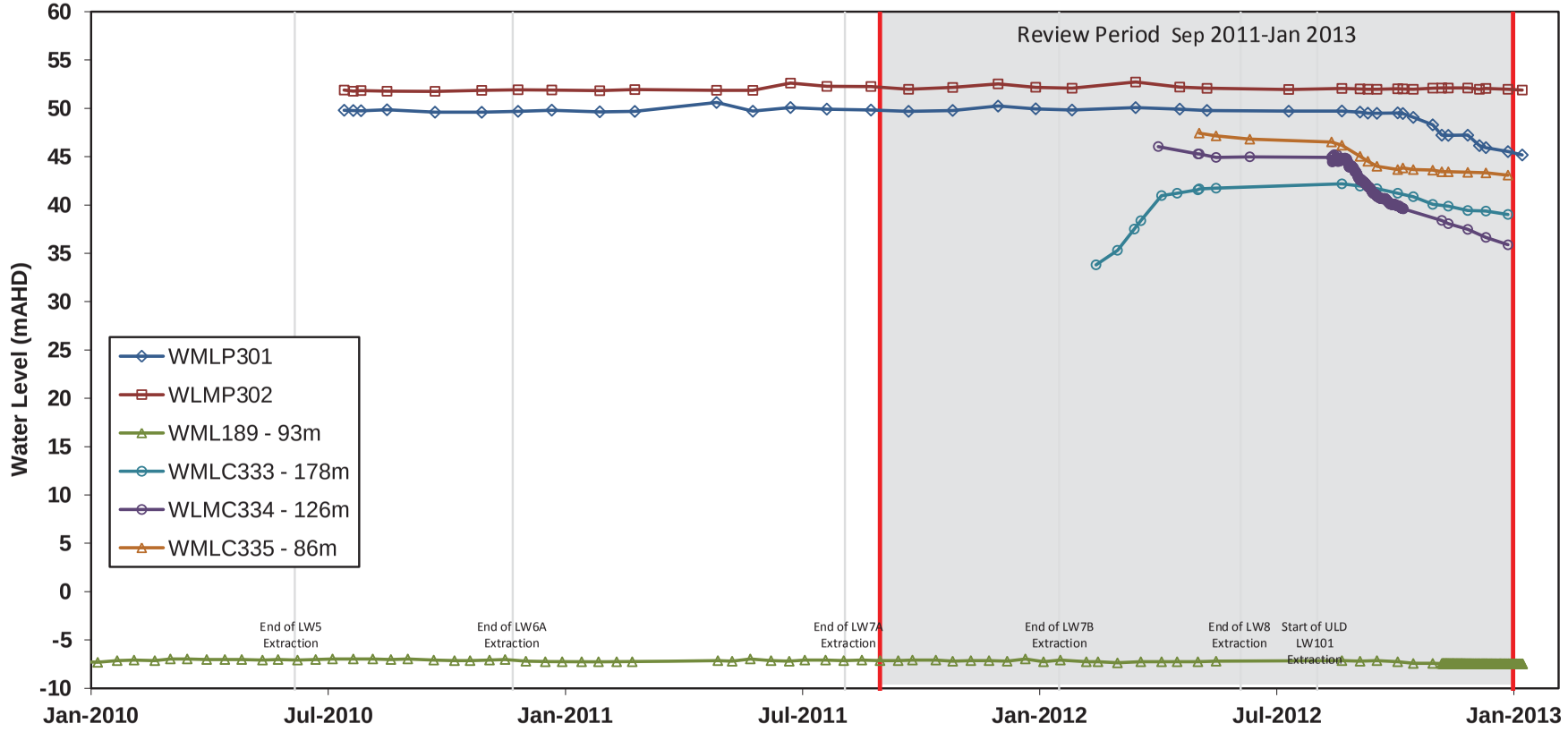

Rainfall (mm)
200
150
100
50
0
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median

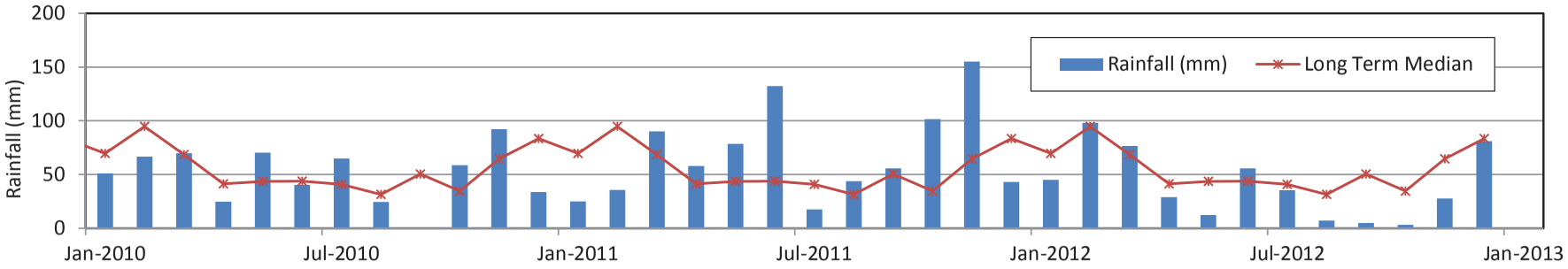

Review Period Sep 2011-Jan 2013
WML106 - 38m (Lemington 15 Seam)
WML106 - 68m (Lemington 19 Seam)
WML107A - 69m (Lemington 15 Seam)
WML107A - 98m (Lemington 19 Seam)
WML113A - 124m (Lemington 15 Seam)
WML115 - 93m (Lemington 15 Seam)
WML189 - 49m (Lemington 15 Seam)
WML191 - 52m (Lemingtion 15 Seam)
WML213 - 169.5m (Lemingtion 15 Seam)
WML213 - 185.5m (Lemington 19 Seam)
WML269 - 112m (Lemington 15 Seam)
WML269 - 142m (Lemington 19 Seam)
WMLC334 - 63m (Lemington 15 Seam)
WMLC334 - 91m (Lemington 19 Seam)
WMLC335 - 23m (Lemington 15 Seam)
WMLC335-29m (Lemington 17 Seam)
Water Level (mAHD)
60
40
20
0
-20
-40
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0

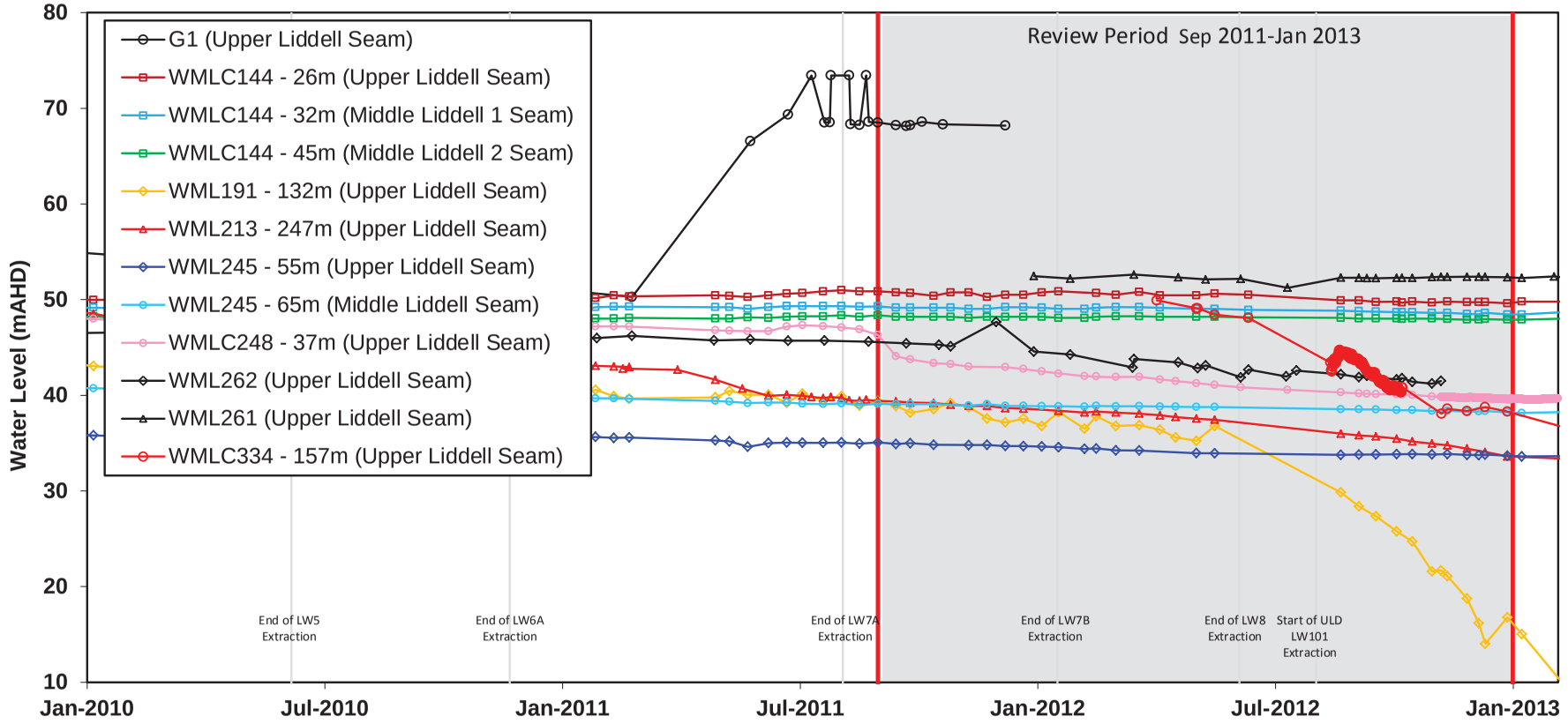

WML119
WML181
WML182
WML183
WML184
WML185
WML186
WML120A
Review Period Sep 2011-Jan 2013
Water Level (mAHD)
55
50
45
40
35
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0

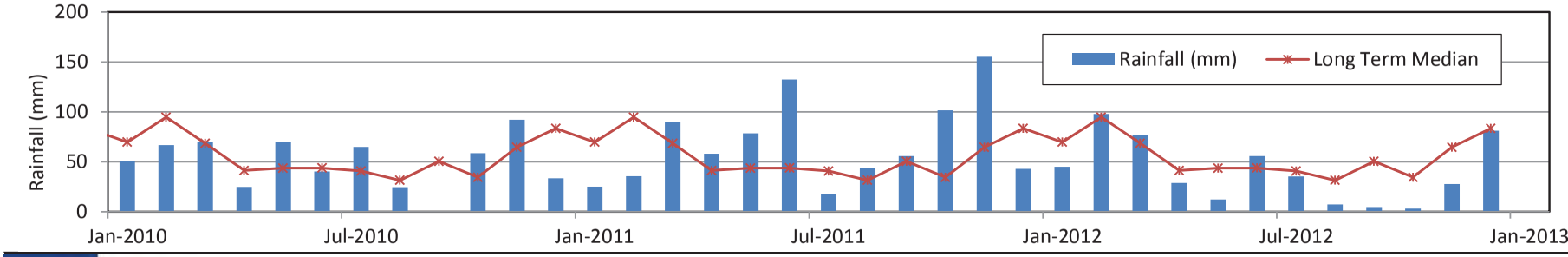

WML21
WML106 - 84m
WML189 - 93m
WML191 - 100m
WML115A - 144m
WML213 - 205.5m
WMLC335 - 67m
Review Period Sep 2011-Jan 2013
Water Level (mAHD)
60
40
20
0
-20
-40
-60
-80
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013

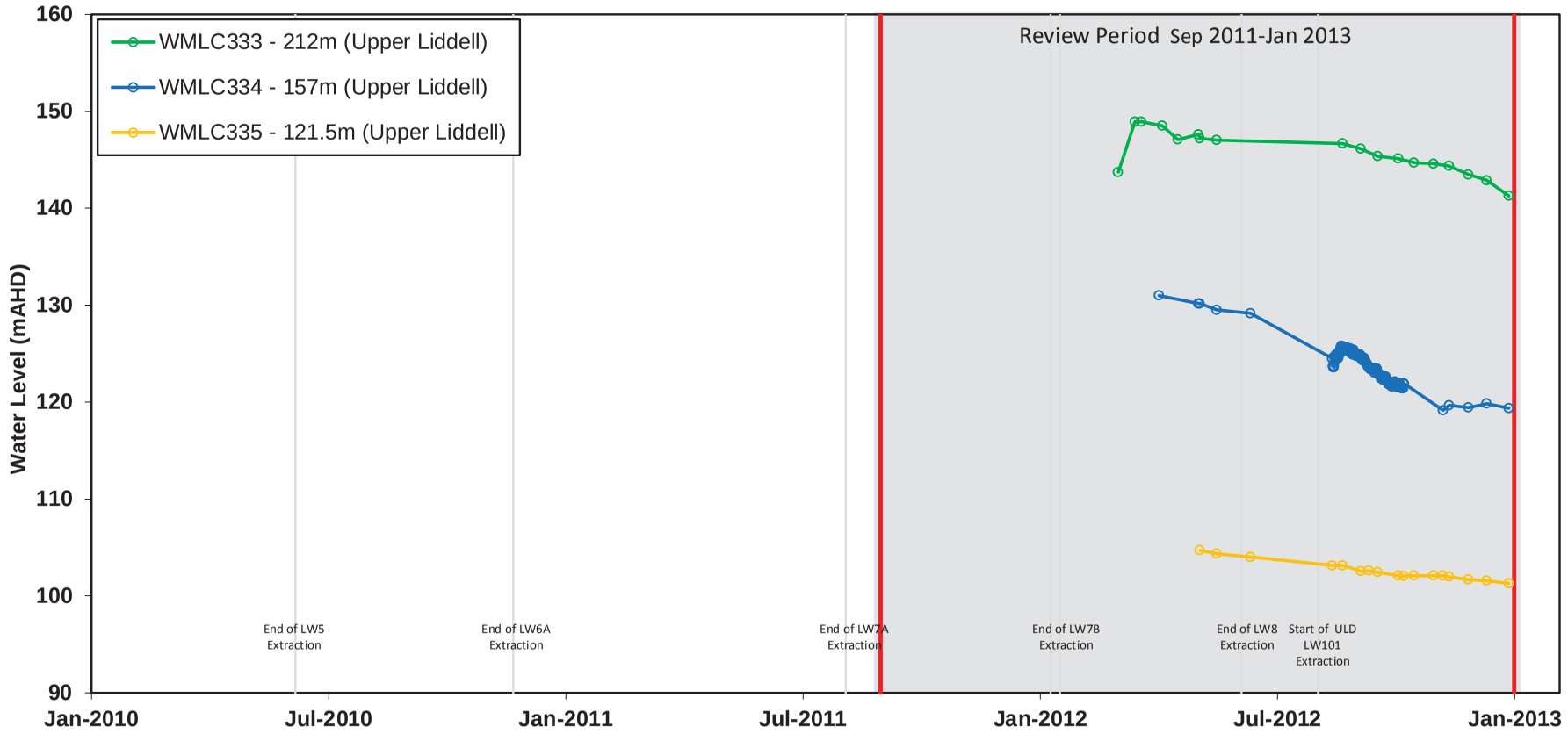

Rainfall (mm)
Long Term Median
Rainfall (mm)
200
150
100
50
0
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013

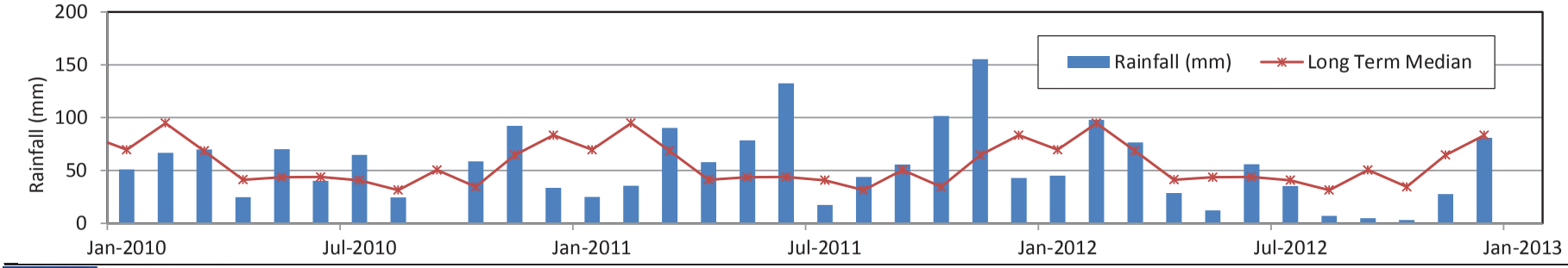

Review Period Sep 2011-Jan 2013
Water Level (mAHD)
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
WMLP301
WLMP302
WML189 - 93m
WMLC333 - 178m
WLMC334 - 126m
WMLC335 - 86m
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013


Rainfall (mm)
200
150
100
50
0
Rainfall (mm)
Long Term Median
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013


G1 (Upper Liddell Seam)
WMLC144 - 26m (Upper Liddell Seam)
WMLC144 - 32m (Middle Liddell 1 Seam)
WMLC144 - 45m (Middle Liddell 2 Seam)
WML191 - 132m (Upper Liddell Seam)
WML213 - 247m (Upper Liddell Seam)
WML245 - 55m (Upper Liddell Seam)
WML245 - 65m (Middle Liddell Seam)
WMLC248 - 37m (Upper Liddell Seam)
WML262 (Upper Liddell Seam)
WML261 (Upper Liddell Seam)
WMLC334 - 157m (Upper Liddell Seam)
Review Period Sep 2011-Jan 2013
Water Level (mAHD)
80
70
60
50
40
30
20
10
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013


Rainfall (mm)
Long Term Median
Rainfall (mm)
200
150
100
50
0
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013

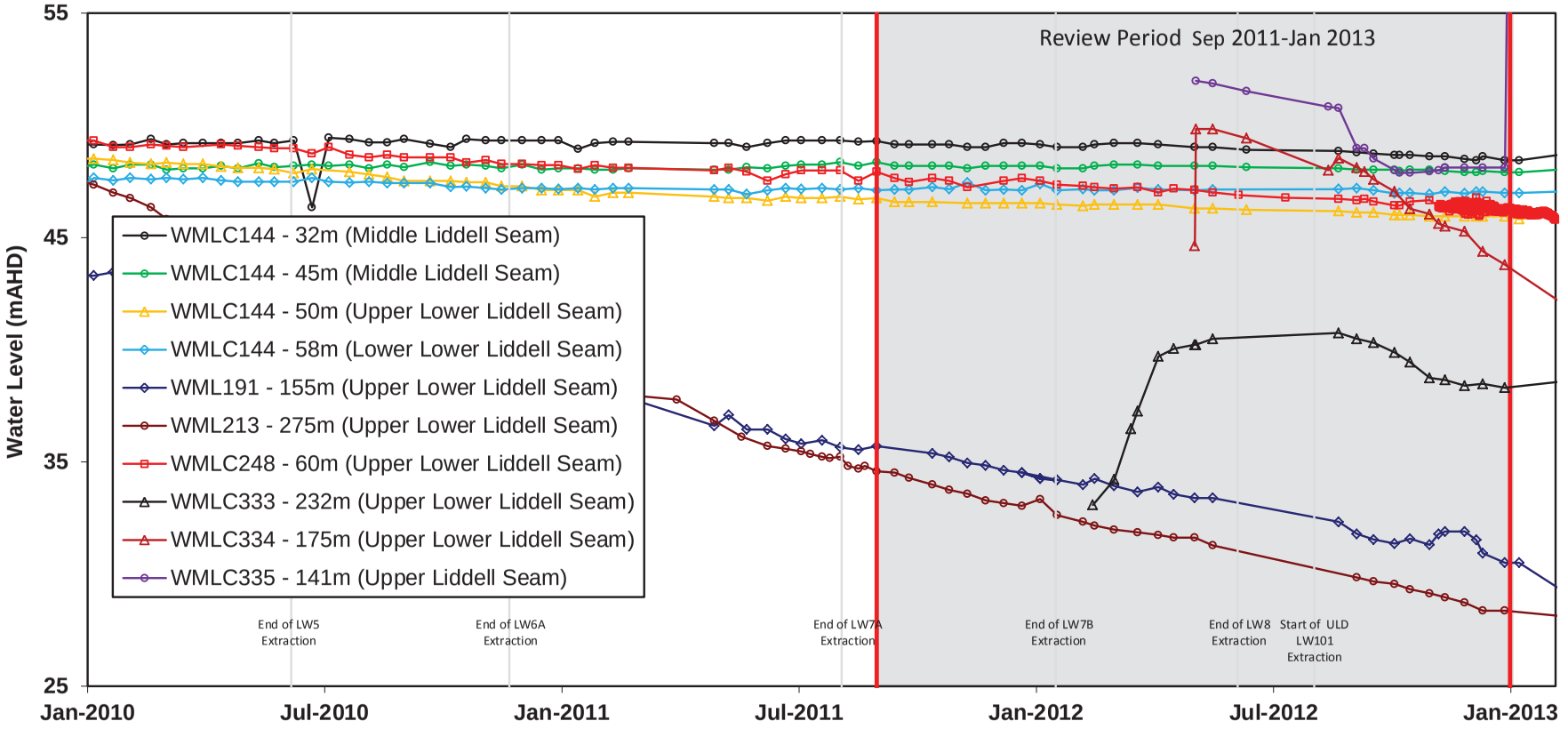


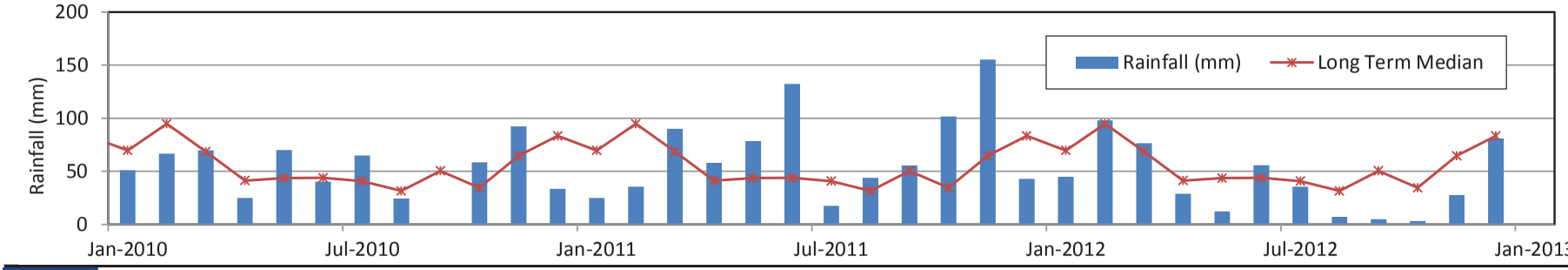


RPS Aquaterra

Ashton Coal Operations Pty Ltd

GROUNDWATER LEVEL HYDROGRAPHS - UPPER-MIDDLE LIDDELL SEAM Figure 20

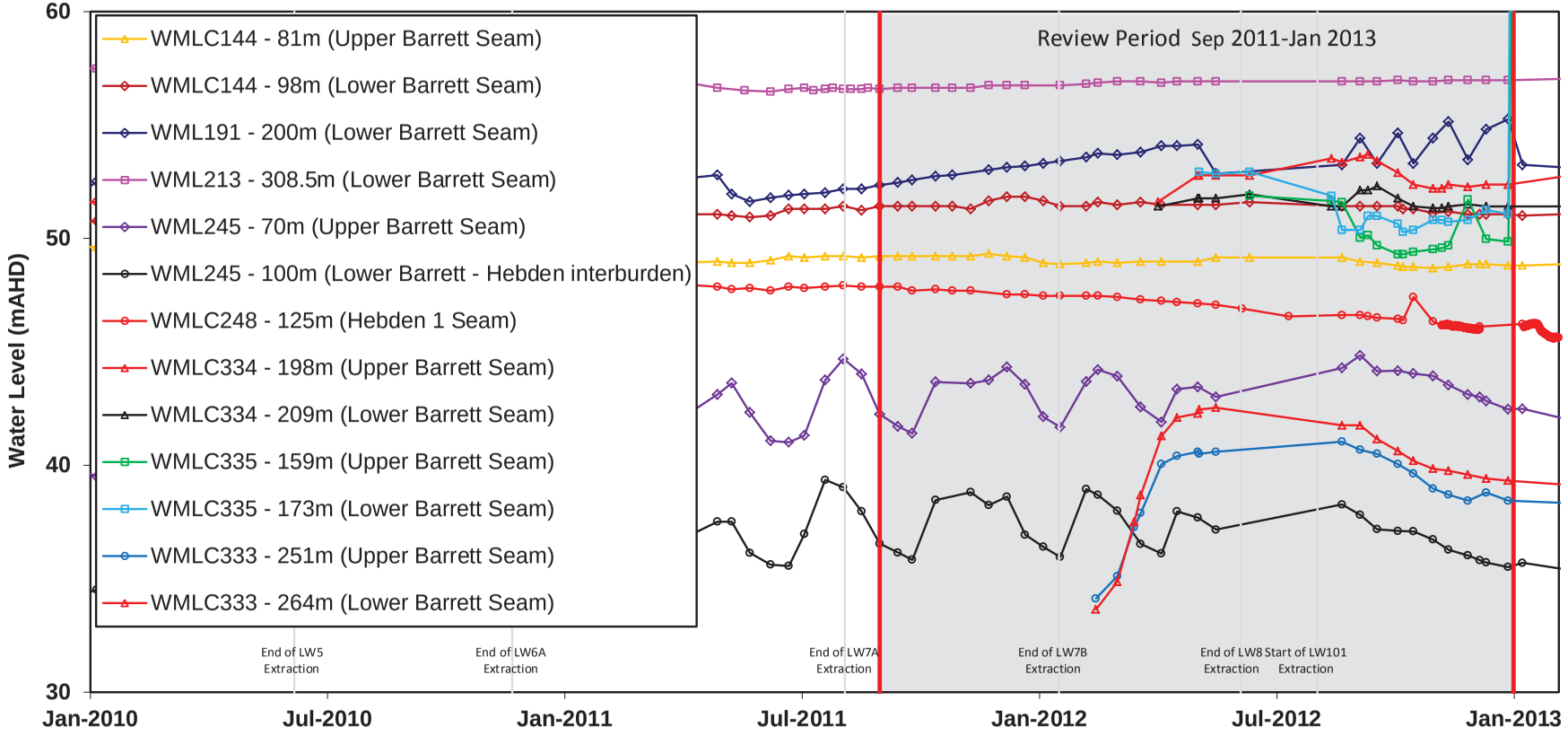


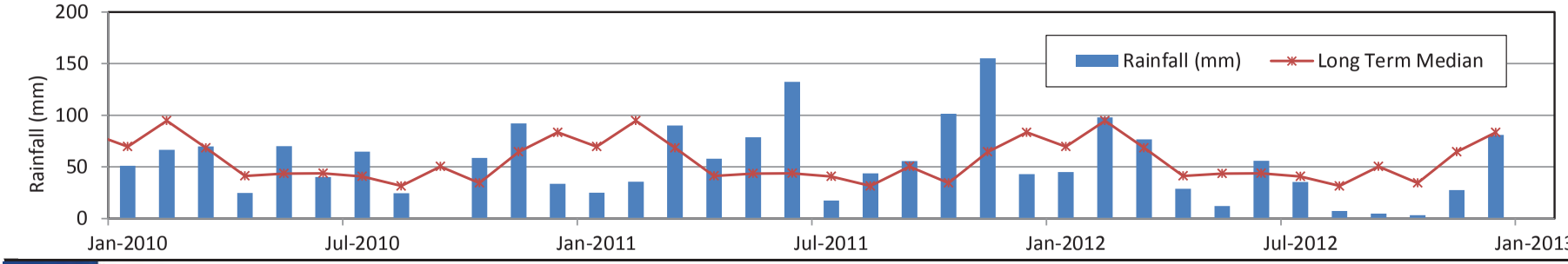


RPS Aquaterra

Ashton Coal Operations Pty Ltd

GROUNDWATER LEVEL HYDROGRAPHS - MIDDLE AND LOWER LIDDELL SEAM Figure 21

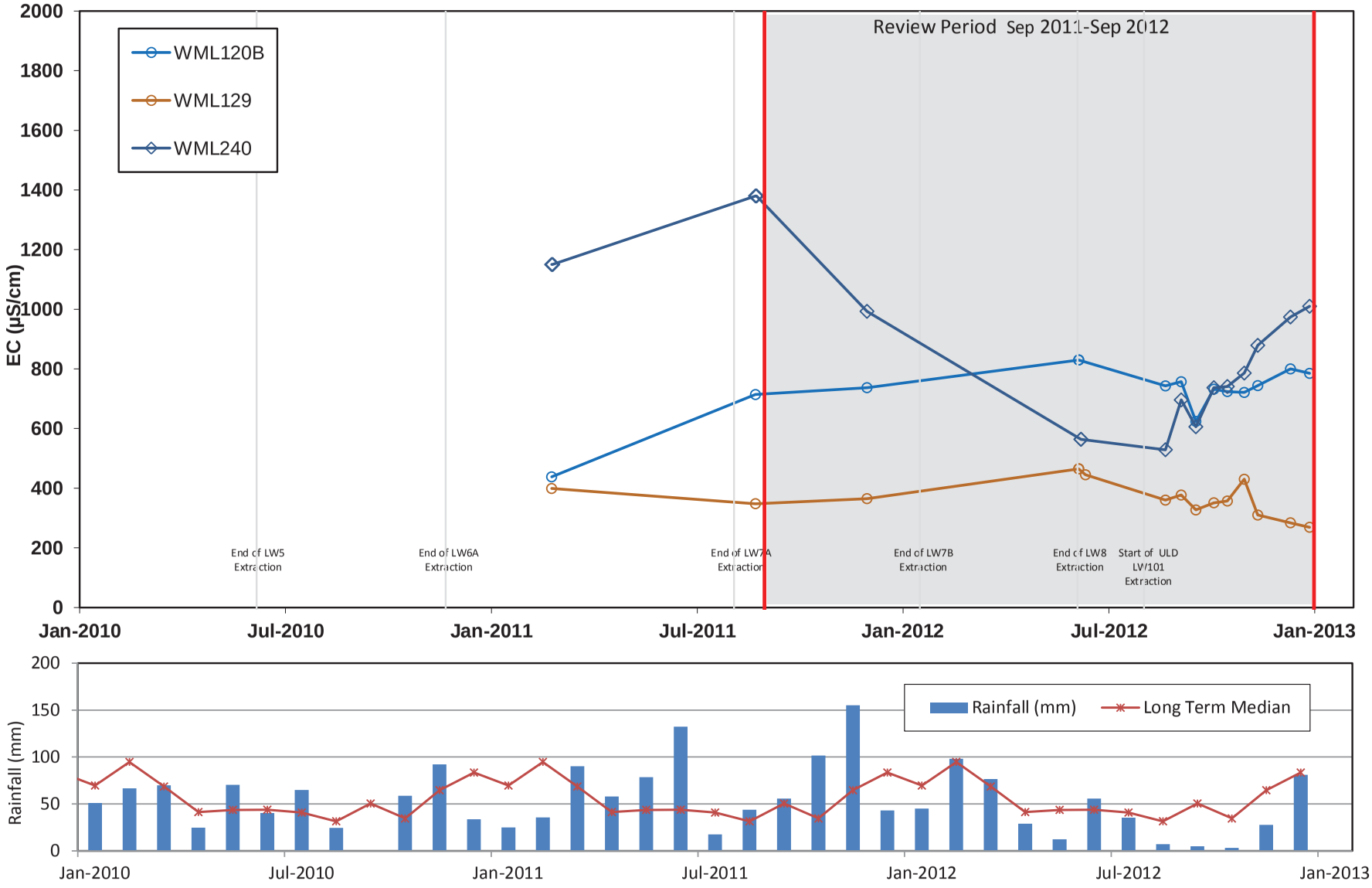


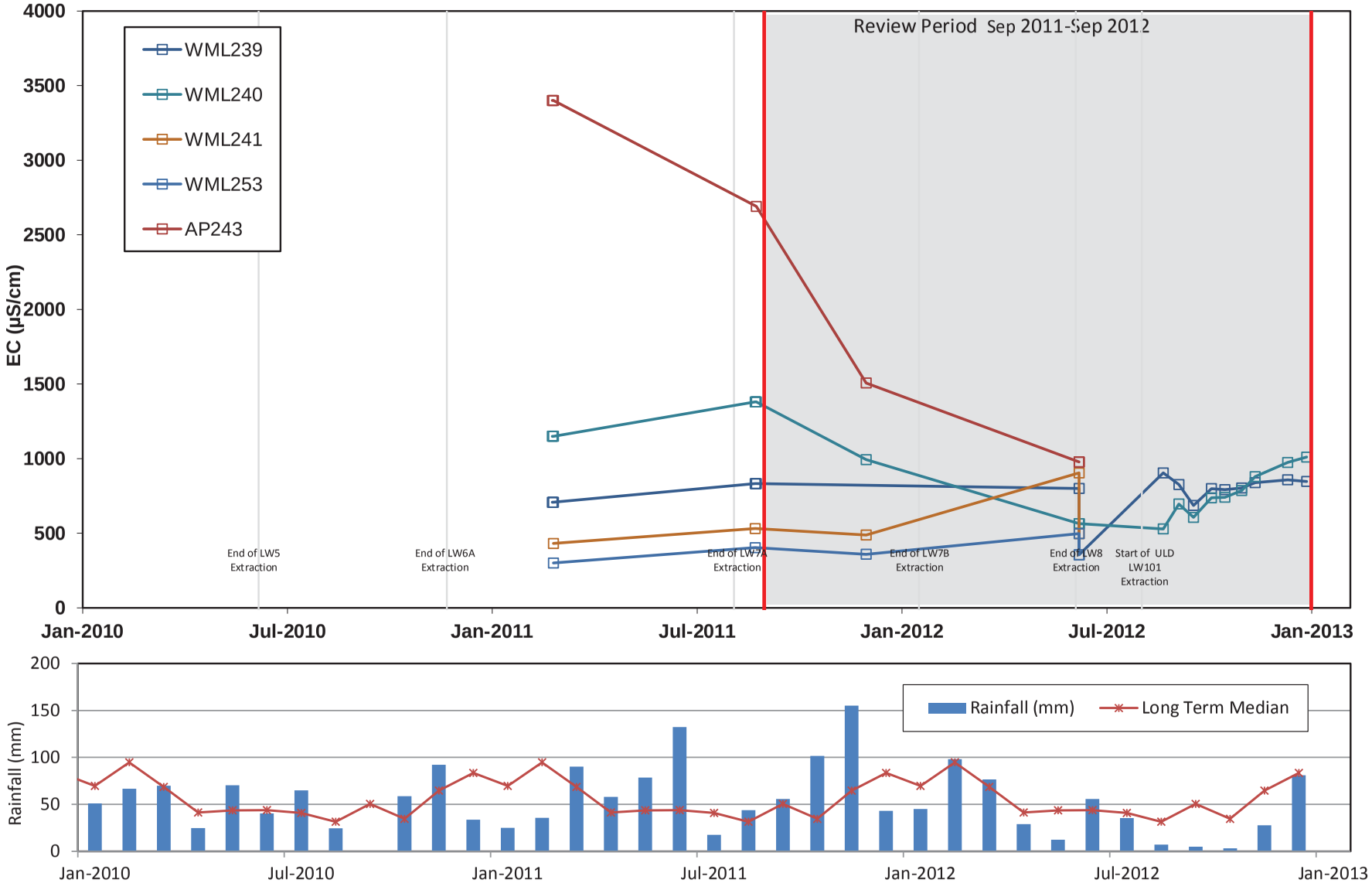


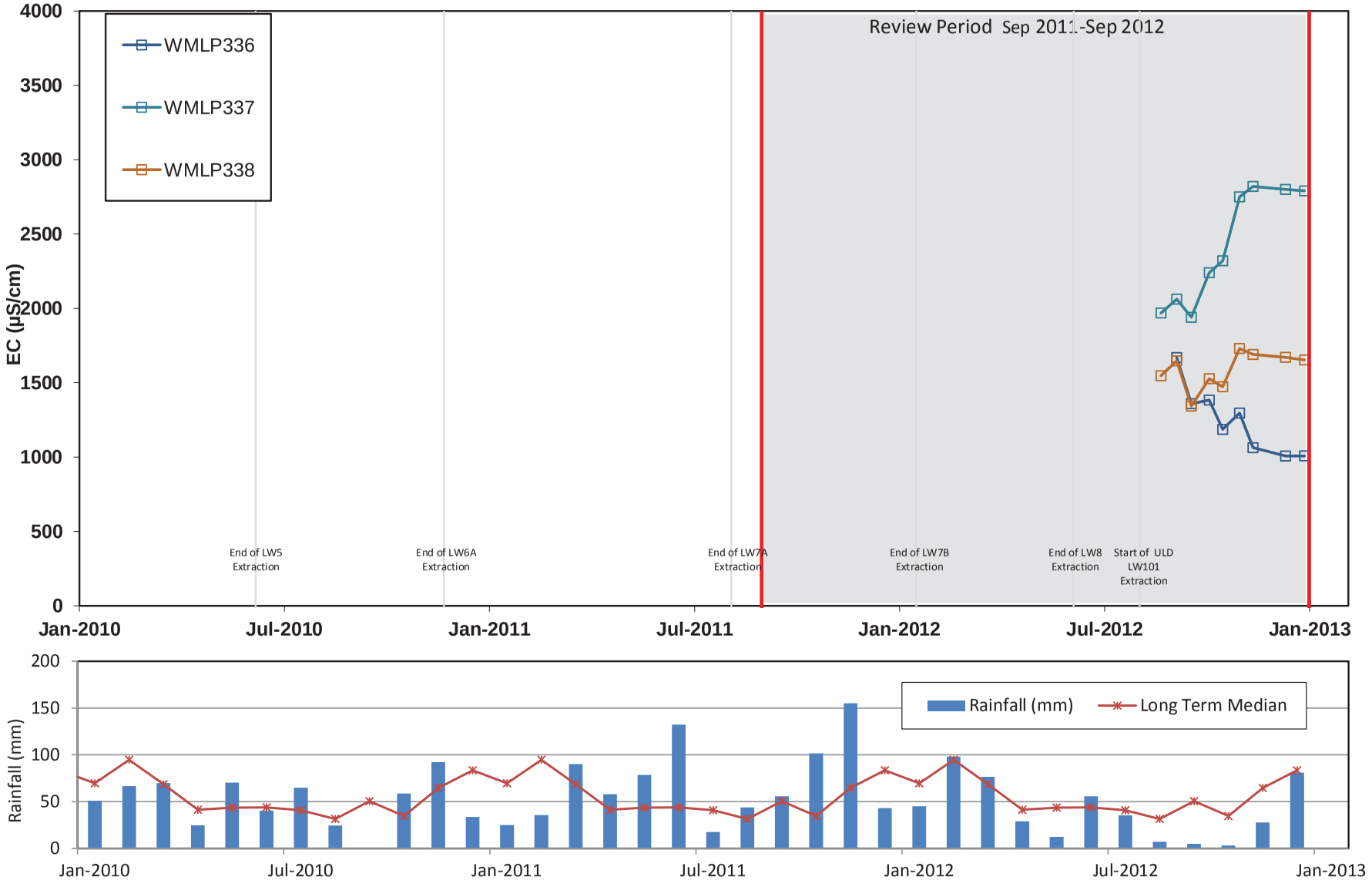
RPS Aquaterra

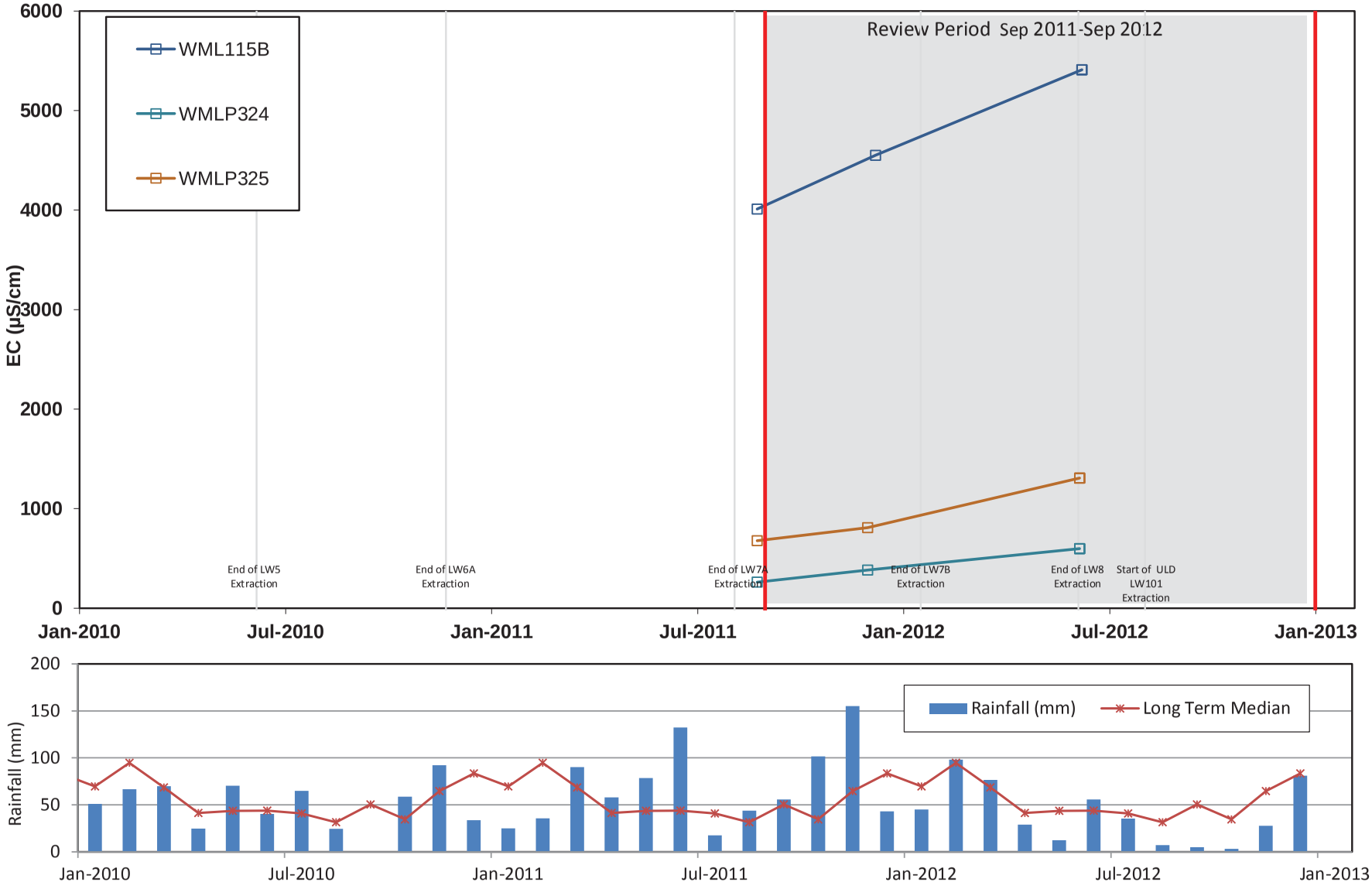
Ashton Coal Operations Pty Ltd

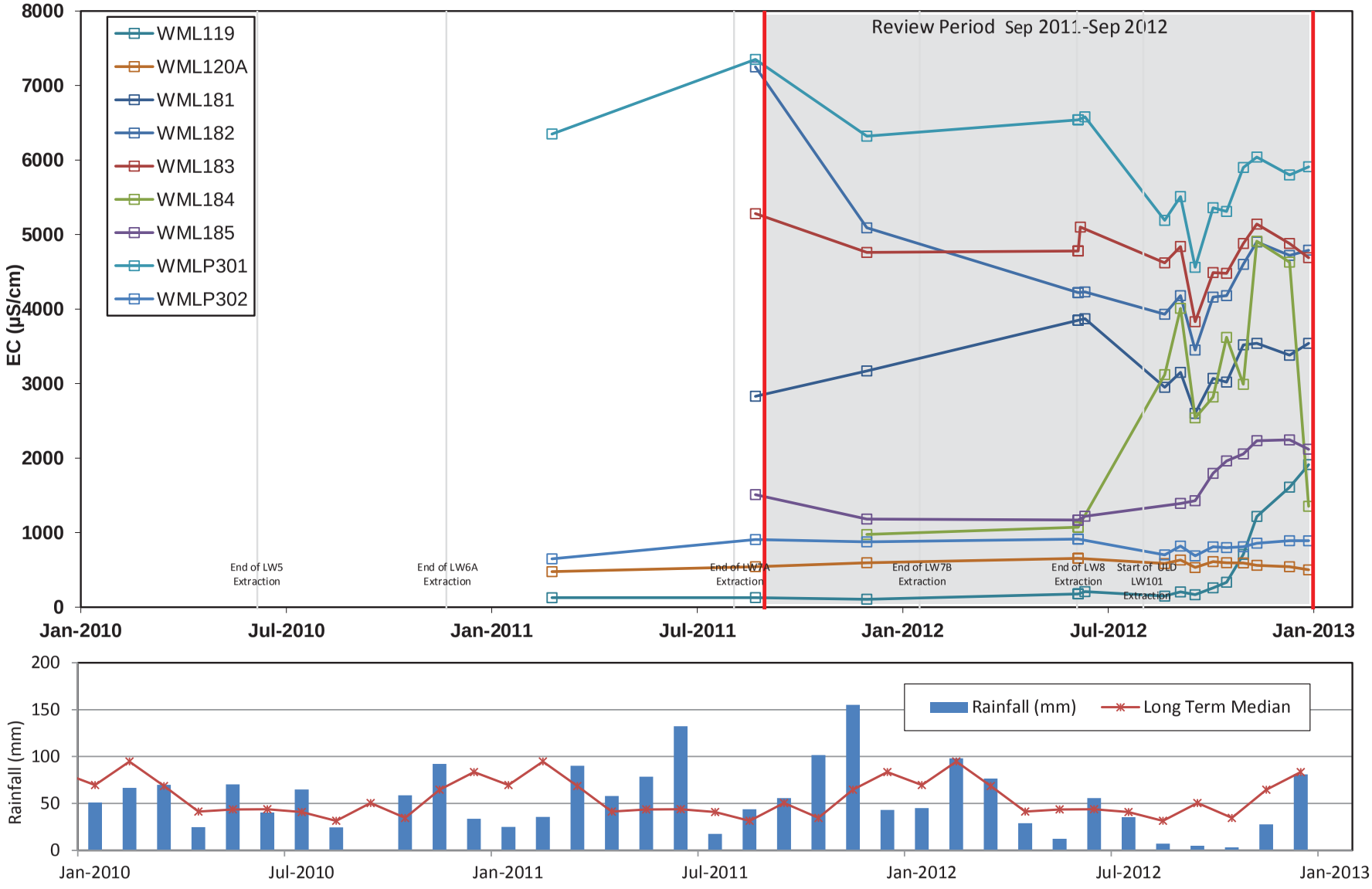
GROUNDWATER LEVEL HYDROGRAPHS - UPPER AND LOWER BARRETT AND HEBDEN SEAM Figure 22

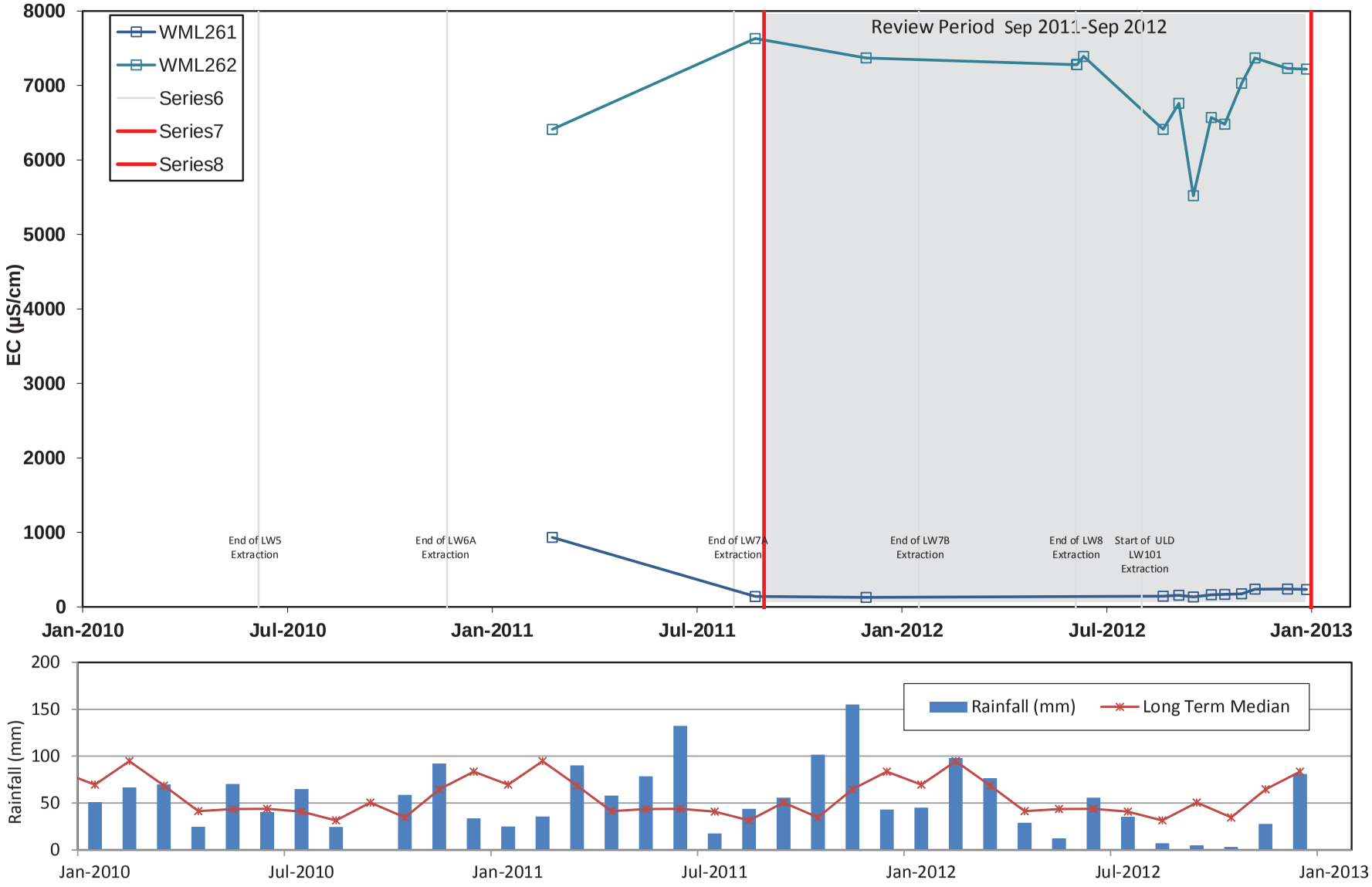

WML120B
WML129
WML240
Review Period Sep 2011-Sep 2012
EC (µS/cm)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
Rainfall (mm)
200
150
100
50
0
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013

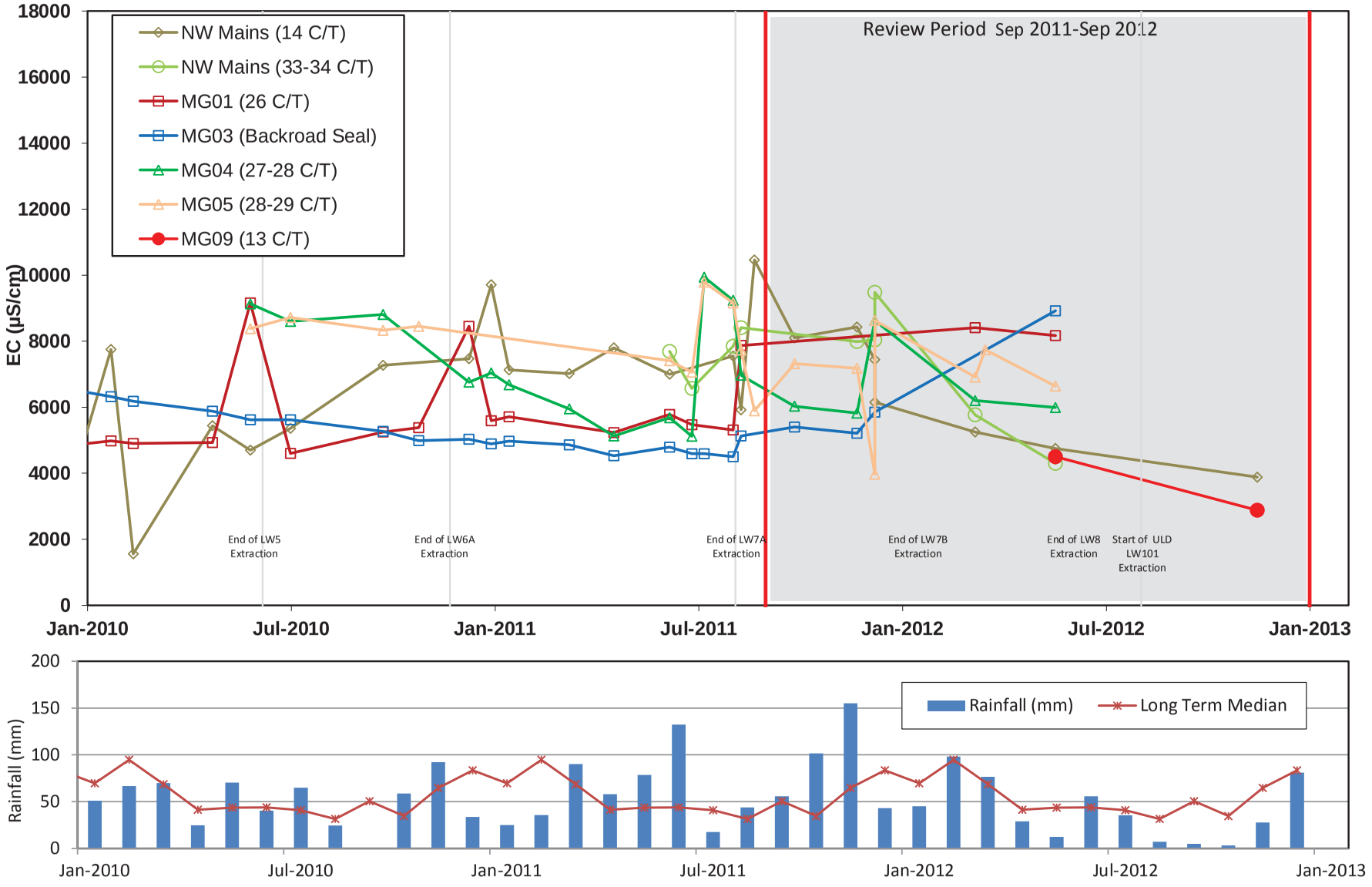

WML239
WML240
WML241
WML253
AP243
Review Period Sep 2011-Sep 2012
EC (µS/cm)
4000
3500
3000
2500
2000
1500
1000
500
0
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
Rainfall (mm)
200
150
100
50
0
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013

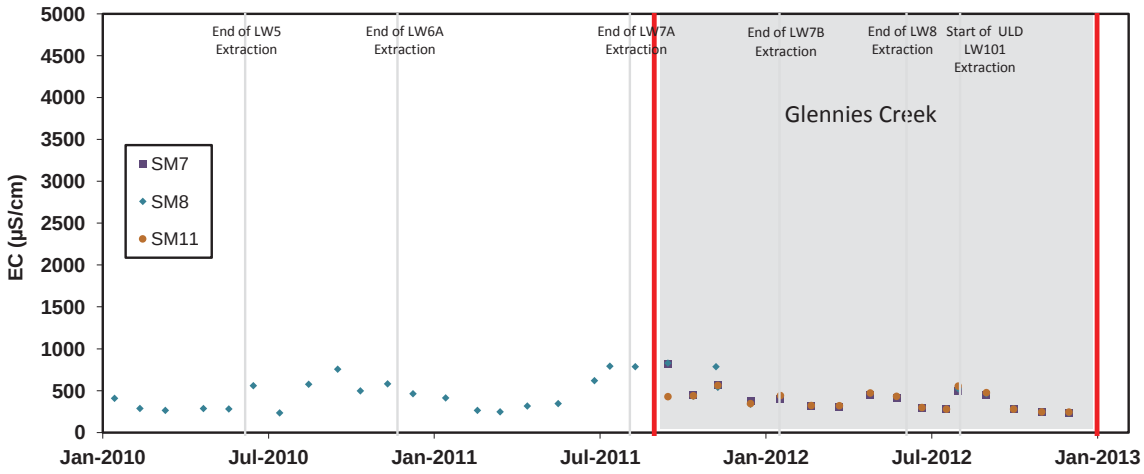

WMLP336
WMLP337
WMLP338
Review Period Sep 2011-Sep 2012
EC (µS/cm)
4000
3500
3000
2500
2000
1500
1000
500
0
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0

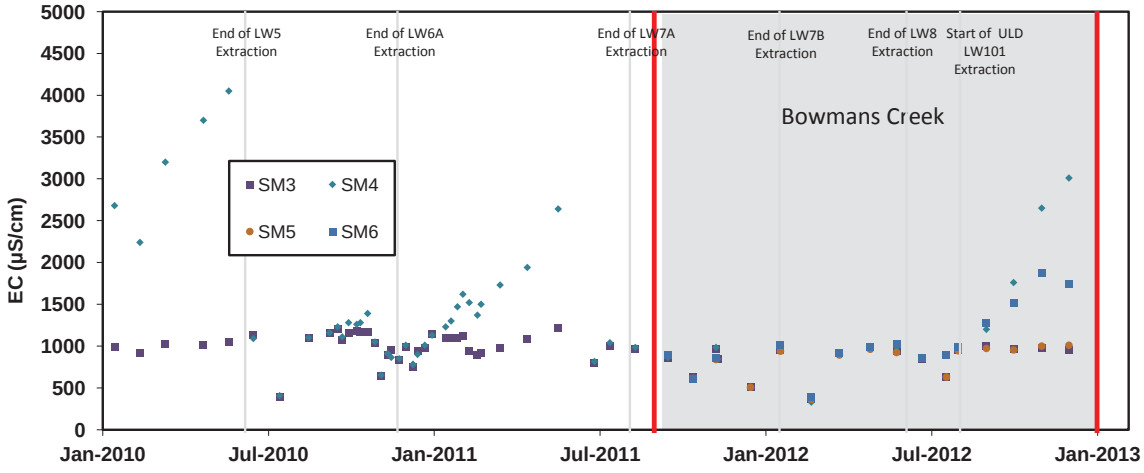

WML115B
WMLP324
WMLP325
Review Period Sep 2011-Sep 2012
EC (µS/cm)
6000
5000
4000
3000
2000
1000
0
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0

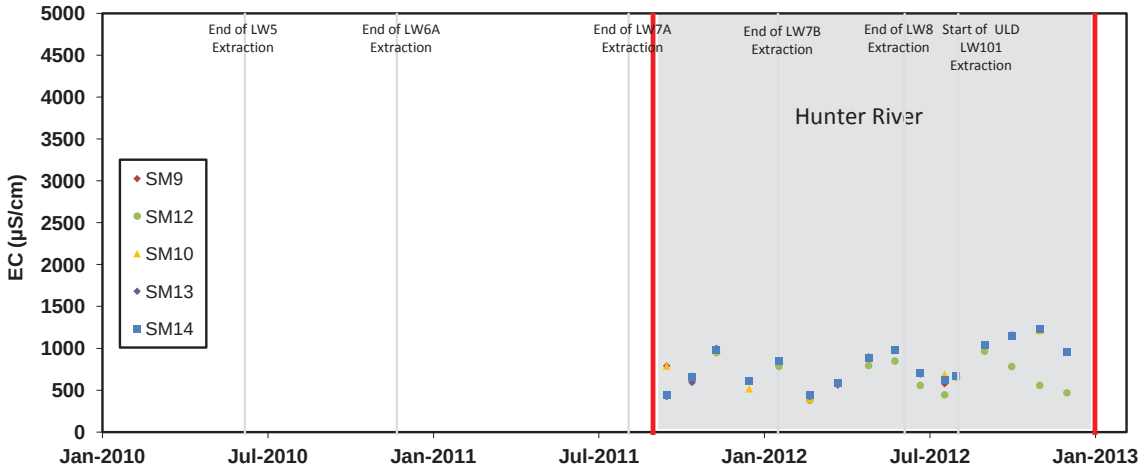

WML119
WML120A
WML181
WML182
WML183
WML184
WML185
WMLP301
WMLP302
Review Period Sep 2011-Sep 2012
EC (µS/cm)
8000
7000
6000
5000
4000
3000
2000
1000
0
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0

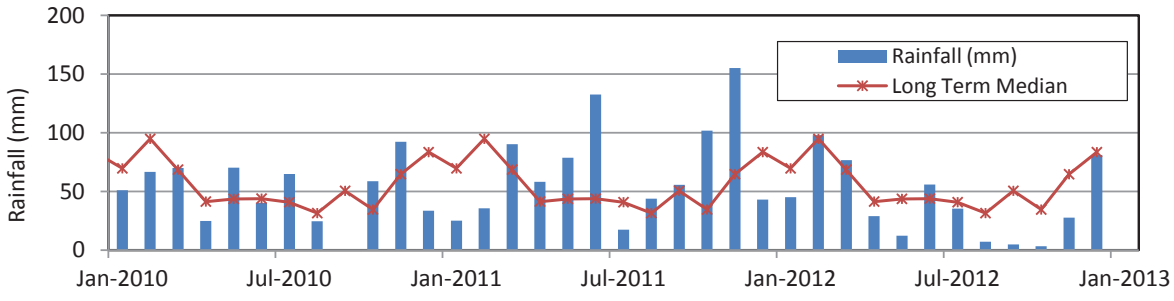

WML261
WML262
Series6
Series7
Series8
Review Period Sep 2011-Sep 2012
EC (µS/cm)
8000
7000
6000
5000
4000
3000
2000
1000
0
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0

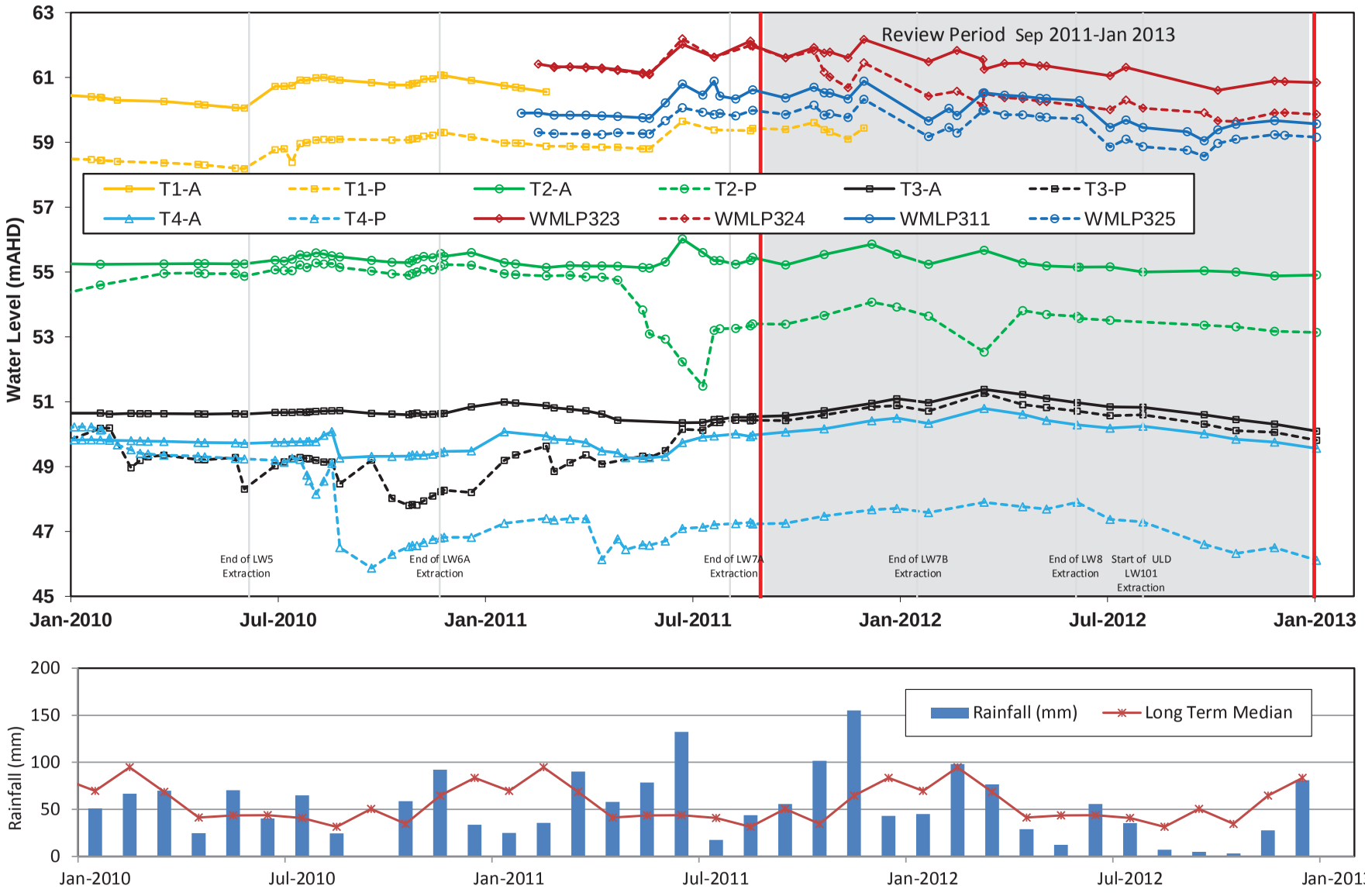

NW Mains (14 C/T)
NW Mains (33-34 C/T)
MG01 (26 C/T)
MG03 (Backroad Seal)
MG04 (27-28 C/T)
MG05 (28-29 C/T)
MG09 (13 C/T)
Review Period Sep 2011-Sep 2012
EC (µS/cm)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0

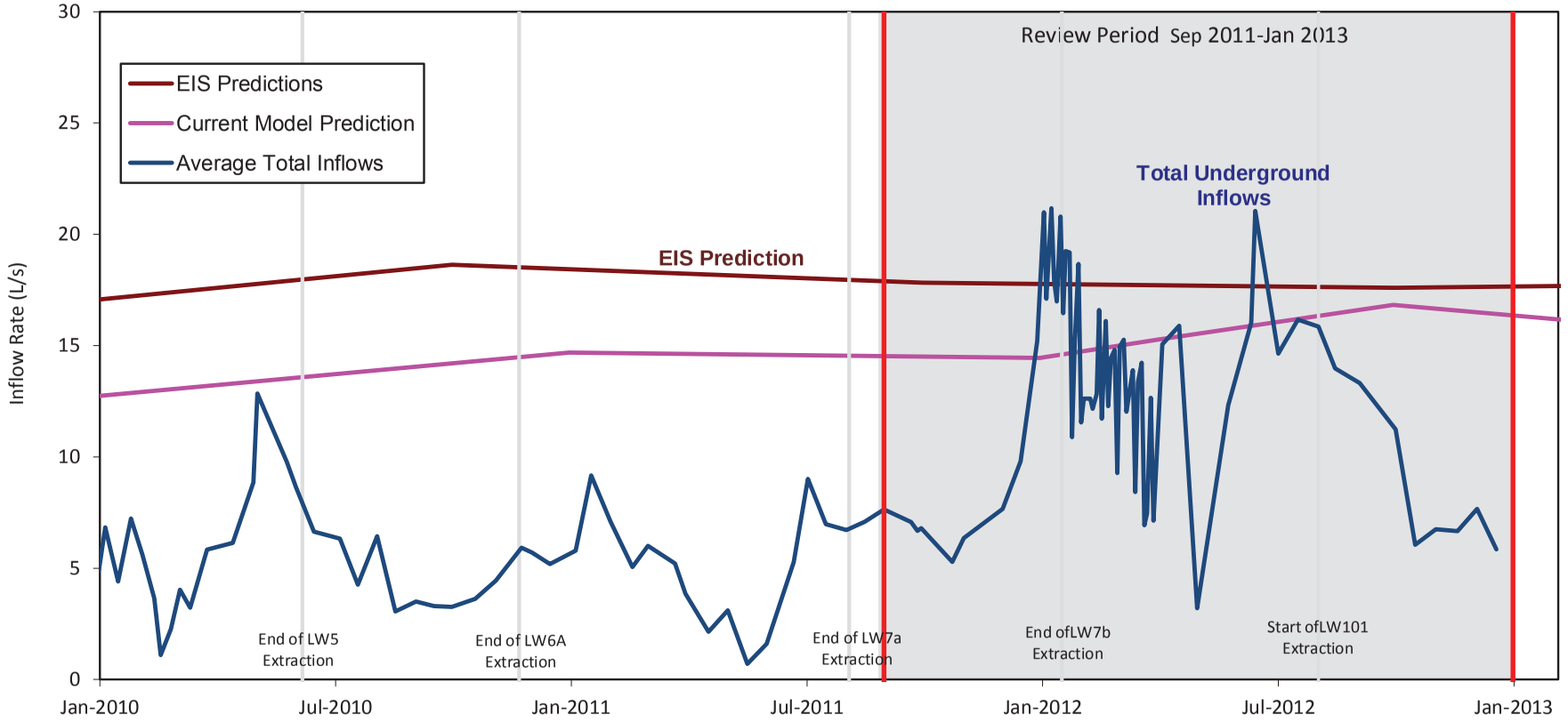

Glennies Creek
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
SM7
SM8
SM11
EC (µS/cm)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013

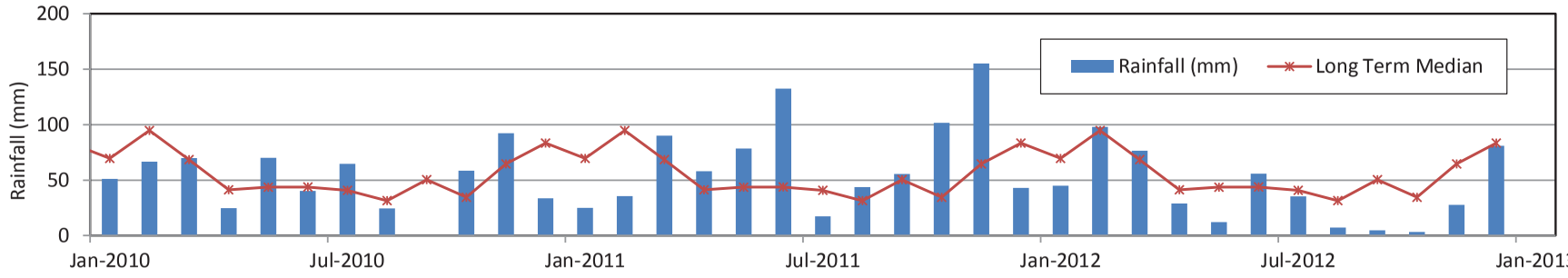

Bowmans Creek
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
SM3
SM4
SM5
SM6
EC (µS/cm)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013


Hunter River
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
SM9
SM12
SM10
SM13
SM14
EC (µS/cm)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013


Rainfall (mm)
Long Term Median
Rainfall (mm)
200
150
100
50
0
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013


Review Period Sep 2011-Jan 2013
T1-A
T1-P
T2-A
T2-P
T3-A
T3-P
T4-A
T4-P
WMLP323
WMLP324
WMLP311
WMLP325
Water Level (mAHD)
63
61
59
57
55
53
51
49
47
45
End of LW5 Extraction
End of LW6A Extraction
End of LW7A Extraction
End of LW7B Extraction
End of LW8 Extraction
Start of ULD LW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013
Rainfall (mm)
Long Term Median
200
150
100
50
0


Review Period Sep 2011-Jan 2013
EIS Predictions
Current Model Prediction
Average Total Inflows
Total Underground Inflows
EIS Prediction
Inflow Rate (L/s)
30
25
20
15
10
5
0
End of LW5 Extraction
End of LW6A Extraction
End of LW7a Extraction
End ofLW7b Extraction
Start ofLW101 Extraction
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013


Rainfall (mm)
Long Term Median
Rainfall (mm)
200
150
100
50
0
Jan-2010
Jul-2010
Jan-2011
Jul-2011
Jan-2012
Jul-2012
Jan-2013

APPENDIX A:
ASHTON COAL GROUNDWATER MONITORING NETWORK

Ashton Coal – Current Groundwater Monitoring Network

Table 1: 2001 Environmental Impact Statement Piezometers

Piezometer	Location	Aquifer
RM02	Located within maingate chain pillars of LW5	Colluvium/CM
RM05	Located south-west corner LW8	CM Overburden
RM07	Located in oxbow between LW6A and LW6B	BC Alluvium/CM
RSGM1	Located within LW8	Bayswater Seam

Table 2: 2008 Test Piezometers

Piezometer	Location	Screened Aquifer
T2-A	Located within LW7A, close to the northern end of extraction	BC Alluvium
T2-P		CM Overburden
T3-A	Located within southern part of LW7A, 65m from LW6A goaf edge	BC Alluvium
T3-P		CM Overburden
T4-A	Located within the southern part of LW6A, about 155m from the start line	BC Alluvium
T4-P		CM Overburden
T5	Located within tailgate chain pillars of LW7B	BC Alluvium
T6		
T7	Located within maingate chain pillars of LW8	BC Alluvium
T10	Located within chain pillar between LW6A and LW7A	BC Alluvium

Table 3: 2008 Bowmans Creek Alluvium Investigation Piezometers

Piezometer	Location	Screened Aquifer
RA10	Located above maingate chain pillar of LW7A	BC Alluvium
RA12	Located mid-panel within LW5	Colluvium
RA14	Located inside LW7A	BC Alluvium
RA15	Located west of LW7A	BC Alluvium
RA16	Located within maingate chain pillars of LW5	Colluvium
RA18	Located just outside northern end of LW6A	BC Alluvium
RA27	Located to the south of LW5-LW7A, along the bank of Hunter River.	HR Alluvium
RA30	Located within LW7B	BC Alluvium

Table 4: General Underground Monitoring Network

Piezometer	Location	Screened Aquifer	Installation date
WML107B	Located outside southern end of LW2	Lem8-9	Sep-06
WML108B			
WML110C	Located inside southern end above LW6A	BC Colluvium	
WML111B	Located inside southern end of LW6A	CM Overburden	May-06
WML112C	Located near LW7A maingate	BC Alluvium	Jul-06
WML112B		Bayswater 1-2	
WML113C	Located just west of southern end of LW7A	BC Alluvium	May-06
WML113B		Bayswater 1	
WML115B	Located in eastern chan pillars of LW7B	CMOB & Lem3-4	-
WML115C		BC Alluvium	
WMLP316	Located adjacent to the west diversion	BC Alluvium	Feb-11
WMLP320			
WMLP308	Located adjacent to the eastern creek diversion	BC Alluvium	Feb-11
WMLP311			
WMLP323			
WMLP324		CM Overburden	
WMLP325			
WMLP326	Located southwest of LW6A	BC Alluvium	Feb-11
WMLP327		CM Overburden	
WML275	Located within/close to southern end of LW6A	BC Alluvium	-
WML276			
WML277	Located to the south of LW5-LW7A, along the bank of Hunter River.	HR Alluvium	-
WML278			
WML279			
WML280			
WML119	Located to the east of LW1 and west of Glennies Creek	Pikes Gully	Jun-06
WML120A			
WML120B		GC Alluvium	Jun-06
WML129			-
WML181		Pikes Gully	Mar-07
WML182			
WML183			
WML184			
WML185			
WML186			
WML187			
WMLP301		Arties	Jul-10
WMLP302			
WML261		Upper Liddell	Oct-09

Piezometer	Location	Screened Aquifer	Installation date
WML262		Upper Liddell	Oct-09
WML239	Located to the East of Glannies Creek		
WML240			
WML241			
WML243			
WML247			
WML249			
WML252			
WML253			
WMLP336	Located south of LW1	HR Alluvium	Jul-12
WMLP337	Located south of LW3		
WMLP338	Located south of LW2		

Table 5: Multi-level Vibrating Wire Piezometers

Piezometer	Location	Aquifer	Installation Date
WML106-32*	Located outside southern end of LW1	Lem15	Jul-06
WML106-68*		Lem19	
WML106-84*		PG	
WML107A -38	Located outside southern end of LW2	Lem11	May-06
WML107A -69		Lem15	
WML107A -69		Lem15	
WML107A -98		Lem19	
WML108A-53	Located outside southern end of LW3	Lem11-12	Apr-06
WML108A-80		Lem15	
WML113A-40	Located just west of southern end of LW7A	Bayswater 2	May-06
WML113A-65		Lem9	
WML113A-95		Lem10-12	
WML113A-124		Lem15	
WML189-49	Located in chain pillars between LW1 and LW2	Lem15	-
WML189-93		Arties	
WML189-101		Pikes Gully	
WML191-52	Located in chain pillars between LW1 and LW2	Lem15	-
WML191-100		Pikes Gully	
WML191-132		Upper Liddell	
WML191-155		Upper Lower Liddell	
WML191-200		Lower Barrett	
WML213-48	Located southwest of LW7A	Bayswater	-
WML213-110.5		Lem8-9	
WML213-169.5		Lem15	

Piezometer	Location	Aquifer	Installation Date
WML213-185.5		Lem19	
WML213-205		Pikes Gully	
WML213-247		Upper Liddell	
WML213-276		Upper Lower Liddell	
WML213-300		Lower Barrett	
WML269-24	Located in main gate chain pillars close to LW5 start line	Lem5	-
WML269-56		Lem7	
WML269-64		Lem8-9	
WML269-92		Lem11-12	
WML269-122		Lem15	
WML269-142		Lem19	
WMLC333-124m	Located to the south of LW4	Lem15B	Feb-12
WMLC333-144m		Lem17A	
WMLC333-178m		Arties	
WMLC333-212m		Upper Liddell	
WMLC333-232m		Upper Lower Liddell	
WMLC333-251m		Upper Barrett	
WMLC333-264m		Lower Barrett	
WMLC334-29.5m	Located to the south of LW1 and LW2	Lem10	Apr-12
WMLC334-63m		Lem15	
WMLC334-91m		Lem19	
WMLC334-126m		Arties	
WMLC334-157m		Upper Liddell	
WMLC334-175m		Upper Lower Liddell	
WMLC334-209m		Lower Barrett	
WMLC334-198m		Upper Barrett	
WMLC335-23m	Located to the south of LW1 and LW2	Lem15A	Apr-12
WMLC335-29.5m		Lem17	
WMLC335-67m		PG-U	
WMLC335-86m		Arties	
WMLC335-121.5m		Upper Liddell	
WMLC335-141.5m		Upper Lower Liddell	
WMLC335-159m		Upper Barrett	
WMLC335-173m		Lower Barrett	

* Piezometer destroyed by longwall extraction in September 2012

APPENDIX B:
ALS COMPREHENSIVE GROUNDWATER QUALITY ANALYSIS

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1206357**	Page	: 1 of 22
Client	: **ASHTON COAL OPERATIONS LIMITED**	Laboratory	: Environmental Division Sydney
Contact	: KRISTINA RAJKOVIC	Contact	: Client Services
Address	: PO BOX 699 SINGLETON NSW, AUSTRALIA 2330	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: krajkovic@ashtoncoal.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 65761111	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 65761122	Facsimile	: +61-2-8784 8500
Project	: ASHTON BIANN G WATER	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: PAC0056412		
C-O-C number	: ----	Date Samples Received	: 19-MAR-2012
Sampler	: CBE	Issue Date	: 27-MAR-2012
Site	: ----		
		No. of samples received	: 62
Quote number	: ----	No. of samples analysed	: 62

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Dianne Blane	Laboratory Supervisor	Newcastle
Hoa Nguyen	Inorganic Chemist	Sydney Inorganics
Raymond Commodor	Instrument Chemist	Sydney Inorganics
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics

General Comments

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

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

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

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

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

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

- **EA015: TDS by method EA-015 may bias high for various samples due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**
- **ED041G:LOR raised for SO4 analysis on sample ID(WML 119) due to sample matrix.**
- **EG020: LCS recoveries for particular element(s) fall outside ALS Dynamic control limit, however, they are within the acceptance criteria based on ALS DQO. No further action is required.**
- **EK055G LOR raised for NH3 on the sample ID (WML 108B,WML 249,WML 294) due to sample matrix.**
- **EK059G:spk failed for NOx analysis due to matrix interference(confirmed by re analysis)**
- **EK067G: LCS recoveries for Total Phosphorus fall outside ALS Dynamic control limit, however, it is within the acceptance criteria based on ALS DQO. No further action is required**
- **Metals LOR for particular sample(s) raised due to high TDS content.**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: GM1	PB1	RM02	RM05	RM07
				Client sampling date / time: 15-MAR-2012 15:00	14-MAR-2012 15:00	15-MAR-2012 15:00	16-MAR-2012 15:00	16-MAR-2012 15:00
				ES1206357-001	ES1206357-002	ES1206357-003	ES1206357-005	ES1206357-006
EA005: pH								
pH Value	----	0.01	pH Unit	7.48	7.60	7.04	7.15	7.46
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	1190	1080	1750	2370	841
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	648	626	1770	1390	442
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	420	----	----	----	58
EA045: Turbidity								
Turbidity	----	0.1	NTU	29.0	----	----	----	5.6
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	139	----	----	----	152
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	151	----	----	----	187
Total Alkalinity as CaCO3	----	1	mg/L	151	----	----	----	187
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	65	----	----	----	69
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	277	----	----	----	122
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	26	----	----	----	31
Magnesium	7439-95-4	1	mg/L	18	----	----	----	18
Sodium	7440-23-5	1	mg/L	212	----	----	----	125
Potassium	7440-09-7	1	mg/L	5	----	----	----	2
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	1.43	----	----	----	0.26
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	<0.0001
Chromium	7440-47-3	0.001	mg/L	0.002	----	----	----	<0.001
Copper	7440-50-8	0.001	mg/L	0.004	----	----	----	0.001
Lead	7439-92-1	0.001	mg/L	0.004	----	----	----	<0.001
Manganese	7439-96-5	0.001	mg/L	0.158	----	----	----	0.008
Nickel	7440-02-0	0.001	mg/L	0.002	----	----	----	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	<0.01

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: GM1	PB1	RM02	RM05	RM07
				Client sampling date / time: 15-MAR-2012 15:00	14-MAR-2012 15:00	15-MAR-2012 15:00	16-MAR-2012 15:00	16-MAR-2012 15:00
				ES1206357-001	ES1206357-002	ES1206357-003	ES1206357-005	ES1206357-006
EG020T: Total Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	**0.042**	----	----	----	**0.009**
Iron	7439-89-6	0.05	mg/L	**1.82**	----	----	----	**0.36**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	<0.0001
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	----	----	----	<0.004
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.2**	----	----	----	**0.5**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.13**	----	----	----	**0.06**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	----	----	----	**0.01**
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**1.05**	----	----	----	**0.15**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**1.05**	----	----	----	**0.16**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.16**	----	----	----	**0.04**
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**12.2**	----	----	----	**8.61**
Total Cations	----	0.01	meq/L	**12.1**	----	----	----	**8.52**
Ionic Balance	----	0.01	%	**0.25**	----	----	----	**0.59**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	RM10	RSGM1	WML 108B	WML 112B	WML 115B
Client sample ID								
Client sampling date / time				14-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
				ES1206357-007	ES1206357-008	ES1206357-009	ES1206357-010	ES1206357-011
EA005: pH								
pH Value	----	0.01	pH Unit	7.50	7.29	7.22	7.37	7.26
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	996	6360	18200	1970	5560
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	636	3650	13000	900	3510
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	168	108	362	34	----
EA045: Turbidity								
Turbidity	----	0.1	NTU	24.4	18.1	141	20.5	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	185	889	5820	261	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	219	415	523	433	----
Total Alkalinity as CaCO3	----	1	mg/L	219	415	523	433	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	87	392	894	40	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	165	1740	6660	333	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	41	117	900	50	----
Magnesium	7439-95-4	1	mg/L	20	145	867	33	----
Sodium	7440-23-5	1	mg/L	154	1190	2130	277	----
Potassium	7440-09-7	1	mg/L	3	3	42	15	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	1.68	2.39	1.31	0.06	----
Arsenic	7440-38-2	0.001	mg/L	0.001	0.002	0.005	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.0002	0.0004	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	0.001	0.003	0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L	0.002	0.005	0.006	<0.001	----
Lead	7439-92-1	0.001	mg/L	0.002	0.003	0.010	<0.001	----
Manganese	7439-96-5	0.001	mg/L	0.113	0.050	2.53	0.128	----
Nickel	7440-02-0	0.001	mg/L	<0.001	0.003	0.014	<0.001	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.02	<0.01	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: RM10	RSGM1	WML 108B	WML 112B	WML 115B
Client sampling date / time				14-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
				ES1206357-007	ES1206357-008	ES1206357-009	ES1206357-010	ES1206357-011
EG020T: Total Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	0.018	0.011	0.042	0.008	----
Iron	7439-89-6	0.05	mg/L	2.03	1.92	12.8	0.54	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.6	0.7	0.3	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	1.17	0.03	<0.10	16.6	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	0.34	<0.01	<0.01	<0.01	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.75	0.28	8.26	0.03	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	1.09	0.28	8.26	0.03	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.82	0.26	<0.01	3.10	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	10.8	65.5	217	18.9	----
Total Cations	----	0.01	meq/L	10.5	69.6	210	17.6	----
Ionic Balance	----	0.01	%	1.77	3.00	1.62	3.40	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	WML 119	WML 120A	WML 120B	WML 129	WML 172
				Client sampling date / time	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
					ES1206357-012	ES1206357-013	ES1206357-014	ES1206357-015	ES1206357-016
EA005: pH									
pH Value	----	0.01	pH Unit		7.34	6.90	7.70	7.36	7.37
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		149	607	790	344	1040
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L		149	352	454	212	574
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		134	22	382	673	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		30.3	8.6	70.8	118	----
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		51	153	191	96	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		59	126	146	105	----
Total Alkalinity as CaCO3	----	1	mg/L		54	126	146	98	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<10	27	36	12	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		14	112	154	44	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		14	30	37	22	----
Magnesium	7439-95-4	1	mg/L		4	19	24	10	----
Sodium	7440-23-5	1	mg/L		11	69	95	36	----
Potassium	7440-09-7	1	mg/L		5	1	<1	2	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		1.93	0.10	2.70	7.30	----
Arsenic	7440-38-2	0.001	mg/L		0.001	<0.001	<0.001	0.001	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L		0.002	0.001	0.005	0.005	----
Copper	7440-50-8	0.001	mg/L		0.005	0.001	0.003	0.006	----
Lead	7439-92-1	0.001	mg/L		0.010	<0.001	0.005	0.006	----
Manganese	7439-96-5	0.001	mg/L		0.058	0.009	0.071	0.118	----
Nickel	7440-02-0	0.001	mg/L		0.003	<0.001	0.003	0.006	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: WML 119	WML 120A	WML 120B	WML 129	WML 172
				Client sampling date / time: 15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
				ES1206357-012	ES1206357-013	ES1206357-014	ES1206357-015	ES1206357-016
EG020T: Total Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	**0.049**	**0.024**	**0.024**	**0.023**	----
Iron	7439-89-6	0.05	mg/L	**2.40**	**0.26**	**3.02**	**5.32**	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.1**	**0.3**	**0.3**	**0.2**	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.48**	<0.01	<0.01	<0.01	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	**0.03**	**0.01**	<0.01	<0.01	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.29**	**0.45**	**0.26**	<0.01	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.32**	**0.46**	**0.26**	<0.01	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.40**	**0.03**	**0.20**	**0.20**	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**1.47**	**6.24**	**8.01**	**3.45**	----
Total Cations	----	0.01	meq/L	**1.63**	**6.09**	**7.95**	**3.54**	----
Ionic Balance	----	0.01	%	----	**1.24**	**0.36**	**1.26**	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: WML 181	WML 182	WML 183	WML 184	WML 185
				Client sampling date / time: 15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
				ES1206357-017	ES1206357-018	ES1206357-019	ES1206357-020	ES1206357-021
EA005: pH								
pH Value	----	0.01	pH Unit	**7.86**	**7.56**	**7.39**	**7.84**	**7.17**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**3590**	**4120**	**4300**	**1010**	**1110**
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	**2020**	**2450**	**2580**	**638**	**614**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	WML 239	WML 240	WML 241	WML 243	WML 249
				Client sampling date / time	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
					ES1206357-022	ES1206357-023	ES1206357-024	ES1206357-025	ES1206357-026
EA005: pH									
pH Value	----	0.01	pH Unit		7.29	7.35	7.27	7.68	7.49
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		855	449	513	5900	11900
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L		528	290	296	3640	7600
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		47	64	55	112	1110
EA045: Turbidity									
Turbidity	----	0.1	NTU		9.6	4.4	15.9	55.5	452
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		220	101	80	951	510
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		134	103	125	644	777
Total Alkalinity as CaCO3	----	1	mg/L		143	103	125	644	777
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		27	25	15	308	764
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		177	64	81	1540	3630
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		50	24	17	155	41
Magnesium	7439-95-4	1	mg/L		23	10	9	137	99
Sodium	7440-23-5	1	mg/L		86	54	80	1090	2680
Potassium	7440-09-7	1	mg/L		2	<1	1	3	9
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.28	0.08	0.24	4.07	18.3
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	0.001	0.003	0.013
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	0.004	0.017
Copper	7440-50-8	0.001	mg/L		0.001	0.001	0.002	0.003	0.015
Lead	7439-92-1	0.001	mg/L		0.002	<0.001	0.003	0.005	0.015
Manganese	7439-96-5	0.001	mg/L		0.017	0.015	0.139	0.374	0.482
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	<0.001	0.006	0.015
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	0.01

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: WML 239	WML 240	WML 241	WML 243	WML 249
				Client sampling date / time: 15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
				ES1206357-022	ES1206357-023	ES1206357-024	ES1206357-025	ES1206357-026
EG020T: Total Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	0.022	0.008	0.034	0.041	0.086
Iron	7439-89-6	0.05	mg/L	0.54	0.16	2.88	4.97	21.1
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.2	0.3	0.8	3.2
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.05	0.10	0.14	<0.01	<0.10
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	0.02	0.02	0.06	0.04	0.10
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.03	1.48	<0.01	19.6	0.99
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.05	1.50	0.06	19.6	1.09
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.21	0.09	0.19	0.27	1.42
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	8.41	4.38	5.09	62.7	134
Total Cations	----	0.01	meq/L	8.18	4.37	5.09	66.5	127
Ionic Balance	----	0.01	%	1.40	0.17	0.03	2.91	2.65

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	WML 252	WML 253	WML 261	WML 262	WML 294
				Client sampling date / time	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
					ES1206357-027	ES1206357-028	ES1206357-029	ES1206357-030	ES1206357-031
EA005: pH									
pH Value	----	0.01	pH Unit		7.90	7.66	7.19	6.71	7.88
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		4260	277	130	7090	10300
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L		2510	202	120	4030	6380
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		788	10	----	----	8
EA045: Turbidity									
Turbidity	----	0.1	NTU		385	2.3	----	----	1.6
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		606	92	----	----	1580
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	----	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	----	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		279	91	----	----	957
Total Alkalinity as CaCO3	----	1	mg/L		279	91	----	----	957
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		287	13	----	----	819
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		1160	27	----	----	3000
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		86	22	----	----	142
Magnesium	7439-95-4	1	mg/L		95	9	----	----	297
Sodium	7440-23-5	1	mg/L		769	20	----	----	2040
Potassium	7440-09-7	1	mg/L		2	<1	----	----	9
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		19.1	0.10	----	----	0.10
Arsenic	7440-38-2	0.001	mg/L		0.007	<0.001	----	----	<0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	<0.0001
Chromium	7440-47-3	0.001	mg/L		0.012	<0.001	----	----	0.001
Copper	7440-50-8	0.001	mg/L		0.009	<0.001	----	----	0.002
Lead	7439-92-1	0.001	mg/L		0.011	0.002	----	----	0.003
Manganese	7439-96-5	0.001	mg/L		0.454	0.176	----	----	0.049
Nickel	7440-02-0	0.001	mg/L		0.011	<0.001	----	----	0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	----	----	<0.01

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: WML 252	WML 253	WML 261	WML 262	WML 294
				Client sampling date / time: 15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
				ES1206357-027	ES1206357-028	ES1206357-029	ES1206357-030	ES1206357-031
EG020T: Total Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	**0.061**	**0.011**	----	----	**0.017**
Iron	7439-89-6	0.05	mg/L	**24.1**	**0.18**	----	----	**0.19**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	<0.0001
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	----	----	<0.004
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.6**	**0.2**	----	----	**1.0**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	**0.03**	----	----	<0.10
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	----	----	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**4.68**	**0.03**	----	----	**1.12**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**4.68**	**0.03**	----	----	**1.12**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.51**	**0.05**	----	----	**0.36**
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**44.3**	**2.85**	----	----	**121**
Total Cations	----	0.01	meq/L	**45.6**	**2.71**	----	----	**120**
Ionic Balance	----	0.01	%	**1.47**	----	----	----	**0.15**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: WMLP 301	WMLP 302	WMLP 308	WMLP 311	WMLP 316
				Client sampling date / time: 15-MAR-2012 15:00	15-MAR-2012 15:00	14-MAR-2012 15:00	14-MAR-2012 15:00	16-MAR-2012 15:00
				ES1206357-032	ES1206357-033	ES1206357-034	ES1206357-035	ES1206357-036
EA005: pH								
pH Value	----	0.01	pH Unit	**7.85**	**7.87**	**6.92**	**7.44**	**7.57**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**6180**	**851**	**798**	**887**	**756**
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	**3630**	**472**	**480**	**544**	**424**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: WMLP 320	WMLP 323	WMLP 324	WMLP 325	WMLP 327
				Client sampling date / time: 16-MAR-2012 15:00	14-MAR-2012 15:00	14-MAR-2012 15:00	14-MAR-2012 15:00	15-MAR-2012 15:00
				ES1206357-037	ES1206357-038	ES1206357-039	ES1206357-040	ES1206357-041
EA005: pH								
pH Value	----	0.01	pH Unit	**7.73**	**7.54**	**7.59**	**7.45**	**7.51**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**795**	**520**	**589**	**917**	**332**
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	**486**	**348**	**450**	**562**	**224**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: RA20	RA08	RA10	RA14	RA18
				Client sampling date / time: 14-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	14-MAR-2012 15:00	14-MAR-2012 15:00
				ES1206357-042	ES1206357-043	ES1206357-044	ES1206357-045	ES1206357-046
EA005: pH								
pH Value	----	0.01	pH Unit	**7.36**	**8.11**	**7.95**	**7.53**	**7.38**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**798**	**6180**	**1930**	**1860**	**1040**
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	**490**	**3930**	**1180**	**880**	**480**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: RA27	RA30	T2-A	T2-P	T3-A
				Client sampling date / time: 15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	14-MAR-2012 15:00
				ES1206357-047	ES1206357-048	ES1206357-049	ES1206357-050	ES1206357-051
EA005: pH								
pH Value	----	0.01	pH Unit	**7.75**	**7.89**	**7.31**	**8.00**	**6.36**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**2120**	**1220**	**892**	**227**	**2150**
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	**1240**	**696**	**512**	**143**	**1430**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	T3-P	T4-A	T4-P	T5	T6
				Client sampling date / time	14-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
					ES1206357-052	ES1206357-053	ES1206357-054	ES1206357-055	ES1206357-056
EA005: pH									
pH Value	----	0.01	pH Unit		**7.66**	**7.99**	**7.76**	**7.86**	**7.66**
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**1850**	**1920**	**1830**	**981**	**976**
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L		**1040**	**1110**	**968**	**590**	**600**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	T7	AP243	AP244	WMLP 278	WMLP 279
				Client sampling date / time	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
					ES1206357-057	ES1206357-058	ES1206357-059	ES1206357-060	ES1206357-061
EA005: pH									
pH Value	----	0.01	pH Unit		7.63	7.67	7.81	7.21	7.85
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		5070	1160	299	1360	961
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L		2960	688	250	798	600
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		----	----	----	----	42
EA045: Turbidity									
Turbidity	----	0.1	NTU		----	----	----	----	11.6
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		----	----	----	----	283
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		----	----	----	----	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		----	----	----	----	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		----	----	----	----	215
Total Alkalinity as CaCO3	----	1	mg/L		----	----	----	----	215
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		----	----	----	----	30
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		----	----	----	----	183
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		----	----	----	----	59
Magnesium	7439-95-4	1	mg/L		----	----	----	----	33
Sodium	7440-23-5	1	mg/L		----	----	----	----	98
Potassium	7440-09-7	1	mg/L		----	----	----	----	3
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		----	----	----	----	0.25
Arsenic	7440-38-2	0.001	mg/L		----	----	----	----	<0.001
Cadmium	7440-43-9	0.0001	mg/L		----	----	----	----	<0.0001
Chromium	7440-47-3	0.001	mg/L		----	----	----	----	<0.001
Copper	7440-50-8	0.001	mg/L		----	----	----	----	0.001
Lead	7439-92-1	0.001	mg/L		----	----	----	----	<0.001
Manganese	7439-96-5	0.001	mg/L		----	----	----	----	0.274
Nickel	7440-02-0	0.001	mg/L		----	----	----	----	0.002
Selenium	7782-49-2	0.01	mg/L		----	----	----	----	<0.01

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: T7	AP243	AP244	WMLP 278	WMLP 279
				Client sampling date / time: 15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00	15-MAR-2012 15:00
				ES1206357-057	ES1206357-058	ES1206357-059	ES1206357-060	ES1206357-061
EG020T: Total Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	----	----	----	----	**0.016**
Iron	7439-89-6	0.05	mg/L	----	----	----	----	**1.86**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	----	----	----	----	<0.0001
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	0.004	mg/L	----	----	----	----	<0.004
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	----	----	----	----	**0.2**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	----	----	----	----	**0.02**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	----	----	----	----	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	----	----	----	----	**0.72**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	----	----	----	----	**0.72**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	----	----	----	----	**0.30**
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	----	----	----	----	**10.1**
Total Cations	----	0.01	meq/L	----	----	----	----	**10.0**
Ionic Balance	----	0.01	%	----	----	----	----	**0.41**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	WMLP 280	WML 113C	----	----	----
				Client sampling date / time	15-MAR-2012 15:00	15-MAR-2012 15:00	----	----	----
					ES1206357-062	ES1206357-063	----	----	----
EA005: pH									
pH Value	----	0.01	pH Unit		7.79	7.59	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		1820	978	----	----	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L		1110	598	----	----	----
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		150	516	----	----	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		17.0	202	----	----	----
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		375	219	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		311	136	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		311	136	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		90	105	----	----	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		411	182	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		76	53	----	----	----
Magnesium	7439-95-4	1	mg/L		45	21	----	----	----
Sodium	7440-23-5	1	mg/L		252	127	----	----	----
Potassium	7440-09-7	1	mg/L		5	2	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.43	2.92	----	----	----
Arsenic	7440-38-2	0.001	mg/L		0.002	0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		0.0007	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L		0.001	0.003	----	----	----
Copper	7440-50-8	0.001	mg/L		0.021	0.003	----	----	----
Lead	7439-92-1	0.001	mg/L		0.002	0.006	----	----	----
Manganese	7439-96-5	0.001	mg/L		0.860	0.093	----	----	----
Nickel	7440-02-0	0.001	mg/L		0.007	0.002	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	----	----	----

Analytical Results

Sub-Matrix: WATER				Client sample ID	WMLP 280	WML 113C	----	----	----
				Client sampling date / time	15-MAR-2012 15:00	15-MAR-2012 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1206357-062	ES1206357-063	----	----	----
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L		**0.121**	**0.034**	----	----	----
Iron	7439-89-6	0.05	mg/L		**1.08**	**4.52**	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
EK026G: Total Cyanide By Discrete Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.3**	**0.2**	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.36**	**0.11**	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	**0.02**	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.02**	**1.08**	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.02**	**1.10**	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.44**	**0.15**	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**19.7**	**10.0**	----	----	----
Total Cations	----	0.01	meq/L		**18.6**	**9.95**	----	----	----
Ionic Balance	----	0.01	%		**2.87**	**0.45**	----	----	----

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **ES1221030**	Page	: 1 of 21
Client	: **ASHTON COAL OPERATIONS LIMITED**	Laboratory	: Environmental Division Sydney
Contact	: SCOTNEY MOORE	Contact	: Client Services
Address	: PO BOX 699 SINGLETON NSW, AUSTRALIA 2330	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: smoore@ashtoncoal.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 65761111	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 65761122	Facsimile	: +61-2-8784 8500
Project	: ASHTON BLANN G WATER	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: PAC061158		
C-O-C number	: ----	Date Samples Received	: 31-AUG-2012
Sampler	: CARBON BASED ENVIRO	Issue Date	: 07-SEP-2012
Site	: ----		
		No. of samples received	: 60
Quote number	: ----	No. of samples analysed	: 60

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
		Newcastle
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Dianne Blane	Laboratory Supervisor	Newcastle
Hoa Nguyen	Inorganic Chemist	Sydney Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ED041G:LOR raised for SO4 analysis on sample ID(WML 119) due to sample matrix.**
- **EK055G LOR raised for NH3 on the various samples due to matrix interference.**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	GM1	PB1	RM02	RM10	RSGM1
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
					ES1221030-001	ES1221030-002	ES1221030-003	ES1221030-004	ES1221030-005
EA005: pH									
pH Value	----	0.01	pH Unit		7.48	7.56	7.24	7.47	7.49
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		2320	1020	2790	1020	8420
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L		1290	608	2030	568	4910
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		45	----	----	50	714
EA045: Turbidity									
Turbidity	----	0.1	NTU		9.8	----	----	2.7	285
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		269	----	----	176	1220
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		324	----	----	270	532
Total Alkalinity as CaCO3	----	1	mg/L		324	----	----	270	532
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		116	----	----	59	401
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		535	----	----	137	2350
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		45	----	----	39	158
Magnesium	7439-95-4	1	mg/L		38	----	----	19	201
Sodium	7440-23-5	1	mg/L		430	----	----	152	1500
Potassium	7440-09-7	1	mg/L		4	----	----	3	4
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.16	----	----	0.40	12.3
Arsenic	7440-38-2	0.001	mg/L		0.001	----	----	<0.001	0.005
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	<0.0001	0.0002
Chromium	7440-47-3	0.001	mg/L		0.001	----	----	0.002	0.011
Copper	7440-50-8	0.001	mg/L		0.001	----	----	0.005	0.010
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	<0.001	0.010
Manganese	7439-96-5	0.001	mg/L		0.382	----	----	0.157	0.121
Nickel	7440-02-0	0.001	mg/L		<0.001	----	----	0.002	0.006
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	<0.01	0.01

Analytical Results

Sub-Matrix: WATER				Client sample ID	GM1	PB1	RM02	RM10	RSGM1
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
Compound	CAS Number	LOR	Unit		ES1221030-001	ES1221030-002	ES1221030-003	ES1221030-004	ES1221030-005
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L		**0.008**	----	----	**0.014**	**0.034**
Iron	7439-89-6	0.05	mg/L		**1.49**	----	----	**0.78**	**12.3**
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	<0.0001	<0.0001
EK026G: Total Cyanide By Discrete Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	----	----	<0.004	<0.004
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.3**	----	----	**0.3**	**0.7**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.37**	----	----	**1.81**	**0.02**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	----	----	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.03**	----	----	**0.03**	**1.31**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.03**	----	----	**0.03**	**1.31**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.08**	----	----	**0.87**	**0.26**
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**24.0**	----	----	**10.5**	**85.3**
Total Cations	----	0.01	meq/L		**24.2**	----	----	**10.2**	**89.8**
Ionic Balance	----	0.01	%		**0.39**	----	----	**1.42**	**2.56**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	WML 108B	WML 112B	WML 113C	WML 115B	WML 119
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
					ES1221030-006	ES1221030-007	ES1221030-008	ES1221030-009	ES1221030-010
EA005: pH									
pH Value	----	0.01	pH Unit		6.98	7.68	7.38	7.18	6.68
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		18700	2100	902	5180	198
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L		12200	1070	504	3070	141
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		234	58	1320	----	99
EA045: Turbidity									
Turbidity	----	0.1	NTU		66.6	18.7	556	----	42.9
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		5570	341	188	----	41
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	----	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	----	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		602	532	184	----	59
Total Alkalinity as CaCO3	----	1	mg/L		602	532	184	----	59
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		786	40	70	----	<10
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		6600	382	139	----	22
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		804	64	44	----	10
Magnesium	7439-95-4	1	mg/L		866	44	19	----	4
Sodium	7440-23-5	1	mg/L		2170	349	125	----	18
Potassium	7440-09-7	1	mg/L		43	13	2	----	7
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.48	0.17	23.1	----	1.69
Arsenic	7440-38-2	0.001	mg/L		0.002	0.002	0.014	----	0.001
Cadmium	7440-43-9	0.0001	mg/L		0.0002	<0.0001	<0.0001	----	<0.0001
Chromium	7440-47-3	0.001	mg/L		0.001	0.002	0.022	----	0.003
Copper	7440-50-8	0.001	mg/L		0.002	0.004	0.033	----	0.004
Lead	7439-92-1	0.001	mg/L		0.003	0.001	0.029	----	0.041
Manganese	7439-96-5	0.001	mg/L		0.637	0.158	0.995	----	0.143
Nickel	7440-02-0	0.001	mg/L		0.006	<0.001	0.022	----	0.004
Selenium	7782-49-2	0.01	mg/L		0.02	<0.01	<0.01	----	<0.01

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	WML 108B	WML 112B	WML 113C	WML 115B	WML 119
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
					ES1221030-006	ES1221030-007	ES1221030-008	ES1221030-009	ES1221030-010
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L		0.021	0.021	0.106	----	0.110
Iron	7439-89-6	0.05	mg/L		3.80	1.05	42.2	----	2.95
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	<0.0001
EK026G: Total Cyanide By Discrete Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	<0.004	----	<0.004
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		0.5	0.3	0.3	----	0.1
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		<0.10	17.9	0.05	----	1.40
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	<0.01	<0.01	----	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		6.72	0.05	0.56	----	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		6.72	0.05	0.56	----	<0.01
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<0.01	2.42	0.30	----	0.24
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		214	22.2	9.05	----	1.80
Total Cations	----	0.01	meq/L		207	22.3	9.25	----	1.79
Ionic Balance	----	0.01	%		1.82	0.18	1.04	----	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	WML 120A	WML 120B	WML 129	WML 181	WML 182
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
					ES1221030-011	ES1221030-012	ES1221030-013	ES1221030-014	ES1221030-015
EA005: pH									
pH Value	----	0.01	pH Unit		7.20	7.23	7.29	7.47	7.27
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		708	865	430	3500	4690
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L		394	504	220	1850	2580
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		9	598	544	----	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		8.7	97.0	230	----	----
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		181	208	109	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		166	192	104	----	----
Total Alkalinity as CaCO3	----	1	mg/L		166	192	104	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		24	36	16	----	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		113	142	59	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		33	37	24	----	----
Magnesium	7439-95-4	1	mg/L		24	28	12	----	----
Sodium	7440-23-5	1	mg/L		76	105	43	----	----
Potassium	7440-09-7	1	mg/L		1	<1	2	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.09	11.6	13.3	----	----
Arsenic	7440-38-2	0.001	mg/L		0.003	0.002	0.003	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	0.014	0.011	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	0.009	0.011	----	----
Lead	7439-92-1	0.001	mg/L		0.001	0.008	0.009	----	----
Manganese	7439-96-5	0.001	mg/L		0.033	0.257	0.320	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	0.011	0.011	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: WML 120A	WML 120B	WML 129	WML 181	WML 182
				Client sampling date / time: 30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
				ES1221030-011	ES1221030-012	ES1221030-013	ES1221030-014	ES1221030-015
EG020T: Total Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	**0.009**	**0.036**	**0.046**	----	----
Iron	7439-89-6	0.05	mg/L	**1.01**	**13.6**	**13.1**	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.2**	**0.3**	**0.2**	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.06**	**0.04**	**0.03**	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	**0.30**	**0.09**	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	**0.30**	**0.09**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.11**	**0.18**	**0.20**	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**7.00**	**8.59**	**4.08**	----	----
Total Cations	----	0.01	meq/L	**6.95**	**8.72**	**4.11**	----	----
Ionic Balance	----	0.01	%	**0.37**	**0.72**	**0.38**	----	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	WML 183	WML 184	WML 185	WML 239	WML 240
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
					ES1221030-016	ES1221030-017	ES1221030-018	ES1221030-019	ES1221030-020
EA005: pH									
pH Value	----	0.01	pH Unit		7.42	7.20	7.29	7.09	7.02
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		5420	2300	1420	942	757
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L		3130	1210	728	478	380
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		----	----	----	50	20
EA045: Turbidity									
Turbidity	----	0.1	NTU		----	----	----	6.7	3.2
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		----	----	----	240	173
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		----	----	----	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		----	----	----	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		----	----	----	171	121
Total Alkalinity as CaCO3	----	1	mg/L		----	----	----	171	121
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		----	----	----	23	30
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		----	----	----	180	148
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		----	----	----	55	38
Magnesium	7439-95-4	1	mg/L		----	----	----	25	19
Sodium	7440-23-5	1	mg/L		----	----	----	95	84
Potassium	7440-09-7	1	mg/L		----	----	----	2	<1
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		----	----	----	0.13	0.17
Arsenic	7440-38-2	0.001	mg/L		----	----	----	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L		----	----	----	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		----	----	----	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		----	----	----	0.001	0.002
Lead	7439-92-1	0.001	mg/L		----	----	----	<0.001	0.001
Manganese	7439-96-5	0.001	mg/L		----	----	----	0.006	0.042
Nickel	7440-02-0	0.001	mg/L		----	----	----	0.001	<0.001
Selenium	7782-49-2	0.01	mg/L		----	----	----	<0.01	<0.01

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: WML 183	WML 184	WML 185	WML 239	WML 240
				Client sampling date / time: 30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
				ES1221030-016	ES1221030-017	ES1221030-018	ES1221030-019	ES1221030-020
EG020T: Total Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	----	----	----	**0.010**	**0.015**
Iron	7439-89-6	0.05	mg/L	----	----	----	**0.26**	**0.28**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	----	----	----	<0.0001	<0.0001
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	0.004	mg/L	----	----	----	<0.004	<0.004
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	----	----	----	**0.2**	**0.2**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	----	----	----	**0.03**	**0.02**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	----	----	----	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	----	----	----	**0.14**	**1.44**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	----	----	----	**0.14**	**1.44**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	----	----	----	**0.09**	**0.22**
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	----	----	----	**8.97**	**7.22**
Total Cations	----	0.01	meq/L	----	----	----	**8.99**	**7.11**
Ionic Balance	----	0.01	%	----	----	----	**0.07**	**0.72**

Analytical Results

Sub-Matrix: WATER				Client sample ID	WML 241	WML 243	WML 247	WML 249	WML 252
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
Compound	CAS Number	LOR	Unit		ES1221030-021	ES1221030-022	ES1221030-023	ES1221030-024	ES1221030-025
EA005: pH									
pH Value	----	0.01	pH Unit		7.38	7.30	7.73	7.89	7.38
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		512	6180	15400	13700	7550
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L		254	3580	8840	8050	4400
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		20	252	8680	517	1170
EA045: Turbidity									
Turbidity	----	0.1	NTU		6.4	143	4210	233	686
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		80	915	483	675	1310
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		139	702	1510	1000	394
Total Alkalinity as CaCO3	----	1	mg/L		139	702	1510	1000	394
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		14	248	<1	724	422
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		61	1410	4900	4090	1970
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		17	147	40	51	168
Magnesium	7439-95-4	1	mg/L		9	133	93	133	216
Sodium	7440-23-5	1	mg/L		69	1020	3990	2930	1170
Potassium	7440-09-7	1	mg/L		1	2	18	9	3
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.13	4.60	4.40	10.0	33.4
Arsenic	7440-38-2	0.001	mg/L		<0.001	0.003	0.011	0.011	0.014
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	0.0005	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	0.004	0.008	0.011	0.025
Copper	7440-50-8	0.001	mg/L		0.001	0.004	0.024	0.010	0.020
Lead	7439-92-1	0.001	mg/L		0.001	0.004	0.010	0.011	0.020
Manganese	7439-96-5	0.001	mg/L		0.112	0.548	0.417	0.206	0.753
Nickel	7440-02-0	0.001	mg/L		<0.001	0.006	0.008	0.011	0.024
Selenium	7782-49-2	0.01	mg/L		<0.01	0.02	<0.01	0.02	0.01

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: WML 241	WML 243	WML 247	WML 249	WML 252
				Client sampling date / time: 30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
				ES1221030-021	ES1221030-022	ES1221030-023	ES1221030-024	ES1221030-025
EG020T: Total Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	0.012	0.032	0.100	0.049	0.113
Iron	7439-89-6	0.05	mg/L	3.83	6.14	16.0	15.4	49.8
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.0004
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.7	0.9	2.7	0.4
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.08	0.02	4.80	<0.10	<0.01
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	0.06	<0.01	<0.01	0.07
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.10	14.8	0.02	0.77	5.53
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.10	14.9	0.02	0.77	5.60
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.38	0.23	0.29	1.27	1.62
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	4.79	59.0	168	150	72.2
Total Cations	----	0.01	meq/L	4.62	62.7	184	141	77.1
Ionic Balance	----	0.01	%	1.87	3.05	4.31	3.20	3.27

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	WML 253	WML 261	WML 262	WML 294	WMLP301
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
					ES1221030-026	ES1221030-027	ES1221030-028	ES1221030-029	ES1221030-030
EA005: pH									
pH Value	----	0.01	pH Unit		6.97	6.80	7.94	7.31	8.00
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		285	190	7550	10900	6140
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L		164	126	3960	6300	3440
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		18	----	----	16	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		3.0	----	----	2.2	----
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		96	----	----	1560	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		103	----	----	1100	----
Total Alkalinity as CaCO3	----	1	mg/L		103	----	----	1100	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		11	----	----	708	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		20	----	----	3280	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		22	----	----	132	----
Magnesium	7439-95-4	1	mg/L		10	----	----	300	----
Sodium	7440-23-5	1	mg/L		22	----	----	2040	----
Potassium	7440-09-7	1	mg/L		<1	----	----	8	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.24	----	----	0.08	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	----	----	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	<0.0001	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	<0.001	----
Copper	7440-50-8	0.001	mg/L		0.001	----	----	0.001	----
Lead	7439-92-1	0.001	mg/L		0.001	----	----	<0.001	----
Manganese	7439-96-5	0.001	mg/L		0.070	----	----	0.054	----
Nickel	7440-02-0	0.001	mg/L		<0.001	----	----	<0.001	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	<0.01	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: WML 253	WML 261	WML 262	WML 294	WMLP301
				Client sampling date / time: 30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
				ES1221030-026	ES1221030-027	ES1221030-028	ES1221030-029	ES1221030-030
EG020T: Total Metals by ICP-MS - Continued								
Zinc	7440-66-6	0.005	mg/L	**0.006**	----	----	**0.009**	----
Iron	7439-89-6	0.05	mg/L	**0.49**	----	----	**0.13**	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	<0.0001	----
EK026G: Total Cyanide By Discrete Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	----	----	<0.004	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.2**	----	----	**0.9**	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.02**	----	----	<0.10	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	----	----	<0.01	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.02**	----	----	**0.06**	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.02**	----	----	**0.06**	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.12**	----	----	**0.03**	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**2.85**	----	----	**129**	----
Total Cations	----	0.01	meq/L	**2.88**	----	----	**120**	----
Ionic Balance	----	0.01	%	----	----	----	**3.64**	----

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	WMLP302	WMLP311	WMLP316	WMLP320	WMLP323
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
					ES1221030-031	ES1221030-032	ES1221030-033	ES1221030-034	ES1221030-035
EA005: pH									
pH Value	----	0.01	pH Unit		**6.73**	**7.72**	**7.24**	**7.20**	**7.72**
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**932**	**916**	**948**	**1040**	**1040**
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L		**492**	**470**	**514**	**564**	**560**

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	WMLP324	WMLP325	WMLP326	WMLP327	WMLP328
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
					ES1221030-036	ES1221030-037	ES1221030-038	ES1221030-039	ES1221030-040
EA005: pH									
pH Value	----	0.01	pH Unit		**7.64**	**7.51**	**7.24**	**7.45**	**7.81**
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**690**	**1480**	**2080**	**438**	**881**
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L		**434**	**700**	**1240**	**214**	**484**

Analytical Results

Sub-Matrix: WATER			Client sample ID	RA 8	RA 10	RA 14	RA 18	RA 27
			Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
Compound	CAS Number	LOR	Unit	ES1221030-041	ES1221030-042	ES1221030-043	ES1221030-044	ES1221030-045
EA005: pH								
pH Value	----	0.01	pH Unit	7.55	7.58	7.24	7.64	7.56
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	6750	2000	2490	954	1880
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	3540	1070	1800	560	1090

Analytical Results

Sub-Matrix: WATER			Client sample ID	RA 30	T2 - A	T2 - P	T3 - A	T3 - P
			Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
Compound	CAS Number	LOR	Unit	ES1221030-046	ES1221030-047	ES1221030-048	ES1221030-049	ES1221030-050
EA005: pH								
pH Value	----	0.01	pH Unit	7.10	7.65	7.16	7.74	7.57
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	1380	975	456	2340	2540
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	760	677	230	1200	1320

Analytical Results

Sub-Matrix: WATER			Client sample ID	T4 - A	T4 - P	T5	T6	T7
			Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
Compound	CAS Number	LOR	Unit	ES1221030-051	ES1221030-052	ES1221030-053	ES1221030-054	ES1221030-055
EA005: pH								
pH Value	----	0.01	pH Unit	7.27	7.88	7.34	7.34	7.79
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	1940	2280	988	1080	3550
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	1060	1180	542	614	1970

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	AP243	AP244	WMLP 278	WMLP 279	WMLP 280
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
					ES1221030-056	ES1221030-057	ES1221030-058	ES1221030-059	ES1221030-060
EA005: pH									
pH Value	----	0.01	pH Unit		7.60	6.93	7.38	7.49	7.64
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		1160	634	1760	979	1570
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L		644	378	1030	552	912
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		----	----	----	37	44
EA045: Turbidity									
Turbidity	----	0.1	NTU		----	----	----	21.0	2.5
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		----	----	----	260	279
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		----	----	----	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		----	----	----	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		----	----	----	201	310
Total Alkalinity as CaCO3	----	1	mg/L		----	----	----	201	310
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		----	----	----	27	78
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		----	----	----	174	308
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		----	----	----	53	54
Magnesium	7439-95-4	1	mg/L		----	----	----	31	35
Sodium	7440-23-5	1	mg/L		----	----	----	89	220
Potassium	7440-09-7	1	mg/L		----	----	----	2	2
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		----	----	----	0.49	0.22
Arsenic	7440-38-2	0.001	mg/L		----	----	----	0.001	0.002
Cadmium	7440-43-9	0.0001	mg/L		----	----	----	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		----	----	----	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		----	----	----	0.002	0.004
Lead	7439-92-1	0.001	mg/L		----	----	----	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L		----	----	----	0.344	0.505
Nickel	7440-02-0	0.001	mg/L		----	----	----	<0.001	0.003
Selenium	7782-49-2	0.01	mg/L		----	----	----	<0.01	<0.01

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	AP243	AP244	WMLP 278	WMLP 279	WMLP 280
				Client sampling date / time	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00	30-AUG-2012 15:00
					ES1221030-056	ES1221030-057	ES1221030-058	ES1221030-059	ES1221030-060
EG020T: Total Metals by ICP-MS - Continued									
Zinc	7440-66-6	0.005	mg/L		----	----	----	**0.012**	**0.067**
Iron	7439-89-6	0.05	mg/L		----	----	----	**4.75**	**1.09**
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		----	----	----	<0.0001	<0.0001
EK026G: Total Cyanide By Discrete Analyser									
Total Cyanide	57-12-5	0.004	mg/L		----	----	----	<0.004	<0.004
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		----	----	----	**0.1**	**1.3**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		----	----	----	**0.19**	**0.08**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		----	----	----	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		----	----	----	**0.01**	**0.04**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		----	----	----	**0.01**	**0.04**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		----	----	----	**0.25**	**0.45**
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		----	----	----	**9.49**	**16.5**
Total Cations	----	0.01	meq/L		----	----	----	**9.12**	**15.2**
Ionic Balance	----	0.01	%		----	----	----	**1.98**	**4.15**

APPENDIX 2

Complaints List

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2011 - 2012 Ashton Coal Operations Complaints List								
Complaint No	**Date**	**Time**	**Identifier**	**Issue**	**Wind Speed (m/s)**	**Wind Direction**	**Inversion**	**Comments/Operational Changes**
1	6/09/2011	8:30 AM	49	other	NA	NA	NA	Complaint regarding a local resident having their access restricted on a shared right of way, as ACOL employees had pulled over on the right of way to talk. The environmental manager communicated with the workforce that they are to be conscious of the shared right of way access on the Ashton Property and through traffic must be maintained at all times.
2	9/09/2011	6:32 PM	7	noise	5.8	NW	No inversion	Complaint received regarding mine noise in Camberwell. Open Cut only had 2 drills operating during the evening however at the time of the complaint they were both down for maintenance. CHPP was shutdown, there were no trains being loaded. The Environmental Manager attended the village at time of the complaint and noted that highway noise was the dominant noise.
3	14/09/2011	4:20 PM	9	blast / dust	5.6	NW	No inversion	An Environmental Co-ordinator was in the village during the blast. There was some dust from the blast come toward Camberwell though before it crossed the creek it had dispersed. Due to the afternoon sun it helped intensify the dust particles in the air. Dust and vibration monitoring results were within compliance.
4	14/09/2011	4:12 PM	27	blast	6.6	NW	No inversion	An Environmental Co-ordinator was in the village during the blast. There was some dust from the blast come toward Camberwell though before it crossed the creek it had dispersed. Due to the afternoon sun it helped intensify the dust particles in the air. Dust and vibration monitoring results were within compliance.
5	27/09/2011	7:00 AM	27	noise	0	SSW	No inversion	Complaint received from OEH indicating *"Noise from Ashton Coal Singleton. Apparently the mine has closed down but there is no cease of noise. Digger has been working away since about 7am on the site."* Review of activities at Ashton were undertaken by Environmental Coordinator and the following response was provided to OEH. We finished digging coal over the weekend in our North East Open Cut; however in accordance with ACOL conditions of our approval on going rehabilitation activities are being undertaken within the Open Cut. The areas they are currently working on is the old OC magazine area and then onto the laydown area.
6	12/10/2011	8:00 PM	27	noise	0.8-3.9	SE	>3^{0}deg/ 100m	Due to this complaint not coinciding with a complaint received by the mine, the mine was unable to conduct an investigation until the complaint was forwarded through by the OEH and therefore no operational changes could be considered. A review at the time of the complaint was received identified that there were no abnormal operations onsite which occurred between those hours. There was only 1 module in operation at the washery during those hours. However due to the delay in receiving the time a specific investigation at the time of the complaint was unable to be conducted.
7	4/01/2012	7:55 AM	7	noise	0.7	NW	1.3°C/ 100m	A review of the operations was undertaken at the time of the complaint it was noted that the Open Cut no longer in production, CHPP had one truck running rejects and no significant noise issues were identified.

2011 - 2012 Ashton Coal Operations Complaints List								
Complaint No	Date	Time	Identifier	Issue	Wind Speed (m/s)	Wind Direction	Inversion	Comments/Operational Changes
8	2/03/2012	11:39 AM	27	other	NA	NA	NA	Ashton received a complaint on 2 March from OEH, where they have received a complaint that Ashton are undertaking cultural heritage works without conducting consultation or facilitating involvement of registered aboriginal parties as required by existing authorisations. ACOL have undertaken works on 28 February, 29 February and half a day on 1 March. The works were predominantly within an area associated with AHIP# 1130976 issued in August 2011 and involved a small area of less than 50 x 50m. Eight registered aboriginal parties selected from the rotating roster system participated in this work. During this same period a few hours were also spent on the morning of 28 February undertaking a surface inspection and collection in an area associate with AHIP# 1131017 issued in December 2011. The same registered aboriginal parties were involved in this work.
9	22/05/2012	5:45 PM	27	other	2.8	NW	No inversion	Ashton received a complaint on 23 May from OEH regarding an odour smell coming from site on the 22 May at 5:45pm. Since the 14 May we've been spreading compost on the rehabilitation areas, this is a practice we've undertaken since 2007. As part of this practice we advise the community, as such on 7 May ACOL sent out a letter to the local community indicating over the next few weeks we would be spreading compost on our rehabilitation. We anticipate finishing spreading the compost by end next week. Environmental Co-ordinator also noted as part of our process, prior to undertaking this work we review the weather conditions as to the potential impacts to the local community when spreading on exposed areas to the village.
10	23/05/2012	7:30 AM	27	noise	1.0-2.5	WNW	>3^{0}deg/ 100m	ACOL's rehabilitation contractor is onsite and they have been conducting rehab works since mid April. The works are being conducted on the western slope facing the New England HWY and parts on top of the RL135 Dump. This morning they were working on the western slope with one D6 Dozer, one Road tipper truck, one excavator and one Articulated truck. Wind speeds during the morning ranged from 1.0m/s to 2.5m/s in a WNW direction. There was an inversion in place until 8:30am. Environmental Co-ordinator reviewed ACOL's operational noise logger and there were no changes to the noise levels once we started this morning at 7am. Environmental Co-ordinator was also down in the village this morning at 7:30am on a separate issue and noted no noise issues with the rehabilitation works.
11	15/06/2012	4:30 AM	27	noise	1.4	W	7.5^{0}deg/ 100m	There were no activities at ACOL that would have contributed to the noise levels reported. At the time of the complaint and for the full period into the morning ACOL had no open cut mine activities; our coal washery was not operational; there were no trains being loaded; and the underground operations are currently in a longwall move, there were no noise generating activities on the surface of the underground.
12	25/06/2012	10:30 PM	27	noise	1.2	W	>9^{0}deg/ 100m	There were no activities at ACOL that would have contributed to the noise levels reported. During the specified time period between 2230 to 0130 ACOL had no open cut mine activities; our coal washery was not operational; there were no trains being loaded; and the underground operations are currently in a longwall move, there were no noise generating activities on the surface of the underground.

APPENDIX 3

AEMR Plans

***Please note Plan 4a Open Cut Activities 2013 has been omitted from this AEMR due to the North East Open Cut ceasing operations in September 2011.**

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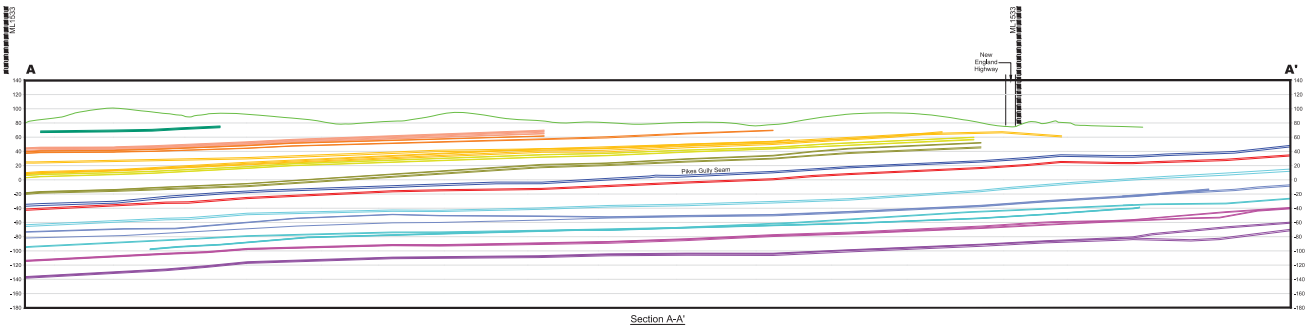

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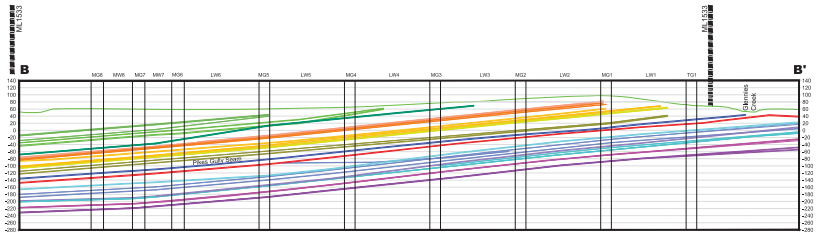

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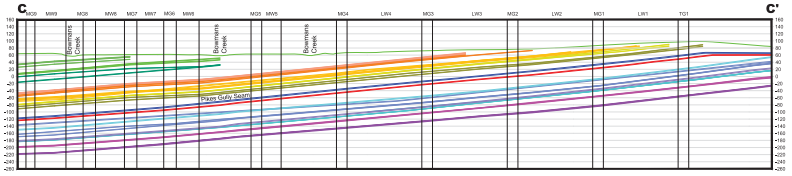

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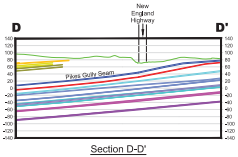

Section D-D'
Vertical Scale 1:5,000
Horizontal Scale 1:5,000

0 100 200 300 400 500metres

LEGEND

- Mining Leases
- Existing Surface
- Lemington Seams 3,4 & 5
- Lemington Seams 6 & 7
- Lemington Seams 8 & 9
- Lemington Seams 10, 11 & 12
- Lemington Seams 13 & 14
- Lemington Seam 15
- Lemington Seams 16 & 17
- Lemington Seams 18 & 19
- Pikes Gully Seam
- Arties Seam
- Upper Liddell Seam
- Middle Liddell Seam
- Upper Lower Liddel Seam
- Lower Lower Liddell Seam
- Upper Barrett

AshtonCoal
PO Box 699 Singleton NSW 2330
Phone 61+ 02 6576 1111 Fax 61+ 02 6576 1122

ASHTON UNDERGROUND MINE
AEMR - 2012
PLAN 7 (b) - Sections

Date	Scale:	Drawn	Checked	Approved	Sheet Size
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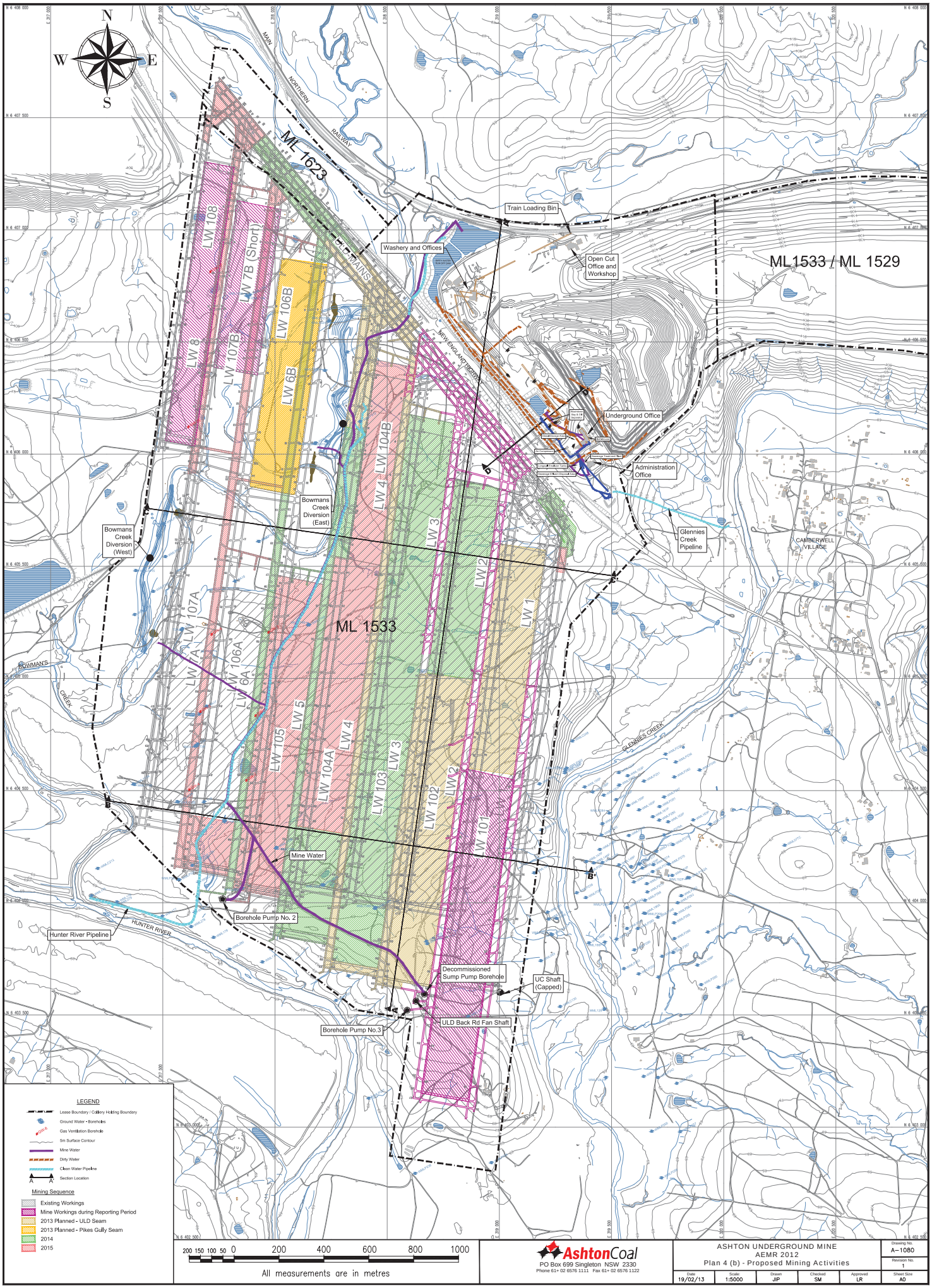
Revision No.



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ASHTON UNDERGROUND MINE
AEMR 2012
Plan 4 (b) - Proposed Mining Activities

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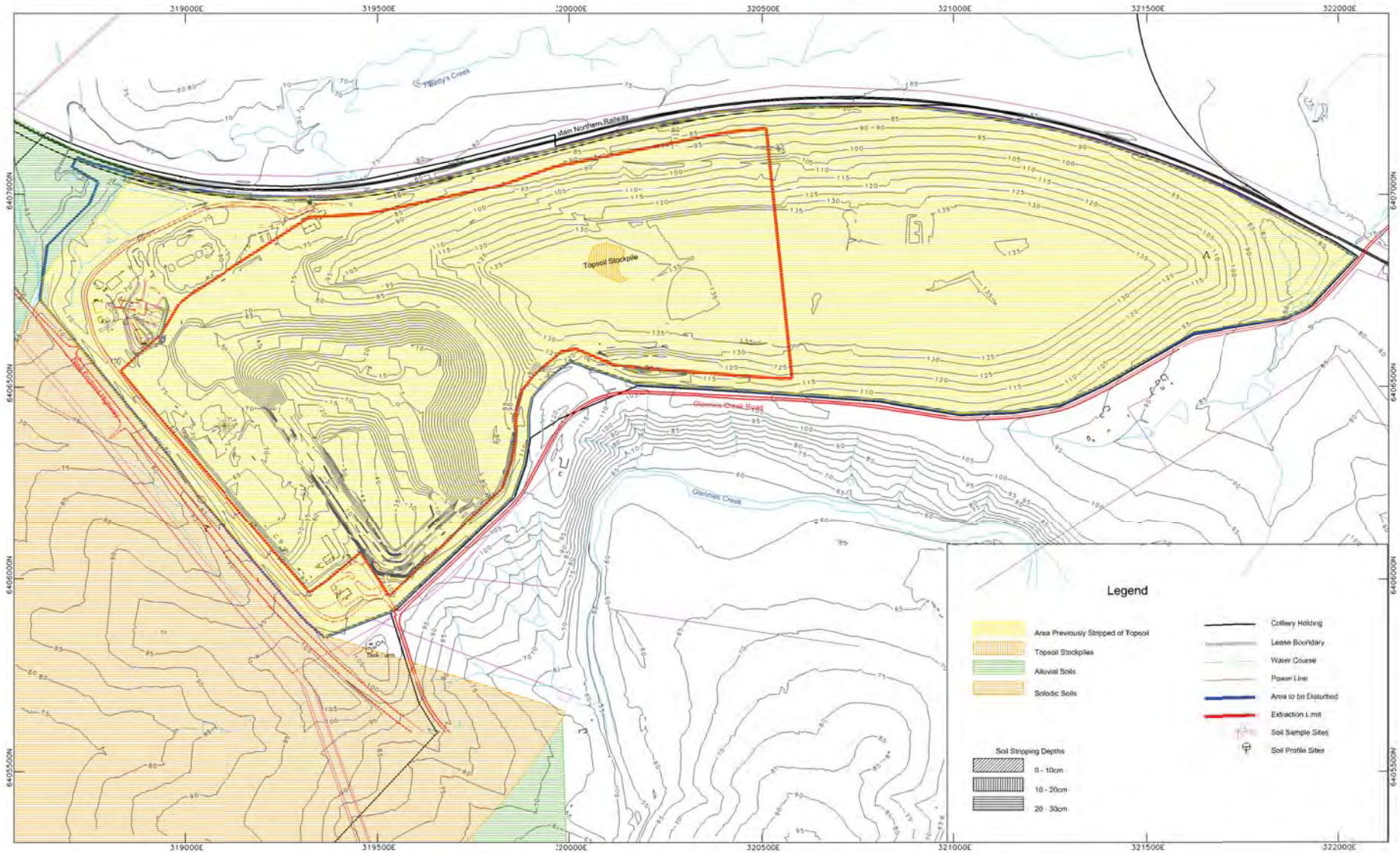
Revision No. 1



AshtonCoal	Ashton Coal Operations
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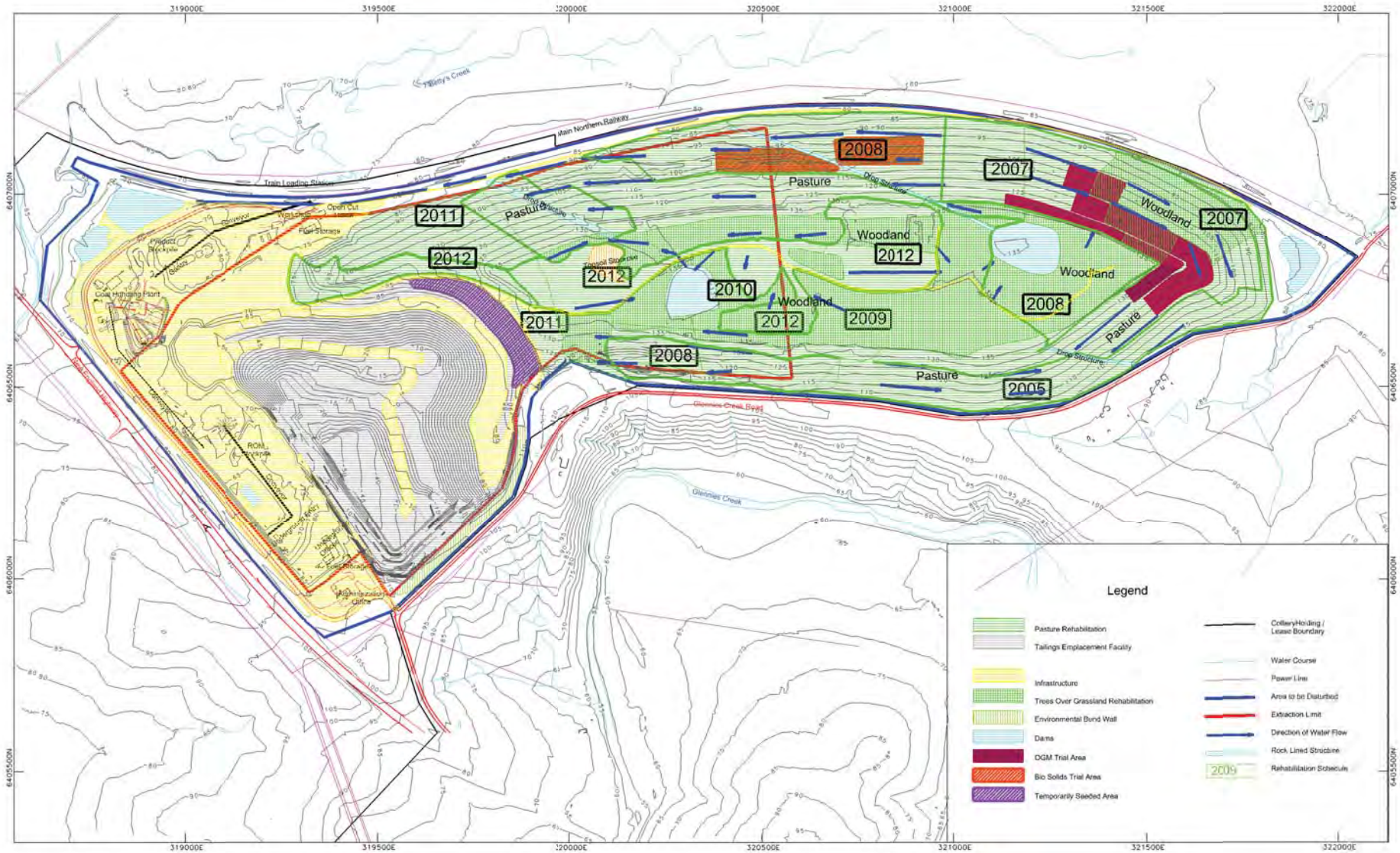
Verify: 14-Feb-2013 3	
Report Name: AEMR	
CAM File: AEMR2013_3	



AshtonCoal | Ashton Coal Operations

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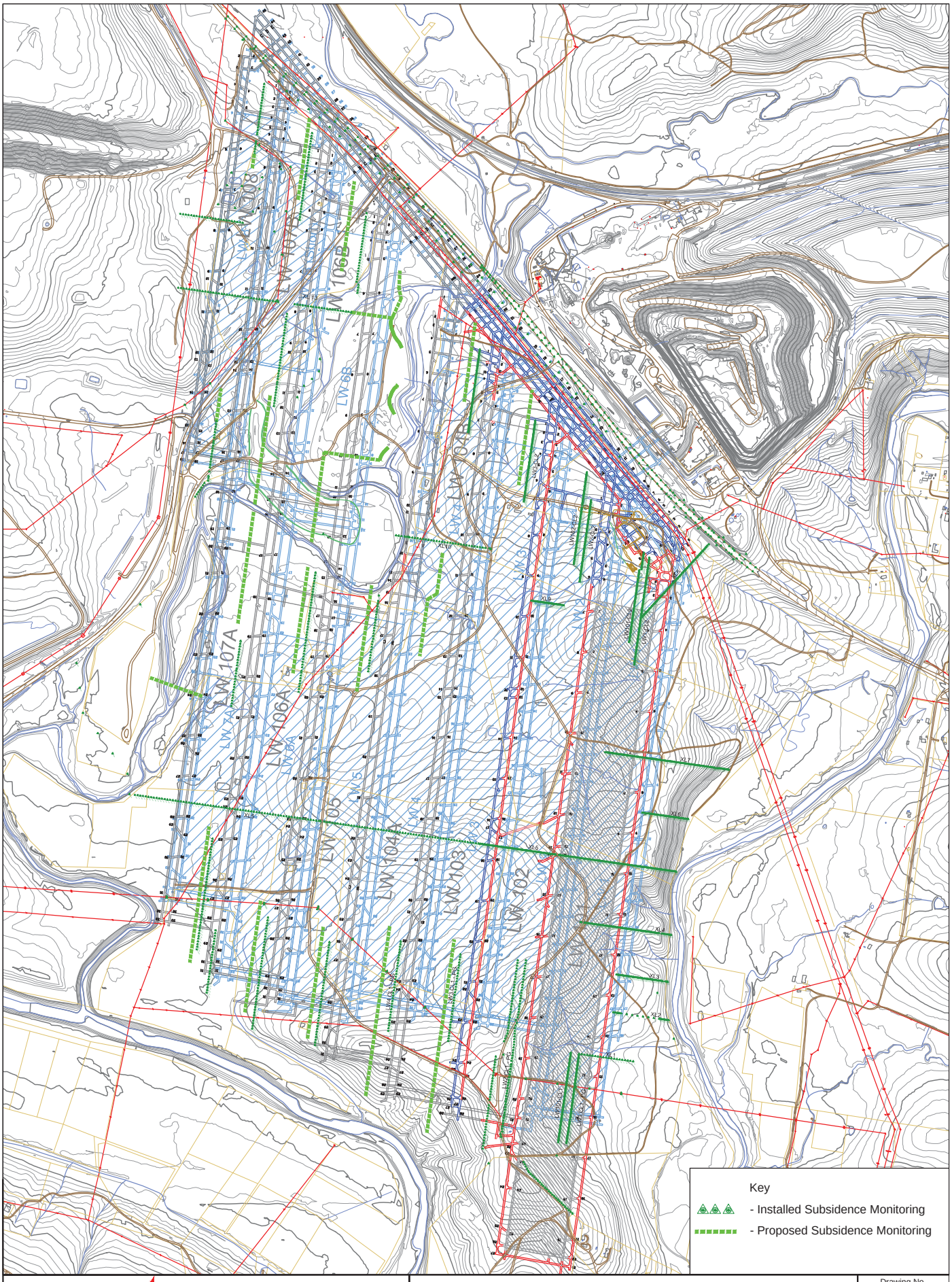
Figure	5
Date	25-Feb-2013
Report Name	AEMR
CAM File	AEMR_2013_5

Ashton Open Cut
AEMR Plan 5
Rehabilitation



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Phone 61+ 02 6576 1111 Fax 61+ 02 6576 1122

ASHTON UNDERGROUND MINE
ULD and Pikes Gully Seam Layouts
Proposed and Existing Subsidence Monitoring

Drawing No.	Revision No.
B–9104	

Date	Scale:	Drawn	Checked	Approved	Sheet Size
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APPENDIX 4

OEH monitoring form for Conservation Area

As a request from OEH after the 2010/2011 AEMR, OEH have asked for their monitoring form to be completed annually on Ashton Coal's Conversation Area and to be included in the AEMR. Ashton Coal commissioned Pacific Environmental Associates to conduct this report.

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MONITORING REPORT FORM

This form is being completed for the following reason:

- ✓ Annual Report by landholder (self reporting)
- ☐ Routine visit by OEH with landholder
- ☐ Compliance visit by OEH with landholder
- ☐ Change of ownership visit by OEH with landholder

- ✓ Conservation Agreement
- ☐ Wildlife Refuge
- ☐ Property Agreement

Please make three copies of the completed form and any additional information. One to be retained by the landowner, one for the local Area office of NPWS and the third to go to Conservation Partnerships Delivery Unit, OEH, PO Box A290, Sydney South NSW 1232.

A LANDOWNER AND PROPERTY DETAILS

Property Owner	ASHTON COAL MINES LTD
Property Name	—
Property Address	PART OF LOT 3 DP 1114626. PO BOX 699 SINGLETON NSW 2330
CA number	AGREEMENT SIGNED BY THE MINISTER FOR NPWS AT 1974 FRANK SARTOR 16/9/2010
Area (ha)	65.66ha
CMA Region	HUNTER - CENTRAL RIVERS
Agreement signed	16/9/2010
Date of last monitoring visit	NIL
Date of visit	JANUARY 2012
Officer undertaking visit	NIL

B LANDHOLDER OVERVIEW SINCE LAST VISIT

1 LANDHOLDER EXPERIENCES RELATING TO THE IMPLEMENTATION OF THE CONSERVATION AGREEMENT /WILDLIFE REFUGE

Points to note	*Comments*
CONSTRUCTION OF NEW SURFACE INFRASTRUCTURE TO MAINTAIN SAFETY OF UNDERGROUND EMPLOYEES HAS OCCURRED DURING THIS PERIOD, AND SUBSIDENCE REPAIRS TO AREAS EFFECTED BY SUBSIDENCE IMPACTS	

☐ Please place an X in this box if new issue(s)/problem(s) require management help

2 WORKS UNDERTAKEN SINCE LAST VISIT

Description of work undertaken	*Source of funding and amount*	*Date completed*
THIS IS THE FIRST REPORT TO OEH, THERE HAS BEEN NO PREVIOUS VISITS BY OEH OFFICERS		

3 FIRE HISTORY MONITORING

Date of fire	Area burnt (% of c.a./approx ha)	Reason (hazard red./wild)	Intensity (low/medium/high)
NO FIRE			

4 VISITATION

Average No. of Visitors per year	Purpose of Visitation	Visitation effects	Strategies to overcome effects
40	WEED CONTROL, FOX & WILD DOG BAITING, ECOLOGICAL MONITORING, WORKS AT UNDERGROUND SURFACE INFRASTRUCTURE, SUBSIDENCE REPAIRS	CONSTRUCTION WORKS	RESTRICTED TO INFRASTRUCTURE AREAS, AND SUBSIDENCE ZONES.

5 COMMUNITY CONSULTATION AND INPUT INTO DECISION MAKING

Type of Involvement	Numbers involved	Outcomes
NIL		

C CONSERVATION VALUES

	Conservation Values noted in Agreement and its significance	Current condition ** (I = improving M= maintain D= declining) *Anecdotal evidence only available at present*	Current and emerging threats	Level (*severe, high, moderate or low*) and extent (*throughout, widespread, scattered or localised*) of threats	New findings; any other relevant information.
Landscape/ Catchment - World/national heritage listings - Landscape & scenic values	N.A.				
Biological - Vegetation Communities - Flora - Fauna & habitat - Water bodies	SIGNIFICANT VEGETATION COMMUNITIES AND WOODLAND BIRDS	I	THERE IS AN INCREASE IN WEED COVER (ST JOHNS WORT) WHICH WILL BE MANAGED OVER THE SUMMER	MODERATE	
Geological	N.A.				
Cultural Heritage - Aboriginal - Historic	SIGNIFICANT ABORIGINAL HERITAGE SITES	M	NONE		
Research/ education	N.A.				
Other	N.A.				

** Current Condition: determine change by comparison with previous Condition Assessments (Pages 5 to 8). Carry out new assessment if not done previously. Biometric can also be used.

D MANAGEMENT ISSUES

	Describe the Issue (short description of current extent of impacts, new sightings and any other relevant information	Description of planning and implementation of control measures being and to be undertaken, and duration
Weeds (where applicable, infestation can be given as a % of total vegetation)	THERE IS AN INCREASE OF BETWEEN 10% - 20% COVER IN WEEDS, WHICH ARE COMING FROM ADJOINING PROPERTIES	UNDERTAKE WEED CONTROL IN SUMMER. FOLLOW UP DURING THE YEAR.
Pest Animals - Feral - Domestic - Native	NO RECORDED INCREASE IN PESTS	1080 FOX & WILD DOG BAITING CARRIED OUT IN 2012. ANOTHER BAITING PROGRAM IS PLANNED FOR MAY 2013.
Fire Management	THERE IS A SIGNIFICANT INCREASE THIS YEAR IN FUEL LOAD, FOLLOWING A GOOD WINTER.	IF LOADS INCREASE THIS YEAR, CONTROLLED BURNING WILL BE CONSIDERED BEFORE THE SUMMER 13/14. SLASHING TO CONTINUE OF BOUNDARY FENCES.
Threatened species; endangered ecological communities etc	THREATENED SPECIES RECORDED ARE STILL PRESENT AND IN SOME CASES INCREASING IN NUMBERS.	INCREASE IN WEEDS AT SOME LOCALITIES MAY HARM HABITAT FOR SOME THREATENED SPECIES. THESE WEEDS WILL BE MANAGED.
Cultural Heritage Management	CONSTRUCTION AND PREDICTED SUBSIDENCE ZONES WERE ARCHEOLOGICALLY CLEARED BY ARCHAEOLOGIST AND REGISTERED ABORIGINAL PARTIES.	WORKS WERE CARRIED OUT IN COMPLIANCE WITH AHIP 1131017 AND ASHTON COAL'S ACHMP.
Visitor Impact Management	RESTRICTED TO INFRASTRUCTURE AREAS, USING EXISTING ROADS AND SUBSIDENCE ZONES.	
Community Consultation and input into decision making.	NIL	
Research/ Education programs	N.A.	
Other permitted uses -vehicle access - use of timber -seed collection - etc	SUBSIDENCE REPAIRS	SMALL 5 TONNE EXCAVATOR CONDUCTS SUBSIDENCE REPAIRS TO REDUCE IMPACT.

E WORKPLAN TO ADDRESS MANAGEMENT ISSUES (in priority order)

Action to be completed or ongoing action (discuss on site and where necessary confirm details later)	*Cost and possible funding sources*	*Completion Date*	*Responsibility (landholder, OEH, other)*
SUBSIDENCE REPAIRS	$20,000	2013	ASHTON
WEED CONTROL	$20,000	2013	ASHTON
REVIEW OF FUEL LOADS AND SLASHING BOUNDARY FENCES	$3200	2013	ASHTON
FOX & WILD DOG BAITING	$350	MAY 2013	ASHTON

F ATTACHMENTS

☑ Map showing location of activities referred to above eg weed infestations; fire; location of past and future management actions.

List further attachments if relevant:

☑ Photos from previously/new identified photopoints

☐ Rapid Assessment Sheets for previous/new sites.

☑ Other Monitoring results.

I/we confirm a field inspection has been undertaken and this form is a summary of the conservation values and management issues discussed.

Signature: _____ _____
Landowner Visiting OEH/NPWS Officer, if applicable

Date report completed: 30/5/2013

Level of threat definition

Table 4 Description of the level of impact categories (adapted from State of the Parks 2007 Guidelines)

Impact of the threat	Description of category
Severe	The threat will lead to loss of property value(s) in the foreseeable future if it continues to operate at current levels
High	The threat will lead to a significant reduction of property e values(s) if it continues to operate at current levels.
Moderate	The threat is having a detectable impact on reserve values(s) but damage is not considered significant.
Mild	The threat is having minor or barely detectable impact on property value(s).

Extent of threat definition For cultural heritage places, sites and objects, classify the extent the impact is having on the place/site/object itself.

Table 5: Description of the extent categories (adapted from State of the Parks 2007 Guidelines)

Extent of the threat	Description of category
Throughout	The impact is occurring in 50% or more of property area/cultural place/site/object.
Widespread	The impact is occurring in more than 15% but less than 50% of reserve area/cultural place/site/object.
Scattered	The impact is occurring in between 5 and 15% of reserve area/cultural place/site/object.
Localised	The impact is occurring is less than 5% of reserve area/cultural place/site/object.

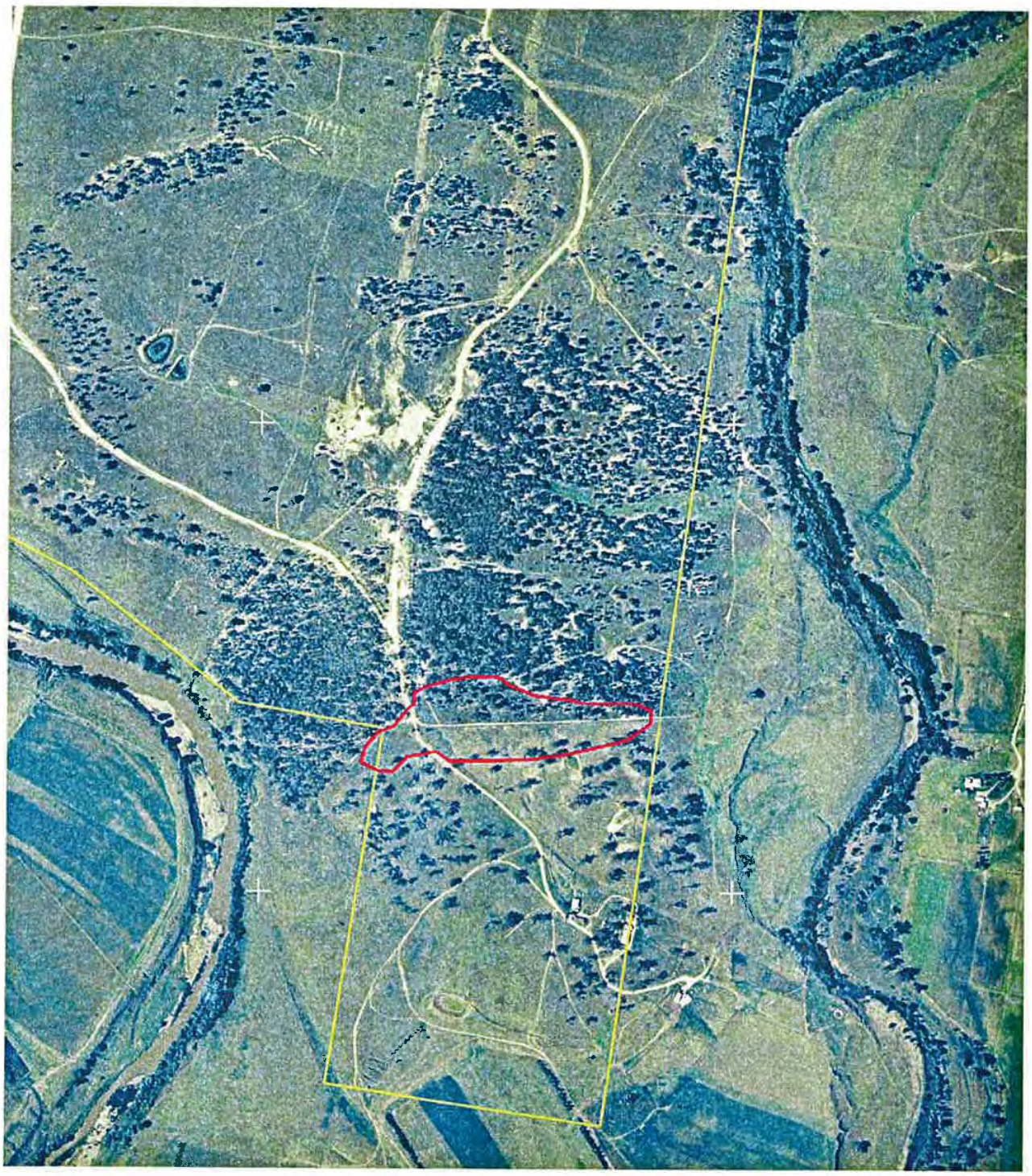


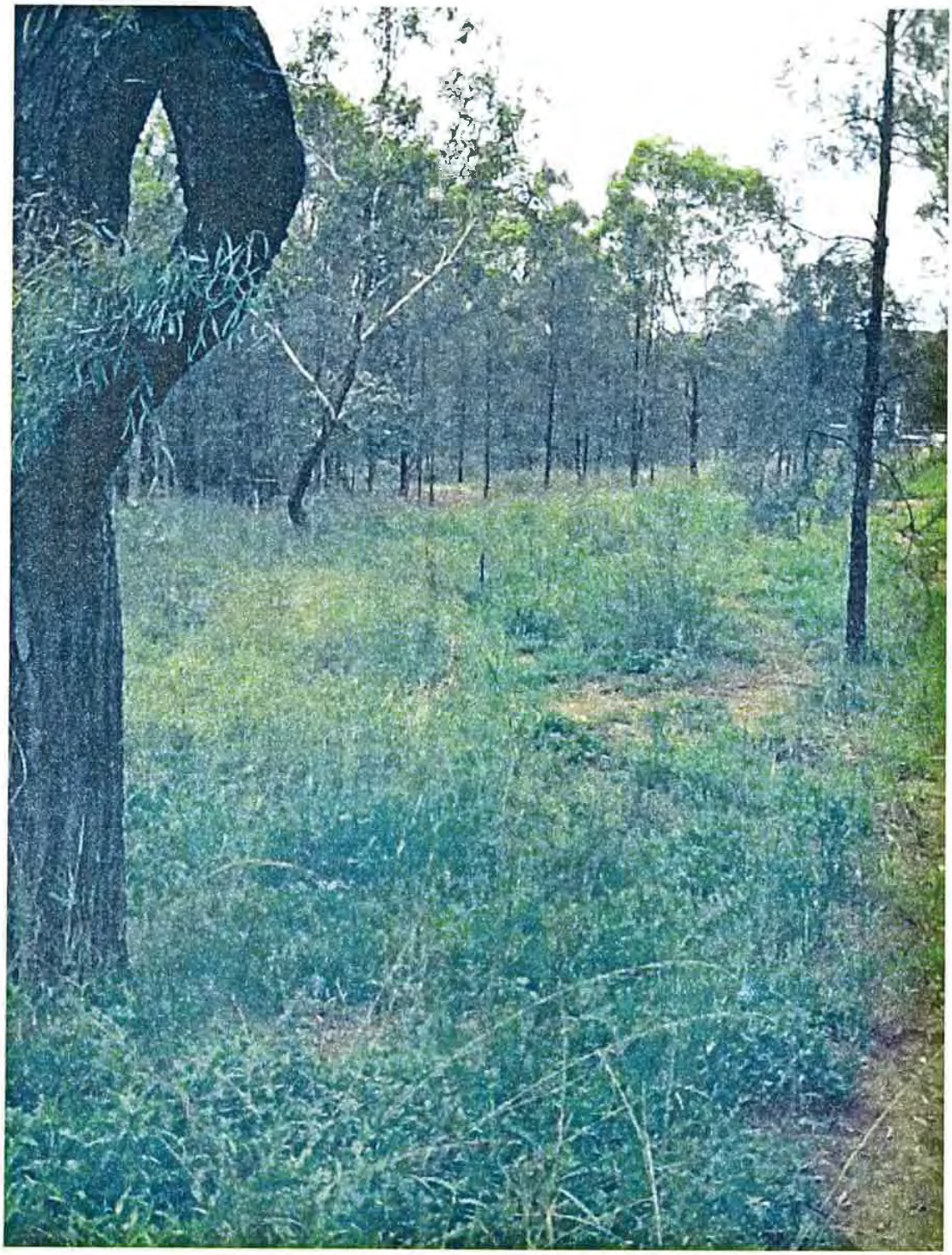
Figure 1.

Area of weed problem recorded in Summer 2012

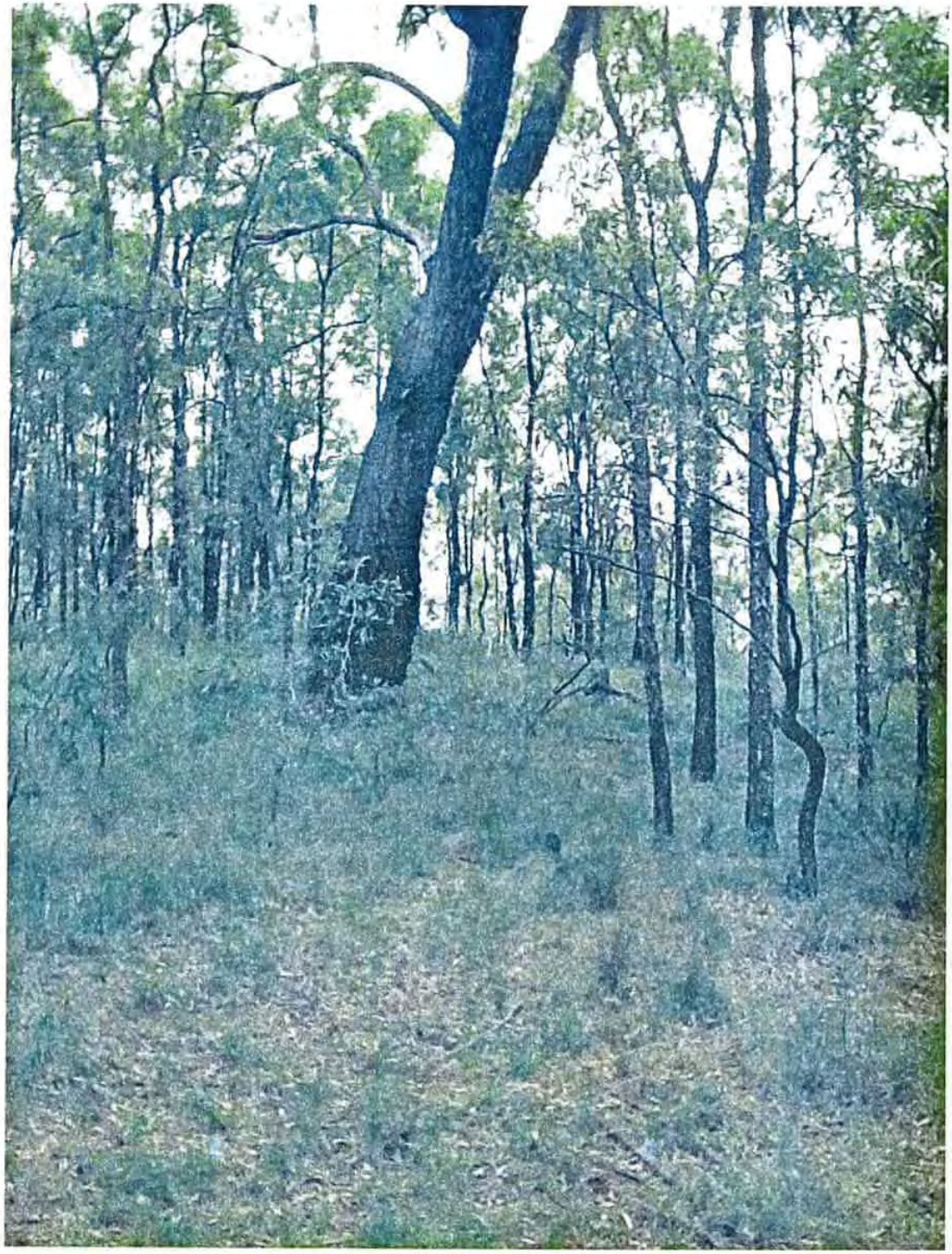
Ashton Southern Woodland Conservation area Photo-Point photographs

Arboreal/ terrestrial Trapline-Bird survey and Pitfall survey areas

Site A (318600, 6403350, WGS84)- Photographs follow in order, south, east, north, west



Site B (318325, 6403425, WGS84)- Photographs follow in order, south, east, north, west



Site C (318500, 6403600, WGS84)- Photographs follow in order, south, east, north, west

APPENDIX 5

Aboriginal Communications Log

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Aboriginal Stakeholder Groups Correspondence Log	Issue
16-September-2011	
Correspondence sent to the stakeholder groups regarding AHIP fieldwork roster: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants -Gidwaa Walang -Wonnarua Culture Heritage -Culturally Aware -Aboriginal Native Title Consultants -Muswellbrook Cultural Consultants -Upper Hunter Heritage Consultants -Hunter Valley Cultural Consultants -Bullem Bullem Heritage -Wanaruah Local Aboriginal Land Council -Yarrawalk Enterprises -Carrawonga Consultants (x 2) -Wonnarua Nations Aboriginal Corporation (x3) -Kayaway Eco-Cultural and Heritage -Hunter Valley Cultural Surveying -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Cacatua Cultural Consultants -Upper Hunter Wonnarua Council Inc -Valley Culture -Wanaruah Custodians (x 2) -Ungooroo Cultural & Community Services Incorporated -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation	Fieldwork
19-September-11	
Invitations to the Aboriginal Community Consultative Forum. The correspondence was sent to: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants -Gidwaa Walang -Wonnarua Culture Heritage -Culturally Aware -Aboriginal Native Title Consultants -Muswellbrook Cultural Consultants -Upper Hunter Heritage Consultants -Hunter Valley Cultural Consultants -Bullem Bullem Heritage -Wanaruah Local Aboriginal Land Council -Yarrawalk Enterprises -Carrawonga Consultants (x 2) -Mingga Consultants -Wonnarua Nations Aboriginal Corporation (x3)	ACCF

-Kayaway Eco-Cultural and Heritage -Hunter Valley Cultural Surveying -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Cacatua Cultural Consultants -Upper Hunter Wonnarua Council Inc -Valley Culture -Wanaruah Custodians (x 2) -Ungooroo Cultural & Community Services Incorporated -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation	
3-November-11	
Information packs were supplied to the following parties regarding ACOL's proposed ventilation shaft works via development consent modification 9: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants -Gidwaa Walang -Wonnarua Culture Heritage -Culturally Aware -Aboriginal Native Title Consultants -Muswellbrook Cultural Consultants -Upper Hunter Heritage Consultants -Hunter Valley Cultural Consultants -Bullem Bullem Heritage -Wanaruah Local Aboriginal Land Council -Yarrawalk Enterprises -Carrawonga Consultants (x 2) -Wonnarua Nations Aboriginal Corporation (x3) -Kayaway Eco-Cultural and Heritage -Hunter Valley Cultural Surveying -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Cacatua Cultural Consultants -Upper Hunter Wonnarua Council Inc -Valley Culture -Wanaruah Custodians (x 2) -Ungooroo Cultural & Community Services Incorporated -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation -Warren Taggart	Development Consent Modification 9
23-November-11	
Invitations to and previous meeting minutes of the Aboriginal Community Consultative Forum. The correspondence was sent to: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants	ACCF

-Gidwaa Walang -Wonnarua Culture Heritage -Culturally Aware -Aboriginal Native Title Consultants -Muswellbrook Cultural Consultants -Upper Hunter Heritage Consultants -Hunter Valley Cultural Consultants -Bullem Bullem Heritage -Wanaruah Local Aboriginal Land Council -Yarrawalk Enterprises -Carrawonga Consultants (x 2) -Mingga Consultants -Wonnarua Nations Aboriginal Corporation (x3) -Kayaway Eco-Cultural and Heritage -Hunter Valley Cultural Surveying -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Cacatua Cultural Consultants -Upper Hunter Wonnarua Council Inc -Valley Culture -Wanaruah Custodians (x 2) -Ungooroo Cultural & Community Services Incorporated -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation	
29-December-11	
Information packs were supplied to the following parties regarding ACOL's LW1-4 AHIP 1131017 for review: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants -Gidwaa Walang -Wonnarua Culture Heritage -Culturally Aware -Aboriginal Native Title Consultants -Muswellbrook Cultural Consultants -Upper Hunter Heritage Consultants -Hunter Valley Cultural Consultants -Bullem Bullem Heritage -Wanaruah Local Aboriginal Land Council -Yarrawalk Enterprises -Carrawonga Consultants (x 2) -Wonnarua Nations Aboriginal Corporation (x3) -Kayaway Eco-Cultural and Heritage -Hunter Valley Cultural Surveying -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Cacatua Cultural Consultants -Upper Hunter Wonnarua Council Inc -Valley Culture -Wanaruah Custodians (x 2)	AHIP 1131017

-Ungooroo Cultural & Community Services Incorporated -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation -Warren Taggart	
22-February-12	
Invitations to and previous meeting minutes of the Aboriginal Community Consultative Forum. The correspondence was sent to: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants -Gidwaa Walang -Wonnarua Culture Heritage -Culturally Aware -Aboriginal Native Title Consultants -Muswellbrook Cultural Consultants -Upper Hunter Heritage Consultants -Hunter Valley Cultural Consultants -Bullem Bullem Heritage -Wanaruah Local Aboriginal Land Council -Yarrawalk Enterprises -Carrawonga Consultants (x 2) -Mingga Consultants -Wonnarua Nations Aboriginal Corporation (x3) -Kayaway Eco-Cultural and Heritage -Hunter Valley Cultural Surveying -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Cacatua Cultural Consultants -Upper Hunter Wonnarua Council Inc -Valley Culture -Wanaruah Custodians (x 2) -Ungooroo Cultural & Community Services Incorporated -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation	ACCF
9-March-12	
A notice of when field work induction were being conducted on the 12th & 14th of March was sent to: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants -Gidwaa Walang -Wonnarua Culture Heritage -Culturally Aware -Aboriginal Native Title Consultants -Muswellbrook Cultural Consultants -Upper Hunter Heritage Consultants -Hunter Valley Cultural Consultants -Bullem Bullem Heritage -Wanaruah Local Aboriginal Land Council	Fieldwork / Inductions

-Yarrawalk Enterprises -Carrawonga Consultants (x 2) -Mingga Consultants -Wonnarua Nations Aboriginal Corporation (x3) -Kayaway Eco-Cultural and Heritage -Hunter Valley Cultural Surveying -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Cacatua Cultural Consultants -Upper Hunter Wonnarua Council Inc -Valley Culture -Wanaruah Custodians (x 2) -Ungooroo Cultural & Community Services Incorporated -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation	
29-March-12	
Information packs were supplied to the following parties regarding ACOL's Voluntary Conservation Area for review: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants -Gidwaa Walang -Wonnarua Culture Heritage -Culturally Aware -Aboriginal Native Title Consultants -Muswellbrook Cultural Consultants -Upper Hunter Heritage Consultants -Hunter Valley Cultural Consultants -Bullem Bullem Heritage -Wanaruah Local Aboriginal Land Council -Yarrawalk Enterprises -Carrawonga Consultants (x 2) -Wonnarua Nations Aboriginal Corporation (x3) -Kayaway Eco-Cultural and Heritage -Hunter Valley Cultural Surveying -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Cacatua Cultural Consultants -Upper Hunter Wonnarua Council Inc -Valley Culture -Wanaruah Custodians (x 2) -Ungooroo Cultural & Community Services Incorporated -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation -Warren Taggart	Voluntary Conservation Area

30-March-12	
Correspondence sent to the stakeholder groups regarding fieldwork roster: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants -Gidwaa Walang -Wonnarua Culture Heritage -Culturally Aware -Aboriginal Native Title Consultants -Muswellbrook Cultural Consultants -Upper Hunter Heritage Consultants -Hunter Valley Cultural Consultants -Bullem Bullem Heritage -Wanaruah Local Aboriginal Land Council -Yarrawalk Enterprises -Carrawonga Consultants (x 2) -Wonnarua Nations Aboriginal Corporation (x3) -Kayaway Eco-Cultural and Heritage -Hunter Valley Cultural Surveying -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Cacatua Cultural Consultants -Upper Hunter Wonnarua Council Inc -Valley Culture -Wanaruah Custodians (x 2) -Ungooroo Cultural & Community Services Incorporated -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation	Fieldwork
24-May-12	
Information packs were supplied to the following parties regarding ACOL's proposed Gas Drainage Network related to development consent modification 10. All consultants reports were included for review: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants -Gidwaa Walang -Wonnarua Culture Heritage -Culturally Aware -Aboriginal Native Title Consultants -Muswellbrook Cultural Consultants -Upper Hunter Heritage Consultants -Hunter Valley Cultural Consultants -Bullem Bullem Heritage -Wanaruah Local Aboriginal Land Council -Yarrawalk Enterprises -Carrawonga Consultants (x 2) -Wonnarua Nations Aboriginal Corporation (x3) -Kayaway Eco-Cultural and Heritage	Development Consent Modification 10

-Hunter Valley Cultural Surveying -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Cacatua Cultural Consultants -Upper Hunter Wonnarua Council Inc -Valley Culture -Wanaruah Custodians (x 2) -Ungooroo Cultural & Community Services Incorporated -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation -Warren Taggart	
28-August-12	
Information packs were supplied to the following parties regarding ACOL's Archaeology & Cultural Heritage Management Plan. The draft management plan was included for review: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants -Gidwaa Walang -Wonnarua Culture Heritage -Culturally Aware -Aboriginal Native Title Consultants -Muswellbrook Cultural Consultants -Upper Hunter Heritage Consultants -Hunter Valley Cultural Consultants -Bullem Bullem Heritage -Wanaruah Local Aboriginal Land Council -Yarrawalk Enterprises -Carrawonga Consultants (x 2) -Wonnarua Nations Aboriginal Corporation (x3) -Kayaway Eco-Cultural and Heritage -Hunter Valley Cultural Surveying -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Cacatua Cultural Consultants -Upper Hunter Wonnarua Council Inc -Valley Culture -Wanaruah Custodians (x 2) -Ungooroo Cultural & Community Services Incorporated -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation -Warren Taggart	Archaeology & Cultural Heritage Management Plan
15-November-12	
Invitations to and previous meeting minutes of the Aboriginal Community Consultative Forum. The correspondence was sent to: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants	ACCF

-Gidwaa Walang
-Wonnarua Culture Heritage
-Culturally Aware -Aboriginal Native Title Consultants
-Muswellbrook Cultural Consultants
-Upper Hunter Heritage Consultants
-Hunter Valley Cultural Consultants
-Bullem Bullem Heritage
-Wanaruah Local Aboriginal Land Council
-Yarrawalk Enterprises
-Carrawonga Consultants (x 2)
-Mingga Consultants
-Wonnarua Nations Aboriginal Corporation (x3)
-Kayaway Eco-Cultural and Heritage
-Hunter Valley Cultural Surveying
-Ungooroo Aboriginal Corporation
-Wattaka Cultural Consultants Services
-Cacatua Cultural Consultants
-Upper Hunter Wonnarua Council Inc
-Valley Culture
-Wanaruah Custodians (x 2)
-Ungooroo Cultural & Community Services Incorporated
-Wonn1 Contracting
-Hunter Valley Natural and Cultural Resource Management
-Hunter Valley Aboriginal Corporation