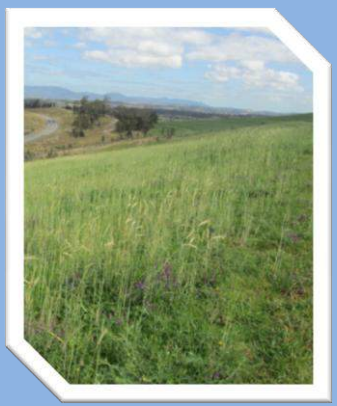
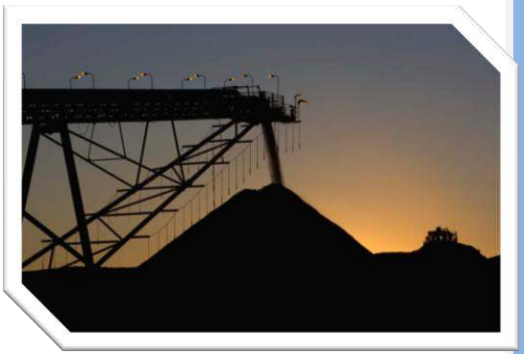
Ashton Coal Operations Pty Limited
Annual Environmental Management Report





2010/2011

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 2010
AEMR Completion Date:	1 September 2011
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** 30/3/12

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1.0 INTRODUCTION

The Ashton Coal Project (ACP) is located approximately 14km north-west of Singleton near the village of Camberwell. During the period of this Annual Environmental Management Report (AEMR), both the Open Cut and Underground mines have been in production, however at certain times during the reporting period they haven't been in full production due to approval delays.

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 has been developed in accordance with the conditions of Environmental Protection Licence No. 11879 and all relevant development consent conditions. 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.

Ashton Coal is owned by Yancoal Australia Limited (90%) and Itochu Corporation (10%) and operated by Ashton Coal Operations Pty Limited (ACOL).

This report covers the period 2 September 2010 to 1 September 2011. 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

An interim Mining Operations Plan (MOP) was submitted to the Department of Mineral Resources (now Department of Trade & Investment, Regional Infrastructure & Services – Mineral Resources and Energy (DTIRIS)) in August 2003, prior to the commencement of construction activities on site. The Open Cut MOP was approved in 2004 and subsequently modified in 2005. The Underground MOP was approved in 2006. A variation to the Underground MOP allowing the installation of a dewatering bore and ventilation bore was approved in March 2007. A combined Site MOP which incorporates both the Open Cut and Underground operations was approved on the 1 September 2008. The Site MOP superseded the Open Cut and Underground MOPs. The Site MOP covers the period 1 November 2007 to 31 December 2012.

ACOL received approval of development consent modification 309-11-2001-i (Mod 6) from the DoP&I on the 24 December 2010, allowing the diversion of Bowmans Creek. The modification will result in removing miniwall 5; replacing miniwall 6 with a full width longwall panel LW6B; replacing miniwalls 7 & 8 with two full width longwall panels LW7a and LW7B; removing miniwall 9 and renaming approved LW9 as LW8. The longwall methods will allow approximately a further 2.7Mt extraction of ROM coal from the Pikes Gully seam

On 15 June 2011 ACOL received approval of development consent modification 309-11-2001-i (M7) from the DoP&I. The approval as granted with conditions allowed for;

- the excavation of a 6ha area of the existing open cut pit floor to a depth of 15m to access an additional 100,000t of ROM coal, and
- the construction of 15 surface gas drainage wells along longwall panels 6B, 7A, 7B and 8.

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. **LEASES, LICENCES AND APPROVALS**

Detail	Granted	Authority	Area	Status	Expiry
PLANNING APPROVALS					
309-11-2001-i Development Consent	11/10/02	DoP&I ^	Schedule 1 of the Consent	Current	11/10/23
309-11-2001-i (M1) Modification to Development Consent (allows EPA to specify noise criteria in Table 5)	15/10/03	DoP&I	Schedule 1 of the Consent	Current	11/10/23
309-11-2001-i (M2) Modification to Development Consent (permits 10 m increase in height of EEA)	27/01/05	DoP&I	Schedule 1 of the Consent	Current	11/10/23
309-11-2001-i (M3) Modification to Development Consent (for the construction and operations of tailings pipelines between the mine and the former Ravensworth Mine)	19/02/07	DoP&I	Schedule 1 of the Consent	Current	11/10/23
309-11-2001-i (M4) 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 Mtpa)	26/03/10	DoP&I	Schedule 1 of the Consent	Current	11/10/23
309-11-2001-i (M6) Modification to Development Consent (Bowmans Creek Diversion)	24/12/10	DoP&I	Schedule 1 of the Consent	Current	11/10/23
309-11-2001-i (M7) Modification to Development Consent (NEOC Hebden seam extraction and Development of Gas Drainage Wells)	15/06/11	DoP&I	Schedule 1 of the Consent	Current	11/10/23
DA 144/1993 Amendment for use of Ravensworth Void 4 – Tailings Disposal. (held by Macquarie Generation)	25/05/07	SSC	NA	Current	NA
ML 1533	26/02/03	DTIRIS^^	883.4 ha	Current	26/02/24
ML 1529	17/09/03	DTIRIS	128.7 ha (sub surface)	Current	11/11/12
ML 1623	5/11/08	DTIRIS	26.17ha	Current	30/10/29

Table 1. Leases, Licences and Approvals cont'					
Detail	**Granted**	**Authority**	**Area**	**Status**	**Expiry**
Exploration Licence (EL) 5860	14/03/04	DTIRIS	272 ha	Current	21/05/12
Exploration Licence (EL) 4918	17/09/99	DTIRIS	370 ha	Current Renewal Application submitted	17/12/10
EPL 11879 (Open Cut Area and processing facilities)	02/09/03	OEH *	As shown on EPL 11879 Fig 1	S/S	S/S
Variation to EPL 11879 (established Construction Noise Criteria)	10/11/03	OEH	As above	S/S	S/S
Variation to EPL 11879 (modified dust sampling requirements)	28/02/05	OEH	As above	S/S	S/S
Variation to EPL 11879 (incorporation of UG mine)	17/11/05	OEH	ML1533	Current	NA
MINING OPERATIONS PLAN					
Interim MOP (for construction and initial 12 months operation of Open Cut & CHPP)	11/08/04	DTIRIS	N/A	S/S	S/S
MOP for Open Cut (for all associated life of mine activities)	22/07/04	DTIRIS	N/A	S/S	S/S
MOP Modification (for increase in EEA height & removal of WEA)	Jan 2005	DTIRIS	N/A	S/S	S/S
MOP Modification (for Glennies Creek Road Environmental Bund)	31/05/05	DTIRIS	N/A	SS	S/S
Interim Underground MOP (for first workings development)	20/12/05	DTIRIS	N/A	S/S	S/S
MOP for the Ashton Underground Mine (Development of underground operations for LW1-4 and associated facilities)	23/01/06	DTIRIS	N/A	S/S	S/S
Variation to the MOP for the Ashton Underground Mine	28/02/07	DTIRIS	N/A	S/S	S/S
MOP combining Open Cut and Underground operations	1/09/08	DTIRIS	N/A	Current	31/12/12
SUBSIDENCE MANAGEMENT PLAN					
Subsidence Management Plan (for the extraction of LW1–4)	08/03/07	DTIRIS	N/A	Current	Based on area not on year
Subsidence Management Plan (for the extraction of LW5–8)	02/07/09	DTIRIS	N/A	Current	Based on area not on year
Subsidence Management Plan (for the extraction of LW/MW 9)	18/06/10	DTIRIS	N/A	Current	Based on area not on year

Table 1. Leases, Licences and Approvals cont'					
Detail	**Granted**	**Authority**	**Area**	**Status**	**Expiry**
WATER ACCESS LICENCES					
WAL1358 / 20AL203056 Glennies Creek Supplementary 4ML	NA	OEH	NA	Current	NA
WAL15583 / 20AL204249 Glennies Creek General Security 354ML					
WAL8404 / 20AL200941 Glennies Creek High Security 80ML					
WAL997 / 20AL201311 Glennies Creek High Security 11ML					
WAL1120 / 20AL201624 Hunter River High Security 3ML					
WAL1121 / 20AL201625 Hunter River General Security 335ML					
WAL6346 / 20AL203106 Hunter River Supplementary 15.5ML					
20AL210986 Bowmans Creek Irrigation 366ML					
20SL042214 Bowmans Creek Irrigation 14ML					
WORKS APPROVALS					
20CA201565 Glennies Creek	1/07/04	OEH	NA	Current	11/03/19
20WA203822 Glennies Creek	14/12/07	OEH	NA	Current	13/12/17
20CA201626 Hunter River	1/07/04	OEH	NA	Current	7/04/19
GROUNDWATER LICENCES					
20BL136766 Stock Domestic	12/01/88	OEH	NA	Current	Perpetuity
20BL168848 Test Bore	27/08/03	OEH	NA	Current	Perpetuity
20BL168849 Test Bore	27/08/03	OEH	NA	Current	Perpetuity
20BL169508 Mining 10ML	15/03/05	OEH	NA	Current	14/03/15
20BL169937 Mining 100ML Objection lodged with NOW regarding modification to new condition statement 09/10	06/04/06	OEH	NA	Current	4/04/2012
20BL170596 Monitoring	16/10/06	OEH	NA	Current	Perpetuity
20BL171364 Mining 100ML	17/05/07	OEH	NA	Current	16/05/12
20BL172142 Test Bore	16/04/09	OEH	NA	Current	Perpetuity
20BL172143 Test Bore	16/04/09	OEH	NA	Current	Perpetuity
20BL172144 Test Bore	16/04/09	OEH	NA	Current	Perpetuity

Table 1. Leases, Licences and Approvals cont'					
Detail	**Granted**	**Authority**	**Area**	**Status**	**Expiry**
OTHER LICENSES					
Dangerous goods notification	17/08/09	Workcover	NA	Current	17/01/12
Licence to Sell/Possess radioactive sources 28485	19/06/09	OEH	NA	Current	18/06/12
Radiation Registration 1281	02/05/09	OEH	NA	Current	01/05/11
Radiation Registration 12903	16/01/08	OEH	NA	Current	16/01/12
Radiation Registration 12905	16/01/08	OEH	NA	Current	16/01/12
Radiation Registration 12906	16/01/08	OEH	NA	Current	16/01/12
Radiation Registration 21160	10/12/09	OEH	NA	Current	09/12/11
AHIMS Permit No 1591 to collect Aboriginal artefacts north of the New England Highway under S90 of NPW Act	21/07/03	OEH (NPWS)	239.8	Complete	21/07/08
AHIMS Permit No 2783 to collect Aboriginal artefacts EWA86 under S90 of NPW Act	28/09/07	OEH (NPWS)	NA	Complete	NA
AHIMS Permit No 1130976 to collect Aboriginal artefacts EWA86 under S90 of NPW Act	26/9/11	OEH (NPWS)	Western UG area	Current	26/9/31
Part 3A permit No P1819 to install two power poles near Bowmans Creek	05/12/03	OEH	N/A	Current	05/12/04
Permit No CW802609 to construct levee bank on Bowmans Creek	08/09/03	OEH	N/A	Current	07/09/13
Clause 88(1) approval for safe operations and stability of workings and resource recovery longwall mining	28/02/07	DTIRIS	N/A	Current	1/06/2011
S126 Approvals for emplacement of carbonaceous materials Ashton Open Cut	08/04/04	DTIRIS	N/A	Current	NA
S126 Approvals for emplacement of carbonaceous materials Ravensworth Void 4	17/01/07	DTIRIS	N/A	Current	NA

^ Department of Planning & Infrastructure (DoP&I)
^^ Department of Trade & Investment, Regional Infrastructure & Services (DTIRIS)
** Office of Environment & Heritage (OEH)*

S/S – superseded
N/A – Not available
TBA – To be advised

1.2 MINE CONTACTS

Positions of responsibility for operations and environment are detailed hereunder:
Brian Wesley has overall responsibility for the operational and development phases of the project.

During the reporting period David Gibson replaced Hugh Drummond as Underground Mine Manager and Ian McTaggart replaced Paul Davis as Declared Plant Manager. Lisa Richards is responsible for day-to-day environmental management and community relations and is the nominated Environmental Manager for the project. ACOL's Board of Directors has ultimate responsibility for Ashton's environmental performance.

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	Declared Plant Manager	(02) 6570 9148
Environment	L. Richards	Environment and Community Relations Manager	(02) 6570 9219
Environmental Contact Line			1800 657 639

1.3 ENVIRONMENTAL MANAGEMENT PLAN UPDATE

In consultation with DoP&I there were no Environmental Management Plans updated during the AEMR period, this was due to the ongoing assessment of the South East Open Cut.
During the next reporting period there will be a major update on ACOL management plans, for a proposed list and timeline see section 7.0 Activities proposed in the next AEMR period.

1.4 ENVIRONMENTAL AUDITING

Under condition 9.2 of DA 309-11-2001-i ACOL is required to undertake 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 2011 an internal audit was undertaken with incorporated a review of the findings and actions required from the previous year's external compliance audit. Only one non-compliance was identified during the Internal Environmental Audit this was related to Environmental Management Plan review during the 2010-11 reporting period and is presented in

Table 3. INTERNAL ENVIRONMENTAL AUDIT – NON-COMPLIANCES

Condition	Description	Comments
3.6	*"Environmental management plans are to be reviewed, and updated as necessary, at least every 5 years or as otherwise directed by the Director-General, in consultation with the relevant government agencies. Plans shall reflect changing environmental circumstances and changes in technology or best-practice management procedures".*	In consultation with DoP&I there were no Environmental Management Plans updated during the AEMR period, this was due to current ongoing assessment of a Major Project associated with the ACOL project. During the next reporting period there will be a major update on ACOL management plans.

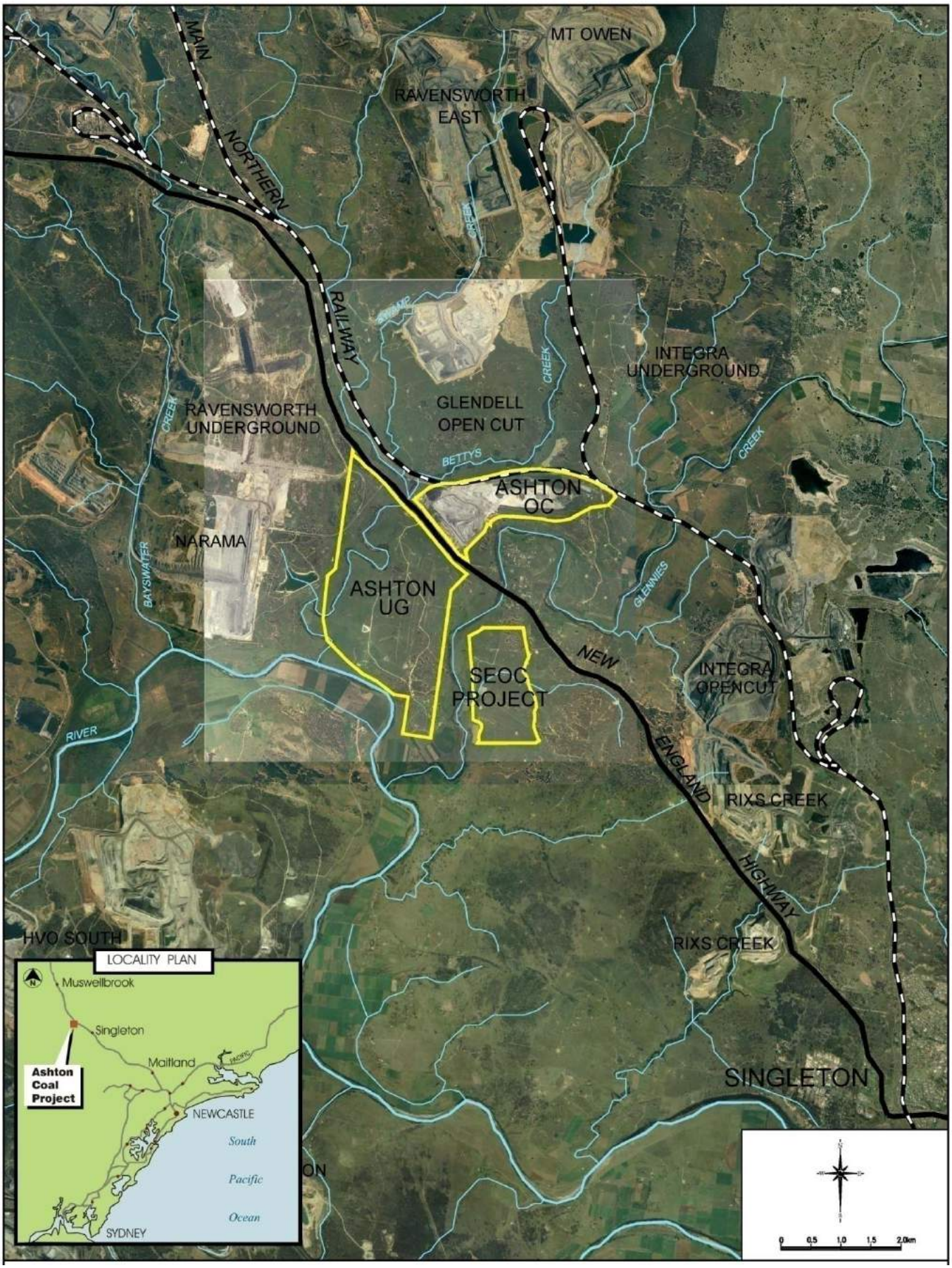

Figure 1. Ashton Coal Location Plan

2.0 OPERATIONS DURING THE REPORTING PERIOD

2.1 EXPLORATION

Mining Lease 1533

- Open Cut - No exploration activities were undertaken.
- Underground - 14 holes (5 cored holes and 9 open holes)

Exploration Licences 5860 & 4918

- Area being assessed - No exploration activities were undertaken.

2.2 LAND PREPARATION

No clearing was undertaken during the reporting period.

2.3 CONSTRUCTION

2.3.1 Underground

During the reporting period ACOL drilled one surface goaf drainage hole above Longwall 6A and a further three holes above Longwall 7A. The holes were drilled, lined with a pressure rated steel casing to the base of the Lemington seams and open holed to within approx 20m of the Pikes Gully seam. 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 four 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 fringe 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, once finalised, was fenced to prevent stock and unauthorised personnel interaction with the active or unused hole.

Within the Underground, an inter-seam drift was commenced and completed during the reporting period. The drift was driven from the Pikes Gully seam to the Upper Liddell seam and includes a transport drift, conveyor drift (for coal clearance) and cut-throughs. Drivage was undertaken using a contract crew using a contract Mitsui S200 roadheader.

Figure 2. Typical layout of the goaf drainage plant

2.3.2 Coal Handling and Preparation Plant

No construction was undertaken in the CHPP during the reporting period.

2.3.3 Open Cut

No construction was undertaken in the Open Cut operations during the reporting period

2.4 MINING

2.4.1 Estimated Mine Life

The life-of-mine plan for the North East Open Cut Mine will cease open cut mining operations by the end of September 2011.

The Underground Mine has now been operating since December 2005. The expected mine life is until 2025.

2.4.2 Mine Production and Mining Constraints

2.4.2.1 Geology

The major coal seams identified at Ashton are (in descending stratigraphical order); the Lemington, Pikes Gully, Arties, Upper Liddell, Middle Liddell, Upper Lower Liddell, Lower Lower Liddell, Upper Barrett, Lower Barrett and Hebden seams.

The strata within the Foybrook Formation comprises in order of predominance, fine to coarse grained sandstone, siltstone, conglomerate, mudstone, shale and coal. The top of the formation corresponds with the base of the overlying Bulga Formation which in turn is overlain by the Archerfield Sandstone and Jerrys Plains Sub group respectively. The later includes the Bayswater Seam that has been mined in the adjacent Ravensworth development. Only a remnant portion of the Bayswater seam exists in the far western part of the project area.

The principal structural feature of the project area is the Camberwell Anticline. The axis of this structure trends along the eastern boundary of EL4918. The coal seams of principal interest subcrop along the eastern part of the mining area. These subcrops define the westerly dipping limb of the Camberwell Anticline. In the north eastern part of the project area the formation is folded around the axis of the Camberwell Anticline. At this location the formation is more steeply inclined, up to 22 degrees on the eastern limb, with a flatter dip of less than 10 degrees on the western limb. As mining has progressed minor faulting has been detected sub parallel with, and adjacent to, the crest of the anticline in the open cut operation. This faulting is predominantly reverse faults formed in conjunction with the Camberwell Anticline.

During the period minor north-south trending normal faults have been intersected in the underground longwall panels. Small scale compression structures have also been encountered in the north-west development panel.

Total geological resources within Ashton was 333 Million tonnes (Mt) at the end of June 2011. Of this quantum, 152 Mt is measured and 146 Mt indicated. Coal resources have been assessed from the in-situ coal inventory and have been further segregated on the basis of Underground or Open Cut development potential.

2.4.2.2 Open Cut

Seams

The seams targeted during Open Cut operations (in descending order) are as follows:

- *Pikes Gully;*
- *Upper Arties;*
- *Arties;*
- *Upper Liddell;*
- *Middle Liddell;*
- *Upper Lower Liddell;*
- *Lower Lower Liddell;*
- *Upper Barrett;*
- *Upper Barrett Split;*
- *Lower Barrett Split;*
- *Lower Barrett; and*
- *Hebden.*

Coal Analysis

An assessment of the ROM coal that is recovered from the Open Cut mine found that it generally has an ash content of 12% to 32%. Following processing in the CHPP, steaming and semi soft coking coal is produced for the export market and sized raw coal for domestic consumption. Analysis of the recoverable coal revealed significant proportions of Vitrinite and low amounts of elements such as sulphur, chlorine and phosphorous.

Coal Reserves

The Open Cut is encompassed by ML 1533 which covers an area of 883 hectares (ha) and by the end of September 2011 all extractable coal reserves will have been mined.

Mining Constraints

Significant mining constraints in the Open Cut operation include:

- The proximity of the village of Camberwell to the site;
- The location of the Main Northern Railway;
- Glennies Creek Road; and

Geological conditions that limit the area available for Open Cut mining

Mining Operations

The Ashton North East Open Cut will cease mining operations in September 2011. The Open Cut operates a fleet of hydraulic excavators and associated haul trucks along with support equipment consisting of watercarts, dozers and graders. Overburden is drilled and blasted prior to removal by the excavators. Overburden between seams is typically 15 – 20 m thick. Coal is usually free-dug by excavator or windrowed by dozers prior to loading in the case of thinner seams.

The Open Cut mine design has been 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 has been progressively changed to east-west strips and mining from north to south. This concentrates 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 minimises hauling of overburden along the southern boundary of the pit and concentrates most of the mining and hauling at levels below the environmental bund for longer periods. Mining is currently situated in the southeast zone with dumping also occurring in this area. The remaining void at the southern end of the operation will be progressively filled with CHPP reject from the continuing Underground operation.

Rehabilitation has continued on the northern face of the RL 135 dump during this reporting period. A total of 9.53ha of rehabilitation was carried out in the reporting period. This occurred on both the northern and southern slopes of the RL135 dump where pasture seed was applied at 45kg/ha with fertiliser at 200 kg/ha. OGM was applied to all areas at 100t/ha.

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

Hours of Operation

Under the conditions of the Development Consent and EPL11879, Open Cut mining operations are limited to the hours of 7:00 am to 10:00 pm, Monday to Saturday and 8:00 am to 10:00 pm on Sundays and public holidays. Hauling of reject material within the Open Cut pit area, operation of water carts and maintenance of equipment may be undertaken 24 hours a day, 7 days a week.

Equipment Fleet

Mining of overburden and coal is conducted using hydraulic excavators supported by a range of trucks and other ancillary equipment.

The Open Cut mining fleet at Ashton consists of the equipment as outlined in **Table 4**.

Table 4. OPEN CUT AND CHPP MINING EQUIPMENT

Number	Description	Number	Description
2	Liebherr 994B excavators	4	Cat D10T dozer
1	Liebherr 994 excavator	2	Cat D10R dozer
9	Komatsu 630E trucks	1	Cat D8R dozer
3	Komatsu 730E trucks	2	Cat 16H grader
2	Cat 789 trucks	1	Komatsu WA 600 wheel dozer
3	Cat 777 water trucks	1	Cat 994 wheel loader
1	Atlas L8 hammer drill	2	Cat 938 wheel loader
1	Atlas PM275 rotary drill	2	Cat 992G wheel loader
1	CAT 950E	1	Cat 992C wheel loader

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.

2.4.2.3 Underground

At the end of September 2011, the Underground Mine had Reserve of 43.3Mt, of which 19.4Mt was proved and 23.9Mt was probable. The mining plan includes sequential mining of the Pikes Gully, Upper Liddell, Upper Lower Liddell and the Lower Barrett coal seams. Underground development commenced on the 21st of December 2005.

The subsidence requirements of the development consent and the subsidence guidelines of DTIRIS have been merged. The SMP for Longwalls 1 to 4 was approved in February 2007. The original SMP for Longwalls 5 & 6 and Miniwalls 7 & 8 was approved in June 2009 which included the undermining of sections of Bowmans Creek using miniwall mining. On the 18 June 2010 ACOL received SMP approval for LW/MW 9 which has a width of 123m due to mining lease boundary constraints. Longwall 9 will not undermine any section of the current or proposed Bowmans Creek channel or 40m high bank offset.

ACOL received approval of development consent modification 309-11-2001-i (Mod 6) from the DoP&I on the 24 December 2010, allowing the diversion of Bowmans Creek. The modification will result in removing miniwall 5; replacing miniwall 6 with a full width longwall panel LW6B; replacing miniwalls 7 & 8 with two full width longwall panels LW7a and LW7B; removing miniwall 9 and renaming approved LW9 as LW8. The longwall methods will allow approximately a further 2.7Mt extraction of ROM coal from the Pikes Gully seam.

On the 21 March 2011, ACOL received SMP approval to replace Miniwalls 7 and 8 with a reduced length longwall block of width 187m. The length of Longwall 7A was determined by the condition that no undermining of Bowmans creek or a 40m offset was to occur. ACOL has applied to vary the Miniwall 7 and 8 approval further to allow extraction of the outbye coal resource referenced

Longwall 7B 'Short'. This panel is expected to contain similar conditions to the approved Longwall 7A panel.

Longwall extraction within this reporting period included the remaining Longwall 6A panel and Longwall 7A. Longwall 6A extraction was completed on the 22 November 2010 while Longwall 7A extracted from the 22 February 2011 to the 5 August 2011. Development undertaken included the completion of Maingate 9, longwall facelines for LW6B, LW7B and LW7B 'short' and pit bottom development in the Upper Liddell seam.

Ashton Underground Mine has approval to operate 24hrs a day 7 days a week. At this stage mining production activities are undertaken on a five day week basis. Additional crews are available on the weekend for maintenance and services support. Underground equipment is listed in **Table 5**.

Table 5. **UNDERGROUND EQUIPMENT**

Number	Development	Number	Production
4	Joy 12CM 12B	1	Eickhoff SL750 DERDS
4	Joy Shuttle Car	120	Bucyrus 2 leg shield
1	Joy FX240 roof bolting miner mounted rigs	1	Bucyrus face conveyer (AFC)
2	Stamler Breaker Feeders	1	Bucyrus stage loader
2	Boot Ends	1	Bucyrus coal crusher
1	Contract road header	2	Contract Eimco LHD's
1	QDS platform roof/rib bolter		
Number	**Ancillary**	**Number**	**Ancillary**
10	PJB Mk4.5 Man transports	1	Ballast trailer
8	Jug-A-O LHD's	5	Rambor portable roof bolters
1	Airtrak - Coalroc	1	QDS platform rib bolter - Coalroc
2	Flaktwoods 315kW centrifugal fans	3	21m^3/s auxiliary ventilation fans
1	1600mm stacker conveyor (single VVVF drive)	3	Integral Rand 160 – 1000cfm air compressors
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)	105,758	115,288	125,288
Overburden (bcm)	67,434,057	71,123,023	71,266,788
Open Cut ROM Coal (t)	12,388,329	13,206,302	13,245,331
Underground ROM Coal (t)	9,739,802	11,491,515	14,039,063
Total ROM Coal (t)	22,128,131	24,697,815	27,284,392
Processing Waste (t)	8,402,110	9,523,687	10,644,878
Open Cut Product Coal (t)	7,583,945	8,057,750	8,088,164
Underground Product Coal (t)	5,687,590	6,661,892	8,096,864
Total Product Coal (t)	13,271,535	14,719,642	16,185,028

2.4.4 Changes in Mining Equipment or Method

During this period there were no changes in mining equipment or methods.

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 2.58Mt ROM coal during the reporting period to produce 1.45Mt of semi-soft product 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 overburden dump for disposal. A total of 765Kt 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 369Kt of fine reject material was pumped to the Mac Gen tailings dam during the period.

2.6.1 Chemical/Physical Characteristics of Residues

Coarse rejects are generally mudstones and claystones, with some sandstones, and generally contain minimal amounts of carbonaceous material.

The fine rejects contain finely disseminated clays and mudstone, which have been flocculated using a relatively inert chemical. It contains a higher concentration of carbonaceous material than the coarse reject.

2.6.2 Handling and Disposal Procedures

Procedures for the disposal of both coarse and fine reject material are contained in the MOP and the Tipping Rules developed by the Open Cut Mine Manager.

2.6.3 Monitoring and Maintenance of Containment Facilities

All coarse reject material is disposed of within the Eastern Emplacement Area and covered with inert overburden material.

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

2.6.4 Sewage Treatment/Disposal

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

1. Underground mine bathhouse and administration building combined, which treats the waste from 48 showers, 14 WC's, 11 hand basins and 2 sinks. 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, which treats waste from 25 showers, 11 WC's, 8 hand basins and 3 sinks. The sewage treatment system is an Envirocycle type with disposal of the treated effluent by spray irrigation.

3. Open cut mine workshop which treats 4 showers, 4 WC's, three hand basins and a sink. The sewage treatment system is an Envirocycle type with disposal of the treated effluent by spray irrigation.

2.6.5 Total Site Waste Management Program

Ashton Coal has contracted Transpacific Industries to operate a total waste management program. The key objective of the program is to reduce waste to landfill by 20% over the first 5 years. 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 which is discussed in Occupational Health, Safety and Environment meetings. Where heavy contamination is identified, the WMO or Ashton Environmental Coordinator will provide a toolbox talk to the relevant employees to increase awareness of the problem.

Waste tracking is also completed by Transpacific with data provided in the monthly reports.

2.6.6 Waste Stream Volumes

The waste stream volumes are shown in **Table 7** below and **0** 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 2010 – AUGUST 2011**

Waste Stream	Volume (kg)^
General Waste (kg)	296,220
Contaminated Rags – Hydrocarbons (kg)	1,560
Effluent (kg)	25,500
Scrap Metal (kg)	151,990
Waste Oil (kg)	151,900
Oil Filters (kg)	2,240
Timber (kg)	93,160
Paper & Cardboard (kg)	12,290
Batteries - Lead Acid (kg)	5,510

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

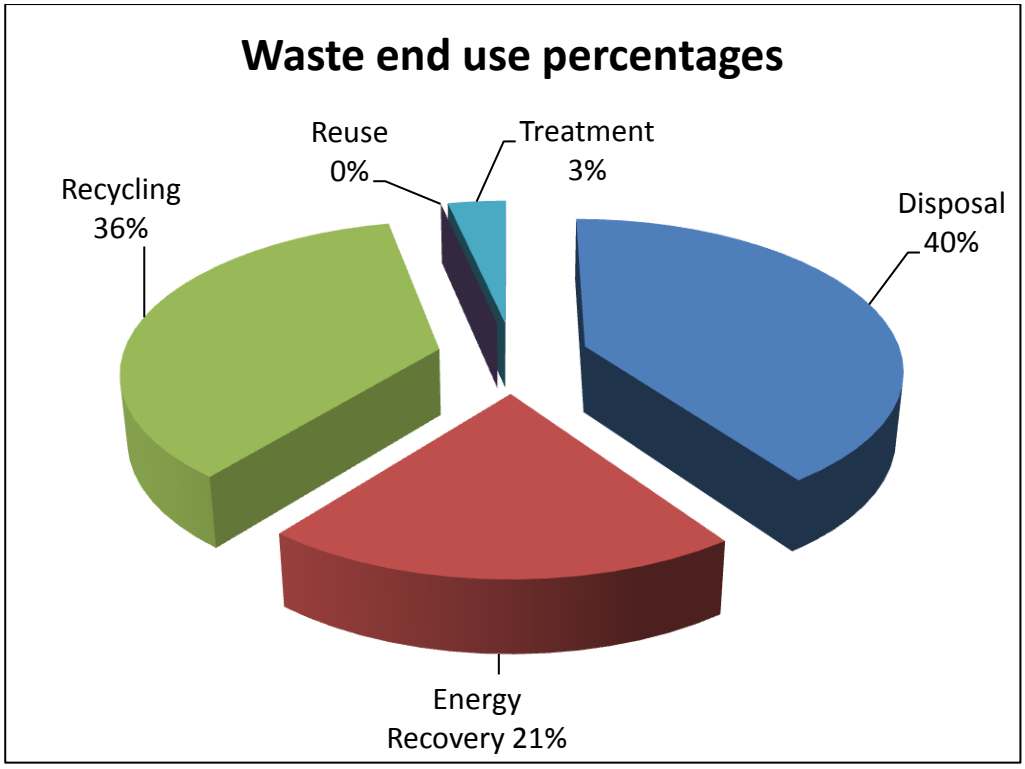

Figure 4. Waste end use percentages

2.7 ROM COAL AND COAL PRODUCT STOCKPILES

Both ROM coal and product coal are stockpiled adjacent to the CHPP. During the reporting period the Open Cut ROM pad was mined to the Arties seam and then partially filled back in. During this time a remote ROM stockpile was established on the edge of the product stockpile to a size of 20Kt. The ROM coal pad for the Underground was extended during the back fill of the Arties pit and is now 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. No changes are envisaged to this mode of transport.

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 2010-11 water year and the current 2011-12 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.

During 2006-2007 an extensive metering network was installed across site to enable detailed monitoring of all water movements. In 2008 Worley Parsons completed a water balance model for the site which has now been calibrated against three years of real site data. This model allows for future water management planning. Site water balances are presented in **Table 10** and **Table 11** for the periods 1 September 2010 to 28 February 2011 and 1 March 2011 to 31 August 2011 respectively. As detailed in **Table 10**, the initial 6 month period experienced below average rainfall with 275mm recorded. This rainfall was reasonably dispersed throughout the period, with no significant runoff producing events. There were reductions in water use at the CHPP, water carts and pumping from Hunter River and Glennies Creek due to reduced production rates during this period. All other water inflows and outflows were close to historical averages, with no water surpluses or deficits experienced.

As detailed in **Table 11** , the second half of the reporting period experienced well above average rainfall with 421mm recorded. A significant rainfall event that comprised 92mm of rain over a five day period occurred in mid June. Anecdotally, this was a 2 to 3 year Average Recurrence Interval event in the Hunter Valley. This resulted in 145ML of rainfall runoff and a sharp increase in stored water onsite. This was mitigated by exporting 65ML to the Ashton Coal Tailings storage facility for storage and reducing water imported from Glennies Creek Underground Mine and extraction from the Hunter River and Glennies Creek. There were reductions in water use at the CHPP, water carts and extraction from Hunter River and Glennies Creek and then an increase of dewatering the open cut pit due to the higher rainfall and reduced production rates during this period. All other water inflows and outflows were close to historical averages, with no water surpluses or deficits experienced.

Table 8. BALANCE OF LICENSED WATER DRAW FROM GLENNIES CREEK

Month	Total Volume Pumped	Underground Seepage	Total Volume Extracted (Total Volume + Underground seepage)	Cumulative Total	Available Water Determination	Total Licensed ML	Drawdown from Total Licensed ML
A	B	C	D	E	F	G	H
			= A + B	= cum D			= G - E
2010-11 Water Year							
Jul-10	16.7	4.9	21.7	21.7	100% GS & HS, 10% CO	480.4	458.7
Aug-10	20.3	5.1	25.4	47.1	100% GS & HS, 10% CO	480.4	433.3
Sep-10	26.9	4.8	31.6	78.7	100% GS & HS, 10% CO	480.4	401.7
Oct-10	41.0	5.8	46.7	125.4	100% GS & HS, 10% CO	480.4	355.0
Nov-10	7.9	4.8	12.6	138.1	100% GS & HS, 10% CO	480.4	342.3
Dec-10	8.4	5.8	14.1	152.2	100% GS & HS, 10% CO	480.4	328.2
Jan-11	14.4	4.6	19.0	171.2	100% GS & HS, 10% CO	480.4	309.3
Feb-11	6.1	4.9	11.0	182.0	100% GS & HS, 10% CO	480.4	298.3
Mar-11	7.7	4.9	12.7	194.8	100% GS & HS, 10% CO	480.4	285.6
Apr-11	19.3	5.6	24.9	219.7	100% GS & HS, 10% CO	480.4	260.7
May-11	36.8	5.1	41.9	261.7	100% GS & HS, 10% CO	480.4	218.8
Jun-11	8.7	5.4	14.1	275.7	100% GS & HS, 10% CO	480.4	204.7
Total at end of Water Year	**214.0**	**61.7**	**275.7**	**275.7**		**480.4**	**204.7**
2011-12 Water Year							
Jul-11	44.5	4.9	49.5	49.5	100% GS & HS, 10% CO	480.4	430.9
Aug-11	9.1	5.1	14.2	63.7	100% GS & HS, 10% CO	480.4	416.7

GS – General Security
HS – High Security
CO – Carry Over

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
2010-11 Water Year					
Jul-10	11.5	11.5	100% GS & HS, 10% CO	371.5	360.0
Aug-10	2.4	13.9	100% GS & HS, 10% CO	371.5	357.6
Sep-10	23.4	37.4	100% GS & HS, 10% CO	371.5	334.1
Oct-10	22.6	60.0	100% GS & HS, 10% CO	371.5	311.6
Nov-10	3.3	63.2	100% GS & HS, 10% CO	371.5	308.3
Dec-10	11.3	74.4	100% GS & HS, 10% CO	371.5	297.1
Jan-11	26.2	100.6	100% GS & HS, 10% CO	371.5	270.9
Feb-11	17.2	117.9	100% GS & HS, 10% CO	371.5	253.7
Mar-11	3.0	120.8	100% GS & HS, 10% CO	371.5	250.7
Apr-11	4.9	125.7	100% GS & HS, 10% CO	371.5	245.8
May-11	13.3	139.0	100% GS & HS, 10% CO	371.5	232.5
Jun-11	3.5	142.5	100% GS & HS, 10% CO	371.5	229.0
Total at end of Water Year	**142.5**	**142.5**		**371.5**	**229.0**
2011-12 Water Year					
Jul-11	2.8	2.8	100% GS & HS, 10% CO	371.5	368.7
Aug-11	4.3	7.1	100% GS & HS, 10% CO	371.5	364.4

GS – General Security
HS – High Security
CO – Carry Over

Table 10. WATER BALANCE RESULTS FROM 1 SEPTEMBER 10 TO 28 FEBRUARY 11		
Rainfall Over Period	275mm	
Stored Water at Start of Period	103 ML	
Stored Water at End of period	104 ML	
Change in Storage	+1 ML	
Water Movements	**Total Flow Over Period (ML)**	**Average Daily Flow (ML/day)**
Water Inflows		
• Rainfall Runoff (estimated)	70	0.39
• Hunter River Extraction (measured)	103	0.57
• Glennies Creek Extraction (measured)	107	0.59
• Inflow from Glennies Creek Mine (measured)	261	1.44
• Pump out from open cut (estimated)	63	0.35
• Net Water make from underground operation (measured)	78	0.43
Total Inflows	**682**	**3.77**
Water Outflows		
• Dust Suppression (estimated)	190	1.05
• Coal Processing Plant (measured)	412	2.28
• Ashton Tailings Dam (metered)	38	0.21
• Evaporation Losses (estimated)	40	0.22
Total Outflows	**681**	**3.76**
Inflows – Outflows	**1**	**0.01**

Table 11. WATER BALANCE RESULTS FROM 1 MARCH 11 TO 31 AUGUST 11		
Rainfall Over Period	421mm	
Stored Water at Start of Period	104 ML	
Stored Water at End of period	138 ML	
Change in Storage	+34 ML	
Water Movements	**Total Flow Over Period (ML)**	**Average Daily Flow (ML/day)**
Water Inflows		
• Rainfall Runoff (estimated)	239	1.30
• Hunter River Extraction (measured)	33	0.18
• Glennies Creek Extraction (measured)	134	0.73
• Inflow from Glennies Creek Mine (measured)	140	0.76
• Pump out from open cut (estimated)	101	0.55
• Net Water make from underground operation (measured)	76	0.42
Total Inflows	**723**	**3.93**
Water Outflows		
• Dust Suppression (estimated)	119	0.65
• Coal Processing Plant (measured)	398	2.17
• Ashton Tailings Dam (metered)	150	0.82
• Evaporation Losses (estimated)	22	0.12
Total Outflows	**689**	**3.75**
Inflows – Outflows	**34**	**0.18**

2.9 HAZARDOUS MATERIAL MANAGEMENT

2.9.1 Fuel Containment

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.

3.0 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

3.1 AIR POLLUTION

3.1.1 Air Pollution 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;
- ACOL has developed protocols involving specific operational controls when the wind is 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;
- The active mining area continues to be minimised.

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. Operations are managed in response to real time air quality and weather data measured within the village and surrounds in accordance with set protocols. Other controls include 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 exceedences, 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 9.53ha of the Eastern Emplacement Area was rehabilitated,

There are daily operational changes which are undertaken as standard practice by the Open Cut Examiner, and CHPP supervisors. These are based on standard scenarios of pit and weather conditions and/or response to complaints. These standard controls are listed above and are inclusive of moving operations within the pit, operation of additional water carts and stockpile water sprays. In addition to these standard scenario controls other higher level operational changes may be undertaken on site at the discretion of the Mine Manager in consultation with the Environmental Officer. These additional higher level operational changes are listed in **Table 12.** Things that may be considered higher level controls include cancellation or change of blast times and shutting down of pit operations.

Table 12. OPERATIONAL CHANGES RELATING TO DUST IMPACTS

Date	Issue	Changes Undertaken
13/09/2010	PM10 10minute dust averages in village starting to climb up.	Moved trucks hauling to high dumps down to the lower dumps in the pit
15/09/2010	PM10 10minute dust averages in village starting to climb up.	Moved trucks hauling to high dumps down to the lower dumps in the pit
16/09/2010	8.3m/s WNW gusty winds.	Blast postponed to Friday 17th at 12:30pm
25/09/2010	Increasing high PM10 10 minute average readings, Due to operational area constraints 3 diggers working close to each other next to the eastern highway, drills were kicking up dust when starting a hole.	Environmental Manager called OCE at 7:30 - OCE checked everything and moved some trucks to lower dumps in pit. Checked drills they had water but they were still kicking up dust when starting a hole, Ensured that all diggers are dropping low in trucks. Dust levels dropped for about 30min then picked back up EM called OCE at 8:30 - OCE shut down 2 drills and moved 1 digger to coal.
27/09/2010	Increasing high PM10 10 minute average readings, Due to operational area constraints 2 diggers working close to each other next to the eastern high wall and the overburden dump was also near the eastern highwall.	Relocated the dump location, PM10 10 minute average reading decreased to be well within compliance.
28/09/2010	Increasing high PM10 10 minute average readings, Due to operational area constraints 2 diggers working close to each other next to the eastern high wall.	Already being implements at the time of the review was, the area in front of one of the diggers iwas being ripped with a dozer and then heavily watered prior to being dug. This wets the material prior to it being loaded and reduces dust generation. Unfortunately due to the dig method of the second digger this ripping and wetting method is not possible. The face of the dump is being heavily watered in the area they are dumping to reduce the amount of dust being generated during dumping.
28/09/2010	PM10 10 minute average readings continuing to increase.	Shut down digger 19 at 1800.
13/10/2010	Dumping on 135 dump.	Moved trucks from 135 dump to dump lower in the pit.
14/10/2010	Predicted high winds from weather website.	Blast for Friday has been postponed until Saturday morning.
15/10/2010	Predicted high winds from weather website.	Blast postponed until 12.30pm Monday when wind speeds will be lower.
8/11/2010	High wind speed and direction.	Blast postponed til Tuesday 9/11/10 at 9:30am.
22/11/2010	Loading issues in the pit.	Blast postponed til Tuesday 23/11/10 at 12:30pm.
9/12/2010	Winds getting towards 10m/s.	OCE changed location of trucks dumping from the RL135 to in the pit.
11/12/2010	Increasing winds with trucks dumping at RL130.	Moved trucks from the RL130 dump back to the Buttress dump inpit at 3pm.

Table 12. OPERATIONAL CHANGES RELATING TO DUST IMPACTS

Date	Issue	Changes Undertaken
13/12/2010	Increasing winds with trucks dumping at RL130.	Moved trucks from the RL130 dump back to the Buttress dump inpit at 7:30pm.
18/12/2010	NW winds predicted to be high for the day.	Environmental Coordinator discussed with OCE at morning meeting to keep truck dumping inpit and not use the top dumps due to the predicted high NW winds.
1/03/2011	NW winds, planned to start galinea weed stripping works on the southern side of the RL 135 dump.	Due to the NW winds Environmental Coordinator decided to start the dozer on the north/eastern end to start off galinea works up that end.
3/03/2011	NW winds, planned to continue with the galinea weed stripping works on the southern side of the RL 135 dump.	Due to the NW winds Environmental Coordinator relocated dozer to north/eastern end to finish off galinea works up that end and then moved onto rock raking on the current rehab on the north side of the RL135 dump.
14/03/2011	Proactive movement to reduce noise and dust in the village, NW winds.	Rehabilitation contractors spoke with Environmental Coordinator prior to start up regarding which rehabilitation area to work on for the day, due the NW winds they decided to work on the northern slope of the RL135 dump until the wind changed around to the east before moving over to the southern slope.
24/03/2011	High NW winds and planned blast at 12pm.	Blast postponed until Friday 25th march due to technical and environmental issues.
30/03/2011	Proactive movement to reduce noise, dust and smell in the village, NW winds.	Environmental Coordinator spoke with Rehabilitation contractors prior to start up regarding which rehabilitation area to work on for the day, due the NW winds and spreading the compost they decided to work on the northern slope of the RL135 dump until the wind changed around to the east before moving over to the southern slope.
5/07/2011	Strong winds, increasing dust levels.	Environmental Coordinator spoke with Open Cut Mine Manager they decided to start up second water for in the pit, resulting in 2 large watercarts for 1 digger and 3 trucks in the pit, another smaller water cart was watering the surrounding areas around the pit.
7/07/2011	Strong winds, winds greater than 10m/s.	Blast postponed until Friday 8 July at 9:30am

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 in the village of Camberwell and at the Repeater Station on the ridge above the village (see **Figure 10**). The repeater station is the primary meteorological station from which wind direction and speed are assessed for mine operation purposes, whilst Location 1 is primarily 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**. Annual rainfall for the period was above the long term median for Singleton NSW, with nearly an inch more than the average. A drier period was experienced throughout the three summer months of the reporting period. Whereas during autumn and early winter there were consistent falls of rain resulting in nearly double the average totals for that period, 355.2mm to 197.2mm respectively.

Table 13. **RAINFALL DATA 2010-2011**

Month	Rainfall (mm)	Long Term Median Rainfall *(mm)
Sep-10	24.6	50.4
Oct-10	58.6	34.5
Nov-10	92.2	64.6
Dec-10	33.6	83.4
Jan-11	25.0	69.6
Feb-11	35.6	94.7
Mar-11	90.2	68.5
Apr-11	54.0	41.3
May-11	78.6	43.6
Jun-11	132.4	43.8
Jul-11	17.4	40.8
Aug-11	43.8	31.5
Total	**686.0**	**666.7**

Wind Speed and Direction

Observed wind patterns for the period are outlined in **Table 14** and seasonal windroses are shown in **Figure 5, Figure 6, Figure 7** and **Figure 8.**

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.

Table 14. WIND PATTERNS BY MONTH 2010- 2011	
Month	**Primary Wind Direction (Quadrant)**
September	NW
October	SE
November	SE
December	SE
January	SE
February	SE
March	SE
April	SE
May	NW
June	NW
July	NW
August	NW

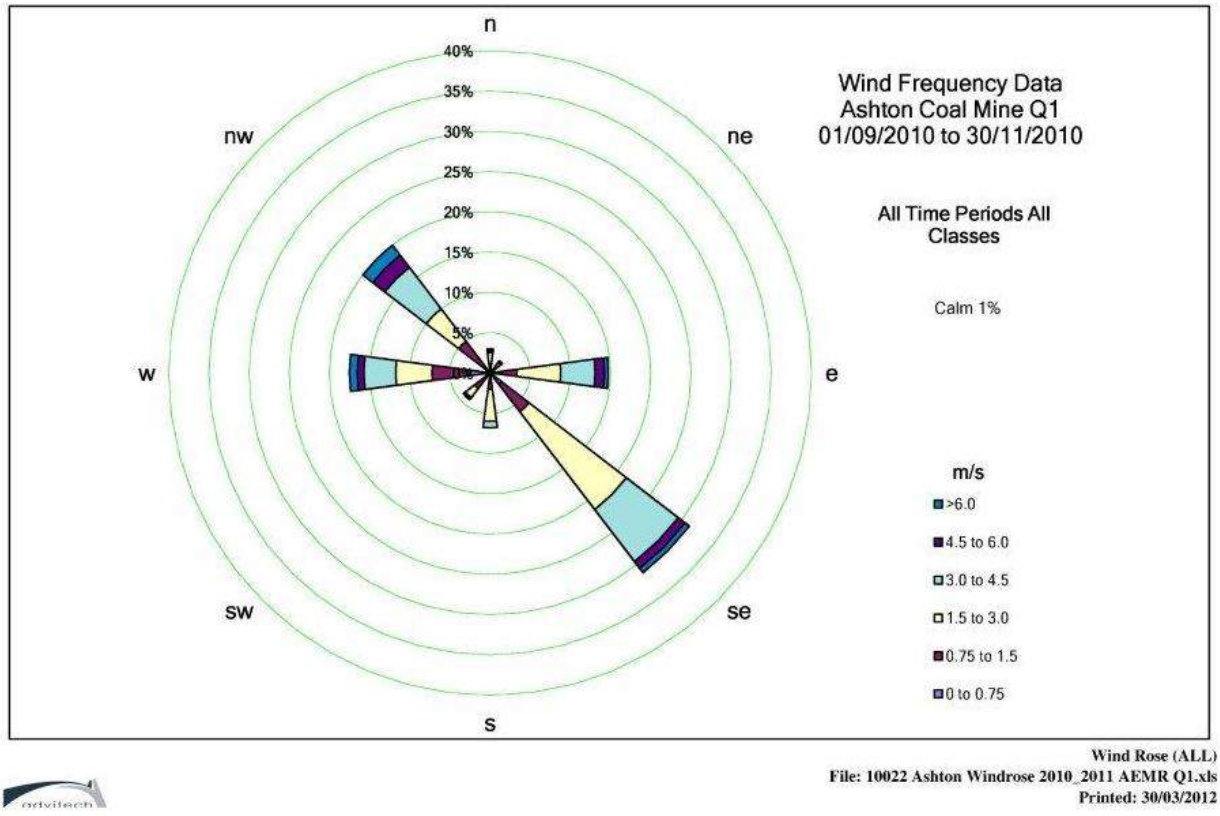

Figure 5. Quarter 1 Windrose

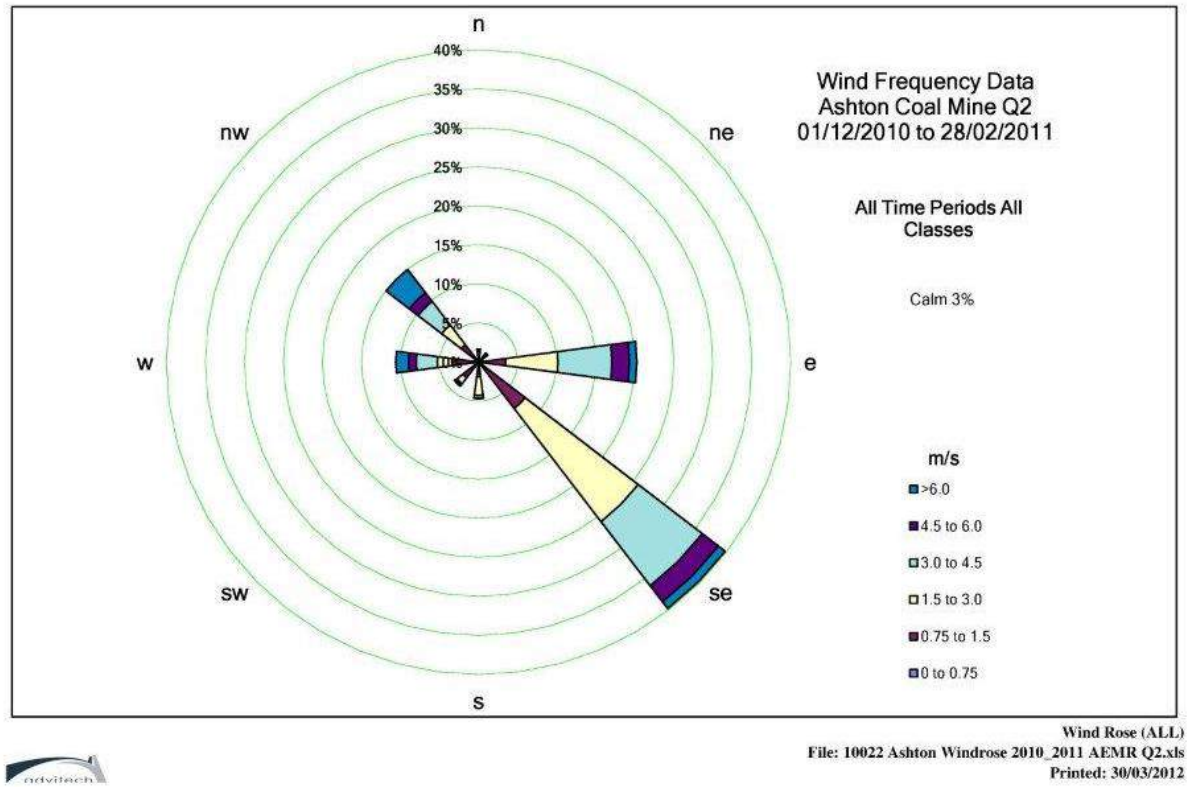

Figure 6. Quarter 2 Windrose

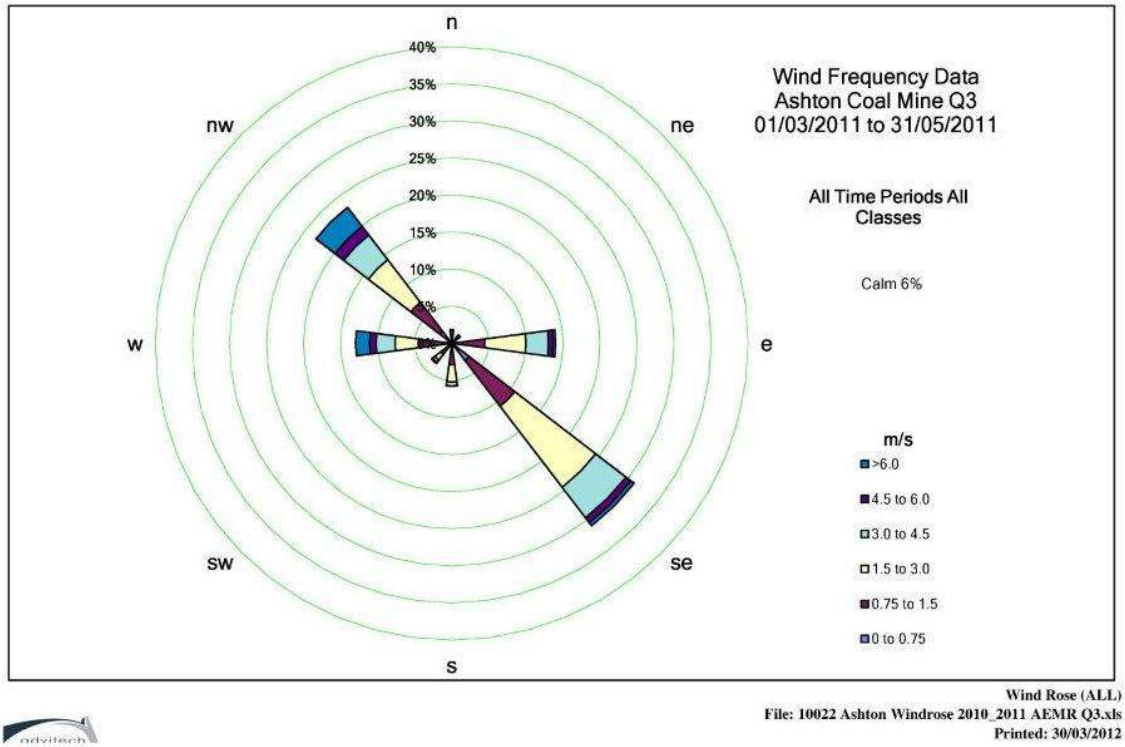

Figure 7. Quarter 3 Windrose

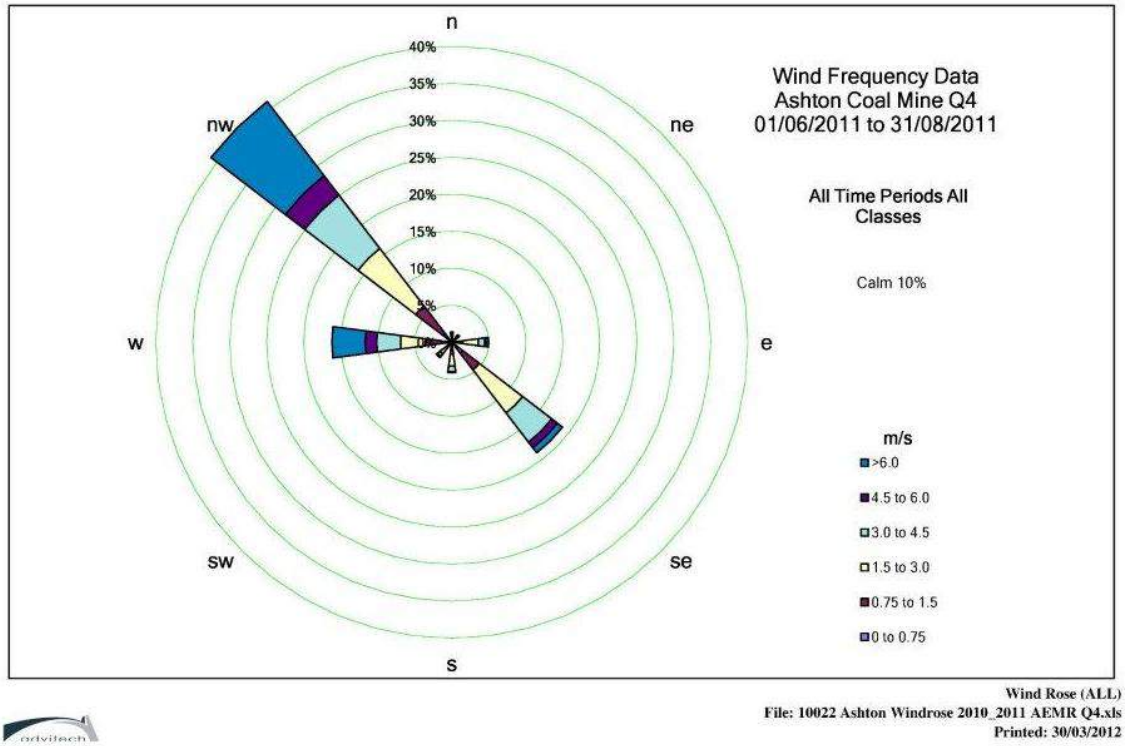

Figure 8. Quarter 4 Windrose

3.1.3 Dust 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.

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

On 15 June 2011 MOD7 of DA No. 309-11-2001-i was approved by the DoP&I, the major change to Air Quality criteria was the change in Table 5: Short term criterion for particulate matter where 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,
- 24 hour average contribution from Ashton Mine not to exceed 50µg/m^3, and
- Maximum cumulative 24 hour average not to exceed 150µg/m^3 (up until 15 June 2011 when MOD7 of DA No. 309-11-2001-i was approved).
- Maximum cumulative 24 hour average not to exceed 50µg/m^3 (after 15 June 2011 when MOD7 of DA No. 309-11-2001-i was approved).

Locations of PM_{10} monitoring stations are detailed on **Figure 10** and **Table 15**.

Table 15. **LOCATION OF PM_{10} MONITORING STATIONS**

Monitoring Station No	Location
1	Camberwell village (north)
2	Camberwell village (south)
3	Property east of Camberwell village
4	Onsite up wind north of Eastern Emplacement Area
7	Onsite up wind at country end of rail siding
8	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 impact to 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. In summary 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.
- With the exception of the regional dust storms experienced near the beginning of the reporting period, there were no recorded exceedences of the 24hour average criteria of 150µg/m³ at all Community sites.
- There were no occasions where the 24hour Average Ashton Contribution of 50µg/m³ was exceeded at the downwind Community sites (1, 2, 3 and 8).

From September 2010 ACOL has implemented a new real-time monitoring system operated by Novecom. This contract has a rigorous maintenance component, and standby equipment is available locally to reduce down time following equipment failure.

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 comparrison of these results with the the ACOL monitoring results as the historic results are based on the operations 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.

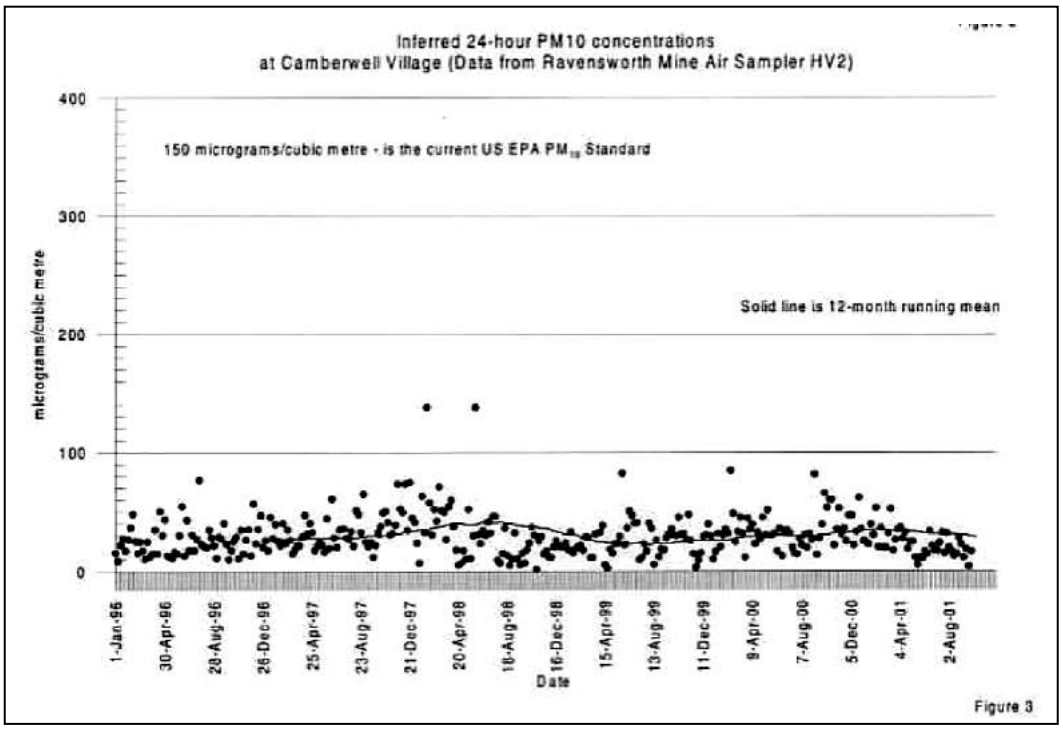

Figure 9. Historic Pre ACOL 24-hr PM_{10} Data

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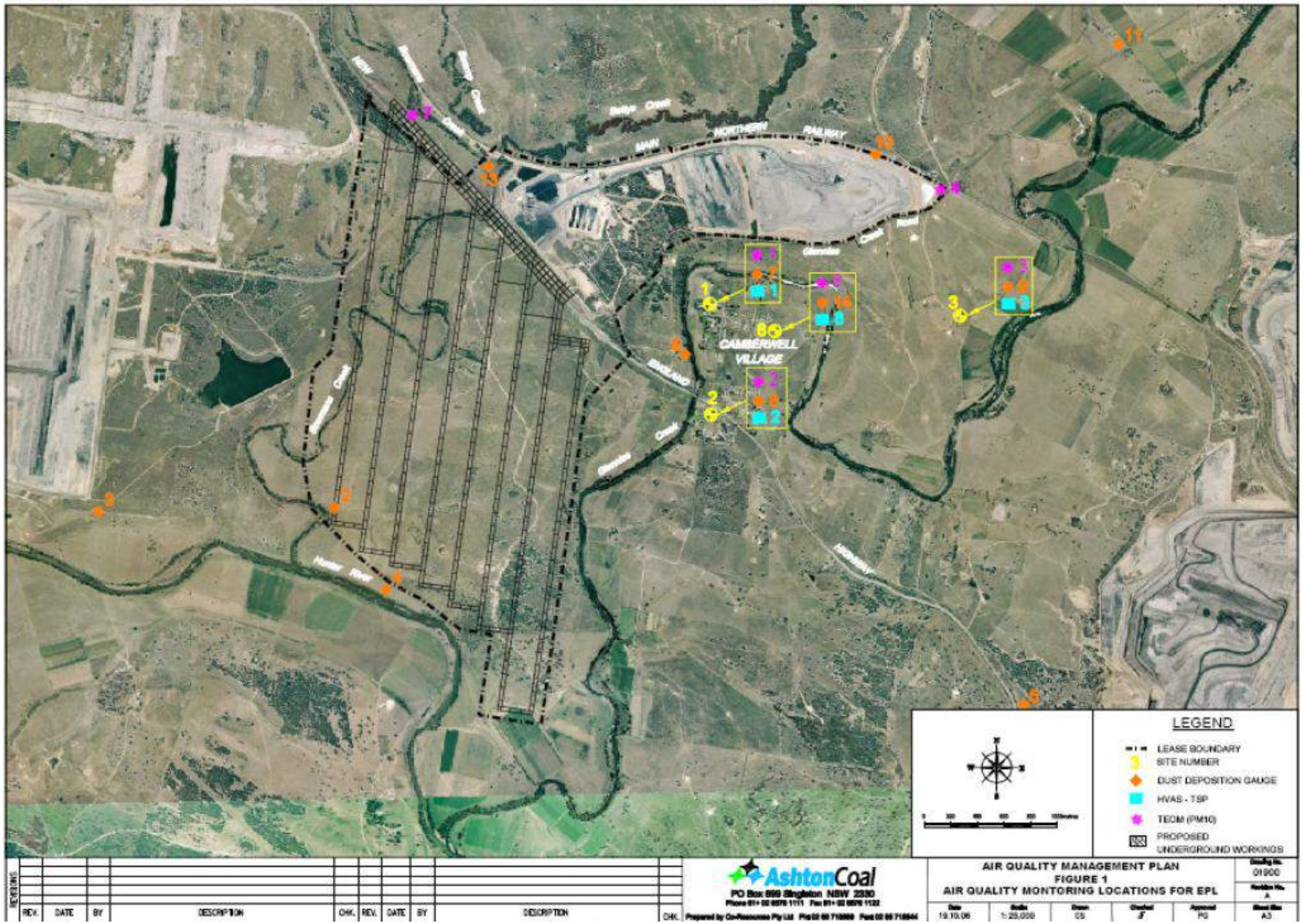

Figure 10. Air Quality Monitoring Locations

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Site 1 TEOM

For the reporting period 100% of Site 1 available data was captured with the exception of 1 day due to the annual calibration. The rolling average PM_{10} results for Site 1 (20µg/m^3) demonstrate compliance with the annual goal of 30µg/m^3 (**0**). Site 1 also demonstrated compliance with the maximum 24hr Criteria of 150µg/m^3 and then also the 50µg/m^3 after the June 2011 MOD7 approval.

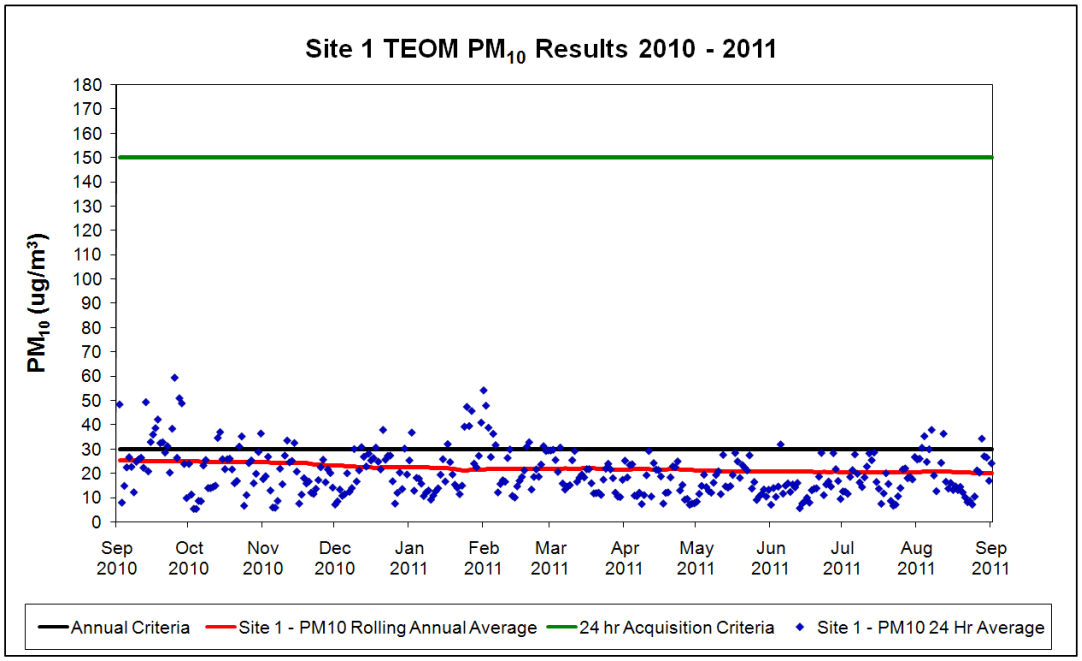

Figure 11. TEOM PM_{10} results for Site 1 - 2010-11 reporting period

Site 1 remained in compliance with the Ashton contribution criteria of 50µg/m^3 at all times.

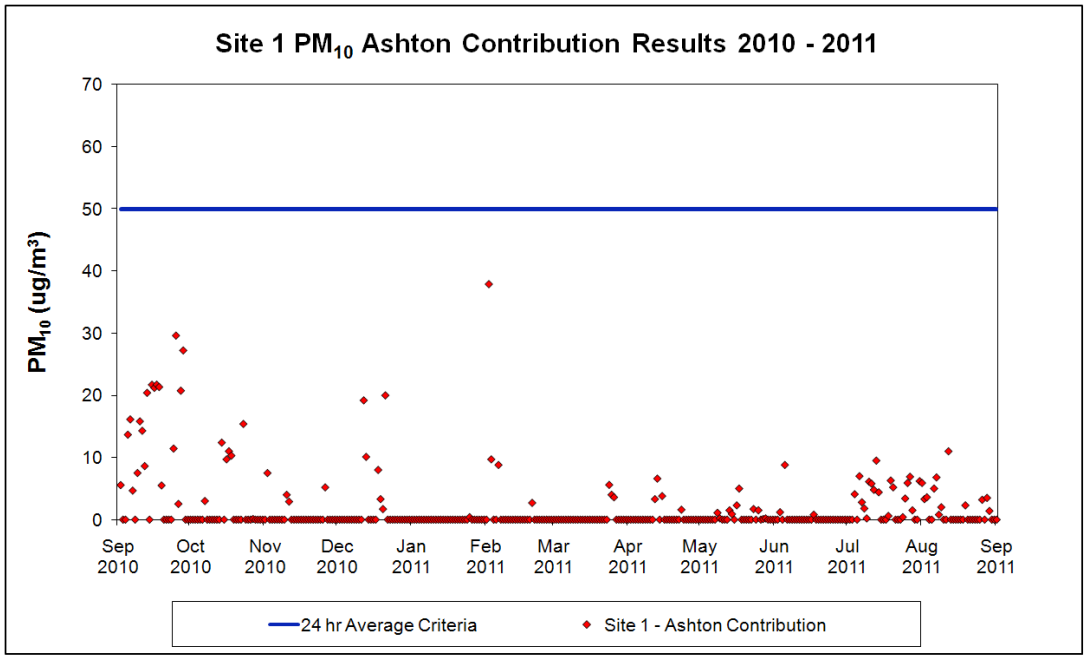

Figure 12. Ashton contribution to PM_{10} results for Site 1

Note: Ashton Contributions are calculated where there is a NW wind direction otherwise the contribution is plotted as 0.

Site 2 TEOM

For the reporting period 100% of Site 2 available data was captured with the exception of 1 day due to the annual calibration. The rolling average PM_{10} results for Site 2 (13µg/m^3) demonstrate compliance with the annual goal of 30µg/m^3 (**Figure 13**). Site 2 also demonstrated compliance with the maximum 24hr Criteria of 150µg/m^3 and then also the 50µg/m^3 after the June 2011 MOD7 approval.

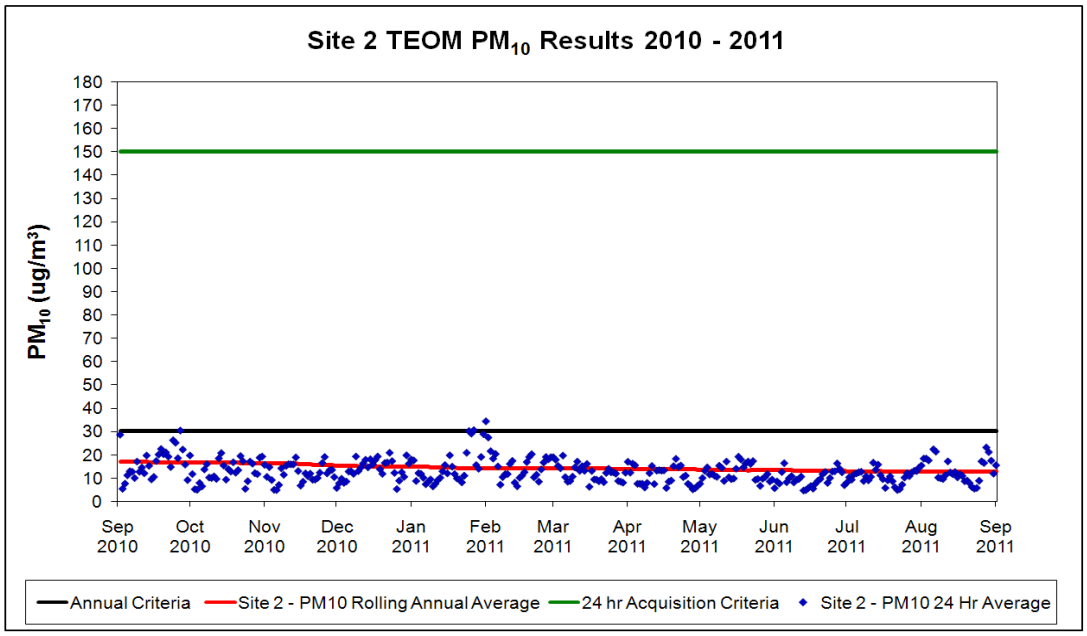

Figure 13. TEOM PM_{10} results for Site 2 - 2010-11 reporting period

Site 2 is located close to the New England Highway, and may be influenced by passing traffic when the winds emanate from the north, however Ashton remained in compliance with the criteria of 50µg/m^3 at all times.

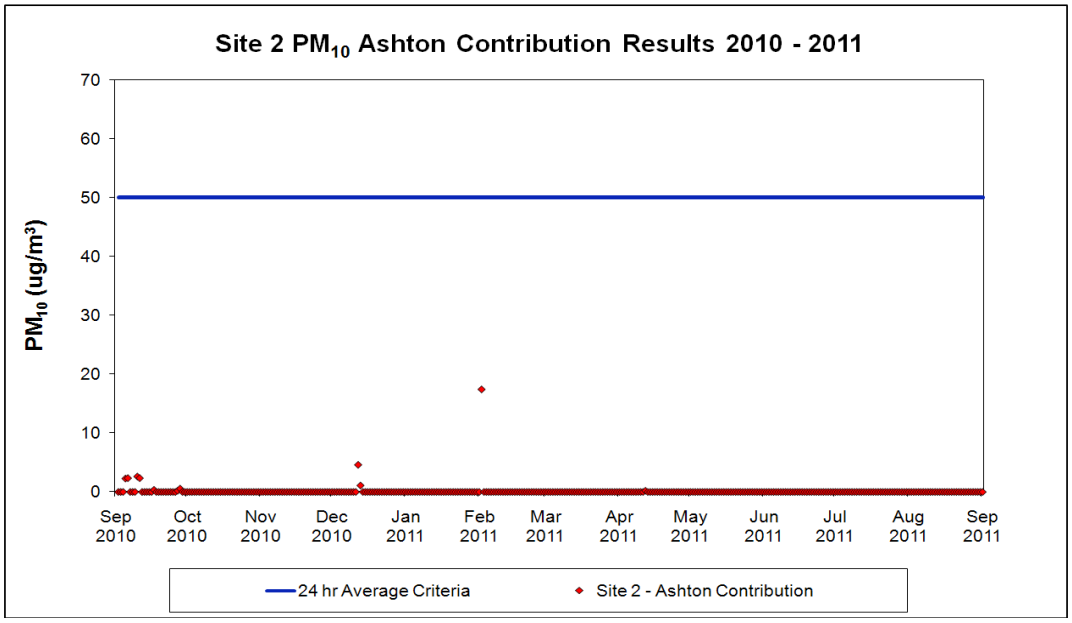

Figure 14. Ashton contribution to PM_{10} results for Site 2

Note: Ashton Contributions are calculated where there is a NW wind direction otherwise the contribution is plotted as 0.

Site 3 TEOM

Site 3 is located on a farming property to the east of the Eastern Emplacement Area. For the reporting period 100% of Site 3 available data was captured with the exception of 1 day due to the annual calibration. The rolling average PM_{10} results for Site 3 (20 µg/m^3) demonstrate compliance with the annual criteria of 30µg/m^3 (**Figure 15**). Site 3 also complied with the maximum 24 hour criteria of 150µg/m^3 and then also the 50µg/m^3 after the June 2011 MOD7 approval.

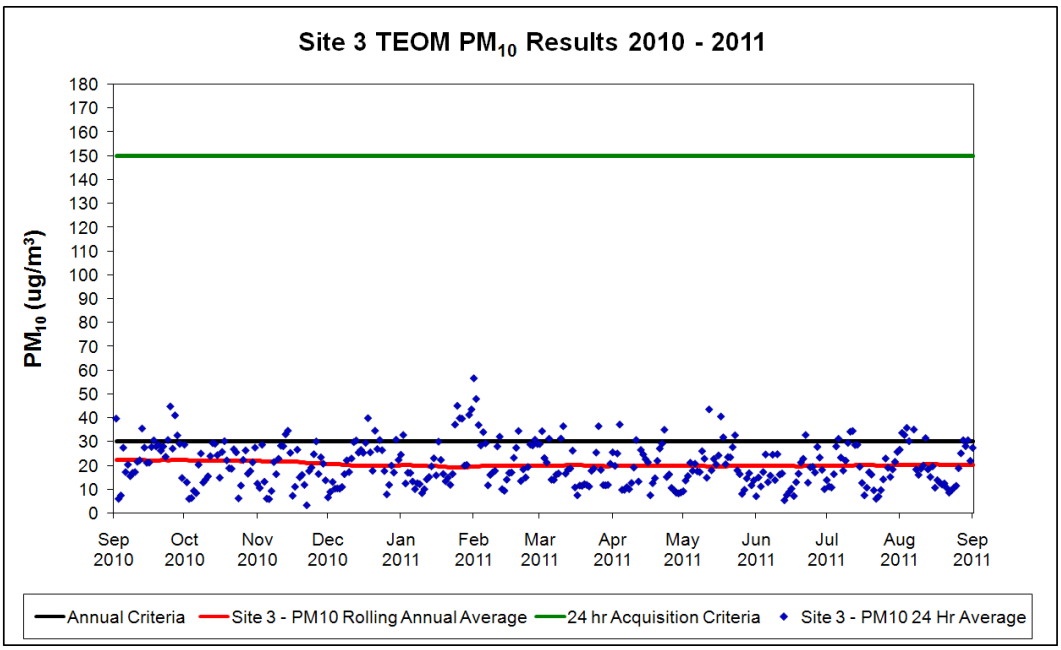

Figure 15. TEOM PM_{10} results for Site 3 - 2010-11 reporting period

Site 3 remained in compliance with the Ashton contribution criteria of 50µg/m^3 at all times.

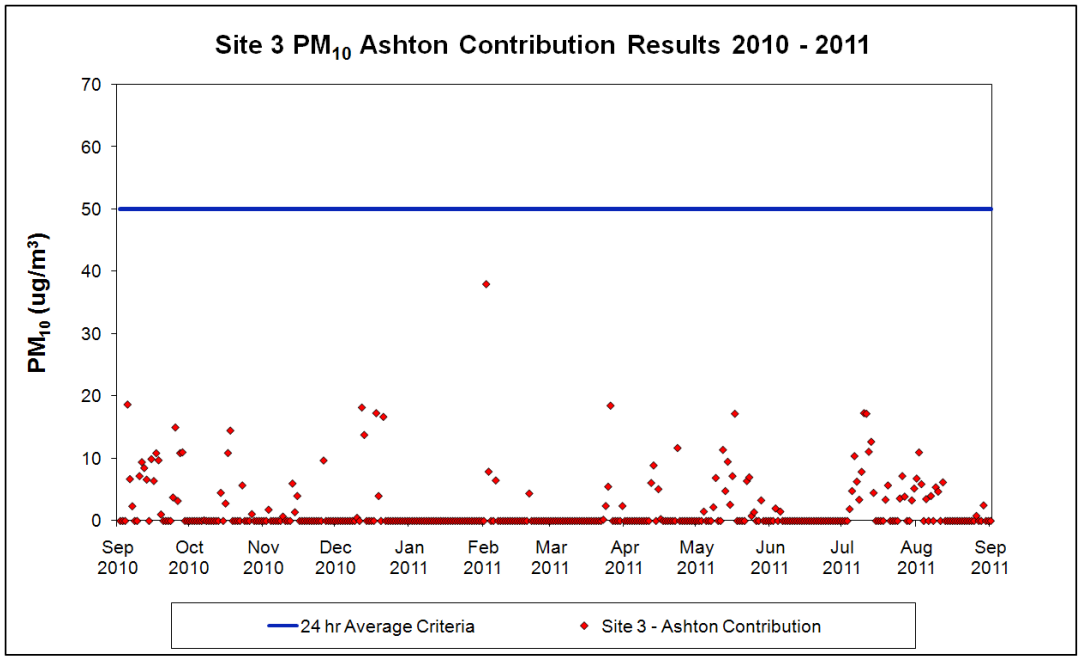

Figure 16. Ashton contribution to PM_{10} results for Site 3

Note: Ashton Contributions are calculated where there is a NW wind direction otherwise the contribution is plotted as 0.

Site 8 TEOM

Site 8 is located on the eastern side of Camberwell Village. The site recorded a 94% data recovery rate; the loss of data was due to power outage and a pump failure. Site 8 (22µg/m^3) showed compliance with the annual criteria of 30µg/m^3 (**Figure 17**). Site 8 also complied with the maximum 24 hour criteria of 150µg/m^3 and then also the 50µg/m^3 after the June 2011 MOD7 approval.

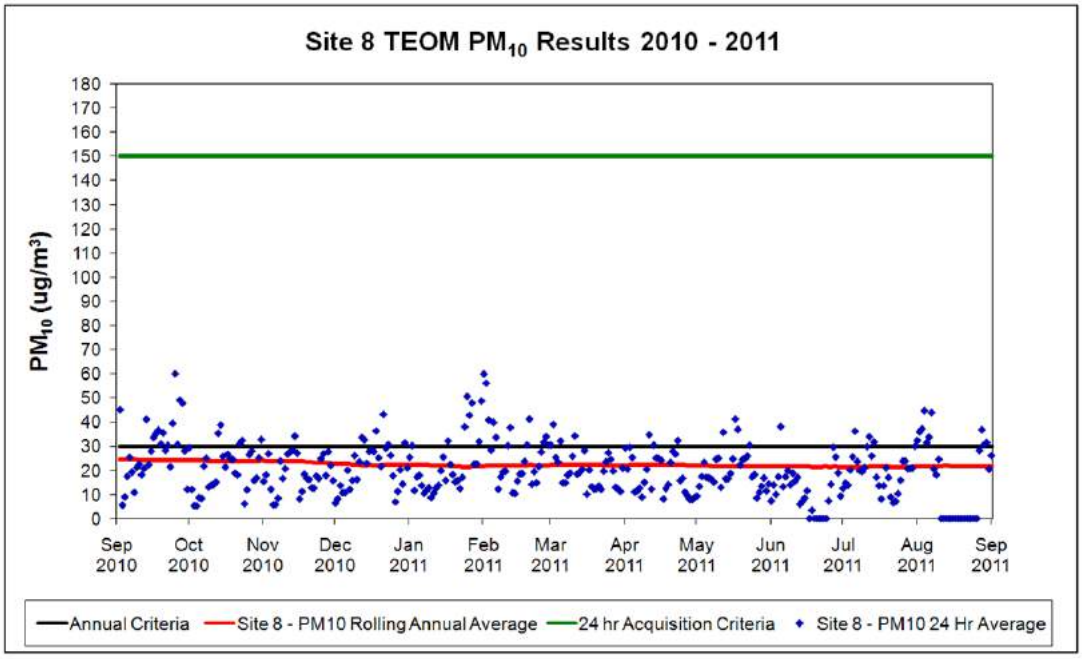

Figure 17. TEOM PM_{10} results for Site 8 during the 2010-11 reporting period

Site 8 remained in compliance with the Ashton contribution criteria of 50µg/m^3 at all times.

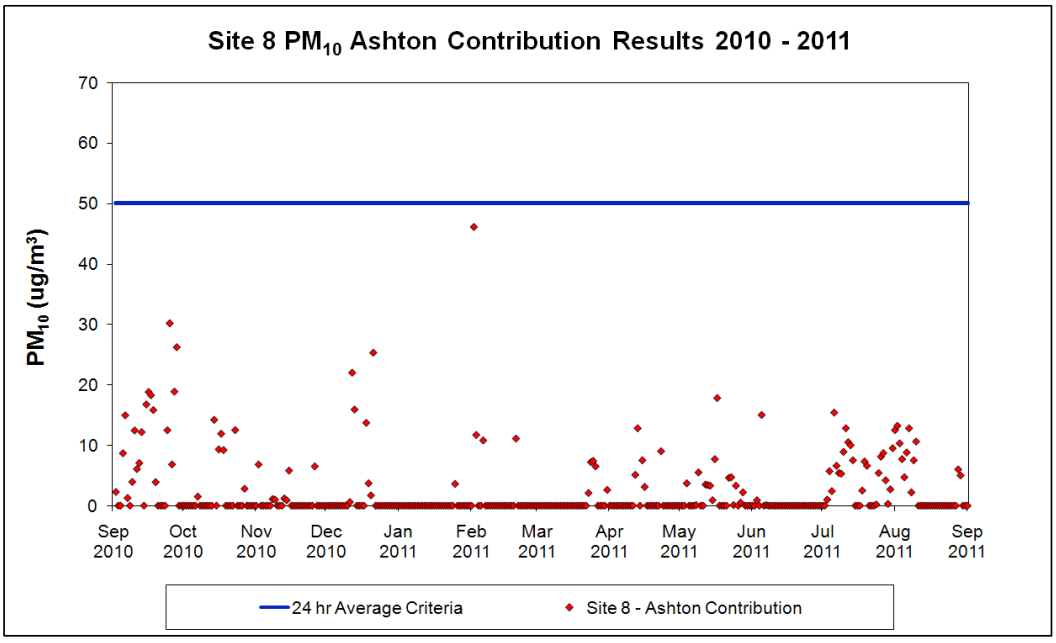

Figure 18. Ashton contribution to PM_{10} results for Site 8

Note: Ashton Contributions are calculated where there is a NW wind direction otherwise the contribution is plotted as 0.

Site 4 / 7 TEOMs (On-Site)

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 (24µg/m^3) is located on the eastern tip of the eastern emplacement area, next to Dam 5/6. For the reporting period 100% of Site 4 available data was captured with the exception of 1 day due to the annual calibration.

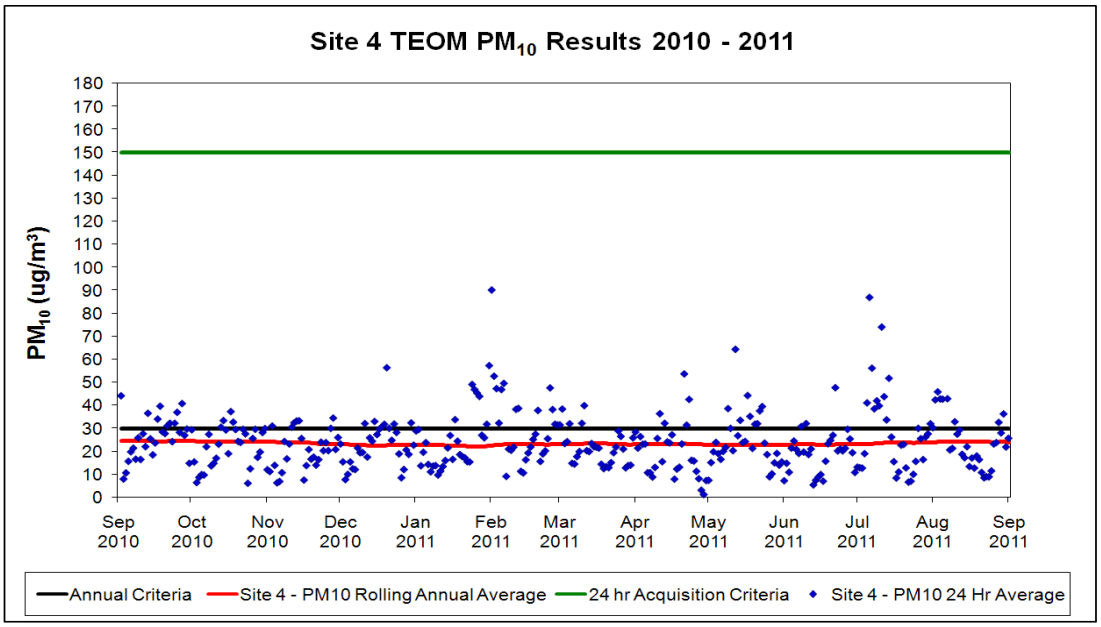

Figure 19. TEOM PM_{10} results for Site 4 during the 2010-11 reporting period

Site 7 (19µg/m^3) is remote from mining operations. 98% of the data was recovered from this site during the monitoring period; the loss of data was due to an air conditioner unit failure which resulting in overheating of the TEOM.

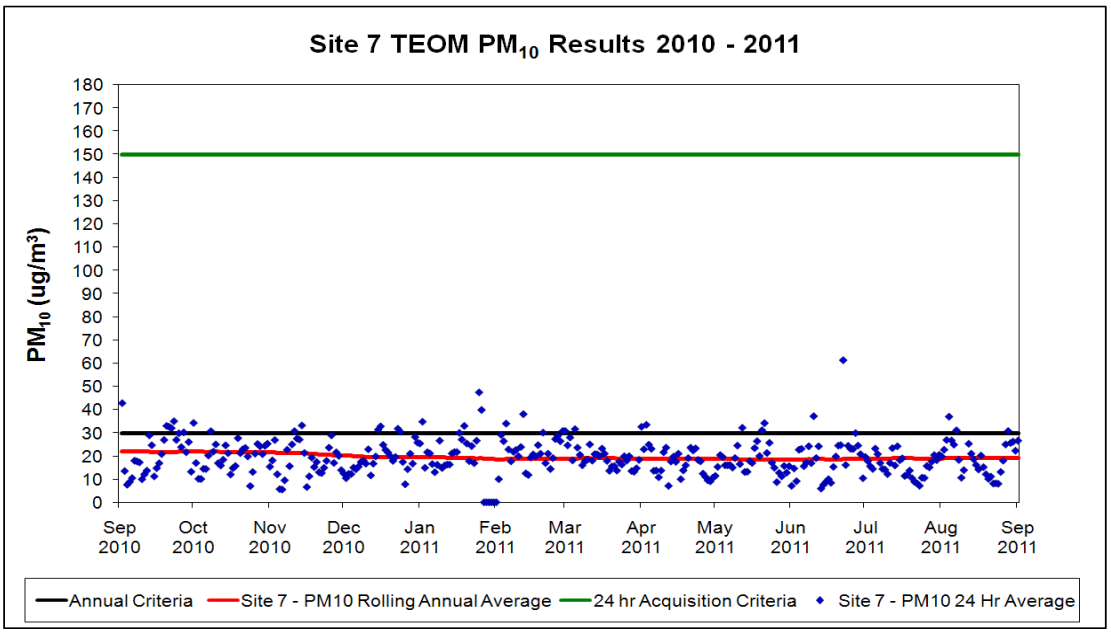

Figure 20. TEOM PM_{10} results for Site 7 during the 2010-11 reporting period

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 sites 1, 2 and 3. 98.4% of data was recovered at site 8 due to a power failure. 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 10** above and detailed in **Table 16**.

Table 16. 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.

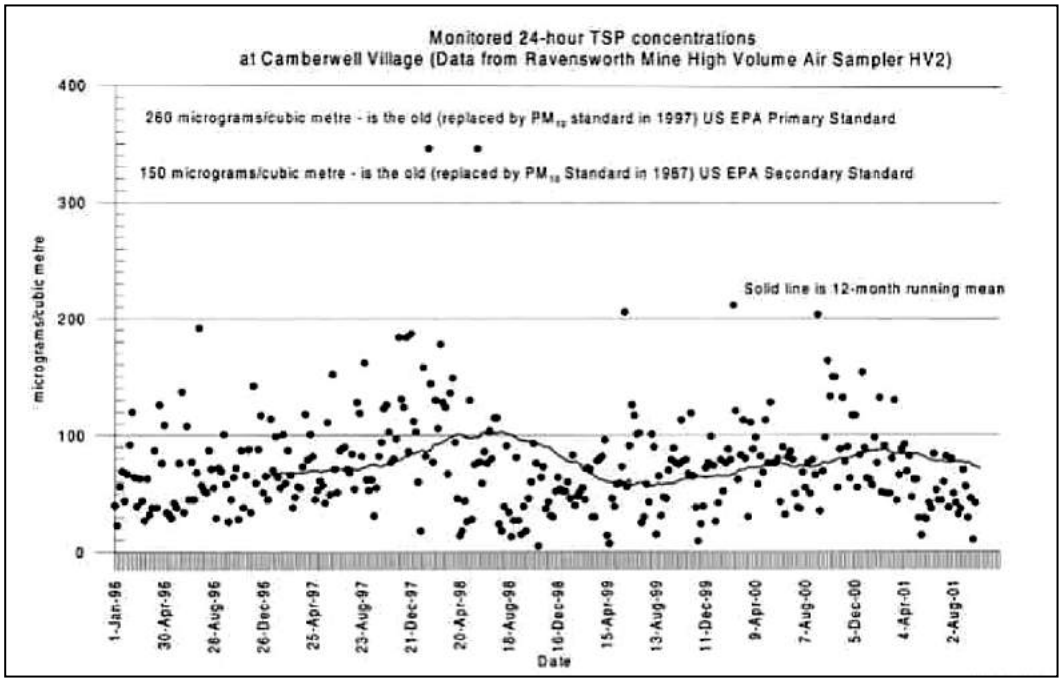

Figure 21. Historical TSP Data

HVAS TSP Rolling Annual Average

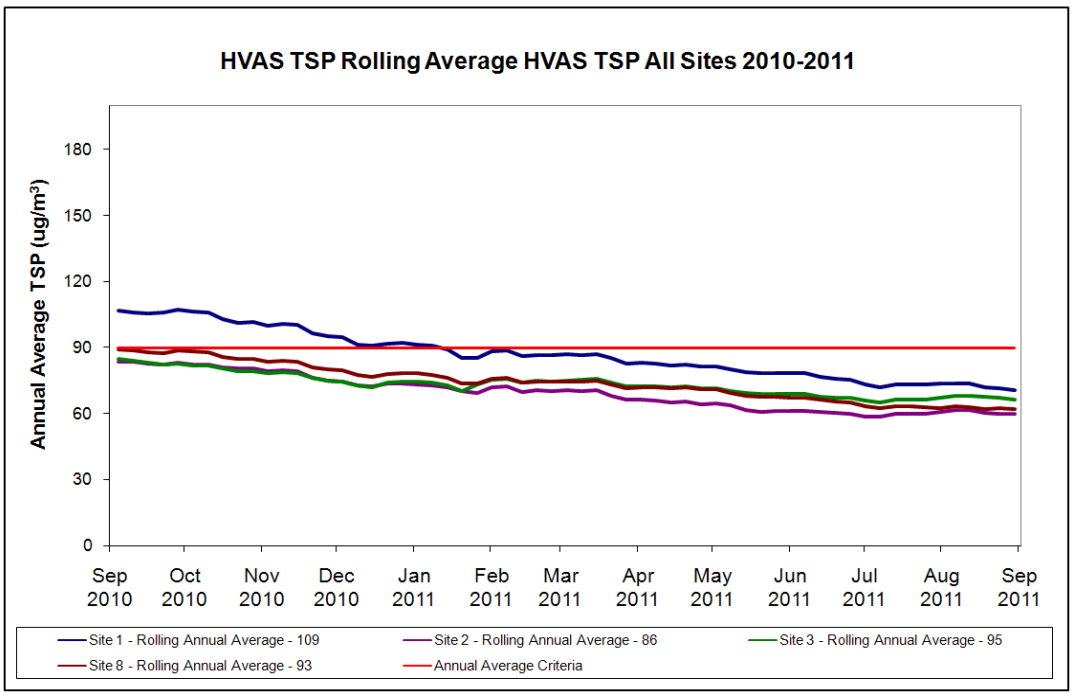

Figure 22. HVAS Total Suspended Particulates for all sites during 2010-11

All four HVAS TSP monitors complied with the annual average criteria of 90µg/m^3 and all had a decreasing trend over the reporting period (**Figure 22**).

Site 1 HVAS

The cumulative rolling annual average for TSP at Site 1 (71µg/m^3) demonstrated compliance with the annual average criteria of 90µg/m^3. (**Figure 23**)

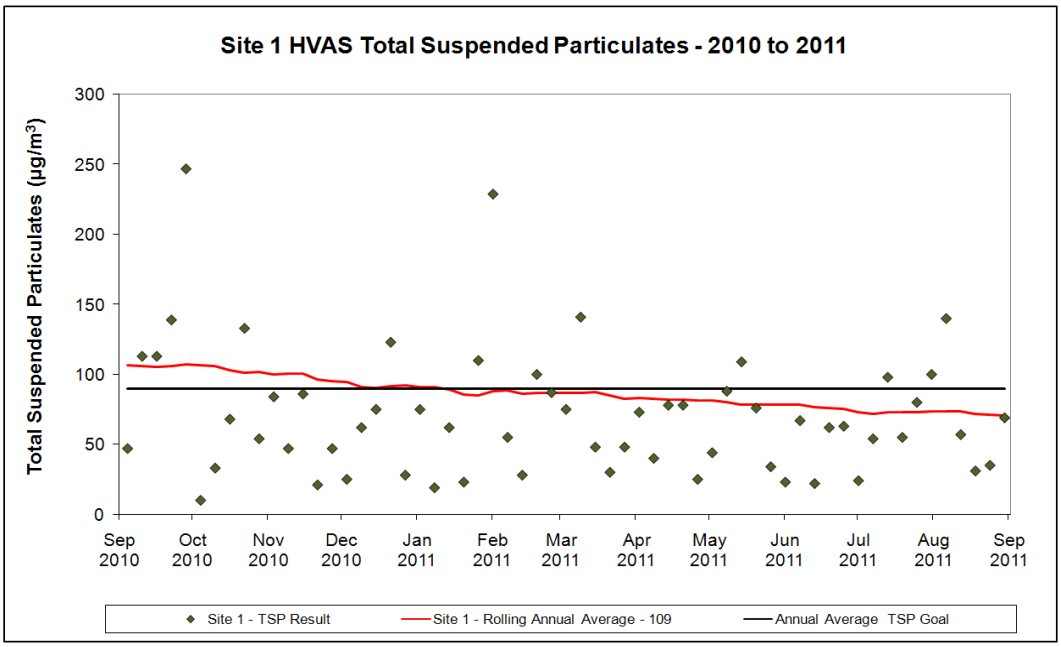

Figure 23. HVAS TSP for Site 1 during the 2010-11 reporting period

Site 2 HVAS

The cumulative rolling average TSP results for Site 2 (60µg/m^3) complied with the annual average TSP goal of 90µg/m^3 for the reporting period. (**Figure 24**)

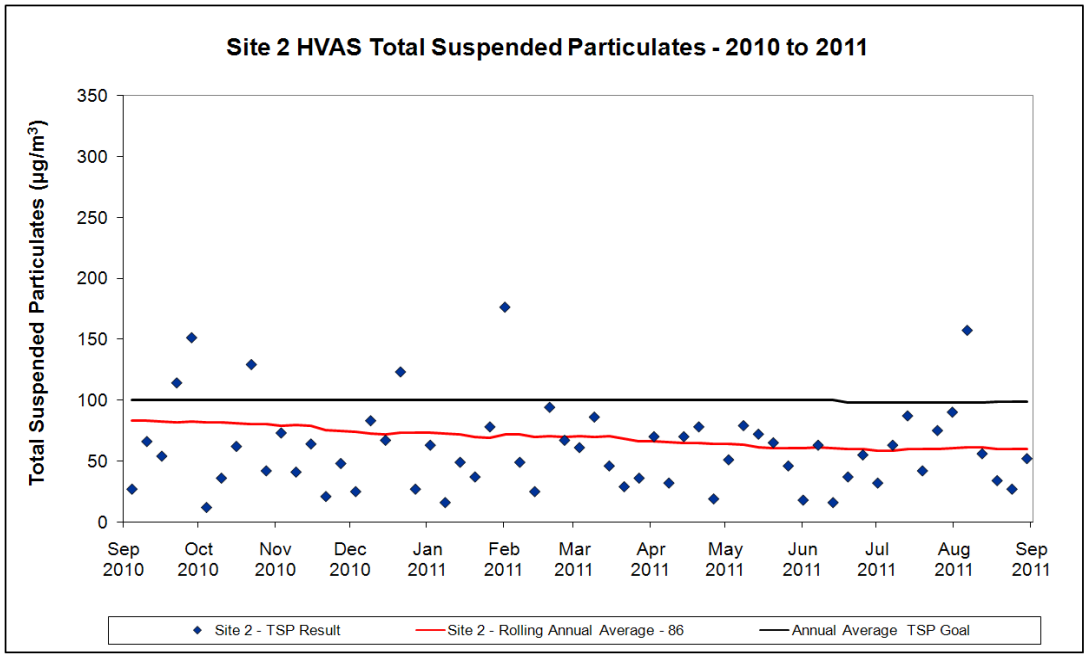

Figure 24. HVAS TSP for Site 2 during the 2010-11 reporting period

Site 3 HVAS

The cumulative rolling average TSP results for Site 3 (66µg/m^3) complied with the annual average TSP goal of 90µg/m^3 for the reporting period (**Figure 25).**

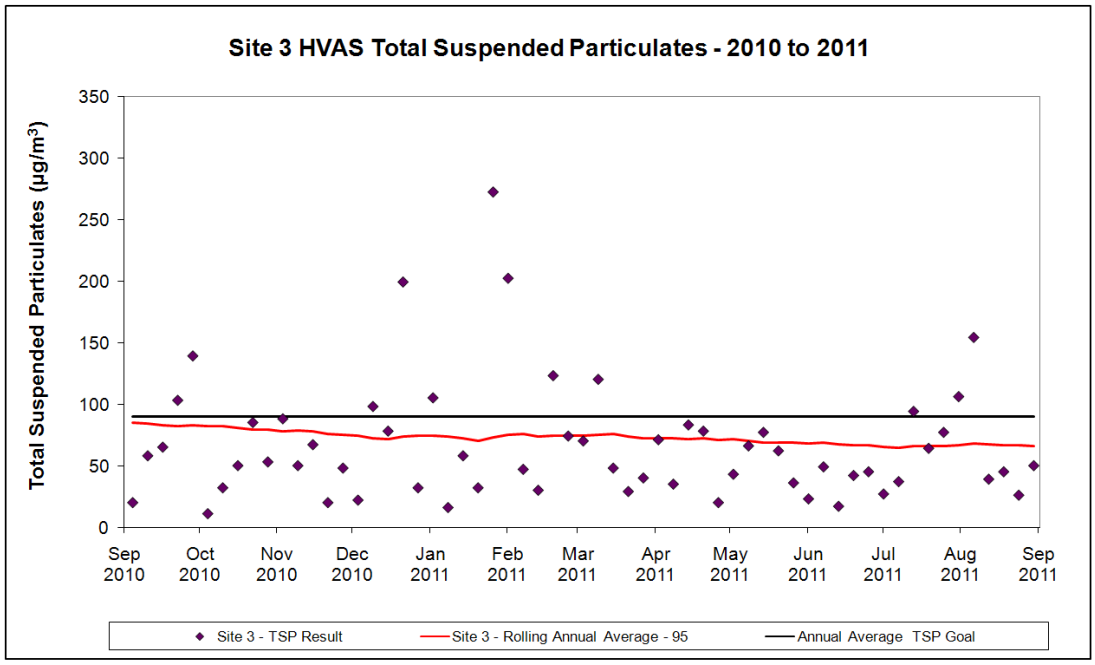

Figure 25. HVAS TSP for Site 3 during the 2010-11 reporting period

Site 8 HVAS

The cumulative rolling average TSP results for Site 8 (62µg/m^3) complied with the annual average TSP goal of 90µg/m^3 for the reporting period (**Figure 22**).

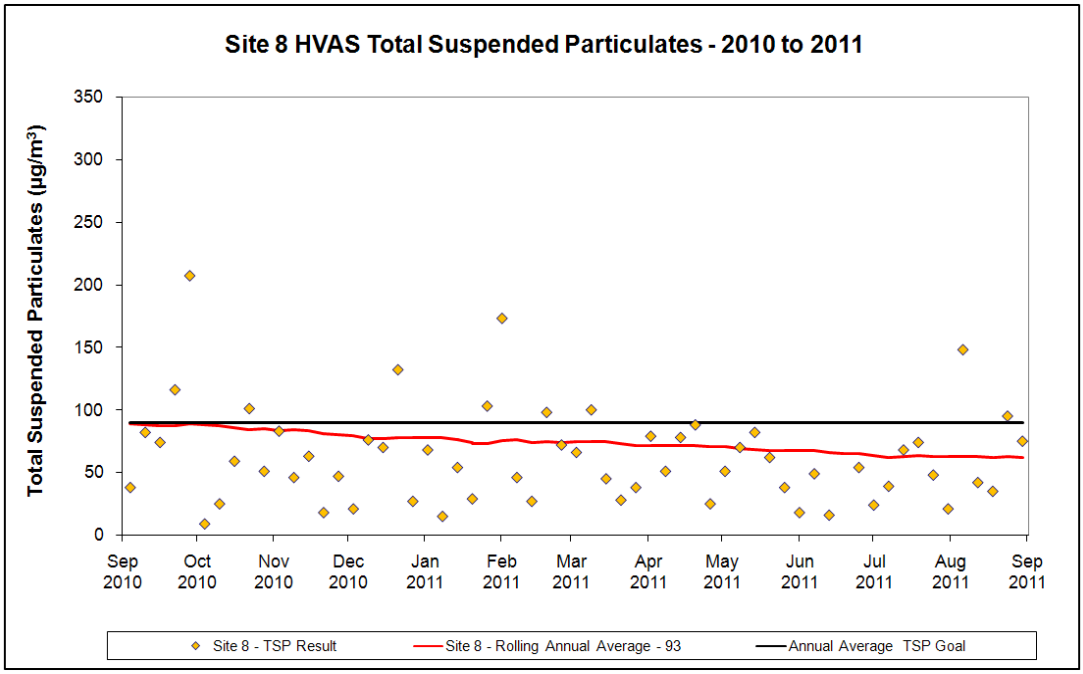

Figure 26. HVAS TSP for Site 8 during the 2010-11 reporting period

3.1.3.3 Dust Deposition Gauges

The locations of Dust Deposition gauges are shown in **Figure 10** and detailed in **Table 17**.

Table 17. 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 East OB dump)
11	NE of Emplacement Area on Glennies Creek Rd
13	Onsite – TEOM site 7 (country end turnout)
14	TEOM site 8 – Camberwell Village

Data recovery for all depositional dust gauges are shown in **Table 18.**

Table 18. 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	92%
D13	92%
D14	100%

Dust gauges D11 and D13 obtained only 92% data availability, this was due to a broken bottle for one sampling period at D11 and then no access to D13 for another sampling period.

Table 19 and **Figure 27** show the annual average insoluble solids for each gauge over the 2010 – 2011 reporting period. There were no depositional dust exceedences during the reporting period.

Table 19. INSOLUBLE SOLIDS ANNUAL AVERAGE RESULTS (EXCLUDING CONTAMINATED GAUGES)

Dust Gauge	Annual Average EIS Background Values (g/m^2.month)	Annual Average 2010– 2011 (g/m^2/month)
D2	3.5	2.91
D4	1.6	3.90
D5	2.0	3.61
D6	1.5	2.82
D7	NA	2.97
D8	NA	2.36
D9	NA	3.84
D10 (onsite)	NA	2.41
D11	NA	2.60
D13 (onsite)	NA	3.81
D14	NA	2.50

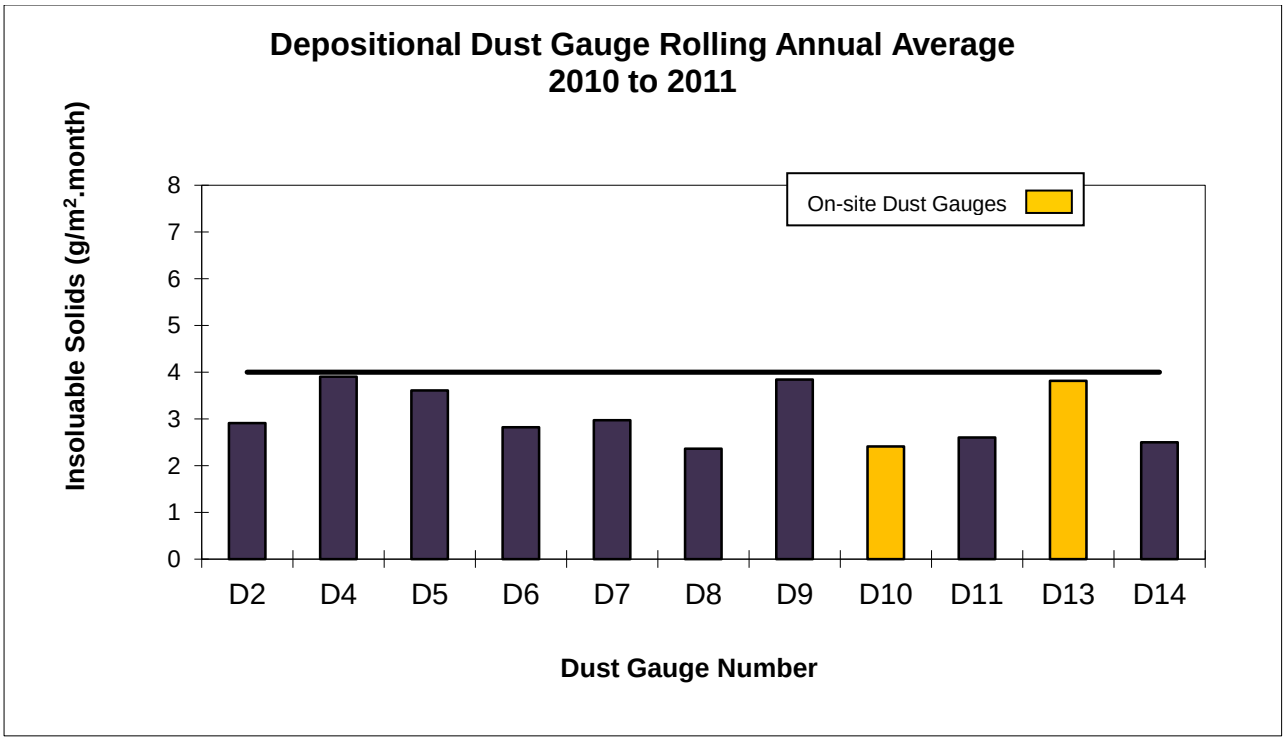

Figure 27. Depositional Dust Rolling Annual Average 2010-11

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 Erosion and Sediment Control Management Plan (ESCP). Monitoring indicates that these dams have been working effectively in controlling sediment flow. Gypsum has been used in drains where there is a high potential for sediment movement during heavy rainfall events. The Gypsum works by dropping the sediment out of entrainment in the overland water 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 5/6); 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 28** and detailed in **Table 20**.

Table 20. 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

Abbreviations used within Section 3.3 are as follows:

µS/cm	microsiemens per centimetre
mg/L	milligrams per litre
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
EC	Electrical Conductivity

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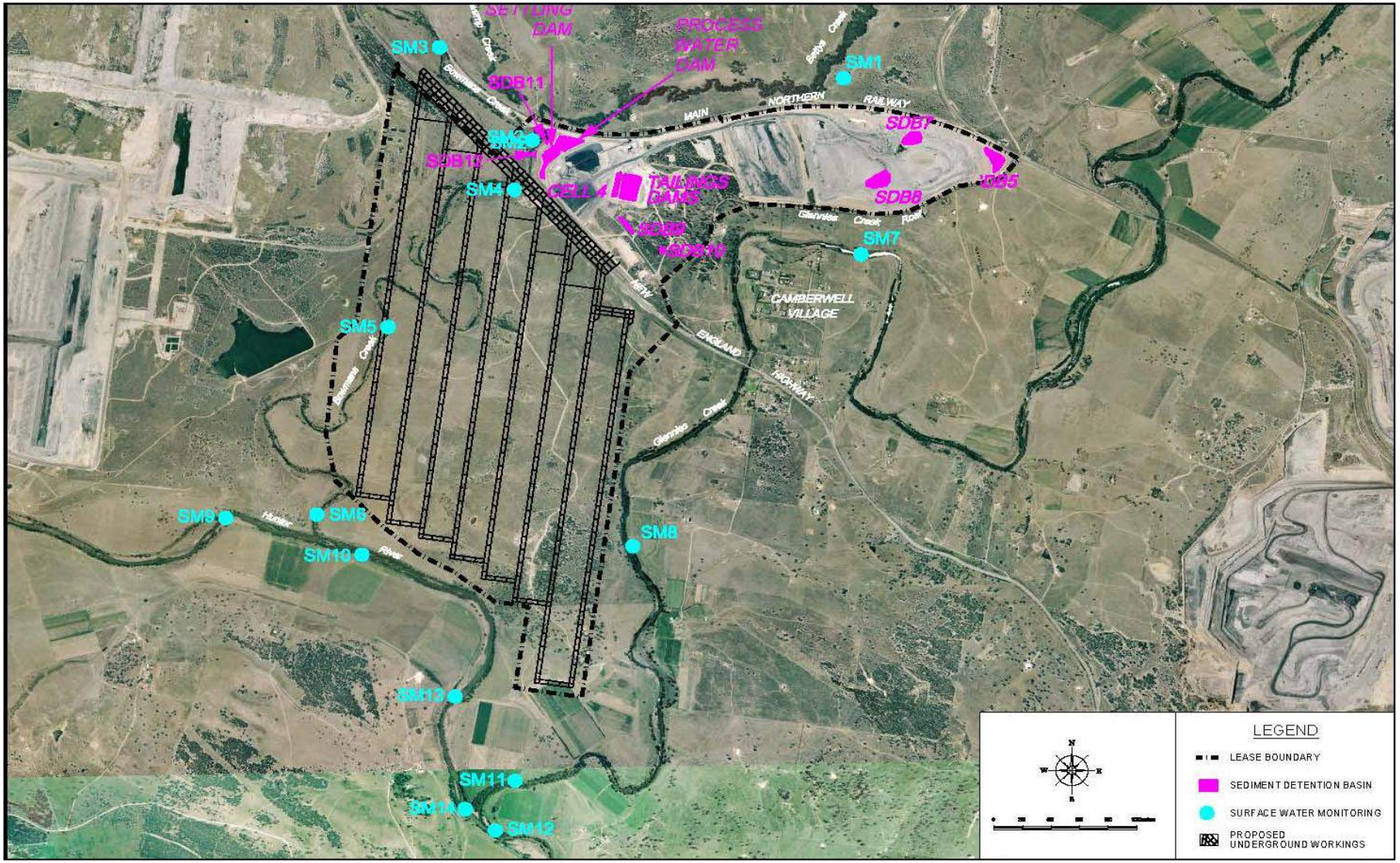

Figure 28. Water Quality Monitoring Locations

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3.3.2.1 Monthly Water Quality Monitoring Results

All 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). Monitoring locations SM1 and SM2 in Betty's Creek were consistently dry with the exception of December 2010.

pH

Results of monthly water quality monitoring in Bowmans Creek, Glennies Creek and the Hunter River (**Table 21**) indicate that pH levels throughout the reporting period were consistently within the neutral to slightly alkaline range (7.0 - 8.4).

Table 21. **pH RESULTS 2010 - 2011**

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-10	dry	dry	7.7	7.9	8.0	8.3	8.1	8.0	8.4	8.4	8.0	8.3	8.4	8.3
Oct-10	dry	dry	7.5	7.9	7.8	7.8	7.9	7.9	7.9	8.3	7.8	8.3	8.4	8.4
Nov-10	dry	dry	8.0	8.0	8.0	8.1	8.1	8.0	8.0	8.3	8.0	8.3	8.3	8.3
Dec-10	7.0	6.9	7.7	8.0	7.8	8.2	7.5	7.4	7.8	8.0	7.1	7.6	7.7	7.8
Jan-11	dry	dry	7.4	7.8	7.9	8.3	7.9	7.7	8.4	8.4	7.7	8.3	8.4	8.3
Feb-11	dry	dry	7.4	8.0	7.7	8.0	7.7	7.3	8.3	8.3	7.7	8.2	8.4	8.3
Mar-11	dry	dry	7.3	7.8	7.7	8.0	7.6	7.4	8.3	8.3	7.8	8.1	8.3	8.2
Apr-11	dry	dry	7.8	8.0	8.0	7.8	7.8	7.8	8.1	8.1	7.9	8.0	8.1	8.1
May-11	dry	dry	7.7	8.0	7.8	8.2	7.9	7.8	8.4	8.3	7.9	8.2	8.3	8.3
Jun-11	dry	dry	7.7	7.7	7.7	7.8	7.7	7.7	8.1	8.0	7.7	NA	8.1	7.9
Jul-11	dry	dry	7.9	8.0	7.9	8.0	8.0	7.9	8.3	8.3	7.7	8.2	8.3	8.3
Aug-11	dry	dry	7.7	7.8	7.9	8.3	8.1	8.0	8.2	8.2	7.8	8.1	8.2	8.1
Min	7.0	6.9	7.3	7.7	7.7	7.8	7.5	7.3	7.8	8.0	7.1	7.6	7.7	7.8
Ave	7.0	6.9	7.6	7.9	7.9	8.1	7.9	7.7	8.2	8.2	7.8	8.1	8.2	8.2
Max	7.0	6.9	8.0	8.0	8.0	8.3	8.1	8.0	8.4	8.4	8.0	8.3	8.4	8.4

pH levels in Bowmans Creek (SM3, SM4, SM5 and SM6) were neutral to slightly alkaline (ranging from 7.3 to 8.3) and remained within the acceptable pH range (**Figure 29**).

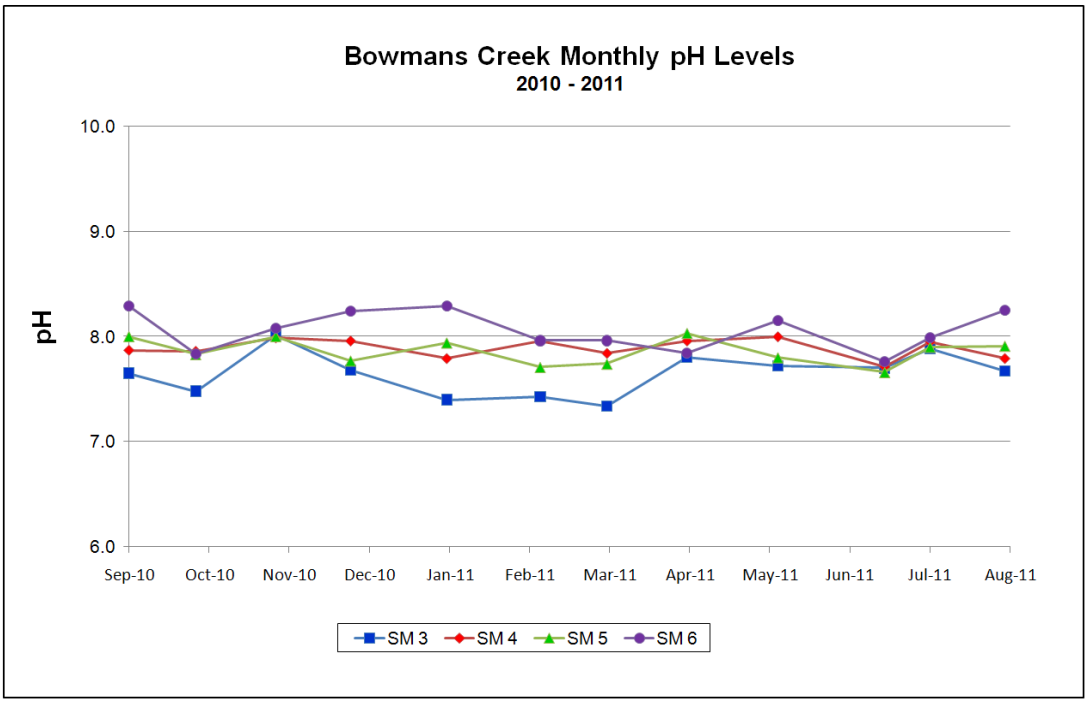

Figure 29. Monthly pH levels at Bowmans Creek sites during 2010-11

Glennies Creek (SM7, SM8 and SM11) pH levels were neutral to slightly alkaline (ranging from 7.1 to 8.1) with little variation between sites for most of the year (**Figure 30**). The pH levels remained within the acceptable recommended pH range.

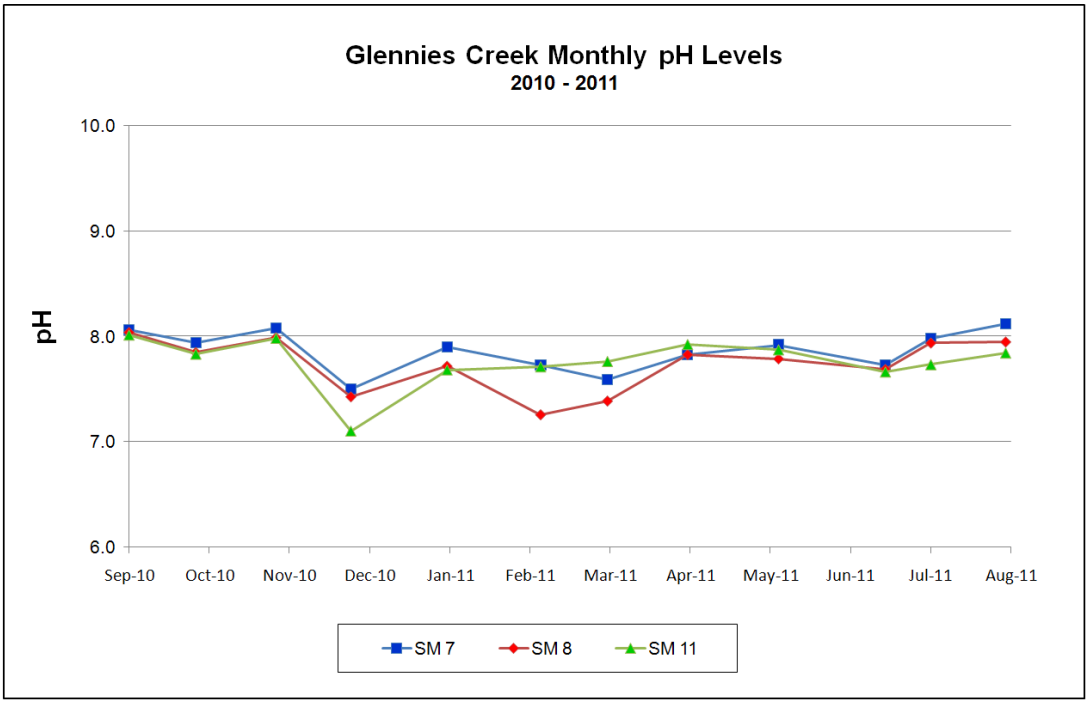

Figure 30. Monthly pH levels at Glennies Creek sites during 2010-11

pH levels in the Hunter River (SM9, SM10, SM12, SM13 and SM14) were neutral to slightly alkaline (ranging from 7.6 to 8.4) with minimal variation between sites, and remained within the acceptable recommended pH range (**Figure 31**). Similar to Glennies Creek slight pH fluctuations throughout the reporting period followed a very similar pattern across all sites.

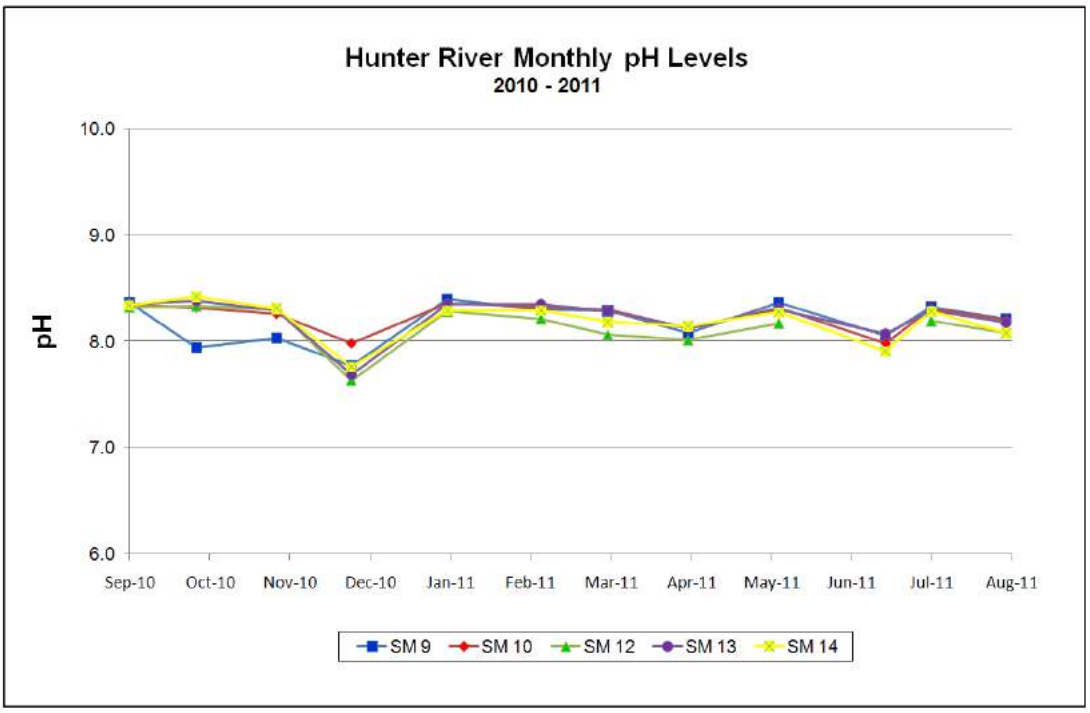

Figure 31. Monthly pH levels at Hunter River sites during 2010-2011

Electrical Conductivity (EC)

Results from monthly readings indicate an EC range between 241-2640 µS/cm, which is at the lower end of the scale. Bowmans Creek sites (SM3, SM4, SM5 and SM6) generally experienced higher EC compared to the other sites with the peak EC of 2640 µS/cm being recorded at SM4 (**Table 22**). This is due to an inflow of saline ground water which during dry months and low surface flow of Bowmans Creek makes up most of the flow, resulting in increased EC levels.

Monthly EC results measured in µS/cm displayed in **Table 22**.

Table 22. **ELECTRICAL CONDUCTIVITY RESULTS 2010 - 2011**

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-10	Dry	Dry	1200	1230	1170	678	670	756	657	684	773	668	656	656
Oct-10	Dry	Dry	1170	1280	1160	1160	482	497	1220	833	524	806	832	831
Nov-10	Dry	Dry	898	911	927	938	605	581	934	605	572	552	551	551
Dec-10	473	381	752	781	795	1120	406	463	374	652	532	440	419	460
Jan-11	Dry	Dry	1100	1230	1030	782	438	413	662	681	467	685	711	686
Feb-11	Dry	Dry	899	1370	899	824	268	264	852	761	269	690	758	758
Mar-11	Dry	Dry	974	1730	955	958	241	247	848	866	256	703	842	845
Apr-11	Dry	Dry	1090	1940	1120	1150	312	316	610	615	320	538	601	610
May-11	Dry	Dry	1220	2640	1310	1020	347	345	902	904	361	828	900	902
Jun-11	Dry	Dry	803	816	829	834	623	619	618	690	619	NA	630	628
Jul-11	Dry	Dry	1000	1040	1020	1030	835	792	838	866	825	845	826	832
Aug-11	Dry	Dry	960	984	958	992	808	786	556	598	783	588	562	554
Min	473	381	752	781	795	678	241	247	374	598	256	440	419	460
Ave	473	381	1006	1329	1014	957	503	507	756	730	525	668	691	693
Max	473	381	1220	2640	1310	1160	835	792	1220	904	825	845	900	902

Electrical Conductivity (EC) levels in Bowmans Creek fluctuated between 678 µS/cm and 2640 µS/cm (**Figure 32**). 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.

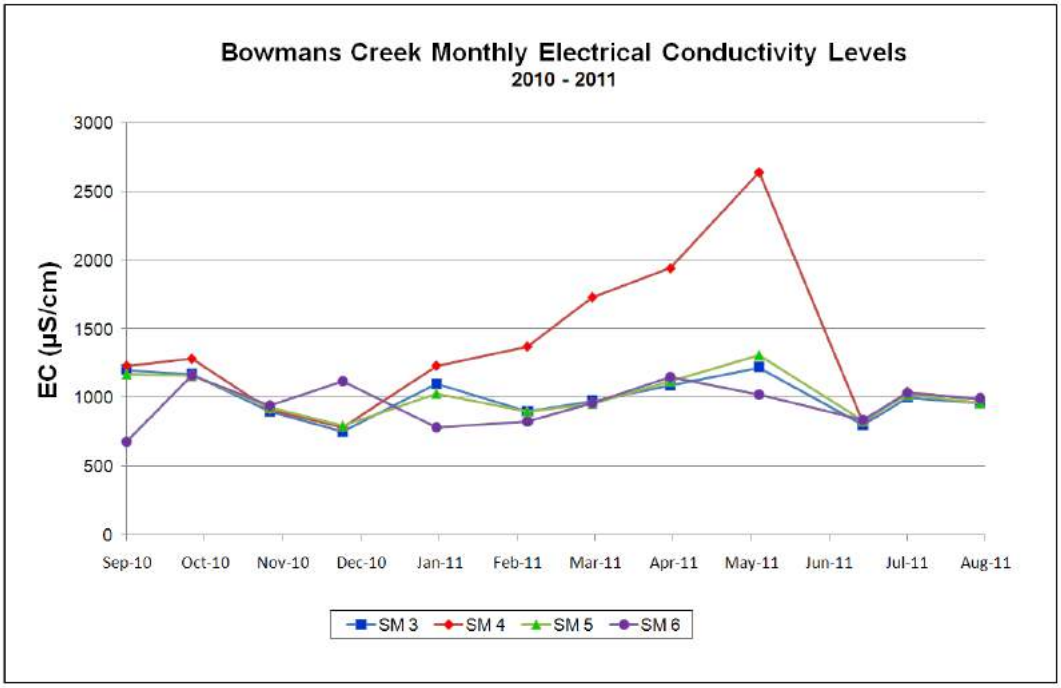

Figure 32. Monthly EC levels at Bowmans Creek sites during 2010-2011

Electrical Conductivity (EC) levels in Glennies Creek (SM7, SM8 and SM11) remained consistently low throughout the year, fluctuating between 241 µS/cm and 835 µS/cm.

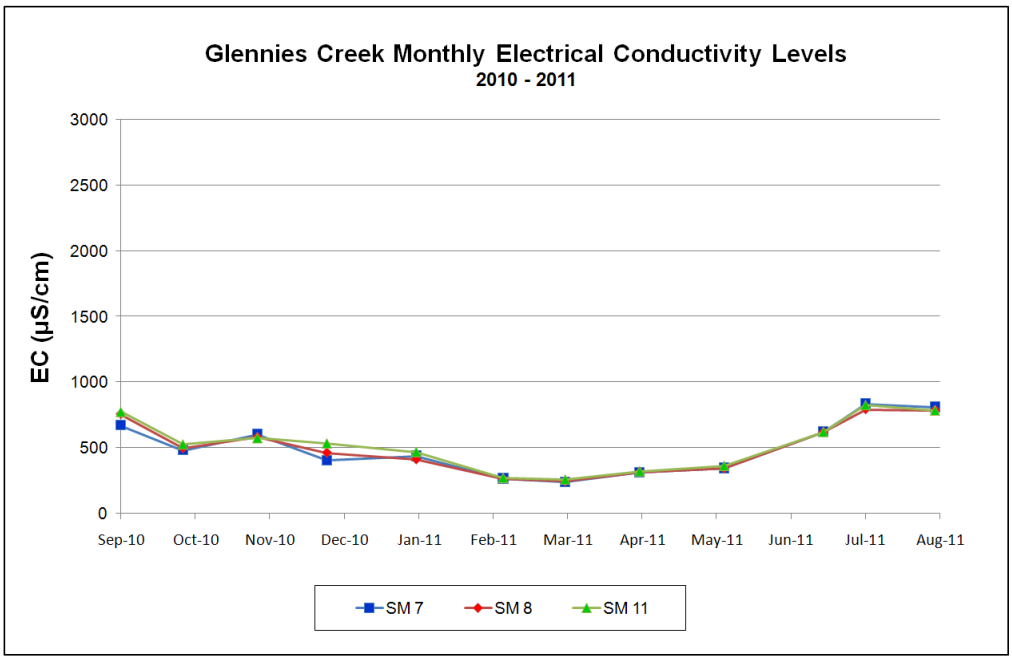

Figure 33. Monthly EC levels at Glennies Creek sites during 2010-2011

Electrical Conductivity (EC) levels in Hunter River (SM9, SM10, SM12, SM13 and SM14) were generally low with minimal variance throughout the year. An exception to this was October and November 2010 where SM9 exhibited slightly higher EC readings compared to other monitoring locations. SM9 is upstream of the confluence with Glennies Creek and Bowmans Creek and therefore excludes Ashton Coal as a source of the high EC levels during that time.

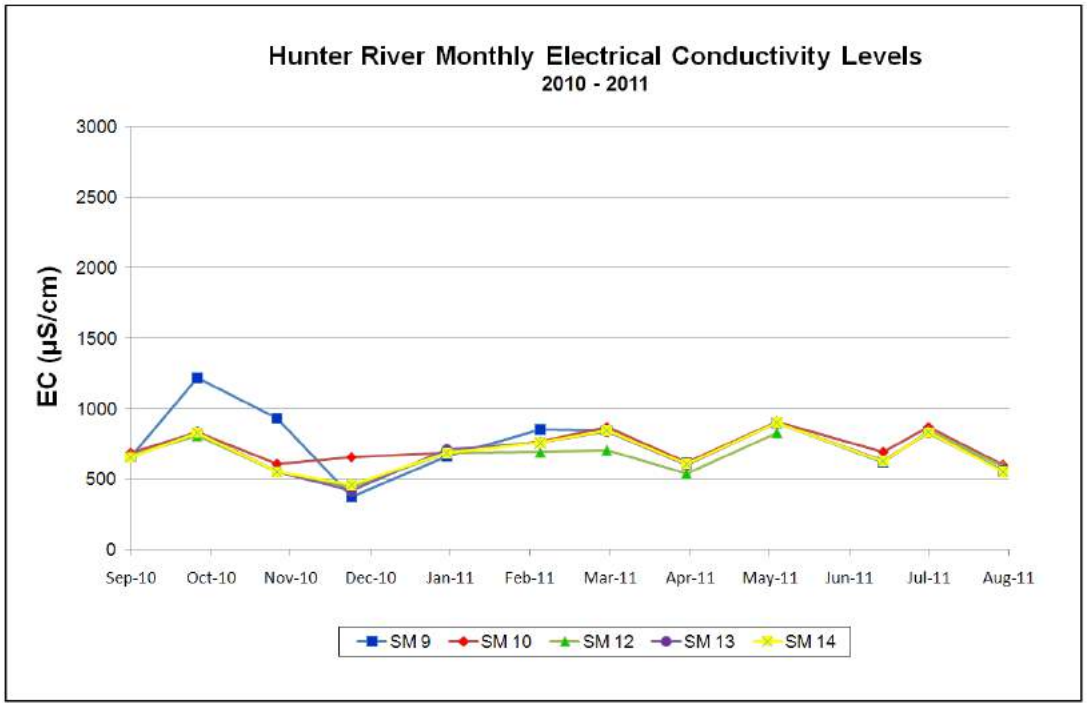

Figure 34. Monthly EC levels at Hunter River sites during 2010-2011

Total Dissolved Solids (TDS)

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

Table 23. **TOTAL DISSOLVED SOLIDS RESULTS 2010 - 2011**

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-10	Dry	Dry	738	654	622	364	332	396	332	430	408	354	364	348
Oct-10	Dry	Dry	672	744	558	558	196	204	598	374	200	354	364	344
Nov-10	Dry	Dry	456	468	442	442	276	284	472	314	302	292	260	240
Dec-10	658	472	414	378	466	654	288	312	274	378	330	280	308	302
Jan-11	Dry	Dry	622	694	610	426	246	262	420	426	272	410	418	392
Feb-11	Dry	Dry	610	904	616	592	202	145	454	456	155	410	474	496
Mar-11	Dry	Dry	648	994	514	552	148	161	584	526	154	340	482	454
Apr-11	Dry	Dry	634	1130	656	668	204	200	352	326	186	314	344	348
May-11	Dry	Dry	608	1360	664	496	192	186	392	406	178	380	448	420
Jun-11	Dry	Dry	496	504	504	488	386	354	358	424	388	NA	384	422
Jul-11	Dry	Dry	514	510	538	526	460	378	414	414	434	420	414	438
Aug-11	Dry	Dry	508	516	518	514	406	400	270	298	394	290	276	286
Min	658	472	414	378	442	364	148	145	270	298	154	280	260	240
Ave	658	472	577	738	559	523	278	274	410	398	283	349	378	374
Max	658	472	738	1360	664	668	460	400	598	526	434	420	482	496

The spike in TDS at SM4 correlates with the EC result for the same time period (**Figure 35**). 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. TDS levels returned to natural flow levels following rainfall in June 2011.

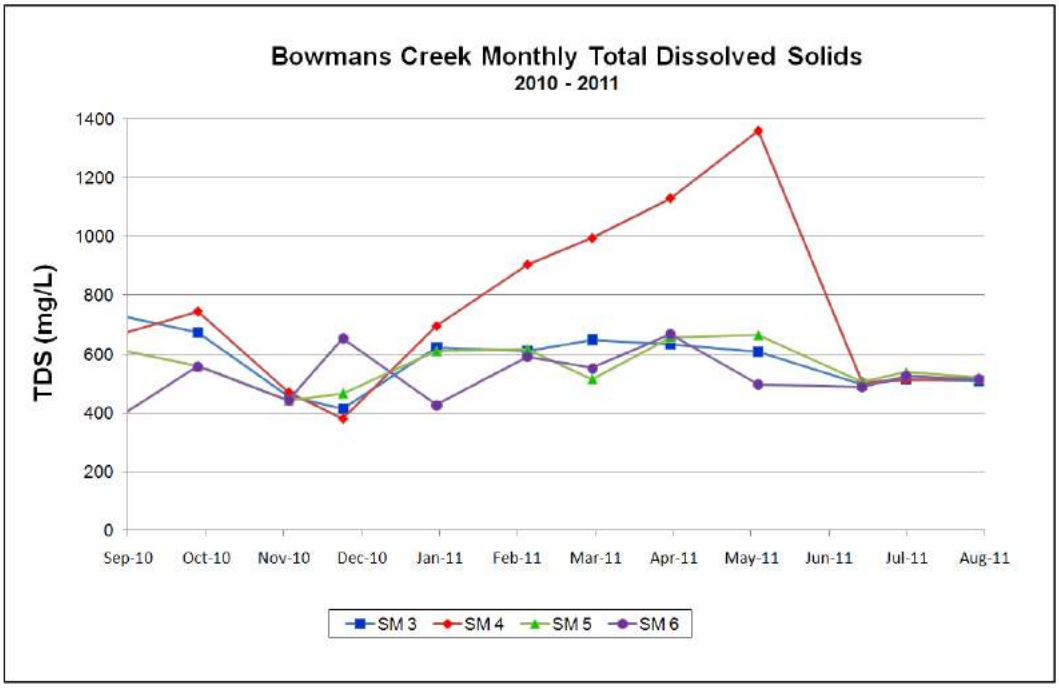

Figure 35. Monthly TDS levels at Bowmans Creek sites during 2010-2011

Levels of TDS in Glennies Creek were consistently low over the monitoring period with minimal variance across the three sites (**Figure 36**).

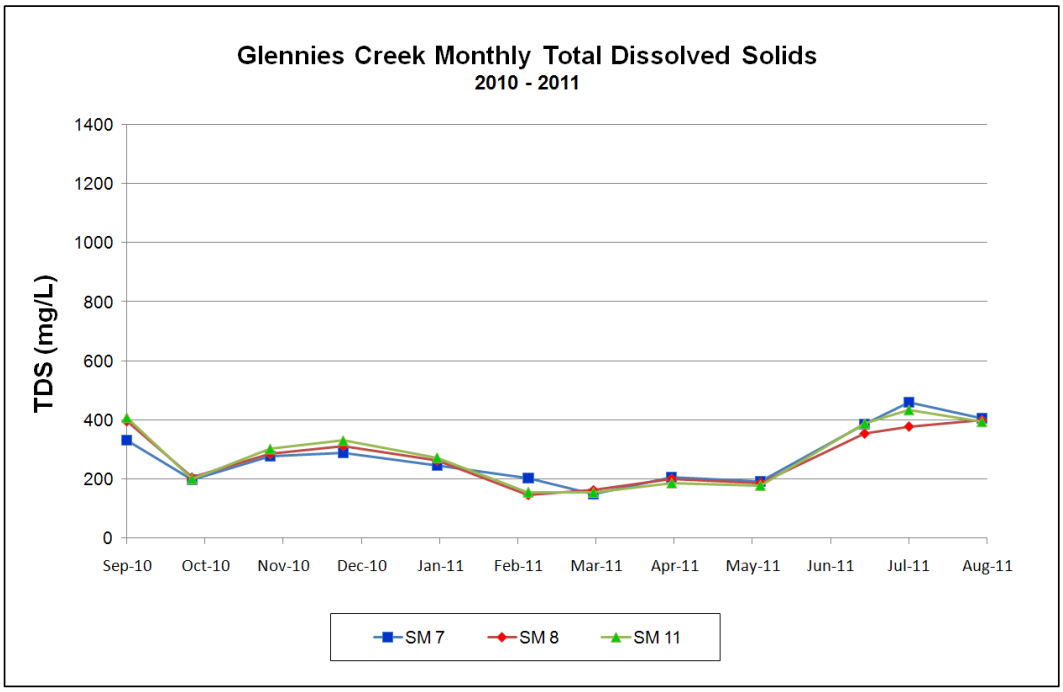

Figure 36. Monthly TDS levels at Glennies Creek sites during 2010-2011

Levels of TDS in the Hunter River were consistently low over the monitoring period with small variance between the sites, with the exception of SM9 which had a spike in October and November 2010 (**Figure 37**). This spike corresponds to the trend seen in EC during the same period, due to the upstream location of SM9 Ashton Coal can be ruled out as the source of this small spike.

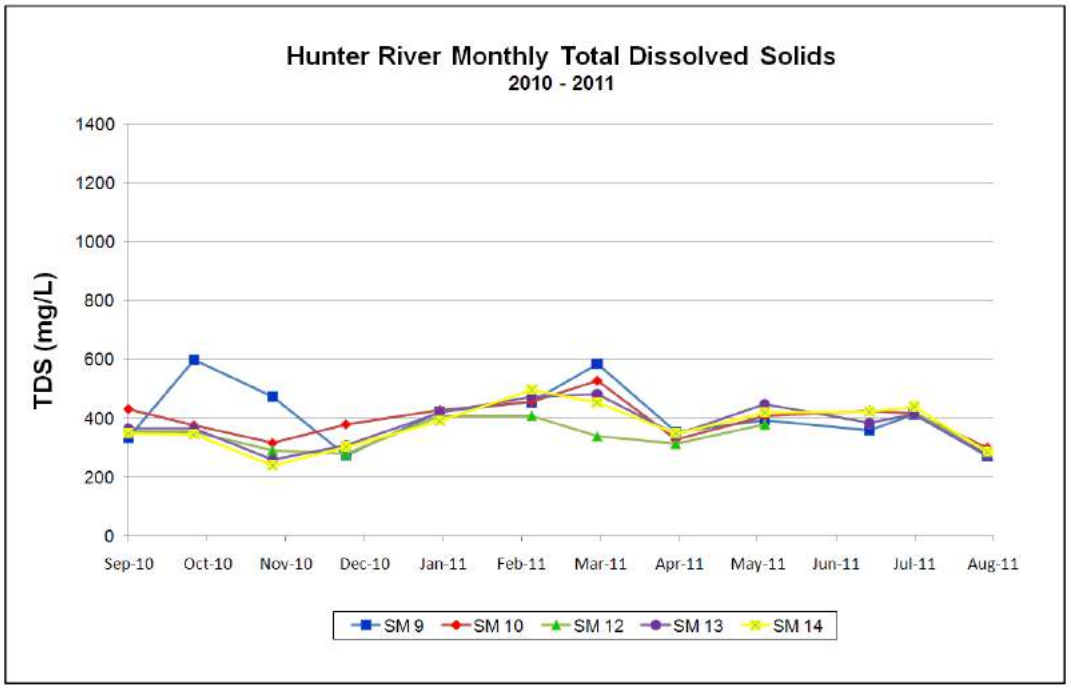

Figure 37. Monthly TDS levels at Hunter River sites during 2010-2011

Total Suspended Solids (TSS)

Monthly TSS results measured in mg/L are displayed in **Table 24**.

Table 24. **TOTAL SUSPENDED SOLIDS RESULTS 2010 - 2011**

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-10	Dry	Dry	5	6	8	14	11	9	24	26	8	19	38	21
Oct-10	Dry	Dry	4	9	8	9	13	10	7	22	13	22	28	20
Nov-10	Dry	Dry	14	16	12	18	19	22	15	56	18	56	57	56
Dec-10	50	72	35	24	23	163	28	45	133	148	48	136	127	138
Jan-11	Dry	Dry	10	15	19	99	20	17	46	46	86	43	42	58
Feb-11	Dry	Dry	13	15	14	48	12	14	34	42	30	16	32	20
Mar-11	Dry	Dry	9	18	14	58	22	14	43	46	21	84	30	33
Apr-11	Dry	Dry	24	29	7	19	9	13	28	26	9	28	22	23
May-11	Dry	Dry	<5	10	<5	12	<5	11	9	11	5	12	10	10
Jun-11	Dry	Dry	<5	<5	6	9	5	6	18	12	<5	NA	13	13
Jul-11	Dry	Dry	<5	<5	<5	6	6	6	6	5	6	6	5	<5
Aug-11	Dry	Dry	<5	<5	6	16	13	11	16	12	10	16	17	7
Min	50	72	4	6	6	6	5	6	6	5	5	6	5	7
Ave	50	72	14	16	12	39	14	15	32	38	23	40	35	36
Max	50	72	35	29	23	163	28	45	133	148	86	136	127	138

Levels of TSS in Bowmans Creek were consistently low during the monitoring period with the exception of a large spike at SM6 in December 2010 that continued through to April 2011 (**Figure 38).**

No other monitoring locations within this stream system demonstrated the same trend. SM6 is downstream of a number of mining operations including ACOL, SM6 is located just above the confluence of Bowmans Creek and the Hunter River and may experience back flows from the Hunter River depending on river levels. SM5 which did not experience the increased levels of TSS seen in SM6 is midstream in Bowmans Creek yet still downstream of any possible surface works undertaken by ACOL. It is noted that ACOL were not undertaking any surface disturbance works in a catchment area up stream of SM6 and downstream of SM5 and hence the elevated TSS levels in SM6 cannot be attributed to any activates being undertaken by ACOL.

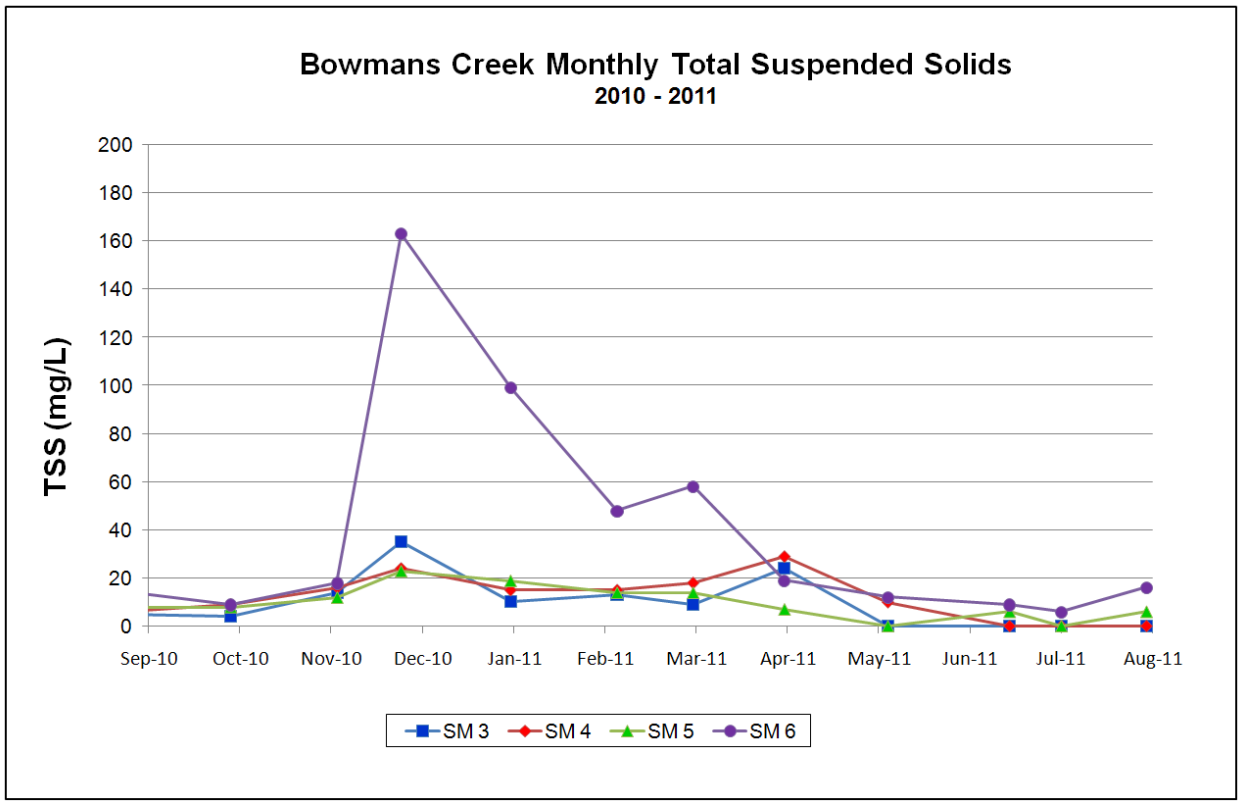

Figure 38. Monthly TSS levels at Bowmans Creek sites during 2010-2011

Levels of TSS in Glenneis Creek were consistently low during the monitoring period with the exception of a spike at SM11 in December 2010 that continued through to February 2011 (**Figure 39**). SM11 is just upstream of the confluence of Glennies Creek and the Hunter River and may experience back flows from the Hunter River depending on Rivers levels in relation to Creek flows. SM8 is mid stream in Glennies Creek and also downstream of ACOL, SM8 did not experience the same elevated levels of TSS as SM11 and as such the event cannot be attributed to any activities associated with ACOL.

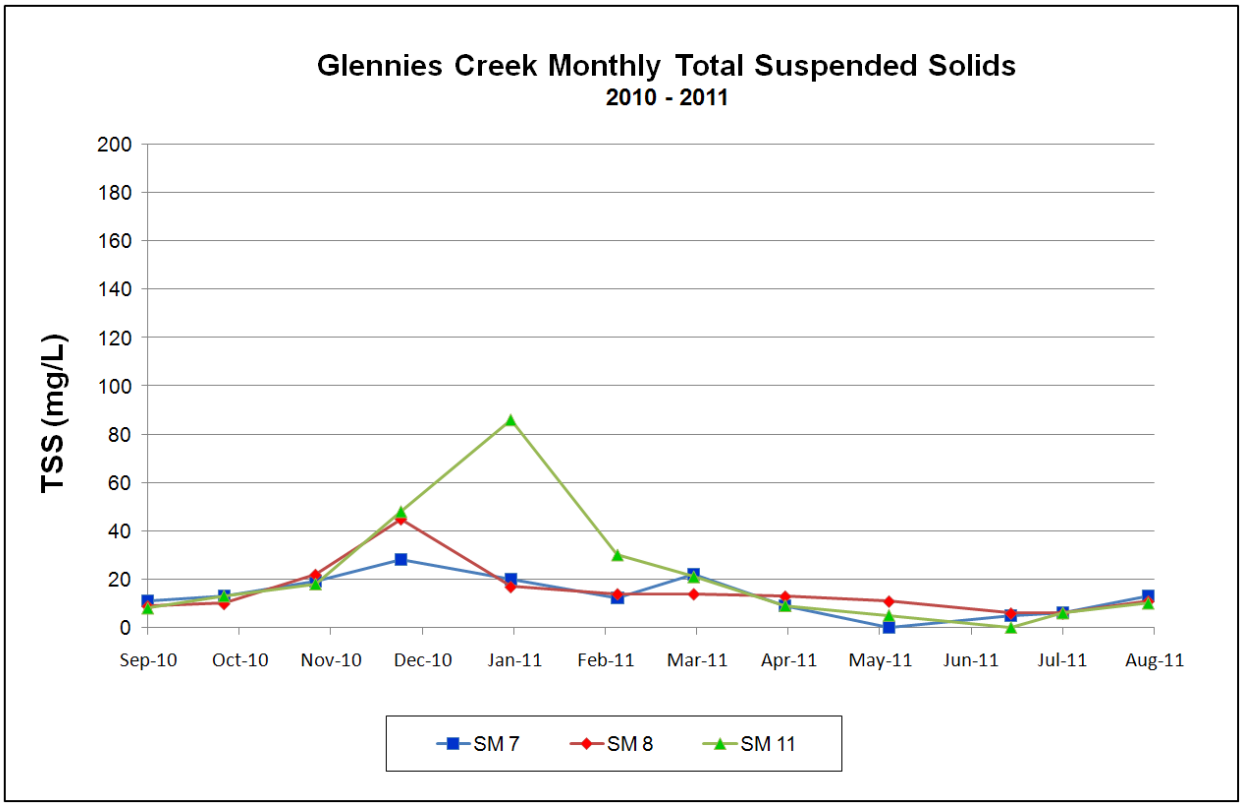

Figure 39. Monthly TSS levels at Glennies Creek sites during 2010-2011

Hunter River monitoring locations suffered the identical spike in TSS during December 2010 as seen in Bowmans Creek, and to a lesser extent Glennies Creek, monitoring points close to their confluence with the Hunter River. (**Figure 40**). Of particular note is SM9 which is a monitoring location upstream of Bowmans Creek and Glennies Creek, based on this upstream monitoring it is evident that Ashton Coal was not the source of the increased levels of TSS.

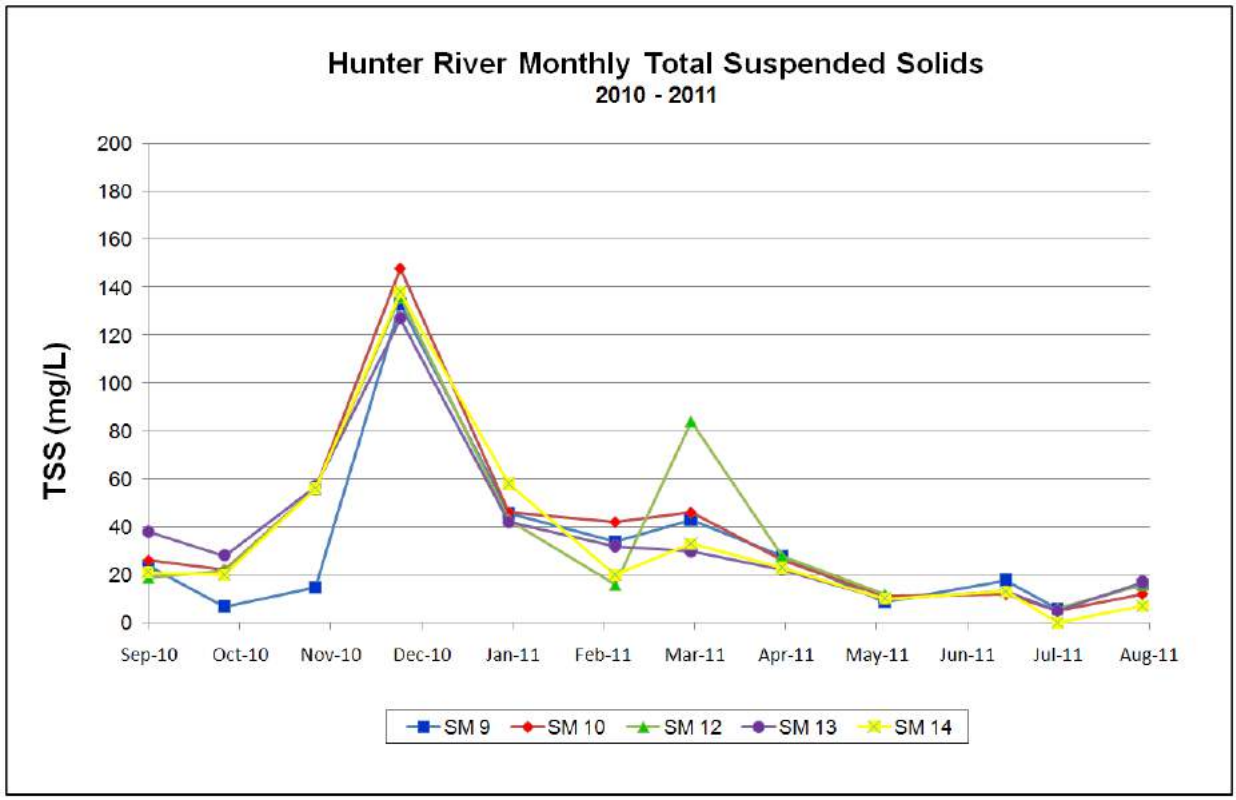

Figure 40. Monthly TSS levels at Hunter River sites during 2010-2011

Total Hardness

Monthly Total Hardness results measured in mg/L of $CaCO_3$ are displayed in **Table 25**.

Table 25. **TOTAL HARDNESS RESULTS 2010 - 2011**

$CaCO_3$ (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-10	Dry	Dry	271	269	247	218	170	190	221	220	190	217	216	217
Oct-10	Dry	Dry	248	253	222	223	120	123	231	262	128	250	263	260
Nov-10	Dry	Dry	194	194	200	203	143	133	194	172	124	168	171	174
Dec-10	87	73	186	123	190	167	112	98	127	143	134	136	139	138
Jan-11	Dry	Dry	220	230	194	211	95	95	224	208	104	198	202	202
Feb-11	Dry	Dry	228	125	204	283	78	75	282	278	82	258	282	298
Mar-11	Dry	Dry	234	328	210	274	73	75	295	273	75	238	291	298
Apr-11	Dry	Dry	232	364	231	256	84	87	206	211	84	180	190	199
May-11	Dry	Dry	215	442	217	245	82	82	245	242	82	218	240	242
Jun-11	Dry	Dry	166	166	163	163	138	136	176	170	132	NA	179	179
Jul-11	Dry	Dry	197	194	204	208	183	176	252	246	171	239	243	246
Aug-11	Dry	Dry	214	217	201	208	163	152	184	186	155	184	186	177
Min	87	73	166	123	163	163	73	75	127	143	75	136	139	138
Ave	87	73	217	242	207	222	120	119	220	218	122	208	217	219
Max	87	73	271	442	247	283	183	190	295	278	190	258	291	298

Oil and Grease

Monthly Oil and Grease results measure din mg/L are displayed in **Table 26.**

Table 26. **TOTAL OIL & GREASE RESULTS 2010 - 2011**

Oil & Grease (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-10	Dry	Dry	5	5	5	7	5	5	<5	<5	5	6	5	6
Oct-10	Dry	Dry	<5	39	<5	<5	<5	<5	<5	<5	<5	6	17	5
Nov-10	Dry	Dry	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dec-10	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Jan-11	Dry	Dry	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Feb-11	Dry	Dry	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Mar-11	Dry	Dry	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Apr-11	Dry	Dry	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
May-11	Dry	Dry	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Jun-11	Dry	Dry	<5	<5	<5	<5	<5	<5	<5	<5	<5	NA	<5	<5
Jul-11	Dry	Dry	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Aug-11	Dry	Dry	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Min	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ave	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Max	<5	<5	5	39	5	7	5	5	<5	<5	5	6	17	6

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 sites SM3 and SM4 are to identify if the process water dam located adjacent to Betty's and Bowmans Creek is discharging dirty water into the creek system. 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 periods of low flow in Bowmans Creek, the groundwater discharge dominates the water supply to the pool. Following heavy rainfall observed in June 2010, water chemistry returned to natural flow levels following the dilution of the groundwater discharge.

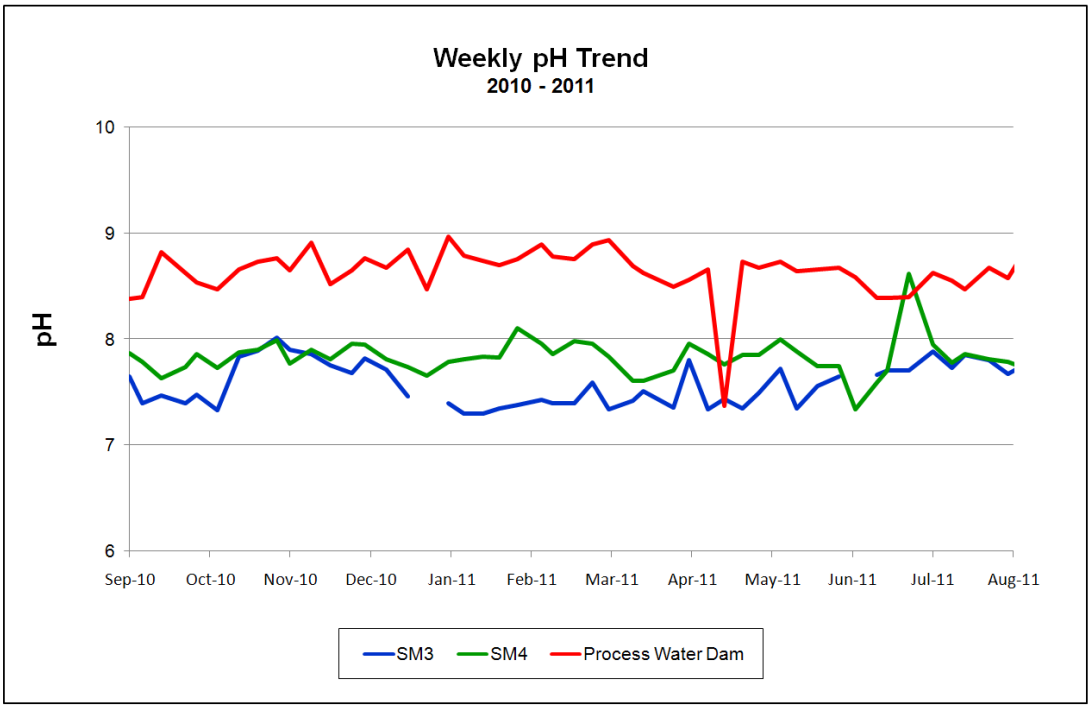

Figure 41. Weekly pH levels during 2010-2011 for sites SM3, SM4 and PWD

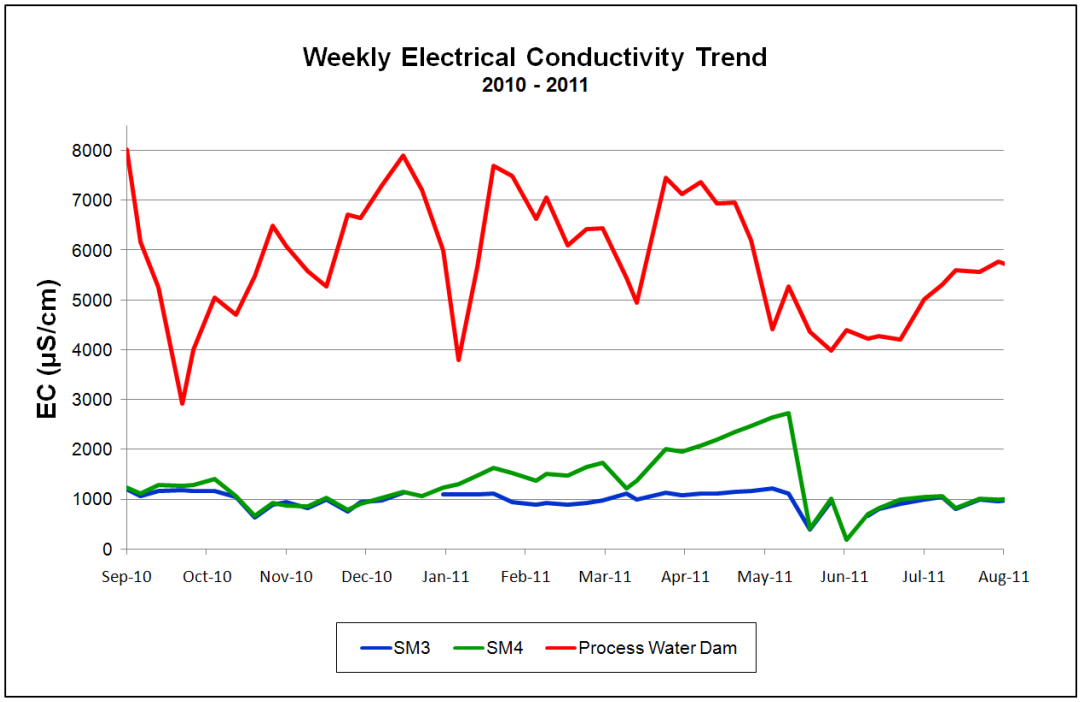

Figure 42. Weekly EC levels during 2010-2011 for sites SM3, SM4 and PWD

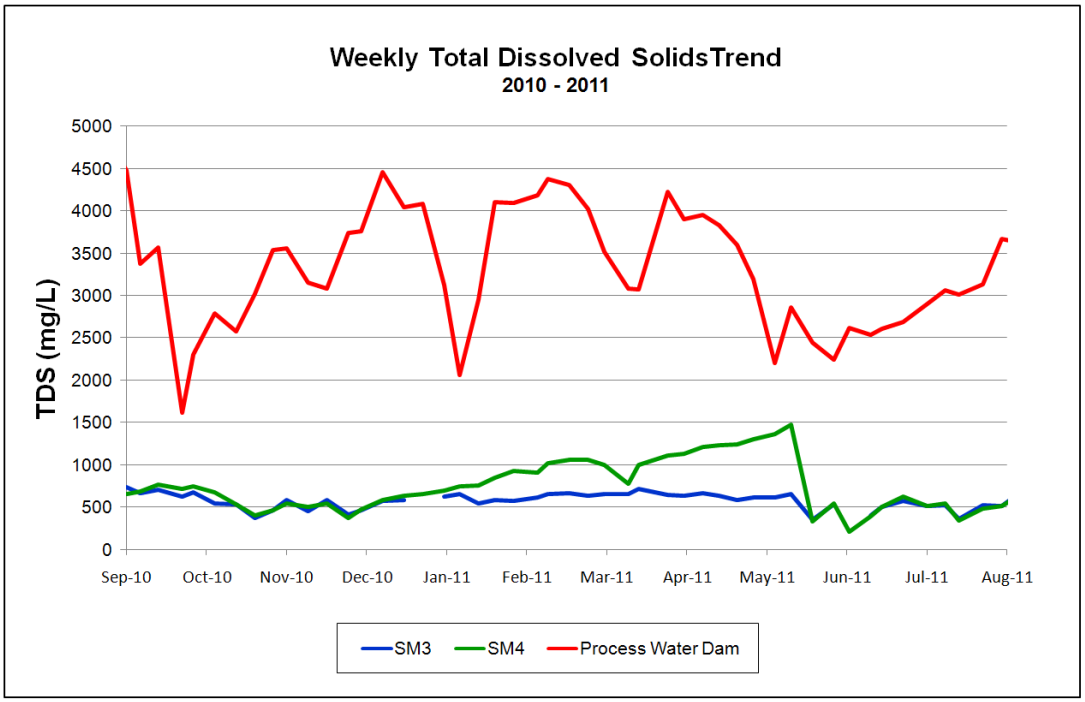

Figure 43. Weekly TDS levels during 2010-2011 for sites SM3, SM4 and PWD

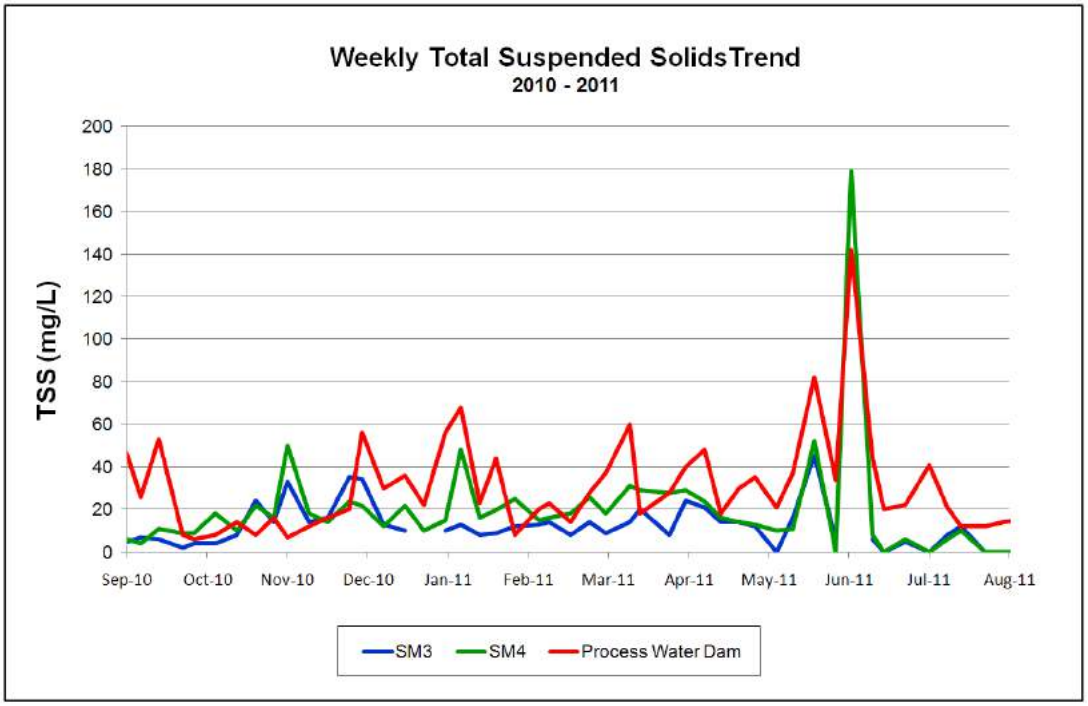

Figure 44. Weekly TSS levels during 2010-2011 for sites SM3, SM4 and PWD

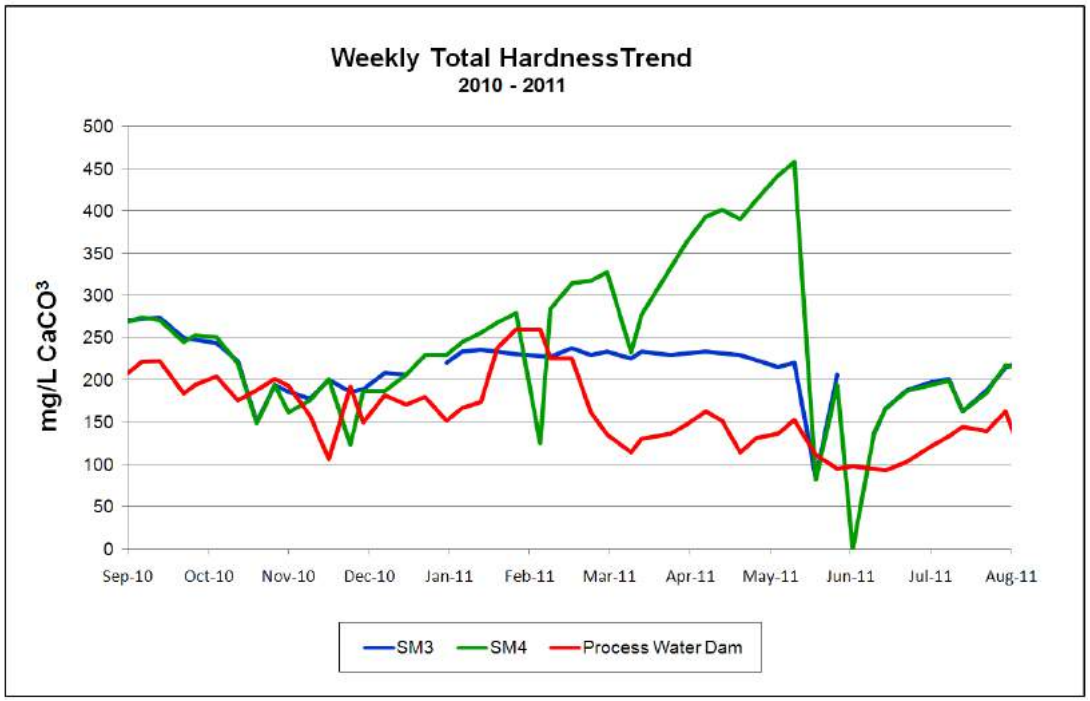

Figure 45. Weekly Total Hardness levels during 2010-2011 for sites SM3, SM4 and PWD

3.4 GROUND WATER

As required by Consent Condition 9.2 (d), a groundwater reports has been prepared by an independent expert covering the reporting period 1 September 2010 to 1 September 2011. This report has been included in **Appendix 2**.

3.4.1 Summary

The groundwater report included in **Appendix 2** 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 reporting 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 Environmental Impact Statement (EIS) (HLA Envirosciences, 2001), the Bowmans Creek Diversion Environmental Assessment (EA) (Evens & Peck, 2009 & Aquaterra, 2009) and the Subsidence Management Plan (SMP) variation for Longwall 7A (Aquaterra, 2010a and RPS Aquaterra, 2010).

Over the 2010-11 reporting period:

- Mining was near completion in the North East Open Cut (NEOC) and underground mining was completed in LW6A and LW7A in the Pikes Gully seam, which occurred under parts of the Bowmans Creek Alluvium. The development headings for Upper Liddell LW1 have been taking place over the reporting period and are still in progress.
- The groundwater monitoring network was expanded which included 3 nested monitoring sites, installed in the Bowmans Creek Alluvium and the Permian overburden units (This was undertaken in accordance with the Bowmans Creek EA Section 13 Commitments). An additional 6 standpipe piezometers were also installed to verify the hydraulic properties of the Bowmans Creek Alluvium and monitor any effects of the Bowmans Creek Diversion and mining beyond LW6A.
- Groundwater monitoring frequency was increased in key monitoring bores during the early and final stages of LW6A and LW7A panel extraction, to monitor the 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.
- Apart from the initial drawdown observed in the Glennies Creek Alluvium during the mining of LW1, no mining impacts have been observed in the Glennies Creek, Bowmans Creek or Hunter River Alluvium as a result of underground mining.
- There were no additional baseflow impacts to Glennies Creek. Actual seepage inflow rates from the Glennies Creek Alluvium were about 0.66L/s (0.06ML/d), and therefore continued to be below the EIS and EA predictions of 3.2L/s (0.28ML/d) and 2.6L/s (0.21ML/d), respectively.

- Mining of LW6A and LW7A occurred beneath parts of the Bowmans Creek Alluvium and no reduction in Alluvium storage was evident, hence no baseflow impacts on Bowmans Creek have been observed to date. The actual seepage rates have therefore continued to be less than the rates contained in the EIS (4.5L/s / 0.38ML/d), EA and SMP (0.34L/s / 0.03ML/d) predictions.
- There were no baseflow impacts to the Hunter River and therefore no impacts to the small stands of River Red Gums near the Hunter River, which is consistent with the EA and SMP predictions, and lower than the EIS prediction of 3L/s (0.27ML/d) for this stage of mining.
- Large drawdown responses in the Pikes Gully Seam and Permian overburden units have been observed in the immediate LW1 to 7A mining area. Piezometers located in the barrier between LW1 and Glennies Creek have demonstrated that groundwater levels continue to show steady recovery so that most of the initial 3.0m drawdown has now been recovered. The recovery in water levels suggests a steady reduction in the hydraulic conductivity of the Pikes Gully Seam between LW1 and the subcrop line beneath the Glennies Creek floodplain, possibly due to delayed response to the in-seam grouting carried out in 2007. The gradual recovery in water levels has been accompanied by a gradual reduction in the rate of underground seepage inflows to the tailgate 1 backroad weir. No additional responses to underground mining were observed.
- Total groundwater inflows to the underground mine ranged from 0.4 to 10L/s and have been below maximum inflow rates contained in the EIS (18L/s / 1.5ML/d) EA (16L/s / 1.4ML/d) and SMP (16L/s / 1.4ML/d), for this stage of mining.

In summary, all groundwater-related impacts from underground mining during the review period were below the levels predicted in the groundwater impact reports for the 2001 EIS, 2009 EA and 2010 SMP for LW7A. As such, the monitoring results have shown that the LW extractions have been completed in full compliance with Development Consent Condition 3.9.

3.5 CONTAMINATED AND POLLUTED LAND

There were no discharges to land during the reporting period.

3.6 FLORA AND FAUNA MANAGEMENT

Condition 3.46 of the Development Consent requires the preparation of a Flora and Fauna Management Plan (FFMP), which was approved by DoP&I, OEH, NoW and DTIRIS in August 2006. Fauna monitoring was conducted in spring 2010 and autumn 2011 as part of the Flora and Fauna Management Plan. These monitoring surveys continually assess habitat value and species abundance and diversity within ACOL lands and monitor any changes to allow for an appropriate action towards a healthier ecosystem.

The main focus of the monitoring is the southern woodland (SW), also known as the Voluntary Conservation Area (VCA) 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* (grey box).

One new site was added to the monitoring schedule in autumn 2011, the underground subsidence zone (UG). This was done due to the original survey design not having a good representation of underground impact areas outside of conservation reserves. Monitoring sites are illustrated in **Figure 46.**

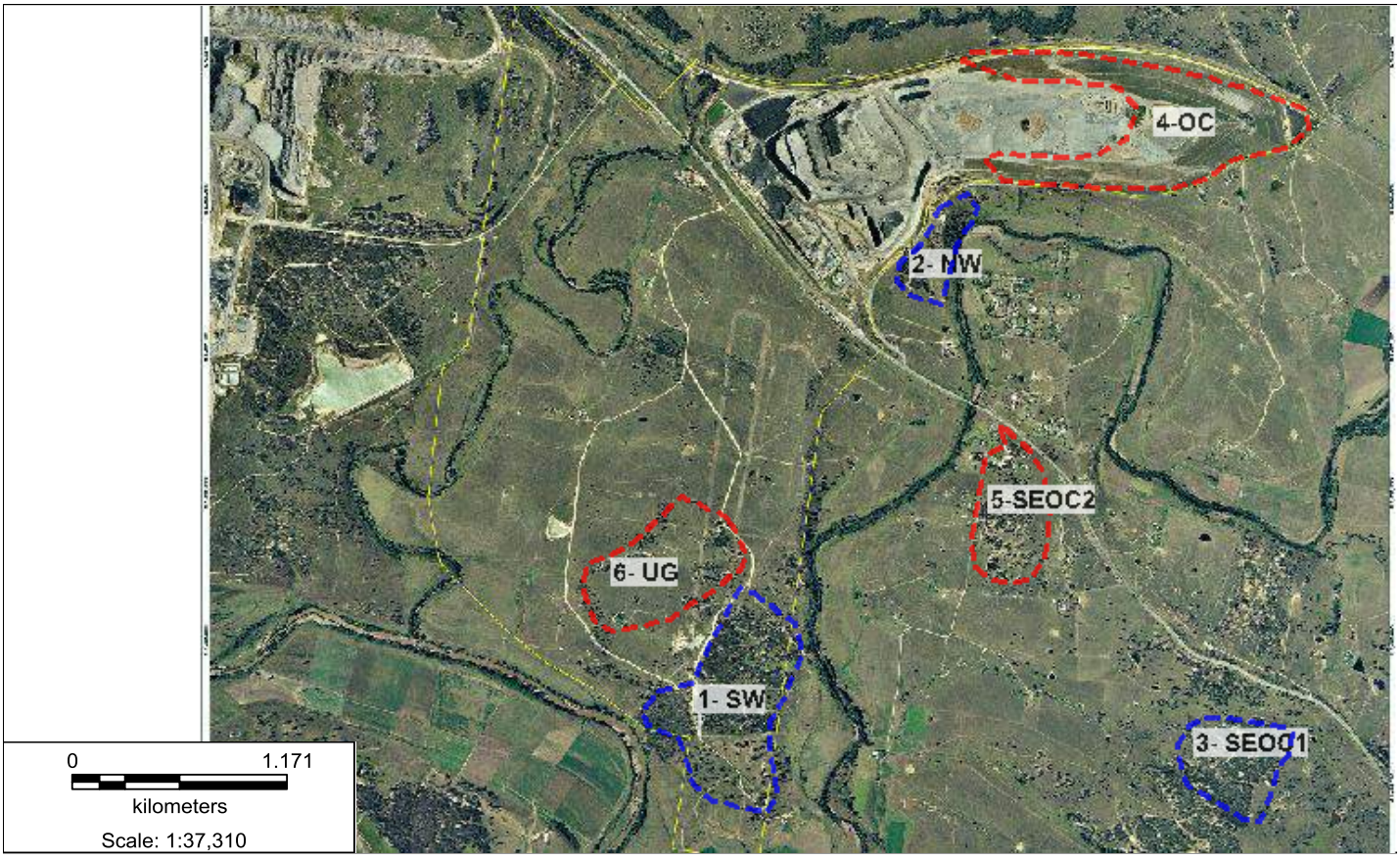

Figure 46. Monitoring locations for spring 2010 and autumn 2011 ecological surveys

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).

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

- Bird Survey – using the standardized search method and fixed area transect method
- Fauna trapping – using "A Type" Elliot traps, cage traps, arboreal HWR Glider traps and 100mm diameter hairtubes
- Frog Survey – by listening for frog calls followed by an active spotlight search of that area
- Ant Survey – ant nests were identified along a transect and few individuals collected for identification
- Reptile Survey – using passive and active search methods and subplots of pitfall traps, as well as targeting likely reptile habitats such as rocks, hollows and rubbish
- Micro-bat Survey – eight Anabat stations were established within the study area. Spotlighting along transects was also conducted as well as targeting flowering myrtaceous vegetation where micro-bats are likely to be found feeding
- Large Ground Mammal Survey - using "A Type" Elliot traps, cage traps and 100mm diameter hairtubes along a transect
- Nocturnal Birds of Prey and Mammals – surveyed by spotlighting along a transect
- River Red Gum Study - Vegetative Cover Estimation (vertical photographs) were used to estimate foliage cover
- Landscape Functions Analysis – assessed along a down slope direction transects, with the assessment including spatial relationship of patches and inter-patches and at the soil level. Also included is a micro assessment defining soil type and parameters which include: soil cover, perennial grass butt cover and canopy cover of trees and shrubs, litter cover, soil surface crust broken-ness, lichen and moss cover, forms of erosion, loose and mobile material, surface nature, surface roughness and the slake test. This data is then used to determine the Stability Index, Infiltration Index and Nutrient Cycling Index.

3.6.1 Voluntary Conservation Area (VCA)/ Southern Woodland (SW)

On 11 November 2010 ACOL received notification from OEH NPWS of the registration of ACOL's Voluntary Conservation Area (VCA) conservation agreement (also know as the southern woodland SW). Monitoring of the flora and fauna within the VCA has been ongoing including monitoring of a number of nest boxes. The VCA has been fully fenced for several years to exclude grazing and sign posted as a conservation area. Weed works have been conducted during the reporting period including the maintenance follow up spraying of Green Cestrum, and spraying of St John's Wort. Works to be conducted in the next reporting period include further follow up maintenance weed works focusing on St John's Wort, Green Cestrum and African Boxthorn.

Landscape Function Analysis results signify that the VCA is a sound benchmark for ecosystem trajectory assessment and should allow for the successful assessment of the rehabilitation works. Whilst the analogue sites within the proposed South East Open Cut reserve area are not as established and as well managed as the VCA site, they still provide habitat for important species and communities and is an excellent example of area regenerating to a more natural state.

3.6.2 River Red Gum Study

During the reporting period a new assessment has commenced focusing on River Red Gum health. Under the Threatened Species Conservation Act 1995 the regional population of River Red Gums is listed as an Endangered Population. This assessment will aid governments in collating data for the larger study that aims to better manage the endangered regional population. No results are provided in this report however future reporting should present the results and see an improvement in understanding which is required to ensure a future preservation of the River Red Gum populations.

3.6.3 Bird Survey Results

A total of 89 bird species were identified within the study area which is an increase of 35 species since the 2007 surveys. A total of 4 significant species were recorded (Grey-crowned Babbler, Turquoise Parrot, Speckled warbler, Hooded Robin). The Turquoise Parrot has not been previously been recorded in the area. The Turquoise Parrot and the Hooded Robin both carry a high significance. The southern woodland and south east open cut 1 areas scored significantly higher diversity compared to the other locations and provided habitat for a greater range of woodland bird species.

Results have identified at least 7 breeding groups of up to 66 individuals of the Grey-crowned Babbler within the study area. This equates to an increase of 13 individuals from 2007 surveys. These findings indicate that the population is steadily increasing and it would be expected to expand into any surrounding regenerating habitats when they become available.

Three different breeding groups of the Speckled warbler were recorded. A total of 13 individuals were found which is an increase from the 2007 survey by 3 individuals.

Historic records indicate an overall increase in diversity in the area as shown by **Figure 47**. This could be a result of a decrease in grazing pressure and a habitat improvement in the area. Based on the area and the quality of habitat it is expected that the species diversity will plateau at around 110 species.

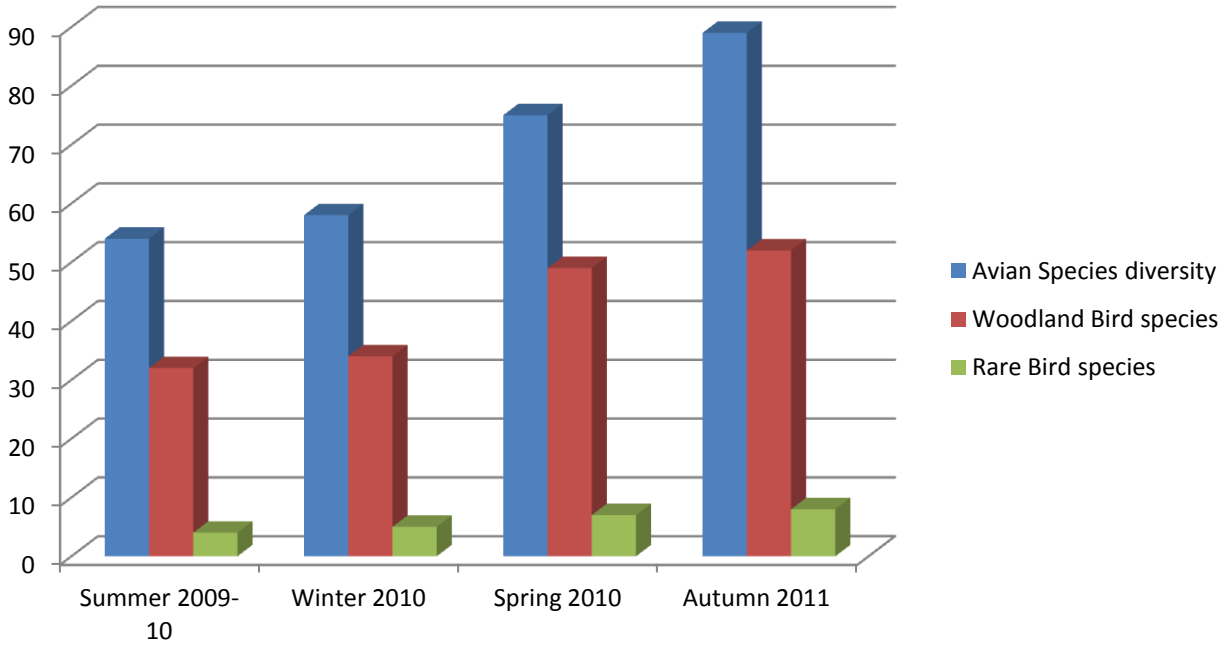

Figure 47. Avian diversity historic changes within transects

Woodland and rare species numbers have also seen similar trends as the overall diversity, with woodland birds increasing by 20 and rare species numbers by 4.

3.6.4 Fauna Trapping Results

Results were consistent with past trends of the area however these results are considered poor. Only two species; Yellow footed Antechinus and House mouse were recorded.

3.6.5 Frog Survey Results

Frog survey results during the Spring 2010 surveys were the best results recorded onsite since field surveys commenced onsite. In total 17 frog species have now been recorded onsite with the greatest diversity being recorded within the SW, refer to **Figure 48.** Identification of frog species diversity on any site is a function of two factors: 1) surveys are undertaken during cross sections of seasons to accommodate the different breeding times of the range of local species, and 2); that these surveys are undertaken within the ideal conditions for breeding individuals. The spring 2010 survey was undertaken during the peak activity time for a range of frogs and was also undertaken during ideal conditions.

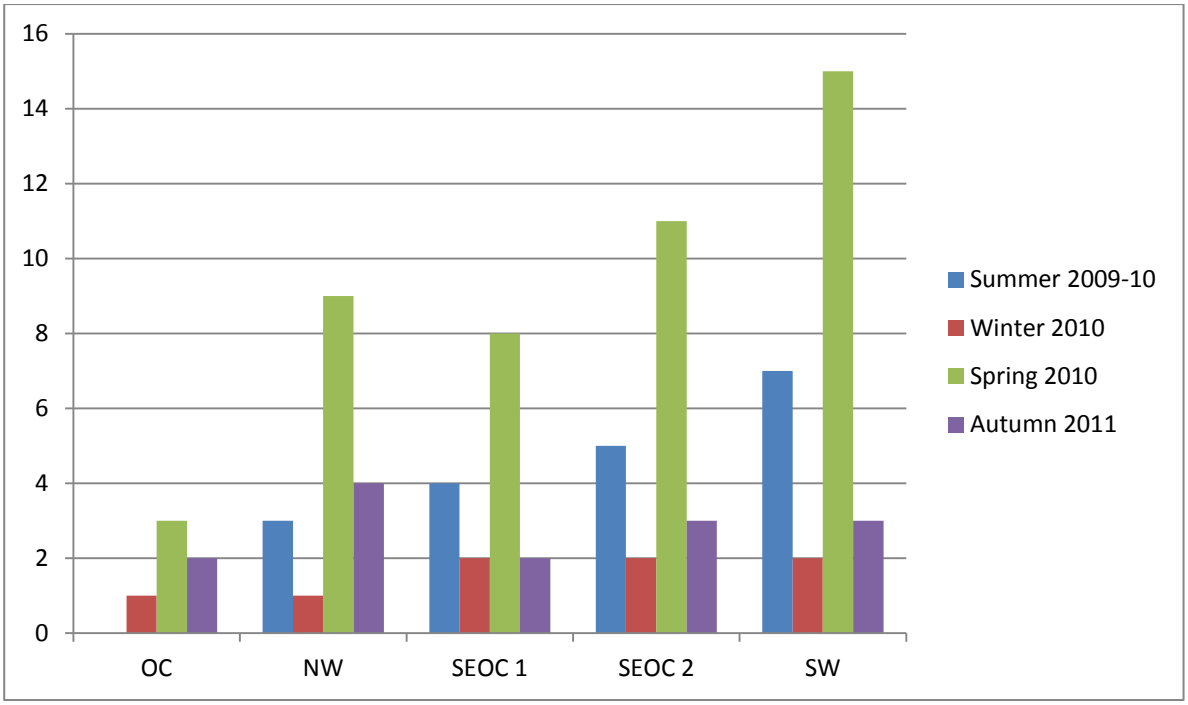

Figure 48. Frog survey results across sites

3.6.6 Ant Survey Results

Ant assemblages are a useful indicator of ecosystem health and will be used extensively in the future to confirm progress of the rehabilitated areas. The following genera of ants were found: Cerapachys, Iridomyrex, Papyrius, Camponotus and Melophorus.

3.6.7 Reptile Survey Results

A total of 10 reptile species were recorded during the monitoring period which is a considerable increase to previous surveys as seen in **Figure 49**. SW and SEOC show to have a much greater reptile habitat compared to the other sites, which is largely a function of habitat area and debris.

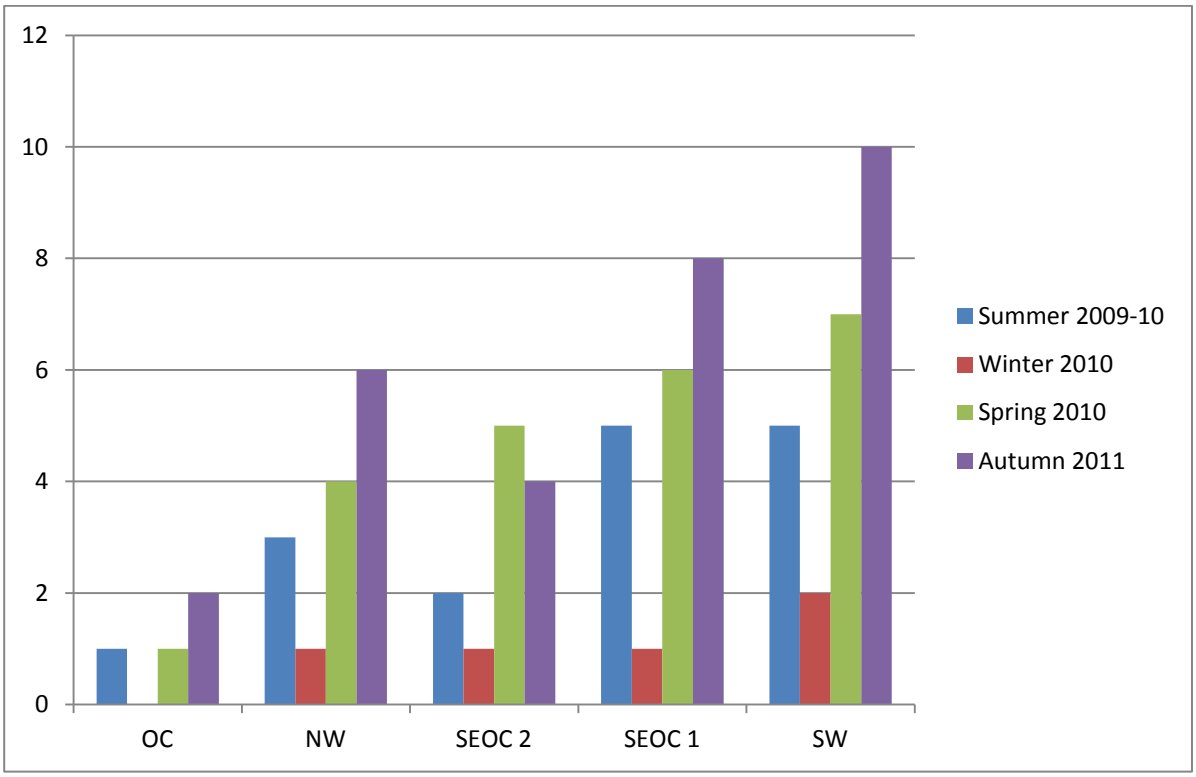

Figure 49. Reptile Diversity recorded over four seasons

Similarly to the increase in avian species diversity the increase in the reptile diversity may be a result of improved habitat due to a decrease of grazing pressure over the recent years.

3.6.8 Micro-bats Survey Results

There was a significant increase in the number of bat calls and diversity of bats in the peak of summer compared to other seasons (**Figure 50**), which is an expected trend with what is known about bat ecology.

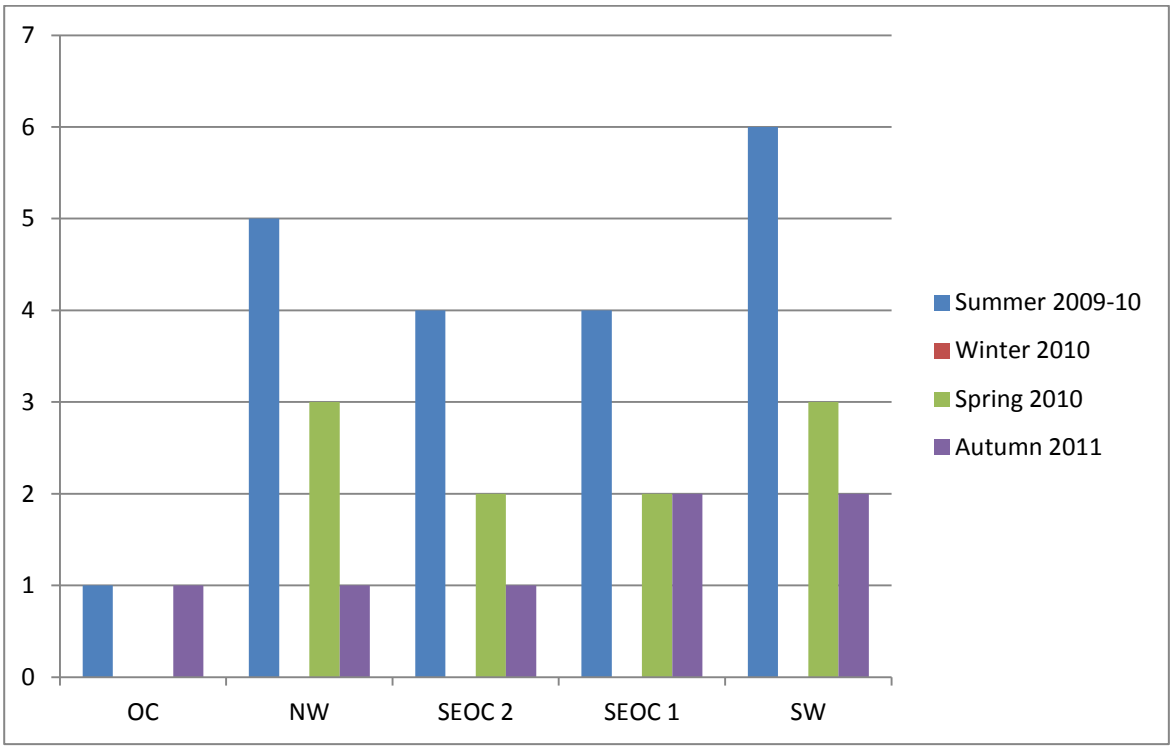

Figure 50. Recorded bat calls over four seasons

There doesn't appear to be a clear relationship between the size of an area and bat diversity. Although it is evident that there is greater diversity within the reserve areas that have been managed for conservation such as the northern woodland (NW) and southern woodland (SW). Five out of the 10 species recorded within these habiats are threatened.

3.6.9 Large Ground Mammal Survey Results

The most recent survey shows the greatest diversity of large mammals compared to previous 3 surveys (**Figure 51**). The reduced grazing pressure would have played a part in this increase.

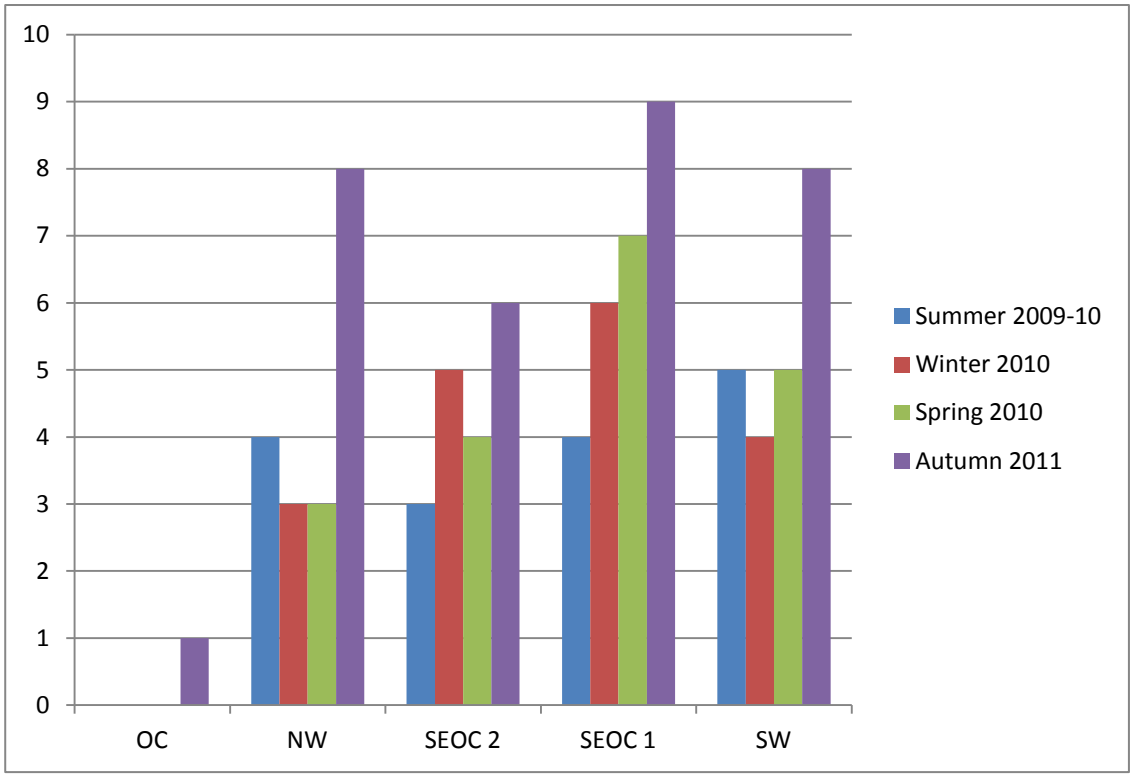

Figure 51. Large ground mammal diversity

It was also evident that the areas closer to semi-rural/urban areas (NW & CW) had a greater proportion of introduced animals compared to native species. The smaller area, lesser habitat diversity and proximity to human inhabited areas make these sites more prone to edge effects which are characterised by an increased presence of introduced species.

3.6.10 Nocturnal Birds of Prey and Mammals Survey Results

Spotlighting results indicate a greater abundance and diversity recorded at the common woodland, however this is again due to the closeness to areas inhabited by humans.

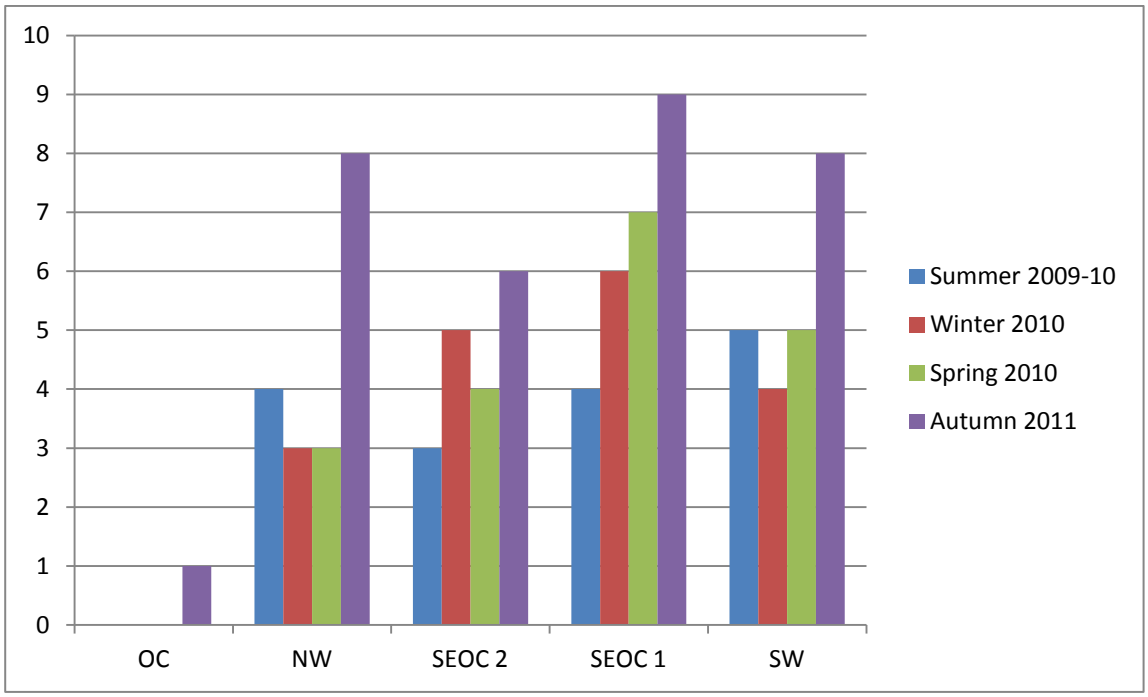

Figure 52. Spotlighting results of birds of prey and mammals

There appears to be no relationship between area size and diversity at this scale of study. Generally there is a greater proportion of introduced species to native species at all sites except for SW (**Figure 53**).

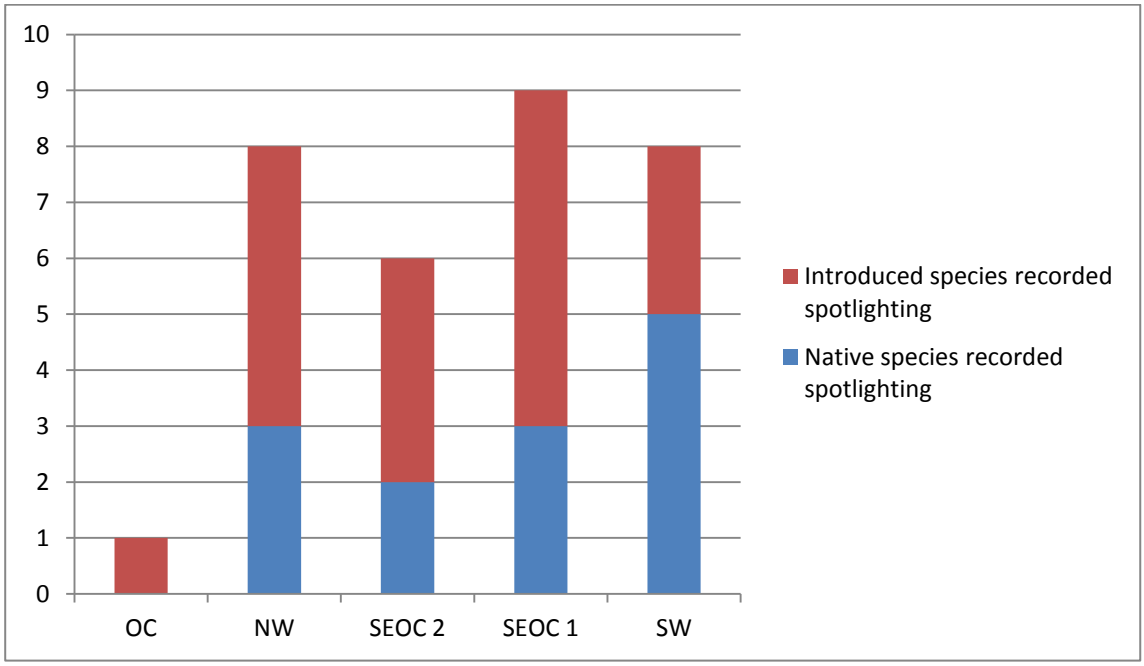

Figure 53. Proportion of native and introduced species observed during spotlighting

3.6.11 Landscape Function Analysis Results

LSFA is a scientifically method for identifying and assessing the status of processes that affect the availability of scarce or vital resources in space and time. The size of vegetation patches and inter-patches is recorded along a gradient. These are affected by biological features and litter accumulation. Nested within this landscape is an assessment of soil surface. The patch and inter-patch characteristics are highlighted by the 11 indicators outlined in the method section and are used to obtain values presented in **Error! Reference source not found.** which compares the four sites.

Table 27. **INDICES VALUES FOR MONITORING IN JUNE 2011**

Indices	SW	CW	NW	SEOC
Stability	84.1	81.9	73.5	79.8
Infiltration	71.3	63.2	52.7	58.0
Nutrient cycling	69.5	59.0	31.3	42.5

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 2010 and the initial benchmarking conducted during the EIS phase in 2001. Monitoring was conducted in spring 2010 and autumn 2011 in Bowmans Creek and Glennies Creek. Monitoring locations are shown in **Figure 54**

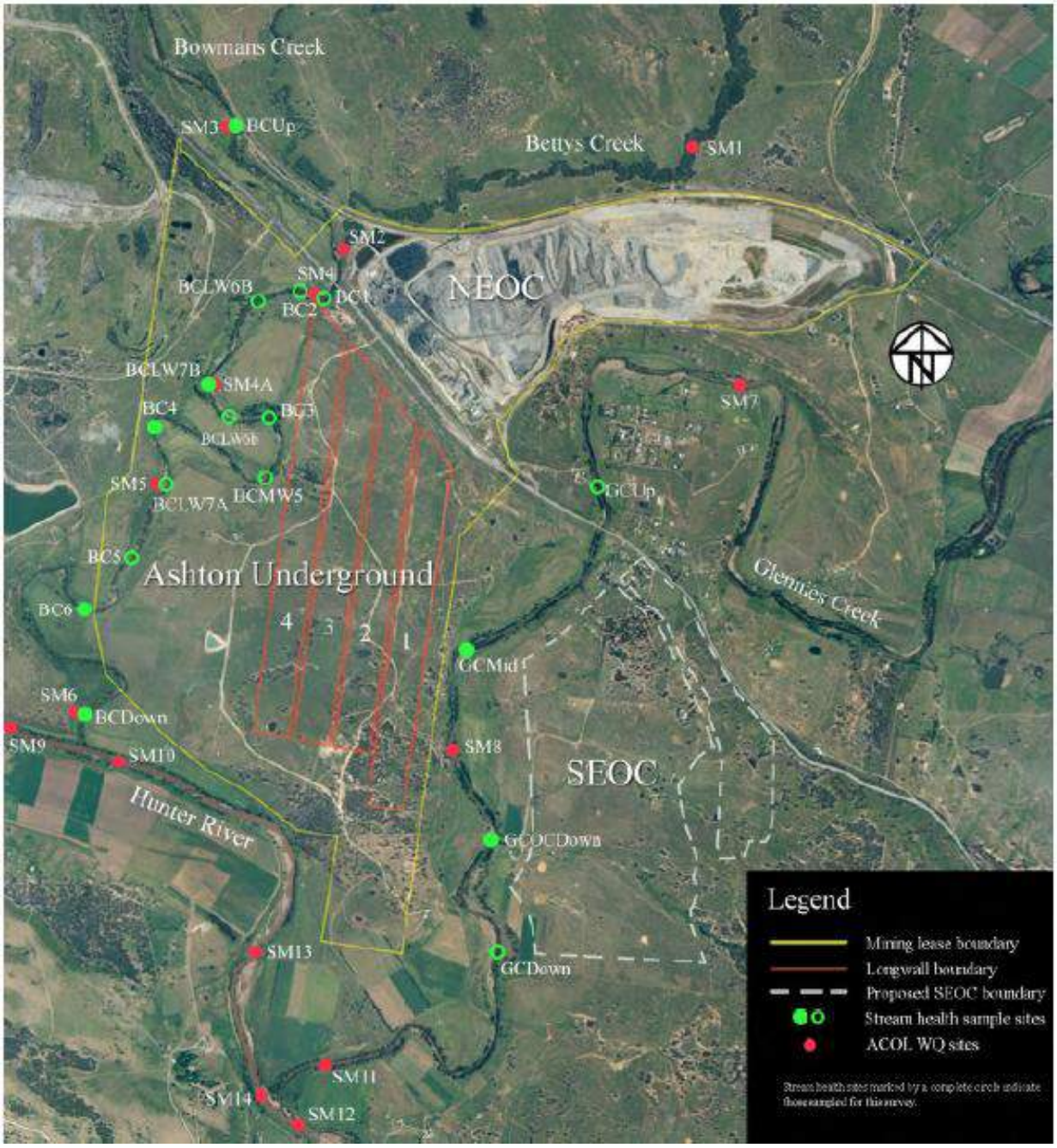

Figure 54. Aquatic Monitoring Location

In terms of overall study aims, the Aquatic Ecology Monitoring study endeavours to answer the following questions:

- Are there measurable differences in aquatic ecological 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:

- 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 several of the Illawarra coal mining catchments (e.g., BHP Billiton 2001). 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 now 13 monitoring sites located on Bowmans Creek plus 4 sites on the proposed diversion

channels which will be brought into the monitoring schedule consecutively as the construction progresses. 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 28. SITES UTILISED DURING AQUATIC MONITORING

Indices	Bowmans Ck Spring 2010	Bowmans Ck Autumn 2011	Glennies Ck Spring 2010	Glennies Ck Autumn 2011
Water quality profiling	7	5	3	2
Over-night fish trapping	5	4	0	0
Macroinvertebrate sampling plus aquatic habitat assessment	5	5	3	2

This new 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

In spring 2010 two new sites were added to the monitoring schedule; BC4 and BC6 located in the proximity of the lower end of the diversion channel. Spring 2010 sampling period experienced the highest mean daily flow rates (635.8ML/day) since the spring 2007 sample (839.8ML/day). Daily mean data for autumn 2011 was unavailable however five consecutive hourly reading were recorded ranging between 181.6ML/day and 190.4ML/day. The flow caused significant flooding throughout the study area.

During the spring 2010 survey a total of 39 macroinvertebrate taxa were recorded. This is a slight decline from the previous three seasons, one of which saw the highest number recorded (spring 09 had 46 taxa). Autumn 2011 saw a further decline to 32 taxa. This decline can possibly be explained by the recent high flows which can cause displacement of macoinvertebrates as well as disturbance to stream substrate on which the macroinvertebrates heavily rely on. The spring 2010 sample found a new taxon part of the Dolichopodidae family bringing the total number of macroinvertebrate taxa identified from Bowmans Creek sites to 71. The average number of taxa for spring 2010 was 19.0 ± 2.0 and for the autumn 2011 survey the average number of taxa increased slightly to 19.8 ± 0.6.

In terms of SIGNAL grades, the most sensitive taxon found was the mayfly Leptophlebiidae family Ephemeroptera (SIGNAL value of 8). SIGNAL scores for spring 2010 ranged between 3.33 and

3.84 with a combined Bowmans Creek survey score of 3.56. While for autumn 2011 the SIGNAL scores ranged between 3.44 and 3.62 with a combined Bowmans Creek survey score of 3.55 (**Figure 55**).

There were 3 fish species (native flathead gudgeon *Philypnodon grandiceps*, Australian smelt *Retropinna semoni* and the introduced pest species plague minnow *Gambusia halbrooki*) confirmed from Bowmans Creek sites in the spring 2010 and 4 species (Australian smelt *Retropinna semoni,* flathead gudgeon *Philypnodon grandiceps,* plague minnow *Gambusia halbrooki* and carp *Cyprinus carpio*) in autumn 2011 surveys. The plague minnow was the most widespread occurring at all the sites.

Tadpoles were observed only during spring 2010 at BCLW7B and a broad-palmed frog *Litoria latopalmata* was recorded at BCDown in autumn 2011. The overnight traps caught one freshwater prawn (*Macrobrachium sp*) at BC1 in spring 2010.

A juvenile long-necked turtles (*Chelodina longicollis*) were observed at BCDown. An eastern water dragon (*Physignathus lesueurii lesueurii*) was noted at BCUp.

BC4 recorded the highest macroinvertebrate diversity in spring 2010 survey and BCDown recorded the lowest. Once again BC4 recorded the highest macroinvertebrate diversity in autumn 2011 survey equal with BCDown which in the previous sampling season recorded the lowest. BC6 recorded the lowest macroinvertebrate diversity for the autumn 2011 survey.

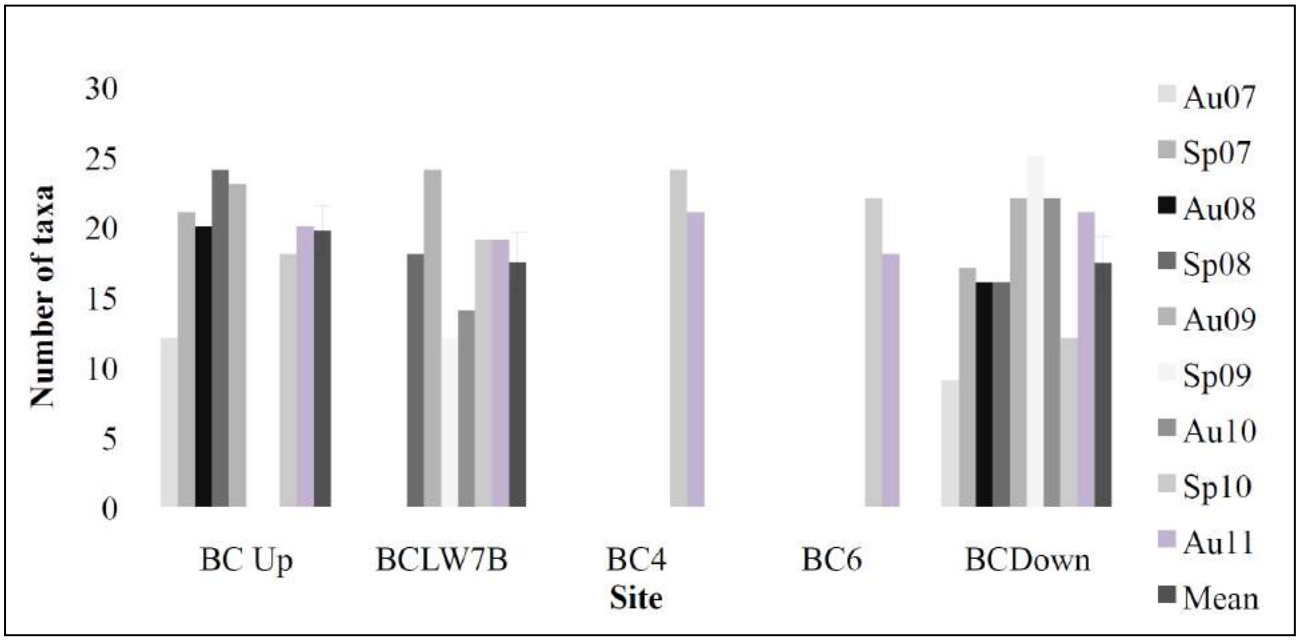

Figure 55. Bowmans Creek Seasonal Site Macroinvertebrate Diversity

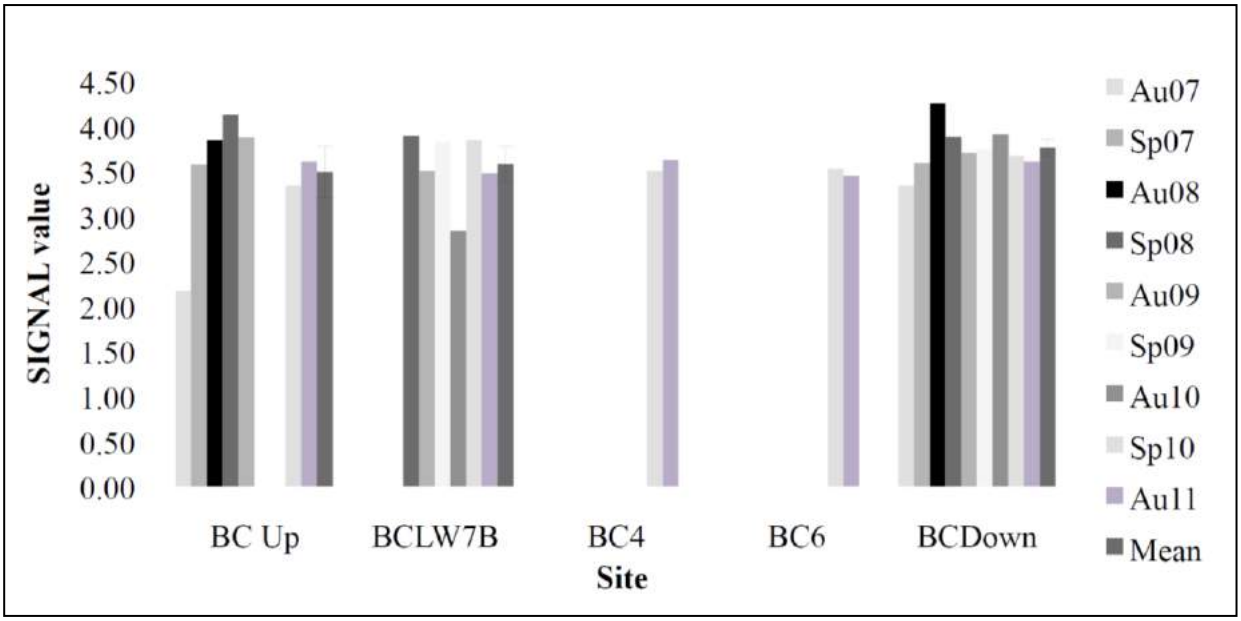

Figure 56. Bowmans Creek Seasonal Site SIGNAL Index

3.7.2.2 Glennies Creek

During spring 2010 Glennies Creek was experiencing a moderate flood during November where its mean daily flow reached 1974.2ML/day which was the highest recorded to date.
For autumn 2011 the mean daily flow was much lower ranging between 106.5 to 123.1ML/day, however these were recorded at the tail end of a high flow event which peaked at 16748.3ML/day. The flooding scoured river substrate of debris, fine silt deposits and detritus. Macrophytes recorded from the Glennies Creek study area consisted of *Myriophyllum sp,* clasped pondweed *Potamogeton perfoliatus*, cumbungi *Typha sp*, and common reed *Phragmites australis*, slender knotweed *Persicaria decipens* and river clubrush *Schoenoplectus validus.* All the species have been recorded previously.

Water quality was generally good across all parameters measured for the spring 2010 and autumn 2011 surveys.

There were 34 macroinvertebrate species indentified from the Glennies Creek sites for both spring 2010 and autumn 2011 surveys. The mean number of taxa identified were 20.3 ± 6.1 for spring 2010 and 25.0 ± 2.0 for autumn 2011 (**Figure 56**). The autumn 2011 mean taxa is the highest recorded on record. Also there were 3 new taxa (family Dolichopodidae and Philopotamidae and Class Collembola) identified at the Glennies Creek sites during the spring 2010 and autumn 2011 surveys bringing the total of macro invertebrate taxa to 72.

SIGNAL scores ranged between 3.22 and 3.61 with an overall combined creek score of 3.53 for the spring 2010 survey and 3.74 and 3.81 with a combined creek score of 3.78 for autumn 2011(**Figure 58**). Spring 2010 saw the lowest diversity of all the previous seasons surveys for site GCUp (9 taxa) which was significantly lower than the mean for that season. That same season GCMid recorded a significantly higher taxa diversity compared to the mean for that site, and is the highest diversity recorded over all the surveys.

There were at least five fish species recorded (plague minnow *Gambusia halbrooki, carp Cyprunus carpio,* native long-finned eel *Anguilla reinhardtii*, Australian smelt *Retropinna semoni* and juvenile gudgeons) for the spring 2010 survey and two species (plague minnow and firetail gudgeon) during the autumn 2011 survey. The introduced pest species plague minnow was the most common occurring at all sites during both surveys.

Tadpoles have not been recorded from Glennies Creek sites, although a few adult dwarf tree frogs (*Litoria fallax*) were observed at GCUp during spring 2010 in the same location as previously recorded.

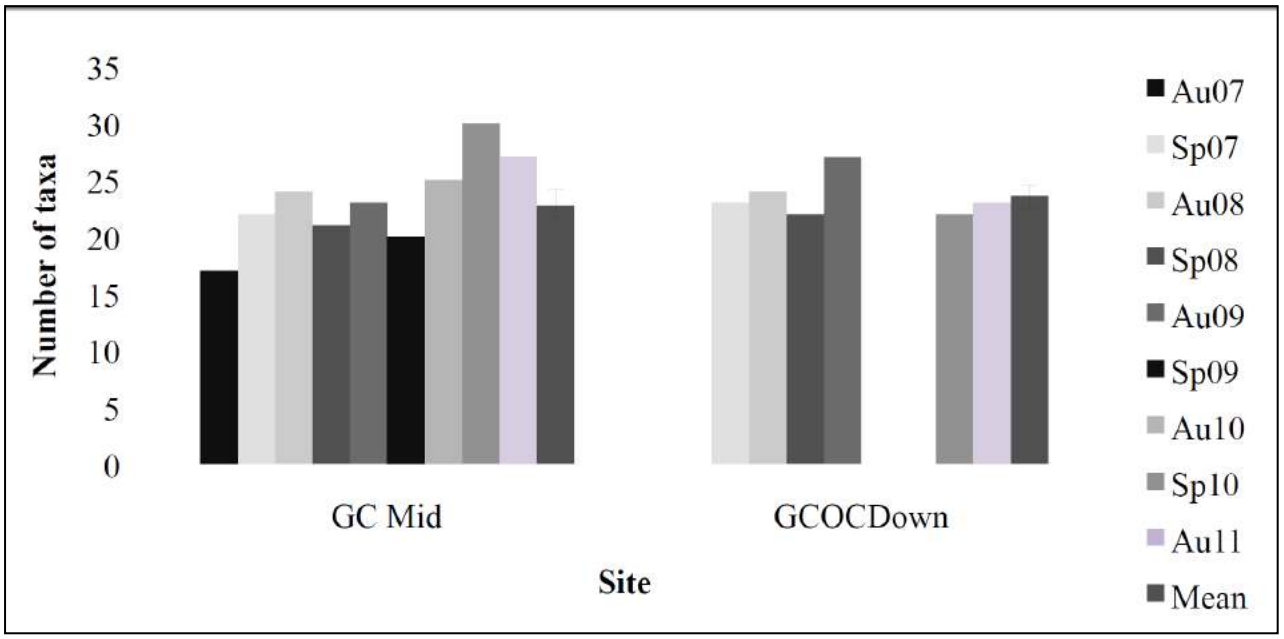

Figure 57. Gennies Creek Seasonal Site Macroinvertebrate Diversity

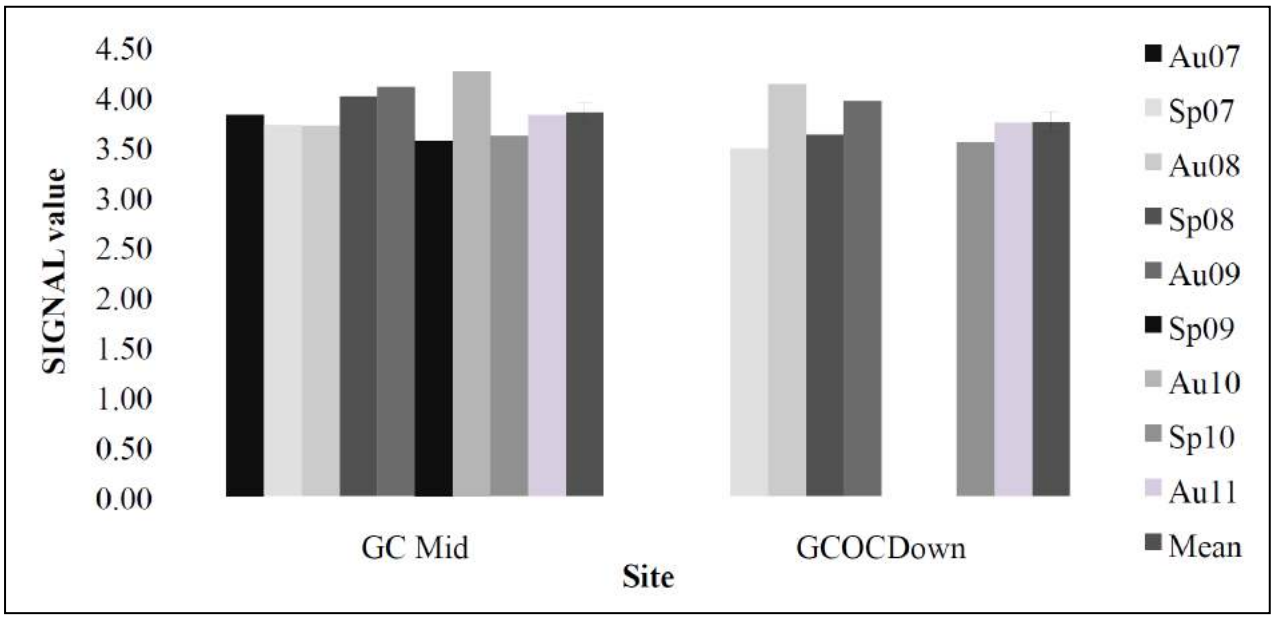

Figure 58. Glennies Creek Seasonal Site SIGNAL Index

3.8 WEEDS

3.8.1 Weed Management

Weed works conducted during the period are shown in **Figure 59** and focused on the following species:

- Green Cestrum, a Class 3 noxious weed. Approximately 67.83ha situated along the banks of Glennies Creek and the Hunter River were treated;
- African Boxthorn, a Class 4 noxious weed. A total of 230.67ha was treated;
- Galinea an environmental weed. A heavily affected rehabilitation area had the Galinea stripped off using a rock rake on a D6 dozer, then area was then reseeded and fertilised. A total of 5.5ha was treated;
- St John's Wort, a Class 4 noxious weed. A total of 62.23ha was treated;
- Mother of Millions, a Class 3 noxious weed. A total of 15.83ha was treated;
- Lantana, a Class 4 noxious weed. A total of 4.92ha was treated;
- Tobacco Tree / Broad Leaf Privet, a environmental weed and a Class 4 noxious weed, respectively. A total of 2.11ha was treated; and
- Blackberry / Narrow Leaf Pivet, are Class 4 noxious weeds. A total of 2.88ha was treated.

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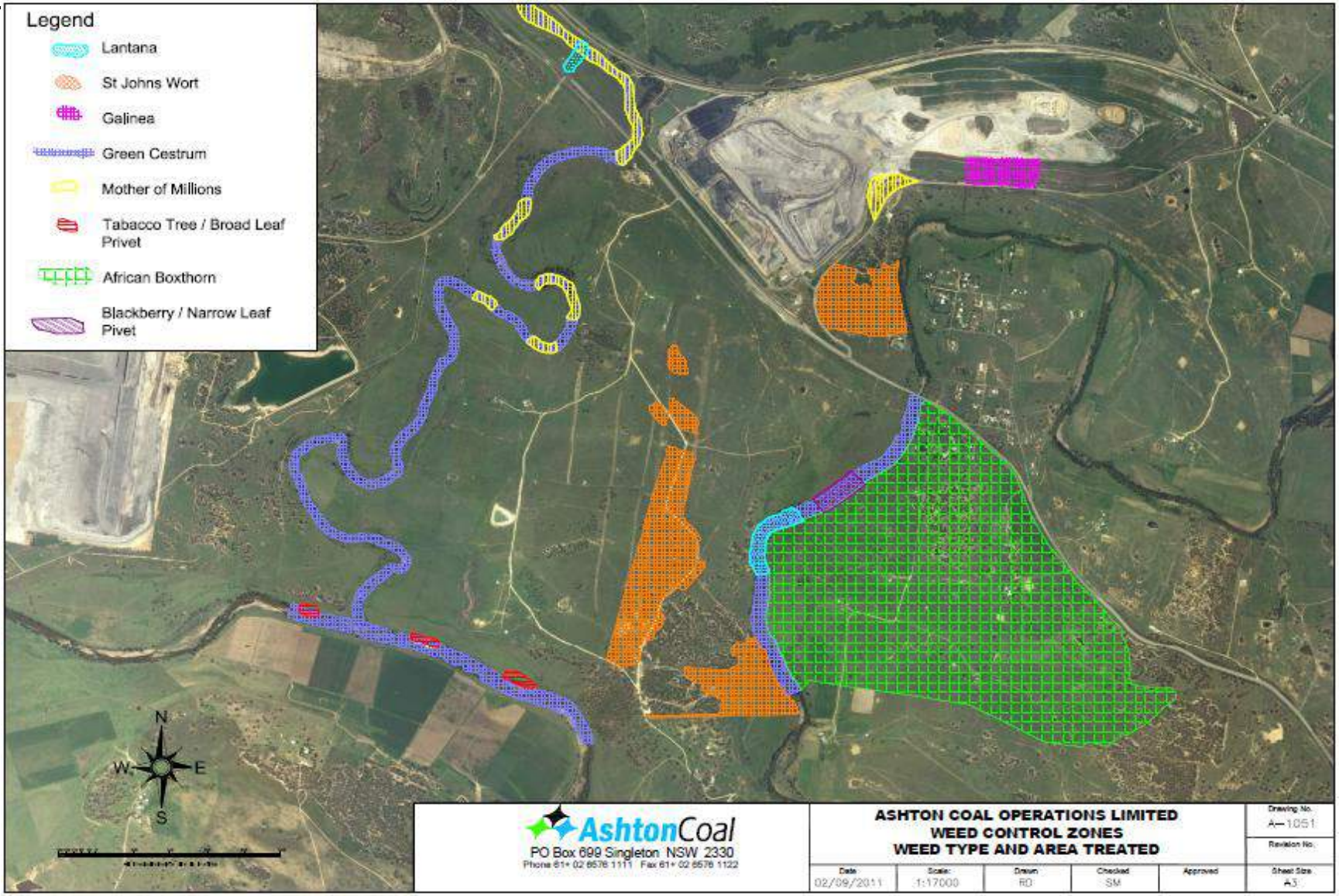

Figure 59. Overview of weed control works September 2010 to August 2011

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3.9 BLASTING

3.9.1 Blast Management

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) along with a complex series of controls have been established to ensure that blasts conform 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 the prior approval of the DECC. 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 also placed in the collar of each blast hole to minimise the effects of 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 Road and Rail Closure Management Plan (RRCMP) also requires the closure of Glennies Creek Road or the New England Highway if any part of the road comes within the 300 metre zone of exclusion that is required to be established around each blast. If any blast is within 200 metres of the Main Northern Railway, ACOL seek possession of the railway for the duration of the blast. This ensures that no rail traffic enters the zone of exclusion within the blast period.

The private residents of Camberwell village and all occupiers of buildings within 2 kilometres of blasting locations are 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.

Due to fire damage to St Clements Church caused by an arsonist attack in 2008, no structural assessments were undertaken by ACOL on St Clements Church during the reporting period. Ashton Coal had assisted with the cleanup project by providing labour and support and has extended an offer to provide any assistance to the congregation where required.

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."

A total of 87 blasts took place during the reporting period. A summary of the results is provided below while a comprehensive list of blast monitoring results is presented in **Appendix 3**.

Blast monitoring locations are detailed hereunder:

Table 29. LOCATION OF BLAST MONITORING STATIONS

Monitoring Station No	Location
1	Camberwell village (north)
2	St Clements Church

Table 30. SUMMARY BLAST MONITORING RESULTS

	St Clements Church		Camberwell Village	
	Vibration	Overpressure	Vibration	Overpressure
Results Captured	87	87	87	87
Data Recovery (%)	100%	100%	100%	100%
Results >2mm/s	0		2	
Results >2mm/s (%)	0%		2.30%	
Results >10mm/s	0		0	
Results > 115dBL		2		0
Results > 115dBL (%)		2.30%		0%
Results > 120bBL		0		0

At the end of the 2010-11 reporting period blast vibration and overpressure results remained within all criteria at both the St Clements Church and Camberwell Village locations.

Throughout the reporting period a number of blasts were cancelled or rescheduled due to weather forecasts or experienced weather conditions. These are detailed in **Table 31**.

Table 31. OPERATIONAL CHANGES RELATING TO BLAST IMPACTS

Date	Issue	Changes Undertaken
16/09/2010	8.3m/s WNW gusty winds	Blast postponed to Friday 17th at 12:30pm
15/10/2010	Predicted high winds from weather website	Blast postponed until 12.30pm Monday when wind speeds will be lower
8/11/2010	High wind speed and direction	Blast postponed til Tuesday 9/11/10 at 9:30am
22/11/2010	Loading issues in the pit	Blast postponed til Tuesday 23/11/10 at 12:30pm
7/07/2011	Winds greater than 10m/s	Blast postponed until Friday 8 July at 9:30am

3.9.3 Long-term Blasting Trends

Long term blasting trends are presented in **Figure 60**. Compliance with the 5% criteria for overpressure and vibration has significantly improved over the past 7 years of operation. Electronic detonation has allowed the continued decrease in blast vibration results at both the Church and Village monitors.

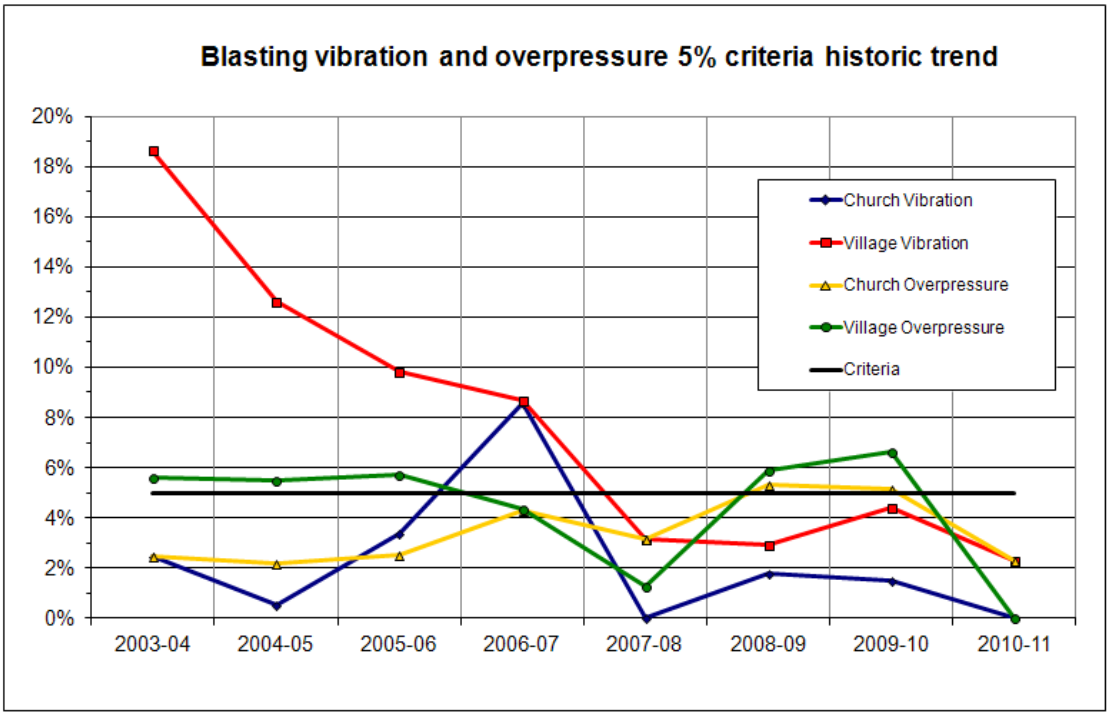

Figure 60. Blasting vibration and overpressure % criteria historic trend

3.10 OPERATIONAL NOISE

3.10.1 Noise Management

The Noise Management Plan for phase 2 of Ashton Coal's mining operations has been approved by the Department of Planning. 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. The inversion study conducted by Spectrum Acoustics during the 2007-2008 reporting period indicated that even when a strong inversion (+7.5^{O}C/100m) is in place, trucks that are dumping on the northern side of the 135RL dump, Camberwell village falls in the acoustic shadow zone of the eastern emplacement. As a result ACOL has committed to restricting dumping at night to both the northern side and lower areas of the Open Cut, particularly when winds are emanating from the North West.

Ashton Coal undertake a number of standard operational controls to reduce the noise impact on the Village of Camberwell, these are;

- During inversion and NW wind conditions (noise enhancing conditions) machinery is removed from the southern exposed faces and relocated to the northern boundary or lower levels within the pit.
- When achievable after 6pm in the evening, machinery is removed from the southern exposed faces and relocated to the northern boundary or lower levels within the pit.

In addition to these standard practices a number of specific operational changes were made during the reporting period in response to either complaints or identified noise issues, these are presented in **Table 32** below.

Table 32. OPERATIONAL CHANGES REGARDING NOISE IMPACTS

Date	Issue	Changes Undertaken
8/12/2010	While in the village CHPP Manager noticed noise from a reversing dozer on overburden facing the village at 6:30pm.	CHPP Manager rang OCE and advised him of the noise in the village due to the reversing dozer. OCE moved the dozer from that location into the pit.
14/12/2010	Proactive movement to reduce noise in the village	Moved trucks from the RL130 dump back to the Buttress dump inpit at 7:30pm
15/12/2010	Proactive movement to reduce noise in the village	Moved trucks from the RL130 dump back to the Buttress dump inpit at 7:30pm
16/12/2010	Proactive movement to reduce noise in the village	Moved trucks from the RL130 dump back to the Buttress dump inpit at 7:30pm
22/12/2010	Proactive movement to reduce noise in the village	OCE waited until 8:45am before getting the trucks to dump at the RL130 dump
23/12/2010	Proactive movement to reduce noise in the village	OCE waited until 8:00am before getting the trucks to dump at the RL130 dump
24/02/2011	8:30 machinery commenced working on exposed face to the village, one dozer on high dump with low number of trucks dumping, dozer also working on high level of rehabilitation bulk push, one dozer on lower level bulk push with low volume of trucks dumping. 8:35 Environmental Manager inspected village.	The higher level dozer working on rehabilitation seemed to be the dominate noise source in the village. Env Manager called Mine Manager to discuss locations. Env Manager returned to office to look at real-time noise results. Results for the one 15min period just prior when env was in the village were elevated. Env Manager called OCE at 9.05 and had operations halted. OCE went to work site and considered operations and consultation with Env Manager. At 9:15 the dozers on the rehabilitation were halted for the day.
4/03/2011	Noise complaint - Dozer working on galinea weed works on southern side of RL 135 dump	Env Manager moved dozer to northern side of RL 135 dump to work on rehab.
11/03/2011	Noise complaint - Rehabilitation works on southern side of RL 135 dump	Noise complaint was due to a sharp piercing sound rather than the noise from the one dozer on the southern slope, Env Coordinator spoke with OCE regarding the sharp piercing noise, there were no issues with the machines this morning during start up and he was unaware of what the piercing sound may have been.
11/03/2011	Proactive movement to reduce noise in the village - Rehabilitation works on southern side of RL 135 dump	There were 3 dozers working on the rehabilitation on the southern slope, D10T (sound suppressed dozer) on bulk shaping, D7R on reshaping contour drains down low and a D6T pushing topsoil. Env Coordinator shutdown the D6T dozer as it was the lowest priority job.
14/03/2011	Proactive movement to reduce noise and dust in the village, NW winds	Rehabilitation contractors spoke with Env Coordinator prior to start up regarding which rehabilitation area to work on for the day, due the NW winds they decided to work on the northern slope of the RL135 dump until the wind changed around to the east before moving over to the southern slope.
24/05/2011	Dozer working on stockpiles at CHPP	CHPP Manager rang the CHPP Supervisor around 4am and advised him of audible dozer in the village. Considered to be the dozer working on the stockpiles. CHPP Manager had the Supervisor shut down the dozer.

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), which is detailed hereunder (**Table 33**), except as may be expressly provided by an EPA Licence,

Table 33. **(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 detailed 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 exceedences of the EPL and DC criteria recorded during the 4 quarterly surveys conducted during this reporting period.

Table 34. 1ST QUARTER NOISE RESULTS NOVEMBER 2010 (25 NOVEMBER 2010):

ACP Noise Monitoring Results – 25 November 2010 – Day							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Stability Class**	**ACP Noise Sources**
Richards	3:40 pm	37	Inaudible	Farm noise (32), train (31), traffic (30), birds (28), **ACP inaudible**	2.0/ENE	n/a	n/a
Stapleton	4:19 pm	43	Inaudible	Birds (41), traffic (39), **ACP inaudible**	2.5/ESE	n/a	n/a
Clark	4:36 pm	34	ACP barely audible (<30)	Traffic (33), birds & insects (28), **ACP barely audible (<30)**	2.5/SE	n/a	Dozer
Horadam	4:01 pm	51	Inaudible	Traffic (51), insects (33), **ACP inaudible**	2.0/SE	n/a	n/a
Moss	4:55 pm	65	Inaudible	Traffic (65), **ACP inaudible**	1.5/ESE	n/a	n/a
ACP Noise Monitoring Results – 25 November 2010 – Evening							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Stability Class**	**ACP Noise Sources**
Richards	8:15 pm	45	Inaudible	Train (43), birds (38), traffic (31), cattle (30) **ACP inaudible**	3.0/E	E-G	n/a
Stapleton	8:52 pm	44	ACP barely audible (<30)	Traffic (42), insects (38), **ACP barely audible (<30)**	2.5/E	E-G	Dozer
Clark	9:10 pm	47	ACP barely audible (<30)	Insects (47), traffic (35), **ACP barely audible**	3.0/E	E-G	Dozer
Horadam	8:35 pm	57	Inaudible	Insects (55), traffic (52), **ACP inaudible**	2.5/E	E-G	n/a
Moss	9:30 pm	67	Inaudible	Traffic (67), **ACP inaudible**	2.5/E	E-G	n/a
ACP Noise Monitoring Results – 25 November 2010 – Night							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Stability Class**	**ACP Noise Sources**
Richards	10:05 pm	38	Inaudible	Train (35), other mines (33), insects (32), **ACP? barely audible**	1.5/SE	D	Haul trucks
Stapleton	10:42 pm	49	Inaudible	Traffic (49), insects (37), **mine noise (30)**	2.0/SE	E-G	Haul trucks
Clark	11:00 pm	46	Inaudible	Traffic (44), insects (38), **mine noise (30)**	3.0/SE	E-G	Dozer
Horadam	10:25 pm	49	Inaudible	Traffic (49), insects (36), **ACP inaudible**	2.0/SE	E-G	n/a
Moss	11:17 pm	67	Inaudible	Traffic (67), **ACP inaudible**	3.0/SE	E-G	n/a

Throughout the monitoring conducted on the 25 November 2010 winds were light to medium and emanating from the East to South East throughout the period. There were no noise exceedences recorded during the survey.

Table 35. **2ND QUARTER NOISE RESULTS FEBRUARY 2011 (2 FEBRUARY 2011):**

ACP Noise Monitoring Results – 2 February 2011 – Day							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Inversion °C/ 100m**	**ACP Noise Sources**
Richards	2:20 pm	39	Inaudible	Insects (37), farm animals (32), farm machinery (30), **ACP inaudible**	2.6/127	n/a	n/a
Stapleton	3:32 pm	48	Inaudible	Insects (46), plane (44), traffic (38), **ACP inaudible**	6.2/33	n/a	n/a
Clark	3:15 pm	42	ACP barely audible (<30)	Insects (42), traffic (34), **ACP barely audible**	1.7/71	n/a	Mine hum
Horadam	2:41 pm	53	Inaudible	Traffic (50), insects (50), **ACP inaudible**	2.4/109	n/a	n/a
Moss	2:58 pm	71	Inaudible	Traffic (71), **ACP inaudible**	1.5/104	n/a	n/a
ACP Noise Monitoring Results – 2 February 2011 – Evening							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Inversion °C/ 100m**	**ACP Noise Sources**
Richards	7:20 pm	38	Inaudible	Insects (35), farm animals (32), train (30), traffic (28), **ACP inaudible**	2.9/98	nil	n/a
Stapleton	8:06 pm	55	Inaudible	Insects (55), traffic (40), **ACP inaudible**	0.3/145	Nil	n/a
Clark	7:50 pm	47	Inaudible	Insects (45), train (40), traffic (38), **ACP inaudible**	0.8/145	Nil	n/a
Horadam	8:45 pm	48	Inaudible	Traffic (46), insects (43), **ACP inaudible**	1.1/225	<3	n/a
Moss	8:26 pm	67	Inaudible	Traffic (67), **ACP inaudible**	1.0/278	<3	n/a
ACP Noise Monitoring Results – 2 February 2011 – Night							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Inversion °C/ 100m**	**ACP Noise Sources**
Richards	10:02 pm	42	Inaudible	Insects (39), farm animals (36), other mines (35), **ACP inaudible**	0.9/231	<3	n/a
Stapleton	10:44 pm	47	Inaudible	Insects (45), traffic (42), **ACP inaudible**	1.0/265	<3	n/a
Clark	10:27 pm	43	Inaudible	Insects (42), traffic (36), **ACP inaudible**	1.3/269	<3	n/a
Horadam	11:05 pm	47	Inaudible	Traffic (46), insects (41), **ACP inaudible**	1.5/274	<3	n/a
Moss	10:47 pm	65	Inaudible	Traffic (65), **ACP inaudible**	0.7/257	<3	n/a

During the monitoring of the afternoon there were medium winds emanating from the east. Though the evening and night the winds eased and swung around to the west. There were no noise exceedences recorded during the survey.

Table 36. **3RD QUARTER NOISE RESULTS MAY 2011 (6 MAY 2011):**

ACP Noise Monitoring Results – 6 May 2011 – Day							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Inversion °C/ 100m**	**ACP Noise Sources**
Richards	4:55 pm	42	Inaudible	Traffic (38), train on main line (37), birds & insects (32), farm animals (32), **ACP inaudible**	0.6/105	n/a	n/a
Stapleton	2:59 pm	48	Inaudible	Traffic (42), insects (30), **ACP inaudible**	0.9/105	n/a	n/a
Stapleton	5:15 pm	51	Inaudible	Traffic (51), insects (30), **ACP inaudible**	1.0/105		n/a
Clark	3:16 pm	38	ACP barely audible (<30)	Traffic (37), birds (33), **ACP barely audible**	0.8/105	n/a	n/a
Clark	5:30 pm	44	Inaudible	Traffic (42), birds & insects (37), **ACP inaudible**	2.0/105		n/a
Horadam	2:20 pm	48	Inaudible	Traffic (48), **ACP inaudible**	1.2/84	n/a	n/a
Horadam	5:47 pm	57	Inaudible	Traffic (57), **ACP inaudible**	2.1/105		n/a
Moss	6:04 pm	70	Inaudible	Traffic (70), **ACP inaudible**	2.0/105	n/a	n/a
ACP Noise Monitoring Results – 6 May 2011 – Evening							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Inversion °C/ 100m**	**ACP Noise Sources**
Richards	7:47 pm	43	Inaudible	Other mines (42), traffic (35), **ACP inaudible**	1.8/105	>3	n/a
Stapleton	8:25 pm	49	Inaudible	Traffic (49), insects (25), **ACP inaudible**	1.1/105	>3	n/a
Clark	8:08 pm	37	Inaudible	Traffic (37), insects (20), **ACP inaudible**	1.4/105	>3	n/a
Horadam	9:01 pm	50	Inaudible	Traffic (50), **ACP inaudible**	1.7/105	>3	n/a
Moss	8:43 pm	66	Inaudible	Traffic (66), **ACP inaudible**	1.2/105	>3	n/a
ACP Noise Monitoring Results – 6 May 2011 – Night							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Inversion °C/ 100m**	**ACP Noise Sources**
Richards	10:00 pm	48	Inaudible	Other mines (45), train on main line (45), **ACP inaudible**	0.1/105	>3	n/a
Stapleton	10:37 pm	54	Inaudible	Traffic (54), **ACP inaudible**	Calm	>3	n/a
Clark	10:21 pm	48	Inaudible	Traffic (48), **ACP inaudible**	0.3/105	>3	n/a
Horadam	10:55 pm	48	Inaudible	Traffic (48), insects (25), **ACP inaudible**	Calm	>3	n/a
Moss	11:13 pm	67	Inaudible	Traffic (67), frogs (30) **ACP inaudible**	0.1/105	>3	n/a

During the survey period the winds were light from the east-south-east direction. A strong inversion was present for the evening and night time periods. There were no exceedences of noise criteria recorded

Table 37. **4TH QUARTER NOISE RESULTS AUGUST 2010 (16 AUGUST 2011):**

ACP Noise Monitoring Results – 16 August 2011 – Day							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Inversion °C/ 100m**	**ACP Noise Sources**
Richards	3:28 pm	44	Inaudible	Farm animals (43), other mines (35), **ACP inaudible**	2.4/125	n/a	n/a
Stapleton	4:08 pm	47	Inaudible	Traffic (46), birds (40), **ACP inaudible**	2.2/126	n/a	n/a
Clark	3:50 pm	47	Inaudible	Birds (45), traffic (42), **ACP inaudible**	2.6/129		n/a
Horadam	4:27 pm	52	Inaudible	Traffic (52), birds (40), **ACP inaudible**	2.1/111	n/a	n/a
Moss	4:45 pm	65	Inaudible	Traffic (65), **ACP inaudible**	2.0/118	n/a	n/a
ACP Noise Monitoring Results – 16 August 2011 – Evening							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Inversion °C/ 100m**	**ACP Noise Sources**
Richards	8:00 pm	50	Inaudible	Train (49), other mines (42), frogs (30), **ACP inaudible**	1.8/102	>3	n/a
Stapleton	8:47 pm	47	Inaudible	Traffic (47), other mines (32), frogs (32), **ACP inaudible**	1.5/121	>3	n/a
Clark	8:29 pm	41	Inaudible	Traffic (39), other mines (35), frogs (30), **ACP inaudible**	1.4/102	>3	n/a
Horadam	9:10 pm	50	Inaudible	Traffic (50), other mines (38), **ACP inaudible**	2.4/147	>3	n/a
Moss	9:30 pm	66	Inaudible	Traffic (66), other mines (40),**ACP inaudible**	2.3/159	>3	n/a
ACP Noise Monitoring Results – 16 August 2011 – Night							
Location	**Time**	**dB(A) Leq**	**ACOL dB(A)**	**Comments**	**WS (m/s)/ WD (°)**	**Inversion °C/ 100m**	**ACP Noise Sources**
Richards	10:02 pm	44	Inaudible	Other mines (44), frogs (32), **ACP inaudible**	2.1/151	>3	n/a
Stapleton	10:41 pm	48	Inaudible	Traffic (48), other mines (34), frogs (30), **ACP inaudible**	1.9/138	>3	n/a
Clark	10:25 pm	44	Inaudible	Traffic (43), other mines (36), frogs (30), **ACP inaudible**	1.9/153	>3	n/a
Horadam	11:00 pm	49	Inaudible	Traffic (49), other mines (32), **ACP inaudible**	1.7/116	>3	n/a
Moss	11:21 pm	60	Inaudible	Traffic (60),other mines (34), frogs (30) **ACP inaudible**	1.2/131	>3	n/a

During the survey period winds were light and from the south east. A strong inversion was present during the evening and night periods. Throughout the monitoring survey ACOL operations were inaudible. There were no exceedences of noise criteria recorded.

3.11 VISUAL, STRAY LIGHT

Lighting issues on site are managed through the Lighting Management Plan (LMP).

Three types of lighting are utilised on site. They are:

- Fixed lighting utilised to illuminate the areas arrange the CHPP and open cut workshop;
- Mobile lighting plants utilised to illuminate the open cut, the overburden dump, the tailings disposal area and some maintenance operations; and
- Lighting equipped on mobile plant.

Fixed lighting is generally high pressure sodium vapour lights, which minimise the glare usually associated with “white” lights.

Historically mobile lighting plants have been the source of lighting complaints, particularly those stationed on the Eastern Emplacement Area (EEA). During the reporting period there were no lighting complaints received. Positioning of lighting plants to reduce off-site impacts is included in ACOL’s induction process to ensure employees and contractors are aware of potential impacts to Ashton’s neighbours.

3.12 ABORIGINAL HERITAGE

In December 2010, Ashton Coal submitted two Aboriginal Heritage Impact Permit Applications.

1. a reissue of existing Aboriginal Heritage Impact Permit (AHIP) #2783 covering longwall areas 1-4, that had recently expired, and
2. an application for a new AHIP covering the surface area associated with Longwall 5-8 inclusive of the Bowmans Creek Diversion Project area .

The AHIP for the Longwall 5-8 area was approved by the Land & Environment Court on 26 August 2011. At the end of the reporting year ACOL were in consultation with OEH regarding the lapsed AHIP #2783.

While preservation is the ongoing aim of ACOL , the resubmission of AHIP #2783, will allow for works related to subsidence remediation impacts including any potential emergency remediation works being required due to safety related issues that may be required to be carried out in a timely manner .

The implementation of the Archaeology & Cultural Heritage Management Plan related to Subsidence Management is considered to have been effective to date. The process of assessing the potential impacts on artefacts based on predictions of crack locations, and only disturbing sites where necessary, has led to only a single artefact requiring to be salvaged during Longwall mining. Ongoing monitoring of subsidence has shown minimal impact at other known artefact locations and hence the need for destructive remediation has been avoided.

The ACHMP was developed in conjunction with registered community groups, Ashton Coal and Insite Heritage. The plan will be revised at the end of mining of each seam in consultation with the registered community groups and OEH and where required amendments made to the management plan. The plan aims to minimise impact on Aboriginal objects.

Consultation with the Indigenous Community

Consultation with Indigenous community was undertaken throughout the year on various topics related to cultural heritage management. These included the Western Panels (inclusive of BCD Project) draft and final ACHMP, AHIP approval , Notification of Subsidence Management Plan Approval for 7B and Longwall 1-4 AHIP re-submission of application. Full details of the consultation can be found in **Appendix 6**.

Pre-disturbance inspections for minor surface works within underground surface areas continued throughout the year. Each of the ACOL RAPs participate in the inspections on a rostered basis. These inspections are part of ACOL's environmental management processes and align with OEH's Due Diligence Assessment Process. Details including dates of this work, including name of participants, can be found in the full correspondence log in **Appendix 6**.

The Wonnarua Liaison Committee constituted as part of the current Native Title Deed of agreement associated ML 1533, met five times during the reporting period. Discussions included;

- potential business opportunities for the Wonnarua people
- employment opportunities and
- cultural heritage issues .

3.13 NATURAL HERITAGE

No items of natural or European heritage were identified during the EIS process as being likely to be disturbed by 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 included in the report. Monitoring during this period has shown a decrease in instances of Spontaneous combustion.

3.15 BUSHFIRE

A Bushfire Management Plan (BMP) has been developed and implemented on site. This BMP requires that a risk assessment be undertaken in consultation with the Singleton Rural Fire Service to assess the risks of fire breaking out, or entering on to the site, as well as the development of risk reduction measures. This risk assessment was completed prior to the commencement of the 2003 / 2004 fire season and all agreed actions have been implemented. The BMP is currently being reviewed in consultation with the Singleton Rural Fire Service. There were no outbreaks of bushfire on the project lands during this reporting period.

3.16 MINE SUBSIDENCE

During the reporting period the Underground mine continued 1st workings and secondary workings in the Pikes Gully Seam. Mining of first workings have been geotechnically assessed as long term stable thus no subsidence was experienced in these area. The mined height within the Pikes Gully seam was generally 2.6m to 2.8m for 1st workings development while the longwall targeted a 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 overburden ranges in thickness from 132m at the end of Longwall 6A to 198m at the start of Longwall 7A. The final extraction void is nominally 216m which includes gate road development. Chain pillar dimensions 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 Longwalls 1 to 7A are complete with longwall equipment being relocated into the Longwall 7B 'short' panel. The progress of longwall extraction is shown in **Figure 61.**

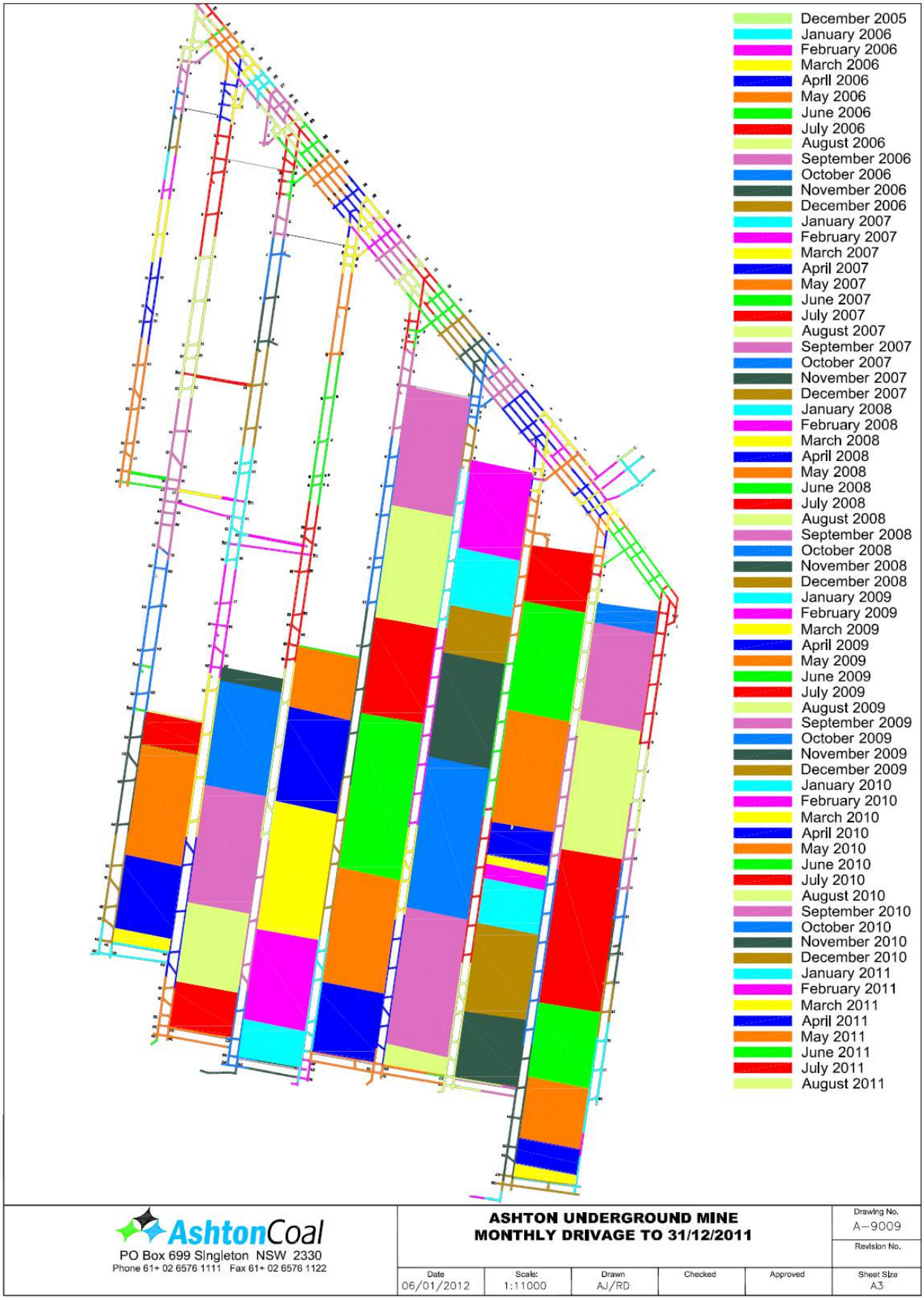

Figure 61. Progression of Longwall Extraction

3.16.1 Monitoring

Ashton Coal has monitored the subsidence movement on the surface during the extraction of Longwalls 1 to 6 using longitudinal subsidence lines over the start and finish of each panel and a main cross line extending over all three panels. Several other subsidence lines have been used to monitor the slope leading down to Glennies Creek, closure across the New England Highway, and subsidence across a dyke.

A plan showing the location of the subsidence monitoring cross lines is included as **Figure 62**.

Table 38 outlines the maximum subsidence parameters recorded during regular survey of subsidence lines throughout the mine life as the longwall passed each location.

Additional monitoring was undertaken of fixed stations on a 132kV power line crossing the longwall panels on the southern side of the mining lease. Monitoring was conducted prior to, during and post undermining of the 2 and 3 pole structures. Survey monitoring was supplemented with visual monitoring of subsidence areas, powerlines, infrastructure, dams and any applicable steep slopes. Subsidence information was reported and distributed to relevant stakeholders including the DII, Energy Australia, and an adjacent land owner.

During mining of LW7A, monthly survey was required on Narama Dam. Narama Dam is a prescribed dam under the Dam Safety Act 1978 and is located a minimum of 486m from the goaf edge of LW7A. Monthly survey of the dam indicated negligible (macro) movement of the dam wall during LW7A extraction. Survey results were distributed in accordance with the *Ashton Mine Subsidence Monitoring Program of Narama Dam.*

Table 38. **SUBSIDENCE LEVELS**

	Maximum Predicted EIS	Maximum Predicted SMP	Maximum Measured		
North End of LW1			**CL2**	**XL8**	
Subsidence (mm)	1430	1800	1528	1500	
Tilt (mm/m)	122	244	100	103	
Horizontal Movement (mm)	-	>500	476	500	
Tensile Strain (mm/m)	16	73	40	15	
Compressive Strain (mm/m)	25	98	28	27	
Remainder of LW1			**CL1**	**XL5**	
Subsidence (mm)	1690	1700	1318	1436	
Tilt (mm/m)	60	141	60	75	
Horizontal Movement (mm)	-	300-500	480	503	
Tensile Strain (mm/m)	8	42	49	17	
Compressive Strain (mm/m)	12	56	23	24	
Longwall 2			**CL1**	**CL2**	**XL5**
Subsidence (mm)	1690	1600	1296	1513	1266
Tilt (mm/m)	91	102	40	82	78
Horizontal Movement (mm)	-	300-500	440	298	390
Tensile Strain (mm/m)	12	30	17	16	11
Compressive Strain (mm/m)	18	41	16	32	28
Longwall 3			**CL1**	**CL2**	**XL5**
Subsidence (mm)	1500	1600	1420	1354	1429

Table 38. SUBSIDENCE LEVELS						
Tilt (mm/m)	65	78	41	48	97	
Horizontal Movement (mm)	-	300-500	463	345	394	
Tensile Strain (mm/m)	9	23	10	17	22	
Compressive Strain (mm/m)	13	31	7	18	24	
Longwall 4			**CL1**	**CL2**	**XL5**	**XL10**
Subsidence (mm)	1430	1600	1397	1194	1546	1263
Tilt (mm/m)	46	78	36	40	53	33
Horizontal Movement (mm)	-	300-500	230	560	360	258[1]
Tensile Strain (mm/m)	6	23	10	18	9	6
Compressive Strain (mm/m)	9	31	9	67	9	10
Longwall 5			**CL1**	**CL2**	**XL5**	
Subsidence (mm)	1430	1600	1266	1326	1376	
Tilt (mm/m)	29	78	23	29	35	
Horizontal Movement (mm)	-	300-500	399	339	360	
Tensile Strain (mm/m)	4	23	21	6	5	
Compressive Strain (mm/m)	5	31	9	8	17	
Longwall 6A			**CL1**	**CL2**	**XL5**	
Subsidence (mm)	1430	1600	1405	1279	1362	
Tilt (mm/m)	30	57	19	25.4	39	
Horizontal Movement (mm)	-	300-500	294	246	260	
Tensile Strain (mm/m)	4	17	7	10	8	
Compressive Strain (mm/m)	6	23	7	10	9	
	Maximum Predicted EIS	**Maximum Predicted SMP**	**Maximum Measured**			
Longwall 7A			**CL1**	**CL2**	**XL5**	
Subsidence (mm)	1430	1600	1415	>860	139	
Tilt (mm/m)	29	57	24	13	23	
Horizontal Movement (mm)	-	300-500	338	118	365	
Tensile Strain (mm/m)	4	17	7.6	2.4	10	
Compressive Strain (mm/m)	5	23	9.6	>3.8	12.1	

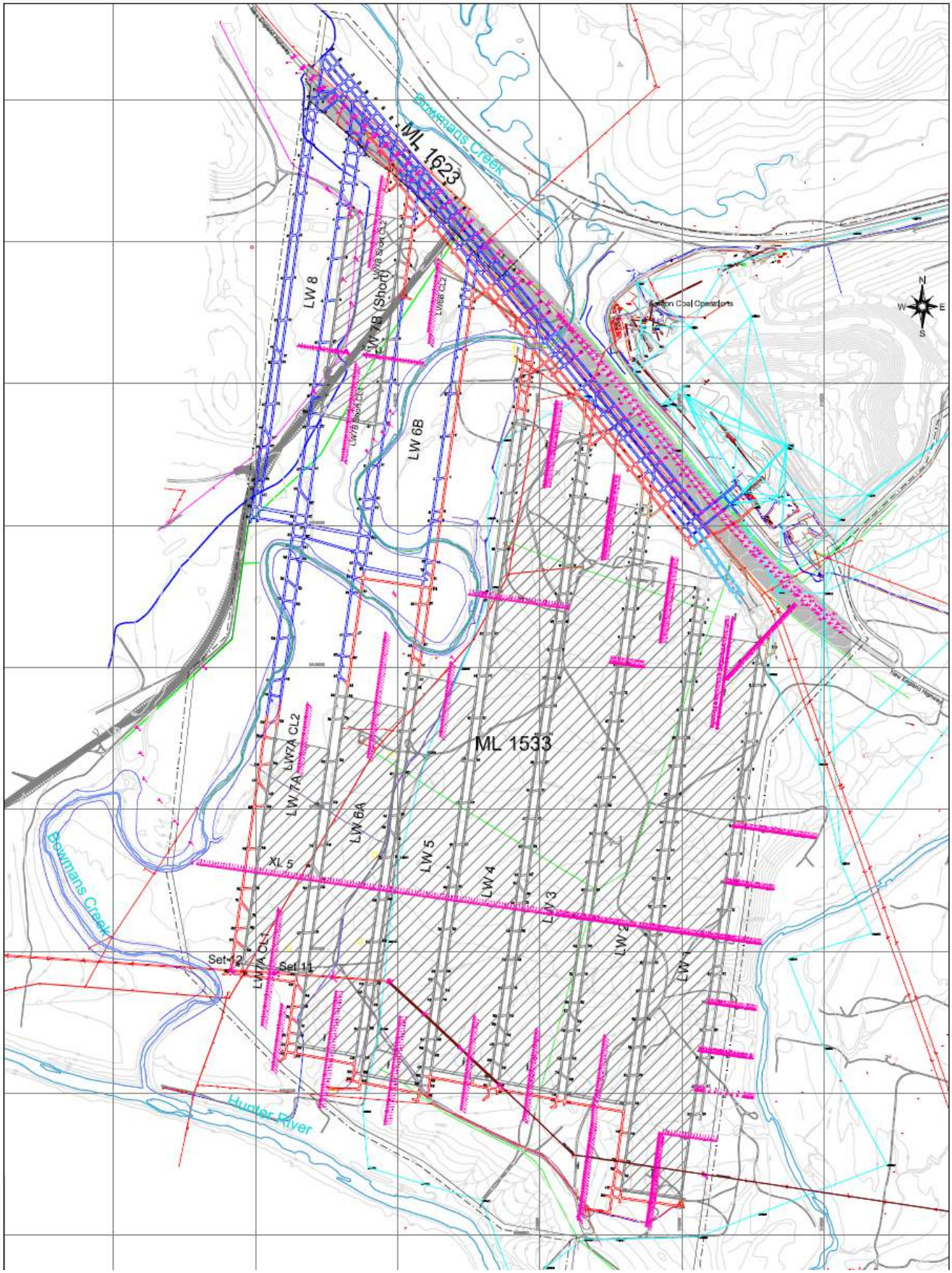

Figure 62. Subsidence Monitoring Cross Lines

3.16.1 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 may be rehabilitated. The method and extend of remediation reqired is dependent on the extand of cracking and the environmental and other surface feature in the vicinity of the crack zone. During this reporting period, Longwall 6A and 7A were remediated in some areas post mining of each panel.

Remediation of cracking above Longwall 6A involved ripping the ground with a bull dozer and blading off the area. The bladed off ground was compacted using a pad-foot roller and harrowed to encourage grass regrowth. The results of this extra work was beneficial for grass re-growth, ease of travelling across the paddock/worked area and due to the ground being flat/compact identifying secondary cracking was made significantly easier.

Remediation of Longwall 7A cracking involved filling the cracks with loam (sand and clay mixture). This was pushed into the cracks by hand using a small ‘dingo’ loader and shovels. The loader was used to compact the soil into the void where possible. Post initial filling of the crack, secondary filling occurred once the loam had settled into the crack. Secondary filling was minimal for most cracks which were able to be compacted with the loader. The extent of subsidence remediation at the goaf edge is outlined in **Figure 63.**

Initial subsidence above Longwalls 6A and 7A was typical of the subsidence behaviour observed in previous panels. However no cracking has been observed to date around the start line of Longwall 6A or 7A. Gateroad cracking was slow to develop due to the alluvial soil being undermined. This, along with moderate rainfall, allowed the ground surface to behave plastically with subsidence. The measured subsidence has been within SMP predictions for Longwalls 6A and 7A.

No subsidence induced cracking occurred over the main access or alternate access roads to Property 130 during the reporting period. This was due to Longwalls 6A and 7A not undermining the roads. Small farm dams in overlying Longwalls 6A and 7A were dewatered prior to longwall undermining. Following undermining subsequent rain events re-filled these dams indicating no wall or floor damage had occurred.

A buried Telstra cable that runs over Longwall 6A undermined without any negative impacts. This line remained in service during the impact period. An overhead 132kV and 11kV electricity transmission line was also undermined without damage. Prior to undermining, the affected powerlines were placed in rollers to prevent overstressing of the line as the pole moved with the subsidence.

Two ACOL owned water supply lines were also undermined by Longwall 6A with no damage observed.

An unoccupied ACOL owned dwelling was undermined during the reporting period. Subsidence monitoring on this dwelling included visual inspections and GPS survey. The dwelling’s condition post undermining has remained relatively unchanged with some doors now ‘sticking’ and some

small cracking evident between the roof and wall cornice. No remediation is planned due to it not being re-occupied in the foreseeable future.

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. 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.

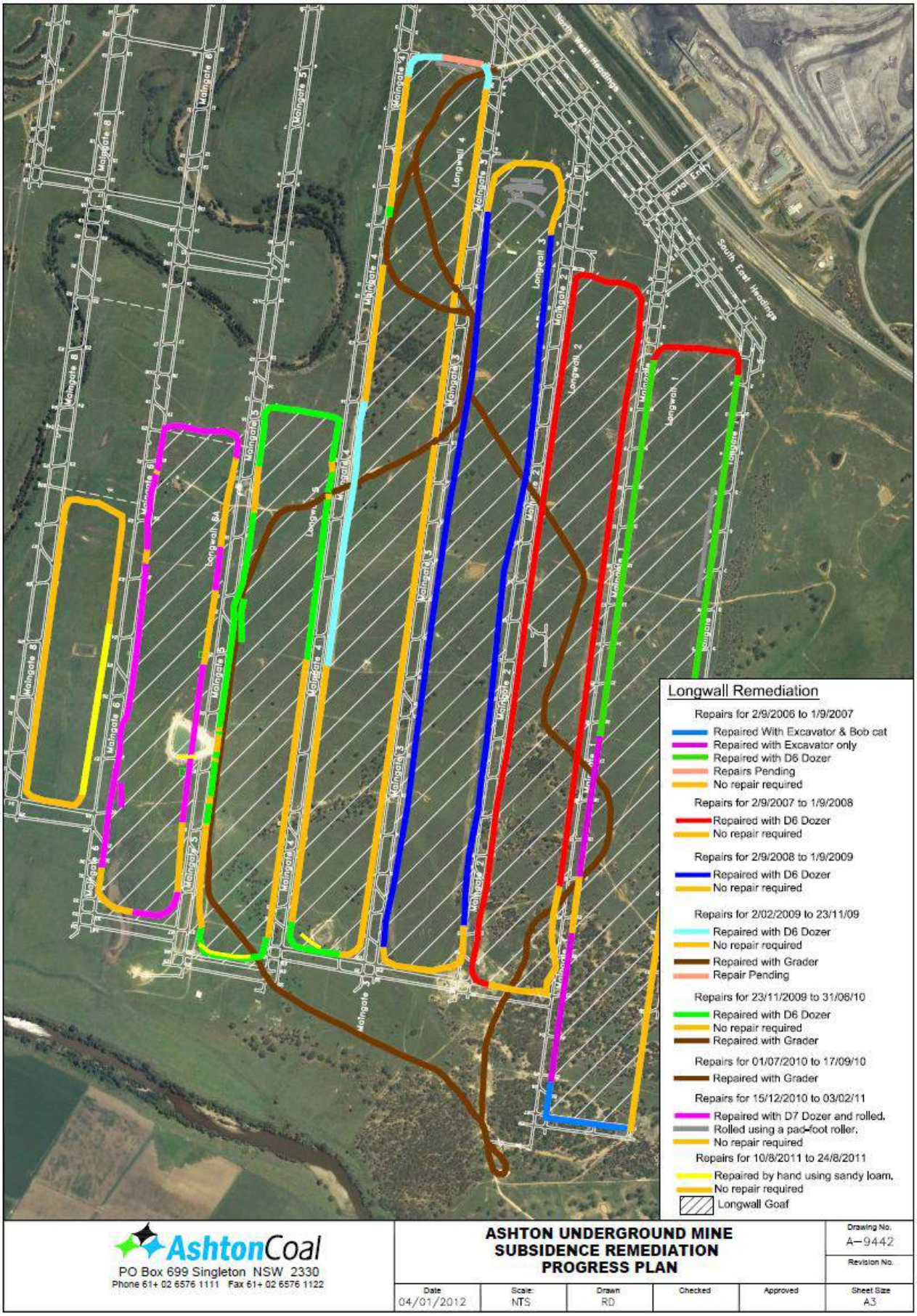

Figure 63. Subsidence Remediation Progress

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 216 cubic metres per second. This airflow quantity is pulled through the mine via two main ventilation fans at the portal and one at the backroad ventilation fan on the surface adjacent to Longwall 1.

Total emissions from the underground ventilation were: access.

- Main Fans Total Emissions – 206,230.4 Co2-e tonnes;
- Backroad fan Total Emissions – 51,685 Co2-e tonnes; and
- Gas Drainage Total Emissions – 79,996 Co2-e tonnes.

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 LW6A and LW7A. There were a total of 6 holes drilled however only 4 were used. The gas wells were in use from September to December 2010 and then April to June 2011.

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 on trains or along the access roads alongside the railway has also been an area of focus. Procedures are in place to ensure the Main Northern Railway is clear of trains before blasting within 500 metres of the rail line, and to take possession of the rail line if blasting occurs within 200 metres. This has occurred for every relevant blast in the reporting period.

The safety of public travelling along the New England Highway has been of major consideration when blasting within 500m. Due to the progression of Open Cut mining to the western portion of the pit there were a small number of highway closures undertaken during the first half of this reporting period. Highway closures are designed to impact on motorists for a maximum of 2 to 3 minutes.

The safety of public travelling along Glennies Creek Road has also been a major consideration during the reporting period, with numerous closures of the road when blasting occurs within 500 metres. The Glennies Creek Road Environmental Bund has further isolated mining activities from the public's view increasing safety levels along the road.

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 also 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.

3.20 OTHER ISSUES AND RISKS

No other risks or issues have been identified during the reporting period.

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. After hours 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. These complaints are addressed immediately by the site supervisor and responded to by either the Environment and Community Relations Manager or the Environmental 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 DECC 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 DECC complaints.

A total of 51 complaints were received during the 2010-2011 reporting period. 30 of these complaints were received directly by ACOL and then a further 21 complaints were received through OEH. Of the 30 complaints received directly to ACOL, 22 were received from a single resident. This is a continuing trend observed in previous reporting periods. For the second reporting period in a row there has been a shift to OEH complaints not corresponding with complaints received by ACOL compared to historical records where the majority of complaints received through the OEH did corresponded to a complaint received directly to ACOL. This can be observed in **Figure 64** and **Figure 65** below. Another difference noted from historic trend was the majority of the complaints received occurred around the summer months compared to the winter months. Most of these complaints were due to rehabilitation works which occurred on the southern slopes of the eastern emplacement dump. These works were in a location visible to Camberwell, as such to try and reduce the impact on Camberwell residents works were only conducted within the hours of 8am til 5pm and during southerly winds

A full list of complaints is provided in **Appendix 4**.

Complaints received during the reporting period are presented in **Table 39** and **Table 40.**

Table 39. SUMMARY OF COMPLAINT ISSUES RECEIVED TO ASHTON COAL 2010 - 2011

Month	Noise	Lights	Dust	Operating Time	Blast	Flora & Fauna	Other	TOTAL
Sep-10	0	0	4	0	0	0	0	4
Oct-10	1	0	1	0	0	0	0	2
Nov-10	1	0	0	0	0	0	0	1
Dec-10	0	0	0	0	1	0	0	1
Jan-11	0	0	0	0	0	0	0	0
Feb-11	3	0	0	0	0	0	0	3
Mar-11	10	0	0	0	0	0	0	10
Apr-11	1	0	0	0	0	0	0	1
May-11	1	0	0	0	0	0	0	1
Jun-11	1	0	0	0	0	0	0	1
Jul-11	5	0	0	0	0	0	0	5
Aug-11	1	0	0	0	0	0	0	1
TOTAL	24	0	5	0	1	0	0	30

Table 40. SUMMARY OF COMPLAINT ISSUES RECEIVED FROM OEH 2010 - 2011

Month	Noise	Lights	Dust	Operating Time	Blast	Flora & Fauna	Other	TOTAL
Sep-10	0	0	2	0	2	0	0	4
Oct-10	2	0	1	0	0	0	0	3
Nov-10	1	0	0	0	0	0	0	1
Dec-10	5	0	2	0	1	0	0	*8
Jan-11	0	0	1	0	0	0	0	1
Feb-11	0	0	0	0	0	0	0	0
Mar-11	3	0	0	0	1	0	0	4
Apr-11	0	0	0	0	0	0	0	0
May-11	1	0	0	0	1	0	0	*2
Jun-11	0	0	0	0	0	0	0	0
Jul-11	0	0	0	0	0	0	0	0
Aug-11	0	0	0	0	0	0	0	0
TOTAL	12	0	6	0	5	0	0	*23

*The total number of OEH complaints was 21 however there were some complaints which had multiple issues resulting in a total of 23 issues.

Complaints received by ACOL during the months of September 2010 and August 2011 were solely noise complaints with the peak being reached in March 2011 with 10 complaints for that month. There were no complaints received by ACOL in January 2011 as shown in **Figure 64.**

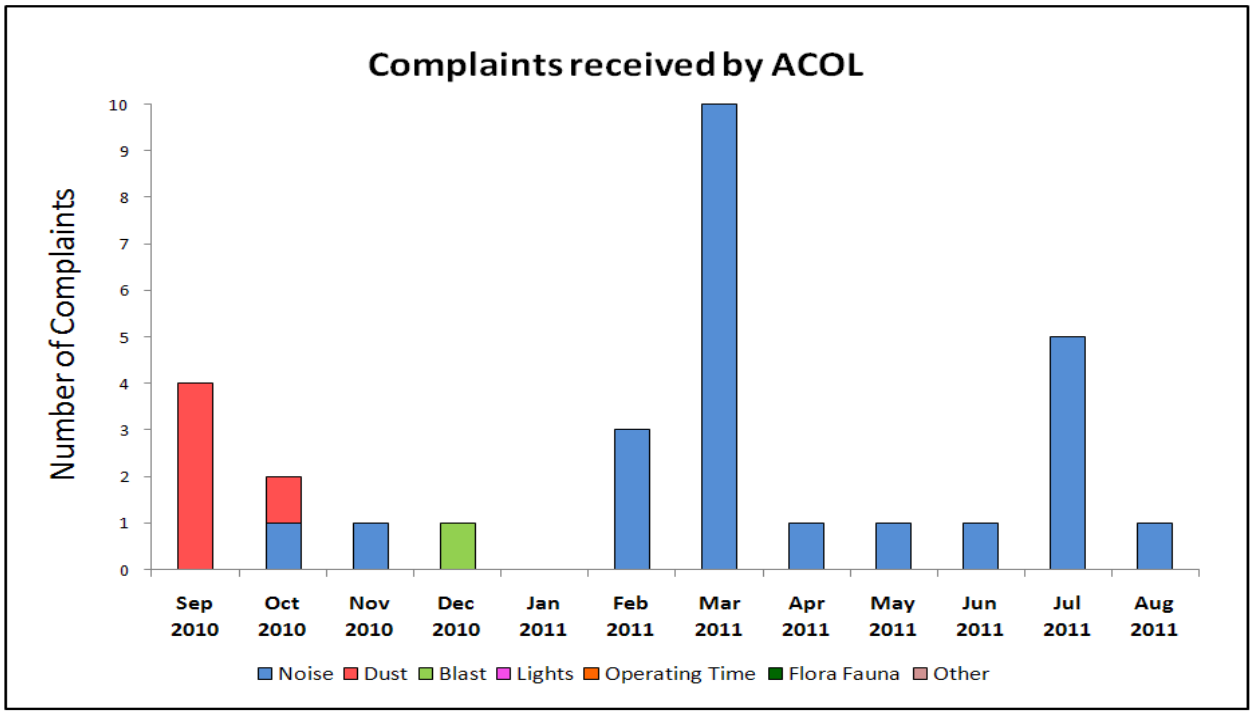

Figure 64. Complaints received to Ashton Coal by Month, 2010 – 2011

Complaints received by OEH reduced significantly in the second half of the reporting period as can be seen in **Figure 65.** No complaints were received by OEH in the months of February, April, June, July and August 2011.

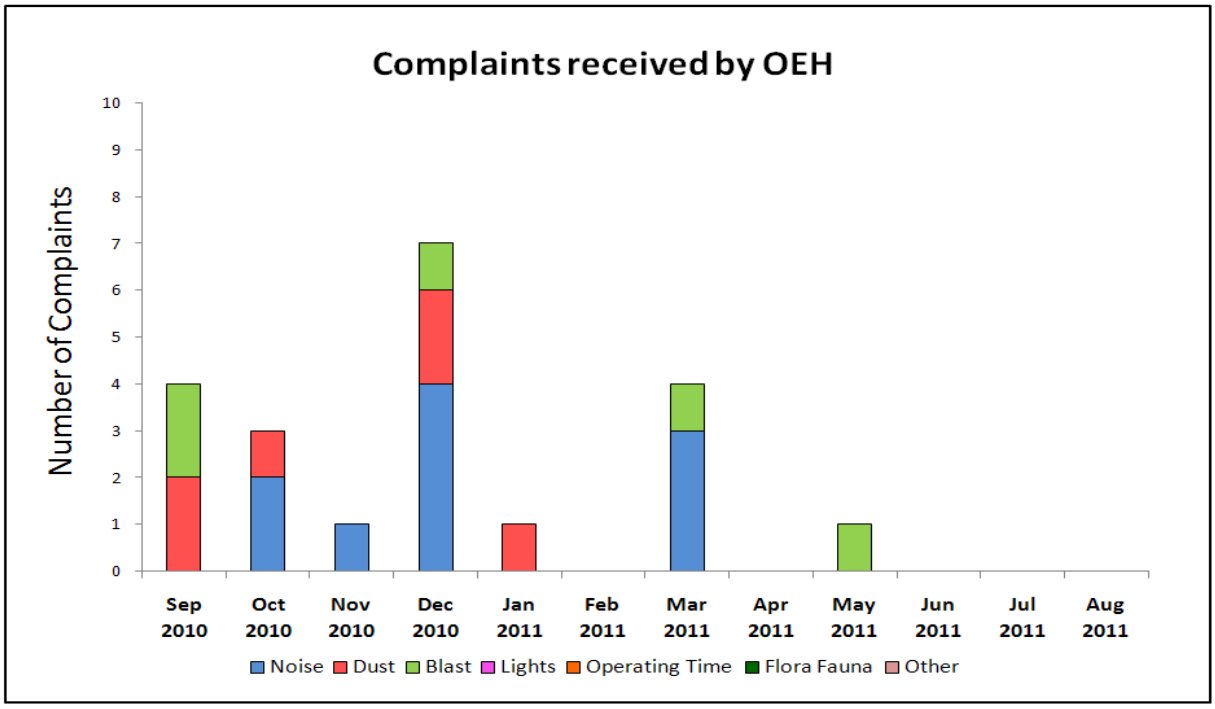

Figure 65. Complaints received to OEH by Month, 2010 – 2011

Percentage breakdown of complaint issue is shown below. Majority of complaints received by ACOL as seen in **Figure 66** were concerning noise (80%). Dust (17%) and blast (3%) made up the rest of the complaints; while there were no complaints received relating to any other issues.

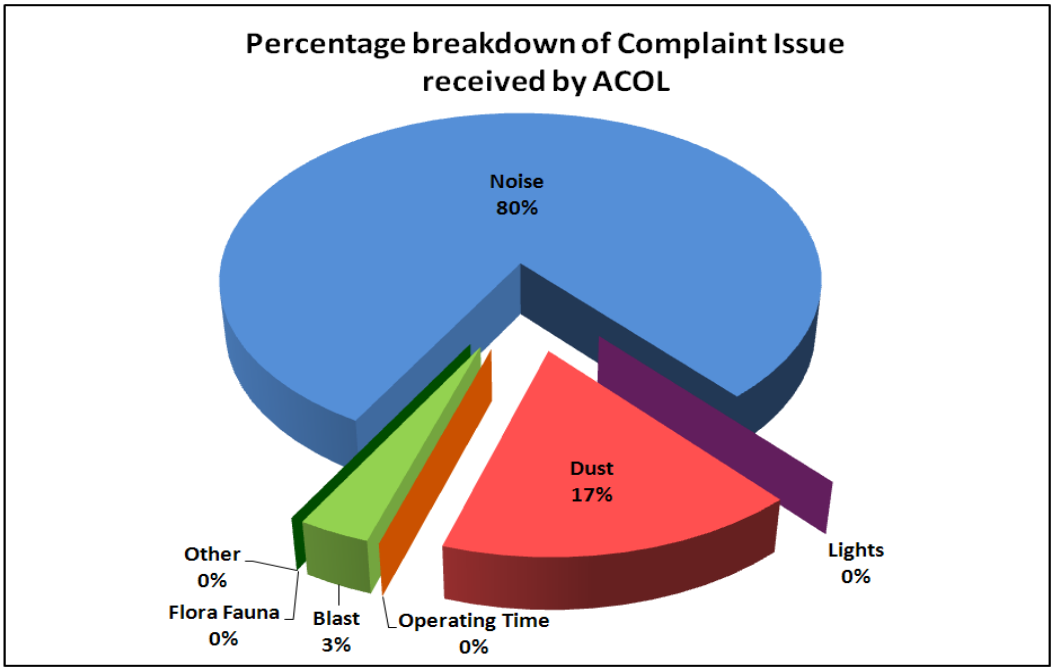

Figure 66. Percentage Breakdown of Complaint Issue received by ACOL

Similarly, the complaints received by OEH, as seen in **Figure 67**, were mostly relating to noise (52%). Dust (26%) and blasting (22%) made up the remainder.

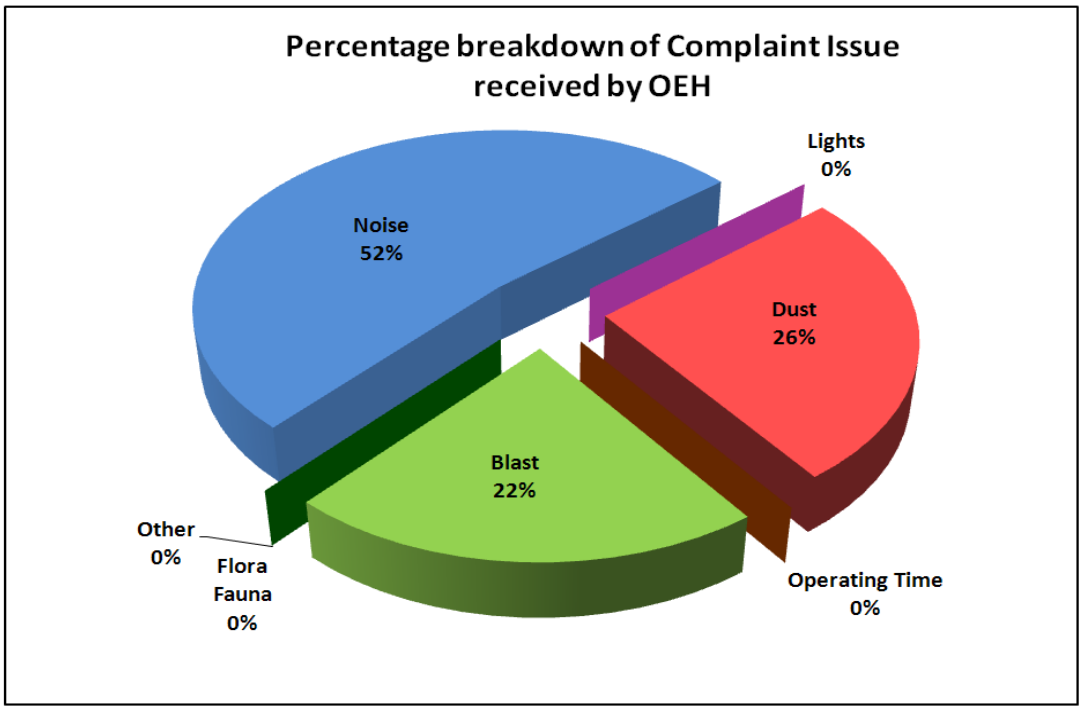

Figure 67. Percentage Breakdown of Complaint Issue received by OEH

The complaints number received by ACOL is primarily being driven by one resident as **Figure 68** shows.

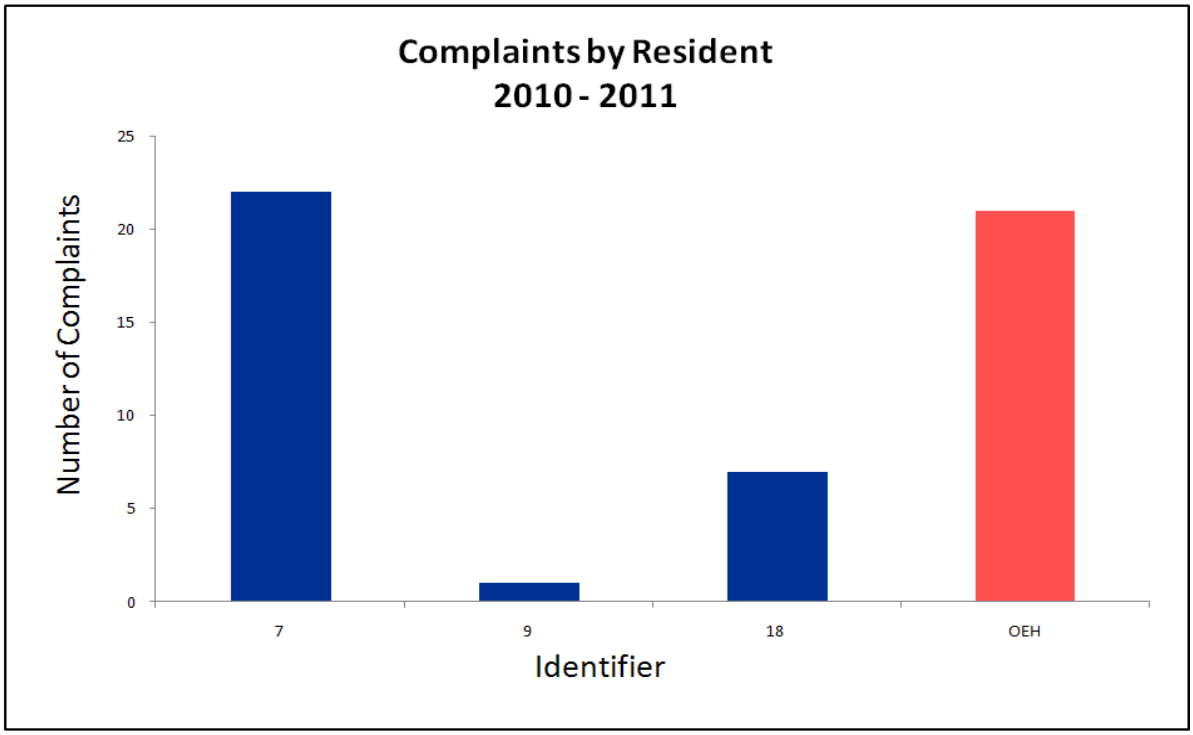

Figure 68. Complaints by Resident 2010 - 2011

Historically there is a reduction in total complaints of the reporting period compared to previous years as seen in **Figure 69**. The number of complaints is more consistent between OEH and ACOL this reporting period compared to most previous years.

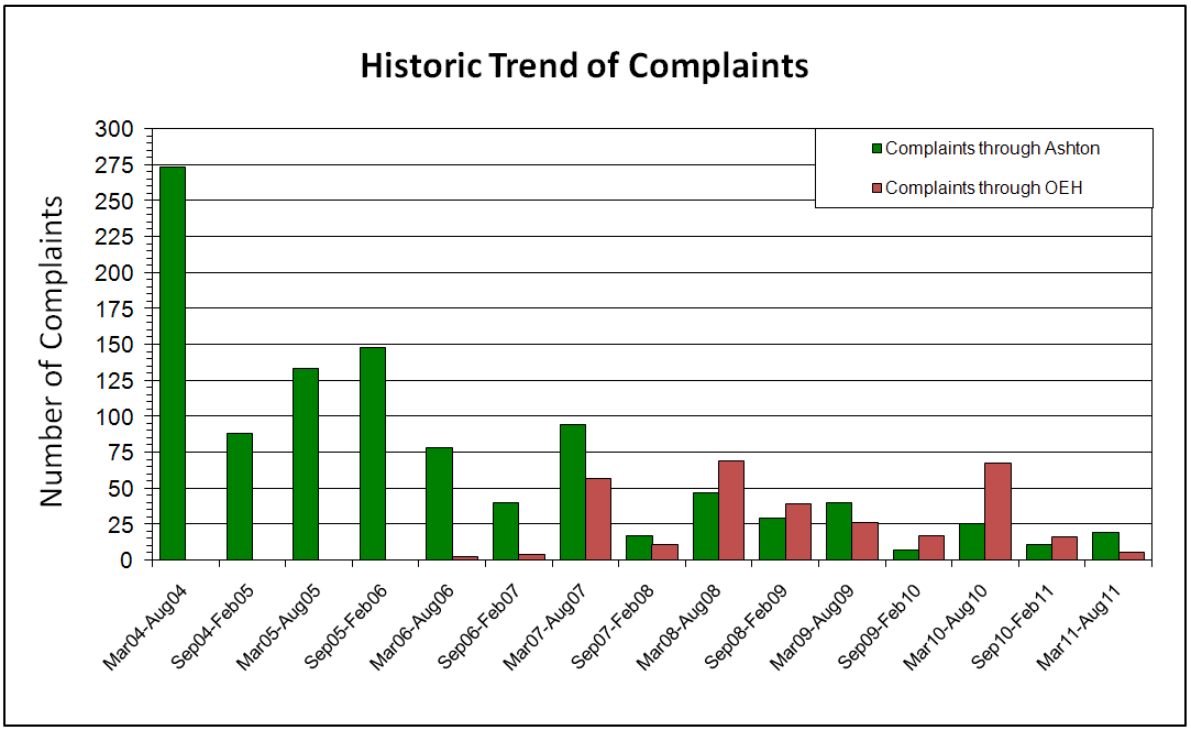

Figure 69. Historic Trend of Complaints

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

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 any 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 Approval, rehabilitation, dust generation, blasts and the project for the S94 contribution funds. The S94 contribution will go towards the construction of entry signs to Camberwell Village which ACOL are liaising with Singleton Shire Council to gain the relevant approvals to allow construction to begin. The CCC met on the following dates:

Table 41. COMMUNITY CONSULTATIVE COMMITTEE

Meeting Date	Items Addressed
28th September 2010	Environmental monitoring, operations overview, SEOC update, Bowman's Creek Diversion update, rehabilitation report.
14th December 2010	Environmental monitoring, operations overview, SEOC update, Bowman's Creek Diversion update, NEOC update, underground operations, proposed gas drainage & ventilation development consent modification.
4th March 2011	Environmental monitoring, operations overview, NEOC update, gas drainage network & ventilation development consent modification.
9th June 2011	Environmental monitoring, operations overview, SEOC update, Bowman's Creek Diversion update, gas drainage network & ventilation, underground operations update.

4.2.2 Community Newsletter

There was one newsletter distributed amongst the local community detailing progress of operations at ACOL, see **Table 42** below.

Table 42. COMMUNITY NEWSLETTERS

Newsletter #	Issued	Contents
32	March 2011	SEOC update, rehabilitation on the Eastern Emplacement Area, operations update, Bowmans Creek Diversion Project update, staff at Ashton Coal, advertisement for a CCC member.

4.2.3 Community Support

During the reporting period ACOL gave support to;

- Cancer Council Relay for Life;
- Leukaemia Foundation World's Greatest Shave;
- Children's Cancer;
- Hunter Medical Research Institute;
- Aboriginal Rugby League Knockout Competition;
- Singleton Mens Shed;
- Hunter Barbarians U11's Rugby Union team for the "Anti Bullying" Program – Enough is Enough Anti Violence Movement

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

4.2.4 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 compost on rehabilitation. Ashton has been using the compost in rehabilitation for four 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,
- 25 Chinese Ministry of Land and Resources delegation on a rehabilitation technical site visit as part of their Sydney University Environmental Sustainability course;
- SITA (supplier of the compost) are also currently co-ordinating a film clip with Channel 9's Garden Gurus in the next reporting period, at the use of compost in large scale rehabilitation.
-

4.2.5 ACOL Website Upgrade

In January - February 2011 ACOL conducted upgrade works to the operations website (www.ashtoncoal.com.au). The aim of the refurbishment was;

- to improve external stakeholders access to view / download information relating to ACOL operations including contact details, environmental monitoring results, approvals and management plans. Links to environmental monitoring reports and licences and approvals are now available on the front page of the site.
- Improve the usability from a site perspective so that updates and data uploads can be undertaken more efficiently ensuring the information in the site can be kept up to date more effectively.

Upgrades to the website were carried out in conjunction with the DPI guidelines for establishing and maintaining websites for mining projects released in 2011. Positive feedback has been received from external stakeholders on the format and layout of the website. Further modifications to improve the site are conducted on a continual basis.

5.0 REHABILITATION

5.1 OPEN CUT

A total of 9.53 hectares grazing pasture was rehabilitated during the reporting period. Organic Growth Medium (OGM) was spread across all rehabilitation areas at 100t/ha. The rehabilitation processes used during the reporting period were as follow:

- Pasture Rehabilitation – a total of 9.53ha of pasture was seeded. Pasture seed was applied at 45kg/ha with fertiliser at 200 kg/ha. OGM was applied to all areas at 100t/ha.

Figure 70. Pasture rehabilitation seeded Autumn 2011

5.2 REHABILITATION TRIALS AND RESEARCH

DTIRIS in conjunction with ACOL conducted a Galinea treatment trial program. The trial was conducted in ACOL's woodland rehabilitation areas. The trial aimed to identify alternative herbicides and spray rates for eradicating Galinea around native saplings. Grazon, the chemical traditionally used to treat Galinea on mine site rehabilitation is highly aggressive against Eucalypt and Acacia saplings. The trial addressed the effects on both young saplings (<18 months and < 1 m height) and adolescent saplings (3 years old and 2 to 3 m height). The results of these trials will give a greater range of herbicides to use on Galinea in woodland areas. For more information on these trials contact Tony Cook – Department of Primary Industries, Tamworth Agricultural Institute tony.cook@industry.nsw.gov.au.

5.3 REHABILITATION SUMMARY

Table 43. **REHABILITATION SUMMARY 2010– 2011**

	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	26.17	26.17	26.17
B: DISTURBED AREAS			
B1 Infrastructure area	45.7	41.8	42.3
B2 Active Mining Area (Excluding B3 – B5)	3.4	17.9	0
B3 Waste Emplacement (Active / unshaped)	41.8	31.9	11.1
B4 Tailings emplacements (active / uncapped)	13	13	13
B5 Shaped waste emplacement (awaits final vegetation)	7.7	13.8	0
B6 Ravensworth Void 4 area of responsibility (Active / unshaped / partially rehabilitated)	41	41	41
ALL DISTURBED AREAS	139.6	146.4	94.4
C. REHABILITATION PROGRESS			
C1 Total Rehabilitated Area (except for maintenance)	128	118	144
D. REHABILITATION ON SLOPES			
D1 10 to 18 degrees	99	89.5	102
D2 Greater than 18 degrees	0	0	0

Table 44. REHABILITATION SUMMARY 2010- 2011

	Area Affected / Rehabilitated (hectares)		
	End of this reporting period (ha)	Last Report (ha)	Next Report (estimated) (ha)
E. SURFACE OF REHABILITATED LAND			
E1 Pasture and grasses	82	72.5	90
E2 Native woodland / ecosystems	39.8	39.8	47.8
E3 Plantations and crops	0	0	0
E4 Other (includes non-vegetative outcomes)	5	5 (Dams and drainage)	5

Table 45. 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)	0.5	0	A small part of the Highwall drain on the southern side was regraded, to get better stormwater flow.
Re-covering (detail – further topsoil, subsoil sealing, etc)	0	0	No areas were re-covered during the period.
Soil treatment (detail – fertiliser, lime, gypsum, ogm, etc)	5.5	40	A heavily affected Galinea area was stripped and fertilised
Treatment / Management (detail – grazing, cropping, slashing, etc)	0	0	
Re-seeding / Replanting (detail – species density, season, etc)	5.5	0	A heavily affected Galinea area was stripped and reseed
Adversely Affected by Weeds (detail – type and treatment)	5.5	10	A heavily affected Galinea area was stripped and reseed and fertilised
Feral animal control (detail – additional fencing, trapping, baiting, etc)	0	0	No feral animal control within rehabilitation areas was undertaken during the reporting period.

Figure 71. Maintenance works – Galinea stripped, the area pasture reseeded and fertilised Winter 2011

5.4 Rehabilitation Monitoring

Rehabilitation monitoring report was undertaken by DnA Environmental and Carbon Based Environmental. The purpose of monitoring is to present the results of an ongoing annual rehabilitation program which first 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 (NSW I&I 2010) whilst addressing the range of technical issues identified in the ACARP project (Nichols 2005).

ACOL's agreed post mining land use aims to incorporate a combination of habitat conservation and managed cattle grazing. Therefore 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 72.**

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 were situated on the main waste emplacement and consisted of two main vegetation communities including "native woodland" and "exotic pasture". The sites varied in age of establishment and were revegetated between 2005 and 2009. There are a total of four "woodland" and four "exotic pasture" rehabilitation sites incorporated into the annual rehabilitation monitoring program.

In 2010, rehabilitation monitoring was undertaken between 8 - 12th November by Dr Donna Johnston and Andrew Johnston (DnA Environmental). The methodology used for undertaking the monitoring was consistent with that used in 2008 and 2009.

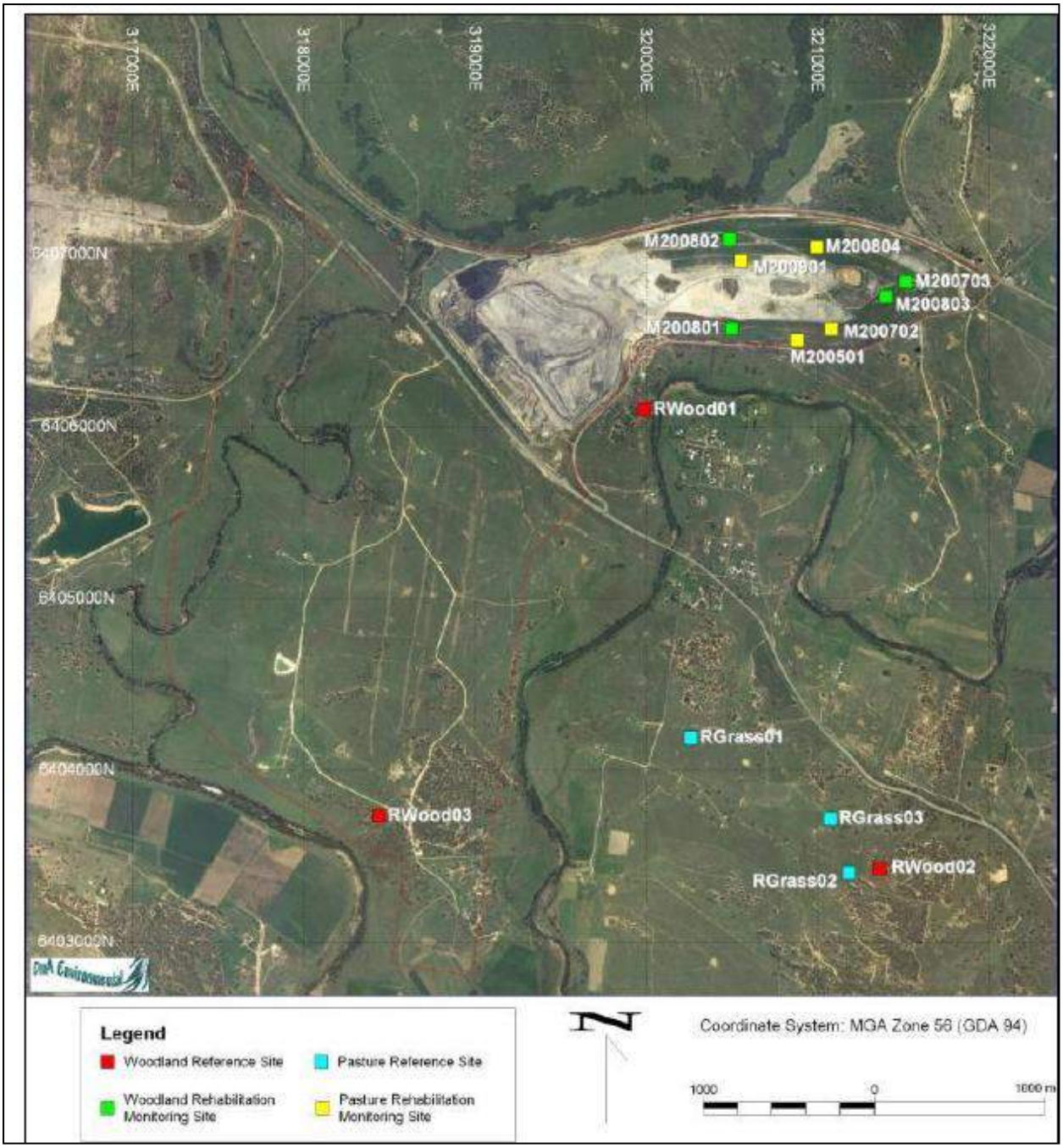

Figure 72. Locations of rehabilitation monitoring sites in relation to reference sites

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). 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.

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 that or exceed values obtained from the reference site under the same set of conditions or demonstrate a positive trend towards those target values.

Summary of results Woodland sites

In 2010, there was generally a decline in stability in all woodland sites, except M200803 despite the improved growing conditions. The primary reasons are probably due to overestimating the soil stability when conducting the slake test in 2009. In some sites however the decrease could be attributed to the incorporation of the OGM/Biosolids into the soil surface profile, and with slight erosion and sediment deposition there were more exposed areas of the unstable substrate material. The LFA infiltration indices had generally increased since 2009, but there were a few exceptions including M200703 and M200801. These increases were due to increased perennial vegetation cover, higher level of decomposition of dead leaf litter and OGM/Biosolids and typically increased cryptogam cover. Similar trends were also observed in nutrient recycling indices and most sites showed an increase in LFA indices except M200801. While many of the woodland rehabilitation sites have improved in ecological function, this has been largely due to the rapid and extensive colonisation of the perennial sub-shrub Galenia.

One *Acacia saligna* (>5cm dbh) was recorded in M200703 in 2010 (due to the increase in growth of the shrub population) but no mature trees were yet recorded in the other rehabilitation sites due to their immaturity. In 2009, the rehabilitation sites M200703 and M200803 had a significantly higher number of shrubs than were recorded in 2008 and exceeded or fell within the reference site range. However, in M200703, 51% of the population was comprised of non endemic or weed species. In 2010 the number of shrubs and juvenile trees had declined in this site, as well as in M200801 and M200803. Many shrubs had died in M200703 due to adverse soil conditions affecting the health of the vegetation, while in the remaining rehabilitation sites, the colonisation of

Galenia pubescens (Galenia) had smothered young seedlings, or they may have remained undetected under the dense ground cover.

In 2010 all woodland rehabilitation sites increased in total ground cover, except site M200802 which had a negligible decrease and all sites except M200703 fell within or exceeded the new target range. In the rehabilitation sites in 2009 there was significant perennial vegetation cover in sites M200801, M200802 and M200803 and this had further increased in 2010, but this was primarily due to the extensive colonisation of *Galenia pubescens*. Site M200703 however has demonstrated a declining trend in perennial plant cover and fell well short of meeting this Key Performance Indicator (KPI) target. Improved seasonal conditions has resulted in an increase in floristic diversity in the reference sites and while no rehabilitation site was as diverse as the reference sites, an increase in total species diversity was apparent in M200703, but a decline in floristic diversity was recorded in the remaining three woodland rehabilitation sites, due to increased cover of *Galenia pubescens.* While exotic species were more common than native species in the rehabilitation sites, all but M200703 had fewer weeds species than in 2009 and the number of exotic species fell within or were lower than recorded in the reference sites and therefore met this KPI target this year.

In 2010, there were 24 species recorded in at least two of the four woodland rehabilitation and 16 (67%) species were exotic species. *Galenia pubescens, Cynodon dactylon, Sonchus oleraceus* and *Medicago sativa* continued to be recorded in all four woodland rehabilitation sites and in 2010, so did *Anagellis arvensis*.

No rills were recorded in M200801 and M200803 while a very small rill was recorded for the first time in site M200802. In site M200703, nine rills were recorded, with a total cross-sectional area of 1.259 m_2 which has been increasing since 2008, due to adverse soil conditions and lack of vegetative cover and requires amelioration. Since 2008 there has been no consistent change in pH across the sites. All of the woodland rehabilitation sites continued to have a higher pH than the reference sites. Changes in pH are likely to be the result of the natural variability occurring within the sites, rather than from actual causes, but changes in pH should be monitored carefully especially in site M200703 and M200803 which had moderately alkaline soils.

There has been a significant decrease in Electrical Conductivity (EC) recorded in all rehabilitation sites since 2008 and while no rehabilitation sites fell within the target KPI, site M200703 continued to fall within desirable levels but M200801, M200802 and M200803 continued to exceed desirable levels. Sites M200802 and M200803 had very similar concentrations to each other were on the borderline of being slightly saline.

There was an increase in the Organic Matter (OM) recorded in the woodland reference sites and these exceeded the desirable levels of 4.5%. The rehabilitation sites demonstrated increased OM levels in all sites between 2008 and 2009 (except M200803) and in 2010 all rehabilitation sites fell within the target KPI range. Phosphorous levels were significantly lower than desirable levels in all reference sites in all years reflecting the naturally low soil fertility in the woodland remnants around the Ashton Mine. There were significantly high phosphorous concentrations in M200802 in 2009 likely to be due to the release of nutrient from the biosolids but these levels have since shown a significant decline probably due to the utilisation by plants and perhaps leaching after heavy rainfall throughout the year. M200703 continued to fall within desirable levels, but the remaining sites did not.

In 2009 all rehabilitation sites exceeded the nitrate range provided by the reference sites with all sites except M200802 falling within desirable levels. In 2010, a significant increase in nitrate was recorded in all reference and all rehabilitation sites and in many sites these levels exceeded the high levels recorded in 2008. All rehabilitation sites with the exception of M200703 exceeded the range provided by the reference sites and also exceeded the desirable levels. While the reasons for this significant increase is largely unknown, nitrate levels can demonstrate significant fluctuations due to natural events (Col Davies, pers. comm.) and these may be related to the improved seasonal conditions, initiating microbial activity and release of nutrients, including nitrate, into the soil profile. There has been no change in the sampling methodology or laboratory analyses.

There was no consistent trend in the changes in Cation Exchange Capacity (CEC) within the rehabilitation sites and some sites had increased CEC (M200703 and M200803) but some sites had decreased CEC (M200801 and M200802). There is no plausible explanation for these results other than that the soils in these sites are naturally variable, and that the biosolid and OGM treatments may be influencing the chemical characteristics of the soils profile.

There was a further reduction in Exchangeable Sodium percentage (ESP) in two rehabilitation sites, including M200802 and M200803 and while there was a slight increase in ESP in M200703, all three sites now fell within the desirable levels. There was an increase in ESP in site M200801 and it continued to have ESP's greater than the desirable levels and were therefore still sodic. The application of gypsum may be required in this site.

Pasture sites

All monitoring sites were characterised as "pasture" patches which subsequently resulted in a Landscape Organisation Index (LOI) of 100%, indicating that all rehabilitation sites have become well established with 100% of the site capable of harnessing resources. The stability of the grassland rehabilitation sites have generally improved since 2009 with the exception of M200804 suggesting soil stability results in 2009 may have been overestimated in this site. While they did not meet performance indicator targets, they were typically trending in a positive direction. The LFA infiltration and nutrient recycling indices demonstrated a similar positive trend with all sites increasing in indices since 2009 and in 2010, site M200901 fell within the target KPI ranges.

Since 2008 there has been an increasing trend in total ground cover and three sites met this target of 100% ground cover while M200501 was only 1% lower. Improved seasonal conditions showed a considerable increase in the cover provided by perennial vegetation in all sites and all rehabilitation sites fell within or exceeded the target range. The perennial vegetation was largely dominated by exotic pasture species such as Rhodes Grass (*Chloris gayana*), Perennial Ryegrass (*Lolium perenne)* and Kikuyu (*Pennisetum clandestina*), but Galenia was very dominant in M200501, M200904 and M200901. Couch (*Cynodon dactylon*) also provided good cover in M200702 and *Galenia* was less dominant in this site. Due to the increase in perennial plant cover in all sites, there has been a declining trend in litter cover in all rehabilitation sites due to the increase in Galenia and other introduced pasture species. There was no annual plant cover recorded in most of the rehabilitation sites, due to the dominance of the perennial species.

In 2010 improved seasonal conditions resulted in an increase in floristic diversity but the total number of species recorded in the pasture rehabilitation sites did not yet contain the diversity recorded within the reference sites. Native species were recorded in all rehabilitation areas but the diversity continued to be significantly lower than the reference sites, however the rehabilitation sites had fewer or an equivalent number of exotic species and therefore met this KPI target.

In 2009, 35 species were identified across the pasture rehabilitation sites with 27 (77%) of these being exotic species. In 2010, 52 species were recorded in the pasture rehabilitation sites and 27 (52%) were exotic species. In 2009, 11 species were recorded in at least two of the four pasture rehabilitation sites with seven (67%) of these being exotic species and *Galenia pubescens* was the only species common to all sites. In 2010, this number of species remained the same but *Chloris gayana* and *Cichorium intybus* were also common to all sites.

No rills were recorded in M200501, M200804 or M200901 but one rill continued to be recorded in site M200702. The total cross-sectional area of the rill has declined indicating the rill has become increasingly more stable as the vegetation establishes.

Site M200702 continued to have neutral soil pH, but M200501, M200804 and M200901 had a high pH level and were in the slightly to strongly alkaline categories. In most rehabilitation sites there was a reduction in EC since 2009, especially in site M200901, but a slight increase was recorded in M200501.

Three of the rehabilitation sites were lower than or fell within the target range this year. Despite a significant reduction in EC, soils in site M200901 remained slightly saline which may potentially impact on plant growth and site stability and may require further investigation. There was no consistent trend in the changes in Organic Matter but three rehabilitation sites had a lower OM than in 2009 while in M200702 there was a slight increase. Sites M200501, M200702 and M200804 continued to have a lower OM than the target range. Despite a reduction of 2%, site M200901 continued to have significantly high OM and exceeded the target range and desirable values due to the application of the OGM onto the site.

In the reference sites, phosphorous levels continued to be significantly lower than the desirable level and since 2009, all rehabilitation sites recorded declining phosphorous concentrations. Site M200501 continued to have very low phosphorous levels while M200901 continued to have significantly high levels and these sites did not meet this KPI. Site M200702 was equivalent to the desirable level and M200804 was only slightly higher. In 2008 and 2009 nitrate levels were significantly lower than the desirable level but in 2010, a significant increase in nitrate was recorded in all reference and all rehabilitation sites. While the reasons for this significant increase is largely unknown, nitrate levels can demonstrate significant fluctuations due to natural events (Col Davies, pers. comm.) and these may be related to the improved seasonal conditions, initiating microbial activity and release of nutrients, including nitrate, into the soil profile. There has been no change in the sampling methodology or laboratory analyses.

There was no consistent trend in the changes in CEC within the rehabilitation sites but three sites had lower CEC (M200702, M200804 and M200901) while M200501 had slightly increased. All rehabilitation sites however exceeded the target range and in site M200901, CEC was high and greatly exceeded the desirable level and therefore all sites met this KPI target. Since 2009, all reference and rehabilitation sites had a lower ESP recording except in M200804. Despite these

changes, three sites continued to have an ESP that exceeded the desirable levels with the soils considered to be sodic and may require the application of gypsum after further investigation. Site M200702 had a significantly lower ESP this year and now fell within the target range and desirables levels.

6.0 MAJOR PROJECTS

6.1 DEVELOPMENT CONSENT MODIFICATION – BOWMANS CREEK DIVERSION

In December 2010 ACOL received approval for the Bowmans Creek Diversion DA 309-11-2001 Modification 6. The modification proposes to re-design the underground mine layout to allow additional extraction beneath the creek and its alluvium. Throughout the remainder of the reporting period ACOL sort to obtain relevant subordinate approvals required for the commencement of the construction activities. Construction of the diversions is expected to commence in the next reporting period with civil works also being completed during the period. Ecosystem resoration activities associated with the diversions is expected to continue for a further 7 years following construction.

The proposal involves:

- allowing longwall mining operations that would result in a direct hydraulic connection between the Bowmans Creek alluvium and the underground workings due to connective cracking;
- amending the mine plan for all four coal seams to optimise resource extraction;
- diverting two sections of Bowmans Creek to ensure that the integrity of the creek system and associated alluvium is not permanently impacted by the proposal; and
- modifying relevant development consent conditions to facilitate the above

Key Benefits of the Project

The revised underground mine plan, which is the subject of this proposal, contains the following key benefits:

- It permits the maintenance of a cost effective business, with sustainable capital and operating costs, and thereby provides security of employment for 195 direct employees and 35 construction positions as well as flow on effects to the regional economy;
- It provides access to an additional 5.3 million tonnes of run of mine (ROM) coal through significantly improved resource recovery, and reduced sterilisation, over the four targeted seams than would be possible under constraints imposed by the existing development consent;
- It provides approximately $80 million of additional revenue to the State and Federal Governments;
- It provides significantly improved flexibility to modify the mine plan within the mining footprint and certainty that mining of lower seams will be technically and economically feasible;

In order to mitigate the effects of subsidence on the flow transmission capacity of Bowmans Creek, the project involves the diversion of two sections of Bowmans Creek (total 1.7km) that will mimic or enhance the hydraulic, geomorphic and habitat features of the existing channel

Including pools and terraces within the stream bed, and large woody debris as a supplementary habitat feature;

- It will create diversions that can evolve in time to form ecologically diverse habitat in association with adjoining floodplain areas from which domestic stock will be excluded;
- It provides significant environmental benefits by way of enhanced riparian vegetation and a large area of existing creek and floodplain that will be excluded from degradation by domestic stock; and
- It reduces the salt load to Bowmans Creek and the Hunter River.

Background

The original underground mining proposal in the EIS (HLA, 2001) involved 250m wide longwall panels and a 2.4km diversion of Bowmans Creek around the northern and western sides of the proposed underground mine footprint. At the time of the original EIS, there were a number of concerns relating to the Bowmans Creek alluvial aquifer that influenced the approved project:

- The Bowmans Creek alluvium aquifer was considered worthy of preservation;
- Groundwater was considered to flow downwards from alluvium to underlying coal measures;
- Following underground mining, the groundwater levels in the coal measures were predicted to be higher than pre-mining, and higher than those in the alluvium; and
- In the event of direct hydraulic connection between the Bowmans Creek alluvium and the underground workings through connective cracking, saline groundwater would flow upwards from the coal measures and would contribute to the baseflow in Bowmans Creek. This would result in an increase in salinity in the Hunter River.

New Understandings

With the benefit of additional monitoring of groundwater, subsidence and surface water since the commencement of the development of the ACP, several studies have been undertaken that have improved the understanding of the Bowmans Creek alluvium since the preparation of the original EIS. In particular, groundwater investigations have improved the understanding of the nature, extent and quality of Bowmans Creek alluvial aquifer and its degree of connection to Bowmans Creek. Monitoring of groundwater during the first five years of open cut mining and three years of underground mining has provided significantly better understanding and greater certainty in relation to potential impacts of longwall mining. The recent data and analysis shows that:

- The quality of water in the alluvial aquifer ranges from moderately to highly saline (up to 6,400 µS/cm EC). The alluvial groundwater is not a high quality resource and provides only limited environmental and economic value;
- Prior to mining there is a natural upwards seepage of saline groundwater from the coal measures to the alluvium;
- The alluvium has relatively low hydraulic conductivity and only makes a very small contribution to baseflow to Bowmans Creek;
- Contrary to the 2002 EIS prediction there will be a decrease in Hunter River salinity post
- mining; and
- The existing creek provides a range of aquatic and riparian ecosystem services but has been degraded as a consequence of past land use practices.

The Project

In addition to the improved understanding of groundwater and subsidence issues, the detailed features of this project are based on a range of physical, ecological and heritage issues that have been the subject of specialist studies. In particular, significant attention has been given to the development of designs for the diversion channels which will have similar hydraulic and geomorphic characteristics to the existing creek and provide opportunities for significant enhancement of the riparian and aquatic habitat.

6.2 MODIFICATION IN CONVEYOR AND CHPP FOR SOUTH EAST OPEN CUT

The South East Open Cut (SEOC) is located outside of the area of the existing development consent for the Ashton Coal projects (ACP) and as such will be developed as a separate project with its own Project Approval hence it has not been addressed in detail within the Major Project section of this report. However it is intended that the SEOC will be managed as a part of the ACOL operation and to achieve this integration it will be necessary to also modify the existing ACP. As such the Environmental Assessment submitted during the reporting period for the SEOC incorporated DA 309-11-2001 Modification 5. The modification seeks to;

- Increase the through put of the CHPP and rail loading facilities to cater for approximately 8.6Mtpa of ROM coal (or an additional 2.3Mtpa of product coal);
- Modification of the existing CHPP facilities to allow the receipt of coal from the SEOC;
- Disposal of coal tailings form the existing underground coal mine in the SEOC final void;
- Increased coal extraction rate from 2.95Mtpa ROM to 5MtpaROM coal in the existing Underground mine; and
- Associated modifications to the conditions of DA 309-11-2001 to facilitate the above changes.

Assessment of this project by DoPI continued during the reporting period.

7.0 ACTIVITIES PROPOSED IN THE NEXT AEMR PERIOD

7.1 EXPLORATION

Anticipated Exploration for period to Aug 2012

Mining Lease 1533

- Open cut - No activity planned.
- Underground - It is expected that between 6 holes are likely to be drilled for gas drainage and up to another 10 exploration holes if required.

Exploration Licences 5860 & 4918

- Exploration continuing with 10 holes planned (3 cored and 7 open holes).

7.2 ENVIRONMENTAL MANAGEMENT PLAN UPDATE

In consultation with DoP&I there were no Environmental Management Plans updated during the 2010/2011 AEMR period, this was due to the ongoing assessment of a major project associated with the ACOL project area. During the 2011/2012 reporting period there is planned for a major update on ACOL management plans, see **Table 46**.

Table 46. MANAGEMENT PLANS STATUS

	Current Version Date	Revised By
Archaeology and Cultural Heritage Management Plan	Sep 2006	1st Quarter 2012
Flora and Fauna Management Plan	Aug 2006	1st Quarter 2012
Site Water Management Plan	Aug 2006	1st Quarter 2012
Waste Management Plan	Sep 2003	3rd Quarter 2012
Lighting Management Plan	Jan 2004	3rd Quarter 2012
Road and Rail Closure Management Plan	Jan 2004	3rd Quarter 2012
Spontaneous Combustion Management Plan	Jan 2004	3rd Quarter 2012
Bushfire Management Plan	Mar 2005	3rd Quarter 2012
Air Quality Management Plan	Aug 2006	3rd Quarter 2012
Blast/Vibration Management Plan	Aug 2006	3rd Quarter 2012
Noise Management Plan	Aug 2006	3rd Quarter 2012
Landscape and Revegetation Management Plan	May 2006	4th Quarter 2012
Land Management Plan	Jul 2006	4th Quarter 2012
Final Void Management Plan	NA	4th Quarter 2012
Rehabilitation Management Plan	Due Dec 2012	4th Quarter 2012

7.3 REHABILITATION

A further 16ha of rehabilitation is expected to be undertaken during 2010 - 2011. This area will include pasture rehabilitation on the slopes of the EEA and woodland rehabilitation on the top of the EEA.

Now the Galinea treatment trial program has been conducted on site and the reports are finished, Tony Cook is applying for Pesticide Permits to the Australian Pesticides and Veterinary Medicines Authority APVMA to legally allow more herbicide selection, when treating Galinea surrounding native saplings. Once the pesticides permits have been approved there will be a Galinea spraying program implemented on site for the rehabilitation area.

7.4 BUFFER LAND

It is proposed to undertake more weed works and tree planting within the crown land lease areas. A large campaign is planned for St Johns Wort spraying during November 2011 to January 2012 across all the land managed by Ashton Coal. There will be more maintenance weed works in the Voluntary Conservation Area targeting African Boxthorn and St John's Wort.

7.5 PROPOSED DEVELOPMENT MODIFICATIONS

Ventilation Shaft

Currently ACOL have two surface exhaust vent fans located in the UG surface lay down area. Progression of mining operations to the Upper Liddell seam will require an update to the mine ventilation system. To deliver necessary ventilation to allow mining to proceed, within the next reporting period ACOL are planning to apply for a DA modification to construct a new main ventilation shaft and install two new surface centrifugal fans, as well as a new backroad vent shaft.

The ventilation fan shaft project will include:

- 5.5m diameter circular vent shaft will be raise bored. This will run from the surface to the Upper Liddell seam and will be approximately 120m deep.
- A new backroad upcast shaft to assist in relocation of the existing backroad ventilation fan from the Pikes Gully to the new Upper Liddell seam backroad vent
- Two exhaust fans will be placed over the main shaft.
- Each will be fitted with noise reduction
- Total height of 7 metres
- Fan and infrastructure will occupy an area approx. 50m x 30m
- Will be located within a recessed position above Longwall 1. The top of the vent fan structures will be the only part visible from New England Highway

Gas Drainage

ACOL is required to manage gas levels within safe operating levels in the underground mine. Geological investigations prior to the development of the ACOL project determined that the coal seams for the underground mine contained low to moderate gas yields and that the gas content in the shallower seams would not form a constraint to mining, however gas management would be required for the deeper coal seams.

Gas levels have now been encountered in the underground mine, which require the implementation of measures to maintain safe operating conditions. To date, ACOL has implemented the following infrastructure as an interim response to gas management requirements:

- In 2010, three gas drainage wells were installed into the Pikes Gully (PG) seam on Longwall Panel 6A. Development of these wells was carried out under the exempt development provisions of the *State Environmental Planning Policy Mining Petroleum Production and Extractive Industries 2007* (Mining SEPP); and
- In 2011, an application was lodged under *Section 75W of the Environmental Planning and Assessment Act 1979*, to modify ACOL's development consent DA 309-11-2001-i-MOD 7 to allow additional gas drainage infrastructure. The application included an additional fifteen gas drainage wells to be drilled into the PG seam on LW 6B, 7A , 7B and 8. The gas drainage wells provided an interim measure to enable the continued safe operations of the mine until a full gas drainage network could be designed. The application was granted approval on the 15 June, 2011.

During the next reporting period ACOL are planning to apply for a DA modification to which will compromise the following elements:

- Construction of a central gas drainage plant to provide continuous extraction of gas from a series of gas drainage wells.
- Construction of a flaring facility and ventilation stack located a safe distance from the central gas drainage plant.
- Drilling of a maximum of 77 gas drainage wells over the underground workings, staged with the progression of underground mining.
- Construction of a temporary surface reticulation network for the conveyance of gas to the central gas drainage plant.
- Minor associated infrastructure required to provide access and electricity as necessary.

The proposed infrastructure will be integrated with that already approved to provide comprehensive gas drainage for the underground mine.

DISTRIBUTION

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Annual Environmental Management Report 2010 - 2011

30 March 2012

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APPENDIX 1

AIR QUALITY MONITORING DATA

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2010 - 2011 High Volume Air Sampler TSP Results

		Site 1 - TSP			Site 2 - TSP			Site 3 - TSP			Site 8 - TSP		
Date	Event	TSP Result	Rolling Annual Average-109	Data %	TSP Result	Rolling Annual Average-86	Data %	TSP Result	Rolling Annual Average-95	Data %	TSP Result	Rolling Annual Average-93	Data %
04-09-10	1	47	107	100	27	84	100.0	20	85	100.0	38	89	100.0
10-09-10	2	113	106	100	66	84	100.0	58	84	100.0	82	89	100.0
16-09-10	3	113	105	100	54	83	100.0	65	83	100.0	74	88	100.0
22-09-10	4	139	106	100	114	82	100.0	103	82	100.0	116	88	100.0
28-09-10	5	247	107	100	151	83	100.0	139	83	100.0	207	89	100.0
04-10-10	6	10	107	100	12	83	100.0	11	82	100.0	9	88	100.0
10-10-10	7	33	106	100	36	82	100.0	32	82	100.0	25	88	100.0
16-10-10	8	68	103	100	62	81	100.0	50	81	100.0	59	86	100.0
22-10-10	9	133	101	100	129	81	100.0	85	79	100.0	101	85	100.0
28-10-10	10	54	102	100	42	81	100.0	53	79	100.0	51	85	100.0
03-11-10	11	84	100	100	73	79	100.0	88	78	100.0	83	84	100.0
09-11-10	12	47	101	100	41	80	100.0	50	79	100.0	46	84	100.0
15-11-10	13	86	100	100	64	79	100.0	67	78	100.0	63	84	100.0
21-11-10	14	21	96	100	21	76	100.0	20	76	100.0	18	81	100.0
27-11-10	15	47	95	100	48	75	100.0	48	75	100.0	47	80	100.0
03-12-10	16	25	95	100	25	75	100.0	22	74	100.0	21	80	100.0
09-12-10	17	62	91	100	83	73	100.0	98	73	100.0	76	78	100.0
15-12-10	18	75	91	100	67	72	100.0	78	72	100.0	70	77	100.0
21-12-10	19	123	92	100	123	74	100.0	199	74	100.0	132	78	100.0
27-12-10	20	28	92	100	27	74	100.0	32	74	100.0	27	78	100.0
02-01-11	21	75	91	100	63	73	100.0	105	75	100.0	68	78	100.0
08-01-11	22	19	91	100	16	73	100.0	16	74	100.0	15	78	100.0
14-01-11	23	62	89	100	49	72	100.0	58	73	100.0	54	76	100.0
20-01-11	24	23	85	100	37	70	100.0	32	70	100.0	29	74	100.0
26-01-11	25	110	85	100	78	70	100.0	272	73	100.0	103	74	100.0
01-02-11	26	229	88	100	176	72	100.0	202	76	100.0	173	76	100.0
07-02-11	27	55	89	100	49	72	100.0	47	76	100.0	46	76	100.0
13-02-11	28	28	86	100	25	70	100.0	30	74	100.0	27	74	100.0
19-02-11	29	100	87	100	94	71	100.0	123	75	100.0	98	75	100.0
25-02-11	30	87	87	100	67	70	100.0	74	75	100.0	72	74	100.0
03-03-11	31	75	87	100	61	71	100.0	70	75	100.0	66	75	100.0
09-03-11	32	141	87	100	86	70	100.0	120	75	100.0	100	75	100.0
15-03-11	33	48	87	100	46	71	100.0	48	76	100.0	45	75	100.0
21-03-11	34	30	85	100	29	68	100.0	29	74	100.0	28	73	100.0
27-03-11	35	48	83	100	36	66	100.0	40	72	100.0	38	72	100.0
02-04-11	36	73	83	100	70	67	100.0	71	73	100.0	79	72	100.0
08-04-11	37	40	83	100	32	66	100.0	35	72	100.0	51	72	100.0
14-04-11	38	78	82	100	70	65	100.0	83	72	100.0	78	71	100.0
20-04-11	39	78	82	100	78	65	100.0	78	72	100.0	88	72	100.0
26-04-11	40	25	81	100	19	64	100.0	20	71	100.0	25	71	100.0
02-05-11	41	44	81	100	51	65	100.0	43	72	100.0	51	71	100.0
08-05-11	42	88	80	100	79	64	100.0	66	70	100.0	70	69	100.0
14-05-11	43	109	79	100	72	62	100.0	77	69	100.0	82	68	100.0
20-05-11	44	76	78	100	65	61	100.0	62	69	100.0	62	68	100.0
26-05-11	45	34	79	100	46	61	100.0	36	69	100.0	38	68	100.0
01-06-11	46	23	78	100	18	61	100.0	23	69	100.0	18	67	100.0
07-06-11	47	67	78	100	63	61	100.0	49	69	100.0	49	67	100.0
13-06-11	48	22	77	100	16	61	100.0	17	68	100.0	16	66	100.0
19-06-11	49	62	76	100	37	60	100.0	42	67	100.0	N/A	66	98.0
25-06-11	50	63	75	100	55	60	100.0	45	67	100.0	54	65	98.0
01-07-11	51	24	73	100	32	59	100.0	27	66	100.0	24	64	98.0
07-07-11	52	54	72	100	63	59	100.0	37	65	100.0	39	62	98.1
13-07-11	53	98	73	100	87	60	100.0	94	66	100.0	68	63	98.1
19-07-11	54	55	73	100	42	60	100.0	64	66	100.0	74	64	98.1
25-07-11	55	80	73	100	75	60	100.0	77	66	100.0	48	63	98.2
31-07-11	56	100	74	100	90	61	100.0	106	67	100.0	21	63	98.2
06-08-11	57	140	74	100	157	62	100.0	154	68	100.0	148	63	98.2
12-08-11	58	57	74	100	56	62	100.0	39	68	100.0	42	63	98.3
18-08-11	59	31	72	100	34	60	100.0	45	67	100.0	35	62	98.3
24-08-11	60	35	71	100	27	60	100.0	26	67	100.0	95	63	98.3
30-08-11	61	69	71	100	52	60	100.0	50	66	100.0	75	62	98.4

2010 – 2011 Tapered Element Oscillating Microbalance (TEOM) PM_{10} Results																	
	Site 1		Site 2		Site 3		Site 8		Site 4		Site 7			Ashton Contribution (calculated for NW winds only)			
Date	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	Wind Direction	Site 1	Site 2	Site 3	Site 8
02-Sep-10	48	25	29	17	40	22	45	25	44	24	43	22	NW	6	0	0	2
03-Sep-10	8	25	5	17	6	22	6	25	8	24	14	22	SE	0	0	0	0
04-Sep-10	15	25	7	17	7	22	9	25	11	24	8	22	SE	0	0	0	0
05-Sep-10	22	25	11	17	27	22	17	25	16	24	9	22	NW	14	2	19	9
06-Sep-10	27	25	13	17	17	22	25	25	20	24	10	22	NW	16	2	7	15
07-Sep-10	23	25	13	17	20	22	19	25	22	24	18	22	NW	5	0	2	1
08-Sep-10	12	25	10	17	15	22	11	24	17	24	18	22	SE	0	0	0	0
09-Sep-10	25	25	17	17	17	22	21	24	26	24	17	22	NW	8	0	0	4
10-Sep-10	26	25	13	17	17	22	22	24	17	24	10	22	NW	16	3	7	12
11-Sep-10	26	25	14	17	22	22	18	24	28	24	12	22	NW	14	2	9	6
12-Sep-10	22	25	12	17	22	22	21	24	22	24	14	22	NW	9	0	8	7
13-Sep-10	49	25	20	17	36	22	41	24	37	24	29	22	NW	20	0	7	12
14-Sep-10	21	25	15	17	27	22	22	24	26	24	25	22	SE	0	0	0	0
15-Sep-10	33	25	9	17	21	22	28	24	19	24	11	22	NW	22	0	10	17
16-Sep-10	36	25	10	17	21	22	34	24	24	24	15	22	NW	21	0	6	19
17-Sep-10	39	25	17	17	28	22	35	24	34	24	17	22	NW	22	0	11	18
18-Sep-10	42	25	20	17	31	22	37	24	40	24	21	22	NW	21	0	10	16
19-Sep-10	32	25	22	17	28	22	31	24	29	24	27	22	NW	6	0	1	4
20-Sep-10	33	25	20	17	29	22	35	24	28	24	33	22	SE	0	0	0	0
21-Sep-10	29	25	21	17	26	22	28	24	31	24	33	22	NW	0	0	0	0
22-Sep-10	31	25	19	17	28	22	30	24	32	24	32	22	SE	0	0	0	0
23-Sep-10	20	25	15	17	24	22	21	24	24	24	35	22	SE	0	0	0	0
24-Sep-10	38	25	26	17	31	22	39	24	32	24	27	22	NW	11	0	4	12
25-Sep-10	59	25	25	17	45	22	60	24	37	24	30	22	NW	30	0	15	30
26-Sep-10	26	25	18	17	27	22	31	24	28	24	24	22	NW	3	0	3	7
27-Sep-10	51	25	30	17	41	22	49	24	41	24	30	22	NW	21	0	11	19
28-Sep-10	49	25	22	17	33	22	48	24	27	24	22	22	NW	27	1	11	26
29-Sep-10	24	25	16	17	29	22	28	24	30	24	26	22	SE	0	0	0	0
30-Sep-10	10	25	9	17	15	22	12	24	15	24	13	22	SE	0	0	0	0
01-Oct-10	24	25	20	17	29	22	29	24	29	24	34	22	SE	0	0	0	0
02-Oct-10	11	25	12	17	13	22	12	24	15	24	17	22	SE	0	0	0	0
03-Oct-10	5	25	5	17	6	22	5	24	6	24	10	22	SE	0	0	0	0
04-Oct-10	5	25	5	17	6	22	5	24	9	24	10	22	SE	0	0	0	0
05-Oct-10	9	25	8	17	9	22	9	24	10	24	14	22	SE	0	0	0	0
06-Oct-10	9	25	6	17	8	22	8	24	10	24	14	22	SE	0	0	0	0
07-Oct-10	23	25	14	17	20	22	22	24	22	24	20	22	NW	3	0	0	2
08-Oct-10	26	25	16	17	25	22	25	24	28	24	31	22	SE	0	0	0	0
09-Oct-10	14	25	10	17	13	22	13	24	14	24	22	22	SE	0	0	0	0
10-Oct-10	14	24	10	17	14	22	14	24	15	24	25	22	SE	0	0	0	0
11-Oct-10	14	24	11	17	15	22	14	24	17	24	17	22	SE	0	0	0	0
12-Oct-10	15	24	10	17	24	22	15	24	23	24	16	22	SE	0	0	0	0
13-Oct-10	35	24	18	17	29	22	35	24	31	24	18	22	SE	0	0	0	0
14-Oct-10	37	25	21	17	29	22	39	24	34	24	25	22	NW	12	0	5	14
15-Oct-10	26	25	15	17	24	22	26	24	29	24	21	22	NE	0	0	0	0

2010 – 2011 Tapered Element Oscillating Microbalance (TEOM) PM_{10} Results																	
	Site 1		Site 2		Site 3		Site 8		Site 4		Site 7			Ashton Contribution (calculated for NW winds only)			
Date	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	Wind Direction	Site 1	Site 2	Site 3	Site 8
16-Oct-10	22	25	9	17	15	22	21	24	19	24	12	22	NW	10	0	3	9
17-Oct-10	26	25	14	17	26	22	27	24	37	24	15	22	NW	11	0	11	12
18-Oct-10	26	25	13	17	30	22	25	24	33	24	16	22	NW	10	0	15	9
19-Oct-10	22	25	17	17	22	22	25	24	30	24	28	22	NW	0	0	0	0
20-Oct-10	16	24	12	17	19	22	19	24	24	24	21	22	SE	0	0	0	0
21-Oct-10	17	24	13	17	19	22	18	24	24	24	23	22	SE	0	0	0	0
22-Oct-10	31	24	19	17	27	22	31	24	30	24	24	22	SE	0	0	0	0
23-Oct-10	35	24	17	16	26	22	32	24	28	24	20	22	NW	15	0	6	13
24-Oct-10	7	24	5	16	6	22	6	24	6	24	7	21	SE	0	0	0	0
25-Oct-10	11	24	9	16	12	22	12	24	13	24	13	21	SE	0	0	0	0
26-Oct-10	24	24	17	16	22	22	27	24	26	24	21	21	SE	0	0	0	0
27-Oct-10	25	24	16	16	26	22	28	24	30	24	25	22	NW	0	0	1	3
28-Oct-10	16	24	12	16	17	22	16	24	18	24	24	22	SE	0	0	0	0
29-Oct-10	20	24	12	16	18	22	17	24	20	24	21	22	SE	0	0	0	0
30-Oct-10	29	24	19	16	21	22	25	24	28	24	24	22	SE	0	0	0	0
31-Oct-10	36	24	19	16	28	22	33	24	30	24	25	22	SE	0	0	0	0
01-Nov-10	18	24	16	17	12	22	15	24	12	24	15	22	SE	0	0	0	0
02-Nov-10	19	24	10	16	11	22	18	24	11	24	18	22	NW	8	0	0	7
03-Nov-10	27	24	15	16	29	22	27	24	31	24	27	22	NW	0	0	2	0
04-Nov-10	13	24	9	16	13	22	12	24	14	24	12	21	SE	0	0	0	0
05-Nov-10	6	24	5	16	6	22	6	24	6	24	6	21	SE	0	0	0	0
06-Nov-10	6	24	5	16	6	22	6	24	7	24	6	21	SE	0	0	0	0
07-Nov-10	9	24	7	16	9	22	8	24	11	24	10	21	SE	0	0	0	0
08-Nov-10	22	24	14	16	21	22	24	24	24	24	23	21	NW	0	0	0	1
09-Nov-10	16	24	11	16	16	22	17	24	17	24	16	21	NW	0	0	1	1
10-Nov-10	27	24	15	16	23	22	21	24	23	24	25	21	NW	4	0	0	0
11-Nov-10	34	24	16	16	28	22	27	24	31	24	31	21	NW	3	0	0	0
12-Nov-10	25	24	16	16	28	22	28	24	33	24	28	21	SW	0	0	0	0
13-Nov-10	25	24	16	16	33	22	28	24	33	24	27	21	NW	0	0	6	1
14-Nov-10	33	24	19	16	35	22	34	24	33	24	33	21	NW	0	0	1	1
15-Nov-10	21	24	13	16	25	22	27	24	26	24	21	21	NW	0	0	4	6
16-Nov-10	8	24	7	16	7	22	8	24	8	24	7	21	SE	0	0	0	0
17-Nov-10	11	24	8	16	11	22	11	24	14	24	11	21	SE	0	0	0	0
18-Nov-10	18	24	12	16	27	22	18	24	21	24	19	21	SE	0	0	0	0
19-Nov-10	16	24	11	16	15	21	17	24	17	24	15	21	SE	0	0	0	0
20-Nov-10	17	24	12	16	16	21	16	23	18	23	17	21	SE	0	0	0	0
21-Nov-10	12	24	9	16	12	21	13	23	14	23	13	21	SE	0	0	0	0
22-Nov-10	12	23	9	16	3	21	13	23	17	23	13	21	NE	0	0	0	0
23-Nov-10	14	23	10	16	18	21	18	23	24	23	15	20	SW	0	0	0	0
24-Nov-10	17	23	12	16	19	21	17	23	20	23	18	20	SE	0	0	0	0
25-Nov-10	23	23	16	16	25	21	25	23	24	23	24	20	SE	0	0	0	0
26-Nov-10	26	23	19	16	30	21	27	23	20	23	29	20	NW	5	0	10	7
27-Nov-10	16	23	12	15	16	21	18	23	30	23	17	20	NE	0	0	0	0
28-Nov-10	22	23	13	15	23	21	28	23	35	23	22	20	SE	0	0	0	0
29-Nov-10	20	23	13	15	21	21	22	23	21	23	20	20	SE	0	0	0	0
30-Nov-10	14	23	10	15	14	21	16	23	26	23	14	20	SE	0	0	0	0

2010 – 2011 Tapered Element Oscillating Microbalance (TEOM) PM_{10} Results																	
	Site 1		Site 2		Site 3		Site 8		Site 4		Site 7			Ashton Contribution (calculated for NW winds only)			
Date	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	Wind Direction	Site 1	Site 2	Site 3	Site 8
01-Dec-10	7	23	6	15	7	21	6	23	23	23	12	20	SE	0	0	0	0
02-Dec-10	8	23	8	15	9	21	8	23	16	23	10	20	SW	0	0	0	0
03-Dec-10	13	23	10	15	13	21	14	23	8	23	12	20	SE	0	0	0	0
04-Dec-10	11	23	8	15	10	21	11	23	10	23	12	20	SE	0	0	0	0
05-Dec-10	11	23	8	15	10	20	11	23	16	23	15	20	SW	0	0	0	0
06-Dec-10	20	23	13	15	10	20	20	23	13	23	14	20	SE	0	0	0	0
07-Dec-10	12	23	13	15	11	20	12	23	12	23	15	20	SW	0	0	0	0
08-Dec-10	14	23	12	15	16	20	16	22	22	23	17	20	SE	0	0	0	0
09-Dec-10	30	23	19	15	22	20	26	22	20	23	18	20	SW	0	0	0	0
10-Dec-10	17	22	13	15	17	20	16	22	20	22	17	20	NW	0	0	1	0
11-Dec-10	21	22	14	15	23	20	24	22	32	22	23	20	NW	0	0	0	1
12-Dec-10	31	22	16	15	30	20	34	22	18	22	12	20	NW	19	5	18	22
13-Dec-10	27	22	18	15	31	20	33	22	26	22	17	20	NW	10	1	14	16
14-Dec-10	23	22	15	15	25	20	23	22	25	22	20	20	SE	0	0	0	0
15-Dec-10	28	22	18	15	27	20	28	22	33	22	31	20	SE	0	0	0	0
16-Dec-10	25	22	16	15	25	20	29	22	27	22	33	20	SE	0	0	0	0
17-Dec-10	26	22	18	15	30	20	28	22	30	22	25	19	SE	0	0	0	0
18-Dec-10	31	22	19	15	40	20	36	22	31	22	23	19	NW	8	0	17	14
19-Dec-10	25	22	14	15	26	20	25	22	32	22	22	19	NW	3	0	4	4
20-Dec-10	22	22	12	15	18	20	22	22	57	22	20	19	NW	2	0	0	2
21-Dec-10	38	22	16	15	35	20	43	22	30	22	18	19	NW	20	0	17	25
22-Dec-10	26	22	17	15	27	20	29	22	25	22	20	19	SW	0	0	0	0
23-Dec-10	27	22	21	15	31	20	31	22	32	22	32	19	SE	0	0	0	0
24-Dec-10	27	22	17	15	26	20	26	22	28	22	31	19	SE	0	0	0	0
25-Dec-10	17	22	12	15	18	20	18	22	19	22	17	19	SE	0	0	0	0
26-Dec-10	8	22	5	15	8	20	7	22	9	22	8	19	SW	0	0	0	0
27-Dec-10	12	22	9	15	12	20	11	22	12	22	14	19	SE	0	0	0	0
28-Dec-10	20	22	12	15	20	20	20	22	21	23	21	20	SE	0	0	0	0
29-Dec-10	14	22	10	15	17	20	14	22	19	23	17	20	SE	0	0	0	0
30-Dec-10	30	22	20	15	31	20	31	22	33	23	28	20	SE	0	0	0	0
31-Dec-10	20	22	16	15	22	20	21	22	23	23	26	20	SE	0	0	0	0
01-Jan-11	25	22	18	15	25	20	25	22	29	23	25	20	SE	0	0	0	0
02-Jan-11	37	22	18	15	33	20	30	22	30	23	35	20	SE	0	0	0	0
03-Jan-11	13	22	9	15	12	20	12	22	14	23	15	20	SE	0	0	0	0
04-Jan-11	18	22	12	15	17	20	17	22	20	23	22	20	SE	0	0	0	0
05-Jan-11	18	22	12	15	17	20	18	22	24	23	21	20	SE	0	0	0	0
06-Jan-11	16	22	10	15	13	20	14	22	14	23	17	20	SE	0	0	0	0
07-Jan-11	11	22	7	15	10	20	10	22	11	23	13	20	SE	0	0	0	0
08-Jan-11	12	22	8	15	13	20	12	22	14	23	16	20	SE	0	0	0	0
09-Jan-11	13	22	9	15	12	20	13	22	14	23	27	20	SE	0	0	0	0
10-Jan-11	9	22	6	15	8	20	9	22	10	23	15	19	SE	0	0	0	0
11-Jan-11	11	22	7	15	10	20	11	22	12	23	16	19	SE	0	0	0	0
12-Jan-11	13	22	9	15	14	20	13	22	14	22	16	19	SE	0	0	0	0
13-Jan-11	14	22	10	15	15	20	14	22	16	22	16	19	SE	0	0	0	0
14-Jan-11	19	22	13	15	20	20	20	22	22	22	21	19	SE	0	0	0	0
15-Jan-11	26	22	16	15	23	20	26	22	27	22	22	19	SE	0	0	0	0

2010 – 2011 Tapered Element Oscillating Microbalance (TEOM) PM_{10} Results																	
	Site 1		Site 2		Site 3		Site 8		Site 4		Site 7			Ashton Contribution (calculated for NW winds only)			
Date	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	Wind Direction	Site 1	Site 2	Site 3	Site 8
16-Jan-11	17	22	12	15	16	20	16	22	17	22	22	19	SE	0	0	0	0
17-Jan-11	32	22	20	14	30	20	32	22	34	22	30	19	SE	0	0	0	0
18-Jan-11	25	22	15	14	22	20	22	22	25	22	27	19	SE	0	0	0	0
19-Jan-11	20	22	12	14	16	20	18	22	19	22	33	19	SE	0	0	0	0
20-Jan-11	15	21	10	14	13	19	15	22	18	22	25	19	SE	0	0	0	0
21-Jan-11	14	21	9	14	15	19	16	22	17	22	18	19	SE	0	0	0	0
22-Jan-11	11	21	8	14	12	19	12	21	16	22	24	19	SE	0	0	0	0
23-Jan-11	15	21	11	14	16	19	17	21	16	22	17	19	SE	0	0	0	0
24-Jan-11	39	21	21	14	37	19	38	21	49	22	27	19	SE	0	0	0	0
25-Jan-11	47	21	30	14	45	19	51	21	47	22	48	19	SE	0	0	0	4
26-Jan-11	40	21	29	14	40	19	43	21	46	22	40	19	SE	0	0	0	0
27-Jan-11	46	21	31	14	40	19	48	21	44	22	0	19	SE	0	0	0	0
28-Jan-11	24	21	16	14	20	19	23	21	27	22	0	19	SE	0	0	0	0
29-Jan-11	23	21	14	14	20	19	23	21	26	22	0	19	SE	0	0	0	0
30-Jan-11	27	21	19	14	41	19	32	22	32	22	0	19	SE	0	0	0	0
31-Jan-11	41	21	29	14	44	19	49	22	57	22	0	19	SE	0	0	0	0
01-Feb-11	54	21	34	14	57	20	60	22	90	22	0	19	SE	0	0	0	0
02-Feb-11	48	22	27	14	48	20	56	22	53	22	10	19	SE	38	17	38	46
03-Feb-11	39	22	22	14	37	20	41	22	47	23	29	19	SE	10	0	8	12
04-Feb-11	27	22	18	14	28	20	28	22	32	23	26	19	SE	0	0	0	0
05-Feb-11	36	22	20	14	34	20	40	22	47	23	34	19	SE	0	0	0	0
06-Feb-11	32	22	15	14	29	20	34	22	50	23	23	19	SE	9	0	7	11
07-Feb-11	12	22	7	14	12	20	12	22	9	23	18	19	SE	0	0	0	0
08-Feb-11	16	22	10	14	16	20	17	22	21	23	22	19	SE	0	0	0	0
09-Feb-11	17	22	12	14	17	20	19	22	21	23	23	19	SE	0	0	0	0
10-Feb-11	17	22	12	14	18	20	20	22	22	23	20	19	SE	0	0	0	0
11-Feb-11	26	22	16	14	28	20	30	22	38	23	24	19	SE	0	0	0	0
12-Feb-11	30	22	17	14	32	20	38	22	39	23	38	19	SE	0	0	0	0
13-Feb-11	11	22	8	14	10	20	11	22	11	23	13	19	SE	0	0	0	0
14-Feb-11	10	22	6	14	9	20	10	22	11	23	12	19	SE	0	0	0	0
15-Feb-11	15	22	10	14	14	20	16	22	16	23	19	19	SE	0	0	0	0
16-Feb-11	17	22	11	14	17	20	19	22	19	23	21	19	SE	0	0	0	0
17-Feb-11	19	22	12	14	17	20	19	22	22	23	20	19	SE	0	0	0	0
18-Feb-11	21	22	17	14	23	20	24	22	25	23	25	19	SE	0	0	0	0
19-Feb-11	31	22	19	14	27	20	31	22	28	23	21	19	SE	0	0	0	0
20-Feb-11	33	22	20	14	35	20	41	22	38	23	30	19	SE	3	0	4	11
21-Feb-11	13	22	10	14	13	20	14	22	16	23	17	19	SE	0	0	0	0
22-Feb-11	19	22	11	14	18	20	19	22	19	23	21	19	SE	0	0	0	0
23-Feb-11	22	22	8	14	15	20	15	22	20	23	14	19	SE	0	0	0	0
24-Feb-11	19	22	14	14	19	20	22	22	26	23	19	19	SE	0	0	0	0
25-Feb-11	24	22	17	14	29	20	28	22	48	23	27	19	SE	0	0	0	0
26-Feb-11	31	22	19	14	28	20	32	22	38	23	29	19	SE	0	0	0	0
27-Feb-11	29	22	18	14	31	20	34	22	32	23	26	19	SE	0	0	0	0
28-Feb-11	29	22	19	14	29	20	30	22	32	23	31	19	SE	0	0	0	0
01-Mar-11	29	22	19	14	29	20	30	22	32	23	31	19	NE	0	0	0	0
02-Mar-11	30	22	18	14	34	20	39	22	39	23	25	19	SE	0	0	0	0

2010 – 2011 Tapered Element Oscillating Microbalance (TEOM) PM_{10} Results																	
	Site 1		Site 2		Site 3		Site 8		Site 4		Site 7			Ashton Contribution (calculated for NW winds only)			
Date	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	Wind Direction	Site 1	Site 2	Site 3	Site 8
03-Mar-11	26	22	15	14	23	20	25	22	24	23	28	19	SW	0	0	0	0
04-Mar-11	21	22	14	14	21	20	23	22	24	23	18	19	SE	0	0	0	0
05-Mar-11	31	22	20	14	31	20	32	22	32	23	32	19	SE	0	0	0	0
06-Mar-11	16	22	10	14	14	20	15	22	15	23	24	19	SE	0	0	0	0
07-Mar-11	13	22	8	14	14	20	15	22	15	23	21	19	SE	0	0	0	0
08-Mar-11	15	22	9	14	16	20	18	22	18	23	16	19	SE	0	0	0	0
09-Mar-11	15	22	11	14	17	20	19	22	20	23	18	19	SE	0	0	0	0
10-Mar-11	25	22	15	14	31	20	26	22	32	23	18	19	SE	0	0	0	0
11-Mar-11	29	22	17	14	37	20	34	22	40	23	25	19	SW	0	0	0	0
12-Mar-11	17	22	13	14	17	20	18	22	20	23	18	19	SE	0	0	0	0
13-Mar-11	18	22	15	14	18	20	19	22	20	23	21	19	SE	0	0	0	0
14-Mar-11	20	22	13	14	19	20	20	23	24	23	21	19	SW	0	0	0	0
15-Mar-11	18	22	16	14	26	20	28	23	22	23	20	19	SE	0	0	0	0
16-Mar-11	22	22	6	14	11	20	10	23	22	23	23	19	SE	0	0	0	0
17-Mar-11	22	22	13	14	7	20	20	23	22	23	21	19	SE	0	0	0	0
18-Mar-11	16	22	9	14	12	20	13	23	15	23	18	19	SE	0	0	0	0
19-Mar-11	12	22	9	14	11	20	12	22	13	23	14	19	SE	0	0	0	0
20-Mar-11	12	22	9	14	12	20	13	22	13	23	16	19	SE	0	0	0	0
21-Mar-11	12	22	9	14	12	20	14	22	13	23	16	19	SE	0	0	0	0
22-Mar-11	11	22	8	14	11	20	12	22	15	23	14	19	NE	0	0	0	0
23-Mar-11	17	22	12	14	18	20	20	22	20	23	18	19	NW	0	0	0	2
24-Mar-11	22	22	14	14	19	20	24	22	22	23	16	19	NW	6	0	2	7
25-Mar-11	24	22	12	14	25	20	27	22	29	23	20	19	NW	4	0	6	7
26-Mar-11	22	22	12	14	37	20	25	22	27	23	18	19	NW	4	0	19	7
27-Mar-11	18	21	12	14	18	20	20	22	21	23	20	19	SE	0	0	0	0
28-Mar-11	12	21	9	14	12	20	13	22	13	23	14	19	SE	0	0	0	0
29-Mar-11	10	21	8	14	12	20	12	22	14	23	13	19	SE	0	0	0	0
30-Mar-11	10	21	8	14	12	20	11	22	14	23	15	19	SE	0	0	0	0
31-Mar-11	17	21	12	14	21	20	21	22	26	23	18	19	NW	0	0	2	3
01-Apr-11	25	21	17	14	26	20	29	22	29	23	33	19	SE	0	0	0	0
02-Apr-11	18	21	12	14	20	20	21	22	22	23	23	19	SE	0	0	0	0
03-Apr-11	23	21	16	14	25	20	30	22	27	23	34	19	SE	0	0	0	0
04-Apr-11	24	22	15	14	37	20	25	22	23	23	25	19	SE	0	0	0	0
05-Apr-11	11	22	7	14	10	20	11	22	23	23	23	19	SE	0	0	0	0
06-Apr-11	11	22	7	14	10	20	11	22	11	23	14	19	SE	0	0	0	0
07-Apr-11	12	22	7	14	11	20	13	22	11	23	14	19	SE	0	0	0	0
08-Apr-11	7	21	6	14	10	20	9	22	9	23	11	19	SE	0	0	0	0
09-Apr-11	11	21	8	14	13	20	15	22	13	23	14	19	SE	0	0	0	0
10-Apr-11	19	21	12	14	19	20	20	22	26	23	22	19	SE	0	0	0	0
11-Apr-11	29	21	15	14	31	20	35	22	37	23	24	19	SW	0	0	0	0
12-Apr-11	10	21	7	14	13	20	12	22	16	23	7	19	NW	3	0	6	5
13-Apr-11	24	21	13	14	27	20	30	22	32	23	18	19	NW	7	0	9	13
14-Apr-11	22	21	13	14	25	20	25	22	24	23	20	19	SW	0	0	0	0
15-Apr-11	21	21	13	14	23	20	25	22	24	23	18	19	NW	4	0	5	8
16-Apr-11	19	21	13	14	21	20	24	22	27	23	21	19	NW	0	0	0	3
17-Apr-11	8	21	6	14	7	20	8	22	8	23	10	19	SE	0	0	0	0

2010 – 2011 Tapered Element Oscillating Microbalance (TEOM) PM_{10} Results																	
	Site 1		Site 2		Site 3		Site 8		Site 4		Site 7			Ashton Contribution (calculated for NW winds only)			
Date	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	Wind Direction	Site 1	Site 2	Site 3	Site 8
18-Apr-11	12	21	8	14	13	20	12	22	12	23	14	19	SE	0	0	0	0
19-Apr-11	12	21	9	14	15	20	14	22	13	23	16	19	SE	0	0	0	0
20-Apr-11	18	22	15	14	22	20	23	22	23	23	19	19	SW	0	0	0	0
21-Apr-11	23	22	18	14	27	20	28	22	54	23	24	19	SE	0	0	0	0
22-Apr-11	23	22	15	14	29	20	27	22	32	23	22	19	SW	0	0	0	0
23-Apr-11	25	21	15	14	35	20	32	22	43	23	23	19	NW	2	0	12	9
24-Apr-11	13	21	10	14	15	20	16	22	16	23	18	19	SW	0	0	0	0
25-Apr-11	15	21	11	14	16	20	17	22	16	23	18	19	SE	0	0	0	0
26-Apr-11	9	21	7	14	11	20	11	22	11	23	12	19	SE	0	0	0	0
27-Apr-11	9	21	7	14	10	20	10	22	8	23	11	19	SE	0	0	0	0
28-Apr-11	7	21	5	14	9	20	8	22	3	23	10	19	SE	0	0	0	0
29-Apr-11	8	21	6	14	8	20	8	22	1	23	9	19	SE	0	0	0	0
30-Apr-11	8	21	7	14	9	20	9	22	7	23	11	19	SE	0	0	0	0
01-May-11	8	21	7	14	9	20	9	22	8	23	11	19	SE	0	0	0	0
02-May-11	12	21	10	14	14	20	13	22	15	23	15	19	SE	0	0	0	0
03-May-11	15	21	13	14	16	20	17	22	20	23	20	19	NW	0	0	0	0
04-May-11	19	21	15	14	21	20	23	22	24	23	20	19	NW	0	0	2	4
05-May-11	14	21	11	14	18	20	17	22	19	23	16	19	SE	0	0	0	0
06-May-11	13	21	12	14	21	20	17	22	17	23	16	19	SE	0	0	0	0
07-May-11	12	21	11	14	18	20	16	22	20	23	16	19	SE	0	0	0	0
08-May-11	16	21	10	14	17	20	15	22	22	23	15	19	NW	1	0	2	0
09-May-11	19	21	15	13	26	20	25	22	39	23	19	19	NW	0	0	7	6
10-May-11	21	21	14	13	23	20	25	22	30	23	25	19	SW	0	0	0	0
11-May-11	11	21	9	13	15	20	13	22	20	22	17	19	NW	0	0	0	0
12-May-11	28	21	17	13	44	20	36	22	65	23	32	19	NW	0	0	11	4
13-May-11	15	21	10	13	18	20	17	22	27	23	13	19	NW	2	0	5	3
14-May-11	14	21	9	13	23	20	17	22	34	23	13	19	NW	1	0	10	3
15-May-11	15	21	10	13	20	20	19	22	24	23	18	19	NW	0	0	3	1
16-May-11	19	21	14	13	24	20	25	22	24	23	17	19	NW	2	0	7	8
17-May-11	28	21	19	13	41	20	41	22	44	23	23	19	NW	5	0	17	18
18-May-11	25	21	18	13	32	20	37	22	35	23	26	19	NE	0	0	0	0
19-May-11	18	21	15	13	21	20	22	22	21	23	20	19	SE	0	0	0	0
20-May-11	23	21	16	13	24	20	25	22	32	23	31	19	NW	0	0	0	0
21-May-11	22	21	17	13	23	20	25	22	32	23	34	19	NW	0	0	0	0
22-May-11	21	21	16	13	28	20	26	22	38	23	21	19	NW	0	0	6	5
23-May-11	27	21	17	13	33	20	30	22	40	23	26	19	NW	2	0	7	5
24-May-11	14	21	9	13	18	20	17	22	24	23	17	19	NW	0	0	1	0
25-May-11	16	21	10	13	16	20	18	22	19	23	15	19	NW	2	0	1	3
26-May-11	9	21	7	13	8	20	9	22	9	23	9	19	SE	0	0	0	0
27-May-11	10	21	10	13	10	20	11	22	10	23	13	19	NW	0	0	0	1
28-May-11	11	21	10	13	15	20	13	22	15	23	11	19	NW	0	0	3	2
29-May-11	13	21	12	13	17	20	17	22	19	23	16	19	SE	0	0	0	0
30-May-11	10	21	8	13	12	20	11	22	14	23	13	19	SE	0	0	0	0
31-May-11	13	21	9	13	14	20	14	22	16	23	16	19	SE	0	0	0	0
01-Jun-11	7	21	6	13	7	20	7	22	7	23	7	19	SE	0	0	0	0
02-Jun-11	14	21	8	13	15	20	14	22	15	23	15	19	SE	0	0	0	0

2010 – 2011 Tapered Element Oscillating Microbalance (TEOM) PM_{10} Results

	Site 1		Site 2		Site 3		Site 8		Site 4		Site 7			Ashton Contribution (calculated for NW winds only)			
Date	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	Wind Direction	Site 1	Site 2	Site 3	Site 8
03-Jun-11	10	21	8	13	11	20	10	22	11	23	9	19	NW	1	0	2	1
04-Jun-11	15	21	13	13	17	20	17	22	22	23	23	19	NW	0	0	0	0
05-Jun-11	32	21	16	13	25	20	38	22	25	23	23	19	NW	9	0	2	15
06-Jun-11	12	21	8	13	13	20	13	22	21	23	16	19	NW	0	0	0	0
07-Jun-11	15	21	10	13	16	20	17	22	19	23	17	19	NW	0	0	0	0
08-Jun-11	16	21	11	13	25	20	20	22	31	23	24	19	SW	0	0	0	0
09-Jun-11	12	21	8	13	14	20	14	22	20	23	17	19	NW	0	0	0	0
10-Jun-11	15	21	9	13	25	20	19	22	32	23	37	19	NW	0	0	0	0
11-Jun-11	14	21	9	13	16	20	16	22	19	23	19	19	SW	0	0	0	0
12-Jun-11	16	21	11	13	17	20	17	22	21	23	24	19	SE	0	0	0	0
13-Jun-11	6	21	5	13	5	20	6	22	6	23	6	19	SE	0	0	0	0
14-Jun-11	8	21	5	13	8	20	7	22	8	23	8	19	SE	0	0	0	0
15-Jun-11	8	21	6	13	9	20	9	22	9	23	9	19	SE	0	0	0	0
16-Jun-11	10	21	6	13	10	20	12	22	10	23	10	19	SE	0	0	0	0
17-Jun-11	8	20	5	13	7	20	N/A	22	7	23	8	19	NW	1	0	0	N/A
18-Jun-11	13	20	8	13	13	20	3	21	16	23	15	19	NW	0	0	0	0
19-Jun-11	14	20	9	13	17	20	N/A	21	23	23	20	19	NW	0	0	0	N/A
20-Jun-11	14	20	10	13	21	20	N/A	21	25	23	25	19	NW	0	0	0	N/A
21-Jun-11	19	20	12	13	23	20	N/A	21	27	23	25	19	NW	0	0	0	N/A
22-Jun-11	28	20	13	13	33	20	N/A	21	48	23	61	19	NW	0	0	0	N/A
23-Jun-11	11	20	8	13	13	20	N/A	21	20	23	16	19	NW	0	0	0	N/A
24-Jun-11	15	20	10	13	19	20	N/A	21	21	23	24	19	NW	0	0	0	N/A
25-Jun-11	17	20	13	13	19	20	7	21	20	23	23	19	NW	0	0	0	0
26-Jun-11	15	20	13	13	17	20	14	21	21	23	23	19	NW	0	0	0	0
27-Jun-11	28	20	16	13	28	20	30	21	30	23	30	19	NW	0	0	0	0
28-Jun-11	22	20	14	13	23	20	26	21	26	23	25	19	NE	0	0	0	0
29-Jun-11	17	20	12	13	18	20	19	21	20	23	21	19	SE	0	0	0	0
30-Jun-11	9	20	7	13	10	20	9	21	11	23	10	19	SE	0	0	0	0
01-Jul-11	13	20	8	13	14	20	13	21	13	23	20	19	SE	0	0	0	0
02-Jul-11	12	20	10	13	11	20	15	21	13	23	18	19	SE	0	0	0	0
03-Jul-11	12	20	9	13	11	20	14	21	13	23	16	19	NW	0	0	0	1
04-Jul-11	19	20	12	13	16	20	20	21	19	23	14	19	NW	4	0	2	6
05-Jul-11	21	20	12	13	28	20	26	21	41	23	23	19	NW	0	0	5	2
06-Jul-11	28	20	12	13	31	20	36	21	87	23	21	19	NW	7	0	10	15
07-Jul-11	20	20	13	13	23	20	24	21	56	23	17	19	NW	3	0	6	7
08-Jul-11	16	20	9	13	18	20	20	21	39	23	14	19	NW	2	0	3	5
09-Jul-11	14	20	11	13	22	20	19	21	42	23	14	19	NW	0	0	8	5
10-Jul-11	18	20	9	13	30	20	21	21	40	23	12	19	NW	6	0	17	9
11-Jul-11	23	20	10	13	34	20	30	21	74	23	17	19	NW	6	0	17	13
12-Jul-11	28	20	17	13	35	20	34	21	44	24	23	19	NW	5	0	11	11
13-Jul-11	25	20	13	13	29	20	26	22	34	24	16	19	NW	10	0	13	10
14-Jul-11	29	20	16	13	29	20	32	22	52	24	24	19	NW	4	0	5	8
15-Jul-11	16	20	11	13	19	20	17	22	26	24	18	19	SE	0	0	0	0
16-Jul-11	14	20	9	13	13	20	14	22	16	24	19	19	SE	0	0	0	0
17-Jul-11	7	20	6	13	7	20	8	22	9	24	11	19	SE	0	0	0	0
18-Jul-11	12	20	9	13	11	20	14	22	11	24	12	19	NW	1	0	0	3

2010 – 2011 Tapered Element Oscillating Microbalance (TEOM) PM_{10} Results																	
	Site 1		Site 2		Site 3		Site 8		Site 4		Site 7			Ashton Contribution (calculated for NW winds only)			
Date	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	PM_{10} 24 Hr Average	PM_{10} Rolling Annual Average	Wind Direction	Site 1	Site 2	Site 3	Site 8
19-Jul-11	20	20	11	13	17	20	21	21	23	24	14	19	NW	6	0	3	7
20-Jul-11	16	20	9	13	16	20	17	21	23	24	10	19	NW	5	0	6	7
21-Jul-11	9	20	6	13	10	20	9	21	13	24	9	19	SE	0	0	0	0
22-Jul-11	7	20	5	13	6	20	7	21	7	24	8	19	SE	0	0	0	0
23-Jul-11	7	20	5	13	7	20	7	21	7	24	7	19	SE	0	0	0	0
24-Jul-11	11	20	7	13	10	20	10	21	10	24	11	19	NW	0	0	0	0
25-Jul-11	14	20	10	13	14	20	16	21	16	24	11	19	NW	3	0	4	5
26-Jul-11	22	20	12	13	23	20	24	21	30	24	16	19	NW	6	0	7	8
27-Jul-11	22	20	11	13	19	20	24	21	26	24	15	19	NW	7	0	4	9
28-Jul-11	18	20	12	13	15	20	21	21	17	24	18	19	NW	2	0	0	4
29-Jul-11	19	20	13	13	18	20	21	21	26	24	20	19	NW	0	0	0	0
30-Jul-11	18	20	13	13	22	20	21	21	28	24	18	19	NW	0	0	3	3
31-Jul-11	27	20	14	13	26	20	30	21	32	24	21	19	NW	6	0	5	10
01-Aug-11	26	20	15	13	27	20	32	22	30	24	20	19	NW	6	0	7	13
02-Aug-11	26	20	18	13	34	20	36	22	43	24	23	19	NW	3	0	11	13
03-Aug-11	31	20	18	13	33	20	37	22	46	24	27	19	NW	4	0	6	10
04-Aug-11	35	20	18	13	36	20	45	22	43	24	37	19	NW	0	0	0	8
05-Aug-11	25	20	N/A	13	30	20	31	22	43	24	27	19	NW	0	0	4	5
06-Aug-11	30	20	22	13	N/A	20	34	22	N/A	24	25	19	NW	5	0	0	9
07-Aug-11	38	20	21	13	35	20	44	22	43	24	31	19	NW	7	0	4	13
08-Aug-11	19	20	10	13	18	20	21	22	21	24	18	19	NW	1	0	0	2
09-Aug-11	13	20	10	13	16	20	18	22	21	24	11	19	NW	2	0	5	8
10-Aug-11	N/A	20	10	13	19	20	25	22	33	24	14	19	NW	0	0	5	11
11-Aug-11	24	20	11	13	20	20	N/A	22	28	24	N/A	19	NW	0	0	0	N/A
12-Aug-11	36	21	17	13	32	20	N/A	22	29	24	25	19	NW	11	0	6	N/A
13-Aug-11	17	21	12	13	18	20	N/A	22	19	24	21	19	SW	0	0	0	N/A
14-Aug-11	14	21	12	13	15	20	N/A	22	17	24	19	19	SE	0	0	0	N/A
15-Aug-11	16	20	13	13	20	20	N/A	22	22	24	16	19	NE	0	0	0	N/A
16-Aug-11	13	20	10	13	11	20	N/A	22	14	24	14	19	SE	0	0	0	N/A
17-Aug-11	15	20	12	13	14	20	N/A	22	17	24	20	19	SE	0	0	0	N/A
18-Aug-11	13	20	11	13	13	20	N/A	22	13	24	15	19	SE	0	0	0	N/A
19-Aug-11	14	20	9	13	12	20	N/A	22	18	24	12	19	NW	2	0	0	N/A
20-Aug-11	12	20	9	13	12	20	N/A	22	17	24	10	19	SE	0	0	0	N/A
21-Aug-11	10	20	8	13	11	20	N/A	22	11	24	11	19	SE	0	0	0	N/A
22-Aug-11	8	20	6	13	9	20	N/A	22	9	24	8	19	SE	0	0	0	N/A
23-Aug-11	9	20	5	13	10	20	N/A	22	9	24	8	19	SE	0	0	0	N/A
24-Aug-11	7	20	6	13	11	20	N/A	22	9	24	8	19	SE	0	0	0	N/A
25-Aug-11	10	20	9	13	11	20	N/A	22	12	24	13	19	SW	0	0	0	N/A
26-Aug-11	21	20	17	13	19	20	N/A	22	23	24	18	19	NW	3	0	1	N/A
27-Aug-11	20	20	16	13	25	20	28	22	24	24	25	19	SW	0	0	0	0
28-Aug-11	34	20	23	13	31	20	37	22	33	24	31	19	NW	4	0	0	6
29-Aug-11	27	20	21	13	28	20	31	22	28	24	26	19	NW	1	0	3	5
30-Aug-11	27	20	17	13	31	20	32	22	36	24	26	19	SE	0	0	0	0
31-Aug-11	17	20	12	13	22	20	21	22	22	24	22	19	SE	0	0	0	0
01-Sep-11	24	20	15	13	27	20	26	22	26	24	27	19	SE	0	0	0	0

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APPENDIX 2

GROUNDWATER REPORT

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RPS Aquaterra

ASHTON COAL MINE 2010-2011 AEMR
GROUNDWATER MANAGEMENT REPORT

ASHTON COAL MINE 2010-2011 AEMR GROUNDWATER MANAGEMENT REPORT

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Our ref: S56C/113b
Date: 30 March 2012

Document Status

	Issue Date	Purpose of Document
Revision A	20/01/2012	First Draft
Revision B	30/03/2012	Final

	Name	Position	Signature	Date
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Reviewer	Greg Sheppard	Principal Hydrogeologist		30/03/2012

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 reporting period 1 September 2010 to 1 September 2011. This report has been prepared as a supporting document for the Ashton Coal Operations Ltd 2010-11 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 Environmental Impact Statement (EIS) (HLA Envirosciences, 2001), the Bowmans Creek Diversion Environmental Assessment (EA) (Evens & Peck, 2009 & Aquaterra, 2009) and the Subsidence Management Plan (SMP) variation for Longwall 7A (Aquaterra, 2010a and RPS Aquaterra, 2010).

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

The main outcomes over the 2010-11 reporting period review are summarised in Table E1 and are discussed below.

Table E1: Comparison of observed impacts against the 2001 EIS, 2009 EA and 2010 SMP predictions

Impact Description	Impact observed over the review period (Sep 2010-11 including LW6A to LW7A)	Predicted Groundwater Related Impacts for the September 2010-11 Review Period		
		EIS, 2001	EA, 2009	SMP, 2010 (LW7A)
Groundwater drawdown to the Glennies Creek Alluvium (east of LW1)	up to 0.4m during LW1, followed by full recovery	2.2m	0.2m	No additional impact predicted
Groundwater drawdown to the Bowmans Creek Alluvium (above LW6a and LW7a)	0m	NR	0.5 to 2m	0.5 to 2m
Groundwater drawdown to the Bowmans Creek Alluvium (SE of LW7A, near GDE's)	0m	NR	<0.5m	<0.5m
Groundwater drawdown to the Hunter River Alluvium (South of LWs 6 to 8)	0m	<0.5m	0.01m	0.01m
Baseflow impacts to Glennies Creek	0.06ML/d (0.66L/s)	0.29 ML/d (3.2L/s)	0.21 ML/d (2.6L/s)	No additional Impact, 0.2ML/d (2.3L/s)
Baseflow reduction to Bowmans Creek	0m	0.38ML/d (4.5L/s)	0.03ML/d (0.34L/s)	0.03ML/d (0.34L/s)
Baseflow reduction to the Hunter River	0m	0.27ML/d (3L/s)	0.006ML/d (0.07L/s)	0.01ML/d (0.12L/s)
Total Underground Inflows	0.17 – 0.86 Ml/d (2 – 9L/s)	1.5ML/d (18L/s)	1.4ML/d (16L/s)	1.4ML/d (16L/s)

NR Not Reported

Over the 2010-11 AEMR reporting period:

- Mining was near completion in the North East Open Cut (NEOC) and underground mining was completed in LW6A and LW7A in the Pikes Gully seam, which occurred under parts of the Bowmans Creek Alluvium. The development headings for Upper Liddell LW1 have been taking place over the review period and are still in progress.
- The groundwater monitoring network was expanded which included 3 nested monitoring sites, installed in the Bowmans Creek Alluvium and the Permian overburden units (This was undertaken in accordance with the Bowmans Creek EA Section 13 Commitments). An additional 6 standpipe piezometers were also installed to verify the hydraulic properties of the Bowmans Creek Alluvium and monitor any effects of the Bowmans Creek Diversion and mining beyond LW6A (Locations shown on Figure 2).
- Groundwater monitoring frequency was increased in key monitoring bores during the early and final stages of LW6A and LW7A panel extraction, to monitor the 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.
- Apart from the initial drawdown observed in the Glennies Creek Alluvium during the mining of LW1, no mining impacts have been observed in the Glennies Creek, Bowmans Creek or Hunter River Alluvium as a result of underground mining.
- There were no additional baseflow impacts to Glennies Creek. Actual seepage inflow rates from the Glennies Creek Alluvium were about 0.66L/s (0.06ML/d), and therefore continued to be below the EIS and EA predictions of 3.2L/s (0.28ML/d) and 2.6L/s (0.21ML/d), respectively.
- Mining of LW6A and LW7A occurred beneath parts of the Bowmans Creek Alluvium and no reduction in Alluvium storage was evident, hence no baseflow impacts on Bowmans Creek have been observed to date. The actual seepage rates have therefore continued to be less than the rates contained in the EIS (4.5L/s / 0.38ML/d), EA and SMP (0.34L/s / 0.03ML/d) predictions.
- There were no baseflow impacts to the Hunter River and therefore no impacts to the small stands of River Red Gums near the Hunter River, which is consistent with the EA and SMP predictions, and lower than the EIS prediction of 3L/s (0.27ML/d) for this stage of mining.
- Large drawdown responses in the Pikes Gully Seam and Permian overburden units have been observed in the immediate LW1 to 7A mining area. Piezometers located in the barrier between LW1 and Glennies Creek have demonstrated that groundwater levels continue to show steady recovery so that most of the initial 3.0m drawdown has now been recovered. The recovery in water levels suggests a steady reduction in the hydraulic conductivity of the Pikes Gully Seam between LW1 and the subcrop line beneath the Glennies Creek floodplain, possibly due to delayed response to the in-seam grouting carried out in 2007. The gradual recovery in water levels has been accompanied by a gradual reduction in the rate of underground seepage inflows to the tailgate 1 backroad weir. No additional responses to underground mining were observed.
- Total groundwater inflows to the underground mine ranged from 0.4 to 10L/s and have been below maximum inflow rates contained in the EIS (18L/s / 1.5ML/d) EA (16L/s / 1.4ML/d) and SMP (16L/s / 1.4ML/d), for this stage of mining (Figure 17).

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TABLES

FIGURES (compiled at end of report)

1. INTRODUCTION

The Ashton Coal Project, located 14km west of Singleton in the Hunter Valley Region consists of both open cut and underground mining operations to access a series of coal seams within the Permian Foybrook Formation.

The Ashton Coal Project was granted approval on 11 October 2002 (Department of Planning, 2002). The development approval (DA) included both the open cut mine located to the north of the New England Highway, and the underground mine.

The open cut mine commenced operations in 2003. The coal has been recovered from several seams of varying thickness from two open cuts, the smaller Arties Pit and the larger Barrett Pit. Approval was granted in 2011 to deepen the Barrett pit to access the Hebden seam.

The underground mine is located south of the New England Highway with the mine accessed from the northern side of the highway via a portal in the Arties pit. The current approved mine plan comprises eight longwall Panels (LWs 1 to 8), which have been approved for mining the Pikes Gully seam.

Underground mine development commenced in July 2006, and underground mining of the Pikes Gully seam has now been completed in LW1 to LW7A panels. The layout of LWs 1 to 8, together with the progress of mining completed to September 2011, is shown on Figure 1.

During the 2010-11 review period, underground operations included the extractions of LW6A (09/07/2010 to 22/11/2010) and LW7A (23/03/2011 to 05/08/2011) in the Pikes Gully Seam, and the LW1 development headings for Upper Liddell Seam. The open cut operations included mining down to the Hebden seam.

Consent Condition 9.2 of the DA requires that Ashton Coal Operations Pty Ltd (ACOL) prepare and submit an Annual Environmental Management Report (AEMR) throughout the life of the project and for five years after completion of mining in the DA area. Condition 9.2 (d) requires that the AEMR shall 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.

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 the mining operations.

This report covers the reporting period 1 September 2010 to 1 September 2011 and is prepared as a supporting document for ACOL's 2010-11 AEMR.

This document presents a review of the groundwater management work undertaken and the level of compliance with the consent conditions and the WMP (which is currently being updated in accordance with the latest DC). A detailed analysis of trends displayed by the monitoring data is presented, together with a comparison of the observed trends against the predictions that were made in the groundwater impact assessment reports for the EIS (HLA Envirosciences, 2001), the Bowmans Creek Diversion Environment Assessment (EA) (Evens & Peck, 2009 and Aquaterra, 2009e), and the SMP variation for LW7A (Aquaterra, 2010a and RPS Aquaterra, 2010).

2. GROUNDWATER MONITORING

2.1 Piezometers

Ashton maintains a comprehensive groundwater monitoring program covering 173 piezometers, at 94 sites, as well as mine inflow monitoring within the underground mine. The network of monitoring piezometers, their function and current status are detailed in Table 2.1. The piezometers include both open standpipes and multi-level vibrating wire piezometers. The locations of all ACOL groundwater monitoring bores are shown on Figure 1, and the groundwater monitoring bores, specific to LW6A and LW7A are shown on Figure 2.

Table 2.1: Ashton Coal Project Monitoring Bore Network

	Location	Aquifer/ Geological Unit	Type of Monitoring Bore	Comments
North East Open Cut Monitoring:				
GM1	Rail loop	ULD	SP	EIS recommended monitoring bores. Installed 2003.
GM3	Camberwell Village	GC Alluvium	SP	
GM3A	Village	UB	SP	
WML172	Glennies Ck		SP	Replacements for OC1 and OC2 (lost to mining activity). Installed 2007.
WML173	Glennies Ck		SP	
WML174	Glennies Ck Rd		SP	
Underground Mine Monitoring:				
RSGM1	Bowmans Ck	Seam unknown	SP	Pre-existing bore/well
Ashton Well		BC Alluvium	Well	
RM01*	Bowmans Ck	BC Alluvium	SP (Dry)	EIS Investigations. Installed 2001.
RM02		BC Alluvium & CM OB	SP	
RM03		BC Alluvium & CM OB	SP	
RM04		BC Alluvium	SP	
RM05		CM OB	SP	
RM06		BC Alluvium & CM OB	SP	
RM07		BC Alluvium & CM OB	SP	
RM08		BC Alluvium & CM OB	SP	
RM09		BC Alluvium	SP	
RM10		BC Alluvium & CM OB	SP	
RA02		BC Alluvium	SP	
PB1		BC Alluvium	SP	
RA8		Colluvium	SP	Bowmans Creek Alluvium investigations and baseline monitoring (2007 & 2010)
RA10		BC Alluvium	SP	
RA12		Colluvium	SP	
RA14		BC Alluvium	SP	
RA15		BC Alluvium	SP	
RA16		Colluvium	SP	
RA17		BC Alluvium	SP	
RA18		BC Alluvium	SP	
RA20* / WMLP328 (replacement)		BC Alluvium	SP	

	Location	Aquifer/ Geological Unit	Type of Monitoring Bore	Comments
RA30		BC Alluvium	SP	
T1-A*		BC Alluvium	SP	
T1-P		CM OB	SP	
T2-A		BC Alluvium	SP	
T2-P		CM OB	SP	
T3-A		BC Alluvium	SP	
T3-P		CM OB	SP	
T4-A		BC Alluvium	SP	
T4-P		CM OB	SP	
T5		BC Alluvium	SP	
T6		BC Alluvium	SP	
T7		BC Alluvium	SP	
T10		BC Alluvium	SP	
WMLP299*		BC Alluvium	SP	
WMLP300		BC Alluvium	SP	
WMLP275		BC Colluvium	SP	
WMLP276		BC Colluvium	SP	
WMLP323	Eastern Diversion, East of LW6B	BC Alluvium	SP	Installed in accordance with Schedule 13 Commitments, 2011
WMLP324		CM OB	SP	
WMLP311		BC Alluvium	SP	
WMLP325		CM OB	SP	
WMLP326		BC Alluvium	SP	
WMLP327		CM OB	SP	
WMLP312		BC Alluvium	SP	BC Diversion dewatering assessment, 2011
WMLP314	Western Diversion, West of LW7A	BC Alluvium	SP	
WMLP315		BC Alluvium	SP	
WMLP316		BC Alluvium	SP	
WMLP320		BC Alluvium	SP	
WMLP277	Hunter River Alluvium, South of LW5 to 7	HR Alluvium	SP	
WMLP278		HR Alluvium	SP	
WMLP279		HR Alluvium	SP	
WMLP280		HR Alluvium	SP	
RA27		HR Alluvium	SP	
WML20*	Above underground mine, LW1 to 8	PG	SP (Dry)	EIS Investigations. Installed 2001.
WML21*		PG	SP (WL >100m)	
WML106		Lem15	VW	Subsidence monitoring network–UG mine (2006-2007)
		Lem19		
		PG		
WML107A		Lem11	VW	
		Lem15		
		Lem19		

	Location	Aquifer/ Geological Unit	Type of Monitoring Bore	Comments
WML107B*		Lem8-9	SP (Dry)	
WML108A		Lem11-12	VW	
		Lem15		
WML108B		Lem8-9	SP	
WML109A*		Lem8-9	VW	
		Lem12		
		Lem15		
WML109B*		Lem7	SP (Dry)	
WML110A*		Lem6	VW	
		Lem8-9 IB		
		Lem11-12		
		Lem15		
WML110B*		CM OB	SP (Cemented up)	
WML110C		Alluvium	SP (Currently dry)	
WML111A*		Lem4	VW	
		Lem7		
		Lem11-12		
		Lem15		
WML111B		CM OB	SP	
WML112A*		Lem2-3	VW	Subsidence monitoring network–UG mine (2006-2007)
		Lem6-7		
		Lem8		
		Lem15		
WML112B		Bays1-2	SP	
WML112C		Alluvium	SP	
WML113A*		Bays2	VW	
		Lem3-4		
		Lem9		
		Lem10-12		
WML113B		Bays1	SP	
WML113C		Alluvium	SP	
WML114A*		Lem10-12	VW	
		Lem15		
		Lem19		
WML114B*		Lem6-9	SP (Dry)	
WML115A*		Lem7	VW	
		Lem8-9		
		Lem15		
		Lem19		
		PG		
WML115B		CM OB	SP	

	Location	Aquifer/ Geological Unit	Type of Monitoring Bore	Comments
WML115C		Alluvium	SP	
WML189		Lem15	VW	Subsidence impacts of LW2-3 (2007)
		PG		
		Arties		
WML191		Lem15	VW	Subsidence impacts of LW2-3 and Multi-seam baseline monitoring (2007)
		PG		
		ULD		
		ULLD		
		LB		
WML213		Bays	VW	Multi-seam baseline monitoring (2008)
		Lem 8-9		
		Lem 15		
		Lem 19		
		PG		
		ULD		
		ULLD		
		LB		
WML269		Lem5	WV	Monitoring of subsidence impacts of LW5 (2010)
		Lem 7		
		Lem 8-9		
		Lem11-12		
		Lem15		
WML263		Regolith	SP	
WML119	Between Glennies Ck and LW1 (East of LW1)	PG	SP	Monitoring of impacts of LW1-4 on Glennies Ck Alluvium (2006)
WML120A		PG	SP	
WML120B		GC Alluvium	SP	
WML129		GC Alluvium	SP	
WML181		PG	SP	Monitoring subsidence impacts in barrier between LW1 and Glennies Ck (2007)
WML182		PG	SP	
WML183		PG	SP	
WML184		PG	SP	
WML185		PG	SP	
WML186		PG	SP	
WMLC248		ULLD	VW	ULD Extraction Plan, baseline monitoring (2009)
		ULLLD		
		LB		
		Heb1		
WML261		ULD	SP	
WML262		ULD	SP	
WMLP301		ART	SP	
WMLP302		ART	SP	

	Location	Aquifer/ Geological Unit	Type of Monitoring Bore	Comments
South East Open Cut Monitoring:				
WMLC144	East of Glennies Ck	ULD	VW	Deeper seam baseline monitoring (2007)
		MLD1		
		MLD2		
		ULLD		
		LLLD		
		UB		
		LB		
WMLC245		ULD	VW	Deeper seam Baseline monitoring (2009)
		MLD		
		LB		
		LB-Heb interburden		
WML239		GC Alluvium	SP	Glennies Ck Alluvium baseline monitoring (2009)
WML240		GC Alluvium	SP	
WML241		GC Alluvium	SP	
WML243		GC Alluvium	SP	
WML247		GC Alluvium	SP	
WML249		GC Alluvium	SP	
WML252		GC Alluvium	SP	
WML253		GC Alluvium	SP	
WML256		GC Alluvium	SP	
WML294		GC Colluvium	SP	
AP243		GC Alluvium	SP	
AP244		GC Alluvium	SP	
AP245		GC Alluvium	SP	

Alluvium: BC = Bowmans Creek; GC = Glennies Creek; HR = Hunter River

Overburden: CM OB = coal measures overburden

Coal seams: Bays = Bayswater; Lem = Lemington; PG = Pikes Gully; ART = Arties; ULD = Upper Liddell seam; MLD = Middle Liddell; ULLD = Upper Lower Liddell; LLLD = Lower Lower Liddell; UB = Upper Barrett; LB = Lower Barrett

VW = multi-level vibrating wire piezometer bore; SP = standpipe piezometer

*Decommissioned/Dry Bores

The monitoring network was expanded during the review period, viz:

- Three nested monitoring sites, installed in the Bowmans Creek Alluvium and the Permian overburden units, to the southwest of LW6A (WMLP326 and WMLP327), above the northern end of LW6B (WMLP311 and WMLP325), and above the southern end of LW6B (WMLP323 and WMLP324). These piezometers were drilled in accordance with the Bowmans Creek EA Section 13 Commitments and were installed to evaluate the potential of flows entering the old creek channel and entering the workings via connective cracking above LW6B.
- Standpipe piezometers which target the Bowmans Creek Alluvium near the Bowmans Creek Diversion areas (WMLP308, WMLP312, WMLP314-316, and WMLP320). These piezometers were installed to verify the hydraulic properties of the Bowmans Creek Alluvium and monitor any effects of the Bowmans Creek Diversion and mining beyond LW6A.

- Standpipe piezometer WMLP328, which targets the Bowmans Creek Alluvium, and was drilled as a replacement bore for RA20. As this piezometer had either partly collapsed or accumulated sediment.

All new monitoring piezometers were installed on allotment 3 of DP1114623 under licence 20BL170596, and were drilled and completed in accordance with the minimum construction requirements for boreholes in Australia.

The piezometers have been monitored at various frequencies during the review period, with the EIS investigation and monitoring bores generally monitored monthly in accordance with the WMP. Selected piezometers associated with underground mining are generally monitored more frequently (weekly to fortnightly) during critical stages of the longwall panel advance. Furthermore, piezometers south of the NEOC were monitored fortnightly to monitor any unforseen impacts from the extension of the Barrett Pit.

Over the review period, the monitoring frequency was intensified in the early and final stages of LW6A and LW7A extraction, above that specified in the WMP, until the groundwater system response became clear. The monitoring frequency in most cases has then reverted to that outlined in the WMP, while some bores in the Bowmans Creek Alluvium and Permian continue to be monitored with increased frequency in preparation for the proposed extension of mining beyond LW6A.

For a period of time, a number of the piezometers were equipped with dataloggers set to record water levels/pressures at hourly or 6-hourly intervals so that any impacts related to subsidence effects of LW6A, LW7A, and LW7B could be detected and related precisely to the position of the active longwall face or other specific site activities occurring at the time. These were:

- WML111A, WML111B, WML112A, WML113A, WML114A, WML114B, WML269A, WMLP299 and WMLP300, RM09, RA16, RA18, RA27, T1-P (installed for LW6A extraction monitoring).
- WML269, WML112A, WML112C, WML113A and WMLP326 (installed on the 17/03/2011 for LW7A extraction monitoring).
- WMLP115A, WML115C, WMLP311 and WMLP325 (installed on the 28/08/2011 for pre LW7B extraction monitoring).

The standpipe piezometers have been monitored for water levels, and also sampled for water quality monitoring. Vibrating wire piezometers have been monitored for groundwater pressures only.

Selected monitoring bores were sampled periodically for detailed laboratory analysis, comprising TDS, EC, pH, major ions, dissolved metals, nutrients, cyanide, fluoride, turbidity and total suspended solids.

The recommended monitoring frequency for the next review period (September 2011 to August 2012 is summarised in Table 2.2.

Table 2.2: Ashton Coal Project – Proposed Piezometer Monitoring Frequency

Area	Piezometers	Current Monitoring Frequency	Proposed Monitoring Frequency
	(refer Table 2.1)	(2010-2011)	(2011-2012)
NEOC	GM1	fortnightly	monthly
	GM3A and GM3B	fortnightly	monthly
	WML172-174	fortnightly	monthly
LW1-8 Area	RM01 to RM10	quarterly (or weekly^)	monthly (fortnightly*)
	RA02, RSGM1, PB1	quarterly (or weekly^)	monthly
	WML21	No longer monitored (dry)	-
	WML106-115, WML269	fortnightly	monthly (fortnightly*)
	WML189, 191 and 213	fortnightly	monthly (fortnightly*)
	RA8-RA30, WML275-276, WML299-300, WMLP308, WMLP311-316 and WMLP320-327	fortnightly (or weekly^)	monthly (fortnightly*)
	T1-10	fortnightly (or weekly^)	monthly (fortnightly*)
Hunter River	WML175 and 180	no longer monitored (dry)	-
	WML277-280, RA27	fortnightly	monthly
SEOC	WML239-WML256, AP243-AP245 and WML294	fortnightly	monthly
	WML144 and WMLC245	fortnightly	monthly (fortnightly*)
Barrier between Glennies Creek and LW1	WML119, 120A-B and 129	fortnightly	monthly (fortnightly*)
	WML181-186	fortnightly	monthly (fortnightly*)
	WML261, WML262, WML301 and WML302, WML248	fortnightly	monthly (fortnightly*)

^ Monitoring frequency of key bores were increased during LW6A and LW7A extractions *Default monitoring frequency = monthly and increased to fortnightly during critical times

2.2 Underground Monitoring

Groundwater monitoring was also carried out within the underground mine, including:

- Groundwater inflow rates (metering of dewatering pipelines).
- Seepage inflows from the eastern rib of the LW1 tailgate, which is conveyed by pipeline to the LW1 backroad sump (V-notch weir at discharge from pipeline).
- Metering of water imported to the underground mine for longwall operation.
- 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) of seepage discharge from the LW1 backroad pipeline.
- Water quality monitoring at various in-mine sumps, and total water pumped out of the mine.

2.3 Rainfall

Monthly rainfall data measured from the Ashton weather station is compared against the Long Term Average (LTA) in Table 2.3. During the review period, the total rainfall was 745mm, which was about 28mm above the long term average for the same time period. The area experienced mostly above average rainfall during the second half of the 2010-11 review period (March to September).

Table 2.3: Ashton Monthly Rainfall

	Sep 10	Oct 10	Nov 10	Dec 10	Jan 11	Feb 11	Mar 11	Apr 11	May 11	Jun 11	Jul 11	Aug 11	Sep 11
Rainfall (mm)	24.6	58.6	92.2	33.6	25	35.6	90.2	58	78.6	132.4	17.4	43.8	55.6
LTA (mm)	50.4	34.5	64.6	83.4	69.6	94.7	68.5	41.3	43.6	43.8	40.8	31.5	50.4

The cumulative deviation of monthly rainfall is plotted on hydrographs (Figures 4 to 6) and salinity plots (Figures 13 and 14) to help explain the groundwater level and salinity trends observed in the Bowmans Creek, Glennies Creek and Hunter River Alluvium (See Section 2.4.2). The cumulative deviation curve (shown as a blue line on Figures 4 to 6) shows how far the monthly rainfall deviates from the long term average. These deviations are cumulatively added to produce the cumulative deviation curve. Positive slopes represent periods of above average rainfall (i.e. February 2011 to September 2011), whilst negative slopes indicate periods of below average rainfall (i.e. May 2009 to February 2011).

2.4 Discussion of Groundwater Level Changes

2.4.1 North East Open Cut

Aside from piezometer G1 and WML172, piezometers which form the NEOC monitoring network were dry and were not monitored during the reporting period. Piezometer G1 which monitors the Upper Liddell seam, showed a steady decline through the review period (Figure 3). Bore GM3A (Glennies Creek Alluvium) remained dry during the reporting period.

Most coal measures piezometers within the SEOC monitoring network (WMLC144 and WMLC248), to the south of the NEOC revealed a general downward trend over the years of Ashton mining, in response to mining from the NEOC. These piezometers are all stratigraphically lower than the Pikes Gully Seam, and have shown no response to underground mining. However, many of these SEOC piezometers, and some deeper piezometers from within the underground mine area, started to show a steady recovery in the Upper and Lower Barrett seams from about April 2009, which is thought to be due to the progressive backfilling of the NEOC void, and recovery of water levels within the backfill. These responses are discussed in more detail below.

2.4.2 Underground Mine

Alluvium

Glennies Creek Alluvium

As reported in the LW1 End of Panel Report (Aquaterra, 2008b), a small drawdown of 0.4m was observed in Alluvium monitoring bore WML120B, between June 2006 and December 2006, coinciding with the advance of TG1A past the bore location, which has since recovered (Figure 4).

The development headings of ULD LW1 have been in progress over the review period. However there have been no additional drawdown impacts observed to date. All drawdown impacts occurred during the development heading stage of PG LW1 and no further drawdown occurred during subsequent extractions of LW1 to LW7A, and the development headings of ULD LW1 that has progressed to date.

Groundwater level drawdown in the Glennies Creek Alluvium has been significantly less than predicted in the EIS. Groundwater levels in bore WML120B indicated an initial drawdown of about 0.4m, which has now recovered to pre mining levels - well below the EIS prediction of 2.2m for this locality by this stage of mining.

Water table responses in Glennies Creek Alluvium to the east of Glennies Creek are consistent with the rainfall controlled natural recharge and discharge responses also observed in the Hunter River and Bowmans Creek Alluvium (Figure 4).

Bowmans Creek

During the review period, the extractions of LW6A and LW7A caused part of the Bowmans Creek Alluvium aquifer to subside. The subsided sections are situated above the south-western corner of LW6A and LW7A and the north-western corner of LW7A (Figure 2).

Hydrographs of piezometers showing the saturated thickness of the Bowmans Creek Alluvium above LW6A and LW7A are shown on Figure 5.

Overall, the Bowmans Creek Alluvium was not significantly impacted by LW6A to LW7B extraction, however, some piezometers (WML112C, T10, T3-A and RA14) which were located around the goaf edge of LW7A, revealed a temporary groundwater response that coincided with the passage of LW7A (Figure 5). T10, T3-A and RA14 became dry for a short period of time. However, following a recharge event, all piezometers have recovered and retained a saturated thickness that is slightly greater than pre LW7A conditions.

The piezometers which responded to LW7A are located near to the goaf edge of LW7A where subsidence cracking was observed at the surface (see Figure 2 for mapped surface cracking). The temporary drawdown was considered to be due to groundwater flowing laterally into the subsided 'Alluvium trough' above the LW7A goaf. This drawdown response was previously observed in RA8 (which is located near the LW5 goaf edge) during the extraction of LW5, and was reported in Aquaterra 2010b.

Piezometers located outside of areas where surface cracking was observed (T2-A and RA18) did not response to LW extractions (Figure 5). Instead the water level trends are due to natural recharge and discharge processes and are not related to mining. The trends are also consistent with pre mining trends and groundwater trends observed in piezometers outside the goaf areas (i.e. WML275 and RA15).

The EIS, EA and SMP for LW7A predicted groundwater drawdowns of 0.5 – 2.0m for this stage of mining. However, no reduction in Alluvium storage occurred during LW6A or LW7A extraction, and hence there was no seepage loss from the Bowmans Creek Alluvium. The impact on Bowmans Creek Alluvium has therefore been less than the EIS, EA and SMP predictions. Therefore the monitoring results have shown that the LW extraction has been completed in full compliance with Development Consent Condition 3.9.

Hunter River Alluvium

Piezometers which monitor the Hunter River Alluvium have shown no response to mining. Instead the water table reflects the rainfall controlled natural recharge and discharge patterns (Figure 6).

All piezometers have shown a recent upward trend in response to above average rainfall recharge. Prior to this a gradual recession following a small recharge event in April 2009 was evident across all piezometers. The recession of the water table was associated with a reduction in rainfall recharge over the period, rather than underground mining, and there has been no discernible response to mining.

Accordingly, there is no impact to the Hunter River Alluvium, which is consistent with the EA and SMP predictions, and is lower than the EIS prediction of <0.5m.

Permian Coal Measures

Composite plots of all Pikes Gully Seam and Permian overburden piezometers are presented in Figures 7 to 12. They include:

- Standpipe piezometers which monitor the weathered near surface coal measures overburden in the Bowmans Creek floodplain area (Figure 7).
- Multi level vibrating wires installed within the Permian overburden units - WML106 to WML115, WML189, WML191, WML269 and WML213 (Figure 8 and Figure 9).
- Pikes Gully seam standpipe piezometers to the east of LW1 – WML119, WML120A, and WML181-WML186 (Figure 10).
- Pikes Gully seam standpipe/vibrating wire piezometers distributed across the current area of underground LW1-4 mining (WML20, WML106-84m, WML189-93m and WML191-100m) and across the LW6-8 mining area (WML21, WML115-144m and WML213-205m) (Figure 11).

- Arties seam standpipe piezometers to the east of LW1 – WML301 and WML302 (Figure 11)
- Multi level vibrating wires installed within the Upper Liddell, Lower Liddell and Lower Barrett coal seams – WML261, WML262, WMLC144, WMLC245, WML191, and WML213 (Figure 12).

Near Surface Coal Measures

Hydrographs of paired standpipe piezometers which monitor the uppermost water-bearing horizon in the Permian (T1-P, T2-P, T3-P, T4-P, WML111B and WMLP327) and overlying Bowmans Creek Alluvium (T1-A, T2-A, T3-A, T4-A, WMLP328) are presented on Figure 5 and Figure 7.

Groundwater levels in standpipe piezometers WML111B, T1-P, T2-P, T3-P T4-P and WMLP327, which monitor the upper-most water bearing horizon of the Permian coal measures (beneath the Bowmans Creek floodplain area) have declined in response to LW6A to LW7A extractions, and earlier LW's, while the Alluvium piezometers have shown no response to mining (Figure 7). Instead the water table has shown an overall rise through the period of LW6A and LW7A extraction, attributed to above average rainfall over the extraction period (Figure 5).

During the review period, the water level response to mining was most notable at the following sites:

- Permian piezometers T4-P and WML111B located above LW6A displayed a drawdown of 4m in response to LW6A followed by a smaller drawdown of 2m in response LW7A extraction, whilst T4-A and WML112A which monitor the overlaying Bowmans Creek Alluvium at the same location did not respond to mining.
- Permian piezometers T2-P, located above LW7A displayed a drawdown of about 3.5m in response to LW7A extraction, whilst T2-A which monitors the overlaying Bowmans Creek Alluvium at the same location, did not respond to mining. Instead it revealed a rise in groundwater level as a result of a recent rainfall event.

All piezometers (WML112B, T1-P, T2-P, T3-P T4-P and WMLP327) displayed a partial recovery after the initial head declines. The timing and magnitude of each response was related to the position of the piezometers in relation to the LW face at the time of monitoring. These responses have been repeated a number of times previously and are related to changes in storage due to bed separation effects and not a dewatering effect.

The water levels in standpipes that were undermined by LW6A and LW7A remain at levels of 10 to 22m above the base of the screened intervals. This indicates that the screened section of the Permian coal measures remains saturated with a positive head of at least 10 to 22m, and confirms that this interval is not directly hydraulically connected with the LW6A or LW7A goafs beneath, even though full subsidence has occurred with the associated fracturing extending upwards from the goaf. This would indicate that connected cracking from the goaf does not extend higher than at least 32 - 50m below ground surface, which is the depth of the screens.

Bayswater and Lemington Seams

Varying drawdown impacts have been observed in piezometers that monitor the Bayswater and Lemington seams above the Pikes Gully seam. Hydrographs for these are presented in Figures 8 and 9.

Bayswater seam piezometers (WML112A, WML113-40m and WML213-48m) show small transient pressure responses during LW6A and LW7A extraction (Figure 8). WML213-48m and WML113-40m are also believed to be responding to mining at the adjacent Narama mine, as they have been on a consistent downward trend throughout the period of monitoring, starting before longwall mining commenced at Ashton.

All piezometers that monitor the Lemington Seams have now shown recognisable drawdowns in response to mining of LW1 to LW7A. Generally, drawdowns occur 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 LW1-5, further pressure responses were detected during the review period (during the mining of LW6A and LW7A). The horizons that showed recognisable drawdowns in response to LW6A and LW7A (Figures 8 to 9) were:

- WML269 – Lem5, Lem7, Lem8-9, Lem10-12, Lem15 and Lem19 (within main gate pillars, south of LW5).
- WML111 – Lem1-3, Lem4 and 7, Lem11-12, Lem15 (southern end of LW6A).
- WML112 – Lem6-7, Lem8 and Lem15 (above start line of LW7A).
- WML113 – Lem3-4, Lem9 and Lem10-12 (outside southern end of LW7A).
- WML213 – Lem8-9, Lem15 and Lem19 (SW of LW7A).

VWP responses in WML111A (located above the southern end of LW6A) and WML112A (located above the southern end of LW7A) indicate that there was significant disturbance of the strata, which coincided with the extractions of LW6A and LW7A. All VWP were lost during the period, presumably due to ground movements, although all were still pressurised at the time they ceased recording. Before the VWP's were lost, pressure responses were noted in Lemington seams (Lem 1 to 15) due to LW6A and LW7A. Similar responses were also observed during the extractions of earlier Longwalls. These responses are interpreted to be due to increased storage due to bed separation effects above the LW panel, and not to dewatering.

Standpipes WML111B and WML112B, which are screened in the uppermost part of the Permian Coal Measures and the shallow coal measures both revealed a temporary drop in pressure during LW6A and LW7A extractions. This response was also interpreted to be due to an increase in storage due to bed separation effects and not a dewatering effect. Although the standpipe piezometers were undermined, there is still more than 8m of water in the bore above the base of the screen at 18m below ground level, indicating continuing saturation in the upper Permian.

Pressure response was also observed in the shallow Lemington seams (Lemington 6-12), outside the current area of mining. Piezometers WML113 and WML213 located to the west and south west of LW6 showed marked drawdown responses to the mining of LW4, LW5, LW6A and LW7A (Figure 8 and Figure 9). It is also thought that this drawdown response represents the lateral expression of bed separation effects above the extracted panels, not dewatering. Similar effects associated with longwall mining elsewhere in the world have been reported in literature (Booth, 2006; Karaman et al, 2001). This effect does not lead to increased mine inflows, and is a transient pressure response that occurs in upper layers in the vicinity of the subsidence zones above longwall panels in a deeper seam. This effect and its implications for impact predictions are discussede in the previous End of Longwall 4 report (Aquaterra, 2010a).

The deeper Lemington 19 seams in WML269 and WML213 responded differently to the shallower Lemington Seams. The observed head declines represent slow dewatering from this interval, which has continued to occur during the review period and is a continuation of trends that first established during the extractions of LW5 and LW6A respectively (Figure 9).

Pikes Gully Seam (East of LW1)

Piezometers which monitor the Pikes Gully Seam to the east of LW1 (between LW1 and Glennies Creek) have not indicated any response attributable to the mining of LW5-7A (Figure 10). The trends observed in the piezometers are continuations of trends established during mining of the LW1 development headings. All the seepage impact occurred during LW1 development, and the actual extraction of LW1 to LW7A has not caused any further drawdown impact.

Groundwater levels in WML120A and WML184 to WML186 have continued to show steady recovery of approximately 0.7m per year, so that nearly all of the initial 3.0m drawdown has now been recovered (Figure 10). The recovery in water levels suggests a steady reduction in the hydraulic conductivity of the Pikes Gully Seam between LW1 and the subcrop line beneath the Glennies Creek floodplain, possibly due to delayed response to the in-seam grouting carried out in 2007. The gradual recovery in water levels has been accompanied by a gradual reduction in the rate of underground seepage inflows (see Section 2.5).

Aside from a number of isolated rainfall recharge events, water levels in WML119, WML181 and WML182 were showing a steady drawdown trend of approximately 0.2m per year since the mining of LW1 began (Figures 10). Since mid 2009, these bores have all showed a reversal of trend, and water levels were rising throughout the mining of LW5 to LW7A, consistent with increased rainfall recharge during that time.

Pikes Gully Seam (In the underground LW1 to LW8 area)

Piezometers which monitor the Pikes Gully Seam in the underground area have all shown responses to underground mining (Figure 11).

Piezometers located inside the LW1-8 area responded during the mining of LW1 to 4. No significant responses were observed during the subsequent LW6A and LW7A extractions, as these were dry or exhibit small residual pressures, prior to LW5 and LW6A development headings. The groundwater responses observed to date are summarised as follows:

- WML106-84m and WML20 responded to LW1 development headings, with WML20 responding further to LW2 headings. WML20 became dry during the nearby mining of LW3 maingate headings.
- Vibrating wire piezometer WML191-100m located in the chain pillar between LW2 and LW3 showed dramatic depressurisation in response to the mining of LW3, but showed no response to the earlier passage of the LW2 development headings. WML189-93m, which is also located in the chain pillar to the north of WML191, showed marked drawdown as the LW2 development heading passed and no further responses during the extraction of LW3 and subsequent LWs.
- WML21, located in the northern part of LW5, responded strongly to the advance of the North West Mains and LW4, LW5 and LW6A development headings past this point. The water level has fallen more than 100m below surface and could no longer be monitored before LW5 started. The Pikes Gully seam is 105m below surface at WML20, and is probably now fully dewatered at that site.

Whilst most responses were observed during the mining of LW1 to LW4, continuing depressurisation responses have been observed during the reporting period, in piezometers outside of the area of current mining, viz:

- WML115-144m is located closer to the North West Mains is almost completely depressurised. Most of the depressurisation occurred during the extractions of LW1 to LW6A and is believed to be due primarily to drainage into the nearby North West Mains and development headings for LW4, LW5 and LW6, where the lowest point in the headings near WML115 is at an elevation of around -45mAHD.
- WML213 is remote from both LW1-7A and the North West Mains. The steady drawdown observed in WML213 during LW3 to LW7A is believed to be due to the combined effect of Ashton's underground operations and possibly mining activities on neighbouring mine sites.

Liddell and Barrett Coal Seams

Piezometers which monitor seams below the Pikes Gully seam (Middle Liddell Seam down to the Lower Barrett Seam) have demonstrated varied trends (Figure 12):

- WMLC248-37m and WML262 which monitor the Upper Liddell seam east of LW1 recently showed a small but sudden drop in pressure, which coincided with the advancement of the development headings for ULD LW1 past these locations.
- WML245-70m (Upper Barrett) and WML245-100m (Lower Barrett – Hebden interburden), located to the north of the proposed SEOC shell, have revealed steady recovery since monitoring began in February 2009. The recovery is thought to be due to the backfilling of the NEOC void and gradual recovery of water levels within the backfill,
- Prior to April 2009, all WML144 piezometers, from the Upper Liddell down to the Lower Barrett seams, had shown marked drawdowns in groundwater pressures in response to mining from the NEOC. However, WML144-32m (Middle Liddell), WML144-58m (Lower Lower Liddell) and WML144-98m (Lower Barrett), located within the proposed SEOC pit

shell, have revealed steady recovery since April 2009. Groundwater pressures in WML144-26m (Upper Liddell) and WML144-45m (Middle Liddell 1), while not recovering, have stabilised over the same period.

- WML191-200m (Lower Barrett), located below the LW1-LW2 chain pillar, has stabilised since February 2009.
- Note that deeper piezometers at WML213, which is more remote from the NEOC, have not shown recovery in the Liddell or Barrett seams. This piezometer has shown a declining trend since monitoring, and is believed to be due to neighboring mining activities.

Several piezometers continue to show a slow but steady downward trend in the upper to lower Liddell seams, which is considered to be unrelated to the Ashton underground mining, and is considered to be due primarily to the NEOC, but may also include a regional response to general mining activity in the broader region, viz:

- WML248-60m (Upper Lower Liddell).
- WML245-65m (Middle Liddell).
- WML213-247m (Upper Liddell) and WML213-275m (Upper Lower Liddell).
- WML191-132m (Upper Liddell) and WML191-155m (Upper Lower Liddell).
- WML144-50m (Upper Liddell).

2.5 Groundwater Quality

The EC data from sampling of piezometers and basic statistical analysis results are summarised in Table 2.3. Surface water EC from Bowmans Creek and Glennies Creek are presented in Figures 13 and 14, respectively. Groundwater EC's from the Bowmans Creek and Glennies Creek Alluvium are shown in Figure 15.

Discussion of groundwater salinity trends is provided under Section 2.5.1

Table 2.4: Salinity Measured as Electrical Conductivity (µS/cm)

Bore	Sep-Dec 2007	Jan-Feb 2008	May-Jun 2008	Jul-Aug 2008	Nov 08	Feb 09	May 09	Oct 09	Nov 09	Feb 10	May 10	Aug 10	Feb 11	Aug 11	Dec 11	Min	Ave	Max
Summary for all Bowmans Creek Alluvium:																**346**	**1564**	**7600**
RM04	1310	1540	972	1240	1240	1220	1140	1110	1110	1100	1040	1220		1180	1001	722	1185	1760
RM06	1170	772	826	806	791	878	824	980	1100	1120	1020	1070		969	704	704	1021	1340
RM07	1320	1230	-	890	813	874	845	897	982	4640	1030	1270	886	1100	909	813	1481	6120
RM09	1220	1350	1190	1080	997	930	921	930	989		997	1090	848			848	1114	1360
RM10	1510	1690	1560	1440	1400	1290	1180	1060	1090	1170	1130	1040	883	1130	972	883	1310	3700
PB1	1560	1640	1520	1340	1260	1140	1080	1010	1030		974	1140		1200	965	965	1277	1640
RA10	1780						1940	2010	1940	2040	1950	1810	1320	1760	1954	1320	1850	2040
RA14	2050						2190		2190	2240	2220	2130	1970	2790	3020	1970	2311	3020
RA17	1190															1190	1190	1190
RA18	2100						1690		1650	1770	1620	1270	845	1140	1061	845	1461	2100
RA30	1560						1530	1610	1450	1320	1310	1430	1170	1630	1136	1136	1415	1630
WML112C	1360			1200				1700		1850		1350	1780	1710		1200	1564	1850
WML113C	1450			1250				1120		1190		1080	906	1290		906	1184	1450
WML115C	4100			5150												4100	4625	5150
T1-A	2040						1080	1080	1160		2230	1680	926			926	1457	2230
T2-A	1680						1270	1210	1160		1070	346	854	1140	985	346	1079	1680
T3-A	2150						2400	2400	2260		2340	2160	2120	2350	2130	2120	2257	2400
T4-A	2270						3470	4130	3550		3500	2640	2080	2180	1985	1985	2867	4130
T5	1330						1260	1310	1260		1210	1200	959	1220	1087	959	1204	1330
T6	1280						1420	1400	1400		1310	1170	1010	1240	1043	1010	1253	1420
T7	6420						5380	5770	4960		5740	5960	5260	7600	5390	4960	5831	7600
T9	2490															2490	2490	2490
T10	2050					2160	2180						1200			1200	1898	2180
WMLP299												1380				1380	1380	1380
WMLP300											1660	1760	1400	1840	1700	1400	1672	1840

Bore	Sep-Dec 2007	Jan-Feb 2008	May-Jun 2008	Jul-Aug 2008	Nov 08	Feb 09	May 09	Oct 09	Nov 09	Feb 10	May 10	Aug 10	Feb 11	Aug 11	Dec 11	Min	Ave	Max
WMLP308														1090	847	847	969	1090
WMLP311														1210	1000	1000	1105	1210
WMLP312														2300	3110	2300	2705	3110
WMLP314														1370	1293	1293	1332	1370
WMLP315														1100	1107	1100	1104	1107
WMLP316														1100	845	845	973	1100
WMLP320														947	784	784	866	947
WMLP323														1170	964	964	1067	1170
Summary for all Hunter River Alluvium:																**1375**	**2103**	**2540**
RA27	2540						2080	2040							2060	2040	2180	2540
WML 280											1950					1950	1950	1950
WML 278											2150					2150	2150	2150
WML 279											1375					1375	1375	1375
WML 275											2300					2300	2300	2300
WML 277											2430					2430	2430	2430
Summary for all Glennies Creek Alluvium:																**348**	**750**	**2610**
WML120B	1220			992	992	915	903	839	781	718	639	637	438	714	737	438	921	1930
WML129	577			571		458	490	571	502	436	433	471	399	348	365	348	474	577
WML148	2610															2610	2610	2610
WML155	915															915	915	915
WML157	803															803	803	803
WML158	705															705	705	705
WML239						903		984	916		950	834	707	832	800	707	866	984
WML241						687		538	602	549		596	431	531	488	431	553	687
WML253						417		411	320	400		453	300	403	359	300	383	453
Summary for all Colluvium:																**993**	**7262**	**16300**
WML110C	9340			9340												9340	9340	9340

Bore	Sep-Dec 2007	Jan-Feb 2008	May-Jun 2008	Jul-Aug 2008	Nov 08	Feb 09	May 09	Oct 09	Nov 09	Feb 10	May 10	Aug 10	Feb 11	Aug 11	Dec 11	Min	Ave	Max
RA8	8370						7660	7660	6800		7490				6510	6510	7415	8370
RA16	13400						11500	13300	12300		13800					11500	12860	13800
WML240						1640		1610	1710		1700	1560	1150	1380	993	993	1468	1710
WML243						3740		5920	4770	6200		4310	5280	7230	6560	3740	5501	7230
WML247						14800		15000				15400				14800	15067	15400
WML249						15300		16300	13900	13500			14900			13500	14780	16300
WML252						3730		5830	5140	5220		4930	4770	4830		3730	4921	5830
WML256						3250		2240	2470	5930		3270	3560	2150		2150	3267	5930
WML294								4130	5950	9310		9410	10500	11300	10950	4130	8793	11300
Summary for all Weathered Coal Measures Overburden:																**105**	**3940**	**18200**
RM02		2290	3630	3860	5250	4450	4410	4610	4600		4500	3860		1680	1583	1583	3727	5250
RM05	2200	2310	2370	2220	2620	2360	2200	2420	2420		2230	1930		1860		1860	2262	2620
T1-P	9220						8510	7870	2740		1990	1840	1660	1830	1670	1660	4148	9220
T2-P	1070						320	648	633		925	1000	845	105	257	105	645	1070
T3-P	2050						1280	1320	1350		1610	1590	1670	1460	1868	1280	1578	2050
T4-P	2000						1790	1870	1850		1790	1650	1580	2010	1649	1580	1799	2010
WML108B				15100			16100	16200	13300	15800	16700	12300	16400	18200	18130	12300	15721	18200
WML109B				11400												11160	11280	11400
WML110B	9415			10000			9190	9610	8600							8600	9323	10000
WML111B	2580			2290			605	735	964	1440	1810	1920	2070			605	1602	2580
WML112B	1720			1600			2100	1910	1910	2050	2040	1980	1950	1830	1604	1420	1843	2100
WML113B	875			835			908	815	926	987	914	901	731	1020	954	731	897	1020
WML114B	6570			5200		4890	4900	5170	4700							4700	5238	6570
WML115B	3790			3440		3770	3720	3940	3600		4270	4240		4010	4550	3440	3933	4550
WMLP324														262	383	262	323	383
WMLP325														678	809	678	744	809
Summary for all Pikes Gully Seam:																**87**	**3875**	**9820**

Bore	Sep-Dec 2007	Jan-Feb 2008	May-Jun 2008	Jul-Aug 2008	Nov 08	Feb 09	May 09	Oct 09	Nov 09	Feb 10	May 10	Aug 10	Feb 11	Aug 11	Dec 11	Min	Ave	Max
WML 20	9820	5720														5720	7770	9820
WML 21	6460	8280	8110	8390		7690	7550	7500	7070							6460	7735	8700
WML119	2320			1820						87		175	126	128	106	87	1926	6470
WML120A	1260			810		1040	919	931	935	1040	1050	533	476	543	596	476	1246	6350
WML181	2380			2460		2680	2640	2600	2610	2560	2670	2600		2830	3170	2380	2655	3170
WML182	8680			6950		6510	6730	6390	6760	7520	7900	8480		7250	5090	5090	7115	8680
WML183	8180			5890		5950	5640	5950	5310	5550	5570	5440		5280	4760	4760	5775	8180
WML184	4580			5140		4940	4940	5210	5040	5390	5440	1790		1330	974	974	4070	5440
WML185	4430			2940		2900	2310	2710	2570	2680	2650	2550		1510	1182	1182	2585	4430
WML186	387				1930	933		1140	1300	1500	1550	1640		2060		387	1382	2060
Summary for all Upper Liddell Seam:																**126**	**4073**	**7630**
WML261							2510	1420	1460	1430		1220	932	138	126	126	1155	2510
WML262							6270	7170	6890	6970		7220	6410	7630	7370	6270	6991	7630
Summary for all Arties Seam:																**648**	**3648**	**7350**
WML301												5920	6350	7350	6320	5920	6485	7350
WML302												812	648	907	876	648	811	907
Summary for all Other Major Coal Seams:																**200**	**5357**	**10600**
WML172				4880		3280	3200								981	981	3085	4880
RSGM1	6250	10300	10200	10600	8760	6490	5590	8370	7070						8660	5590	8229	10600
GM1	369	526	1100	3900	4990	5240	5450	5400	5960		6040	6080	4570	200	374	200	4540	9370

2.5.1 Salinity

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

Bowmans Creek Alluvium:

- Groundwater salinities of monitoring bores that target the Bowmans Creek Alluvium above and distant from the LW6A and LW7A goafs are shown on Figure 13, along with the cumulative deviation of monthly rainfall for reference.
- Salinities in the Bowmans Creek Alluvium ranged from a minimum of 350 to a maximum of 7,600µS/cm EC.
- The average EC for all Bowmans Creek Alluvium samples is 1,560µS/cm (Table 2.4).
- Due to the shallow depth of the water table and the cleaner nature of the Alluvium in the northern reaches of Bowmans Creek (coarse silty sand, with stringers of gravels/cobbles), the aquifer is more responsive to direct rainfall recharge in that part of the floodplain, resulting in lower groundwater salinities than observed to the south (where the depth to water is greater and the Alluvium comprises mostly silty sands).
- The colluvium that exists above the southern half of LW5 (WML110,C RA8, RM2 and RA16) contains saline groundwater (4,500 to 13,800µS/cm EC), indicating that it is not as actively recharged from rainfall, and is not strongly connected hydraulically with less saline groundwater in the rest of the Alluvium aquifer.
- The Alluvium that exists above LW6A and LW7A (T2A - T4A, RA10, RA14, RA18, and WML112C) contains fresher groundwater (850 to 4,130µS/cm EC, with an average of 1,800µS/cm EC), indicating that it is actively recharged from rainfall. The gradual longterm decline in observed EC may be attributed to elimination of upward leakage of saline groundwater from the underlying Permian coal measures, which was also observed in bores which monitor the Glennies Creek Alluvium (Figure 14).
- Following the EC decline, a small spike in EC occurred in some bores during a period of above average rainfall. This spike may be attributed to the sudden flushing of salts from the unsaturated zone towards to water table which accumulated during the period of below average rainfall. This EC spike was also observed in bores which monitor the Hunter River Alluvium (RA27) and Glennies Creek Alluvium (WML239 - 253) which are located outside the influence of underground mining activities.
- Bowmans Creek had ceased continuous flow by early 2007 during extended drought conditions, and water was maintained in disconnected pools only by virtue of small volume groundwater baseflow discharges. The total rate of groundwater baseflow was very small, insufficient to maintain continuous flow. The surface water EC at this time increased to 14,000µS/cm at the monitoring point just downstream of the New England Highway (Figure 13). Flow resumed in the flood event of June 2007, and a reduction in EC has been observed, with occasional increases occurring during low flow periods, although to less than the peak salinity reached in early 2007 (Figure 13).

Glennies Creek Alluvium:

- The Alluvium EC's are all noticeably higher than the EC of surface flow in Glennies Creek, which during the period ranged between 200 and 900µS/cm (Figure 14).
- Historically, the Glennies Creek Alluvium has reported variable salinity, with ECs ranging from 348 to 2,610µS/cm. Over the reporting periods the salinity ranged from about 300 to 830µS/cm.
- The higher Alluvium ECs are historic and are believed to be due to upward seepage of groundwater from the Permian into the Alluvium, which has now been eliminated due to underground mining.
- Piezometers WML120B and WML129 monitor the Glennies Creek Alluvium in the barrier to the west of Glennies Creek and have been monitored for water quality since January 2007. They show a steady reduction in EC due to the elimination of some of the upward leakage of saline groundwater from the underlying Permian coal measures, as the groundwater levels in

the Pikes Gully Seam were lowered below those in the Alluvium in this area, due to the dewatering associated with the underground mine.

- Smaller, but steady declines in groundwater EC have also been observed in some piezometers (e.g. WML239, WML240, WML241) which monitor the Glennies Creek Alluvium close to the eastern side of Glennies Creek, and are likely also due to the elimination of upward leakage of saline Permian groundwater (due to dewatering from the UG and NEOC mines) rather than freshening from rainfall recharge, as this trend was occurring during a period of below average rainfall.

Hunter River Alluvium:

- Standpipe piezometers (WML277, WML278, WML279 and WML280) which were completed within the Hunter River Alluvium, revealed groundwater salinities in the range 1,375 to 2,540µS/cm EC, which is higher than the Hunter River surface flow (240 to 1290µS/cm EC).

Pikes Gully Seam:

- Salinity of Pikes Gully seam groundwater is shown on Figure 15 and ranged from 810 to 9,820µS/cm EC. After some EC decline following the development headings stage of PG LW1, the ECs of WML120A on the western side of Glennies Creek remained steady during LW1 to LW6 panel extractions. Steady decreases in groundwater salinity have also been observed in WML182, WML183 and WML185 during the LW2 extraction, but salinities have been relatively stable through the mining of LW3 to LW7A.

Arties Seam

- Salinity of the Arties seam ranged from 648 to 7,350µS/cm EC and remained steady during the review period. The lower EC encountered in WML302 may reflect partial connection with the fresher groundwaters in the overlying Alluvium.

Upper Liddell Seam:

- The groundwater salinity of the Upper Liddell (ULD) Seam is shown on Figure 15 and ranged from 130 to 7,630µS/cm EC. The lower EC encountered in WML261 may reflect partial connection with the fresher groundwaters in the overlying Alluvium.

Weathered Coal Measures Overburden:

- The groundwater salinity of the coal measures overburden ranged from 105 to 18,200µS/cm EC and have remained relatively steady over the review period.

Underground Seepage:

- Electrical conductivity (data obtained from underground monitoring are presented in Figure 16. Corresponding EC's at various piezometers in the Glennies Creek valley or between Glennies Creek and the mine are plotted on Figure 16.
- After some EC decline during the development headings of PG LW1, the EC's of the LW1 back road pipeline have remained reasonably steady, revealing only a slight decreasing trend over the reporting period. The decrease in groundwater EC during PG LW1 development is similar to that observed in the Pikes Gully and Alluvium piezometers (between LW1 and Glennies Creek), and both are believed to be due to induced water flow from the Glennies Creek Alluvium towards the mine through the Pikes Gully Seam. The salinity has stabilised at a level which reflects the relative proportions of Alluvium and Permian groundwater in the seepage.

- A spike in EC occurred in the MG04 and MG05 sumps in July 2011. This coincided with a pump failure that resulted in temporary flooding of previously dry mine workings for a brief time. It appears that, the flooding of this area, mobilised salt (in a salt crust) that forms in these areas as a result of the precipitation of salts from historical saline inflows.

2.5.2 pH

The groundwater in the Alluvium is near-neutral in pH (range 6.63 to 8.61). Likewise the coal measures groundwater is generally near-neutral, with most pH values lying within a similar range over the reporting period, all piezometers reported pHs within guideline limits for freshwater ecosystems (6.5 to 8).

2.6 Groundwater Mine Inflows

2.6.1 NEOC

Mining from the NEOC was near completion during the review period and the pit is now being progressively backfilled. Prior to this, approximately 0.5ML/d (6L/s) was pumped from the open cut mine on average. This comprises rainfall captured by the mine catchment, including rainfall infiltration to the in-pit waste, as well as groundwater inflows. Total groundwater inflows to the open cut are estimated to be only a small proportion of the total, probably less than 25% of the total or 0.13ML/d (1.5L/s).

2.6.2 Underground Mine

The underground water balance has been closely monitored since the commencement of underground mining. Water balance components have been determined by a combination of V-notch weirs, in-line flow-meters, and timing of filling of storage tanks and sumps.

The main contributions to groundwater inflow are seepage into TG1A (the eastern gate road of LW1), small inflows to the North West Mains, and broadly distributed goaf seepage into the LW1 to LW6 goafs. Typically, no other persistent areas of seepage are seen.

Water is exported from the mine either via a borehole pump direct to the mine water supply circuit, or via pipelines along the gate-roads to a sump in the Arties Pit adjacent the mine portal. Prior to May 2010, a sump borehole situated at the south west corner of LW1 was used, but since that date, a new sump borehole (Sump Bore No 2) located to the South of LW6A, has been used.

Since extraction of LW1, access to TG1 has been lost, and seepage inflows to TG1A from Glennies Creek Alluvium are now collected and conveyed via pipeline to a discharge point in the LW1 Backroad, where the flow rate is measured at a V-notch weir. This discharge then flows to the LW1 Backroad Sump.

Net groundwater inflows to the underground mine have been determined from the mine water balance, to have reached a peak of 9L/s (for a short period of time in July 2010), and averaged 5.1L/s (0.44ML/d) over the 2010-11 review period. The measured inflows were well below the inflow rates predicted in the EIS (17 - 18L/s), EA (16L/s) and SMP (16L/s) for this stage of mining (Figure 17).

During the extraction of LW7A, flooding of the Main Gate 4 (MG04) back road area, south of LW4 was experienced for a short time (around two weeks), requiring increased pumping (9L/s) from the underground dewatering system. Although the increased pumping (as an indicator of mine inflows) was lower than predicted mine inflows for this stage of mining, the sudden increase was outside of the anticipated trend, which represented an event that required further investigation under the site's Water Management Plan (WMP).

Problems were experienced with the underground mine pumping system (which resulted in reduced pumping over a two week period), and a significant rainfall event (109mm), which occurred leading up to the flooding of MG04 back road area. RPS Aquaterra undertook an investigation to assess/determine the reasons for the mine flooding and increased pumping and to determine whether these phenomena represented increase inflows (and if so, why was there an increase in inflows).

It was concluded that the most likely explanation for the flooding, and consistent with observations of mine staff and the data reviewed, was the occurrence of pumping problems around the MG04 back road area, with a requirement for short-term over pumping to remove accumulated floodwaters. There was no evidence of connective cracking from the goaf to the surface that could rapidly transmit rainfall/runoff into the underground workings, and no observed increase inflows

anywhere elsewhere in the underground area. Therefore the flooding is not considered to be directly related to the high rainfall event (109mm) that occurred leading up to the flooding of MG04.

Glennies Creek Seepages

The extractions of LW6A and WL7A did not impact further to the baseflow losses from Glennies Creek and there were no increases in mine inflows (observed at TG1-A) during the period. Actual Glennies Creek Alluvium seepage inflow rates during the review period remained at around 0.66L/s and are well below the EIS prediction of 3.2L/s (0.29ML/d) and EA prediction of 2.6L/s (0.21ML/d) for this stage of the mining operation (Figure 17). The actual seepage rates have also continued to be less than the maximum rates contained in the SMP predictions (Aquaterra, 2010a).

Most of the impacts had stabilised prior to the end of LW1, and no incremental increase in measured seepage rate or influence from mining LW2 to LW7A has been observed. Rather, the plot of seepage inflows is indicating a downward trend, consistent with the gradual recovery in water levels at WML120A and other bores described in Section 2.4.2.

As indicated in Figure 17, the Glennies Creek Alluvium seepage inflow rate has been declining, while lowered groundwater levels in the barrier have been steadily recovering. This suggests a likely reduction in the permeability of the Pikes Gully seam within the barrier, possibly due to clogging by suspended fines, or a delayed benefit from the TG1-A rib grout injection program implemented during 2007.

Bowmans Creek Seepages

During the review period, LW6A and LW7A mining progressed beneath areas of saturated Alluvium. Although it was reported in the EIS, EA and SMP studies that seepage from the Bowmans Creek Alluvium was predicted to occur during this stage of mining, there has nevertheless been no observed mining-induced reduction in Alluvium saturated thickness or an increase in underground inflows, and hence no seepage loss from the Alluvium, as a result of mining.

The extraction of LW6A and LW7A has caused part of the Alluvium aquifer to subside. Hence there is likely to be fracturing both extending up from the goaf and near surface at the base of the Alluvium. Signs of cracking at the ground surface were observed around the edges of the subsidence trough (Figure 2).

Despite the likely presence of subsidence induced fracturing in the Permian beneath the Alluvium, intensive groundwater monitoring has showed no loss of groundwater storage observed in the Alluvium in that area.

Monitoring results collected during LW6A and LW7A extraction show temporary pressure responses in the coal measures (noted in VWP's WML111A and WML112A), but no dewatering of the uppermost sections of the coal measures (noted in standpipes WML111B and WML112B, which are screened to respective depths of 18m and 26m in the Permian Coal Measures). Despite the subsidence, these bores have continued to report water levels that are 8m and 16m above the screens respectively, indicating that this part of the sequence remains saturated, and therefore any fracturing at that site is not providing a direct hydraulic connection between the goaf and the base of the Alluvium.

Accordingly, the impact on Bowmans Creek Alluvium is less than predicted in the EIS (4.5L/s / 0.38ML/d), EA) and SMP (0.34L/s / 0.03ML/d) studies.

Hunter River Seepages

The EA and SMP studies predicted very small seepage losses of around 0.1L/s (<0.01ML/d) from the Hunter River Alluvium during the mining of LW6A to LW7A, which is considerably lower than the EIS prediction of 3L/s (0.27ML/d). However, no reduction in Alluvium storage has been observed during the review period, and consequently no seepage loss from the Hunter River Alluvium is likely to have occurred. Instead the water table in the Hunter River Alluvium has increased over the review period from above average rainfall.

The impact on Hunter River Alluvium has therefore been less than the EIS, EA and SMP predictions.

2.7 Groundwater Dependant Ecosystems

As the impacts on flows in Bowmans Creek, the Hunter River and Glennies Creek, and on groundwater levels within their associated Alluvium from mining of the PG seam are negligible, it is very unlikely that there would be any impact on any groundwater dependant ecosystems associated with those water courses and their floodplain areas. Two stands of River Red Gum have been recorded, which are located next to the creek between the southern end of the western diversion and the Hunter River, however there were no groundwater related impacts observed in this area over the review period.

3. GROUNDWATER MODEL REVIEW

In accordance with Consent Condition 4.14, the performance of the groundwater system in response to mining operations was compared with predicted impacts that were made in the groundwater impact assessment reports for the EIS and EA. The actual impacts were also compared with impacts predicted in the groundwater report accompanying the LW7A SMP variation application (Aquaterra, 2010a).

The groundwater model used for the EIS studies has been modified to allow better definition of subsidence related impacts of underground mining. The modifications 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).

Successful calibration of the model was undertaken, and the model then used to predict the potential impacts of future mining in the LW/MW 5-9 SMP area (Aquaterra, 2008a). The calibration of this model was subsequently refined as part of the groundwater impact assessment for the proposed Bowmans Creek Diversion EA (Aquaterra, 2009), and the subsequent LW7A SMP variation (Aquaterra, 2010a). In order to maximise access to the coal reserve, the proposal that is covered by the SMP groundwater assessment involved longwall panel extraction from LW7A in the PG Seam, as described within the Section 75 'Bowmans Creek Diversion' impact assessment.

The additional modifications that have been incorporated into the latest models (since the DC was first granted) have resulted in an improved simulation of mine inflows (as shown on Figure 17) and some minor reductions of predicted impacts, specifically in terms of baseflow impacts to Glennies Creek (as shown on Figure 17), Bowmans Creek and the Hunter River.

The 2009 and 2010a modelling predicted no further increase in seepage from the Glennies Creek Alluvium with ongoing mining of the Pikes Gully seam. This is consistent with observed inflows from the Glennies Creek Alluvium into LW1 which has reduced to around 0.66L/s (0.06ML/d). This is considerably less than the 3.2L/s (0.29ML/d) predicted in the EIS during extraction of the Pikes Gully seam.

The 2009 and 2010a models predict that losses from Bowmans Creek will commence during the mining of LW6A, and result in a change from gaining about 0.34L/s (0.03 ML/d) to losing about 0.34L/s (0.03ML/d) by the end of mining in LW8. This net impact of 0.7L/s (0.06ML/d) is less than one seventh of the impacts predicted in the EIS, and reflects the greater understanding of the nature and level of risk associated with the hydrogeology at the site.

A comparison of actual impacts with EIS, EA and SMP for LW7A predictions over the 2010-11 reporting period showed the following:

- Average groundwater inflows to the underground (4.7L/s / 0.4ML/d)) were below inflow rates predicted in the EIS (18L/s / 1.5ML/d) EA (16L/s / 1.4ML/d) and SMP (16L/s / 1.4MLd).
- Most of the seepage inflows from Glennies Creek Alluvium had stabilised prior to the end of LW1, and no significant incremental impact or influence from mining LW2 to LW7A has been observed. Seepage inflows to the underground mine from Glennies Creek Alluvium (0.66L/s) have continued to be below the rates predicted in the EIS (3.2L/s / 0.29ML/d) and EA
  (2.6L/s / 0.21ML/d).
- Groundwater level drawdown in the Glennies Creek Alluvium has been significantly less than predicted in the EIS and consistent with EA predictions. Groundwater levels in bore WML120B (between Glennies Creek and LW1) indicated a residual net drawdown of about 0.4m by the completion of LW7A, well below the EIS prediction of 2.2m for this locality by this stage of mining. There was no evidence of any drawdown in the Alluvium east of Glennies Creek.
- Groundwater level drawdown in the Bowmans Creek Alluvium above LW6A and LW7A has been significantly less than predicted in the EIS, EA and SMP (0.5 – 2.0m). The current observations show no permanent drawdown impact on Bowmans Creek Alluvium (i.e. parts

of PG LW6A and LW7A) where mining has occurred beneath saturated Alluvium.

- Although mining of LW6A and LW7A occurred beneath parts of the Bowmans Creek Alluvium, there was no reduction in Alluvium storage, and hence no baseflow impacts on Bowmans Creek have been observed to date. Accordingly, the baseflow impact on Bowmans Creek was less than predicted in the EIS (4.5L/s / 0.38ML/d), EA and SMP (0.34L/s / 0.03ML/d) studies.
- No reduction in the Hunter River Alluvium storage during LW6A and LW7A extraction, and hence no seepage losses from Hunter River Alluvium have been observed to date. The impact has therefore been less than the EIS (3L/s 0.27ML/d) EA and SMP (0.1L/s / 0.01ML/d) predictions.
- Total groundwater inflows to the underground were not observed to increase significantly through direct recharge via open surface subsidence cracks above LW1 to LW7A during any of the rainfall events during the 5+ years of LW mining.

In summary, all groundwater-related impacts from underground mining during the review period were below the levels predicted in the groundwater impact reports for the 2001 EIS, 2009 EA and 2010 SMP for LW7A. As such, the monitoring results have shown that the LW extractions have been completed in full compliance with Development Consent Condition 3.9.

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FIGURES

316000 318000 320000

6406000

6404000

WML115C T6 WML115B T5 WMLP328 WMLP324 RA30 LW8 T7 RSGM1 RM09 RM08 T1-AT1-P WML21 WMLP299 WMLP312 LW7B LW6B WMLP311 WMLP323 RM05 RM06 RM07 WMLP300 RA20 WMLP314 WMLP315 RA18 WMLP320 RM04 RM10 WMLP316 T2-AT2-P RA02 WML114A WML114B LW7A LW6A RA17 RM03 LW5 LW4 LW3 LW2 LW1 RA15 RA16 T3-AT3-P RA14 WML113B WML113C RM02 WML113A WML112C T10 WML112B RA12 WML112A T4-AT4-P RA10 WML110C WMLP276 RA8 WML110B WML213 WMLP326 WMLP327 RM01 WML109B WMLP275 WML175 WMLP279 WML109A WML108B WMLP277 WML108A WMLC333 WMLP278 WML107A WML107B WMLP280 RA27 WML180 WML106 WML189 WML191 WML19 WML174 G3A WML172 WML173 WML245 WML186 WML261 WMLC248 WML185 WML120B WMLP302 WML184 WML246 WML247 WML183 WML250 AP242 WML249 WMLC144 WML182 WML239 WML240 WML181 WML262 WMLP301 WML119 WML83 WML294 WML253 WML252 AP247 WML129 AP243 AP244 AP245 WML241 WML243 AP246 WML256

Ashton Coal Operations Ltd

LEGEND

Monitoring Bores

Type

- Stand pipe
- Test bore
- Vibrating wire
- Well

Mine Plan (Pikes Gully)

Alluvium boundary

Saturated alluvium boundary

Pikes Gully Mining Completed to Sep 2011

N

0 250 500 1,000 Meters

RPS Aquaterra

FIGURE 1

Ashton Coal
Groundwater Monitoring Network
18/1/2012

AUTHOR	JVDA	PROJECT NO	S56
CHECKED BY		REVISION	1
DATE	16/01/2012	DRAWING NO	033b

318000

6404000

318000

LEGEND

Monitoring Bores

Type

- Stand pipe
- Test bore
- Vibrating wire
- Well
- Mapped surface cracking
- Mine Plan (Pikes Gully)
- **Alluvium boundary**
- **Saturated alluvium boundary**
- Pikes Gully Mining Completed to Sep 2011

N

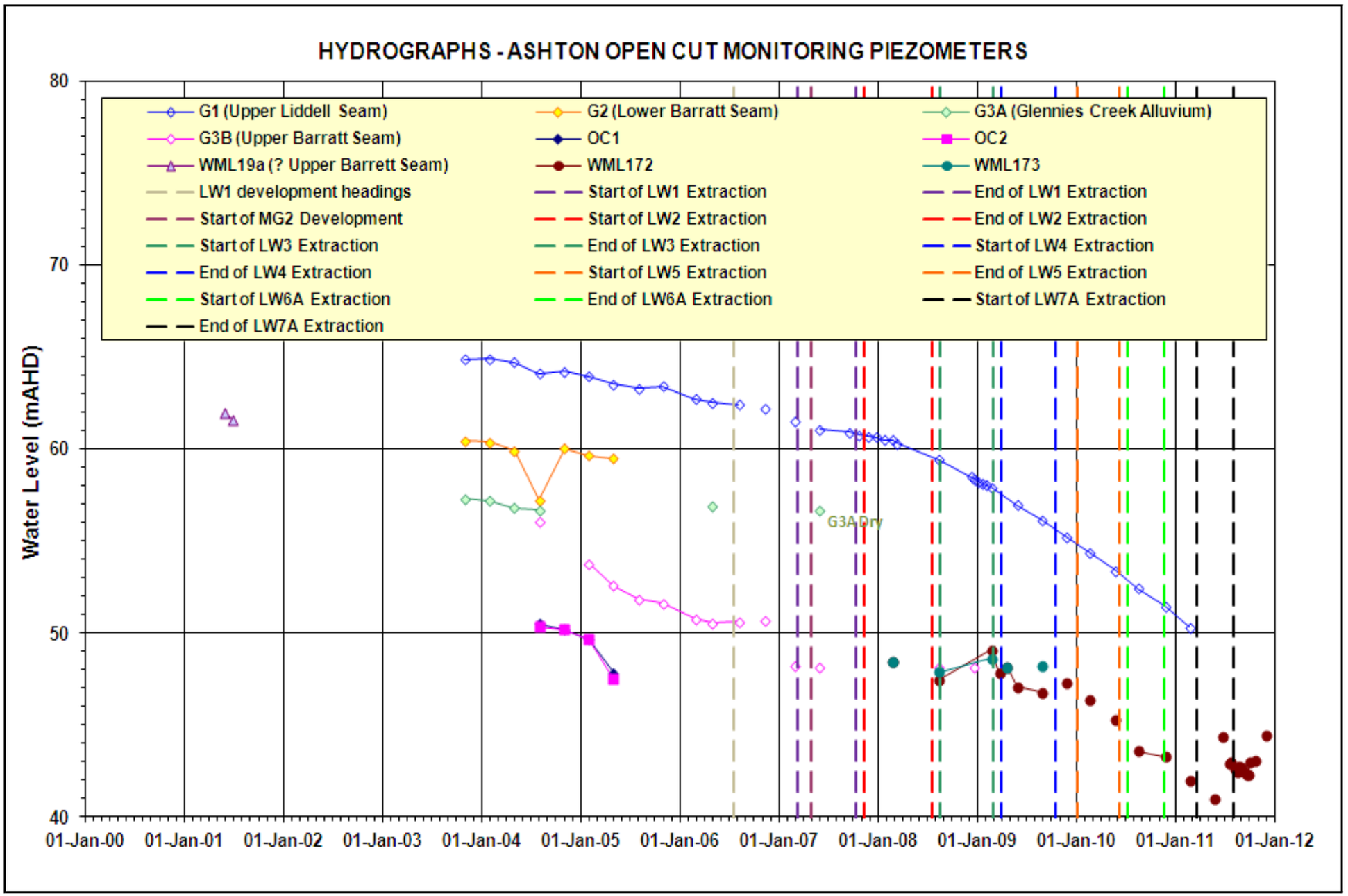
0 100 200 400 Meters

RPS Aquaterra

FIGURE 2

Ashton Coal
Groundwater Monitoring Network
Around LW6A and LW6B
18/1/2012

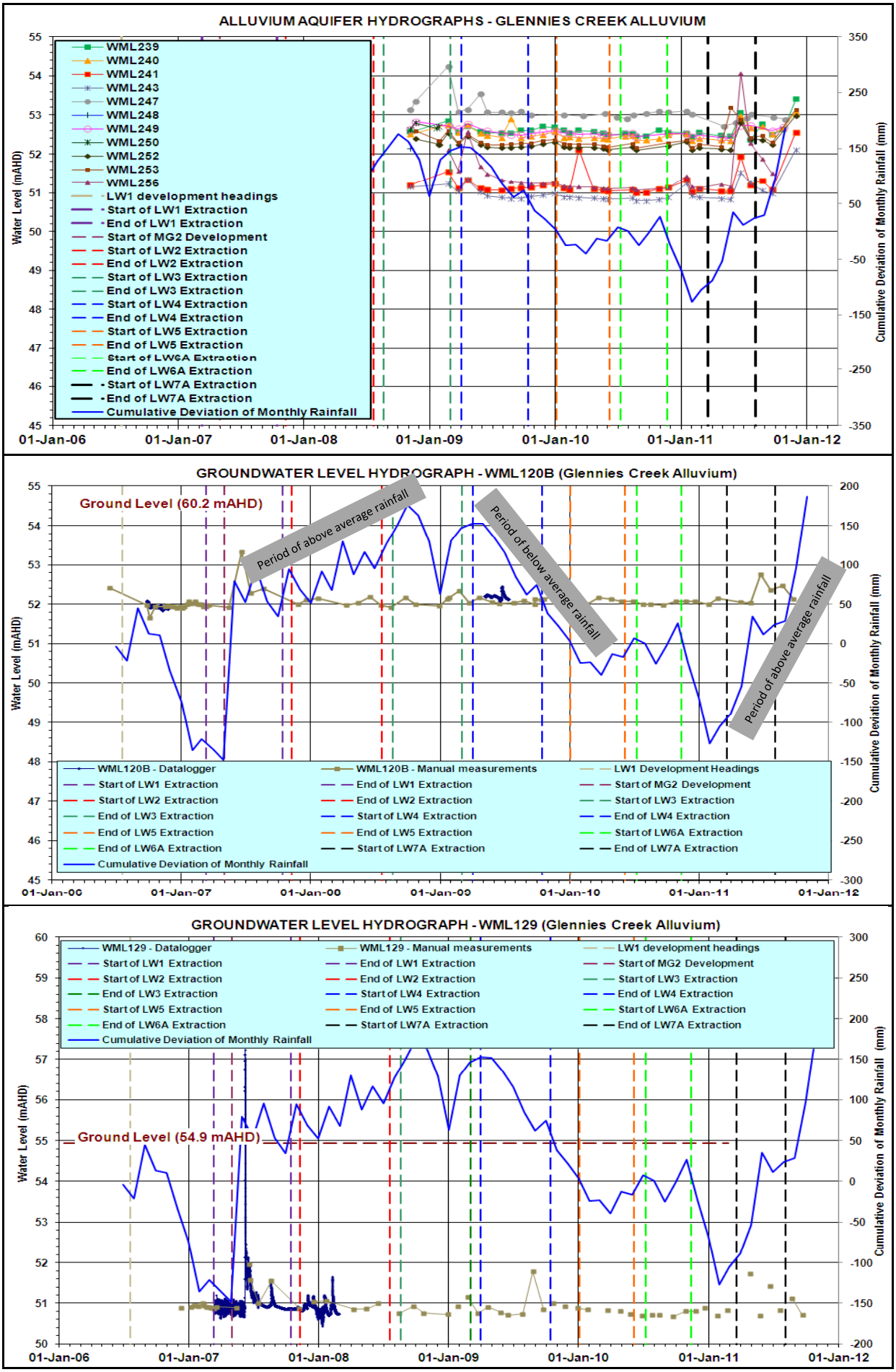
AUTHOR	JVDA	PROJECT NO	S56
CHECKED BY		REVISION	1
DATE	16/01/2012	DRAWING NO	033a



RPS Aquaterra

GROUNDWATER LEVEL HYDROGRAHS - OPEN CUT MONITORING BORES FIGURE 3

F:\Jobs\S56\S56C\300\Figures 2010_11\[Ashton_hydrographs_AEMR_2011_report.xlsx]Fig2



GROUNDWATER LEVEL HYDROGRAPHS - GLENNIES CREEK ALLUVIUM FIGURE 4

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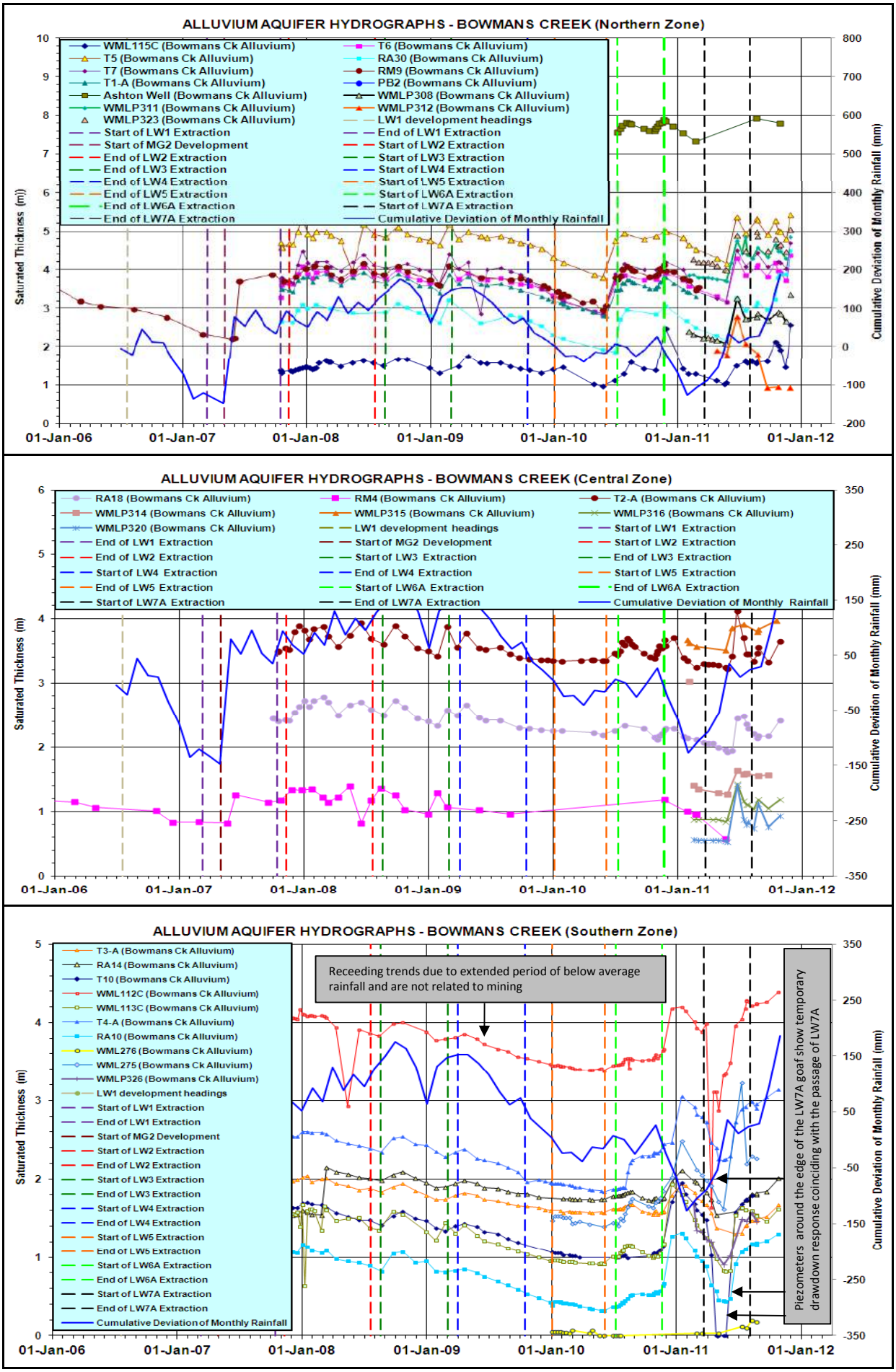

RPS Aquaterra

GROUNDWATER LEVEL HYDROGRAPHS - BOWMANS CREEK ALLUVIUM FIGURE 5

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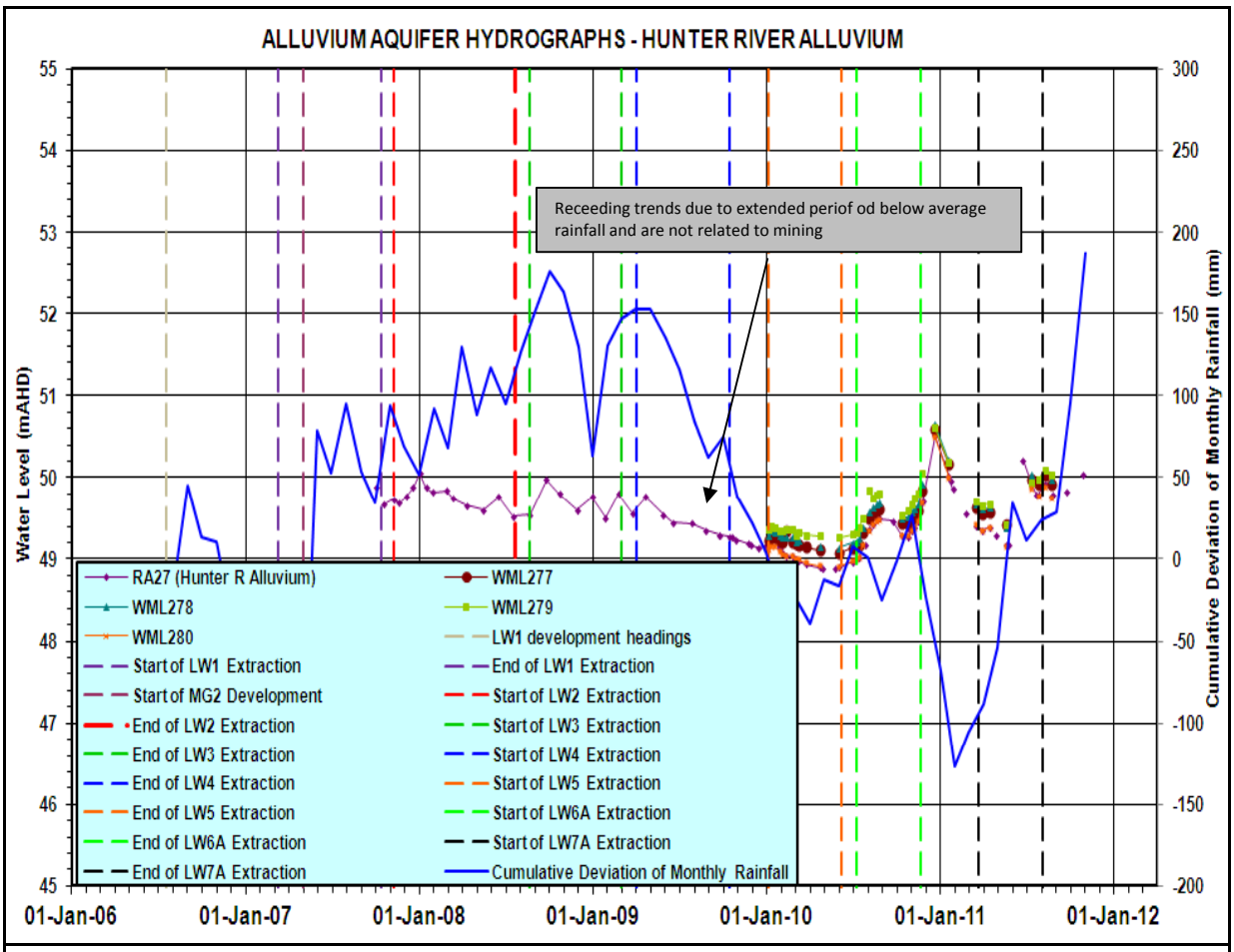
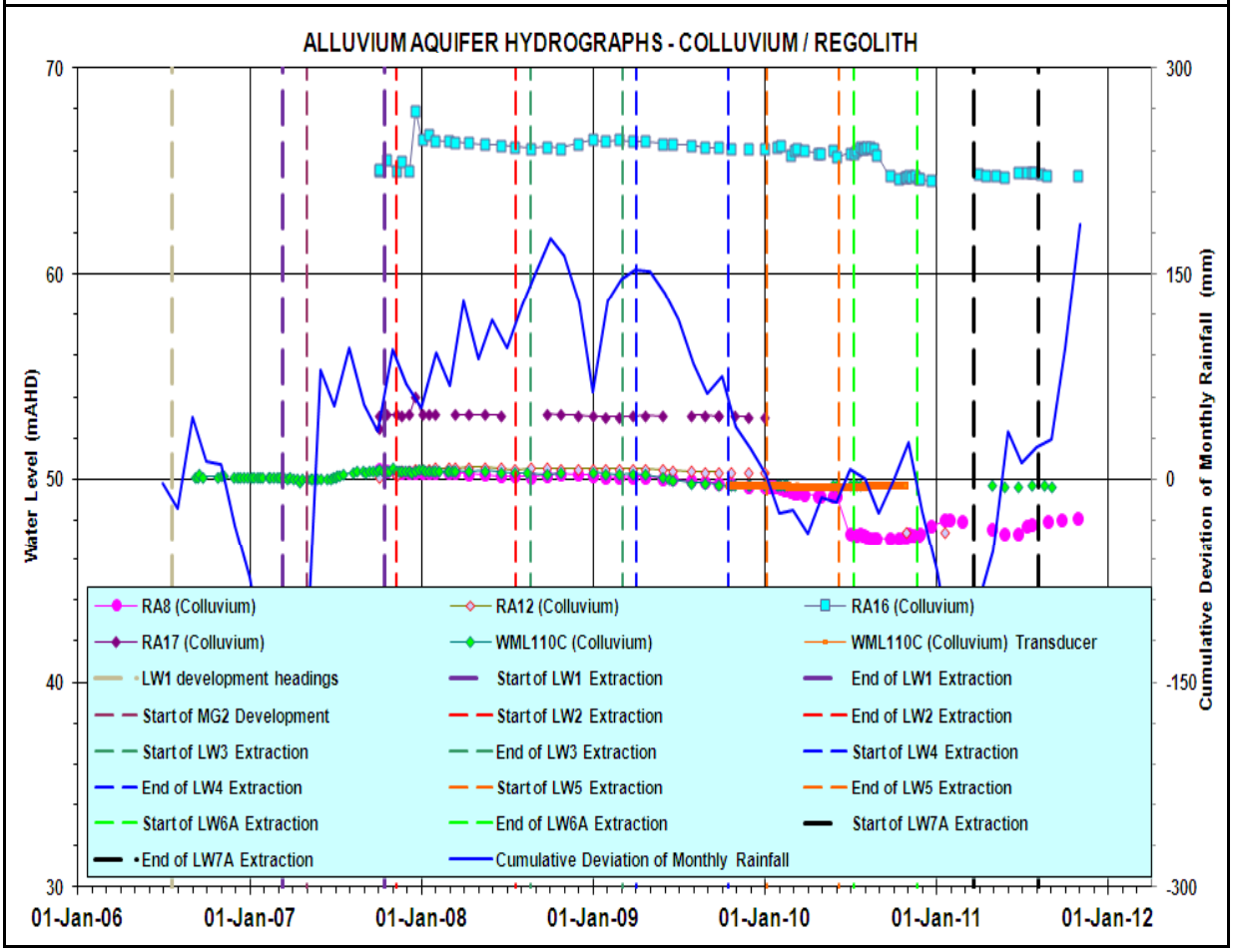
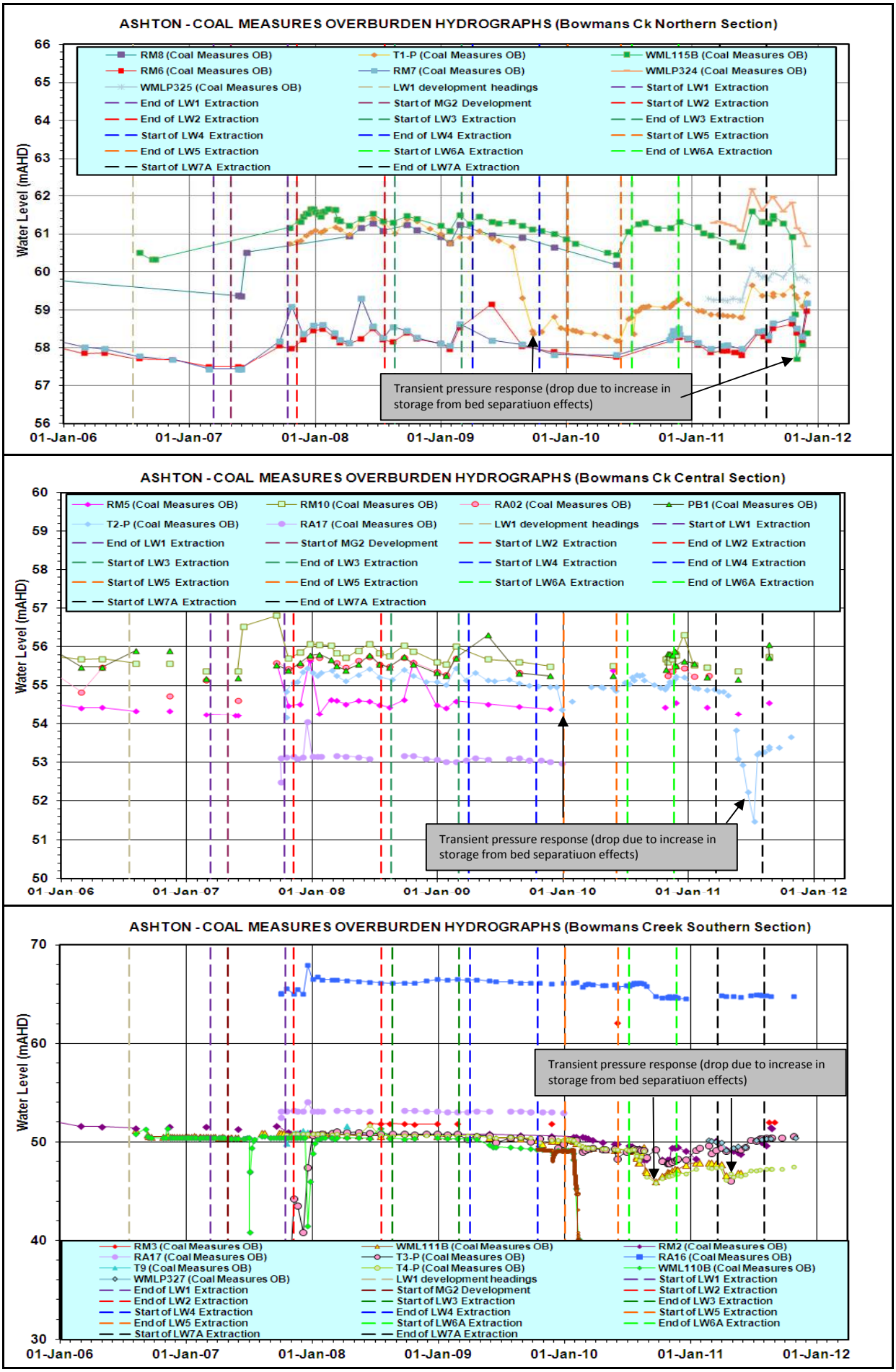




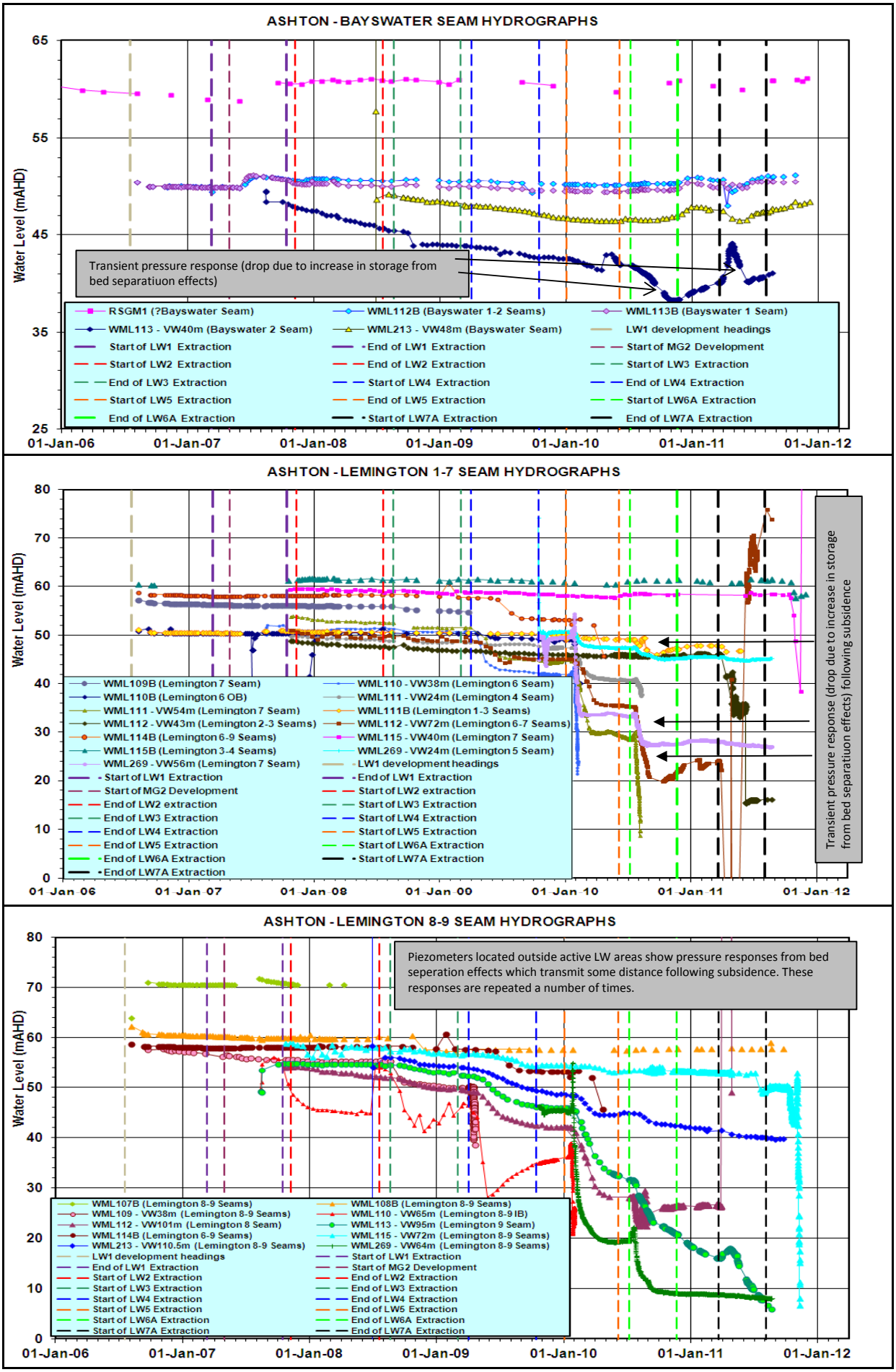
GROUNDWATER LEVEL HYDROGRAPHS - HUNTER RIVER ALLUVIUM AND BOWMANS CREEK COLLUVIUM/REGOLITH FIGURE 6

F:\Jobs\S56\S56C\300\Figures 2010_11\[Ashton_hydrographs_AEMR_2011_report.xlsx]Fig5



GROUNDWATER LEVEL HYDROGRAPHS - WEATHERED NEAR-SURFACE COAL MEASURES OVERBURDEN FIGURE 7

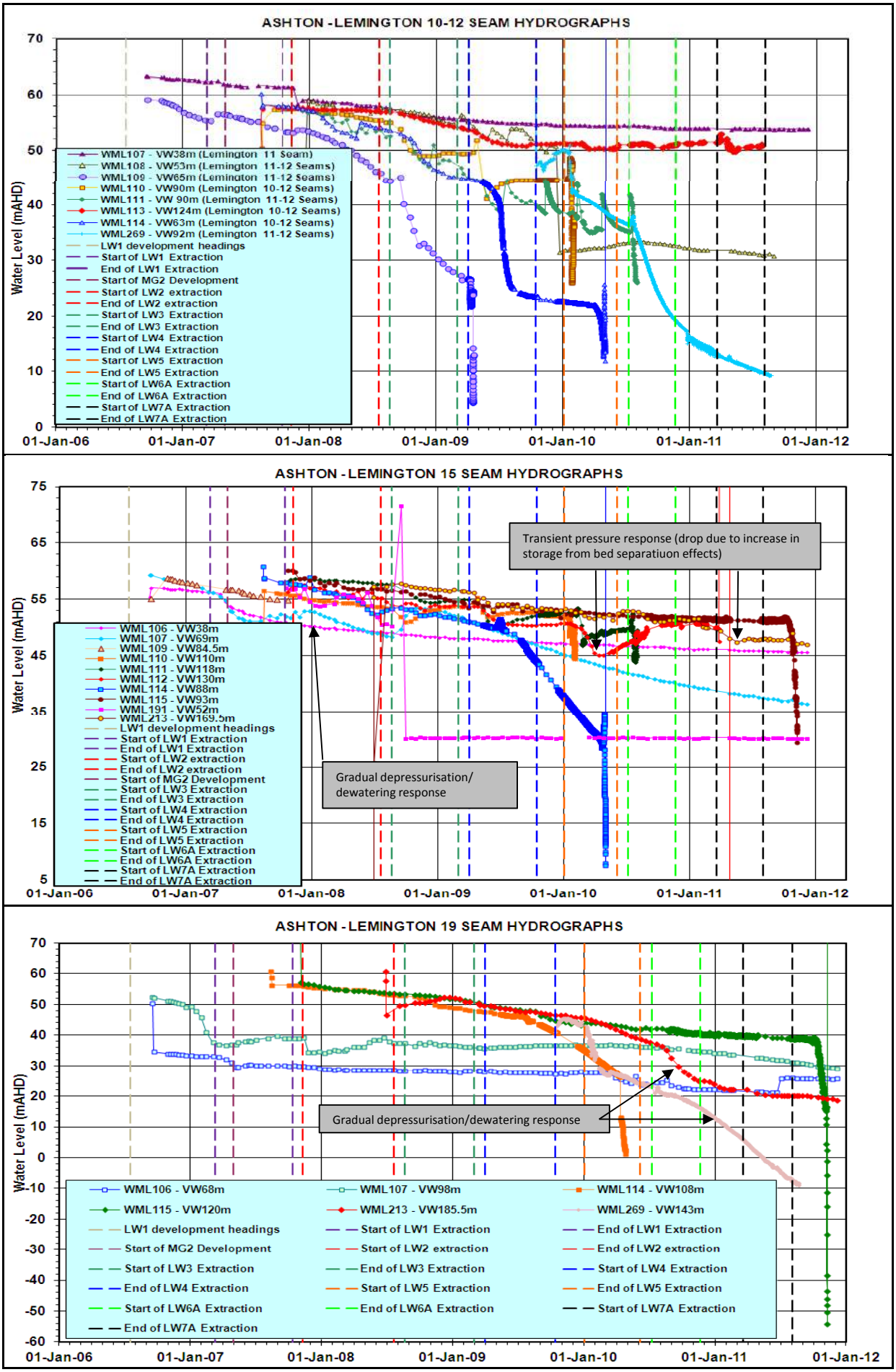
F:\Jobs\S56\S56C\300\Figures 2010_11\[Ashton_hydrographs_AEMR_2011_report.xlsx]Fig6



GROUNDWATER LEVEL HYDROGRAPHS - BAYSWATER SEAM AND LEMINGTON 1-9 SEAMS Figure 8

RPS Aquaterra

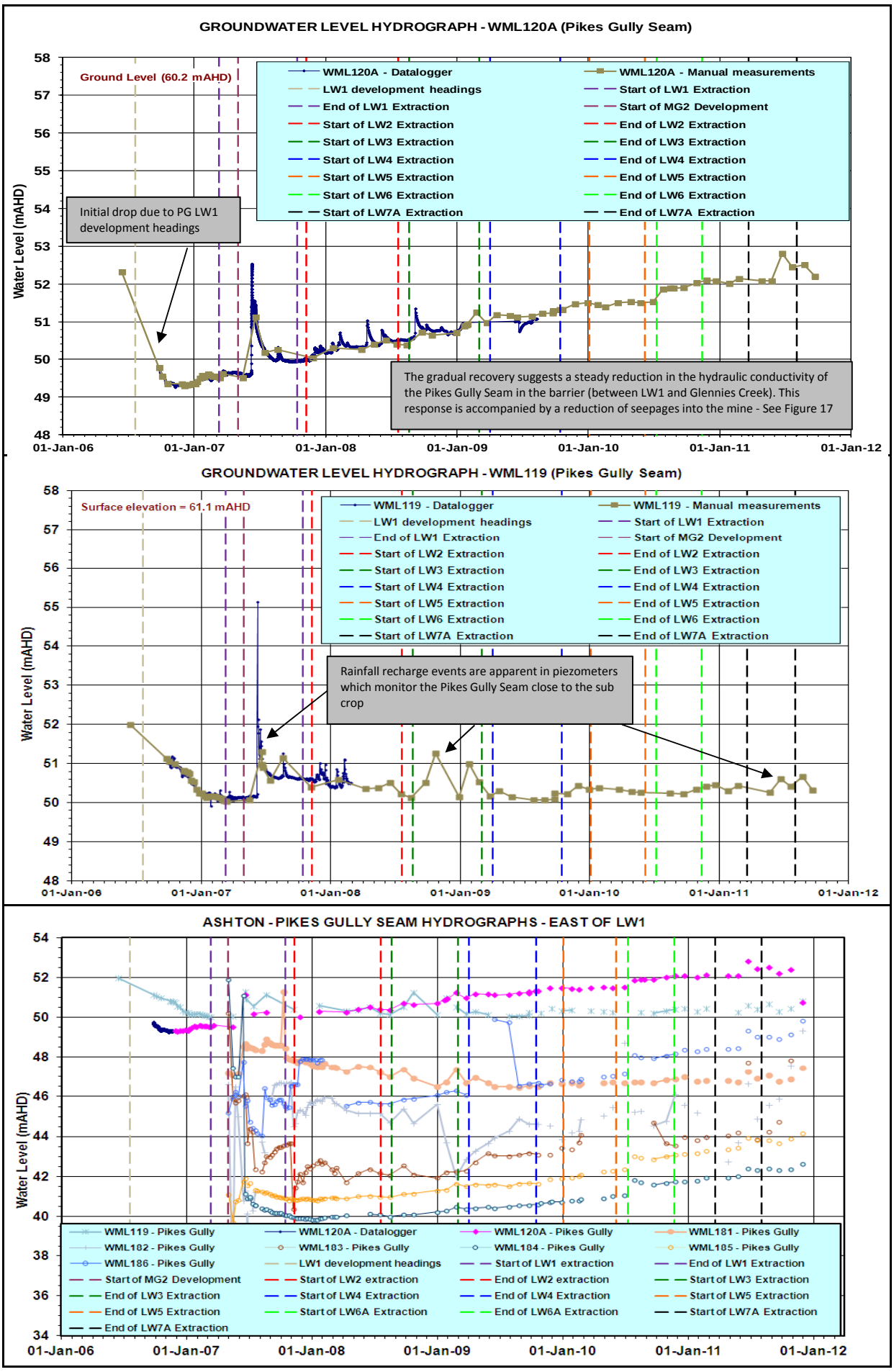
F:\Jobs\S56\S56C\300\Figures 2010_11\[Ashton_hydrographs_AEMR_2011_report.xlsx]Fig7



RPS Aquaterra

GROUNDWATER LEVEL HYDROGRAPHS - LEMINGTON 10-19 SEAMS FIGURE 9

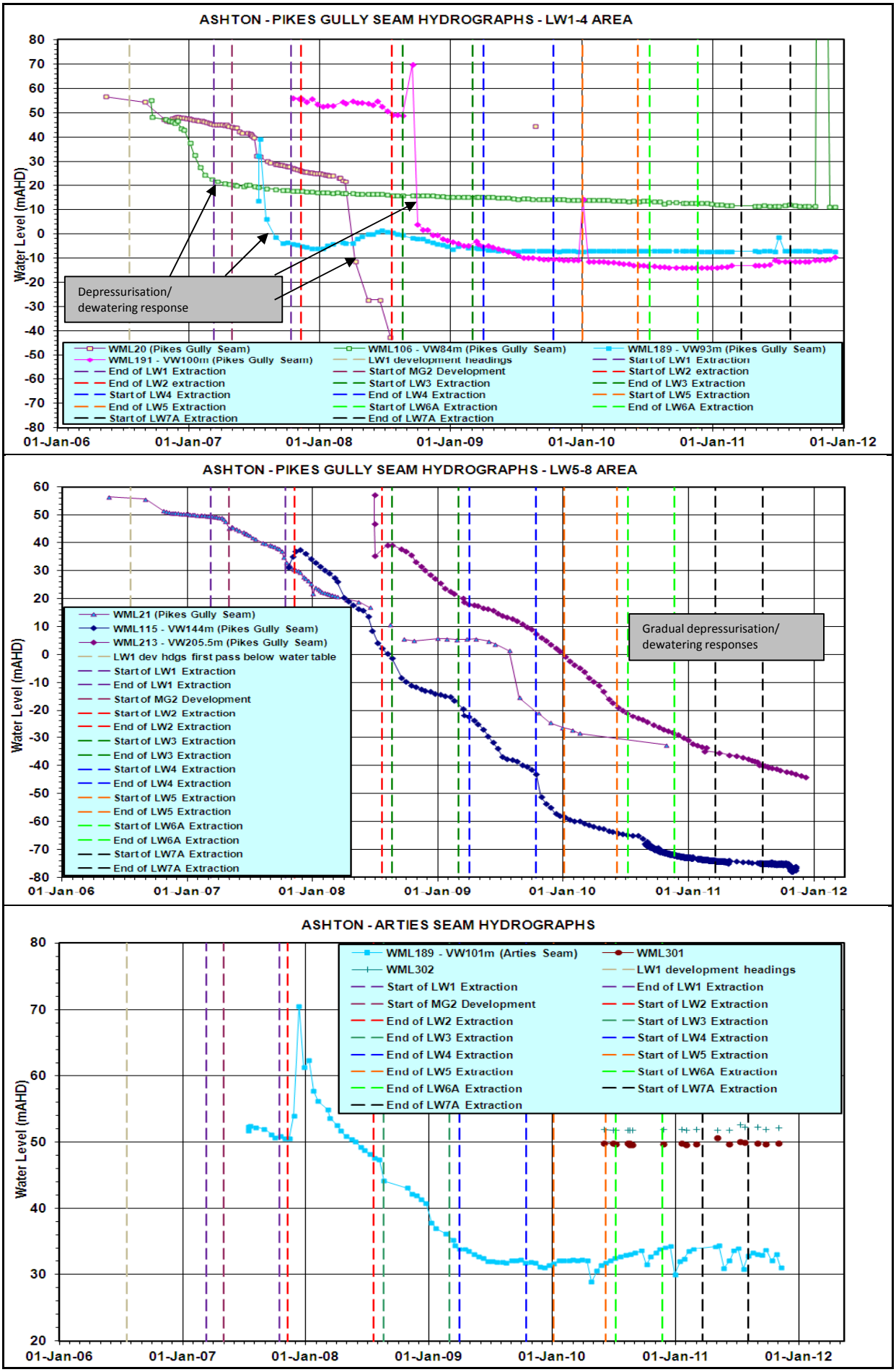
F:\Jobs\S56\S56C\300\Figures 2010_11\[Ashton_hydrographs_AEMR_2011_report.xlsx]Fig8



GROUNDWATER LEVEL HYDROGRAPHS - PIKES GULLY SEAM EAST OF LW1

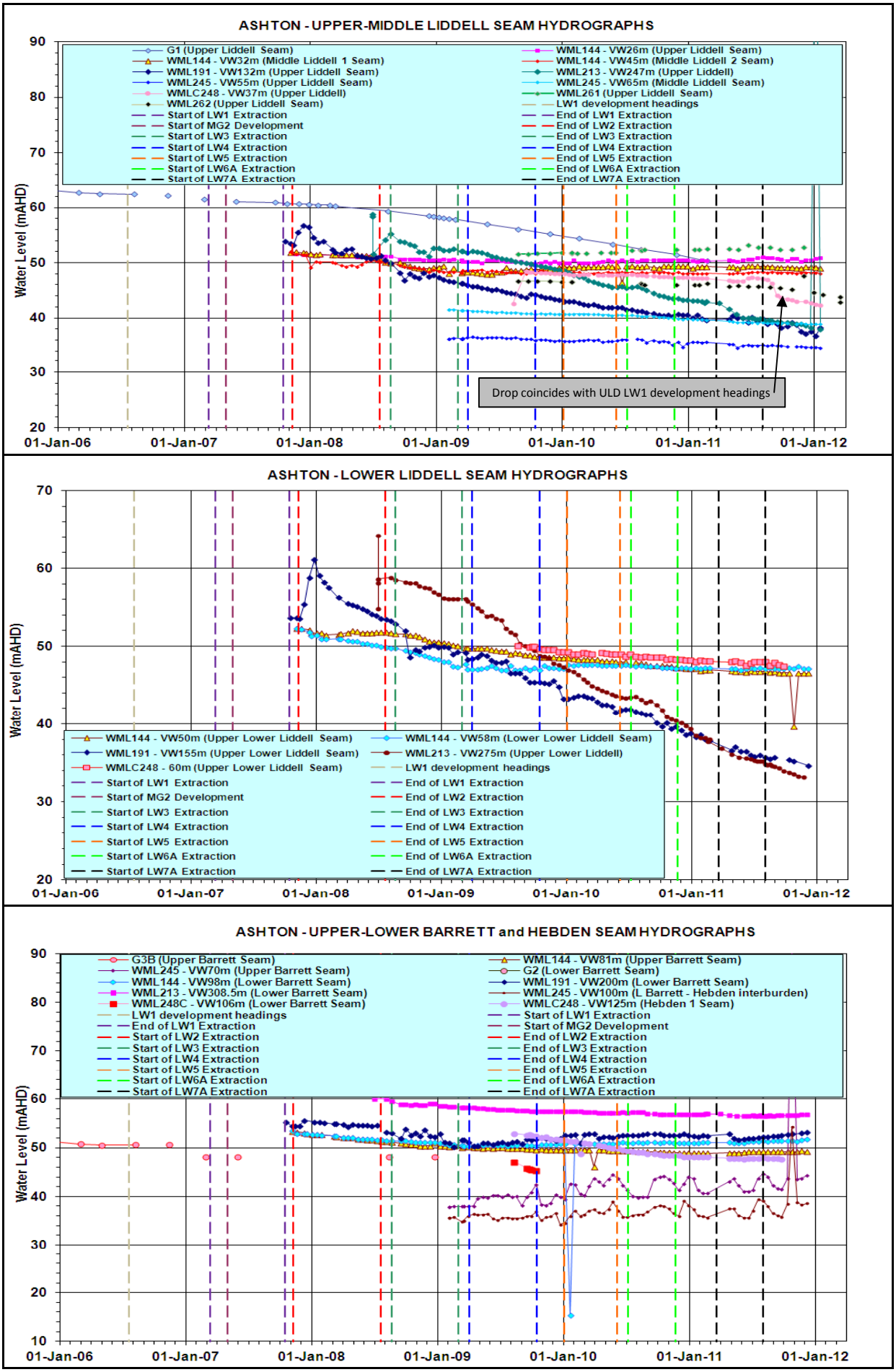
FIGURE 10

F:\Jobs\S56\S56C\300\Figures 2010_11\[Ashton_hydrographs_AEMR_2011_report.xlsx]Fig9



GROUNDWATER LEVEL HYDROGRAPHS - PIKES GULLY SEAM IN THE UNDEERGROUND MINING AREA AND ARTIES SEAM FIGURE 11

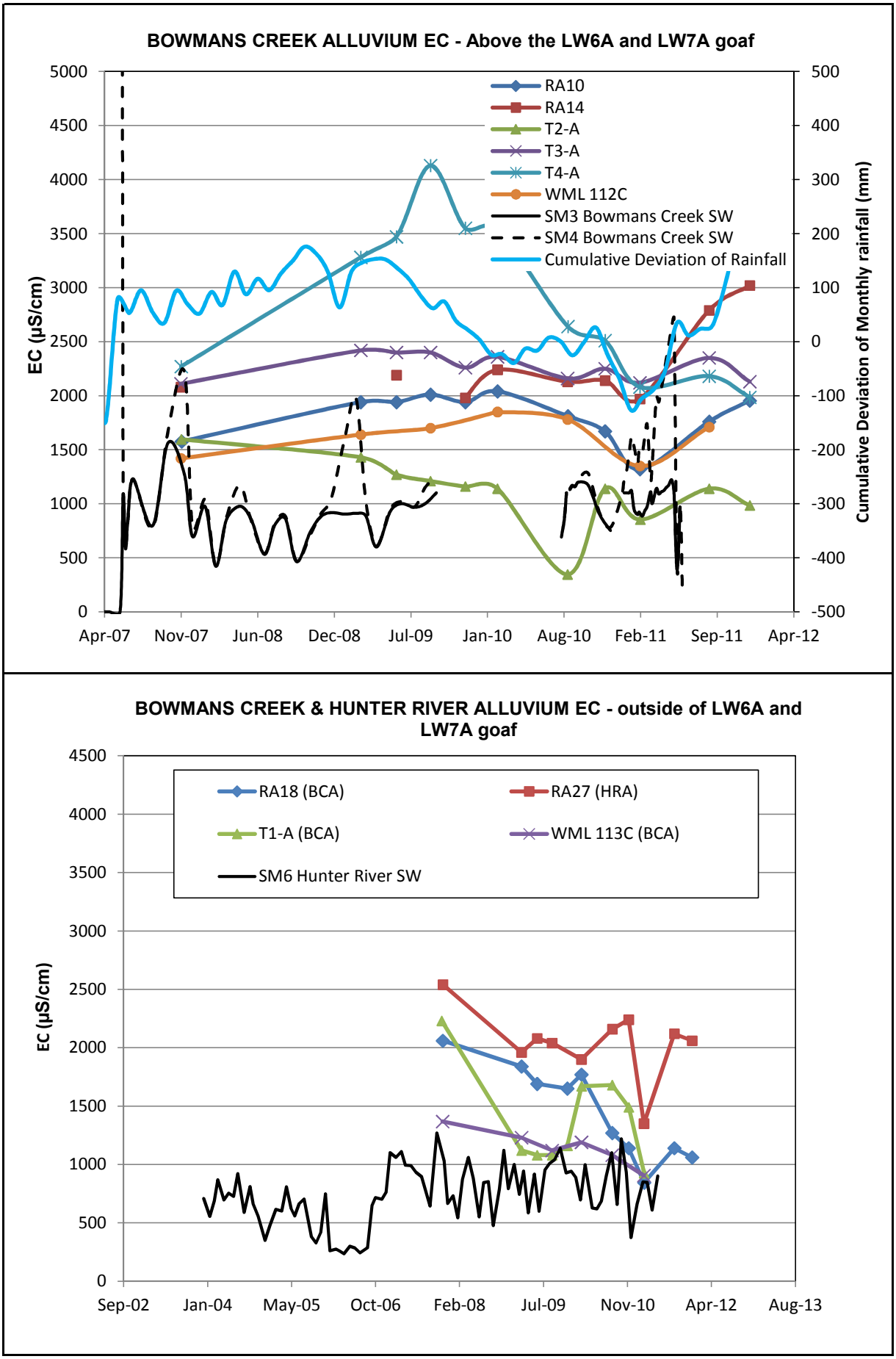
F:\Jobs\S56\S56C\300\Figures 2010_11\[Ashton_hydrographs_AEMR_2011_report.xlsx]Fig10



GROUNDWATER LEVEL HYDROGRAPHS - LIDDELL AND BARRETT SEAMS

FIGURE 12

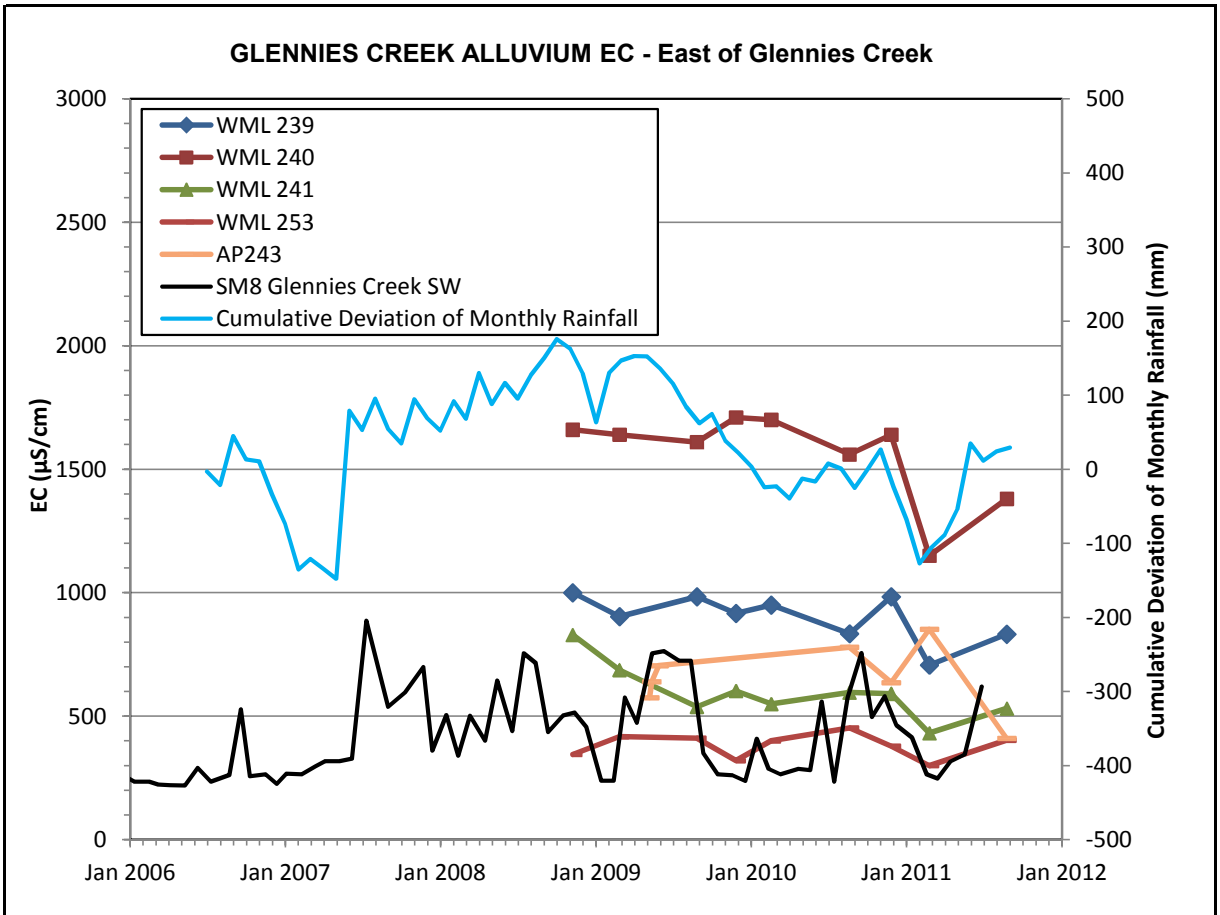
F:\Jobs\S56\S56C\300\Figures 2010_11\[Ashton_hydrographs_AEMR_2011_report.xlsx]Fig11

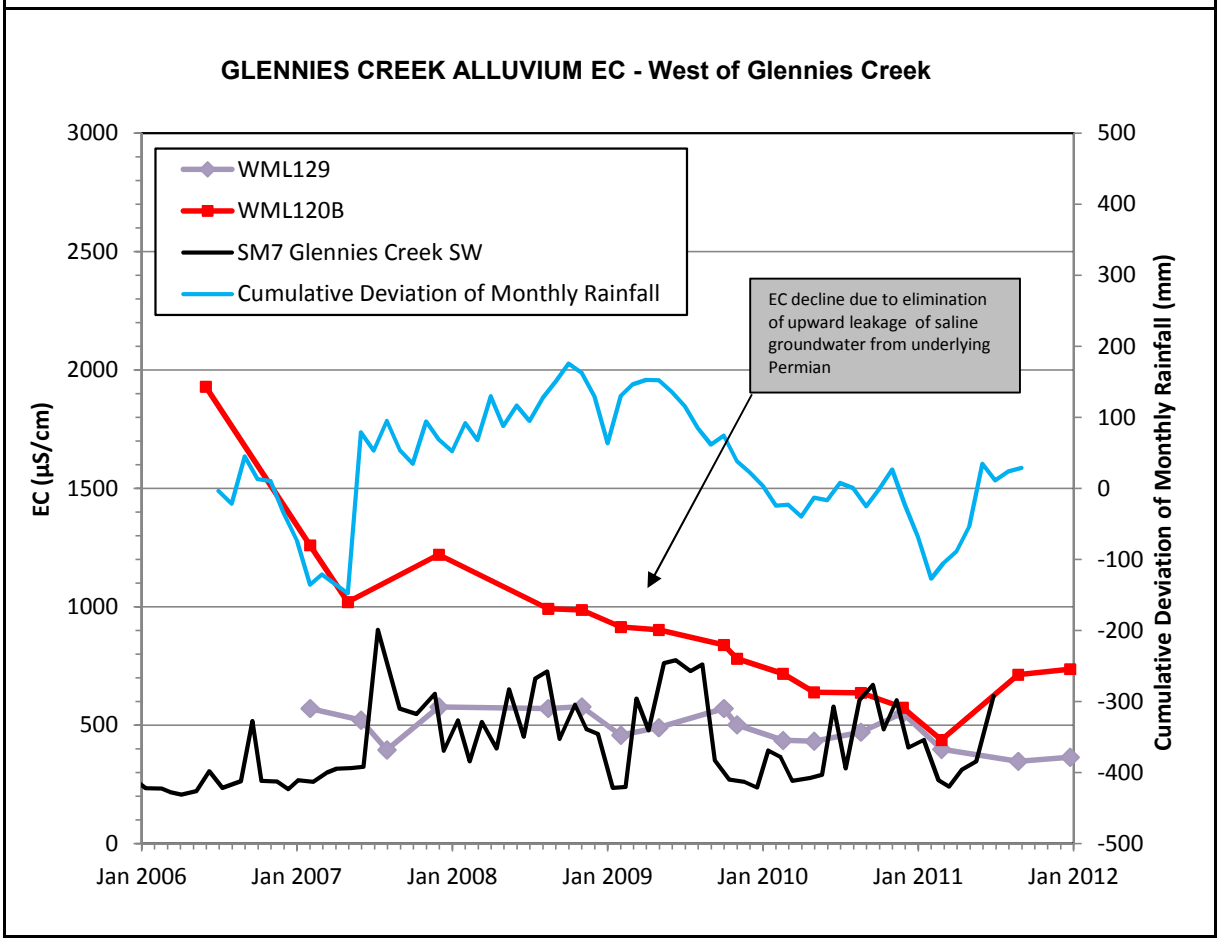


RPS Aquaterra

GROUNDWATER SALINITY - BOWMANS CREEK & HUNTER RIVER ALLUVIUM FIGURE 13

F:\Jobs\S56\S56C\300\Figures 2010_11\[FIG 12 BCA.xlsx]2graphs

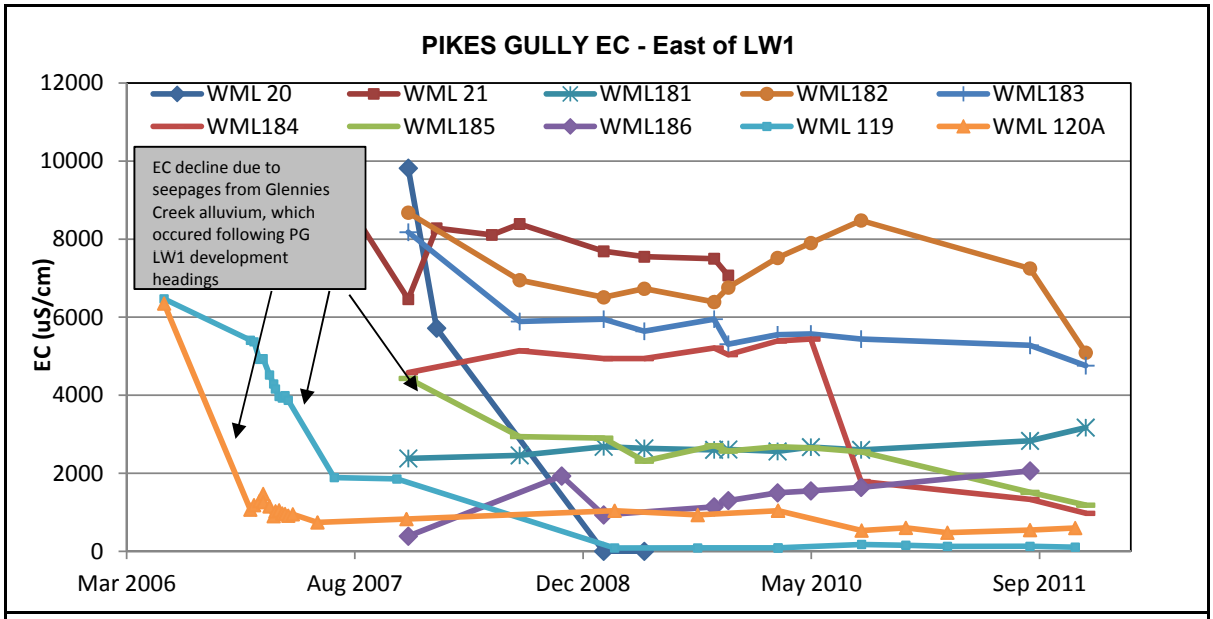


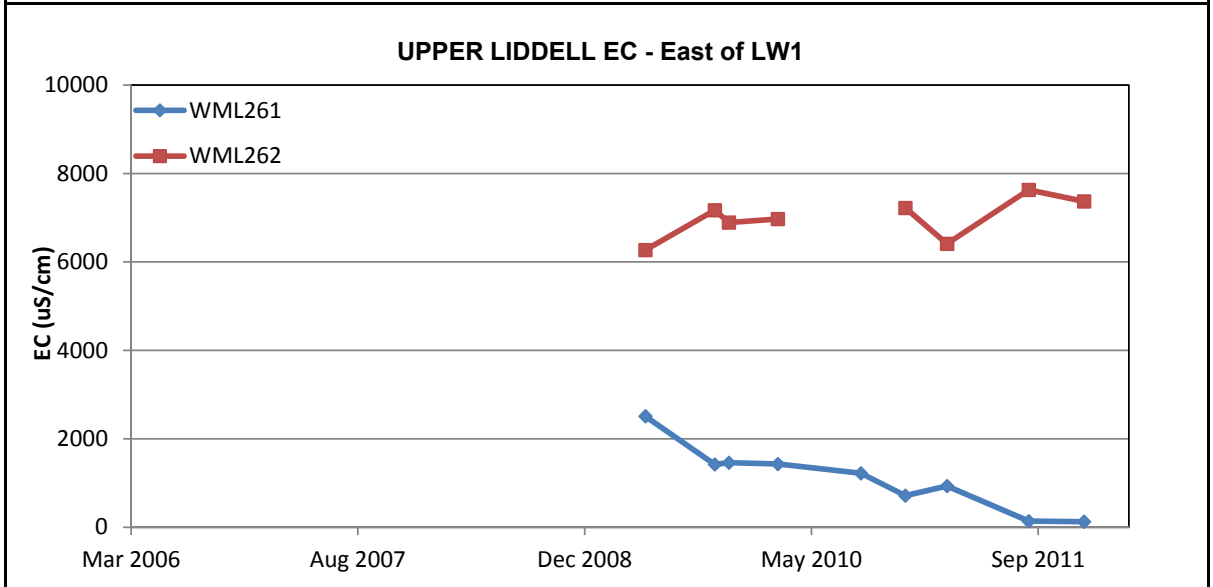


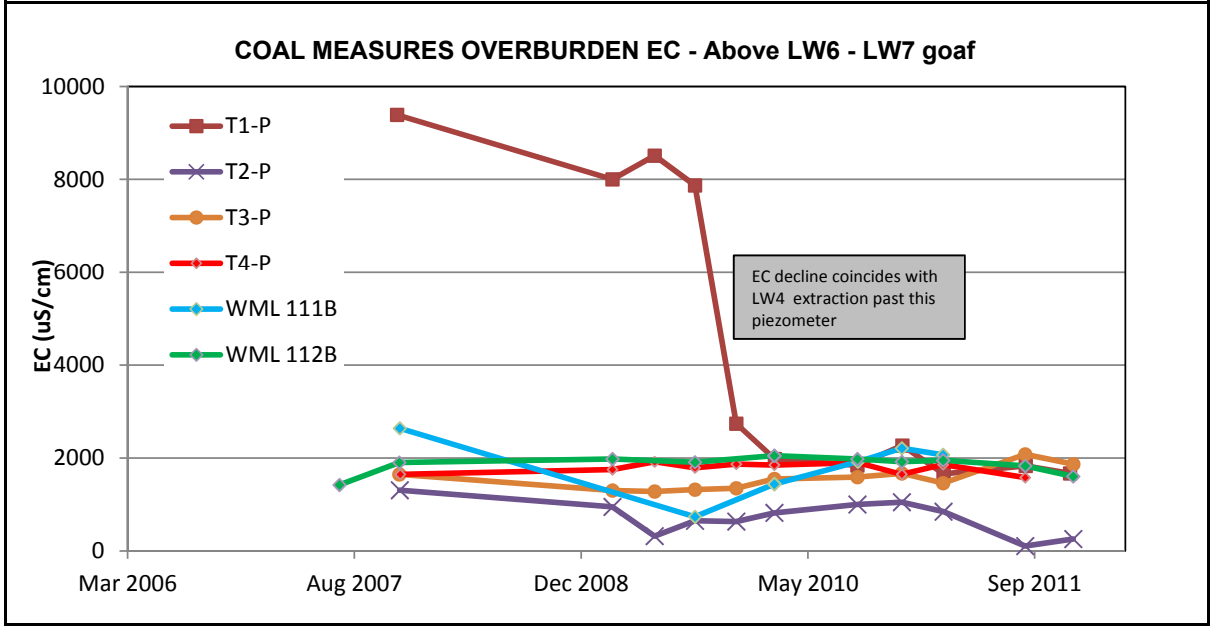
RPS Aquaterra

GROUNDWATER SALINITY - GLENNIES CREEK ALLUVIUM FIGURE 14

F:\Jobs\S56\S56C\300\Figures 2010_11\[FIG 13 GCA.xlsx]2graphs



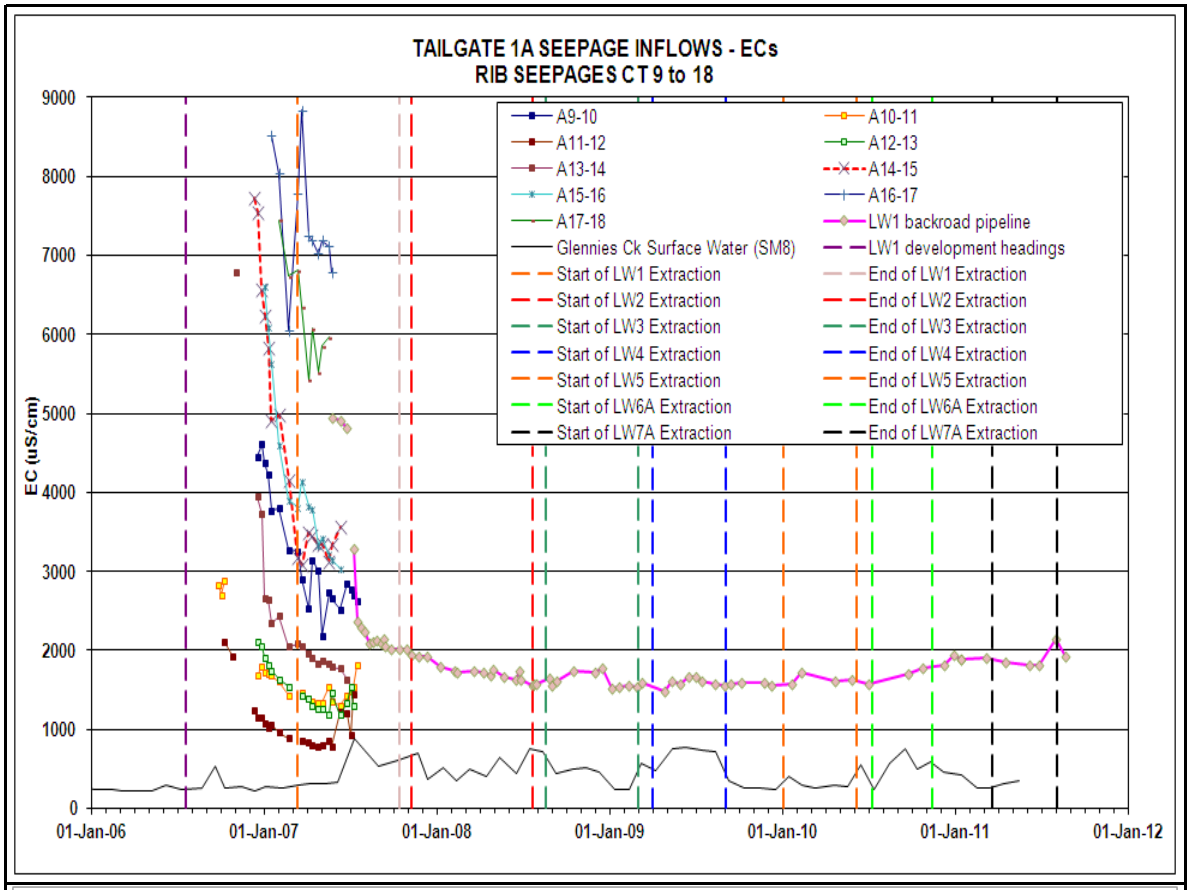


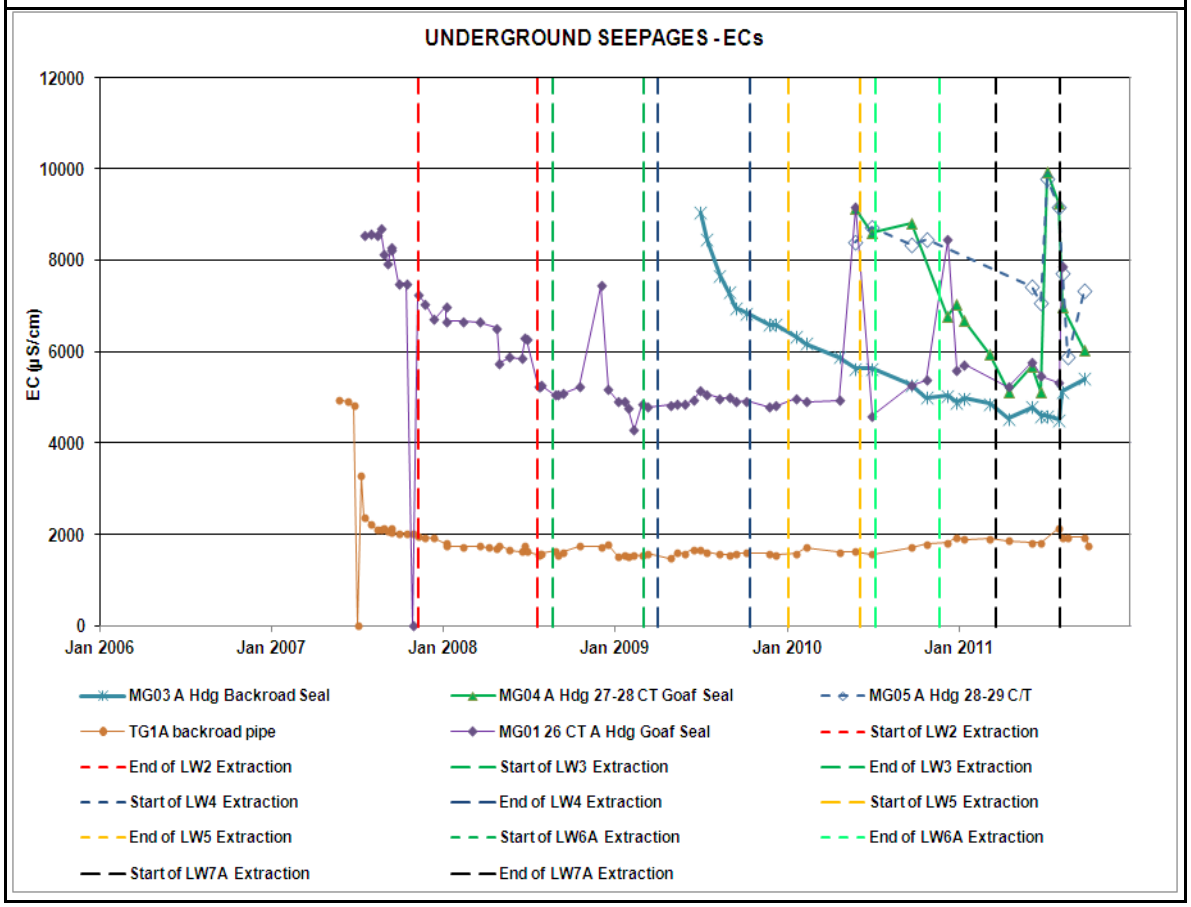


RPS Aquaterra

GROUNDWATER SALINITY - PIKES GULLY, UPPER LIDDELL & CMO FIGURE 15

F:\Jobs\S56\S56C\300\Figures 2010_11\[FIG 14 PG ULD CMO.xlsx]3graphs





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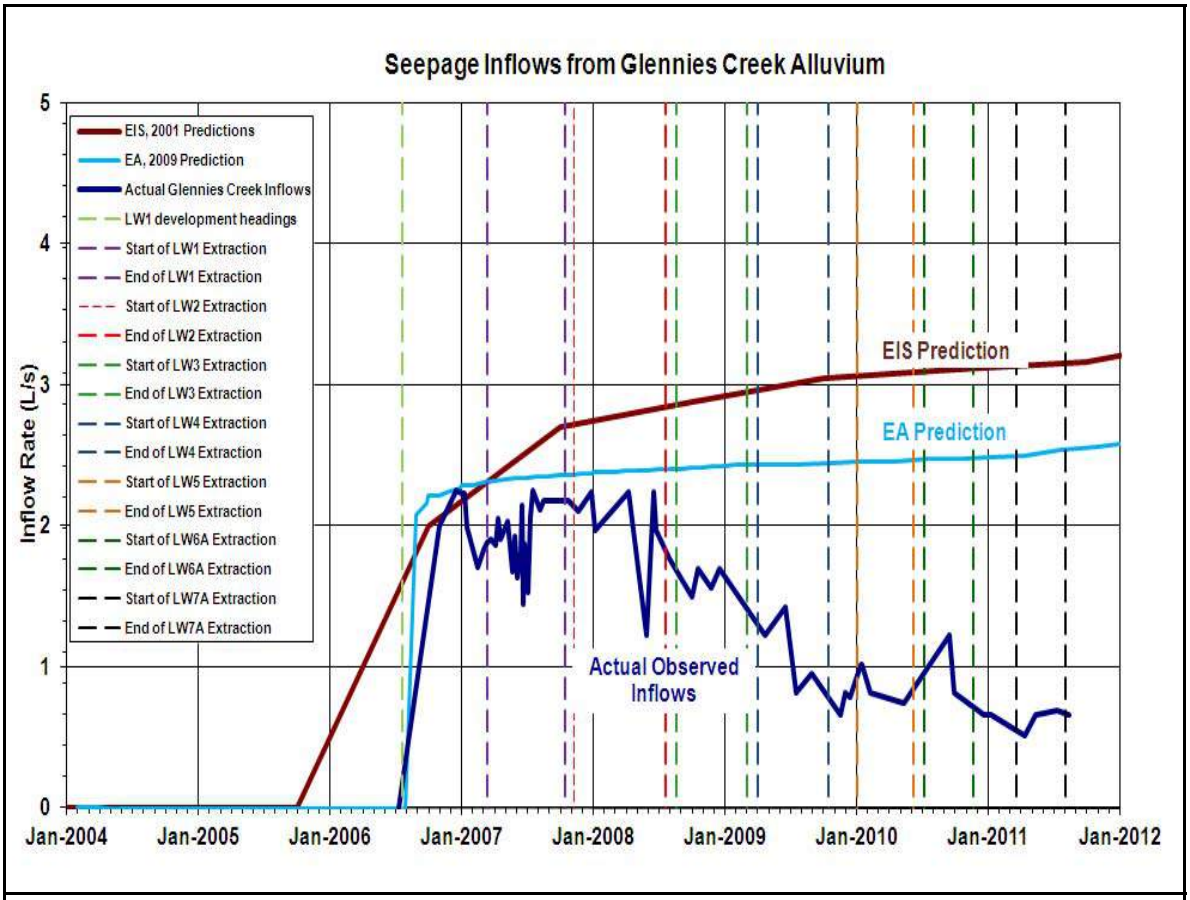
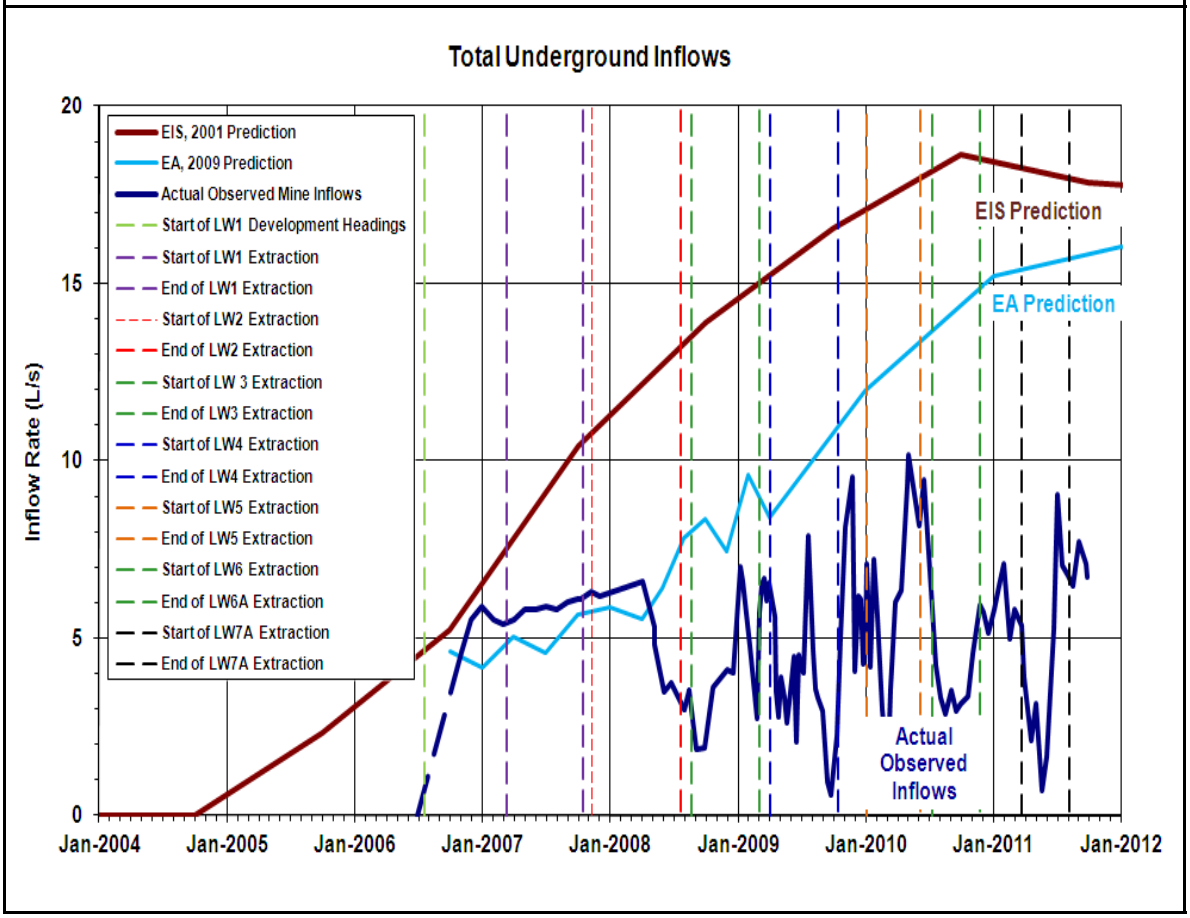
UNDERGROUND SEEPAGE EC's FIGURE 16

F:\Jobs\S56\S56C\300\Figures 2010_11\[FIG 15 UG SEEPAGES.xlsx]2graphs





ASHTON UNDERGROUND MINE– GROUNDWATER INFLOW v EIS & EA PREDICTIONS FIGURE 17

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APPENDIX 3

BLAST MONITORING DATA

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2010 – 2011 Blast Vibration and Overpressure Results							
Shot No	Date	Time	Location	St Clements Church		Camberwell Village	
				Vibration	Overpressure	Vibration	Overpressure
1	02/09/2010	12:04:21	PS_LB_S7B6	DNT	DNT	0	106
2	02/09/2010	12:11:29	UBS_S6-7B6	1	102	1	101
3	02/09/2010	12:11:29	UBS_S6B7-8	1	102	1	101
4	02/09/2010	12:11:29	LB_S7B5 Knob	1	102	1	101
5	03/09/2010	11:55:54	UBS_S4-5B9	DNT	DNT	DNT	DNT
6	09/09/2010	9:05:58	PS_LB_S7B6_2	1	99	1	96
7	09/09/2010	9:10:41	LB_S5B7-8W	2	113	2	114
8	17/09/2010	12:43:43	LB_S4-5B8	2	113	3	114
9	17/09/2010	12:49:06	UBS_S5B8	DNT	DNT	DNT	DNT
10	17/09/2010	12:51:36	UBS_S7B6-7	DNT	DNT	DNT	DNT
11	21/09/2010	12:26:39	PS_LB_S7B7-8	0	103	1	99
12	21/09/2010	12:31:45	LB_S6B7-8E	2	106	2	107
13	21/09/2010	12:31:45	LB_Single hole	2	106	2	107
14	24/09/2010	12:34:28	LB_S4-5B8-9	1	106	1	104
15	24/09/2010	12:39:16	UBS_S6-7B7	DNT	DNT	DNT	DNT
16	28/09/2010	12:29:46	UBS_S6B7-8W	DNT	DNT	DNT	DNT
17	01/10/2010	13:01:33	LB_S6-7B6	2	116	2	113
18	08/10/2010	13:03:13	LB_S6-7B6-7V	1	106	2	106
19	12/10/2010	12:33:20	PS_LB_S6_S	1	101	1	97
20	14/10/2010	9:20:44	UBS_S5-6B8-9	0	101	0	105
21	14/10/2010	9:20:44	PS_LB_S6_S_2	DNT	DNT	DNT	DNT
22	19/10/2010	9:35:00	UBS_S7B7-8	DNT	DNT	DNT	DNT
23	19/10/2010	9:40:43	LB_S5B8-9W	2	106	1	107
24	21/10/2010	12:34:49	PS_LB_S6_S_2	1	99	0	99
25	21/10/2010	12:48:43	LB_S6-7B7East	2	109	2	106
26	22/10/2010	12:27:53	LB_S5B8-9W South	2	108	2	108
27	26/10/2010	12:29:16	UBS_S6B8-9E	0	102	0	101
28	29/10/2010	13:44:40	LB_S6B8-9E	2	105	2	105
29	03/11/2010	9:34:20	UBS_S6B8-9W	DNT	DNT	DNT	DNT

2010 – 2011 Blast Vibration and Overpressure Results							
Shot No	Date	Time	Location	St Clements Church		Camberwell Village	
				Vibration	Overpressure	Vibration	Overpressure
30	04/11/2010	12:44:03	LB_S6-7B7W	1	109	1	111
31	09/11/2010	9:35:51	LB_S6-7B7-8E	2	109	2	108
32	11/11/2010	9:34:48	PS_LB_S6_Last	0	102	DNT	DNT
33	11/11/2010	9:39:44	LB_S6-7B7-8W	1	110	1	107
34	12/11/2010	12:24:53	UBS_S6B9W	DNT	DNT	DNT	DNT
35	23/11/2010	12:48:17	LB_S6-7B8	2	109	2	105
36	23/11/2010	12:48:17	LB secondary	DNT	DNT	DNT	DNT
37	03/12/2010	9:56:20	LB_S6B8-9	1	107	2	105
38	14/12/2010	12:30:43	LB_S6B9	2	109	2	107
39	21/12/2010	9:35am	ART EXT TEST 1	DNT	DNT	DNT	DNT
40	21/12/2010	9:39am	ART EXT TEST 2	DNT	DNT	DNT	DNT
41	21/12/2010	9:43am	ART EXT TEST 3	DNT	DNT	DNT	DNT
42	21/12/2010	9:47am	ART EXT TEST 4	DNT	DNT	DNT	DNT
43	22/12/2010	12:28:11	LB_S6B9S	2	106	2	104
44	13/01/2011	12:06:24	PG_ROM_Sth	0	100	0	102
45	14/01/2011	13:16:38	PS_ART_ROM1	DNT	DNT	DNT	DNT
46	20/01/2011	12:12:43	PG_60_ROM1	DNT	DNT	DNT	DNT
47	21/01/2011	12:14:40	PG_60_ROM1_PartB	DNT	DNT	DNT	DNT
48	22/01/2011	11:53:48	PS_ART_ROM2/LEM19_ROM3-4	DNT	DNT	DNT	DNT
49	25/01/2011	12:07:16	PG_60_ROM2	DNT	DNT	DNT	DNT
50	29/01/2011	09:29:16	LEM19_TEST_HOLE	DNT	DNT	DNT	DNT
51	29/01/2011	09:29:21	PS_LEM19_ROM4-5	DNT	DNT	DNT	DNT
52	29/01/2011	09:29:27	LEM19_ROM3	DNT	DNT	DNT	DNT
53	02/02/2011	12:09:22	LEM19_ROM4	0	96	0	107
54	02/02/2011	12:09:27	PS_LEM19_ROM5	0	96	0	107
55	04/02/2011	12:32:33	LEM19_ROM5	0	102	0	97
56	08/02/2011	12:20:24	PG_50_ROM1	0	96	0	96
57	11/02/2011	12:31:04	PG_50_ROM2	0	111	0	100
58	11/02/2011	12:31:04	LEM19_ROM5	0	111	0	100
59	17/02/2011	11:56:43	PS_ART_ROM5	0	96	0	93

2010 – 2011 Blast Vibration and Overpressure Results							
Shot No	**Date**	**Time**	**Location**	**St Clements Church**		**Camberwell Village**	
				Vibration	**Overpressure**	**Vibration**	**Overpressure**
60	23/02/2011	09:36:29	PG_ROM3-5S	0	100	1	102
61	23/02/2011	09:36:29	PS_ART_ROM3-5	0	100	0	105
62	24/02/2011	11:57:55	ART_ROM1-2S	0	98	0	96
63	28/02/2011	12:30:04	PG_50_ROM3-5	0	105	0	102
64	03/03/2011	11:58:26	PG_ROM1-2S	0	107	0	103
65	10/03/2011	09:34:47	ART_ROM3-5S	0	103	0	99
66	18/03/2011	09:54:52	PG_ROM1-2N	0	94	0	90
67	25/03/2011	11:59:54	ART_ROM1-5	DNT	DNT	DNT	DNT
68	25/03/2011	11:59:54	PG_ROM3-5N	DNT	DNT	DNT	DNT
69	05/04/2011	9am	ART_Test_Hole	DNT	DNT	DNT	DNT
70	05/04/2011	9am	PG_ROM2N_Redrill	DNT	DNT	DNT	DNT
71	06/04/2011	12:28:06	HEB_Test_Hole	0	99	1	101
72	08/04/2011	09:42:25	ART_ROM1-2N	0	101	0	99
73	09/04/2011	9am	ART_ROM3-4N	DNT	DNT	DNT	DNT
74	20/06/2011	09:35:47	PS_HEB_S2East	0	103	1	100
75	24/06/2011	16:29:23	HEB_S2	2	109	2	109
76	29/06/2011	13:21:41	PS_HEB_S3East	1	101	1	103
77	29/06/2011	13:28:40	HEB_S1	1	111	1	114
78	08/07/2011	9:34:23	PS_HEB_S5EAST	1	107	1	106
79	08/07/2011	9:44:54	HEB S3	1	116	3	114
80	12/07/2011	16:28:53	PS_HEBs4-5.EAST	1	98	1	99
81	15/07/2011	11:43:03	HEB_S4	1	106	2	102
82	21/07/2011	12:02:22	Heb_Test Hole 1	1	95	1	95
83	21/07/2011	12:09:30	Heb_Test Hole 2	1	108	1	104
84	29/07/2011	12:35:57	Heb_S5	DNT	DNT	2	103
85	04/08/2011	12:08:55	Heb_S6	2	102	2	97
86	11/08/2011	12:13:41	Heb_S7	1	103	1	97
87	19/08/2011	12:35:39	Heb_S8	1	108	1	104

Total Blasts 87	Number Blasts Recorded	87	87	87	87
	% Blasts Recorded	100%	100%	100%	100%
	Maximum	2	116	3	114
	Average	1	104	1	103
	Minimum	0	94	0	90
	No > 2 mm/s	-		2.00	
	% > 2 mm/s	0.00%		2.30%	
	No > 10mm/s	0		0	
	No > 115 dBL		2.00		-
	% > 115 dBL		2.30%		0.00%
	No > 120 dBL		0		0

APPENDIX 4

Complaints List

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2010 - 2011 Ashton Coal Operations Complaints List								
Complaint No	Date	Time	Identifier	Issue	Wind Speed (m/s)	Wind Direction	Inversion	Comments/Operational Changes
1	13/09/2010	6:05:00 PM	18	dust	2.0	WNW	No inversion	EC called OCE and OCE moved trucks from top dump to the lower dump in pit, the PM10 10 minute readings had increased recently, however the 24hr PM10 readings were well within complaince
2	15/09/2010	2:31:00 PM	18	dust	3.3	W	No inversion	24Hr PM10 levels at time of complaint where very low but the PM10 10mintue average readings were starting to trend up. EC called OCE and OCE moved trucks from top dump to the lower dump in pit.
3	15/09/2010	5:11:00 PM	18	dust	4.7	NW	No inversion	EC inspected the OC and village there was no dust coming from the pit and in the village with the sun setting, the sun's rays were highlighting any particles in the sky, resulting in the sky looking very hazy and dusty. OC trucks were still dumping down low in pit after the change made from the previous complaint made at 2:31pm.
4	22/09/2010	4:25:00 PM	18	dust	2.4	WNW	No inversion	EC spoke with OCE all machinery were working and dumping low in the pit. Diggers were working on overburden and not coal at the time of the complaint. It was very hazy throughout the valley. There were 2 water carts operating in the pit. There was a wind shift at about 2:20 from SE to NW which did cause a slight increase in dust levels that soon dropped off.
5	21/09/2010	12:30:00 PM	OEH	blast	1.5	NW	No inversion	EC was in the village at the time of the blast and there was only a small amount of visual dust from the blast. The dust would not have caused excessive impact on any private residences. Our 2 dust monitors in the village - site 1 recorded a PM10 10min of 34.7 and site 8 recorded PM10 10min of 33.5 following the blast.
6	22/09/2010	3:30:00 PM	OEH	dust	2.4	WNW	No inversion	This complaint coincided with a complaint received by the mine. EC spoke with OCE all machinery were working and dumping low in the pit. Diggers were working on overburden and not coal at the time of the complaint. It was very hazy throughout the valley. There were 2 water carts operating in the pit. There was a wind shift at about 2:20 from SE to NW which did cause a slight increase in dust levels that soon dropped off.
7	28/09/2010	7:00:00 AM	OEH	dust	3.2	NW	No inversion	The area in front of one of the diggers is being ripped with a dozer and then heavily watered prior to being dug. This wets the material prior to it being loaded and reduces dust generation. Unfortunately due to the dig method of the second digger this ripping and wetting method is not possible. The face of the dump is being heavily watered in the area they are dumping to reduce the amount of dust being generated during dumping. Ashton complied with PM10 criteria for the day.
8	28/09/2010	12:39:00 PM	OEH	blast	4.2	NW	No inversion	As expected dust was generated from the blast, Environmental Manager was in Camberwell at the time of the blast and she did not believe that the impact on Camberwell was excessive.
9	13/10/2010	6:02:00 PM	18	dust	4.4	NW	No inversion	OCE spoke with EC asking about dust levels, dust levels were all fine and well within criteria. OCE moved trucks from 135 dump down to buttress dump lower in the pit. Ashton complied with PM10 criteria for the day.
10	13/10/2010	5:00:00 PM	OEH	dust	3.7	NW	No inversion	This complaint coincided with a complaint received by the mine. OCE spoke with EC asking about dust levels, dust levels were all fine and well within criteria. OCE moved trucks from 135 dump down to buttress dump lower in the pit. Ashton complied with PM10 criteria for the day.
11	13/10/2010	9:00:00 PM	OEH	noise	1.0-3.2	NW	No inversion	This complaint coincided with a complaint received by the mine. As regards to the 9pm section of the complaint the CHPP was not operating, no trains were being loaded and the OC was in the process of getting ready to shut down by 10pm. As for the 5am and 6am neither the OC nor CHPP were operating and we were not loading any trains.
12	14/10/2010	6:00:00 AM	9	noise	1.0-3.2	NW	No inversion	As regards to the 9pm section of the complaint the CHPP was not operating, no trains were being loaded and the OC was in the process of getting ready to shut down by 10pm. As for the 5am and 6am neither the OC nor CHPP were operating and we were not loading any trains.
13	12/10/2010	9:00:00 PM	OEH	noise	2.1-2.9 & 0.0-0.9	SE	<3°C/100m	Ashton Coal's Open Cut was not operating at the time of this complaint as it was outside Ashton Coal's open cut operating hours (Mon-Sat 7am to 10pm; Sun 8am to 10pm). Ashton Coal's CHPP was washing coal during night shift and had dozers on the stockpiles. There were no trains being loaded.
14	23/11/2010	7:12:00 PM	18	noise	4.9	E	No inversion	OCE spoke with EC asking about noise levels in the village. EC could see the dozer the resident was complaining about, though there were no abnormal noise levels heard in the village. EC and OCE agreed to have the Dozer moved back into the pit before night fall. OCE moved dozer from working on reshaping the overburden for rehab back in to the pit at 8pm.
15	23/11/2010	6:30:00 PM	OEH	noise	4.9	E	No inversion	This complaint coincided with a complaint received by the mine. OCE spoke with EC asking about noise levels in the village. EC could see the dozer the resident was complaining about, though there were no abnormal noise levels heard in the village. EC and OCE agreed to have the Dozer moved back into the pit before night fall. OCE moved dozer from working on reshaping the overburden for rehab back in to the pit at 8pm.
16	8/12/2010	4:47:00 PM	OEH	noise	1.4	E	No inversion	This complaint did not coincide with a complaint received by the mine, however the CHPP Manager rang the OCE at 6:30pm advising him that while he was outside down at the village the dozer was quite audible while reserving. The CHPP manager said the noise of the reserving dozer was quite audible but was not excessive. The OCE decided to relocate the dozer from the work it was doing on the overburden dump facing the village to back into the pit.
17	14/12/2010	12:44:00 PM	18	blast	3.3	ESE	No inversion	No dust came towards the village due to ESE winds, EC was in the village at the time of the blast and believes the blast vibration was not excessive and results concur with that observation. .

2010 - 2011 Ashton Coal Operations Complaints List								
18	8/12/2010	10:30:00 AM	OEH	noise	1.5	SE	No inversion	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 made.
19	14/12/2010	9:00:00 AM	OEH	noise	1.9	SE	No inversion	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 DECCW and therefore no operational changes could be made.
20	14/12/2010	12:30:00 PM	OEH	blast	3.3	ESE	No inversion	No dust came towards the village due to ESE winds, EC was in the village at the time of the blast and believes the blast vibration was not excessive and results concur with that observation.
21	15/12/2010	2:35:00 PM	OEH	dust	1.1	SE	No inversion	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 made.
22	16/12/2010	7:30:00 AM	OEH	noise/dust	3.9	N	No inversion	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 DECCW and therefore no operational changes could be made.
23	23/12/2010	9:00:00 AM	OEH	noise	0.9	SE	No inversion	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 made.
24	25/01/2011	6:30:00 PM	OEH	dust	3.7	SE	No inversion	All sites in the area showed a similar increase in dust levels both upwind and down. The dust was in relation to a southerly change coming in causing an area wide dust issue.
25	1/02/2011	7:09:00 AM	7	noise	3.3	NW	No inversion	At that time of the complaint the OCE reviewed the equipment locations and it was only just moving on the go line which is about mid pit level on the northern side of the OC away from Camberwell. There was no equipment working on exposed faces and no train being loaded. EC was in Camberwell at the time of receiving the complaint and investigated from that
26	1/02/2011	11:04:00 PM	7	noise	2.3	NW	No inversion	Open Cut was not operating in addition we do not have reversing beepers. EC reviewed sound files and did note that he could hear mining noise however it was too constant for the type of operations that we had on site at the time which was, CHPP was operating with one dozer on the product stockpile the chitter truck and loaders on the ROM's.
27	25/02/2011	10:30:00 AM	7	noise	0.6	SW	No inversion	One dozer working on bulk shaping for upcoming rehabilitation. OCE moved dozer back inpit.
28	2/03/2011	2:19:00 PM	7	noise	2.5	ESE	No inversion	No major issues only one dozer working on rehabilitation. Checked noise levels on monitor and were well within compliance limits.
29	4/03/2011	10:21:00 AM	7	noise	0.9	ESE	No inversion	EC visited the village and there was one dozer which was working on rehabilitation maintenance works. EC had the dozer moved from the southern slope works to the north-eastern slopes.
30	8/03/2011	2:49:00 PM	7	noise	0.9	SE	No inversion	OC Manager and EC visited the village and there were no issues; there was one excavator and two articulated-trucks (wobbley's) working on rehabilitation maintenance works the noise level was very low and the combination of these machines were quieter than one dozer which had been working in the same location in the previous days. Also checked noise levels on monitor and were well within compliance limits. No changes were made; ideal weather conditions, easterly winds and no dust heading towards the village.
31	8/03/2011	3:51:00 PM	7	noise	2.4	SW	No inversion	OC Manager and EC had visited the village just before this complaint for the previous complaint made at 2:49pm and there were no issues; there had been no change in the machinery between the two complaints. Also checked noise levels on monitor and were well within compliance limits. No operational changes were made.
32	11/03/2011	7:00:00 AM	OEH	noise	1.2	NW	No inversion	Even though in this complaint the complainant states she has already been in contact with the mine where as in fact she didn't call the mine until 8:37am – Resulting investigation from that complaint was EC spoke with OCE regarding the sharp piercing noise, unable to work out what the sharp piercing noise could have been, checked noise levels on monitor and were well within compliance limits.
33	11/03/2011	8:37:00 AM	7	noise	0	NW	No inversion	EC spoke with OCE regarding sharp piercing sound, unable to work out what the sharp piercing sound could have been, checked noise levels on monitor and were well within compliance limits.
34	18/03/2011	10:20:00 AM	7	noise	0.6	SE	No inversion	No major issues only one dozer working on rehabilitation. Checked noise levels on monitor and were well within compliance limits. No changes were made; ideal weather conditions, easterly winds and no dust heading towards the village.
35	21/03/2011	10:03:00 AM	7	noise	0.4	SE	No inversion	No major issues only one dozer working on rehabilitation. Checked noise levels on monitor and were well within compliance limits. No changes were made; ideal weather conditions, easterly winds and no dust heading towards the village.
36	24/03/2011	9:20:00 AM	7	noise	0.5-6.0	NW	No inversion	EC spoke with OCE regarding banging and clanging last night and in the morning, unable to work out what the banging and clanging could have been, couldn't hear and major banging or clanging on the noise files.

2010 - 2011 Ashton Coal Operations Complaints List								
37	24/03/2011	2:50:00 PM	OEH	blast	7.1	NW	No inversion	Ashton Coal did not blast – at the time of the proposed incident Ashton had 1 digger and 3 trucks operating in the Arties pit.
38	28/03/2011	8:33:00 AM	7	noise	0.7	SE	No inversion	EC visited the village to inspect the noise levels in the village. No major issues only one dozer working on rehabilitation. Also checked noise levels on monitor and were well within compliance limits. No changes were made; as we were spreading compost in ideal weather conditions, easterly winds and it had been a cool damp morning therefore there was no dust or smell heading towards the village.
39	29/03/2011	8:32:00 AM	7	noise	1.1	ESE	No inversion	EC visited the village to inspect the noise levels in the village. No major issues only one dozer working on rehabilitation. EC also notice he could hear neighbouring mine's dozers and trucks due to the easterly wind. EC spoke with dozer operator to ensure he was only using first gear.
40	10/04/2011	9:03:00 AM	7	noise	2.1	NW	No inversion	No works were being carried out, OCE was about to start his Pre-Start talk with his crew.
41	21/03/2011	8:00:00 AM	OEH	noise	0	SE	No inversion	Ashton had received a complaint at 10:03am regarding dozer noise on the rehabilitation - No major issues only one dozer working on rehabilitation. Checked noise levels on monitor and were well within compliance limits.
42	23/03/2011	1:00:00 AM	OEH	noise	1.4	NW	No inversion	CHPP was operating, however 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 made.
43	11/05/2011	7:00:00 AM	OEH	noise	0.8m/s @ 0700 5.7-15.4m/s between 0800-1200	SW @0700 SW-NW between 0800-1200	No inversion	Ashton Coal for a couple of weeks now have had no open cut operations occurring, other than watercarts operating. Yesterday Ashton had watercarts and the sprays on the coal stockpiles in operation, there were no other activities occurring in the pit.
44	21/05/2011	7:23:00 AM	7	noise	3.3	NW	3.6°C/100m	EC spoke with OCE there were no machinery working in the open cut and no dozers or loaders working on any of the stockpiles at the CHPP. There was no production for all of Saturday – there hasn't been any Open Cut operations for a month now as Ashton are waiting on approvals. EC was in the village at the time of the complaint he could hear mine noise haul trucks and at times dozers to a northerly direction of the village.
45	20/06/2011	9:18:00 AM	7	noise	5.2	NW	No inversion	E&C Manager spoke with OCE, 1 excavator, 2 trucks and a dozer working low in the pit rehandling overburden. E&C manager then spoke with EC who was in the village, the dominant noise was the HWY at times could only just hear the trucks, was also quite windy.
46	3/07/2011	7:07:00 PM	7	noise	0-4.6	NW	>3°C/100m	E&C Manager downloaded noise files and listened. There seems to be a constant reversing beeping and the morning files seem very quite. The 7pm file was very noisy she did not feel it was Ashton noise as it was constant. Though there was a very strong inversion in so may just be a constant highway noise. EC spoke with OCE we have 1 digger, 3 trucks n a dozer working. This evening there has been constant mine noise with reversing beepers very audible - the direction
47	4/07/2011	8:25:00 AM	7	noise	1.7	NW	>10°C/100m	EC spoke with OCE, 1 excavator, 3 trucks and a dozer working low in the pit.
48	18/07/2011	6:04:00 PM	7	noise	3.7	NW	3.1°C/100m	EC spoke with OCE at 6:10pm, EC was in training course OCE said he had 1 excavator, 2 trucks, 2 dozers, 2 drills, 1 grader, 1 watercart working low in the pit. E&C Manager spoke with OCE at 6:55pm after being at mine entrance at 6:45pm and in the Village at 6:50pm. E&C Manager had no issues with noise levels and indicated to OCE there was no need to change any operations.
49	25/07/2011	9:11:00 PM	7	noise	4.7	NW	2.2°C/100m	E&C Manager spoke with OCE at 9:50pm, at the time of the complaint there had been 1 excavator, 2 trucks, and 2 dozers working in the bottom of the pit. All equipment was shut down and on the go line by 9:45pm.
50	30/07/2011	8:30:00 AM	7	noise	0.9	NW	3.4°C/100m	2 trucks dumping into the Arties Pit rest of machinery working down in the bottom of the pit in the Hebden seam.
51	1/08/2011	10:05:00 PM	7	noise	1.5	NW	>9°C/100m	Open Cut was shut down; machinery had been on the go line by 9:45pm. There were no trains being loaded. EC was in the village at time of the complaint. Dozer noise was heard along with hwy noise. Dozer noise appeared to be coming from neighbouring mine to the north.

APPENDIX 5

AEMR Plans

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319000E 319500E 320000E 320500E 321000E 321500E 322000E

6407000N

6406500N

6406000N

6405500N

Betty's Creek

Main Northern Railway

Topsoil Stockpile

New England Highway

Glennies Creek Road

Glennies Creek

Tank Farm

A

A

Legend

- Area Previously Stripped of Topsoil
- Topsoil Stockpiles
- Alluvial Soils
- Solodic Soils
- Vegetation Stockpile
- Existing Vegetation

Soil Stripping Depths

- 0 - 10cm
- 10 - 20cm
- 20 - 30cm

- Colliery Holding
- Lease Boundary
- Water Course
- Power Line
- Area to be Disturbed
- Extraction Limit
- 14 Soil Sample Sites
- Soil Profile Sites
- A — A Section Lines

AshtonCoal

Ashton Coal Operations

Scale :	1:5,000		
Drawn:	SD	Figure	
Date :	29-Dec-2011	AEMR3	
Mount Name:	AEMR		
CGM File:	AEMR_2011_3		

Ashton Open Cut
AEMR Plan 3
Land Preparation

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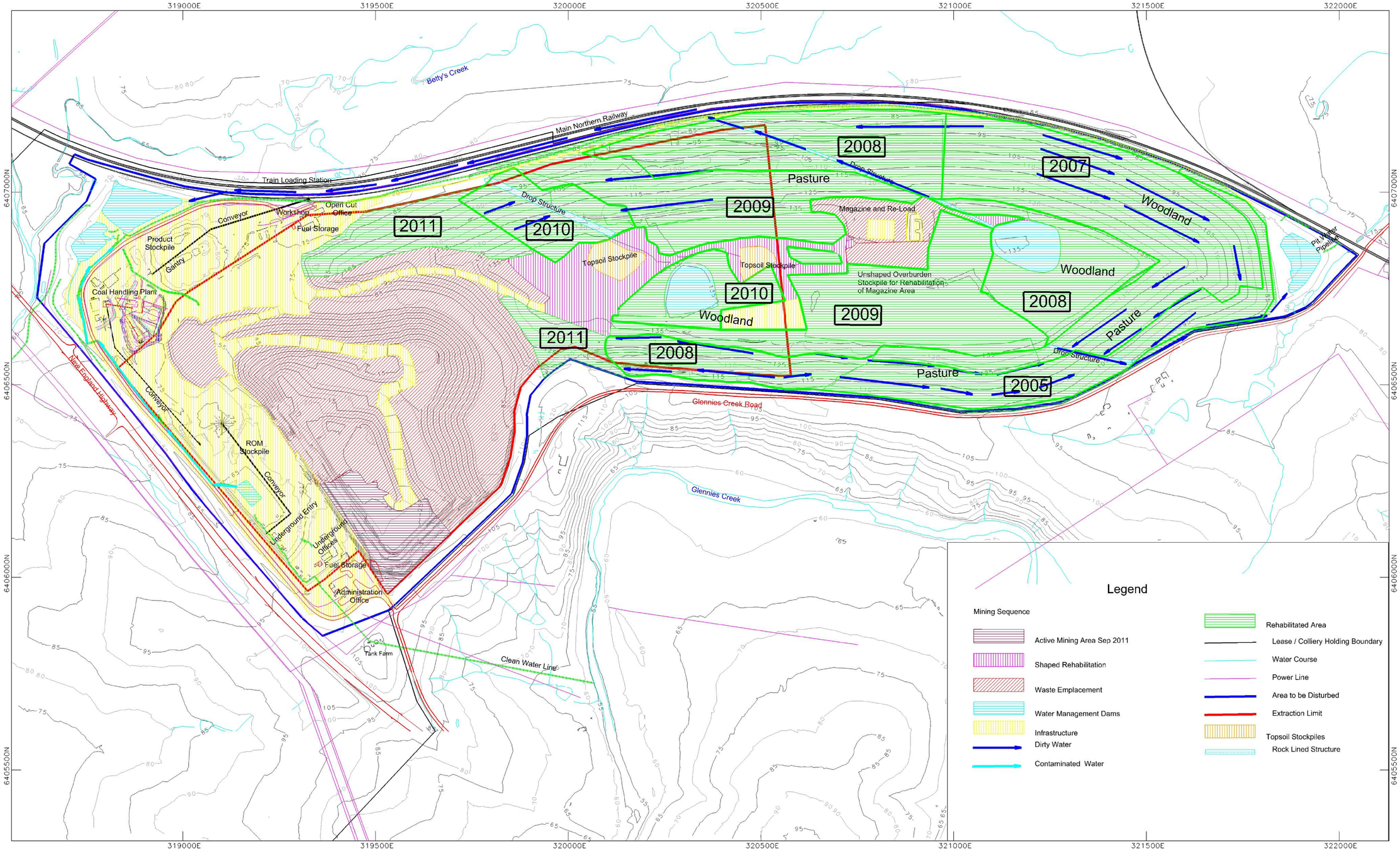

AshtonCoal			Ashton Coal Operations
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Drawn:	SD	Figure	Ashton Open Cut AEMR Plan 4 September 2011 Mining Activities
Date :	30-Dec-2011	AEMR4	
Mount Name:	AEMR		
CGM File:	AEMR_2011_4		

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N 6 408 000 | E 317 000 | E 317 500 | E 318 000 | E 318 500 | E 319 000 | E 319 500 | E 320 000 | E 320 500

N
W E
S

MAIN NORTHERN RAILWAY

NEW ENGLAND HIGHWAY

Train Loading Bin

Washery and Offices

Open Cut Office and Workshop

Underground Office

Administration Office

Glennies Creek Pipeline

CAMBERWELL VILLAGE

LW 108
LW 107B
LW 7B (Short)
LW 106B
LW 6B
LW 104B
LW 107A
LW 7A
LW 106A
LW 6A
LW 105
LW 5
LW 104A
LW 4
LW 103
LW 3
LW 102
LW 2
LW 101
LW 1

A A'
B B'
C C'
D D'

BOWMAN'S CREEK

GLENNIES CREEK

HUNTER RIVER

Mine Water

Borehole Pump No. 2

Hunter River Pipeline

De-comissioned Sump Pump Borehole

UC Shaft Ventilation Fan

0 100 200 300 400 500metres

LEGEND

- Lease Boundary / Colliery Holding Boundary
- SMP Boundary - Approved (PG Seam)
- Current PG Seam Mine Plan
- Current and Proposed ULD Seam Mine Plan
- Boreholes
- 5m Surface Contour
- Mine Water
- Dirty Water
- Clean Water Pipeline
- Section Location (A A')

Mining Sequence

- Existing Workings
- Mine Workings during Reporting Period
- 2011 Planned
- 2012
- 2013

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

Drawing No.	Revision No.
A–1059	

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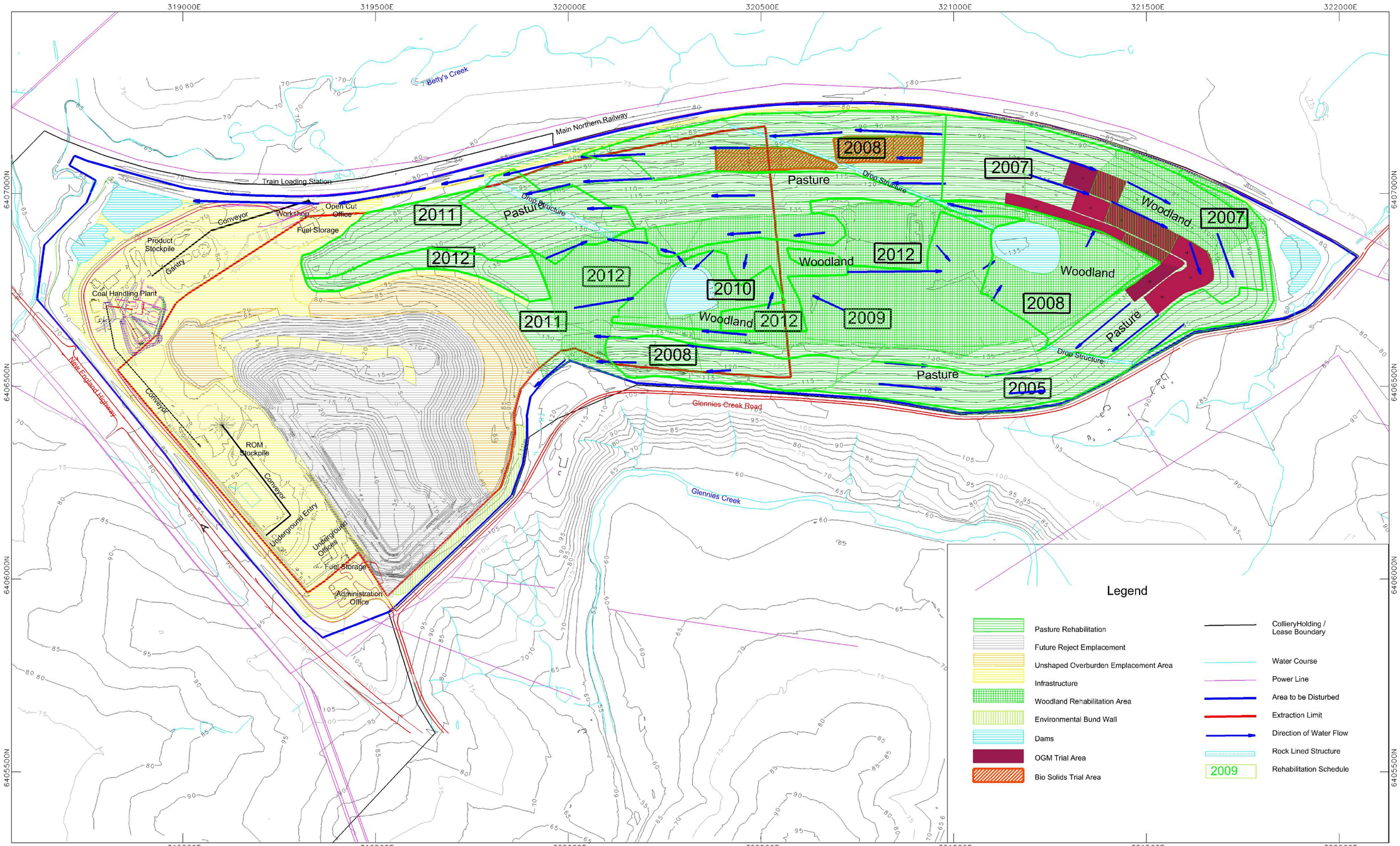

AshtonCoal

Ashton Coal Operations

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Ashton Open Cut
AEMR Plan 5
Proposed Rehabilitation 2012

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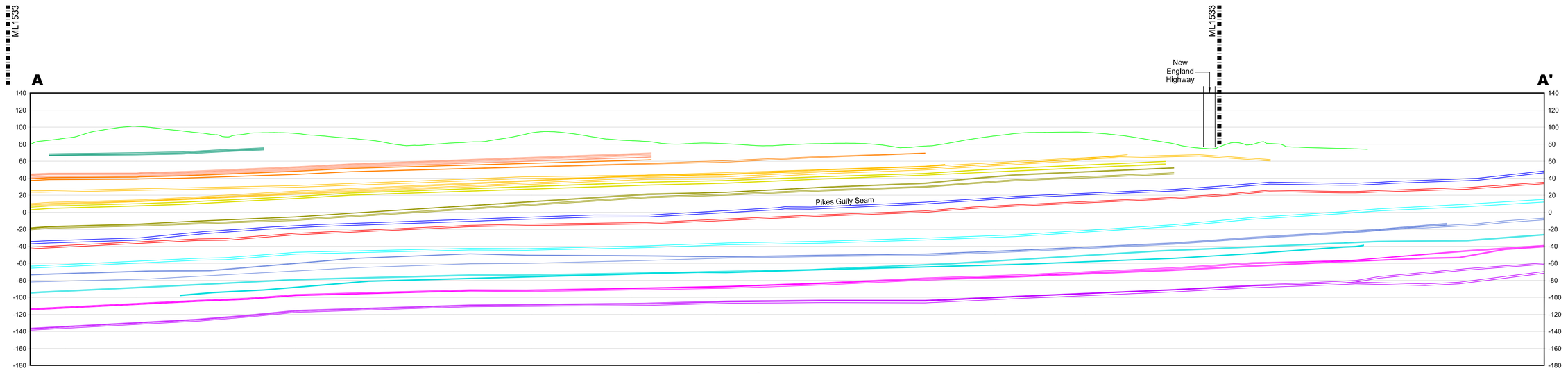

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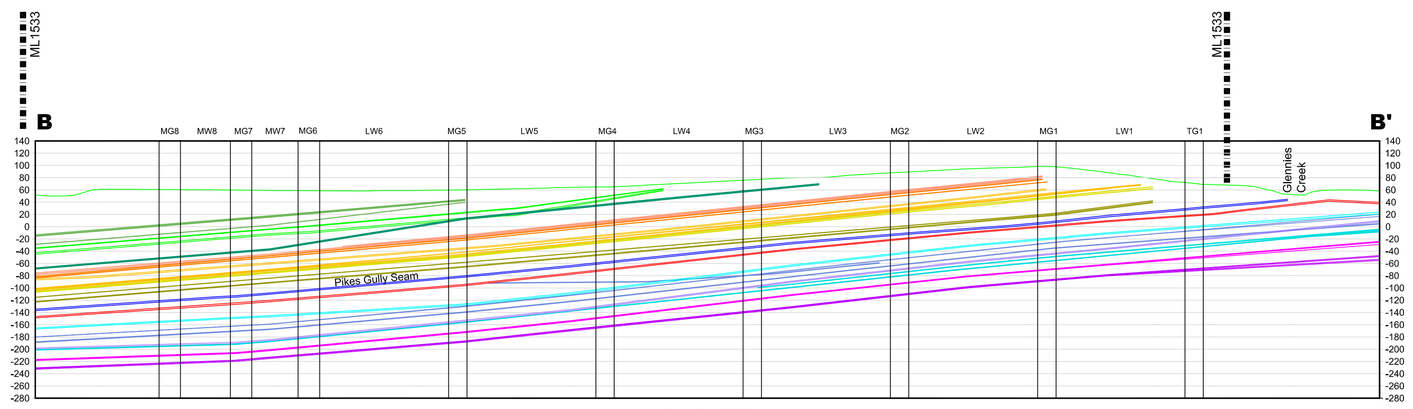

Section B-B'
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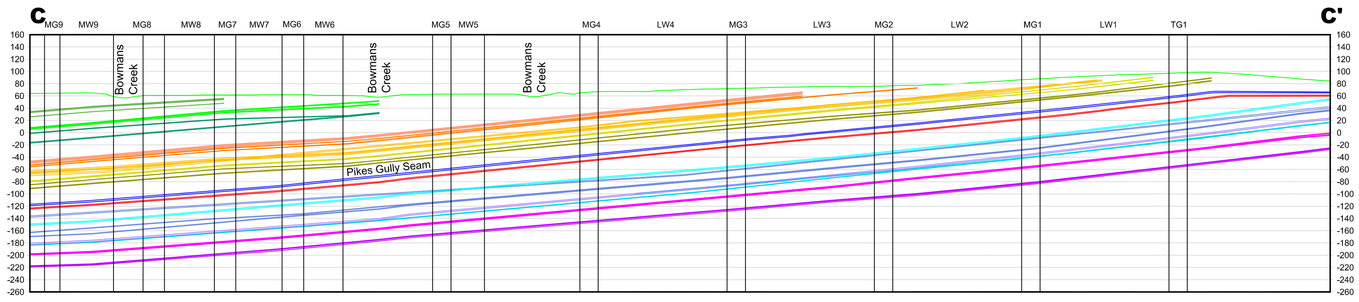
Horizontal Scale 1:5,000

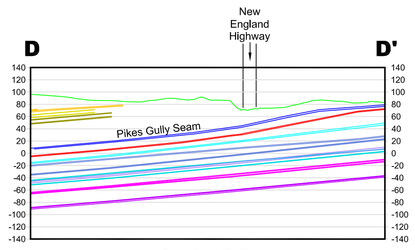


Section C-C'
Vertical Scale 1:5,000
Horizontal Scale 1:5,000

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



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

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ASHTON UNDERGROUND MINE
AEMR
PLAN 7 (b) - Sections

Drawing No. A–1007
Revision No.

Date	Scale:	Drawn	Checked	Approved	Sheet Size
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APPENDIX 6

Aboriginal Communications Log

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Aboriginal Stakeholder Groups Correspondence Log	Issue
22-Dec-10	
Correspondence sent to the stakeholder groups containing a copy of the Western Panels (BCD Project) final draft ACHMP, interim report and copy of stakeholder meeting minutes held in July 2010. Correspondence was sent to the following groups: -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 (undelivered notification received on the 25-Dec-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	Bowmans Creek Diversion Project
19-Jan-11	
Insite Heritage sent a letter out to all Aboriginal stakeholders advising them the BCD Project and Longwall 5-8 project have been approved by the Department of Planning and AHIP application process and proposed salvage dates. 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	Bowmans Creek Diversion Project

Aboriginal Stakeholder Groups Correspondence Log	Issue
-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 -Warren Taggart	Bowmans Creek Diversion Project
27-Jan-11	
Cassandra Ferguson rang each of the registered stakeholders who were sent the Western Panels ACHMP & interim report to see if they had any feedback or comments of the proposed management measures: -Des Hickey (Wattaka Cultural Consultants Services) -Barry McTaggart (Yarrawalk Enterprises) -Margaret Matthews (Aboriginal Native Title Consultants) -Barry Stair (Hunter Valley Aboriginal Corporation) -David French (Hunter Valley Natural &Culture Resource Management) -Tracey Skene (Culturally Aware) -Tom Miller (Lower Hunter Wonnarua Council) -Taasha Layer (Ungooroo Aboriginal Corporation) -Laurie Perry (Wonnarua Nations Aboriginal Corporation) -Arthur Fletcher (Wonn1 Contracting) -Anne Hickey (Gidawaa Walang) -George Sampson (Cacatua Culture Consultants) -Larry Van Vliet (Valley Culture) -Gordon Griffith (Wonnarua Culture Heritage) -Kathleen Kinchella (Yinarr Cultural Services) -Luke Hickey (Hunter Valley Culture Surveying) -Rhoda Perry (Wonnarua Elders Council) -Christine Archebold (Hunter Valley Cultural Consultants) -Clifford Matthews (Mingga Consultants) -Cheryl Matthews (Carrawonga Consultants) -Brian Matthews (Muswellbrook Cultural Consultants) -Barry French (Hunter Valley Aboriginal Corporation) -Rhonda ward (Ungooroo Cultural & Community Services Incorporated)	Bowmans Creek Diversion Project

Aboriginal Stakeholder Groups Correspondence Log	Issue
15-Feb-11	
Correspondence sent to the stakeholder groups containing a copy of the Western Panels (BCD Project) and LW 1-4 AHIP documentation (fact sheet LW1-4 & BCD Project), CD copy of AHIP applications (people without email addresses received a hard copy). The letter noted stakeholders could request a hard copy from ACOL. The documentation was sent to the following groups: -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 -Carrawonga Consultants (x 2) -Mingga Consultants -Wonnarua Nation -Kayaway Eco-Cultural and Heritage -Hunter Valley Natural and Cultural Resource Management -Valley Culture -Hunter Valley Aboriginal Corporation -Wonnaruah Elders Council -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Ungooroo Cultural & Community Services -Cacatua Cultural Consultants -Yarrawalk Enterprises -Warren Taggart -Wonn1 Contracting	Bowmans Creek Diversion Project & LW 1-4 AHIP Application
17-Mar-11	
Michael Moore (ACOL) and Angela Besant (Insite Heritage) had a meeting with representatives from DECCW regarding the WUG AHIP & reissue of LW1-4 AHIP	Bowmans Creek Diversion Project
22-Mar-11	
Contacted the following groups, Wonnarua Culture Heritage (Gordon Griffith), Cacatua Culture Consultants (George Sampson) and Culturally Aware (Tracey Skene) to conduct inspections under due diligence on the works in the Eastern Creek Diversion. Sent a copy of the work details below via email to Culturally Aware and Cacatua. Emailed to Wonnarua Culture Heritage	Bowmans Creek Diversion Project

Aboriginal Stakeholder Groups Correspondence Log	Issue
24-Mar-11	
Sarah Paddington & Bill George from DECCW conducted a site inspection on the Eastern Bowmans Creek Diversion due to complaints received regarding alleged impacts on artefacts by current workings (2.30 - 4.30pm). One potential artefact was found and BCD Project was halted for the time period the investigation was conducted.	Bowmans Creek Diversion Project
Elisabeth W. from Insite Heritage telephoned stakeholders to inform them that ACOL is preparing a roster for field work for inspections of excavation works on post European terrace -Lower Hunter Wonnarua Council -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Wanaruah Local Aboriginal Land Council -Wanaruah Custodians -Junburra Consulting -Yarrawalk Enterprises -Aboriginal Native Title Consultants -Lower Wonnarua Tribal Consultancy -Tocomwall -Girwirr Consultants -Hunter Valley Aboriginal Corporation -Hunter Valley Cultural Surveying -Lower Hunter Wonnarua Council Inc. -Upper Hunter Heritage Consultants -Wonnaruah Elders Council -Valley Culture -Wonnarua Culture Heritage -Wonnarua Nations Aboriginal Corporation -Muswellbrook Cultural Consultants -Mingga Consultants -Wonn1 Contracting -Hunter Valley Natural & Culture Resource Management -Culturally Aware -Ungooroo Cultural & Community Services Inc -Gidawaa Walang -Cacatua Culture Consultants -Warren Taggart -Carrawonga Consultants -Yinarr Cultural Services -Kayaway Eco Cultural & Heritage Services -HTO Environmental Management Services	Bowmans Creek Diversion Project
25-Mar-11	
Elisabeth W. from Insite Heritage telephoned stakeholders to inform them that the field work roster they received a call about yesterday is on hold, DECCW have received some community complaints regarding the work in the due diligence area so all work in that area is on hold until their investigations are completed. -Lower Hunter Wonnarua Council -Ungooroo Aboriginal Corporation	Bowmans Creek Diversion Project

Aboriginal Stakeholder Groups Correspondence Log	Issue
-Wattaka Cultural Consultants Services -Wanaruah Local Aboriginal Land Council -Wanaruah Custodians -Junburra Consulting -Aboriginal Native Title Consultants -Lower Wonnarua Tribal Consultancy -Girwirr Consultants -Hunter Valley Aboriginal Corporation -Hunter Valley Cultural Consultants -Hunter Valley Cultural Surveying -Upper Hunter Heritage Consultants -Wonnaruah Elders Council -Muswellbrook Cultural Consultants -Mingga Consultants -Wonn1 Contracting -Hunter Valley Natural & Culture Resource Management -Culturally Aware -Ungooroo Cultural & Community Services Inc -Gidawaa Walang -Kayaway Eco-Cultural and Heritage -Carrawonga Consultants -Yinarr Cultural Services -Bullem Bullem	Bowmans Creek Diversion Project
7-Apr-11	
ACOL held a Wonnarua Liaison Committee Meeting at the Singleton Youth Venue. ACOL bought up the concerns regarding the Stop Work order on BCD and requested further information regarding the claims of highly significant sites with the BCD Project Area	Bowmans Creek Diversion Project
27-Apr-11	
ACOL received an email from WHAC containing the letter summarising what was discussed at the Wonnarua Elders meeting held on the Saturday 23/04/2012 at the Singleton Youth Centre addressed to Richard Bath OEH	Bowmans Creek Diversion Project
23-May-11	
ACOL sent letter to registered stakeholders providing an update on the BCD Project. Letters were sent to the following groups: -Yinarr Cultural Services -Tocomwall -Lower Hunter Wonnarua Council -Girwirr Consultants (x2) -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	Bowmans Creek Diversion Project

Aboriginal Stakeholder Groups Correspondence Log	Issue
-Wanaruah Local Aboriginal Land Council -Yarrawalk Enterprises -Carrawonga Consultants -Mingga Consultants -Wonnarua Nations Aboriginal Corporation -Kayaway Eco-Cultural and Heritage -Ungooroo Aboriginal Corporation -Wattaka Cultural Consultants Services -Valley Culture -Ungooroo Cultural & Community Services -Wonn1 Contracting -Hunter Valley Natural and Cultural Resource Management -Hunter Valley Aboriginal Corporation -Warren Taggart	Bowmans Creek Diversion Project
2-Sep-11	
ACOL sent AHIP work roster and a copy of the AHIP to the following groups: -Aboriginal Native Title Consultants -Carrawonga Consultants -Hunter Valley Natural & Cultural Resource Management -Mingga Consultants -Muswellbrook Cultural Consultants	Bowmans Creek Diversion Project
ACOL sent AHIP work roster to the following groups: -Wanaruah Custodians -Wanaruah Local Aboriginal Land Council -Wonnarua Culture Heritage -Wonnarua Elders Council	Bowmans Creek Diversion Project