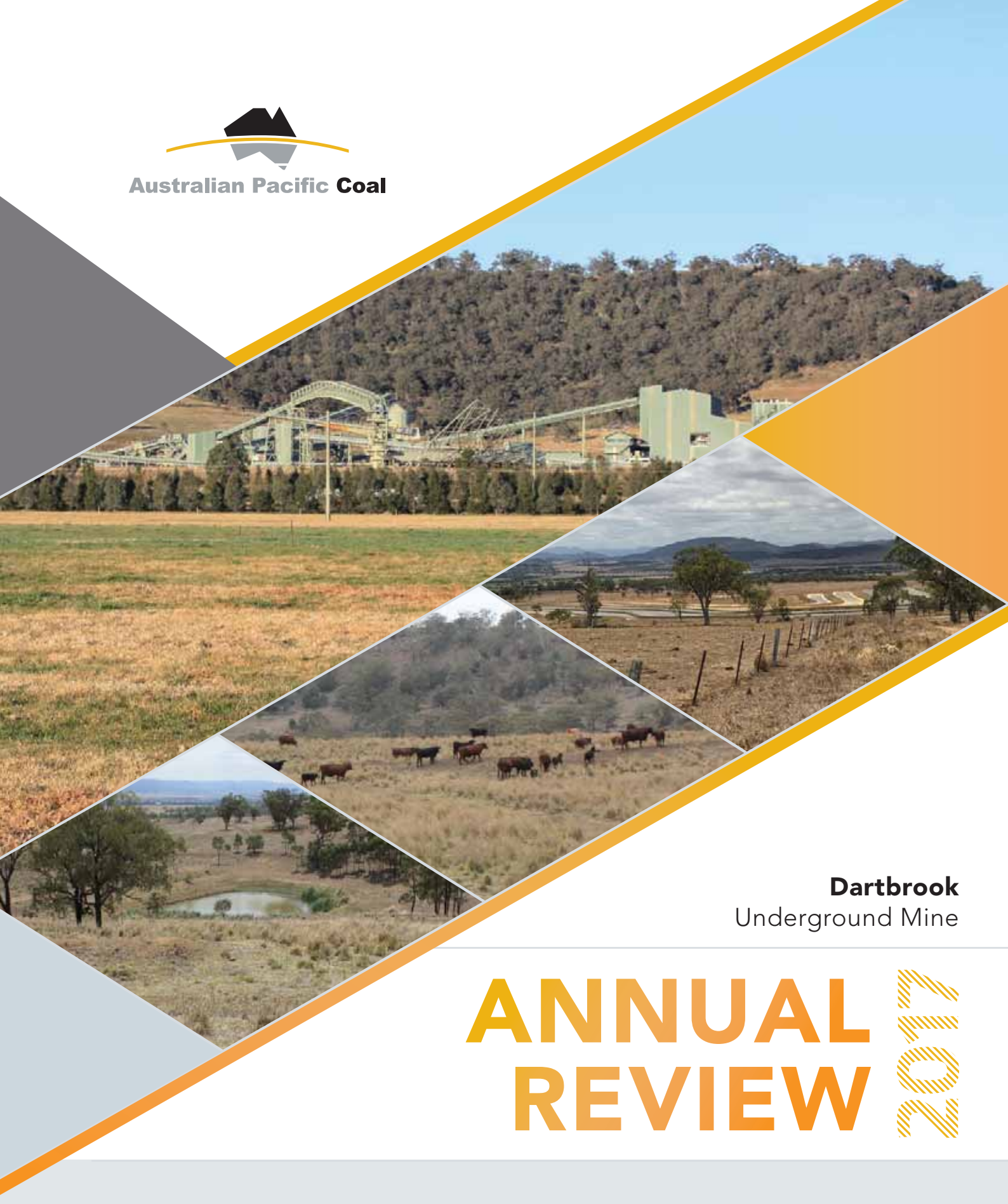
Australian Pacific Coal



Dartbrook
Underground Mine

ANNUAL REVIEW 2012

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

DARTBROOK MINE

ANNUAL REVIEW 2017

Prepared by:

HANSEN BAILEY
127-129 John Street
SINGLETON NSW 2330

March 2018

For:

AUSTRALIAN PACIFIC COAL LTD
PO Box 517
MUSWELLBROOK NSW 2333

Annual Review Title Block

Name of operation	Dartbrook Mine
Name of operator	Australian Pacific Coal
Development consent	DA 231-07-2000
Name of holder of development consent	Dartbrook Coal Pty Ltd
Mining Leases	CL 386, ML 1497, ML 1381, ML 1456
Name of holder of mining leases	AQC Dartbrook Pty Ltd
Water licences	See **Table 20**
Name of holder of water licences	AQC Dartbrook Management Pty Limited
MOP start date	1 January 2018
MOP end date	31 December 2020
Annual Review start date	1 January 2017
Annual Review end date	31 December 2017
I, Andrew Roach, certify that this audit report is a true and accurate record of the compliance status of AQC Dartbrook Pty Ltd for the period (2017) and that I am authorised to make this statement on behalf of AQC Dartbrook Pty Ltd. *Note.* *a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.* *b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications / information/documents—maximum penalty 2 years imprisonment or $22,000, or both).*	
Name of authorised reporting officer	ANDREW ROACH
Title of authorised reporting officer	CFO & Company Secretary
Signature of authorised reporting officer	
Date	29 March 2018

Dartbrook Mine Contacts

Australian Pacific Coal Contacts	
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CFO & Company Secretary:	Andrew Roach
Environmental Officer	Dorian Walsh
Statutory Mine Manager:	Mark Seward
Site Contact Details	
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Dartbrook Postal Address	Australian Pacific Coal Ltd PO Box 517 Muswellbrook NSW 2333
Phone Number:	(02) 6540 8888
Facsimile Number:	(02) 6541 1935
Dartbrook Care and Maintenance Contractor Phone Number:	(02) 6540 8950
Dartbrook 24-hour Environment & Community Hotline:	1300 131 058

Annual Review Distribution

Distribution List
NSW Department of Planning and Environment – Division of Resources and Geosciences (DRG)
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NSW Environment Protection Authority (EPA)
NSW Office of Environment & Heritage
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Rural Fire Service – Muswellbrook Branch
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Upper Hunter Shire Council (UHSC)
Muswellbrook Library
Scone Library
Aberdeen Library
Dartbrook Community Consultative Committee Members

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

1 STATEMENT OF COMPLIANCE

This Annual Review has been prepared to provide a summary of the performance of the Dartbrook Underground Coal Mine (Dartbrook) over the 2017 Calendar Year (the reporting period).

The compliance status of Dartbrook against relevant approvals is summarised in **Table 1**.

Table 1
Statement of Compliance

Were All the Conditions of the Relevant Approvals Complied With?	Yes/No
Development Consent (DA) 231-07-2000	Yes
Environmental Protection Licence (EPL) 4885	Yes
Coal Lease 386	Yes
Mining Lease 1497	Yes
Mining Lease 1381	Yes
Mining Lease 1456	Yes

2 INTRODUCTION

This section provides an overview of Dartbrook operations during the reporting period, outlines the purpose of this Annual Review and provides contact details for relevant site personnel.

2.1 BACKGROUND

Dartbrook Mine is owned and managed by Australian Pacific Coal Limited (AQC). Dartbrook Mine is located 10 kilometres (km) north of Muswellbrook and 4.5 km south-west of Aberdeen (see **Figure 1** and **Figure 2**) in New South Wales (NSW). From 1993 until October 2006, Dartbrook Mine operated as an underground longwall coal mine.

As a result of ongoing operational and geological issues, mining was suspended and the operation was placed under Care and Maintenance from 1 January 2007.

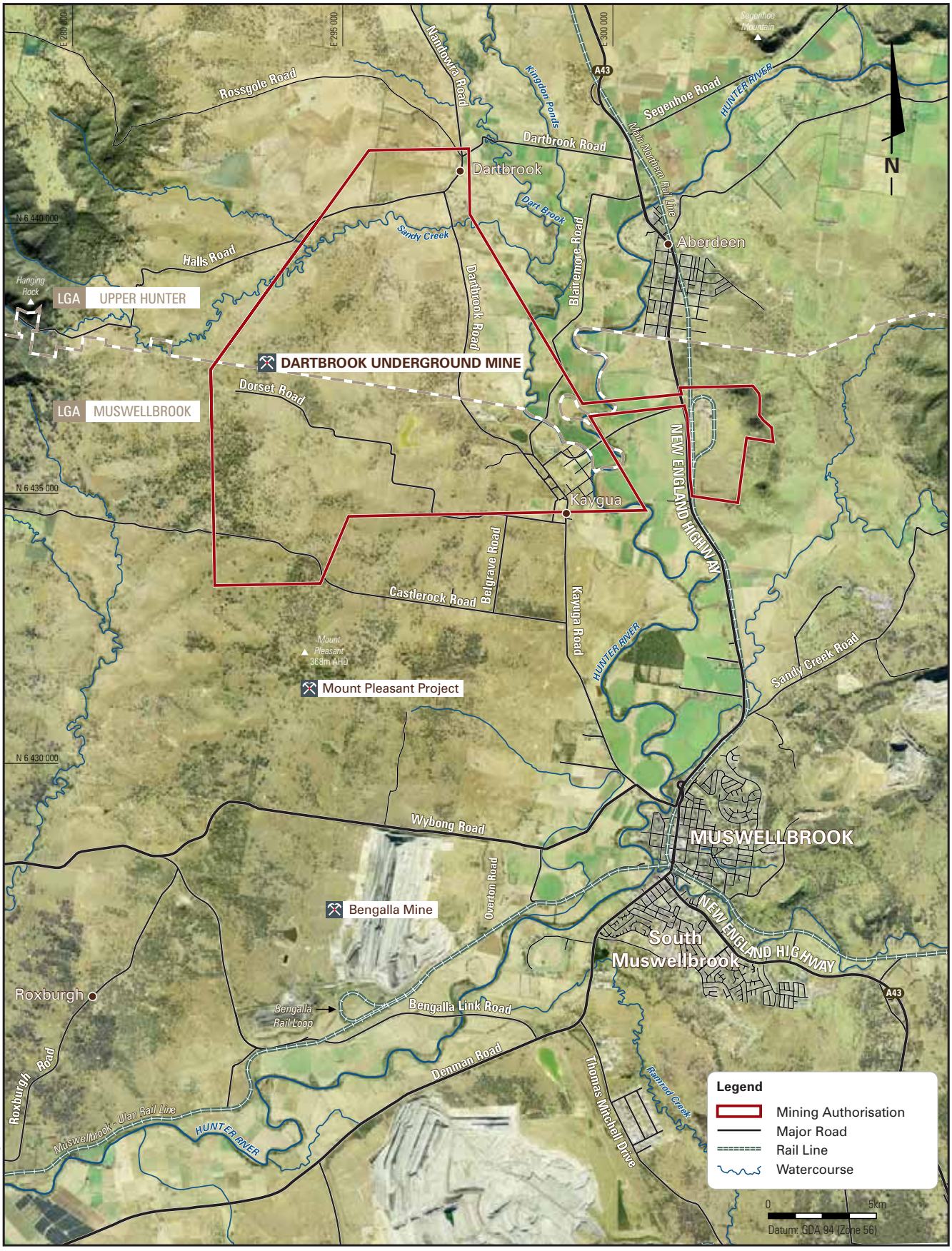
Under Care and Maintenance, site activities are generally limited to the maintenance of:

- The Hunter Tunnel, which along with the Kayuga interseam drift, are the only areas of the underground mine that are still accessible. The Hunter Tunnel and Kayuga interseam drift connect to the Eastern and Kayuga Western mine entrances, respectively;
- The Western Facilities (West Site), which are located west of the New England Highway and include the administration office, a small workshop, and Wynn and Kayuga mine entrances to the underground mine; and
- The Eastern Facilities (East Site), which are located east of the New England Highway and include the Coal Handling and Preparation Plant (CHPP), rail load out facilities, cleared coal stockpiles and the rehabilitated Reject Emplacement Area (REA).

The general site layout of the existing infrastructure at the West and East Sites is shown on **Figure 3** and **Figure 4**, respectively.

During Care and Maintenance, Dartbrook Mine has continued to maintain compliance with relevant DA 231-07-2000, mining authorities and other licences and approvals.

In December 2015, the sale of the majority joint venture interest in Dartbrook Mine to AQC was announced. The sale was completed in May 2017.



HB DARTBROOK Underground 2017 Annual Review HB1801 F1 Site Locality 06 03 2018

DARTBROOK MINE

Site Locality

FIGURE 1

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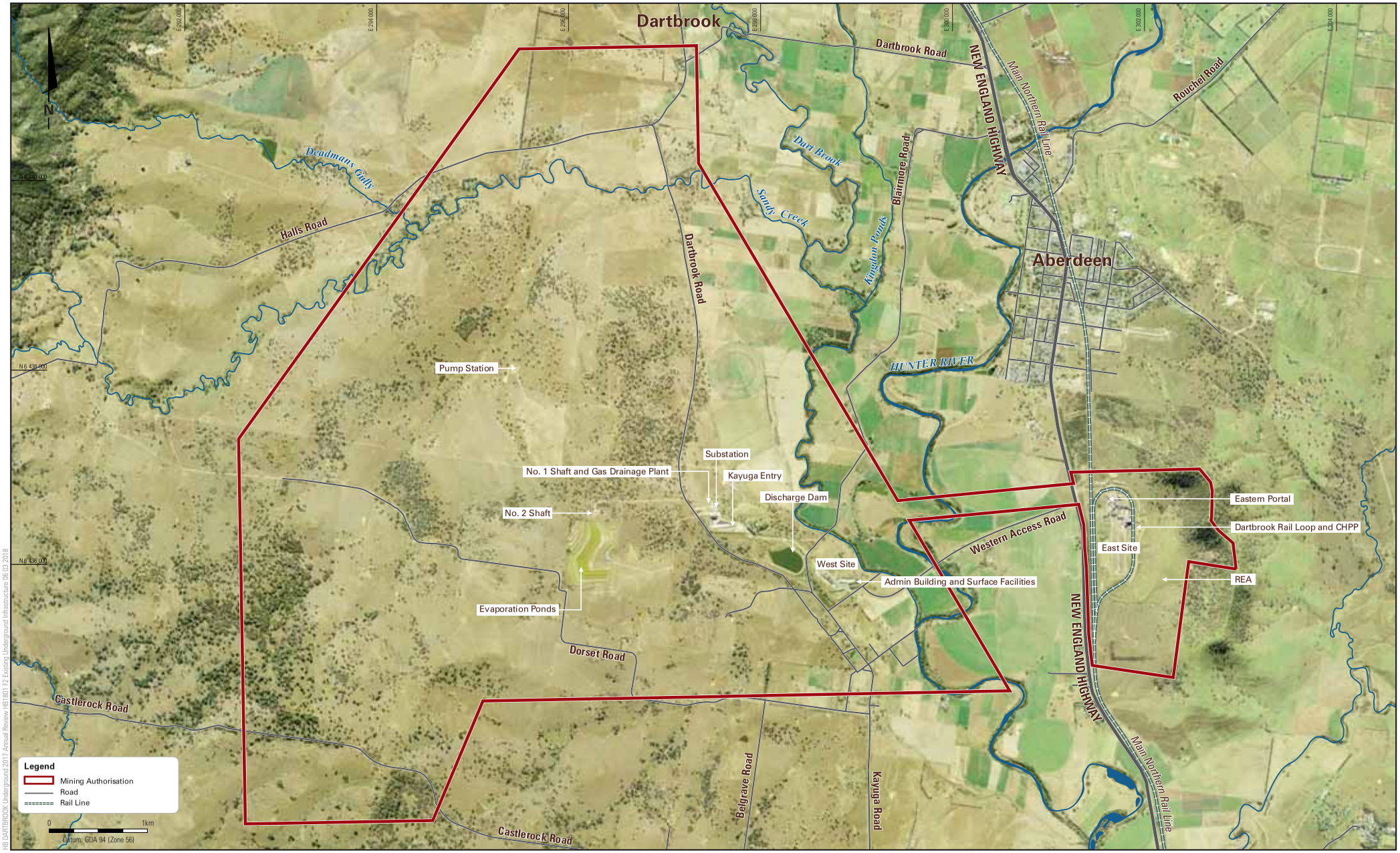

HB DARTBROOK Underground 2017 Annual Review HB1801 F2 Existing Underground Infrastructure 06 03 2018

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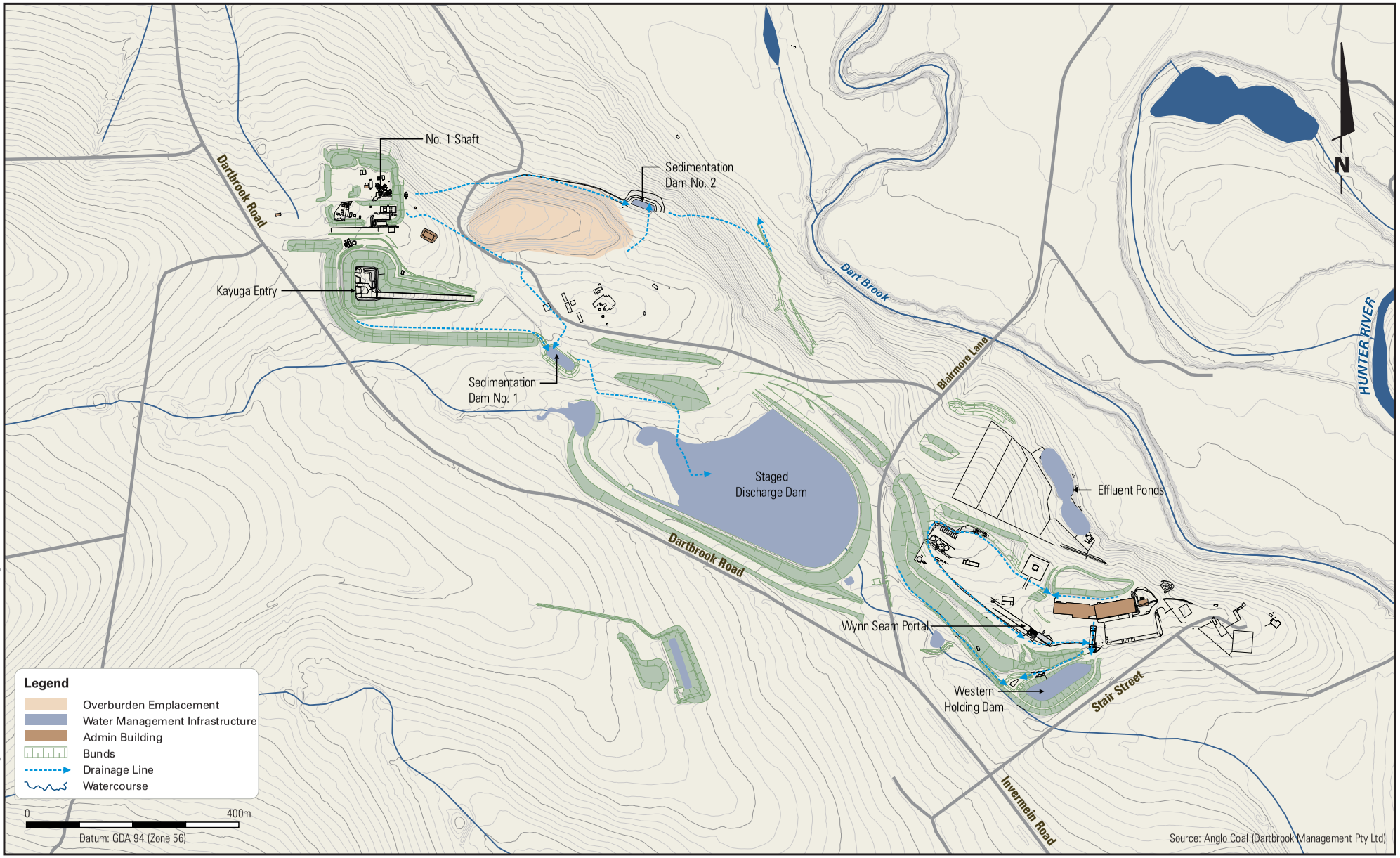
DARTBROOK MINE

Existing Site Layout

FIGURE 2



HB DARTBROOK Underground 2017 Annual Review HB1801 F3 Existing Environment - West Site 22 03 2018

DARTBROOK MINE

Existing Environment - West Site

FIGURE 3

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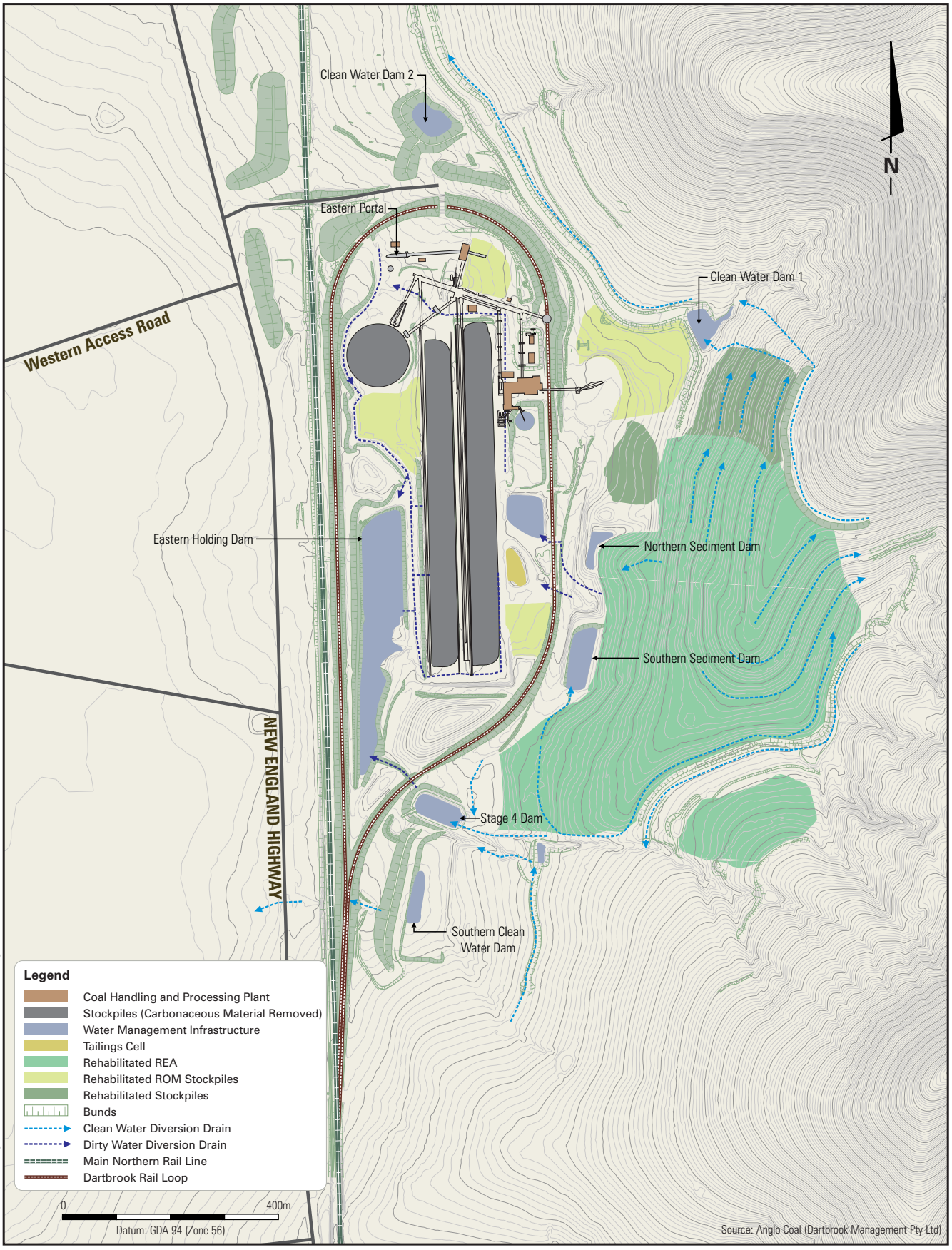

HB DARTBROOK Underground 2017 Annual Review HB1801 F4 Existing Environment - East Site 22 03 2018

DARTBROOK MINE

Existing Environment - East Site

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Australian Pacific Coal

FIGURE 4

2.2 PURPOSE

This Annual Review provides a summary of site activities, environmental management and performance at Dartbrook Mine for the reporting period (i.e. 1 January to 31 December 2017). This Annual Review has been prepared generally in accordance with its approvals including:

- Care and Maintenance Mining Operations Plan (MOP 2013-2017);
- Mining Lease (ML) and Exploration Licence (EL) conditions;
- DA 231-01-2000; and
- EPL 4885.

A summary of where each requirement from the above approvals has been addressed is provided in **Table 2**. All figures, tables and graphs presented in this document pertain to the reporting period, unless stated otherwise. **Figure 5** further shows the existing mining leases held at Dartbrook Mine.

2.3 PERFORMANCE SUMMARY

No coal mining or coal processing activities were undertaken at Dartbrook Mine during 2017. AQC completed the acquisition of Dartbrook in May 2017. During 2017 AQC commenced pre-feasibility studies to investigate the potential for the recommencement of some limited bord and pillar underground mining in addition to studies on how part of the resource could be extracted via low impact, modern open cut mining technologies.

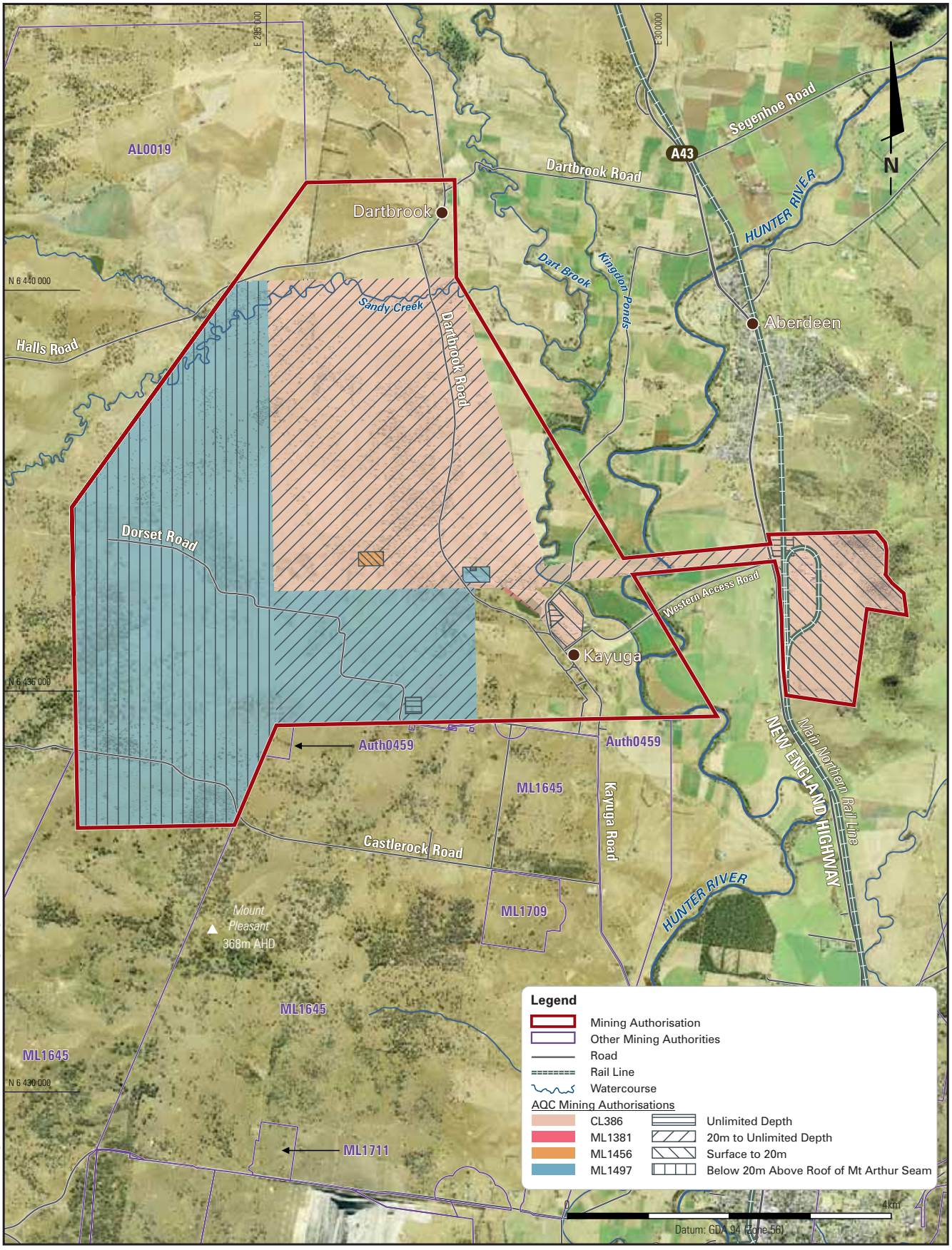
As the appointed contractor, the UGM Group (UGM)continues to act as the statutory manager on site. As such, UGM was responsible for carrying out maintenance activities completed in 2017.

Formal and informal communications with neighbours and community stakeholders were continued throughout the reporting period as discussed in **Section 9.2**.

As noted in **Section 9.1**, no formal complaints were received in 2017.

The Dartbrook Mine Community Consultative Committee (CCC) continued to meet throughout the year, with meetings held in May, August, September and November 2017. A summary of topics discussed at CCC meetings during the reporting period is provided in **Section 9.2.1**.

The specific aspects of Dartbrook Mine environmental performance for 2017 are described further in **Section 6** to **Section 8** of this Annual Review.



HB DARTBROOK Underground 2017 Annual Review HB1801 F5 Existing Mining Leases 22 03 2018

DARTBROOK MINE

Existing Mining Leases

FIGURE 5

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Australian Pacific Coal

Note: EL4574, EL4575, EL5525 and A256 not shown on figure

3 APPROVALS SUMMARY

This section provides a summary of leases, licences and approvals that regulate the operations at Dartbrook Mine.

3.1 OVERVIEW

Dartbrook Mine operates within the Consents, Leases & Licences summarised in **Table 2**. A summary of minor amendments to DA-231-07-2000 requirements approved for the period while Dartbrook Mine is on Care and Maintenance is provided in **Appendix A**.

The MOP relied upon during the reporting period covers the Care and Maintenance phase of operations. The approval period of the existing Care and Maintenance MOP was from 1 January 2013 to 31 December 2017.

A new MOP (for the period from 1 January 2018 – 31 December 2020) was submitted to DRG for review on 20 October 2017 and was subsequently approved on 18 December 2017. The new MOP will apply to activities going forward.

Table 2
Consents, Leases & Licences

Description	Approval Date	Expiry Date	Status/ Renewal Date	Approval Authority
Mining & Exploration Authorisations				
Authorisation 256	16/12/1980	02/05/2015*	Lodged 22/04/2015	DRG
Coal Lease (CL) 386	19/12/1991	19/12/2033	Due 19/12/2032	DRG
ML 1381	23/10/1995	23/10/2016*	Lodged 23/10/2015	DRG
ML 1456	27/09/1999	26/09/2020	Due 26/09/2019	DRG
ML 1497	06/12/2001	05/12/2022	Due 5/12/2021	DRG
Exploration Licence (EL) 4574	13/08/1993	07/04/2015*	Lodged 7/04/2015	DRG
EL 4575	13/08/1993	23/05/2016*	Lodged 23/05/2016	DRG
EL 5525	22/09/1998	21/09/2016*	Lodged 29/09/2016	DRG
Development Consent				
DA 231-07-2000 (as modified)	28/08/2001	28/08/2022	Active	DPE

Description	Approval Date	Expiry Date	Status/ Renewal Date	Approval Authority
Emplacement Area Approvals				
Approval for an Emplacement Area (s126 approval)	13/03/1996	N/A	Active	DPE
Stage 4 Reject Emplacement Approval C95/2265 (s126 approval)	02/01/2000	N/A	Active	DPE
Approval for 14° slopes in the REA Stage 4 (s126 approval	08/04/2004	N/A	Active	DPE
Application for Discontinuance of Use of Emplacement Areas (s101 approval)	13/08/2007	Ongoing	Active	DPE
Licences				
Environmental Protection Licence 4885	Granted 30/11/2000 (Amended 30 March 2017)	N/A	Active	EPA
Notification to Work Cover for storage and handling of Dangerous Goods	10/11/2005	N/A	Active	Safe Work NSW
Notification and Declaration to WorkCover that no dangerous goods stored or handled at Dartbrook Mine	Submitted 13/12/2006	N/A	Active	Safe Work NSW
Radiation Licence 5061080	1/07/2013	14/08/2018	Lodged 20/07/2017	EPA
Surface Water Licences	Various	Various	Active	DoI-Water
Bore Water Licences for Stock, Water and/or Domestic Use	Various	Various	Active	DoI-Water
Other				
Suspension of Mining Operations for Care and Maintenance under Section 70 (1) and Suspension of Conditions under Section 168 (1) of the Mining Act 1992, in respect of CL 386, ML 1381, ML 1456 & ML 1497	Suspension of Mining Operations was extended on 31/12/2014	31/12/2017*	Lodged 25/10/2017	DRG
MOP for Care and Maintenance – Extension	18/12/2012	31/12/2020	Lodged 25/10/2017 Approved 18/12/17	DRG

*Note: * Application lodged with DRG*

3.2 STATUS OF MANAGEMENT PLANS

Dartbrook Mine is required to develop and implement several Management Plans under DA 231-01-2000. **Table 3** outlines the environmental management plans utilised onsite and the approval date for each.

Table 3
Dartbrook Mine Underground Management Plans and Strategies

Management Plan/Program	Approval Date
Environmental Management Strategy	1/11/2016**
Archaeology and Cultural Management Plan	10/08/2011
Blast Management Plan*	10/12/2002
Bushfire Management Plan	30/06/2016
Construction Noise Management Plan*	7/11/2001
Dust Management Plan	24/11/2015
Erosion and Sediment Control Management Plan	21/10/2014
Flora and Fauna Management Plan	21/10/2014**
Land Management Plan	22/04/2016**
Landowner Communication and Consultation Plan	10/12/2002
Landscape and Lighting Management Plan	13/07/2011
Longwall Subsidence Management Plan(s)*	22/13/2003
Noise Management Plan*	15/09/2011
Property Subsidence Management Plans*	22/12/2003
Site Water Management Plan (SWMP)	20/04/2015
Soil Stripping Management Plan	7/11/2016**
Spontaneous Combustion Management Plan	1/11/2016**
Waste Management Plan	28/10/2016**
Vibration Management Plan*	10/12/2002

** Generally not applicable during Care and Maintenance operations*
*** Submitted to DPE for Review in 2016/2017*

4 OPERATIONS SUMMARY

4.1 EXPLORATION

No exploration drilling was undertaken at Dartbrook Mine in 2017.

Renewal applications for EL 4574, EL 4575 and EL 5525 were lodged with DRG in the 2015 and 2016 reporting periods by the previous owner, Anglo American. **Table 2** denotes the status of each mining authorisation held by AQC as of December 2017.

Stage 1 of an exploration drilling program is planned to commence in the first half of 2018. Should the planned drilling program commence in the 2018 reporting period, a summary of works will be provided in the 2018 Annual Review.

Following a 2014 Independent Environmental Audit (IEA) by SLR on the condition of existing exploration boreholes, 26 historic open boreholes were identified as requiring rehabilitation. Rehabilitation of the open boreholes is yet to be completed; however, the identified rehabilitation works are scheduled to be undertaken as part of the Stage 1 exploration program.

4.2 MINING OPERATIONS

The Director-General of DRG had approved the suspension of the labour and expenditure conditions of Dartbrook Mine's Coal and Mining Leases until 31 December 2017. As denoted in **Table 2**, renewal of these mining authorisations has been sought.

Table 4 summarises the coal production and coal processing waste quantities for 2017 and the volumes forecast for 2018 in the MOP. No coal was processed or transported under Care and Maintenance operations at Dartbrook Mine in 2017. None is proposed in 2018.

Table 4
Production Summary

Material	Unit	Approved Limit	Actual Quantity (2016)	Actual Quantity (2017)	Forecast Quantity (2018)
Waste Rock / Overburden	Mbcm	N/A	0	0	0
ROM Coal	Mt	6 Mtpa	0	0	0
Coarse Reject	Mt	N/A	0	0	0
Fine Reject	Mt	N/A	0	0	0
Product Coal	Mt	N/A	0	0	0

4.2.1 Land Preparation

Under Care and Maintenance, land preparation has been restricted to activities associated with exploration drilling and general maintenance (if required). A Permit to Disturb is obtained prior to the commencement of any drilling or activity that will cause surface disturbance.

The Permit to Disturb considers issues such as land ownership, Archaeology, threatened flora and fauna species, surrounding infrastructure and rehabilitation techniques. Any topsoil that is stripped from the area is temporarily stockpiled. On completion, the topsoil is respread and the area is revegetated.

No land preparation work was undertaken in 2017 as part of the Care and Maintenance operations. However, 56 soil test pits were dug on AQC land. Permits to Disturb were prepared before these works commenced, along with due diligence assessments by qualified ecologists and archaeologists. Topsoil was initially stripped from soil test pit areas and separately stockpiled. The test pits were excavated to a depth of 1.2m to allow sampling. The pit was then backfilled and the topsoil respread (see **Plate 1**).

Plate 1
Soil Test Pit Excavation 2017

No topsoil was stripped for mining, exploration drilling or rehabilitation purposes in 2017. Topsoil and overburden continue to be stockpiled at suitable locations onsite. No topsoil or overburden was moved or actively used in operations during 2017.

Table 5 provides an estimate of the quantity of topsoil available to be used for future rehabilitation works.

4.2.2 Operations Summary

Operations were conducted generally in accordance with the existing Care and Maintenance MOP and as a result, no coal was processed in 2017.

UGM was responsible for Dartbrook Mine's Care and Maintenance operations during the 2017 reporting period. UGM is the Statutory Manager responsible for Care and Maintenance Operations at Dartbrook Mine in relation to AQC's obligations under the *Mining Act 1992.*

UGM conducted daily tasks required to maintain the site and the CHPP. These included (but not limited to) the servicing and maintenance of equipment such as pumps, mine ventilation fans, electrical apparatus and underground mine vehicles.

Routine maintenance of the CHPP was undertaken, which involved the periodic dry running of the plant and associated pumps and conveyors. Minor repairs to structural items and the management of corrosion were also undertaken in 2017.

Other routine tasks included road works, housekeeping, strata control, statutory inspections, monitoring and reporting associated with the underground mine.

Access to the underground mine was retained via the Hunter Tunnel and Wynn Seam Portal from the East and West sites, respectively. The underground air quality is monitored utilising a tube bundle system and CITECT. Statutory inspections of accessible areas were carried out by UGM in 2017.

Table 5
Topsoil and Overburden Stockpile Status

Activity / Area	Cumulative Production (t)		
	Start of Period 01/01/2017	End of Period 31/12/2017	End of next period 31/12/2018
Topsoil Stripped	0	0	0
Topsoil used / spread	0	0	0
Topsoil Stockpile	14,780	14,780	14,780
Overburden Stockpiles and Bunds	655,747	655,747	655,747

4.3 WASTE MANAGEMENT

4.3.1 Process Mineral Waste

Dartbrook Mine did not process any mineral waste in 2017.

Mineral waste at Dartbrook Mine is confined to the REA; the footprint of the area covers approximately 29 ha. Final rehabilitation of the majority of the REA was completed in mid-2007, with monitoring and appropriate maintenance works being undertaken since that time. Temperature and monitoring and inspections of the REA are conducted regularly for spontaneous combustion management. Temperature monitoring results for the REA are provided in **Section 6.10**. No elevated results were recorded in 2017.

No rehabilitation was required during the 2017 reporting period. No coarse reject materials were disposed of in the REA in 2017. Tailings or fines were not disposed of in the mine goaf in 2017.

REA drainage was maintained in 2017. The drainage basin and the trash trap flowing into the underground pipe in the REA were kept clean to ensure that the pipeline was kept in working order.

The Section 126 approval requires *"…an independent engineering assessment to be made...at periods not exceeding three years of the dams and holding structures associated with the rejects disposal project..."*.

The latest geotechnical inspection of the REA was undertaken by Douglas Partners in November 2015. The assessed risk of slope failure of the REA was classified as being very low to low in the short to medium term due to the potential for liquefaction of the coal reject under an earthquake loading. This rating will improve to very low in the long term after the coal reject consolidates, provided that drainage is maintained. The next structural inspection of the REA will be undertaken in the 2018 reporting period.

Internal environmental / rehabilitation inspections of the REA were conducted regularly throughout the year. These inspections confirmed that rehabilitated areas were in good condition throughout the reporting period. However, vegetation cover was showing signs of decline due to drier than average conditions experienced during the reporting period.

4.3.2 Non-Process Waste Management

Dartbrook Mine produces a range of non-mineral waste materials as a result of its activities onsite. To maximise recycling opportunities onsite, Dartbrook Mine utilises a colour coded recycling system. Remondis is responsible for the removal and disposal of all non-process waste generated onsite.

Offsite treatment and disposal facilities are used to ensure that all waste is appropriately tracked, disposed of and reported, in accordance with the Dartbrook Mine Waste Management Plan.

During the reporting period, 13.7 tonnes of non-process waste was removed from site. **Table 6** provides a summary of waste tracked at Dartbrook Mine during the reporting period.

This comprised of approximately 9.7 tonnes of general waste and 0.2 tonnes of co-mingled recyclable materials. In 2017, 3.7 tonnes of scrap metal was recycled as part of an ongoing scrap steel recycling and removal campaign onsite (See **Plate 2**).

Table 6
Waste Generation

Waste Type	Disposal	Quantity in 2017
General Waste - Non-hazardous (t)	Landfill	9.756
Scrap Metal (t)	Recycled	3.7
Office Paper and Co-mingled Recyclables (t)	Recycled	0.209
Hazardous Waste – Sewage Sludge (Litres)	Treatment	0
Waste Oil (Litres)	Recycled / Treatment	0
Hazardous Waste - Chemical Anchors / Resins (t)	Treatment	0
	Approved Landfill	0

Plate 2
Removal of scrap steel from site 2017

4.3.3 Hazardous Materials Management

No licensable quantities of dangerous goods were stored or used at Dartbrook Mine in 2017. There are nominal quantities of hazardous substances required for use at Dartbrook Mine during Care and Maintenance operations.

A permit system is in place for the introduction of chemical substances to site and a register of these is maintained. When substances are no longer required they are removed from site.

Dartbrook Mine also has a licence to possess radiation apparatus, which is imbedded in the coal quality monitoring equipment required to be used at the CHPP.

4.4 ROM & PRODUCT COAL STOCKPILES

The capacity of the coal stockpile areas is listed in **Table 7**. No coal was stored on any stockpile in 2017.

Table 7
Coal Stockpile Status

Stockpile	Coal Type	Capacity (Tonnes Approx.)	Status
Emergency Stockpile	ROM	50,000	Rehabilitated
Circular Stockpile	ROM	80,000	Cleared of coal material
Eastern ROM stockpile	ROM	185,000	Rehabilitated
Western ROM Stockpile	ROM	90,000	Rehabilitated
Southern ROM Stockpile	ROM	70,000	Rehabilitated
Northern ROM Stockpile	ROM	5,000	Rehabilitated
Rectangular Product Stockpile No. 1	Product	200,000	Cleared of coal material
Rectangular Product Stockpile No. 2	Product	200,000	Cleared of coal material
Reject Stockpile	Reject	20,000	Cleared of coal material
TOTAL		900,000	

4.5 CONSTRUCTION & DEMOLITION

Minor maintenance repairs to the Riverview Homestead and renovations to Kayuga Homestead were undertaken in 2017. Upgrades to Kayuga Homestead will continue to be undertaken in 2018. No major construction or demolition works are planned for 2018.

4.6 NEXT REPORTING PERIOD

Care and Maintenance operations at Dartbrook Mine during the next reporting period will be generally consistent with the new Care and Maintenance MOP.

AQC intends to seek a modification to its development consent in 2018. This modification is to facilitate the recommencement of a limited first-workings underground mine within the approved footprint of the Kayuga coal seam.

AQC will consult with all relevant stakeholders and regulatory agencies prior to the submission of the Environmental Assessment for the modification. Should the modification be granted approval in 2018, a revised MOP will also be developed to reflect the additional activities approved under the modification.

In accordance with DRG's MOP (2017-2020) letter of approval, AQC will undertake a topsoil audit of Dartbrook Mine in 2018. The results of this audit will be reported on in the next Annual Review.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

This section includes a list of actions from the 2016 Annual Review that were planned for the reporting period and a summary of AQC responses to each item.

AQC consulted with relevant regulatory agencies throughout the previous reporting period to identify the key issues for consideration in this Annual Review.

In correspondence dated 24 May 2016, DPE requested additional information be provided in the 2017 Annual Review. AQC consulted further with DPE on 28 November 2017 following completion of the acquisition of Dartbrook Mine in May 2017, when DPE also requested an update on the complaints handling system used at Dartbrook Mine.

No correspondence was received from DRG requesting additional information for inclusion in the 2017 Annual Review.

DPE and DRG conducted a site inspection of Dartbrook Mine on 7 June 2017. No correspondence was received from either regulator following the visit requesting any additional information or actions.

Table 8 lists the issues raised by regulatory authorities or commitments made in the previous reporting period and indicates where these issues are addressed in this Annual Review.

Table 8
Issues Raised by Regulatory Authorities in 2017

ID	Issue	Where Addressed	Status
DPE Requests			
1	Document the socio-economic impact of Dartbrook Mine, including workforce characteristics	**Section 9.2.3**	Completed
2	Include a report on the surveillance of any prescribed dam onsite to the satisfaction of the Dams Safety Committee (DSC)	**Section 7.3**	Noted
3	Review of Depositional Dust Gauge Locations or Holders	**Section 6.3**	Not Completed
4	Provide information consistent with the requirements of Table 7 '*Post-approval requirements for State significant mining developments, Annual Review Guideline*'	**Section 7.3**	Completed
5	Explanation of Wynn Seam TARP process	**Section 7.1**	Completed
6	Any updates to the Complaint Handling System	**Section 9.1**	Completed
7	Slash Topsoil Stockpiles	**Section 6.5.1**	Completed

6 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

This section describes Dartbrook Mine's environmental monitoring, management and performance for the reporting period. Environmental management actions to be implemented in 2018 are also described, as required.

6.1 OVERVIEW

An internal Safety, Health and Environment Management System (SHEMS) has been developed and implemented for Dartbrook Mine. The SHEMS has been developed generally in accordance with 'AS/NZS ISO14001: Environmental Management Systems' and 'AS 4801: Occupational Health and Safety Management System'. It provides a systematic risk based approach to the management of safety, health, and environmental aspects associated with the environment.

The SHEMS reflects the Care and Maintenance status of the mine and accommodates the relevant UGM procedures for the Statutory Mine Area. Internal operational inspections of rehabilitation, water, biodiversity and hydrocarbon management components of the SHEMS were undertaken regularly in 2017. These inspections did not identify any operational non-compliances.

The SHEMS was revised during the reporting period following AQC's acquisition of Dartbrook Mine. **Table 9** provides a summary of the environmental management actions undertaken during 2017.

6.2 METEOROLOGY

6.2.1 Environmental Management

Dartbrook Mine has two operating meteorological stations, Met-01 and Met-02. The locations of these sites are shown on **Figure 6**.

For reporting purposes, Dartbrook Mine generally uses data from Met02 due to the availability of long term data (from 1995 to the present).

Both meteorological monitoring sites are operated via real-time telemetry to assist with accurate data acquisition.

6.2.2 Environmental Performance

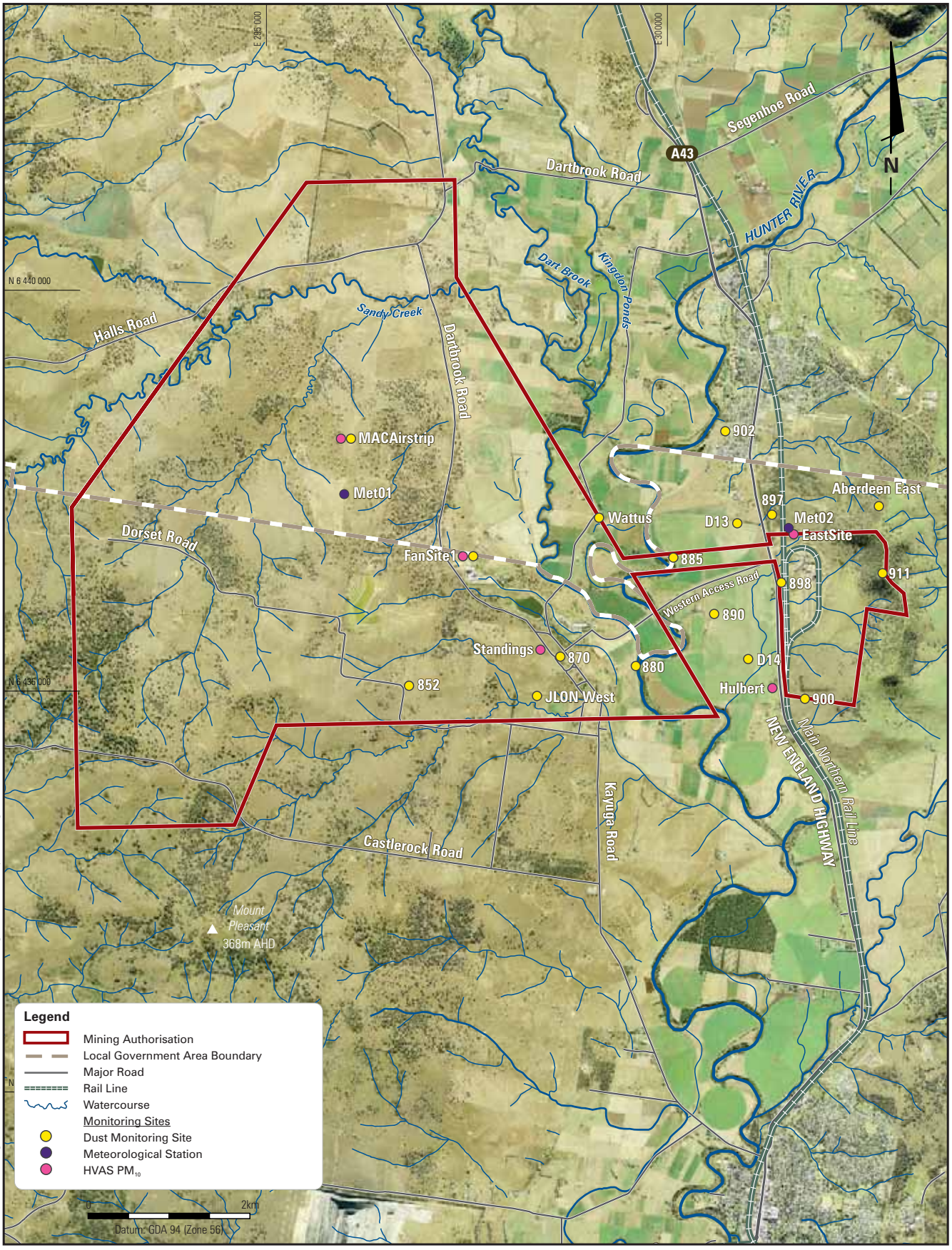
Rainfall

During the reporting period, a total of 406.26 mm of rainfall was recorded over 69 rain days, compared to 690.6 mm over 80 rain days recorded in 2016.

The rainfall received in 2017 was lower than the long-term average annual rainfall of 592 mm. An annual rainfall summary is further provided in **Table 10**. With exception of the rainfall recorded in March 2017 (177 mm), all monthly rainfall volumes were below the respective long term averages. This is further shown **Appendix B**.

Table 9
Environmental Management Overview

Aspect	Performance during 2017	Trends	Management Actions
Air Quality	• Annual average dust deposition rates were within the criteria • PM_{10} concentrations were within the regulatory criteria	• Since mining has not be been undertaken since 2006, any changes in air quality are due to external influences	• Monitoring of PM_{10} and dust deposition (see **Section 6.3**)
Greenhouse	• 66,943 tonnes of CO_2 equivalent gas (CO2-e) was emitted	• Greenhouse gas emissions have remained relatively low during Care and Maintenance	• Methane and CO_2 from the underground workings are released via Ventilation Shaft No. 1 (see **Section 6.14**)
Noise	• Noise levels produced by Care and Maintenance activities are minimal	• Noise levels have remained relatively low since the suspension of mining in 2006	• Dartbrook Mine has an exemption from noise monitoring requirements during Care and Maintenance. (see **Section 6.6**)
Visual	• The tree screen to the west of the New England Highway continued to develop satisfactorily	• The tree screen has steadily developed since it was planted in 2011 (see **Plate 3**)	• Drip irrigation of the tree screen during dry periods (see **Section 6.7**)
Biodiversity	• River Restoration Project, River Red Gum restoration areas and the Forestry Plantation were progressing satisfactorily	• These re-vegetated areas continue to progress well	• Weed and feral animal controls (See **Section 6.5**)
Heritage	• No additional impacts to Aboriginal or European heritage items. Renovations to Kayuga Homestead commenced (see **Section 6.9**).	• No impacts to heritage items have occurred during the Care and Maintenance period	• General maintenance of European Heritage sites. Completion of renovations to Kayuga Homestead.
Subsidence	• No additional subsidence • Previously remediated areas have remained stable	• No subsidence has occurred during the reporting period	• Visual monitoring of previously subsided areas (see **Section 6.12**).



H8 DARTBROOK Underground 2017 Annual Review HB1801 F6 Meteorological and Air Quality Monitoring Network 22 03 2018

DARTBROOK MINE

Meteorological and Dust Monitoring Locations

FIGURE 6

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Australian Pacific Coal

Temperature

Monthly maximum, average and minimum temperatures recorded at Dartbrook Mine are presented in **Table 11**. January was the warmest month in 2017 with an average temperature of 27.0ºC. July was the coldest month in 2017 with an average temperature of 11.2 ºC. Temperatures recorded at Dartbrook Mine were slightly warmer than the long term averages but generally consistent with those in previous years.

Table 10
Rainfall Summary 2017

Month	Rainfall (mm)	Cumulative Rainfall (mm)
January	12.0	12.0
February	10.6	22.6
March	177.2	199.8
April	21.6	221.4
May	24.0	245.4
June	38.2	283.6
July	1.8	285.4
August	13.2	298.6
September	9.6	308.2
October	48.2	356.4
November	25.2	381.6
December	24.6	406.2

Table 11
Monthly Temperature Summary 2017

Month	Min Temperature (°C)	Avg Temperature (°C)	Max Temperature(°C)
January	15.8	27.0	41.7
February	10.6	26.7	45.4
March	11.5	22.2	34.4
April	5.3	16.8	27.4
May	2.8	14.4	24.8
June	0.6	12.2	20.1
July	-0.9	11.2	23.1
August	-0.4	12.9	25.9
September	-0.1	17.2	34.6
October	6.1	20.1	35.3
November	7.7	20.0	33.8
December	14.2	25.6	41.1
Annual	0.9	18.8	45.4

Wind Speed & Direction

In 2017, prevailing winds were generally from the south to south-east during the summer months and from the north during the winter months, consistent with long term observations. Wind speeds were generally similar to those recorded in 2016. **Table 12** provides a summary of the data captured at Dartbrook Mine in 2017. Monthly wind roses compiled from Met-02 are provided in **Appendix B**.

6.2.3 Next Reporting Period

Dartbrook will continue to monitor meteorological conditions on site and will report on the results in the 2018 Annual Review.

No upgrades to the existing meteorological monitoring infrastructure is planned to occur in 2018.

Table 12
Wind Summary 2017

Month	% Period with Wind Speed <3.0 m/s	% Period with Wind Speed >3.0 m/s	Predominant Wind Direction
January	43.0	57.0	SSE
February	48.0	52.0	SSE
March	64.1	35.9	SSE
April	74.8	25.2	SSE
May	83.0	17.0	N
June	83.6	16.4	NNE/S
July	64.6	35.4	N/NNE
August	54.2	45.8	N
September	52.5	47.5	N
October	61.1	38.9	SE
November	56.1	43.9	S/SSE
December	43.7	56.3	SSE

6.3 AIR QUALITY

6.3.1 Environmental Management

Potential impacts to air quality at Dartbrook include airborne dust and odour. These impacts are managed in accordance with the onsite SHEMS, DA 231-01-2000 conditions and relevant environmental management plans, including the Dust Management Plan (DMP). The DMP is the primary tool used to minimise and control dust impacts onsite.

Coal stockpile areas and the REA have been previously cleared of coal material and revegetated (See **Figure 4**) in order to minimise potential dust emissions during Care and Maintenance. Dartbrook Mine is generally not undertaking activities that generate dust during Care and Maintenance.

Dust Monitoring Criteria

The dust standards and goals specified in Condition 6.1(a1) and Condition 6.1(axvii) of DA 231-01-2000 are presented in **Table 13** and **Table 14**. The National Environment Protection Council (NEPC) 24-hour PM_{10} goal allows for five exceedances per year. It is noted that the figures listed in **Table 13** are reporting goals, rather than actual compliance standards.

Table 13
Dartbrook Mine Air Quality Standards & Goals

Health Based Standards/Goals		
Dust Type	Standard/Goal	Agency
Total Suspended Particulate Matter (TSP)	90 μg/m3 (annual mean)	National Health and Medical Research Council
NSW EPA Amenity Based Standards/Goals for Dust Fallout		
Existing Dust Fallout Level (g/m^2/month)	Maximum Acceptable Increase Over Existing Deposition Levels (g/m^2/month)	
	Residential	Other
2	2	2
3	1	2
4	0	1

Table 14
Dartbrook Mine PM_{10} Air Quality Goals

PM_{10} Goal	**Agency**
50 μg/m3 (24-hour average)	NEPC
25 μg/m3 (Annual average)	EPA

Dartbrook Mine maintains an air quality monitoring network consisting of 17 dust deposition gauges and 5 High Volume Air Samplers (HVAS), the locations of which are shown in **Figure 6**. However, not all of these monitoring locations are included as compliance monitoring locations in the approved DMP.

The compliance monitoring network in the approved the DMP includes:

- Five depositional dust gauges:
    - Three dust deposition gauges at locations representative of the closest private residences to the East Site (including Aberdeen);
    - Two dust deposition gauges at locations representative of the closest private residences to the south and west of the West Site surface facilities; and
- Two PM_{10} monitoring locations, one located to the south of the CHPP and one south of the West Site workshop, which are representative of the closest private residences; and
- Meteorological stations at the East and West Sites (see **Section 6.2**).

6.3.2 Environmental Performance

Dust Deposition

In 2017, dust monitoring continued at 17 dust deposition monitoring sites located throughout the area. Dust deposition gauges have been established on a grid network that covers the major areas in relation to all surface activities. Results from dust deposition gauges are expressed as insoluble solids, comprised of combustible matter (or organic matter) and ash residue.

Ash residue is considered to be more representative of the dust component (from soils and weathered rock) while the remainder, typically organic matter, includes bird droppings, leaf or grass litter, insects and coal.

Standard units are reported in g/m^2/month. Most insoluble solid results that are above 4 g/m^2/month undergo a XRD scan (microscopic examination) of the combustible matter to determine whether the material is carbonaceous, organic matter or sandy clay matter. **Appendix C** presents results of air quality monitoring undertaken throughout the year.

Table 15 and **Figure 7** summarise the annual average deposition rate of insoluble solids and the ash component.

'Contaminated samples' as listed in **Appendix C** were excluded from calculations of annual average dust deposition rates. Contaminated samples collected during the reporting period generally contained varying levels of bird droppings, vegetation and insects.

Table 15
Annual Average Dust Deposition for 2017

Site	Location Description	Insoluble Solids (g/m^2/month)	Ash Component (g/m^2/month)	Number of Samples
852	Dorset Road	0.98	0.61	12
860	No. 1 Vent Shaft	1.16	0.61	12
870	Kayuga Village	2.73	1.92	12
880	Hunter River / Dart Brook Junction	1.55	0.84	12
885	Frazer Farm paddock near the Hunter River	1.84	1.09	12
890a	Garoka Dairy	2.06	1.59	12
897	Eastern Site North	1.44	1.73	12
898	Eastern Site West	1.13	1.60	12
900	Eastern Site South	1.03	0.67	12
902	Aberdeen Tree Screen	1.20	0.65	12
911	Browns Mountain	1.32	0.73	12
Aberdeen East	South east of Aberdeen	1.10	0.57	12
D13	Residence northwest of CHPP	1.37	0.73	12
D14	Southwest of CHPP	1.25	2.63	12
JLON West	Residence south of West Site	1.84	1.13	12
Macairstrip	Northwest of West site	*	1.53	12

** All available samples contaminated – unable to calculate annual average*

Results where the monthly Insoluble Solids recorded are greater than 4 g/m^2/month are displayed in **Appendix C**. As Dartbrook Mine is not operating, the majority of elevated dust results can be attributed to elevated background levels generated by farming, grazing activities and other industries on adjacent lands.

The annual average dust deposition for insoluble solids during 2017 ranged from 0.98 g/m^2/month (at Dorset Road) to 2.73g/m^2/month (at Site 870 – Kayuga Village).

In 2017, annual average dust deposition rates were below the limit of 4 g/m^2/month at all sites. The annual average for insoluble solids at Macairstrip was unable to be calculated due to a high number of contaminated samples recorded throughout the reporting period.

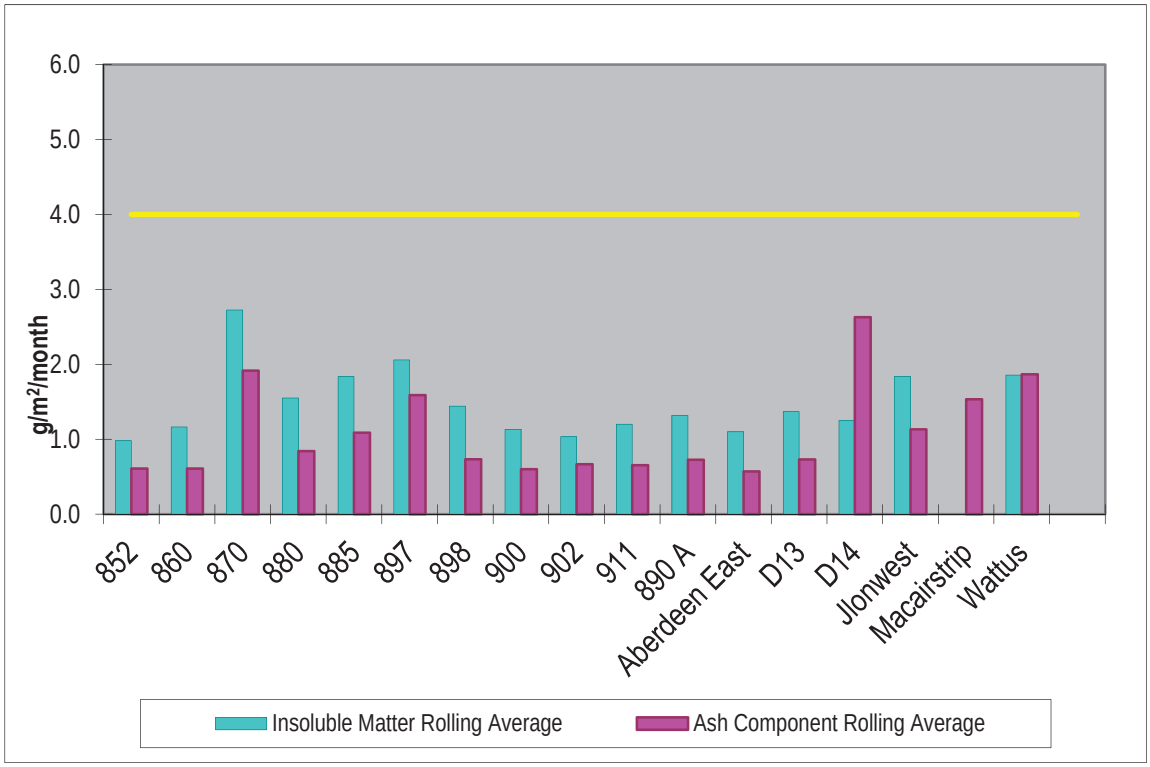


Figure 7
Depositional Dust Annual Average 2017

High Volume Air Samplers

Dartbrook Mine has five HVAS that monitor PM_{10} (particulate matter less than 10 microns) dust concentration.

Dust is monitored for a 24-hour period on a 6-day cycle. Where samples are not captured due to programming or other technical issues, a program re-run is undertaken to capture missing data. Sample analyses are carried out in accordance with the relevant Australian Standards. The locations of the HVAS are illustrated in **Figure 6** and described in **Table 16**.

The data recovery rate was 100% for all HVAS sites in 2017. One program re-run was undertaken at site ESMS during the reporting period, due to a technical fault. All sites were compliant with the NEPC standard for data capture, which requires recovery of data to be greater than 75%.

The 24-hour annual average PM_{10} results for the HVAS show a slight increase across the summer period as presented in **Figure 8**. One elevated PM_{10} HVAS result was recorded at the Hulbert monitor on 11 February 2017. AQC contacted the tenant of the property during a review of the elevated result. The tenant explained approximately 300 head of cattle were using the paddock where the Hulbert HVAS is located on the day in question. A second elevated HVAS result was recorded at the Hulbert monitor on 20 December 2017. This elevated result was likely due to localised agricultural activities in the vicinity of the monitor.

The annual average was below the EPA criteria of 25 µg/m^3 at all sites during the reporting period. **Table 17** presents the annual average PM_{10} concentrations at the five HVAS during 2017 and compares these with the predictions in the EIS and subsequent modifications.

As would be expected during Care and Maintenance, PM_{10} concentrations were less than the predicted levels. 2017 results are slightly higher than the previous reporting period. Elevated results are likely due a drier local environment.

Annual average TSP concentrations for the five HVAS sites were calculated based on measured PM_{10} values and are presented in **Figure 9**. These results show that the monitored annual average for 2017 did not exceed the total predicted annual average as provided in the EIS. Peaks were found to be due to localised industrial and farming activities.

6.3.3 Next Reporting Period

A review of the DMP will be undertaken in the next reporting period. This review will consider the adequacy of the existing dust monitoring network, including the locations of and types of holders used to prevent contamination of Depositional Dust Gauges at Dartbrook Mine, as requested by DPE in May 2017.

Table 16
HVAS Monitoring Sites for PM_{10} and calculating TSP

HVAS Site	Location
East Site Meteorological Station (ESMS)^	East Site, north of the CHPP
Fan Site Number 1 ^	West Site, adjacent to the ventilation fan
Hulbert*	East Site, south-south-west of the CHPP
Standings*	West Site, south of the surface infrastructure
Macairstrip^	West Site, centre of the Mining Leases

** Representative of Private Receiver*
^ Internal Management Site

Table 17
Comparison of Measured PM_{10} Concentrations with EIS Predictions

Location	Units	EIS Predicted Annual Average PM_{10}	Annual Average PM_{10} Results 2017
ESMS	µg/m^3	20.1	15.3
Fan site 1	µg/m^3	18.7	14.1
Hulbert	µg/m^3	17.4	16.7
Standings	µg/m^3	17.3	14.9
Macairstrip	µg/m^3	17.0	15.5

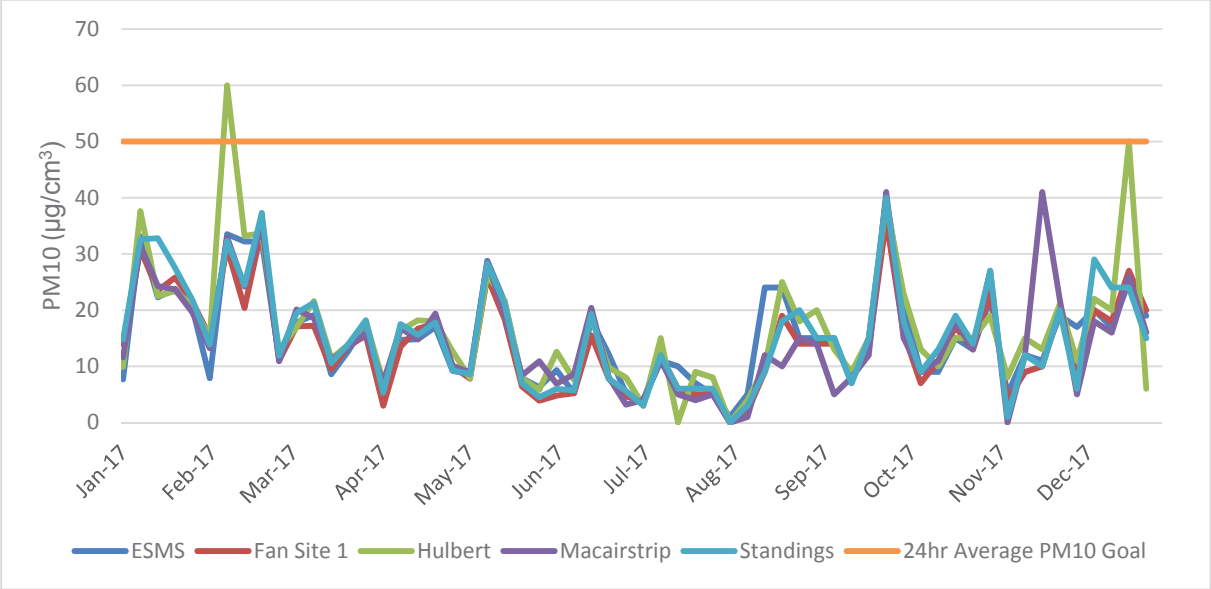


Figure 8
HVAS 24-hr Average PM_{10} Results

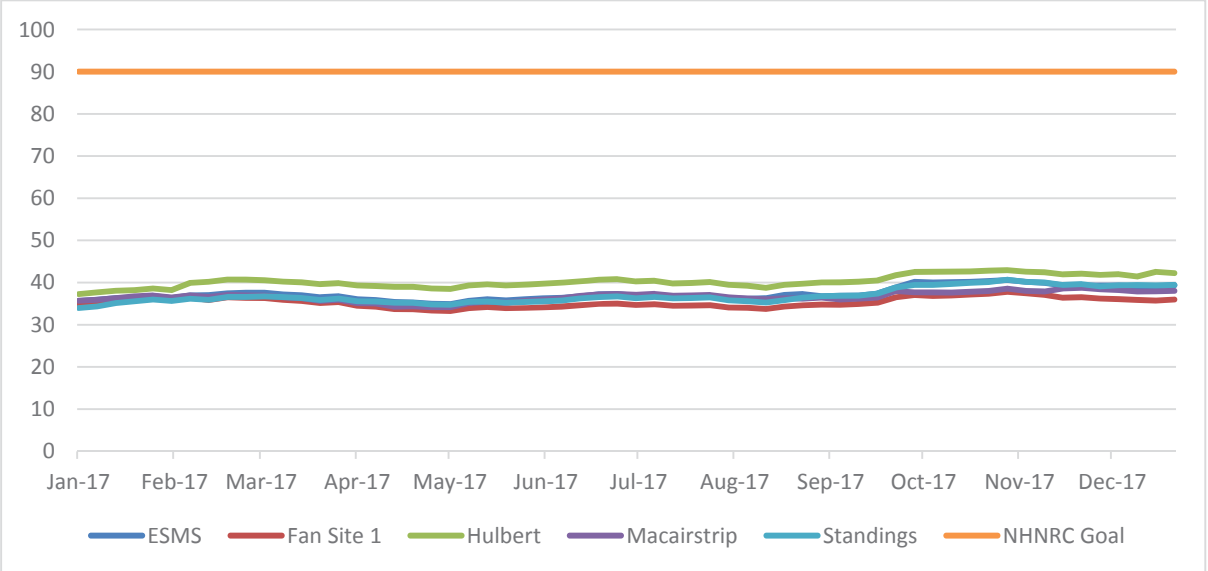


Figure 9
Calculated Rolling Annual Average TSP Concentrations

6.4 THREATENED FLORA AND FAUNA

6.4.1 Environmental Management and Performance

In terms of threatened flora and fauna species and habitat values, the Dartbrook Mine environment is a highly modified and fragmented environment of low ecological significance

Ecological studies previously undertaken at Dartbrook Mine in 2011 (the study) identified two communities listed as Endangered under the *Threatened Species Conservation Act 1995* (now replaced by the *Biodiversity Conservation Act 2016* (BC Act)) within the mining authorisations. This included approximately:

- 2,252 ha of Upper Hunter White Box Grassy Woodland (Box Gum Woodland); and
- 54 ha of Hunter Floodplain Red Gum Woodland.

Two threatened plant species were also identified in this study, including:

- Austral Toadflax (*Thesium australe*); and
- Black Orchid (*Cymbidium canaliculatum*).

The study also found six fauna species that are listed as either threatened under the BC Act or migratory under the Commonwealth *Environmental Protection and Biodiversity Act 1999* (EPBC Act). These species included:

- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), listed as vulnerable under the BC Act;
- Large-footed Myotis (*Myotis macropus*), listed as vulnerable under the BC Act;
- Speckled Warbler (*Chthonicola sagittata*), listed as vulnerable under the BC Act;
- Little Eagle (*Hieraaetus morphnoides*), listed as vulnerable under the BC Act;
- Rufous Fantail (*Rhipidura rufifrons*), listed as marine and migratory under the EPBC Act; and
- White-throated Needletail (*Hirundapus caudacutus*), listed as marine and migratory under the EPBC Act.

Flora and fauna impacts, including all identified threatened and endangered species, are managed in accordance with the approved Flora and Fauna Management Plan.

Care and Maintenance operations at Dartbrook Mine generally do not require the clearing of vegetation. Where minor disturbance is required during Care and Maintenance, activities are undertaken to minimise disturbance to vegetation. A Permit to Disturb system is also used prior to any disturbance to check areas for any significant flora or fauna issues.

6.4.2 Next Reporting Period

During 2018, fauna and flora communities on site will continue to be managed in accordance with the approved Flora and Fauna Management Plan. In circumstances where clearing is required, a Permit to Disturb will be processed and appropriate pre-clearing surveys will continue to be undertaken.

In 2018, the native forest tree screen along the New England Highway and the area north of the CHPP, which is planted with native forest will be surveyed and maintained. The River Restoration Project will continue in 2018 with the maintenance and monitoring of previously rehabilitated areas.

6.5 NOXIOUS WEEDS AND FERAL ANIMALS

6.5.1 Environmental Management and Performance

The management of noxious weeds and feral animals forms an integral part of the ongoing land management practices adopted for the site as described in the approved Land Management Plan.

Weed Management

Noxious weeds such as African Boxthorn, St John's Wort, Galenia, Bathurst Burr and Green Cestrum have been located on Dartbrook Mine owned land in the past. Their control continued to be a key land management objective in 2017.

The control of weeds on the alluvial river flats and riverbank areas on AQC owned land also provides management challenges and AQC seeks to work with leaseholders to manage weed outbreaks in these areas.

Dartbrook Mine maintains a Weed Management Register, which outlines the location of the weeds identified, method for control of the weeds and the control works undertaken across the site. Throughout 2017, any disturbed areas were rehabilitated and seeded as soon as possible to reduce the potential for weed invasion.

Weed management activities undertaken in 2017 included targeted spraying of African Boxthorn, Bathurst Burr, St John's Wort and Green Cestrum.

Topsoil stockpiles were slashed as per DRG's recommendation. In addition, Dartbrook Mine's licensees sprayed weeds, slashed and grazed approximately 120 ha of land in 2017.

Feral Animal Management

Feral animal control at Dartbrook Mine during 2017 was largely focused on kangaroos, feral dogs and pigs. A professional kangaroo shooter holding appropriate licences was engaged to cull the kangaroos, a total of 91 kangaroos were euthanised during the reporting period.

Dog baiting continued to be undertaken in conjunction with Hunter Local Land Services (LLS) around the Kayuga, 100% bait take was reported from the program in May 2017.

There was no confirmed evidence of pig activity within the mining authorisations and no sightings of any pigs in 2017.

6.5.2 Next Reporting Period

In conjunction with scheduled inspection by the Hunter LLS, site personnel will undertake weed and feral animal inspections of the mining authorisations during the next reporting period. In particular, inspections will be undertaken in rehabilitated areas including the REA. Feral animal control and weed management will be ongoing and the Dartbrook Mine Weed Management Register will continue to be maintained in 2018.

6.6 OPERATIONAL NOISE

6.6.1 Environmental Management

In 2012, the DPE granted approval for Dartbrook Mine to suspend noise monitoring while under Care and Maintenance. The Care and Maintenance strategy involves low level noise equipment and machinery operation for maintenance activities only. Since coal is not mined at site, there currently is no need to operate production equipment or the CHPP.

6.6.2 Environmental Performance

Noise monitoring would re-commence should Dartbrook Mine recommence active operations.

6.7 VISUAL AND LIGHTING

6.7.1 Environmental Management and Performance

Dartbrook Mine facilities may still have the potential to generate visual and stray light impacts for sensitive receivers located in the surrounding environment during care and maintenance. With the use of tree screens, earthen bunds, fencing and shielding, the impacts of visual and stray light are minimised.

The approved Landscape and Lighting Management Plan (LLMP) includes a description of the extent of bunding and screening implemented across the mining authorisation.

A 75 ha forestry plantation was established north of the CHPP in 2003 and is detailed further in **Section 8**. This plantation was surveyed in 2015 and was found to be progressing well with Spotted Gum dominating. As the trees mature they are proving effective in screening the township of Aberdeen from views of the CHPP.

The health of the tree screens, located on either side of and adjacent to the New England Highway is monitored regularly. The tree screens provide an effective visual buffer for motorists (see **Plate 3**). During 2017, the western tree screen continued using drip irrigation during dry periods to ensure survival and optimum growth.

6.7.2 Next Reporting Period

Maintenance of the tree screening areas will continue during 2018 subject to the prevailing weather conditions. Replacement trees will continue to be planted in the bunds and tree screens if significant mortalities are identified.

6.8 ABORIGINAL HERITAGE

6.8.1 Environmental Management and Performance

There are over 100 known Aboriginal heritage sites identified within the mining authorisations. Sites that are located within the vicinity of the approved surface facilities are fenced and signposted to ensure their protection.

AQC also has a Permit to Disturb system in place for planned disturbance on site. Part of the permit includes a pre-disturbance requirement to check the location of planned disturbance against a database of the known Aboriginal site locations to ensure that potential impacts are avoided.

All post subsidence monitoring of Aboriginal sites located above previous mining areas has been completed. No incidences of harm or damage to Aboriginal sites have been identified.

Plate 3
Tree Screening adjacent to New England Highway 2017

6.8.2 Next Reporting Period

The existing Permit to Disturb system will continue to be used throughout 2018 prior to any surface disturbance, including exploration and rehabilitation.

The Archaeology and Cultural Management Plan (ACMP) will be revised in 2018. This revision will update the location of the re-located Scar Tree. The revised ACMP will be provided to DPE and relevant stakeholders for comment.

6.9 EUROPEAN HERITAGE

6.9.1 Environmental Management and Performance

Management of European heritage is undertaken in accordance with Dartbrook Mine's Archaeology and Cultural Heritage Management Plan.

General maintenance works, such as mowing, slashing and fence repairs were carried out in 2017 to protect the heritage items under the control of AQC. Such areas include continued work around the Riverview Homestead and the Dartbrook and Kayuga Cemeteries.

Renovations of the Kayuga Homestead began in 2017. As reported in the CCC meeting in November 2017, AQC intends on utilising the homestead for site accommodation.

6.9.2 Next Reporting Period

Renovations of the Kayuga Homestead are expected to be finalised in 2018. AQC proposes to continue existing efforts to minimise the impact of the operation on European heritage sites and to continue the upkeep of the various sites during 2018.

6.10 SPONTANEOUS COMBUSTION

6.10.1 Environmental Management

The REA remained stable during 2017. The risks posed by potential spontaneous combustion at the REA continue to be classified as minimal.

Dartbrook Mine has an approved REA Spontaneous Combustion Management Plan (REA Plan), which outlines measures for monitoring and mitigating potential spontaneous combustion issues.

6.10.2 Environmental Performance

The REA underground temperature is monitored using 13 thermocouples installed in boreholes to measure the temperature of the reject's material. **Figure 10** provides the results of REA thermocouple monitoring in 2017.

The risk of spontaneous combustion continues to be considered 'low' as the REA has been fully rehabilitated and all coal material has been removed from the coal stockpiles (as discussed in **Section 4.3**).

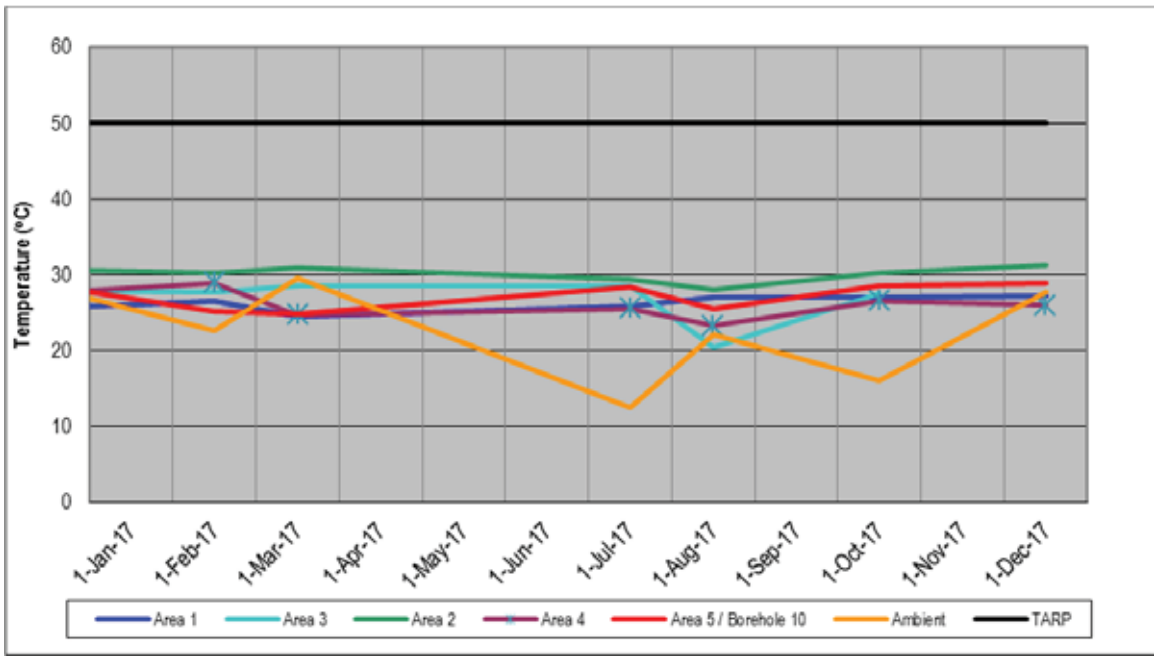


Figure 10
REA Thermocouple Temperature Monitoring Results

There were no incidents of spontaneous combustion in 2017. All temperature monitoring probes read satisfactorily during 2017. All temperatures remained generally stable during 2017 and below the site TARP value of 50 ºC as provided in the approved REA Plan.

Appendix D shows the REA temperature monitoring summary from 2001 to the end of the reporting period 2017. The REA is also monitored for sub-surface water level movements, which have remained stable during the reporting period as presented in **Appendix D**.

6.10.3 Next Reporting Period

REA thermocouple temperatures and piezometric water levels will continue to be monitored and reported during 2018.

6.11 BUSHFIRE

6.11.1 Environmental Management and Performance

As outlined in the Bushfire Management Plan, the fire management strategy employed at Dartbrook Mine relies on prevention as its primary objective.

All surface facilities with the potential to create a fire hazard, such as electrical substations, are kept clear of combustible materials to minimise the risk of a fire within these areas.

Roadsides are slashed on a regular basis and most surface areas managed by AQC are also grazed by cattle, which assists in the control of fuel build up.

Dartbrook Mine has a fire trailer equipped with a 1,000 L water tank and pump, which can be utilised to control any fire outbreaks if required.

A small grass fire occurred adjacent to the East Site on 17 February 2017. This fire was a result of a lightning strike and was extinguished promptly by the Rural Fire Service (see **Plate 4**).

6.11.2 Next Reporting Period

Bushfire fuel loads across the site will continue to be monitored and reduced (as required) in 2018.

Plate 4
East Site Fire February 2017

6.12 MINE SUBSIDENCE

6.12.1 Environmental Management

The management of the effects of subsidence is undertaken as detailed in the originally approved Property Subsidence Management Plans and the Longwall Subsidence Management Plan. The current management generally involves an annual inspection to determine if there are any ongoing impacts from subsidence, with remediation works being undertaken as required.

6.12.2 Environmental Performance

A total of 817.8 ha of land has subsided as a result of historic underground mining operations at Dartbrook Mine. No new active subsidence was identified in the reporting period.

There has been negligible impact to land as a result of subsidence to date, with generally only minor surface cracks (<50 mm) occurring. Surface cracking generally appeared around the beginning and end of longwall blocks. In most instances, earthworks were not required to repair subsidence cracks as the minor cracks naturally sealed themselves.

There have not been any changes to agricultural land suitability classes resulting from previous longwall mining.

The annual subsidence survey included inspection of areas affected by mining of the Kayuga Seam longwall panels KA101 - KA103. This was to check for any redevelopment of surface cracking and to assess the condition of previous remediation works. The inspection found that the previously treated areas have remained stable. Any disturbed areas were sown with a pasture seed mixture and now have good cover established.

Subsidence resulting from mining the Kayuga Seam has affected three 2nd and 3rd order tributaries of Sandy Creek. There has been only minor cracking and grade changes have been subtle and localised with little impact on stream hydrology. There has been no change to agricultural land capability resulting from mining the Kayuga Seam.

6.12.3 Next Reporting Period

Annual subsidence surveys will continue to be undertaken in 2018. Should new areas be identified as a result of the survey, remediation activities will be undertaken as soon as practicable. As part of the inspection process, previously remediated sites will be re-inspected to determine if remedial action is required.

6.13 HYDROCARBON CONTAMINATION

6.13.1 Environmental Management and Performance

There are only minimal quantities of hydrocarbon-based products (such as oils or diesel fuels) stored or used at Dartbrook Mine during Care and Maintenance. This has greatly reduced the potential risk of contamination from such products.

Any oils or fuels that are required to be stored at Dartbrook Mine are appropriately bunded and maintained to prevent spillages to land or water.

The facilities have been constructed so that all drainage from the workshop and service areas flows by gravity into an oil separator for clarification before return to the Western Holding Dam (WHD). The separator and existing sump continued to be serviced and cleaned out regularly during the reporting period to ensure the system remains effective. Inspections of the workplace are ongoing to ensure good housekeeping standards are maintained.

Environmental training, which included spill response, water management and hydrocarbon management continued to be offered to new staff and contractors at the site.

Spill kits containing absorbent materials are strategically located on site to assist in containing and immediately cleaning up any spills should they occur. The hardstand area also has controlled drainage, eventually reaching the WHD through the oil separation system.

As shown in **Plate 5**, contamination monitoring of 54 sites across six areas of the site was undertaken in September 2017. Of the sites sampled, only one site (located within the West Site workshop) was identified to have a small volume of material contaminated with hydrocarbons which would require future treatment. This site has been added to the Dartbrook site contamination register. No new indications of contamination by petroleum hydrocarbons, polycyclic aromatic hydrocarbons, or heavy metals were identified.

Removal of the 93 longwall roof supports stored on the West Site hardstand commenced in 2017. All remaining supports are scheduled to be removed from site by mid-2018.

6.13.2 Next Reporting Period

Environmental training will continue to be provided to new staff and contractors in 2018. Maintenance of the oil separation system will also continue.

Plate 5
Contamination Assessment 2017

6.14 GAS DRAINAGE & VENTILATION

6.14.1 Environmental Management and Performance

The majority of gas from the underground mine is managed by mine ventilation and released through an upcast shaft. During Care and Maintenance, methane (CH_4) and carbon dioxide (CO_2) were vented to the atmosphere via Ventilation Shaft No. 1.

Scope 1 emissions are from underground fugitives (split into methane and carbon dioxide); or use of diesel, petrol, LPG, oils and greases. Scope 2 emissions are those from the use of electricity on site.

The total emissions are calculated from both Scope 1 and Scope 2 emissions. Tube bundles are installed to measure the gas mix, which has been extrapolated to establish monthly quantities, as shown in **Table 18**.

All gas drainage boreholes and plants previously used to extract gas from the mine goaf have been closed. These sites continued to be regularly inspected during 2017.

As shown in **Table 18**, a total of 66,943 tonnes of CO_2 equivalent gas (CO_2) was emitted in 2017. The main contributor to total emissions was CH_4 gas emitted from the underground mine (52,400 tonnes CO_2). This value is higher than the 44,450 tonnes of CO_2 reported for the previous reporting period and is largely associated with an updated emissions calculation method implemented following AQC's acquisition of Dartbrook Mine.

Table 18
Greenhouse Gas Emissions 2017

Date	Scope 1 Emissions			Scope 2 Emissions	Total Emissions (t CO_2-e)
	Methane (t CO_2-e)	Carbon Dioxide (t CO_2-e)	Nitrous Oxide (t CO_2-e)	Carbon Dioxide (t CO_2-e)	
Jan-17	4,420	811	0.01	395	**5,627**
Feb-17	425*	531	0.02	379	**1,335**
Mar-17	2,047	630	0.01	421	**3,097**
Apr-17	2,278	663	0.02	378	**3,319**
May-17	2,354	686	0.02	397	**3,436**
Jun-17	3,349	881	0.01	373	**4,602**
Jul-17	4,098	958	0.02	379	**5,434**
Aug-17	4,152	911	0.02	393	**5,457**
Sep-17	9,232	948	0.01	353	**10,534**
Oct-17	8,252	927	0.02	404	**9,583**
Nov-17	5,712	812	0.02	413	**6,937**
Dec-17	6,083	1,052	0.01	447	**7,582**
2017 Total	**52,400**	**9,811**	**0.19**	**4,732**	**66,943**

** February 2017 - Technical error resulting in lower emission calculation*

6.14.2 Next Reporting Period

Gas emissions, electricity use and fuel use will continue to be calculated in 2018 in accordance with relevant legislative requirements.

6.15 PUBLIC SAFETY

6.15.1 Environmental Management and Performance

AQC seeks to ensure that the safety of visitors, neighbours and the general public is maintained at all times. Signage, restricted access, fencing and inspections by security personnel are established means of warning the public and preventing access to operational areas of the mine.

To account for the Care and Maintenance status and the reduced number of personnel on site, a number of additional security measures have been implemented, including:

- Installation of security fences around the box cut mine entrance and the Hunter Tunnel entrance;
- Establishment of secure gates on all mine portals to prevent unauthorised access; and
- Employment of a security firm to patrol the site nightly from Monday – Friday and on weekends.

There were no significant security breaches in 2017. Regular security patrols are undertaken along the boundary fence between the CHPP and the 'Aberdeen Common' (a public access

area). In addition, remote motion activated cameras have been strategically placed around the site to monitor any areas that are vulnerable to trespassers.

In 2017, Dartbrook Mine's private access road to the New England Highway continued to be strategically closed at night to reduce the risk of unauthorised access. This strategy continues to be successful.

6.15.2 Next Reporting Period

Regular patrols by security personnel will continue during 2018. Fences will be maintained and gates will remain locked and secured. Full-time live in site caretakers will be situated at Dartbrook Mine from early 2018.

7 WATER MANAGEMENT

This section describes the objectives for water management and performance at Dartbrook Mine during the reporting period.

7.1 OVERVIEW

Dartbrook Mine has a water management system whereby all water accumulated on-site has generally been retained in storages (such as mine water dams or the Wynn Seam Goaf). The main inflows to the site water balance occur via rainfall runoff and groundwater seepage into the goaf. Water can be transferred from these storages via pipelines to the CHPP and the underground mine or between the East and West Sites.

AQC holds a licence to discharge excess water under the Hunter River Salinity Trading Scheme (HRSTS) and presently has an entitlement of 12 credits.

The site water management system is generally shown on **Figure 3** and **Figure 4**, with a schematic included as **Appendix G**.

In 2017, AQC continued to manage the water level in the Wynn Seam Goaf by pumping water to surface dams to encourage evaporation. Water accumulating in the goaf is reclaimed by the Wynn Seam Goaf Dewatering Plant, with a pipeline able to transfer water to the Evaporation Ponds, the Staged Discharge Dam (SDD) and the WHD.

Fresh Water Use

Approximately 2.76 megalitres (ML) of potable water was sourced from the Aberdeen town water supply. Approximately 2.09 ML of groundwater was extracted from two bores adjacent to the mine West Site during the reporting period.

Sewage

There was no irrigation of land using treated sewage effluent in 2017.

Surface Water Dams

During the reporting period, water levels in the Eastern Holding Dam (EHD) and WHD were maintained as low as practicable to ensure that there was adequate capacity to capture and contain storm water run-off from site.

This was further assisted by below average rainfall experienced in 2017 which resulted in reduced surface water storage volumes being maintained during the reporting period. Despite the reduced levels of rainfall, the Evaporation Ponds and SDD were maintained at higher levels to maximise water losses to evaporation. Due to the generally dry conditions onsite, levels recorded at EHD and SDD were below 50% capacity as at the end of the reporting period.

Dam storage volumes during 2017 are shown in **Table 19**.

Table 19
Dartbrook Mine Stored Water Summary

Storage	Location	Volume Held (m^3)		
		Start of Period 1/01/2017	End of Period 31/12/17	Storage Capacity
Clean Water				
Clean Water Dam 1	East Site	2,500	0	10,000
Clean Water Dam 2	East Site	5,000	3,500	10,000
Clean Water Dam 3	East Site	0	0	10,000
Southern Clean Water Dam	East Site	0	0	53,000
Dirty Water (runoff)				
Sediment Dam 1	West Site	800	450	1,000
Sediment Dam 2	West Site	0	0	400
Northern Dam REA	East Site	1,840	1,035	2,300
Southern Dam REA	East Site	6,000	4,400	8,000
Stage 4 REA Dam	East Site	3,950	0	7,900
Controlled Discharge Water				
SDD	West Site	280,000	256,000	400,000
Contaminated Water				
Western Holding Dam *	West Site	3,850	3,542	15,400
Eastern Holding Dam *	East Site	48,400	30,080	88,000
Evaporation ponds	West Site	125,400	79,200	132,000
Wynn Seam Goaf	Underground	~3,039,000	~3,090,000	~3,547,000

*Note: * Maintained at <50-70% as standard practice to ensure sufficient capacity for storm events.*

Hunter River Salinity Trading Scheme

In order to maximise evaporation and readiness for the gravity-fed HRSTS discharge system, the SDD was maintained at approximately 65% capacity during 2017.

AQC did not discharge under the HRSTS in 2017.

Table 20
Dartbrook Mine Water Take

Water Licence	Water Sharing plan, source and management zone (as applicable)	Entitlement	Passive Take/inflows	Active Pumping	Total
WSP for Hunter Unregulated and Alluvial Water Sources 2009					
WAL 17739	Dartbrook Alluvial Water Source	30	-	2.09	2.09
WAL 17762		254			
WAL 17781		278			
WAL 17863		5			
WAL 23875		50			
WAL 17790		228			
WAL 30213		105			
WAL 17889	Dartbrook Unregulated River Source	17	-	-	-
WAL 17797		68			
WAL 18134	Hunter Alluvial Water Source	297	-	-	-
WAL 18174		37			
WAL 18210		235			
WAL 18225		121			
WAL 18228		90			
WAL 18239		371			
WAL 18126		98			
WSP for Hunter Regulated River Water Source 2016					
WAL 506	General Security	261	-	-	-
WAL 759		24			
WAL 956		176			
WAL 996		120			
WAL 1005		171			
WAL 1021		480			
WAL 1022		264			
WAL 1024		228			
WAL 1025		3			
WAL 1027		63			
WAL 1235		270			
WAL 13386		270			
WAL 14607		328			
WAL 9048		135			
WAL 955	High Security	3	-	-	-
WAL 1023		3			
WAL 1267	Supplementary Water	*6*	-	-	-
WAL 1313		30.2			
WAL 1316		10			
WAL 1317		42.1			
WAL 1318		23.8			

Water Licence	Water Sharing plan, source and management zone (as applicable)	Entitlement	Passive Take/inflows	Active Pumping	Total
WAL 13336		18.7			
WAL 14605		89			
WAL 9055		35			
WSP for North Coast Fractured and Porous Rock Groundwater Sources 2016					
WAL 41523	Alstonville Basalt Plateau Groundwater Source*	30	182	-	182
WAL 41524		150			

** AQC notified DoI-Water of incorrect Water Source allocation*

Groundwater

There was an estimated 182 ML of groundwater inflow into the Hunter Tunnel during the reporting period (see **Table 20**). This water was pumped directly into the Wynn Seam Goaf for storage. Groundwater seepage, mainly from the Wynn Seam into the goaf, was estimated at 106 ML for the reporting period. These volumes equate to total modelled inflows of 288ML during 2017 (see **Table 21**).

The management of the accumulation of water in the Wynn Seam goaf was the main groundwater management task during the reporting period. The management strategy is to dewater the Wynn Seam Goaf so that the rate of outgoing water is the same as the rate of incoming water.

The management strategy utilised for water levels in the Wynn Seam goaf follows a TARP framework. This strategy seeks to maintain a target depth of 275 m (groundwater depth below surface) at the Pleuger pump monitoring site. When levels show large fluctuations from 275m (groundwater depth below surface), an onsite investigation is undertaken and additional actions are taken to manage levels, consistent with those identified in the SWMP. Previously, the TARP level was 269m (groundwater depth below surface). The revised TARP depth of 275m will be reflected in future revisions of the SWMP planned for in 2018.

Site Inventory

Measured site inventory based on monthly observations decreased from 3,605 ML to 3,535 ML during 2017. This represents a net loss of 68 ML when compared to the gain of 95 ML in 2016. OPSIM model results indicate the site inventory remained consistent with the volume predicted in the 2016 OPSIM volume of 3,547 ML.

Table 21
Estimated Dartbrook Mine Water Balance Components

Water Stream	2017 Volumes (ML)
Inputs	
Fresh Water (Blairemore bore)	2
Groundwater Seepage In (including Hunter Tunnel)	288
Rainfall Runoff	163
Recycled to CHPP from Tails & Storage (not included in total)	0
Imported Potable (Aberdeen)	3
Total Inputs	**456**
Outputs	
Groundwater Seepage Out	49
Dust Suppression	48
Evaporation – Mine Water	361
Entrained in Process Waste	0
Discharged (HRSTS)	0
Potable Usage	1
Total Outputs	**459**
Estimated Change in Total Storage (decreased)	**3***

Source: JP Environmental (2018)
** Estimates of total mine water storage based on monthly observations indicate decrease of 68 ML*

7.2 GROUNDWATER

7.2.1 Environmental Management

There are two main aquifer systems within the Dartbrook area:

- Alluvial aquifer systems associated with the Hunter River, Dart Brook and Sandy Creek; and
- The Permian coal measures (Burnamwood Formation).

The alluvial aquifers are the most important with respect to groundwater dependent ecosystems and human use. The Hunter River alluvial aquifer is a major aquifer providing high yields and good water quality. It is used for irrigation, stock and domestic purposes, whereas the alluvial aquifers associated with Dart Brook and Sandy Creek are primarily used for stock and domestic purposes.

The Permian aquifers are generally deep, low yielding and contain poor quality (brackish to saline) groundwater. They are less productive aquifers and as such, the impact of the mine on these aquifers has less significance.

AQC undertakes an extensive monitoring program at Dartbrook Mine to fulfil the Groundwater monitoring commitments in the SMWP, required under DA 231-01-2000.

The primary objective of the groundwater monitoring program, as prescribed by Condition 4.2 (a) (ii) of DA 231-01-2000 is to collect sufficient data to adequately assess:

- The impact on groundwater levels at neighbouring properties and in the locality, and to identify any water quality impacts;
- The impact of the development on groundwaters associated with the alluvial aquifer of the Hunter River including the ongoing monitoring of the volume and quality of inflows into the Hunter Tunnel;
- Regional groundwater levels and water quality including the extension of the regional groundwater monitoring network to include bores RDH508-511; and
- Any concerns or complaints from surrounding landholders regarding groundwater matters, and any ensuing actions, which shall be recorded and be available to DoI-Water (formerly DLWC).

In particular, the monitoring program is designed to detect impacts on alluvial groundwater levels or quality that may have been induced by mining. The potential impacts of mining include seepage from the:

- Hunter River alluvium to the Hunter Tunnel; and
- REA and Wynn Seam Goaf Tailings water storage area to the Wynn Seam.

Details of the groundwater bores included in the groundwater monitoring program are provided in **Table 22**. The scope of the groundwater monitoring program has been reduced due to the mine being under Care and Maintenance.

As noted in **Table 22**, monitoring of groundwater bores is required on a six-monthly basis during Care and Maintenance. As can be seen in **Appendix E,** a small number of bores were only monitored annually in 2017. AQC will review the groundwater monitoring program in 2018 to ensure its compliance with the SWMP (and revise the SWMP as required).

Figure 11 shows the locations of all groundwater monitoring bores sampled during the 2017 reporting period.

Groundwater monitoring results for 2017 and hydrographs showing long term trends are included in **Appendix E**. **Appendix E** also includes graphs of groundwater levels and water quality parameters for the aquifers that were monitored and monitoring results for pH and EC.

Table 22

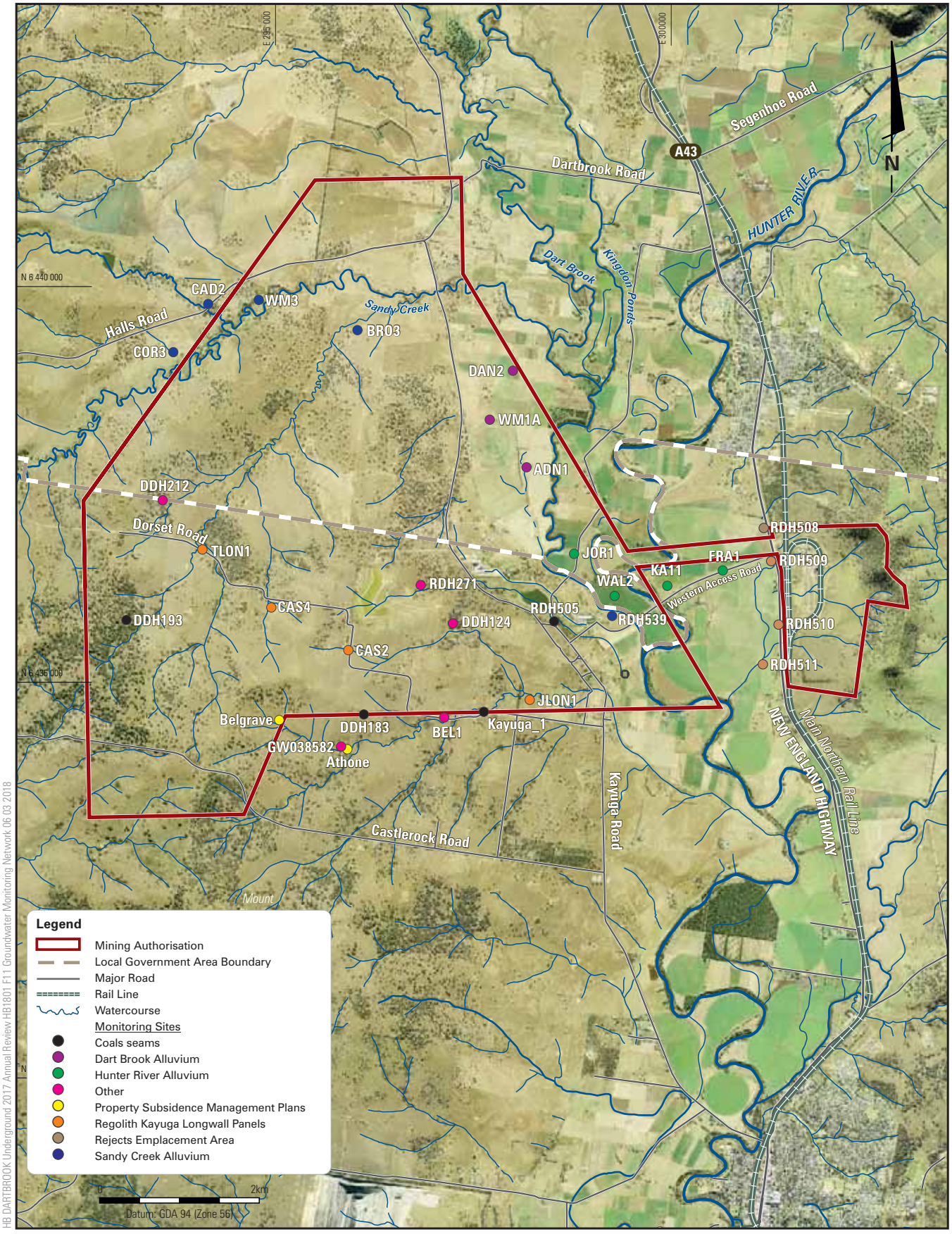
Groundwater Monitoring Bores

Bore	Bore Type	Aquifer Monitored	Details	Parameter / Frequency
Hunter River Alluvium Monitoring Bores				
FRA1	Well	Hunter River Alluvium	Monitor any interaction between the alluvial aquifer to the Hunter Tunnel. Located in a west to east direction across the alluvial plain, along the alignment of the Hunter Tunnel.	Monitored on a six-monthly basis for water depth, pH, EC & additional suite parameters.
JOR1	Well			
KAI1	Well			
WAL2	Well			
Dart Brook Alluvium Monitoring Bores				
ADN1	Well	Dart Brook Alluvium	Monitor water levels and quality within the Dart Brook alluvium. These bores are located between the underground mining area and the Hunter River alluvium.	Monitored on a six-monthly basis for water depth, pH, EC & additional suite parameters.
DAN2	Well			
WM1A	Bore			
Sandy Creek Alluvium Monitoring Bores				
BRO3	Bore	Sandy Creek Alluvium	Located in the Sandy Creek alluvium.	Monitored on a six-monthly basis for water depth, pH, EC & additional suite parameters.
COR3	Bore			
WM3	Bore			
CAD2	Bore			
GW038412	Well			
Coal Seam Monitoring Bores				
Kayuga 1	Bore	Kayuga Seam	Monitor the Kayuga and Wynn Seam aquifers.	Monitored on a six-monthly basis for water depth, pH, EC & additional suite parameters.
DDH183	Bore			
DDH193	Bore			
DDH212a	Bore	Wynn Seam		
Regolith Monitoring Bores				
CAS2	Bore	Regolith – shallow overburden	Monitor the regolith overlying and in the vicinity of the Wynn and Kayuga longwall panels.	Monitored on a six-monthly basis for water depth, pH, EC & additional suite parameters.
CAS4	Windmill			
TLON1	Windmill			
BEL1	Well			
Athlone	Bore			
JLON1	Windmill			
GW038582	Bore			
Belgrave	Bore			

Bore	Bore Type	Aquifer Monitored	Details	Parameter / Frequency
REA Monitoring Bores				
RDH508	Bore	Hunter River Alluvium	These bores are located west of the REA. Monitoring bores RDH508 and RDH509, located on the eastern side of the Hunter River alluvium to detect any seepage from the REA.	Monitored on a six-monthly basis for water depth, pH, EC & additional suite parameters.
RDH509	Bore			
RDH510	Bore			
RDH511	Bore			

Note: Bore = Monitoring bore and not a current water supply.

See SWMP for additional suite of parameters.



HB DARTBROOK Underground 2017 Annual Review HB1801 F11 Groundwater Monitoring Network 06 03 2018

DARTBROOK MINE

Groundwater Monitoring Network

FIGURE 11

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Australian Pacific Coal

7.2.2 Cumulative Rainfall Departure

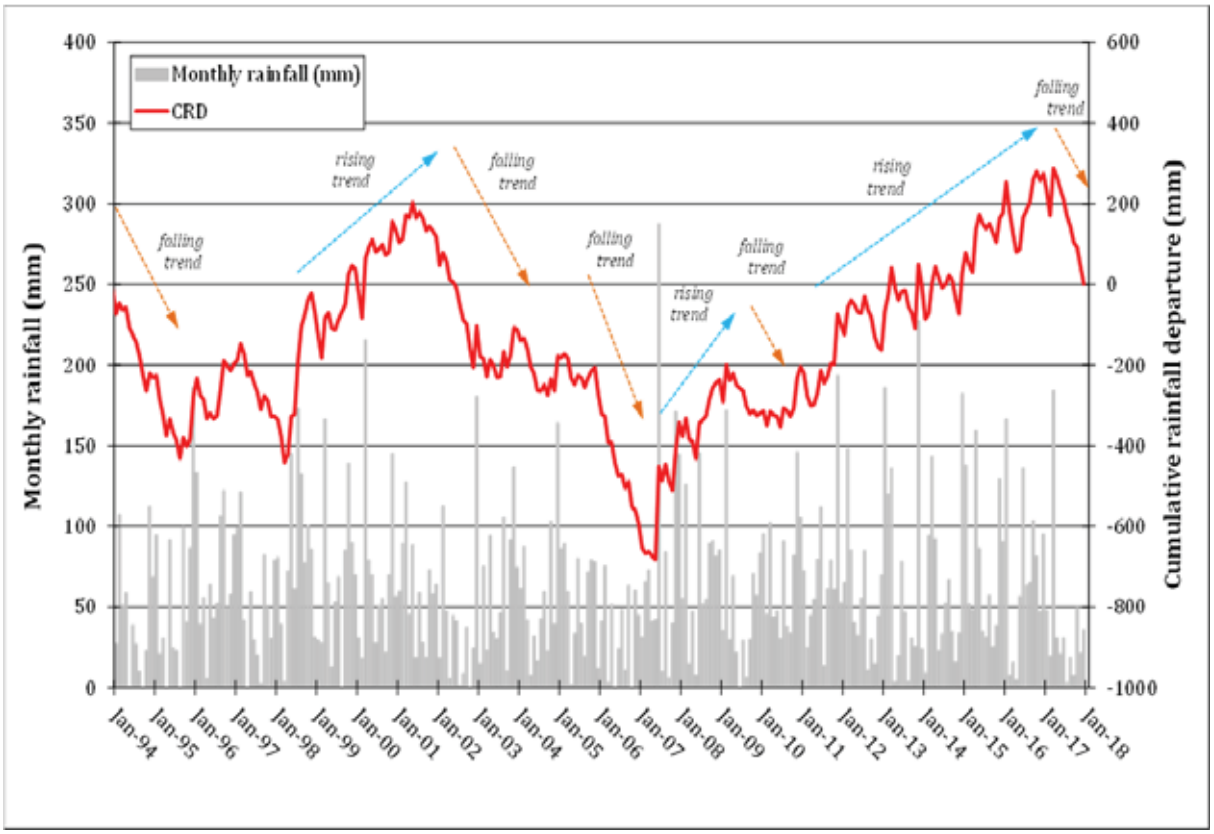
Groundwater levels in relatively shallow wells or bores constructed in alluvium or the regolith are generally highly dependent on rainfall recharge and can rise or decline quite rapidly in response to rainfall events.

Where hydrographs of shallow wells or bores indicate a declining trend in groundwater levels, a comparison is made with the Cumulative Rainfall Departure (CRD).

The CRD is the cumulative difference between average monthly and actual observed monthly rainfall and can be used to assess recharge rates to a shallow, water table aquifer.

The CRD trends on **Figure 12** show that during the reporting period, the area experienced rainfall below the long term average. The CRD indicates that there was an extended dry period from mid-2001 to mid-2007. Dartbrook then experienced an extended period of above average rainfall between 2010 and 2016.

As reported in **Section 6.2**, Dartbrook experienced below average rainfall in 2017, this corresponded with the sharp decline in the CRD as shown in **Figure 12**.



Source: AGE (2018)

Figure 12
Cumulative Rainfall Departure

7.2.3 Hunter River Alluvium

Water Levels

Graph E-1 in **Appendix E** shows groundwater levels from Hunter Alluvium monitoring bores JOR1, FRA1, KAI1 and WAL2.

All bores recorded increases in depth to groundwater levels of between 0.05 to 2.6 m during the reporting period. These declines were within historical levels and did not exceed the SWMP trigger levels. The decline in groundwater levels is likely associated with a sharp decline in average rainfall experienced in the local region during the reporting period.

Water Quality

Graphs E-2 and E-3 in **Appendix E** show water quality measurements from Hunter River Alluvium monitoring bores JOR1, FRA1, KAI1 and WAL2. pH measured at these bores generally ranged between 7.1 to 7.4 during the reporting period. These measurements were within the historical ranges and did not exceed the SWMP trigger levels.

Electrical Conductivity (EC) recorded at JOR1, FRA1 and KAI1 were measured between 475 and 2,260 µS/cm. Levels recorded at each site remained within historical levels and did not exceed the SWMP trigger levels.

EC at WAL2 remained within the long term range of historical levels however, exceeded the SWMP trigger level of 1,917 µS/cm by 73 µS/cm in May and 103 µS/cm in November 2017 (see Graph E -3).

7.2.4 Dart Brook Alluvium

Water Levels

Graph E-4 in **Appendix E** shows groundwater levels from Dart Brook Alluvium monitoring bores ADN1, WMA1 and DAN2. WMA1 and DAN2 recorded increases in depth to groundwater between 0.6 to 2.67 m during the reporting period, while depth to groundwater levels for bore ADN1 recovered slightly. The 2017 groundwater level monitoring results were within the historical levels and did not exceed the SWMP trigger levels.

Water Quality

Graphs E-5 and E-6 in **Appendix E** show water quality measurements from Dart Brook Alluvium monitoring bores ADN1, WMA1 and DAN2. pH measurements at these bores generally ranged between 6.9 and 7.5 during the reporting period. These measurements are within the historical ranges and did not exceed the SWMP trigger levels. EC at these monitoring bores ranged between 2,130 to 2,830 µS/cm; these results were consistent with historical levels and did not exceed the SWMP trigger levels during the period.

7.2.5 Sandy Creek Alluvium

Water Levels

Graph E-7 in **Appendix E** shows groundwater levels from Sandy Creek Alluvium monitoring bores COR3, WM3, BRO3 and GW038412. Measurements at WM3, BRO3 and GW038412 recorded increases in depth to groundwater of between 0.6 to 2.5 m and COR3 recorded an increase of 0.21 m.

The water levels recorded at BRO3 and GW038412 were found to exceed SWMP trigger levels by 0.96m and 0.67m, respectively. Water levels at COR3 and WMS3 remained within historical ranges and did not exceed SWMP trigger levels.

Water Quality

Graphs E-8 and E-9 in **Appendix E** shows water quality measurements from Sandy Creek Alluvium monitoring bores COR3, WM3, BRO3 and GW038412. pH measurements generally ranged between 6.8 and 8.1 during the reporting period. Measurements at COR3, WM3 and BRO3 were within historical ranges and did not exceed the SWMP trigger levels.

pH measurements at GW038412 were within historical levels however did exceed the SWMP trigger level in November 2017 by 0.3 pH. EC levels recorded at all sites ranged from 419 – 3,510 µS/cm and results did not exceed their respective SWMP trigger levels.

7.2.6 Coal Seams

Water Levels

Graph E -12 in **Appendix E** shows groundwater levels from Kayuga Seam monitoring bores, Kayuga-1, DDH183, DDH193 and DDH212a. Bores Kayuga-1, DDH183 and DDH193 were affected by depressurisation associated with mining of Kayuga longwall panels prior to 2007. Groundwater levels recorded in Kayuga-1, DDH183 and DDH193 have remained relatively steady since the cessation of mining in 2006. Water levels at all monitoring bores in the Kayuga Seam remained within historical levels and did not exceed SWMP trigger levels.

Monitoring bore DDH212a measures water levels in the Wynn Seam. Depressurisation of the Wynn Seam occurred during active mining operations prior to 2007. Groundwater levels in DDH212a have continued to remain steady from 2012 to 2017 and did not exceed the SWMP trigger levels.

Water Quality

Graphs E-13 and E-14 in **Appendix E** shows water quality measurements from Kayuga Seam monitoring bores Kayuga-1, DDH183 and DDH193. pH measurements for these bores remained within historical ranges and did not exceed SWMP trigger levels in the reporting period.

Bore DDH212a is screened in the Wynn Seam. pH measurements of 8.3 and 8.4 recorded during the reporting period were within historical ranges and did not exceed the SWMP trigger levels.

EC levels have remained relatively stable for all coal seam bores since 2009. Monitoring results remained within historical ranges and did not exceed the SWMP trigger level during the reporting period.

7.2.7 Regolith

Water Levels

Graph E-15 in **Appendix E** shows the groundwater levels in bores CAS2, CAS4, JLON1 and TLON1.

Monitored groundwater levels in TLON1 have remained relatively stable since the commencement of Care and Maintenance operations, with a recovery observed during the reporting period. Results for TLON1 therefore remained below the SWMP trigger level.

Groundwater levels in CAS2 have steadily declined since 2002. Depth to groundwater levels recorded for CAS2 were in exceedance of the respective SWMP trigger level during the reporting period.

The depth to groundwater level in CAS4 has steadily decreased since 2012. CAS4 levels remained within the historical range and did not exceed the SWMP trigger level during the reporting period.

Water Quality

Graphs E-16 and E-17 in **Appendix E** shows water quality measurements in bores CAS2, CAS4, JLON1 and TLON1. Monitoring at JLON1 was not undertaken during the reporting period; the last sample recovered from this monitoring location in 2011.

pH measurements in the range between 6.7 and 7.3 were recorded for CAS2, CAS4 and TLON1 during the reporting period. These measurements were within historical ranges and did not exceed SWMP trigger levels.

During the reporting period, monitoring at CAS2 recorded EC of 13,060µS/cm in May 2017 and 12,490µS/cm in November 2017. Monitoring at CAS4 recorded EC of 11,120µS/cm in May 2017 and 10,160µS/cm in November 2017 and did not exceed the SWMP trigger levels during the reporting period. The EC levels at bore CAS2 has remained relatively stable between 12,000 and 13,500µS/cm since 2007. The EC levels at bore CAS4 has decreased from 14,000 to 11,000µS/cm over the period from 2008.

An EC result of 3,360 µS/cm was recorded at TLON1 in May 2017, which was within the relevant SWMP trigger level.

7.2.8 Rejects Emplacement Area

Water Levels

Graph E-18 in **Appendix E** shows water quality measurements in REA monitoring bores, RDH508, RDH509, RDH510 and RDH511. Groundwater levels measured during the reporting period remained within historical ranges at all sites and did not exceed the SWMP trigger values.

Water Quality

Graph E-20 and E-21 in **Appendix E** show water quality measurements in REA monitoring bores, RDH508, RDH509, RDH510 and RDH511. A pH result of 7.6 was recorded at RDH511 in November 2017 which was consistent with previous results at the site, however exceeded the SWMP trigger level. All remaining pH values measured at REA monitoring bores RDH508, RDH509 and RDH510 during the reporting period were within historical ranges for each site and did not exceed the respective SWMP trigger levels.

EC levels recorded at bore RDH508 remained relatively stable within a range of 7,000 – 8,000 µS/cm. Monitoring in May 2017 recorded EC at 8,030 µS/cm, this result was within historical levels however, slightly above the SWMP trigger level of 8,003 µS/cm. Monitoring in November 2017 recorded EC at 7,200 µS/cm, this result was within the within historical levels and did not exceed the SWMP trigger level.

EC levels at RDH509 typically fluctuate within a range of 4,000 - 6,000 µS/cm. Monitoring in May 2017 recorded EC at 6,030 µS/cm, this result was within historical levels, however above the SWMP trigger level. Monitoring in November 2017 recorded EC at 4,340 µS/cm; this result with within the historical levels and did not exceed the SWMP trigger level.

EC Levels at RDH510 typically fluctuate within a range of 6,500 - 9,000 µS/cm. Monitoring in May 2017 recorded EC at 8,800 µS/cm, this result was within historical levels however slightly above the SWMP trigger level. Monitoring in November 2017 recorded EC at 8,850 µS/cm; this result was within historical levels however slightly above the SWMP trigger levels. Since Care and Maintenance operations commenced, bore RDH510 has exhibited an upward trend of increasing EC levels.

Since 2009, RDH511 results have recorded relatively large fluctuations of between 3,000 µS/cm and 7,500 µS/cm. Monitoring in May 2017 recorded EC at 7,000 µS/cm and 5,220 µS/cm in November 2017. Monitoring results recorded in 2017 at RDH511 were within historical levels and did not exceed the SWMP trigger levels.

7.2.9 Landowner Bores

Water Levels

Graph E-21 in **Appendix E** shows water levels at Landowner monitoring bores, GW038582, Belgrave, CAS2 and RDH76. Monitoring at RDH76 was not undertaken during the reporting period; the last sample recovered from this monitoring location was in 2013.

The groundwater levels recorded at Belgrave in 2017 remained within historical range and did not exceed the SWMP trigger level. The water level at GW038582 remained within historical levels. GW038582 recorded a water level in November of 5.95m, approximately 0.95m above SWMP trigger level.

Monitoring results for CAS2 during the reporting period have previously been discussed in **Section 7.2.7**

Water Quality

Graph E-22 and E-23 in **Appendix E** shows water quality at landowner monitoring bores GW038582, Belgrave, CAS2 and RDH76.

pH results of 7.5 in May and 7.6 in November recorded at Belgrave during the reporting period remained within historical ranges and did not exceed the SWMP trigger level. The pH result of 8.2 in May recorded at GW038582 remained within historical range however exceeded the SWMP trigger level.

Belgrave monitoring bores have recorded a gradual decline in EC from 12,500 µS/cm in 2007 to 9,000 µS/cm during the reporting period. Monitoring results at Belgrave did not exceed the SWMP trigger levels.

Since 2009 GW038582 has continued to exhibit fluctuations between 3,700 µS/cm and 8,800 µS/cm. Monitoring results at GW038582 did not exceed the SWMP trigger levels during the reporting period.

EC at the Belgrave monitoring bore has continued to decline during Care and Maintenance, and monitoring results for CAS2 during the reporting period have previously been discussed in **Section 7.2.7**

7.2.10 Annual Groundwater Assessment

Condition 4.1(b) of DA 231-01-2000 requires the proponent to conduct an annual assessment of the accuracy of the groundwater model predictions contained in the Dartbrook EIS. The assessment involves comparing the results of actual monitoring with predictions under the model. In 2017, this assessment was carried out by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE).

In regards to the comparison of water levels against the predictions made in the EIS, AGE came to the following conclusions:

- Monitoring results for the alluvium monitoring bores confirmed the statement in the Dartbrook EIS that "*existing bores and wells in the alluvial lands will remain unaffected by depressurisation within the coal measures"* (MER, 2000).
- Variances in groundwater levels are largely attributed to below average rainfall from mid-2001 to mid-2007. This is confirmed by a rise in groundwater levels as a result of above average rainfall from mid-2007 to mid-2009, 2010 to 2012 and a general decline in groundwater levels in 2017 which is comparative to a decline in annual rainfall;

- Monitoring bores in the regolith to the south-east of the completed longwall panels have shown a decline in groundwater levels in response to mining between 2004 and 2006. Monitoring data suggests these bores showed a rapid recovery to pre-mining conditions following the commencement of Care and Maintenance. Current trends in groundwater continue to generally correspond with rainfall patterns and are consistent with the predictions made in the EIS and MER (2000);
- Monitoring bores in the regolith directly overlying the Kayuga longwall panels have shown a decline in groundwater levels in response to mining between 2004 and 2006. Unlike the bores to the south-east of the longwall panels, water levels have not recovered in the overburden directly above the Kayuga longwall panels. These groundwater levels have stabilised in bores CAS4 and TLON1 but at a lower level than pre-mining conditions;
- These trends are likely to be associated with mine subsidence and surface cracking. The level of decline is well within the predictions in MER (2000). The water level at CAS2 has continued to decline following the cessation of mining. This is likely to be related to the position of the bore between the Kayuga Seam and Wynn Seam longwall panels and the predicted connective cracking that occurred as a result of mining; and
- Groundwater levels in the coal seams have declined due to mining related depressurisation. However, the magnitude of the decline had been less than the predictions in the Dartbrook EIS. This is due to the mining being suspended in 2006 rather than progressing for the 20-year period that was modelled by MER (2000). Since the cessation of mining, groundwater levels in the coal seam monitoring bores have recovered to varying degrees. However, by the end of 2017, groundwater level recovery within these bores (notably DDH212a) has stabilised to a level which corresponds with the water level in the flooded Wynn Seam goaf.

In regards to water quality, AGE came to the following conclusions:

- Groundwater quality trends were within the historical levels ranges;
- EC ranges are generally stabilising following the commencement of Care and Maintenance operations; and
- General trends in monitoring bores are consistent over time and have not shown significant sudden changes.

7.2.11 Next Reporting Period

Monitoring will continue in 2018 with the ongoing review of groundwater levels and water quality for bores on lands owned by Dartbrook Mine, in accordance with the requirements of DA 231-07-2000. Dartbrook Mine will review the groundwater monitoring program in 2018 and update the SWMP as required, in consultation with relevant regulatory agencies.

Dartbrook Mine will also review the exceedances of SWMP groundwater trigger levels identified during sampling in 2017. The findings of the review will be discussed in the next Annual Review.

Dartbrook Mine is currently seeking approval to install additional groundwater monitoring bores to complement the existing groundwater monitoring program in the first half of 2018. This proposed program of works will be reported on in the next Annual Review.

7.3 SURFACE WATER

7.3.1 Environmental Management

Dartbrook Mine's SWMP includes strategies for the mitigation of impacts to surface water and groundwater resources during the Care and Maintenance period. Multiple control strategies have been implemented across Dartbrook to minimise the risks associated with water pollution. These strategies include:

- Separation of clean and mine water sources;
- Use of sedimentation dams and traps to collect sediment;
- Diversion of clean water around the site;
- Containment of runoff from disturbed areas;
- Usage and re-use of potentially contaminated runoff and process water from the mine;
- Pumping and pipeline systems to transfer water between the surface and underground and also between the East and West Sites;
- Maximise water evaporation through the Evaporation Ponds (see **Plate 6**);
- Employee and contractor awareness and training in relation to spill response and pollution control;
- Licensed discharge facilities to discharge excess water from the SDD into the Hunter River in accordance with the requirements of the HRSTS; and
- Regular sampling and inspections of surface waters.

Surface water samples are collected and analysed on a regular basis from storage dams and streams in and around the mining authorities to examine water quality. Specifically, samples are collected from an upstream and downstream site in the Hunter River and the Dart Brook. This sampling regime is used to confirm that Dartbrook Mine is not having an adverse impact on the surrounding surface water catchment and streams.

The water analyses include measurement of pH, EC, Alkalinity, Calcium, Chloride, Magnesium, Potassium, Sodium, Sulphates, Total Dissolved Solids (TDS) and Total Suspended Solids (TSS). Selected mine water dams are also tested for reactive phosphorus, Methylene Blue Active Substances (foaming agents), oil and grease, and algae.

All runoff from the West Site workshop and hardstand area eventually flows through the oil separator and into the WHD. Water from the WHD can be pumped to the SDD or to the EHD, as required, to ensure that the WHD is maintained at <50 - 70 % capacity.

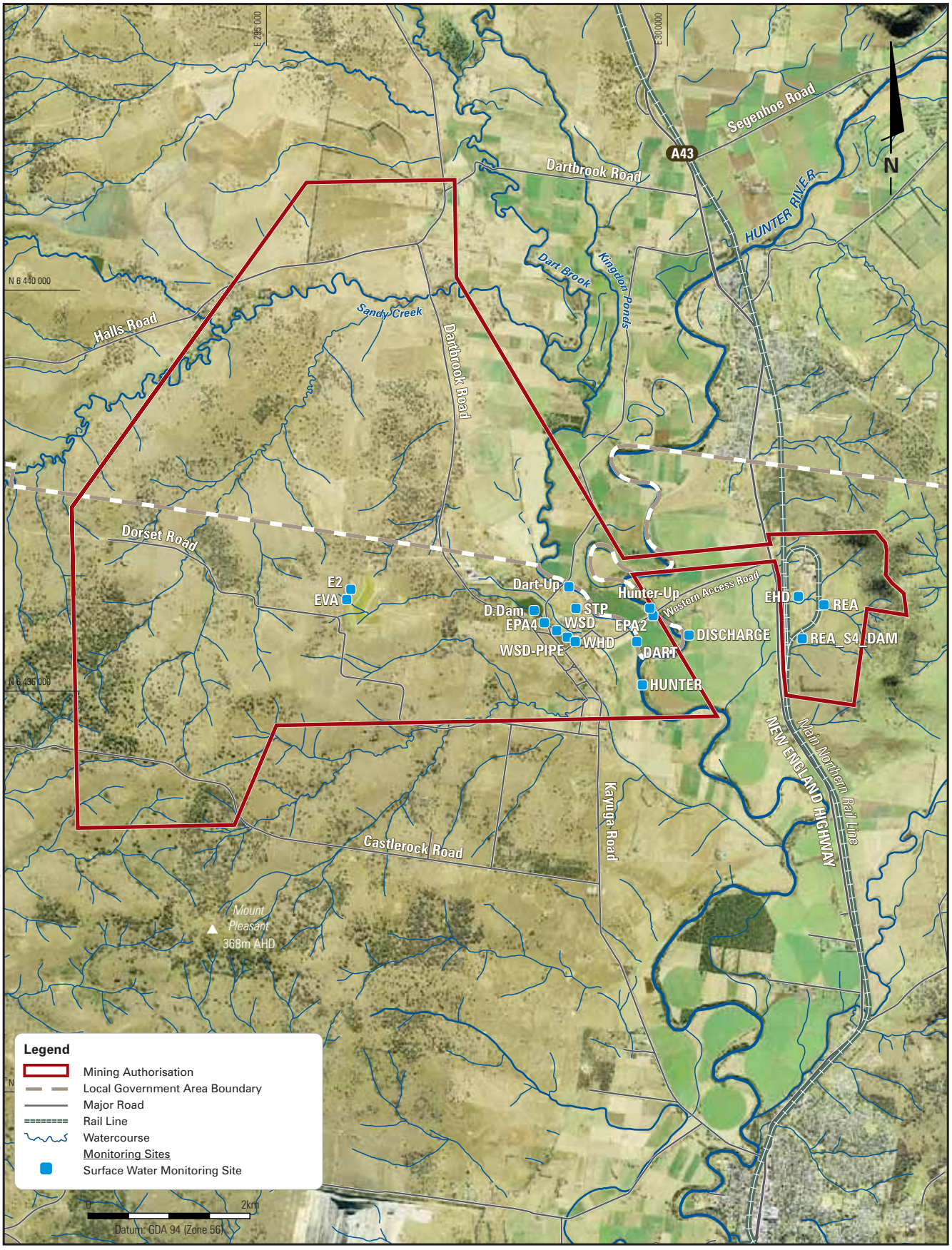
Plate 6
Evaporation Ponds 2017

All runoff from the East Site CHPP and disturbed surrounds eventually flows into the EHD. Water from the EHD is pumped on to the coal stockpile areas for evaporation, to the Wynn Seam Goaf or to the WHD, as required, to ensure the EHD is maintained at approximately 50% capacity.

The general levels of the major dams are inspected weekly and the water level of the SDD, WHD and EHD are continuously monitored via the Dartbrook Mine CITECT system. The SDD is also registered under the Dams Safety Act 1978 and as such, is subject to regular surveillance audits. Inspections during the reporting period did not identify any non-compliances or issues.

A five-yearly review of the SDD was carried out in 2016, as required by the DSC. Both the latest Surveillance Report and the Environmental Management Plan were submitted to the DSC in 2016 and made available to DPE. In accordance with Schedule 2, Condition 9.2 (a)(xii), the five-yearly Dam Safety Committee Surveillance Report will be appended to relevant future Annual Review reports.

The surface water monitoring sites at Dartbrook Mine are illustrated in **Figure 13**.



HB DARTBROOK Underground 2017 Annual Review HB1801 F13 Surface Water Monitoring Network 06 03 2018

DARTBROOK MINE

Surface Water Monitoring Network

FIGURE 13

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Australian Pacific Coal

7.3.2 Environmental Performance

Appendix F includes a summary of surface water quality monitoring undertaken in 2017. Most surface water sampling of internal water storages is undertaken for internal management purposes only.

As noted in **Section 7.1**, Dartbrook Mine did not discharge under the HRSTS in 2017. As a result, no monitoring at the discharge point was undertaken in 2017. All relevant monitors continue to be calibrated annually as required by the HRSTS to maintain compliance with Dartbrook Mine's EPL requirements.

Table 23 presents a summary of the water quality results for the Hunter River and Dart Brook for 2017. Surface water monitoring of the Hunter River in 2017 showed that EC, TDS and pH were generally similar at both upstream and downstream sites and within historical levels. EC at Hunter River Upstream and Downstream recorded elevated EC results in July 2017, exceeding the SWMP trigger levels.

Surface water measurements of Dart Brook generally recorded higher EC upstream than downstream whilst pH and TDS results were generally consistent between sites and all measurements were within historical levels. The downstream monitoring site is located within the vicinity of the Hunter River confluence, meaning this site's recordings can be influenced by backflow from the Hunter River, hence the marginally lower EC and TDS results than upstream.

EC at Dart Brook Upstream recorded elevated EC results in March, June and November of the reporting period. The water salinity trends observed throughout most of 2017 were generally higher for the Hunter River and the Dart Brook when compared to the 2016 readings. This can be largely associated with the below average rainfall experienced

The pH levels for the Dart Brook upstream were slightly higher than the downstream readings - ranging between levels of 7.8 and 8.4.

As denoted in Table F-1 of **Appendix F**, while the main indicative parameters were recorded, monitoring of all the required analytes at the SDD and STP did not occur during the reporting period. Whilst these monitoring locations are situated within the Dartbrook Mine Water Catchment, Dartbrook Mine will undertake a review of the Surface Water Monitoring Program in 2018 to ensure compliance.

7.3.3 Next Reporting Period

Surface water monitoring will continue to be implemented in 2018, as required by DA 231-01-2000 and the approved Site Water Management Plan. Dartbrook Mine will review the groundwater monitoring program in 2018 and ensure its compliance with the monitoring program identified in the SMWP.

The HRSTS discharge system will remain in readiness so that discharges can be undertaken as required.

Table 23
Summary of Water Quality Results for the Hunter River and Dart Brook

Site	EC Range (µS/cm)	TDS Range (mg/L)	pH Range
Hunter River Upstream	333-624	220-420	7.8 - 8.2
Hunter River Downstream	349-690	230-460	7.9 - 8.2
Dart Brook Upstream	2,470-3,830	1,610-2,550	7.9 - 8.4
Dart Brook Downstream	2,360-3,110	1,580-2,570	7.9 - 8.2

7.4 EROSION & SEDIMENT

7.4.1 Environmental Management

Erosion and sediment control across the site remains a priority, despite the relatively small amount of surface disturbance. Strategies to prevent erosion and control sediment include:

- The installation of diversion drains and contour banks to redirect overland flow from disturbed areas into dams and sediment structures;
- The use and maintenance of silt traps to slow water flow and capture water borne sediments;
- Design of rehabilitation areas to reduce slope length and minimise the potential for erosion;
- The re-establishment of vegetation on disturbed areas to minimise exposure of bare ground with erosion risk; and
- Monitoring and inspection of rehabilitation areas and disturbed areas to identify risks of erosion.

Erosion and sediment control is managed as described in Dartbrook Mine's Erosion and Sediment Control Plan.

7.4.2 Environmental Performance

Dartbrook Mine continues to undertake maintenance on drains, sediment traps and sumps, as identified during routine inspections undertaken in 2017. Any drains, sumps or traps that contain greater than 30% sediment are generally required to be cleaned out to prevent and minimise unnecessary risks associated with water storage onsite.

Contour banks, drains and sediment traps were constructed as part of the final landform of the REA to ensure that runoff is directed into appropriate sediment and water control structures.

During 2017, only minor repairs were made to key contour banks to ensure the effective flow of runoff waters, while rehabilitation continues to gradually build up surface vegetation and litter. The pipe drainage system servicing the REA continued to function satisfactorily during 2017.

7.4.3 Next Reporting Period

Sediment structures will continue to be maintained during 2018, and inspections carried out in accordance with an ongoing monitoring and desilting program. Water runoff from any disturbed areas will continue to be directed into sediment dams until areas are adequately revegetated with grass cover.

8 REHABILITATION

8.1 BUILDINGS

Under the Care and Maintenance program, no mine related buildings at the West or East Sites were constructed or rehabilitated in the reporting period.

8.2 REHABILITATION OF DISTURBED LAND

The rehabilitation that has been completed to date is outlined in **Table 24**. No additional rehabilitation was undertaken in 2017. The rehabilitation maintenance activities undertaken during the reporting period are outlined in **Table 25**.

The REA was covered, topsoiled and seeded in 2007. The REA continued to be maintained during the reporting period. Since establishment, REA rehabilitation area has developed land capability characteristics similar to open grassland and a suitable area for cattle grazing (see **Plate 7** and **Plate 8**). No surface rehabilitation works were required above previously mined longwalls in 2017. No subsidence issues were identified during 2017 (See **Section 6.12**).

8.3 OTHER INFRASTRUCTURE

No structural exploration work was undertaken in 2017. AQC will complete a program to rehabilitate the existing open exploration boreholes on site during 2018.

Plate 7
REA Rehabilitation 2017

Plate 8
REA Cattle Grazing 2017

8.4 REHABILITATION TRIALS AND RESEARCH

8.4.1 River Restoration Project

The River Restoration Project was undertaken in conjunction with the HCRCMA from 2005 to 2010. Monitoring and maintenance activities of the River Restoration Project area were undertaken in 2017. The main maintenance activities included:

- Maintenance of native trees planted along the banks of the Russell Island Channel and Hunter River upstream of the bridge (northern site); and
- Weed spraying within the River Restoration Project areas.

Monitoring and maintenance of the River Restoration Project area will continue in 2018.

Two Fish-Hotels and about 20 log jams remained in place over a 6.5km stretch of the Hunter River that interfaces with Dartbrook Mine owned land. These structures create pool and riffle sequences as well as assisting in bank stabilisation.

8.4.2 Riparian Vegetation Management

Approximately 5,000 tree seedlings have been planted to date in riparian zones within the Dartbrook Mine mining authorities. The seedling stock was comprised mostly of River Red Gum but also river oak, yellow and white box, and apple (see **Plate 9**).

The trees have since established themselves to the point where “crash grazing” by cattle can be undertaken in riparian areas without damaging the trees. “Crash grazing” is undertaken on an ad hoc basis to prevent weeds seeding, allowing native and naturalised grasses to dominate. Limited grazing was undertaken in these areas in 2017 however, this method has proven to be an effective land management tool available to reduce the presence of noxious weeds onsite.

Plate 9
Riparian Zone Vegetation Plantings 2017

Table 24

Rehabilitation Status

	Area Affected/ Rehabilitated (ha)		
	To date (End 2017)	**Last report** (End 2016)	**Next Report** (Estimate End 2018)
A: MINE LEASE AREA			
A1 Mine Lease(s) Area CL386, ML1381, ML1497, ML1456	3,258	3,258	3,258
B: DISTURBED AREAS			
B1 Infrastructure area (other disturbed areas to be rehabilitated at closure including facilities, roads)	117	117	117
B2 Active Mining Area (excluding items B3 - B5 below)	-	-	-
B3 Waste emplacements (active/unshaped/in or out-of-pit)	0	0	0
B4 Tailings emplacements (active/unshaped/uncapped)	0	1	0
B5 Shaped waste emplacement (awaits final vegetation)	Nil	Nil	Nil
ALL DISTURBED AREAS	118	118	118
C: REHABILITATION PROGRESS			
Overburden Dump	3.7	3.7	3.7
Wattus Ponds	14.7	14.7	14.7
Rejects Emplacement Area	29.2	29.2	29.2
Infrastructure Area	4	4	4
C1 Total Rehabilitated area (except for maintenance)	51.6	51.6	51.6
D: REHABILITATION ON SLOPES			
D1 10 to 18 degrees	32.9	32.9	32.9
D2 Greater than 18 degrees	-	-	-
E: SURFACE OF REHABILITATED LAND			
E1 Pasture and grasses	51.6	51.6	51.6
E2 Native forest/ecosystems	-	-	-
E3 Plantations and crops	-	-	-
E4 Other (includes non-vegetative outcomes)	-	-	-

Table 25

Maintenance Activities on Rehabilitated Land

NATURE OF TREATMENT	Area Treated (ha)		Comment / control strategies / treatment detail
	Report period (2017)	Next period (2018)	
Additional erosion control works (drains re-contouring, rock protection)	0	<1-2	Maintenance works may be required if settlement has occurred.
Re-covering (detail - further topsoil, subsoil sealing etc.)	0	0	No re-covering of the REA erosion control contour banks was required in 2017.
Soil treatment (detail - fertiliser, lime, gypsum etc.)	0	0	No additional gypsum and fertilizer to the REA erosion control contour banks in 2017.
Treatment/management (detail - grazing, cropping, slashing etc.)	0	0	Continued controlled grazing of Wattus Ponds area. Some areas of the REA rehabilitation were slashed. Grazing recommenced on the REA in late 2017
Re-seeding/replanting (detail - species density, season etc.)	<1	<1	No maintenance of disturbed REA erosion control contour banks areas was required in 2017.
Adversely affected by weeds (detail - type and treatment)	~20	~20	The following weeds were controlled by spraying or slashing in 2017 across the mine area: St John's Wort, Bathurst Burr, African Boxthorn and Green Cestrum. The weed control program will continue in 2018.
Feral animal control (detail - fencing, trapping, baiting etc.)	10	10	Appropriate rabbit controls were implemented at the visual bund and along both sides of the New England Highway (in conjunction with the LLS). Pig trapping and dog / fox poisoning was conducted in conjunction with the LLS where appropriate. Kangaroo culling was undertaken (with the approval of the National Parks and Wildlife Service) in 2017 and will continue in 2018.

8.4.3 River Red Gums Restoration

The purpose of this project is to enhance and protect a population of River Red Gums (listed as being endangered in the Hunter Valley). The project area is remote from any mine related infrastructure, has been fenced to exclude stock, and contains over 2,500 River Red Gums that have been planted amongst the mature population. The River Red Gums that had naturally regenerated as a result of artificial flooding in 2007 continue to thrive within the constructed bunds.

Monitoring conducted in 2015 found that the area was progressing well. Monitoring of the River Red Gum Restoration Project area will continue in 2018.

8.4.4 Forestry Plantation

In 2003, Dartbrook Mine commenced the establishment of a 75ha forestry plantation in conjunction with Forests NSW. The plantation was located on undulating grazing land north of the CHPP, and south of the town of Aberdeen. Approximately 75,000 seedlings, comprised mainly of Spotted Gum (Corymbia maculata) were planted in 2004 and 2005.

The plantation was part of a regional plan to create a sustainable forestry resource on land that was previously grazed.

To date, the project has also been successful at achieving the additional objectives of establishing a biodiversity corridor, visual screening and stabilising the soil. Monitoring of the plantation will be undertaken in 2018.

8.4.5 Sustainable Cattle Grazing Trial

Dartbrook Mine commenced a grazing trial in 2015 to demonstrate that rehabilitated land, in this case the REA, could sustain grazing by livestock, be productive and blend with the adjacent land uses. This trial proved to be successful as evidenced by the weight gains observed in the cattle and results have been previously provided in 2015 and 2016 Annual Review.

Following the successfulness of the grazing trial in 2015, grazing recommenced on the REA in late 2017 (see **Plate 8**), carrying 61 cows with calves until the end of December.

8.5 NEXT REPORTING PERIOD

Dartbrook Mine will continue to undertake rehabilitation maintenance activities as required. Should weather conditions improve, this will include the re-application of pasture mix on the partially rehabilitated former coal stockpiles, as per the 2016 IEA recommendations. Additional maintenance activities may include weed control, feral animal control and drainage works.

Dartbrook Mine will also continue monitoring areas associated with the River Restoration Project, River Red Gum Restoration Project and Forestry Plantation in 2018.

9 COMMUNITY RELATIONS

9.1 ENVIRONMENTAL COMPLAINTS

9.1.1 Protocol

AQC operates Dartbrook Mine under a Complaints Handling Protocol, which details the process for receiving and responding to complaints. The process involves:

1. Recording details of the complaint (including date, time, method of complaint, nature and other general details);
2. Seeking immediate identification and addressing the cause of the complaint (where possible);
3. Telephone contact with the complainant within 24 hours (where possible); and
4. Formal follow up with a letter of response.

Complaints can be received via a dedicated complaints telephone line, 1300 131 058, general telephone number, facsimile, email, letter or in person.

All complaints received are recorded in a Complaints Register. The community complaints procedure was further updated in 2017 following the transfer of ownership to AQC. The Dartbrook Mine Environmental Hotline continues to be advertised within local papers, on the AQC Website and provided to CCC members during meetings.

9.1.2 Complaints

No formal complaints were received during the reporting period. Dartbrook Mine has not received any formal complaints since 2007.

9.2 COMMUNITY LIAISON

9.2.1 Dartbrook Community Consultative Committee

Since 2006, three CCC meetings per year have been held. Due to the transfer of ownership and requirement to draft a new MOP in 2017, four CCC meetings were held throughout the reporting period. The CCC is comprised of community representatives from MSC and UHSC, council staff and community representatives.

The council representatives for 2017 were Cnr Martin Rush (Chair and MSC representative) and Cnr Kiwa Fisher (UHSC representative). Paul Smith and Scott Brooks were the respective staff representatives from UHSC and MSC. The 2017 community representatives on the CCC are Arthur Mitchell, Annette Rahn, Tony Lonergan, Jennifer Lecky and Noel Downs (also representing the Wanaruah Local Aboriginal Land Council).

Table 26 lists the dates of meetings held during 2017 and the topics discussed at each meeting. Minutes of these meetings are posted on the Dartbrook Mine website. Updates of AQC activities and general environment performance at Dartbrook Mine were also distributed to the CCC during the reporting period.

Table 26
Summary of Topics Discussed During 2017 CCC Meetings

Date	Topics Discussed
25/05/2017	• Summary of environmental monitoring and performance • Exploration activities discontinued while the sale of Dartbrook continues • Project Prefeasibility studies will be subject to the sale of Dartbrook to AQC • Kangaroo and Feral Animal Control Program update • Weed Management Program update • General maintenance on rural lands • New EPL premises plan accepted by EPA • HRSTS communication with State Water upgraded using digital technology • All personnel onsite undertook first aid training • Review of Land Management Plan • Submission of Environmental Management Plans to DPE for approval – offer to forward copies of plans to CCC for review • 2016 Annual Review completed, CCC members forwarded copies – no issues identified form CCC members • Dam Safety Committee – Dam Safety Emergency Plan 5 yearly review was completed • Completion of the relocated Scar Tree shed in Muswellbrook • Consultation with MACH Energy over recent operational changes • Cnr Martin Rush assumed the role of Chairperson for the foreseeable future • Status of the Mine Operations Plan, expires on 31 December 2017 • Status of Dartbrook website with new ownership • Discussion over Hunter River and Hunter Tunnel linkages • Dartbrook CCC Trust Fund
8/08/2017	• DRG introductions and description of MOP purpose • DRG recently agreed that AQC can develop 3-year MOP – works currently underway • Additional MOP Consultation required for CCC members • AQC introduction to CCC • AQC planning and feasibility progress • AQC to develop new Community Newsletter • Summary of Dartbrook's environmental performance • Exploration – On-hold pending outcome of pre-feasibility studies • Kangaroo and Feral Animal Control Program update • Weed Management Program update • General maintenance on rural lands • Water licence renewal • AQC planning to recommence grazing trial on REA • AQC Review of MSC LEP • AQC Sponsorship and Donations programme • AQC confirmed that preference will be given to locally sourcing its workforce and suppliers

Date	Topics Discussed
	• Investigation into the condition of some of the leased paddocks beside Dartbrook Rd and Nandowra Road
7/09/2017	• Status of new Mine Operations Plan in development • Consultation requirements for MOP development • Stage 2 MOP Consultation with CCC members • Presentation of draft MOP Contents
8/11/17	• MOP lodged with DRG on 20 October 2017 • NGER Report lodged on 30 October 2017 • AQC confirmed Pre-feasibility studies were ongoing • Health condition of livestock grazing on leased lands owned by AQC • Summary of the Dartbrook Mine's environmental performance • Exploration – On-hold pending outcome of pre-feasibility studies • Kangaroo and Feral Animal Control Program update • Weed Management Program update • General maintenance on rural lands • Construction of new dairy bails at Garoka • Scrap Steel removal • Dartbrook Mine Community Newsletter • Dartbrook Mine Sponsorship and Donations program • Environmental Contact Line is operational • Summary of correspondence with MACH Energy

9.2.2 Community Participation

During the reporting period, AQC continued to support and sponsor community based programs and events, including the Aberdeen Care Package Cadets and the Scone Neighbourhood Community Centre.

AQC continued to advertise its support and sponsorship of community based programs and events on its website, at CCC meetings and in its quarterly newsletters.

9.2.3 Workforce Characteristics

Dartbrook Mine currently maintains a contract workforce of 18 persons residing in the following areas (also see **Figure 14**):

- Muswellbrook (6);
- Upper Hunter (1)
- Singleton (3);
- Cessnock (2);
- Newcastle and Port Stephens (2);
- Lake Macquarie (3); and
- Central Coast (1).

During the reporting period, AQC increased its net contract workforce by three full time equivalent roles. Changes to workforce composition during the reporting period also saw an increase in four employees residing locally within the Muswellbrook or Upper Hunter Shire Local Government Area. Dartbrook Mine continues to provide socio-economic benefits to the local region through indirect employment of contractors and supplementary labour hire for non-routine tasks.

Where practicable, AQC will continue to utilise a locally-sourced workforce for activities on site. AQC continues to lease properties surrounding the site to a number of local families and farmers (see **Section 9.2.4**).

No significant changes to workforce characteristics are expected in 2018.

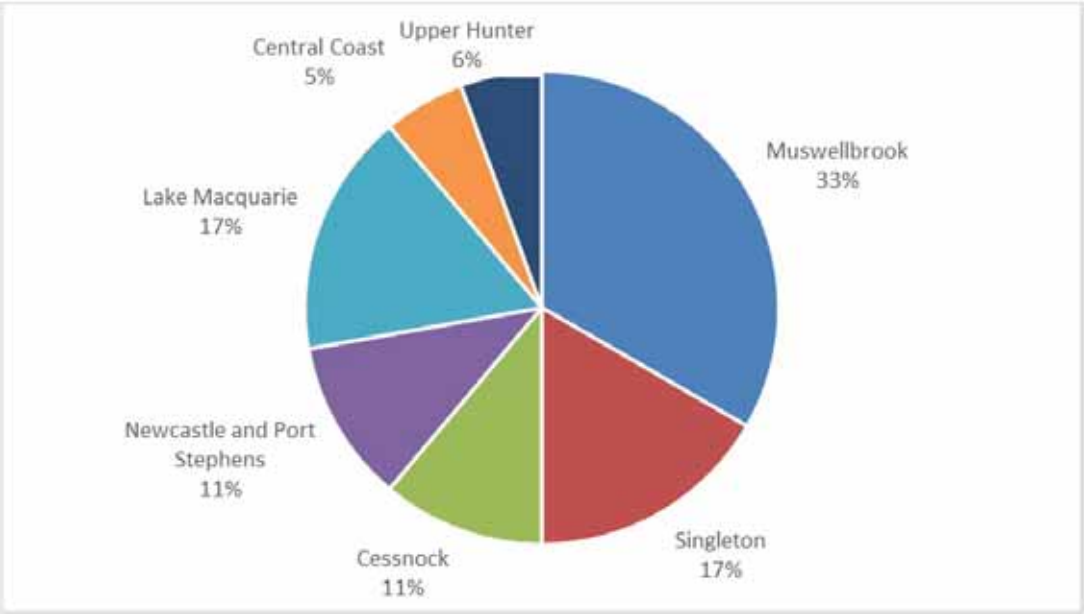


Figure 14
Breakdown of Current Workforce by Place of Residence

9.2.4 Leaseholders and Dairy Farm

AQC has seven major leaseholders and agistees that occupy the Dartbrook Mine owned land surrounding the mining authorisations. There are also 18 tenants who occupy the AQC residences.

The Garoka Dairy has been operating in the vicinity of Dartbrook Mine since 1992 and is generally located on the alluvial lands between the Dartbrook CHPP and the workshop and portal entry. The dairy currently supports 600 to 700 head of cattle.

The Garoka Dairy is an amalgamation of the four farms that were originally established to the east of the Hunter River and Dartbrook Mine's administration office, and one farm at the confluence of the Hunter River and Dart Brook.

In late 2017, a new 50 cow rotary platform and milking shed commenced construction at Garoka Dairy. The upgrade to facilities, jointly funded by AQC, will allow for greater efficiency in milking, improved wellbeing of cows and better OH&S standards for dairy operators (See **Plate 10**). The major upgrade will be competed and in operation by mid-2018.

Plate 10
Garoka Dairy Upgrade Works in 2017

10 INDEPENDENT ENVIRONMENTAL AUDIT

As required by DA 231-07-2000 (as modified), an Independent Environmental Audit of Dartbrook Mine's Operations is undertaken approximately every three years. The previous Independent Environment Audit was undertaken by SLR in July 2016 and reviewed operations at Dartbrook from August 2013 (the previous IEA) to July 2016. The IEA identified one low-risk and five administrative non-compliances and made a number of associated recommendations.

Dartbrook Mine responded to SLR's recommendation from the audit in a letter to DPE dated 29 September 2016. On 13 March 2017, DPE advised that both the audit report and Dartbrook's response were satisfactory. **Table 27** and **Table 28** tracks Dartbrook Mine's progress in 2017 against the non-compliances and recommendations identified in the IEA.

In accordance with DA 231-07-2000, the next IEA is scheduled to be undertaken in 2019.

Table 27
2016 IEA Non-Compliance Summary and AQC Action Plan

Ref	Non-Compliance	Non-Compliance Details	Risk	Status	AQC Action Plan
1	DA 231-07-2000 Condition 3.2(e)	No evidence of submission of DMP to MSC, UHSC and CCC within 14 days of its approval.	Administrative	Noted	AQC will provide all future management plans to MSC, UHSC and CCC within 14 days of the relevant management plan's approval.
2	DA 231-07-2000 Condition 6.1(a)	No evidence that consultation was completed for the 2015 update of the DMP.	Administrative	Noted	AQC will consult relevant regulatory agencies prior to submission of the next revision of the DMP.
3	DA 231-07-2000 Condition 8.1(a)	Copies of the previous IEA were provided to MSC, DPI-Water and OEH three weeks after the completion of the audit. There was no evidence this was submitted to UHSC.	Administrative	Noted	AQC to ensure the next IEA is submitted to Director-General, MSC, SSC, EPA, DLWC, DMR, NPWS and CCC within two weeks of completing the next IEA.
4	EPL 4885 Condition R1.1	The 2014/15 Annual Return indicated that only one sample was collected for TSS and pH. This did not satisfy the requirement for two samples (one for each day of discharge at LDP004). Further evidence was provided illustrating that sampling was completed for the 22 and 23 April 2015 discharge. It was determined that there was an error in the Annual Return for the 2014/2015 period.	Low	Completed	Mistake made in Annual Return document – No action required
5	Previous Non-Compliance	The Site Water Management Plan is only revised plan on the website (at the time of the audit).	Administrative	Ongoing	The DMP was uploaded to the AQC website during the reporting period. Management Plans will be progressively uploaded onto the AQC website following revision and approval from DPE.
6	Previous Non-Compliance	The FFMP was not amended during the audit period.	Administrative	Ongoing	The FFMP was revised and submitted to DPE for comment during the reporting period.

Table 28
2016 IEA Recommendations Summary and AQC Action Plan

Ref	Recommendation	Risk	Status	AQC Action Plan
1	Next MOP should be updated to the new MOP guidelines	Administrative	Noted	AQC will provide all future management plans to MSC, UHSC and CCC within 14 days of the relevant management plan's approval.
2	Key management plans should be uploaded to the company website	Administrative	Noted	AQC will consult relevant regulatory agencies prior to submission of the next revision of the DMP.
3	Relocate the Scar tree in consultation with MSC and update the ACHMP relating to the new location of the Scar Tree	Administrative	Noted	The Scar Tree was relocated to MSC in 2016. The ACHMP will be updated in the 2018 reporting period.
4	Send the ACHMP to the Upper Hunter Wonnarua Tribal Council (UPWTC) and Wannaruah Local Aboriginal Land Council (WLALC)	Low	Completed	AQC will consult with UPWTC and WLALC during the next revision of the ACHMP, prior to submitting to DPE for approval.
5	Send the FFMP to NPWS for consultation during next revision	Administrative	Ongoing	AQC will consult with OEH during the next revision of the FFMP, prior to submitting to DPE for approval.
6	Future updates should indicate a time frame for proposed rehabilitation actions. Monitoring commitments in the BAP	Administrative	Ongoing	The FFMP was revised and submitted to DPE for comment during the reporting period.

11 ENVIRONMENTAL INCIDENTS & NON-COMPLIANCES

11.1 ENVIRONMENTAL INCIDENTS

There were no reportable environmental incidents during 2017.

11.2 ENVIRONMENTAL NON-COMPLIANCES

As part of the SHEMS, internal and external audits are undertaken to assess compliance with regulatory requirements including the conditions of Development Consent, EPL 4885 and Dartbrook Mine mining authorities.

Dartbrook Mine did not identify any operational non-conformances in 2017.

12 ACTIVITIES PROPOSED IN THE NEXT REPORTING PERIOD

The activities proposed to be undertaken in 2018 are summarised in **Table 29**. Further details on the proposed activities are provided in **Section 6** and **Section 7**.

Table 29
Dartbrook Mine Environmental Management Activities Proposed for 2018

Area	Proposed Activity
Operational	• AQC intends to seek a modification to its development consent to facilitate the recommencement of limited first-workings underground mine within the approved footprint of the Kayuga coal seam.
Air Quality	• Dust mitigation and control activities will be employed onsite, where required; • Air Quality Monitoring will continue onsite in accordance with the DMP; • The Air Quality Monitoring Network will be revised, including a review of the location and holders used for Deposition Dust Gauges and installation of an additional real-time monitoring site in Aberdeen. Any amendments to the air quality monitoring network will be reflected in a revised DMP; • The DMP will be revised and provided to DPE, EPA and stakeholders for comment.
Erosion and Sediment	• Sediment structures will continue to be inspected and maintained; • Water runoff from previously disturbed areas will continue to be directed into sediment dams.
Surface Water Management	• Monitoring will continue in accordance with the SWMP; • The SWMP will be revised and provided to DPE, EPA and stakeholders for comment.
Ground Water Management	• Groundwater monitoring will continue in accordance with the frequencies and parameters listed in the SWMP; • Dartbrook will review and investigate all 2017 exceedances of the SWMP groundwater trigger levels; • The Groundwater Monitoring Network will be revised. Any amendments to the network will be reflected in a revised SMWP; • Dartbrook will review existing bore locations and seek approval to install additional monitoring bores in to complement the existing monitoring program. Any amendments will be reflected in a revised SWMP; • The SWMP will be revised and provided to DPE, EPA and stakeholders for comment.
Rehabilitation	• Rehabilitation of historic exploration boreholes will commence. • AQC will undertake a topsoil audit of Dartbrook Mine in 2018. The results of this audit will be reported on in the next Annual Review.

Area	Proposed Activity
Threatened Flora and Fauna	• Fauna and flora communities will be managed in accordance with the approved Management Plan; • In circumstances where clearing is required, the Permit to Disturb system will continue to be implemented; • Monitoring and maintenance of the River Restoration and Forestry Plantation will continue in 2018.
Noxious Weeds and Feral Animals	• Weed control will continue to be conducted within the mining authorisations and the Weed Control Register will be maintained; • Feral animals will continue to be controlled as necessary.
Visual / Stray Light	• Maintenance of the tree screens will continue (as required).
Aboriginal Heritage	• The existing Permit to Disturb system will continue to be implemented prior to commencing ground disturbance activities such as exploration and rehabilitation; • Following the 2016 re-location of the Scar Tree, the ACHMP will be revised and updated. The revised ACHMP document will be provided to DPE and relevant stakeholders for comment.
European Heritage	• Renovations of the Kayuga Homestead will be completed.
Spontaneous Combustion	• REA thermocouple temperatures will continue to be monitored.
Bushfire	• Fuel loads across the site will continue to be monitored and reduced as required.
Mine Subsidence	• Treated areas will be re-inspected to determine if further surface subsidence remediation is required.
Hydrocarbon Management	• Appropriate storage and management of hydrocarbon storages and materials will continue; • Areas identified as contaminated will continue to be recorded on the site contamination register.
Waste Management	• Completion of scrap steel removal and recycling campaign from workshop, stores and hardstand areas.
Gas drainage / Ventilation	• Monitoring of gas emissions from the mine will continue.
Public Safety	• Full-time onsite caretakers will be situated at Dartbrook Mine from 2018 onwards; • Fences will be maintained and gates will remain locked and secured, as required; • Roadside vegetation slashing will continue, as required.
REA	• Continuation of cattle grazing on Rehabilitated REA, weather conditions permitting; and • A structural inspection of the REA will be undertaken in 2018.

APPENDIX A

Summary of Minor Amendments to Development Consent Conditions during Care and Maintenance

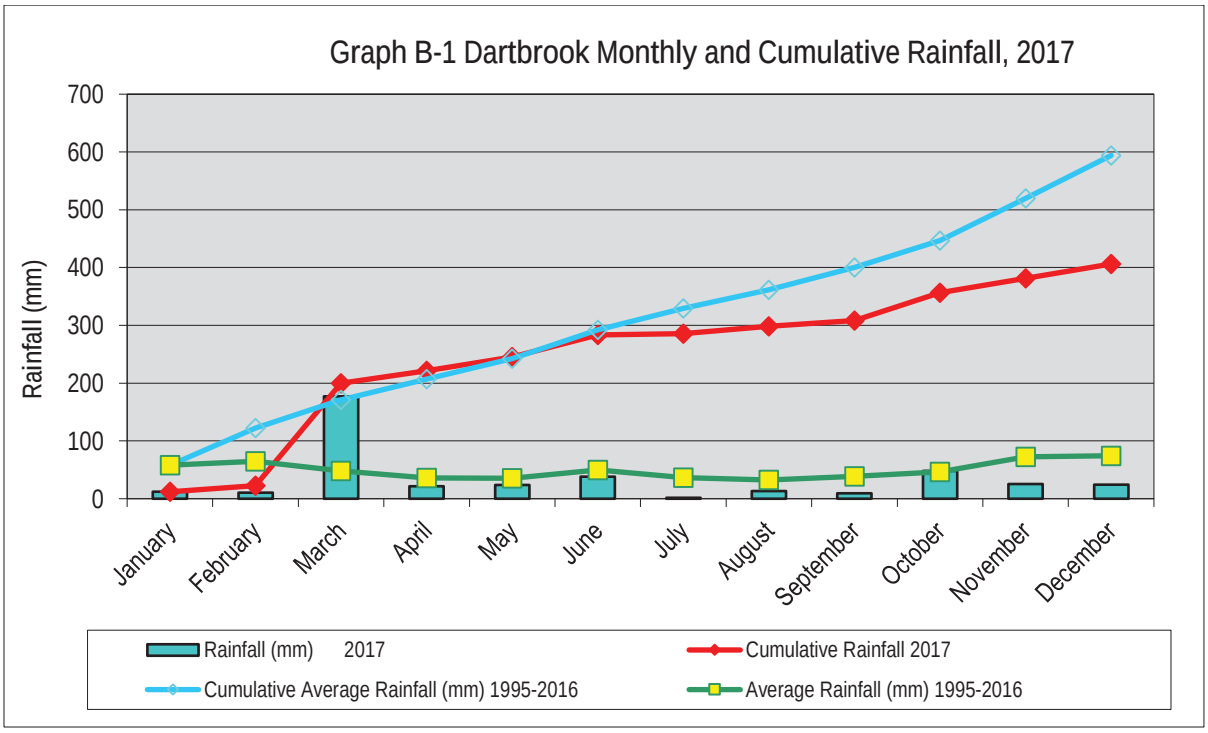
Table 1
Summary of minor amendments to Development Consent conditions during Care and Maintenance

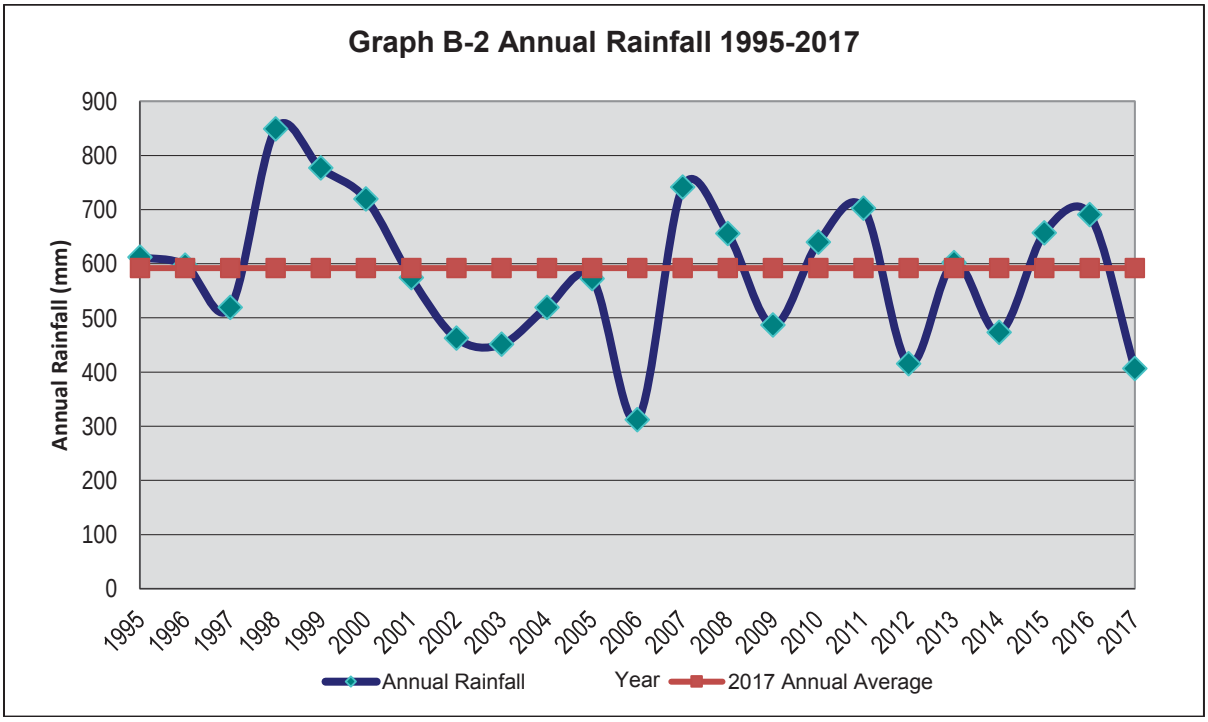
Approval Document Reference	Development Consent No. Reference	Existing Requirement	Requirement During Care & Maintenance
Complaints protocol & Environmental Management Strategy	10.2a (ii)	6 monthly complaints report to DoP (now DPE), MSC, UHSC, EPA, DPI-MR (now DRG) and Dartbrook Community Consultative Committee (DCCC).	Complaints to be included in Annual Environmental Management Report and DCCC Meetings only.
Community Consultation	10.1 (i)	The DCCC meet 6 times per year (every two months).	Three DCCC meetings per annum.
Community Consultation	10.1 (ii)1	Two company representatives required on the DCCC.	One company representative on the DCCC.
Development Consent	10.2b	Required to have two company persons available as EPA contact 24hrs day.	One person as the EPA person contact. This person will be available via a pager system.
Development Consent & Environmental Management Strategy	32.f	Review of Environmental Mgt Plans is required every 5 years (2007 due).	Continue to operate under existing Mgt plans without reviewing. Propose to modify these Mgt Plans should any activities recommence.
Development Consent	3.3 (l)	Surface subsidence monitoring is required up to 3 years following mining.	Reduce this period due to limited impacts observed on the surface from subsidence to-date.
Development Consent	8.1a	An Independent compliance audit is required every 3 years (due 2007).	Audit to occur, scope to be re-defined (e.g. cannot audit against EIS predictions etc).
Development Consent	3.2d	Preparation of the Water Mgt Plan and Soil Stripping Mgt Plan is required prior to construction of the REA.	As the REA is not being constructed and there are no further construction activities proposed, a Soil Stripping Management Plan is not necessary. The Water Management Plan will be prepared prior to Care & Maintenance.
Development Consent	2.1 (e)	A Mine Closure Plan is required to be prepared 2 years prior to completion of mining, in consult with DoP, DPI-MR, DNR, MSC, UHSC & approved by DoP and DPI-MR.	Decision and process to be managed through MOP.

Approval Document Reference	Development Consent No. Reference	Existing Requirement	Requirement During Care & Maintenance
Environmental Management Strategy & Dust Management Plan	6.1b (iii)	Required to report on a quarterly basis the results of air quality monitoring data to DoP and MSC.	Report on annual basis via the AEMR.
Lighting and Landscape Management Plan		Monitoring of tree screens is required 2 - 3 times per year.	Monitor once per year.
Waste Management Plan		A Waste audit is required to be undertaken annually.	Waste to be reported via the AEMR.
Noise Management Plan	6.4.1b	Attended noise surveys are to be undertaken on a quarterly basis.	DP&I advised that noise monitoring could be suspended as from 10/05/12.
REA Surveillance Program		Extensive monitoring requirements for the current REA (e.g. weekly thermocouples).	To be managed through the MOP process with DRG.

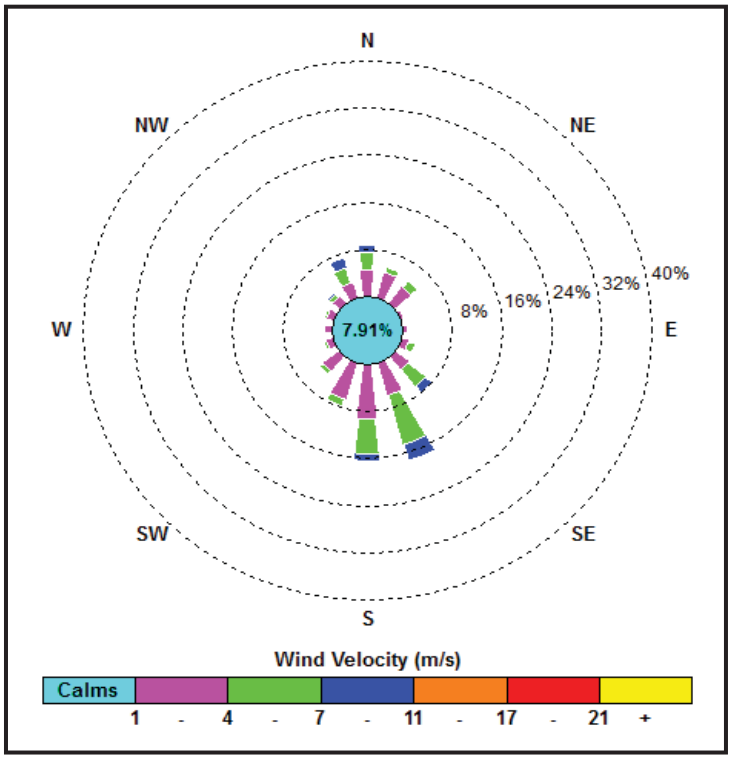
APPENDIX B

Meteorological Summary

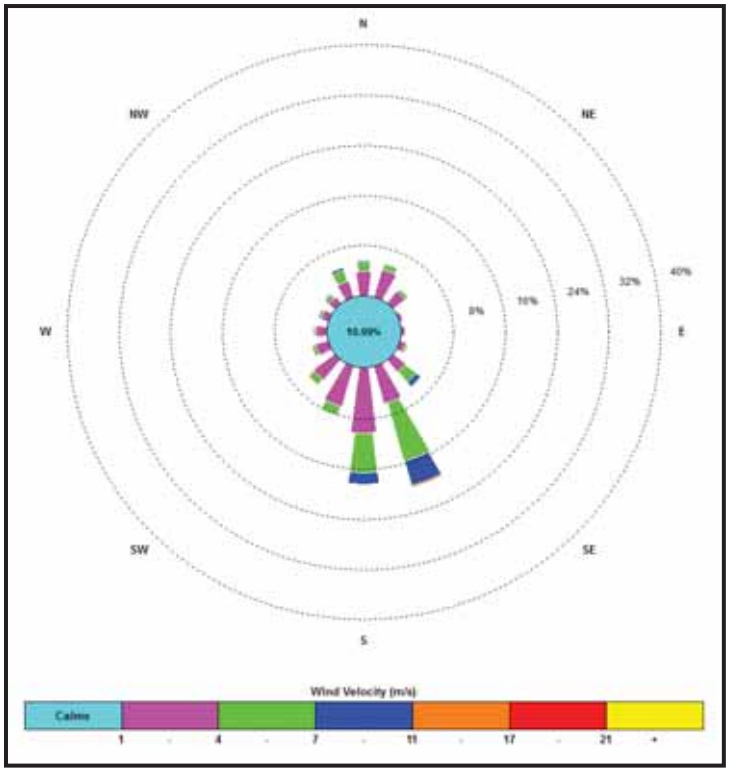

Graph B-1 Dartbrook Monthly and Cumulative Rainfall, 2017
Rainfall (mm)
700
600
500
400
300
200
100
0
January
February
March
April
May
June
July
August
September
October
November
December
Rainfall (mm) 2017
Cumulative Rainfall 2017
Cumulative Average Rainfall (mm) 1995-2016
Average Rainfall (mm) 1995-2016


Graph B-2 Annual Rainfall 1995-2017
Annual Rainfall (mm)
900
800
700
600
500
400
300
200
100
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Annual Rainfall
Year
2017 Annual Average

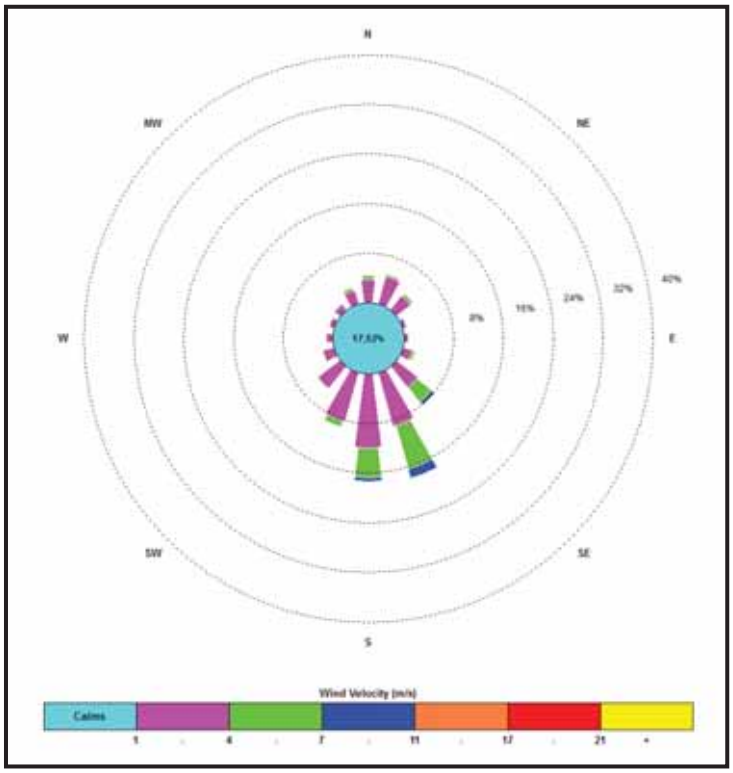
January 2017



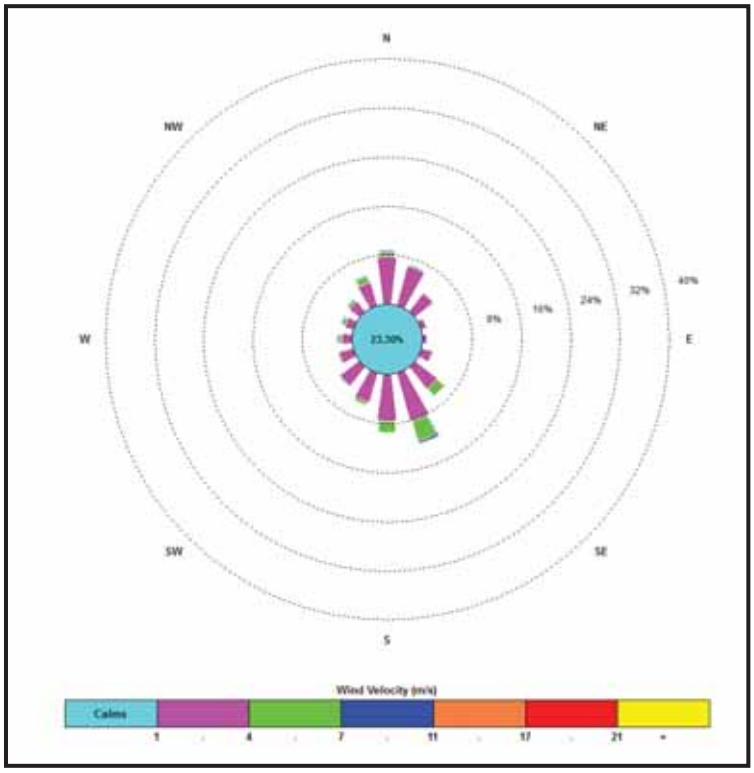
February 2017



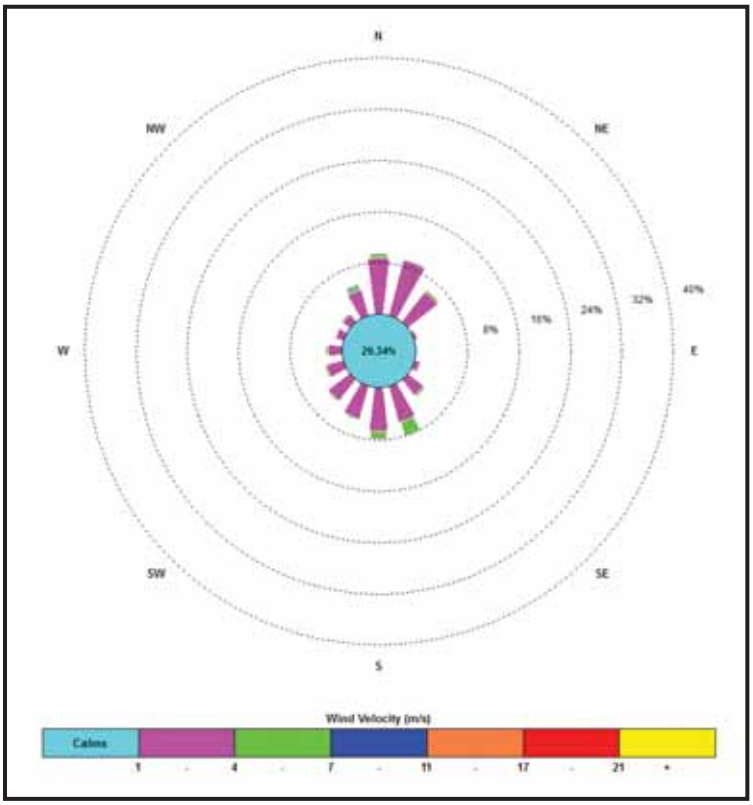
March 2017



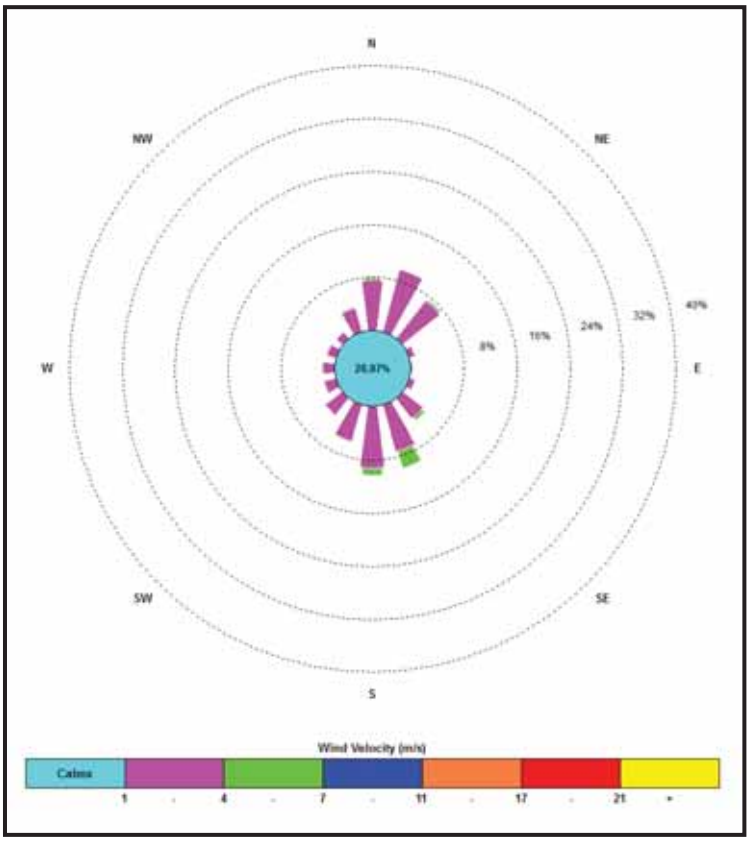
April 2017



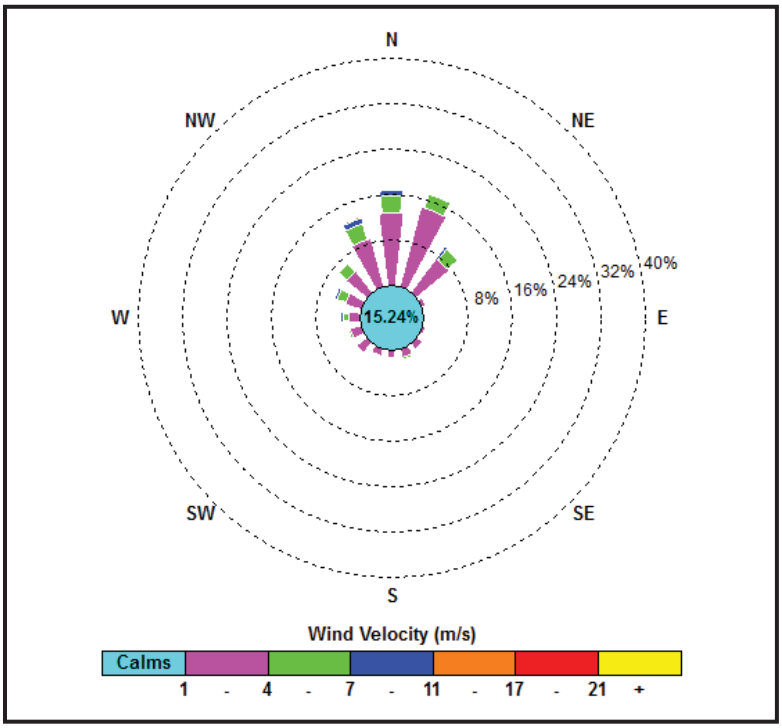
May 2017



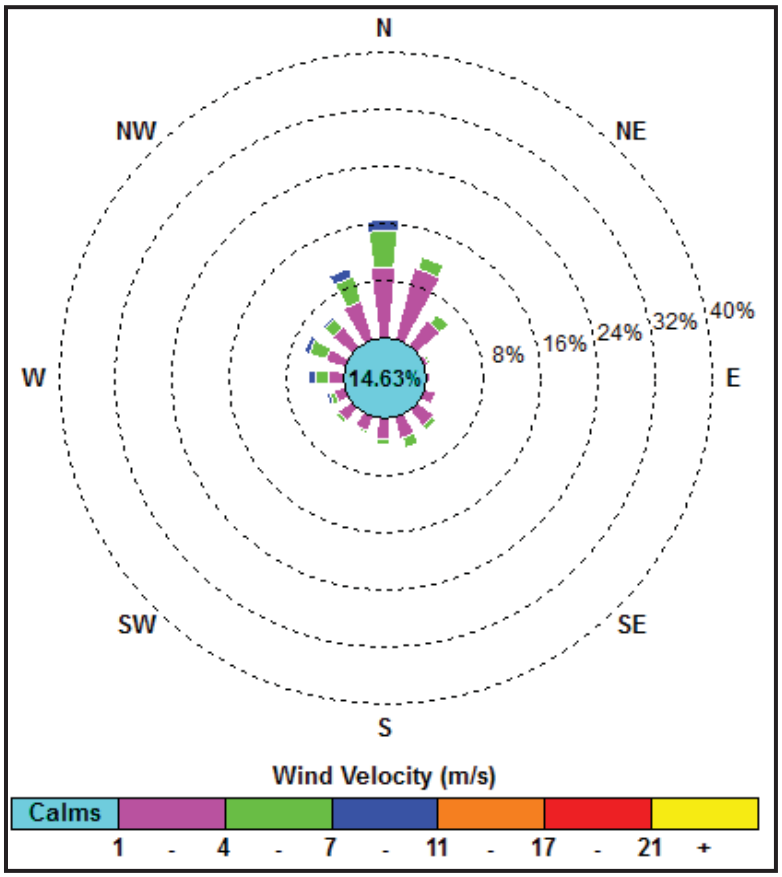
June 2017



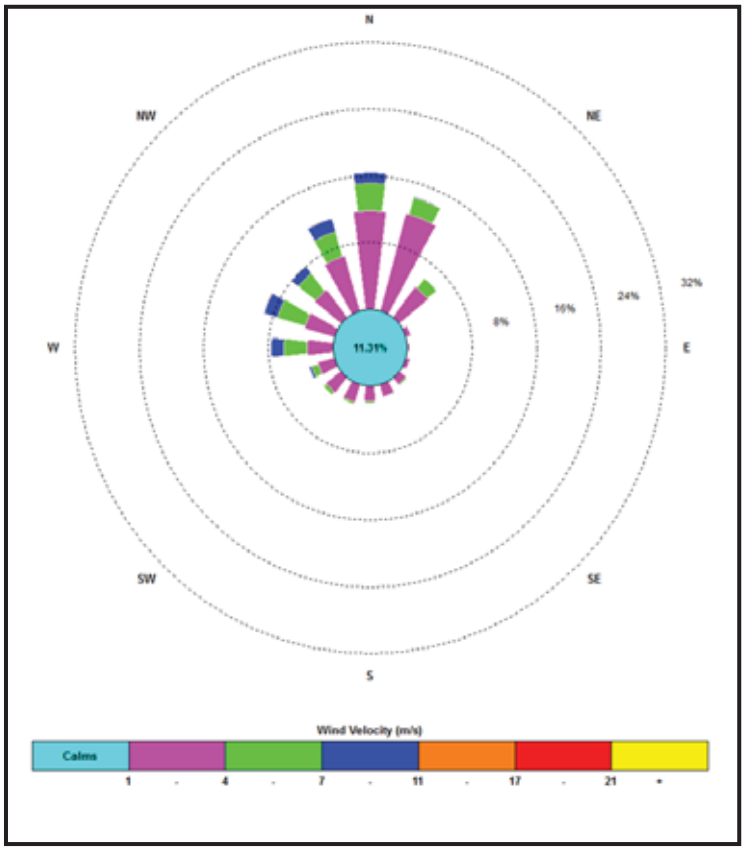
July 2017



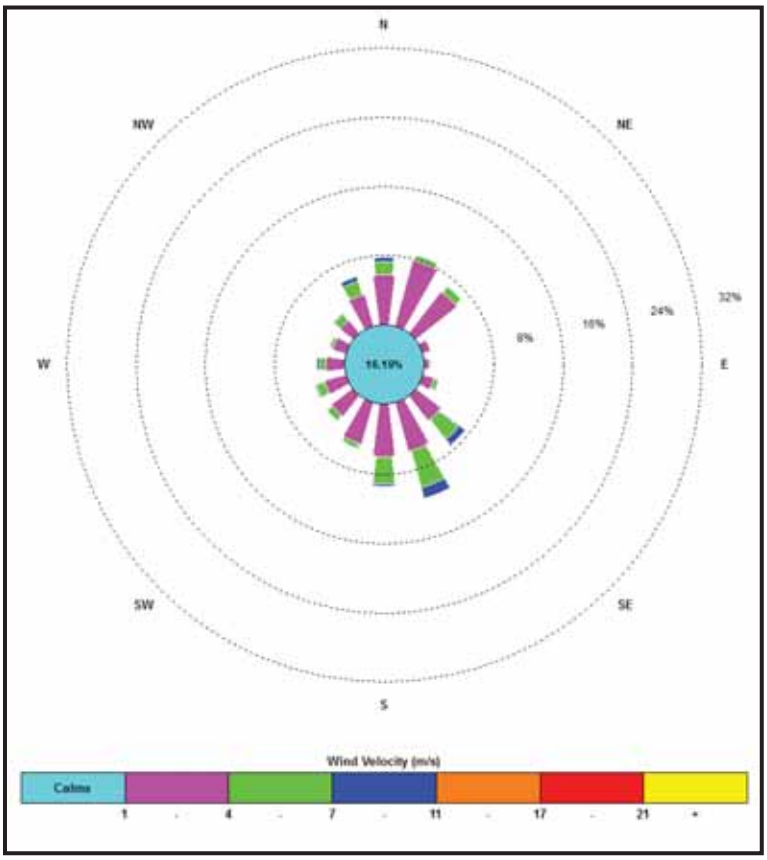
August 2017



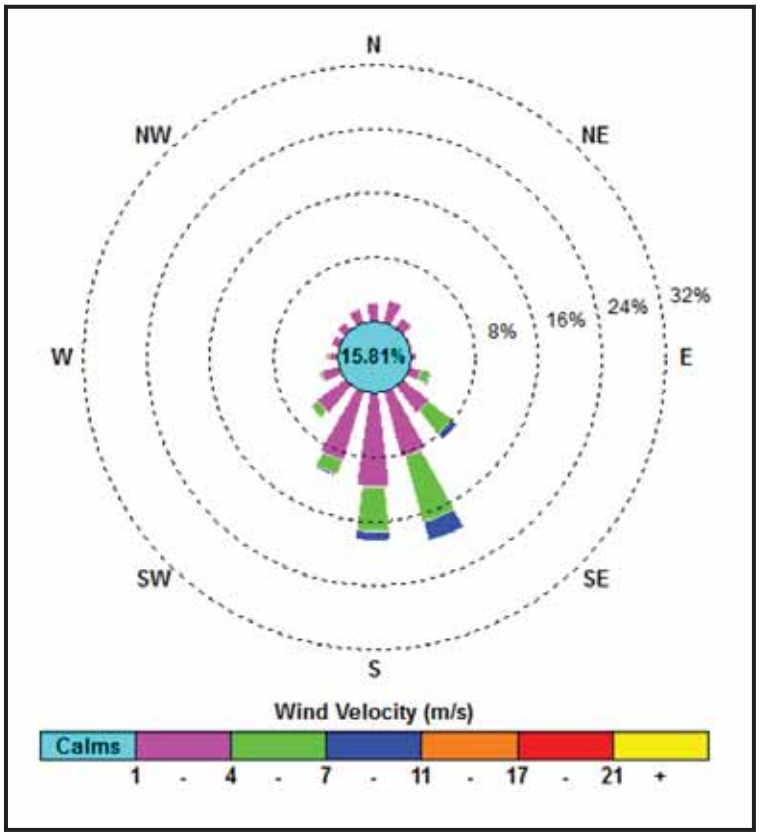
September 2017



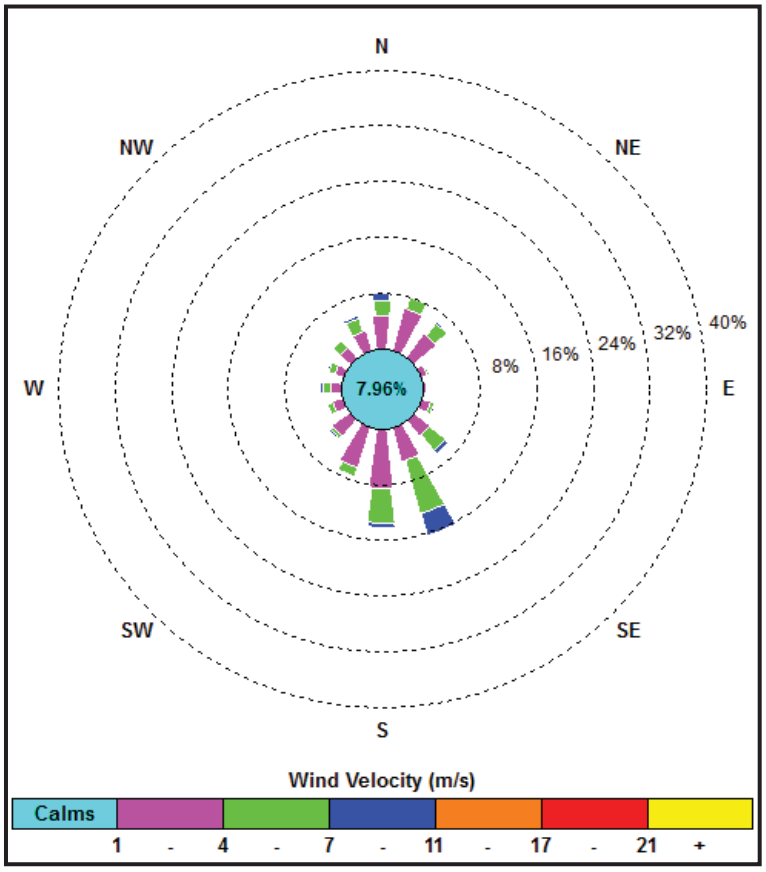
October 2017



November 2017

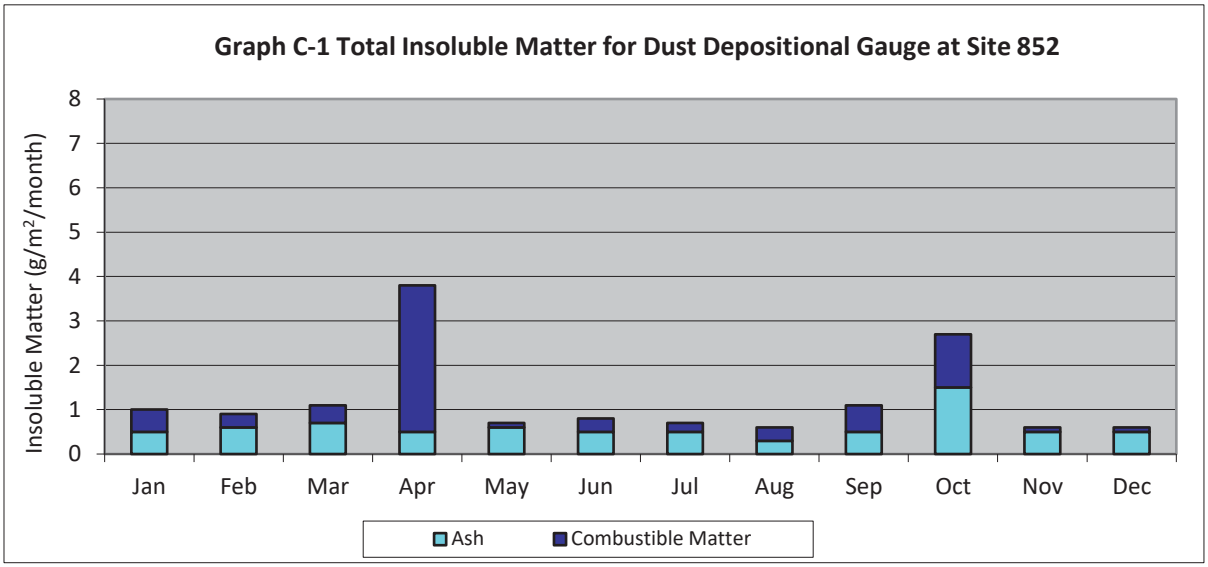


December 2017

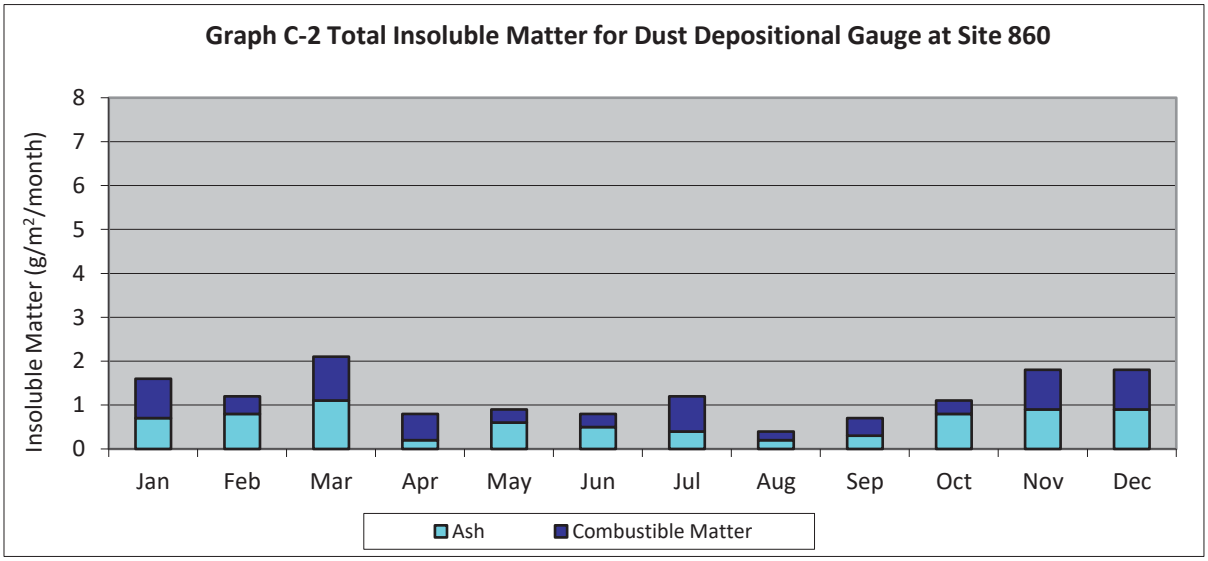


APPENDIX C

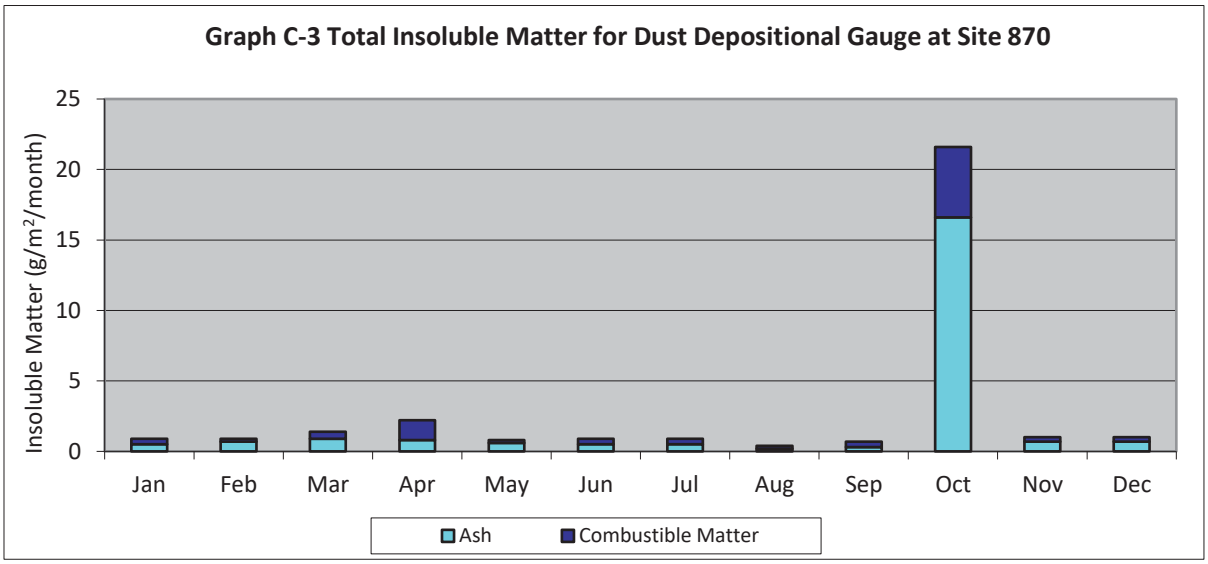
Air Quality Monitoring Summary



** April 2017 Result Contaminated at Site 852*

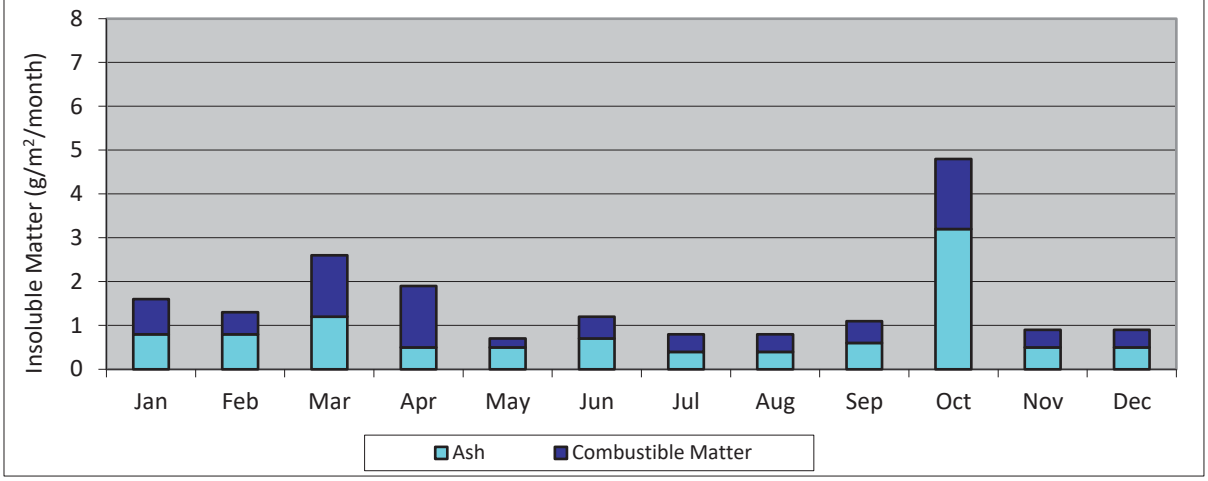


** January 2017 Result Contaminated at Site 860*



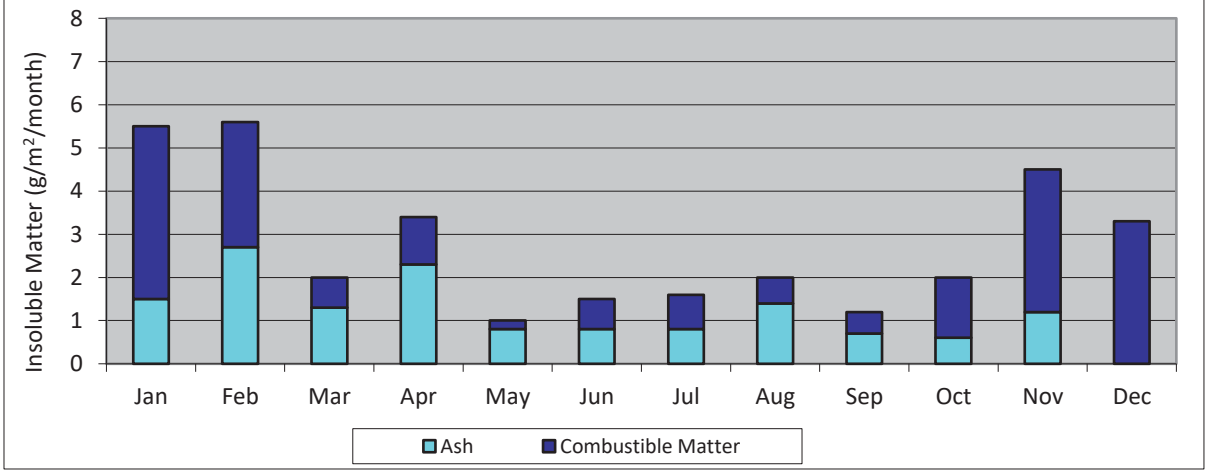
** October 2017 Result Contaminated at Site 870*

Graph C-4 Total Insoluble Matter for Dust Depositional Gauge at Site 880



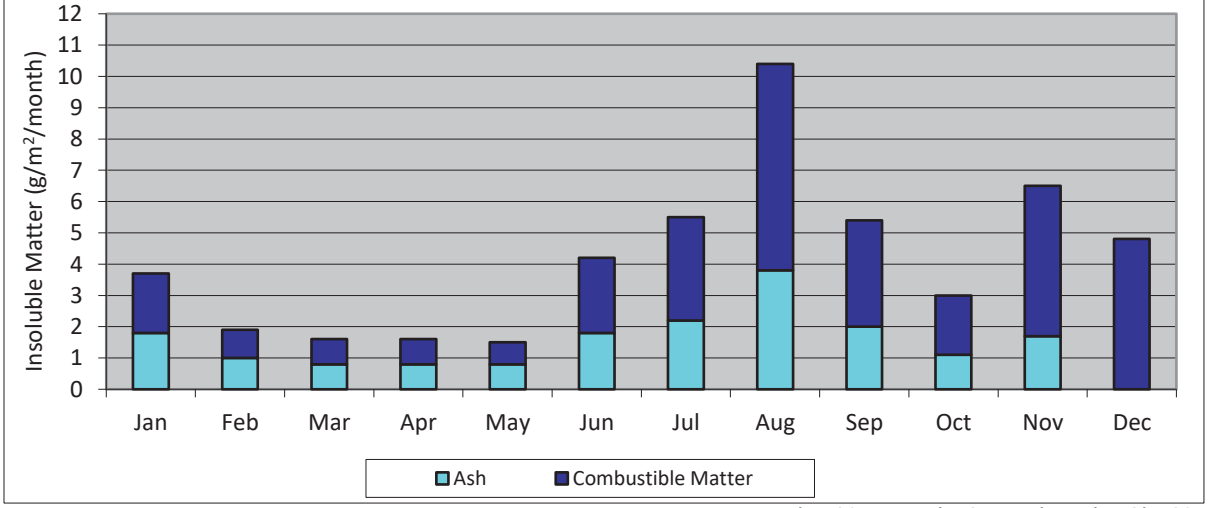
** Elevated Result at Site 880 in October 2017 due to nearby agricultural activities*

Graph C-5 Total Insoluble Matter for Dust Depositional Gauge at Site 885



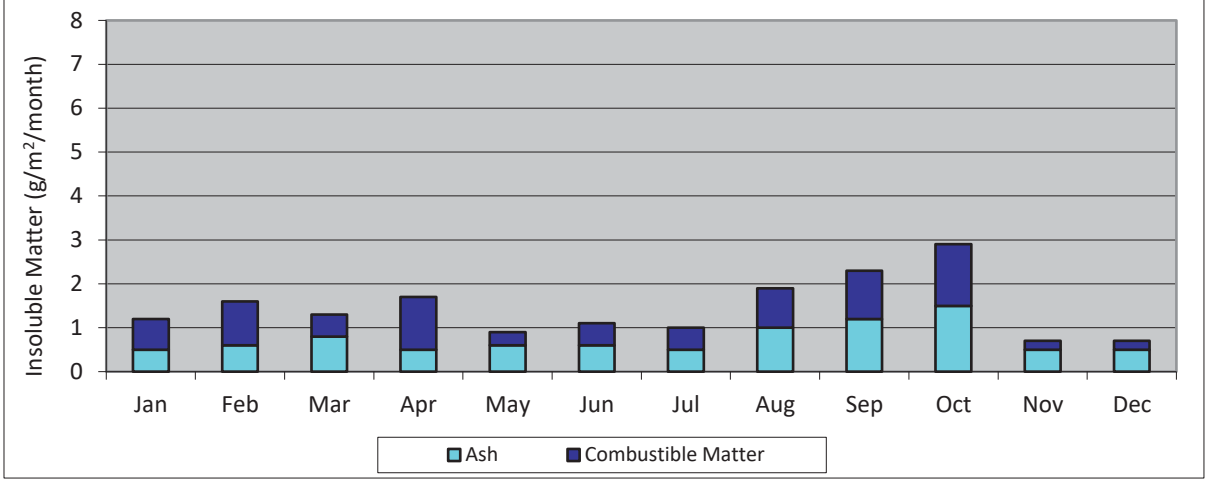
**January, February, November & December 2017 Results Contaminated at Site 885*

Graph C-6 Total Insoluble Matter for Dust Depositional Gauge at Site 897

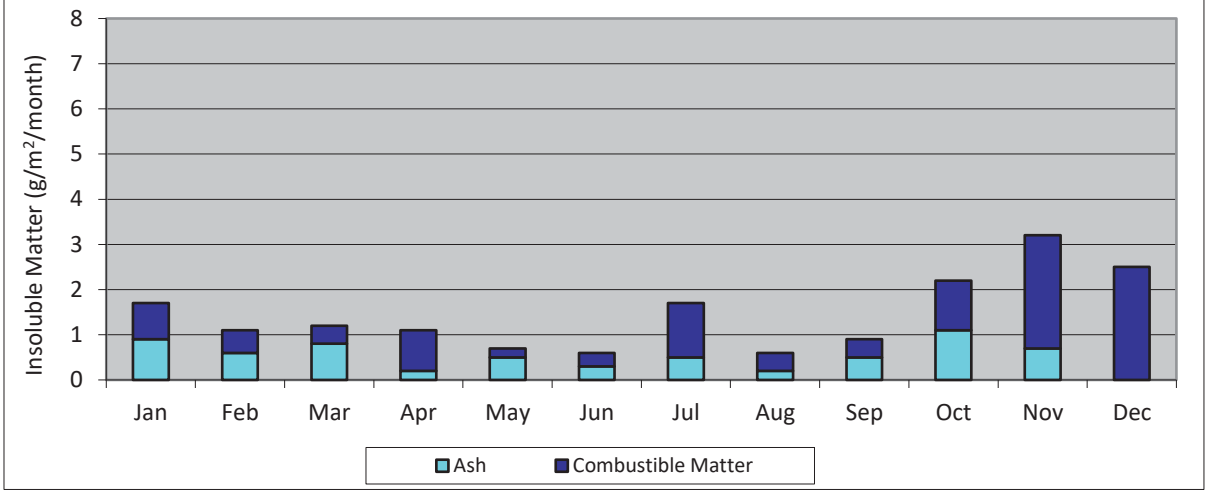


June-December 2017 Results Contaminated at Site 897

Graph C-7 Total Insoluble Matter for Dust Depositional Gauge at Site 898

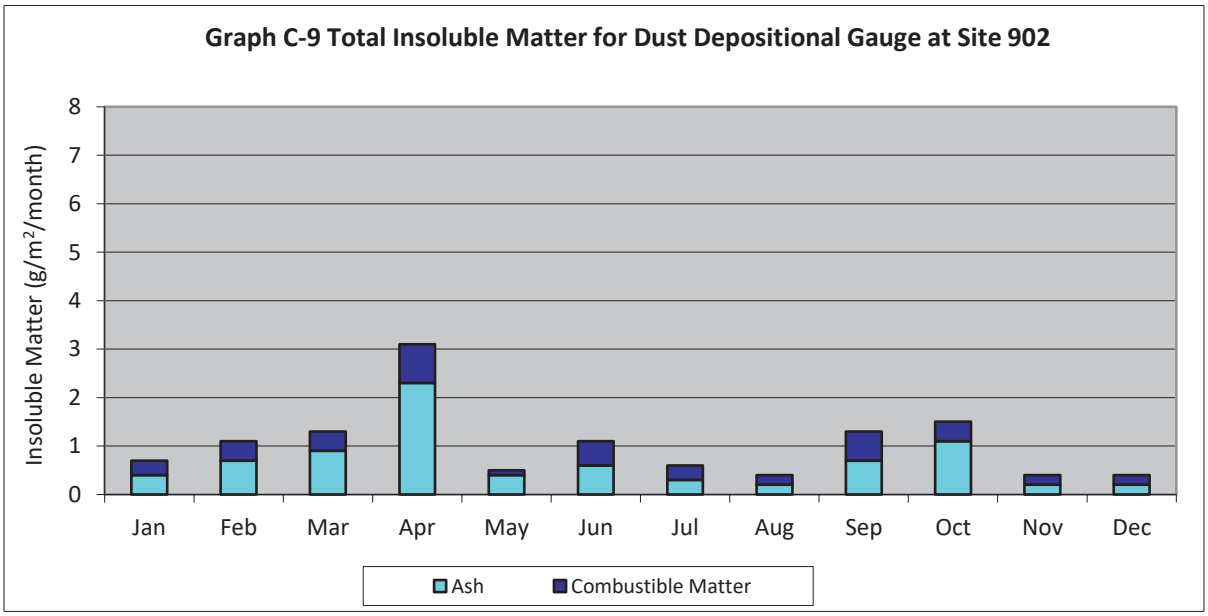


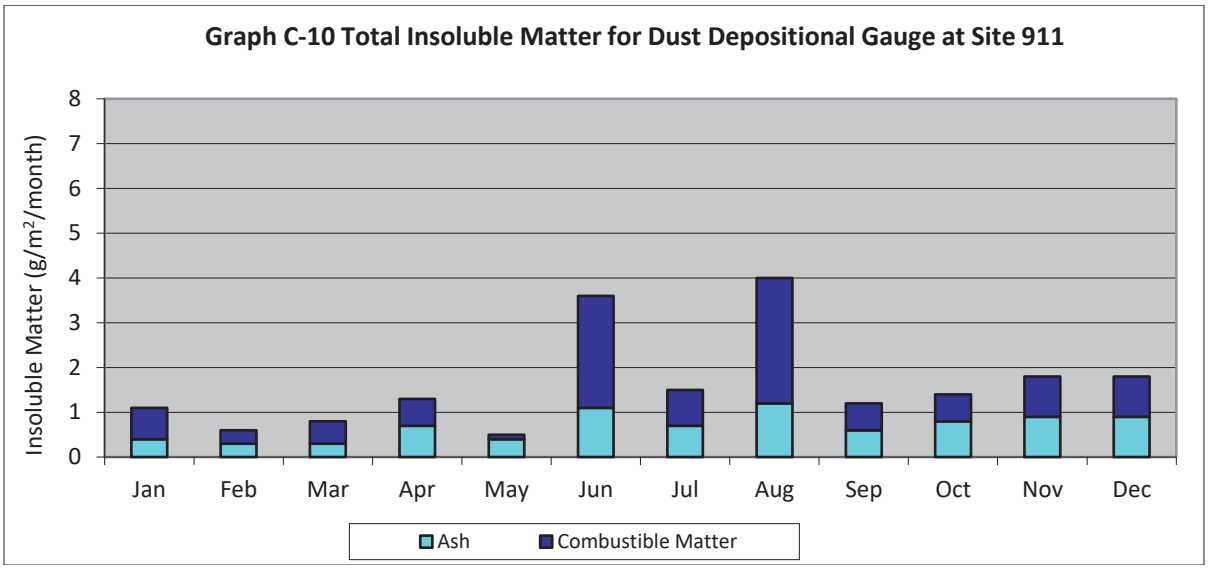
Graph C-8 Total Insoluble Matter for Dust Depositional Gauge at Site 900



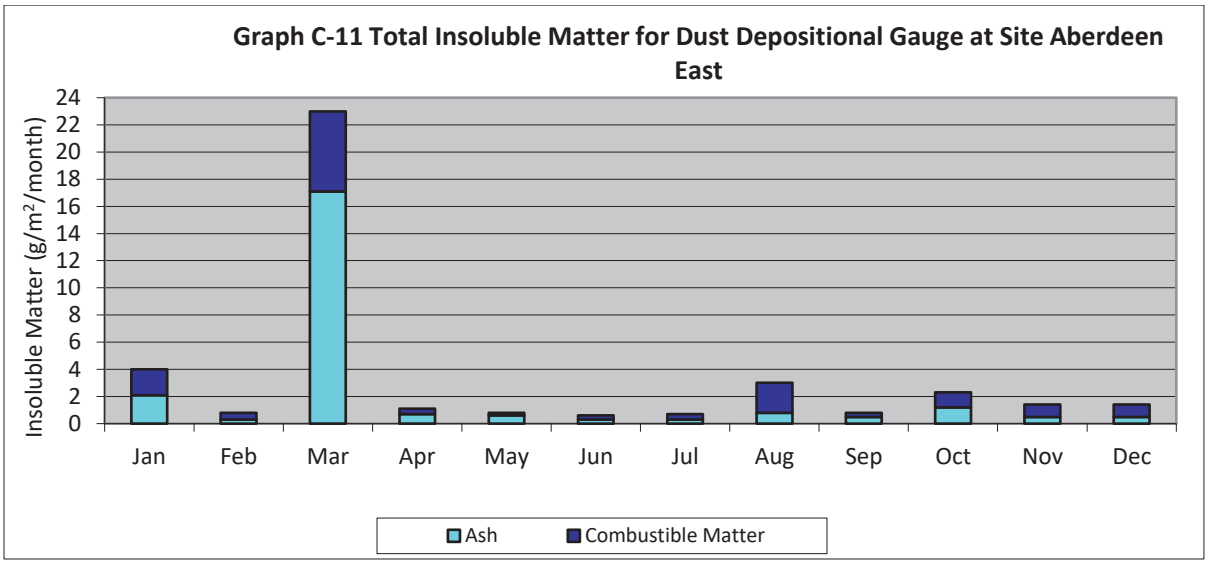
April, November & December Results Contaminated at Site 900

Graph C-9 Total Insoluble Matter for Dust Depositional Gauge at Site 902

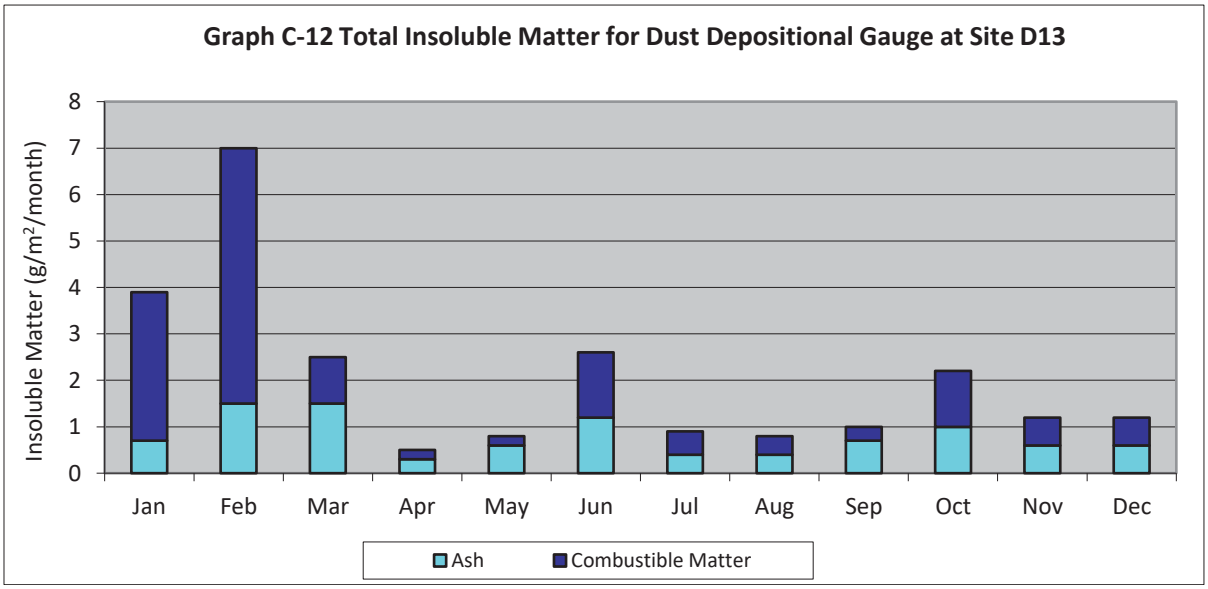




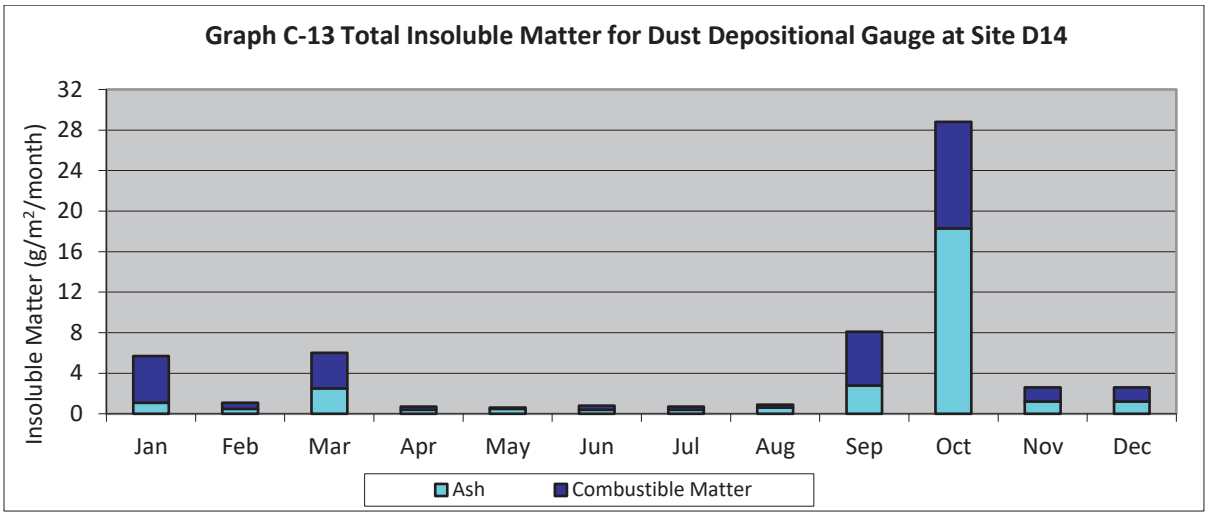
June & August 2017 Results Contaminated at Site 911



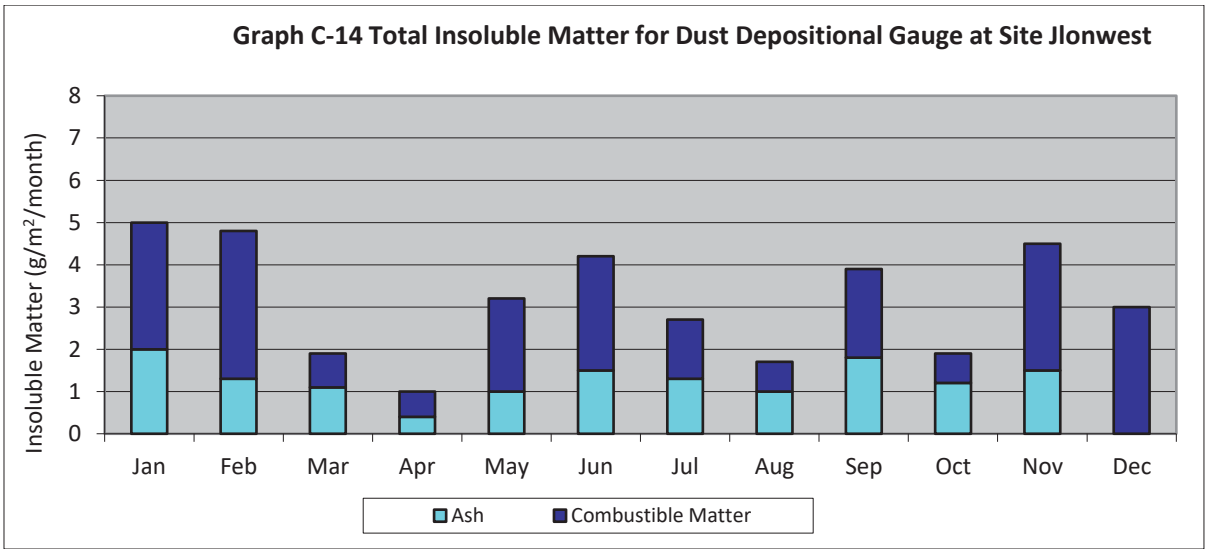
January, March & August 2017 Results Contaminated at Site Aberdeen East



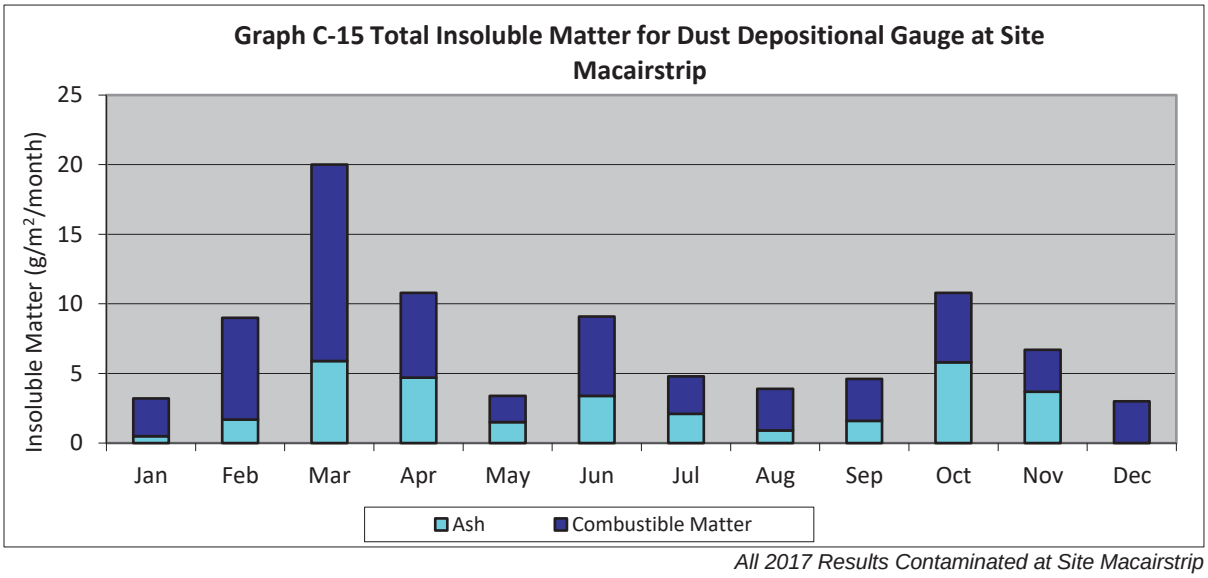
January & February 2017 Results Contaminated at Site D13



January, March, September & October 2017 Results Contaminated at Site D14

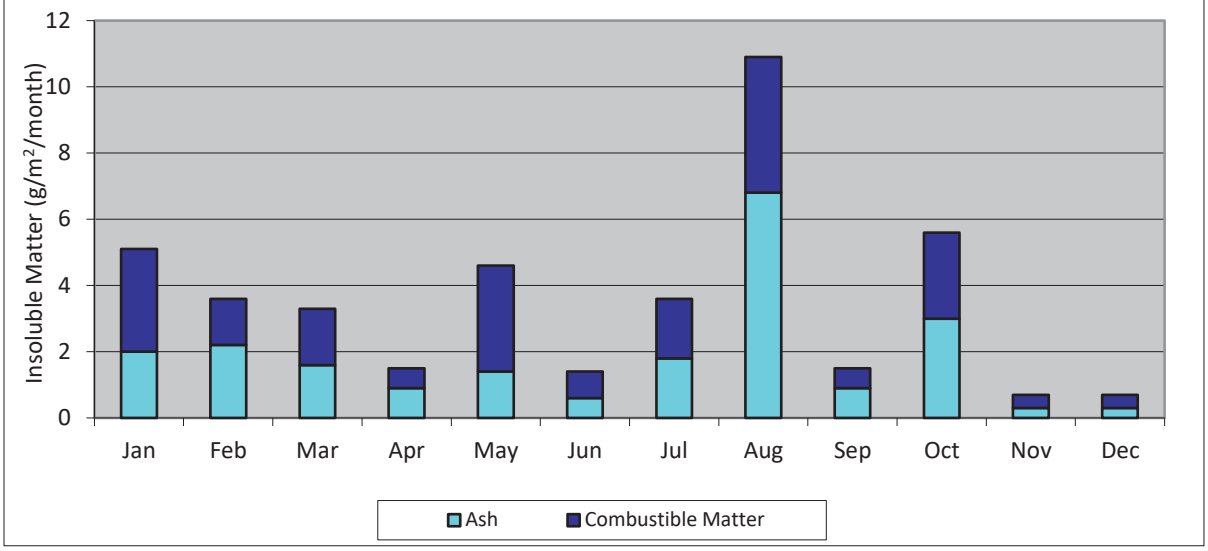


January, February, May, June, September & November 2017 Results Contaminated at Site Jlonwest



All 2017 Results Contaminated at Site Macairstrip

Graph C-16 Total Insoluble Matter for Dust Depositional Gauge at Site Wattus



January, March, May, August & October 2017 Results Contaminated at Site Wattus

Table 1C
Elevated & Contaminated Monthly Depositional Dust Results in 2017

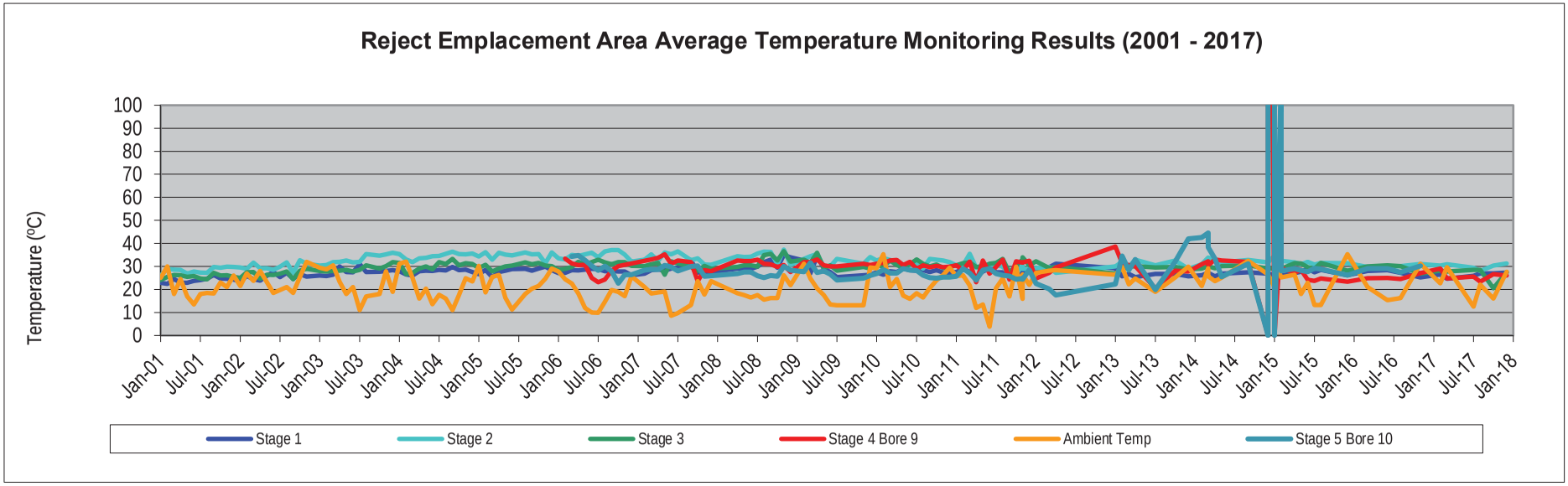
Site	Date	Insoluble Solids (g/m2/month)	Combustible Matter (g/m2/month)	Ash Component (g/m2/month)	Reason for high reading
870	10/11/17	21.6c	5	16.6	Insects & Vegetation
880	13/10/17	4.8	1.6	3.2	Insects & Vegetation. Monitor located on Agricultural Land.
885	12/01/17	5.5c	4	1.5	Insects & Bird droppings
885	13/02/17	5.6c	2.9	2.7	Insects, Vegetation & Bird Droppings
885	10/11/17	4.5c	3.3	1.2	Insects & Vegetation
885	11/12/2017	4.5c	3.3	1.2	Insects & Vegetation
897	13/06/17	4.2c	2.4	1.8	Insects & Bird droppings
897	13/07/17	5.5c	3.3	2.2	Insects, Vegetation & Bird Droppings
897	14/08/17	10.4c	6.6	3.8	Bird Droppings
897	13/09/17	5.4c	3.4	2.0	Insects, Vegetation & Bird Droppings
897	10/11/17	6.5c	1.9	4.6	Insects & Vegetation
897	11/12/2017	6.5c	4.8	1.3	Insects, Vegetation & Bird Droppings
911	14/08/17	4.0c	2.8	1.8	Bird Droppings
Aberdeen East	12/01/17	4.0c	1.9	2.1	Insects & Bird Droppings
Aberdeen East	15/03/17	23.0c	5.9	17.1	Insects
D13	13/02/17	7.0c	5.5	1.5	Insects & Bird Droppings
D14	12/01/17	5.7c	4.6	1.1	Insects & Bird Droppings
D14	15/03/17	6c	3.5	2.5	Insects
D14	12/09/17	8.1c	5.3	2.8	Insects, Vegetation & Bird Droppings
D14	13/10/17	28.8c	10.5	18.3	Insects, Vegetation & Bird Droppings
Jlonwest	12/01/17	5.0c	3	2	Insects & Bird Droppings
Jlonwest	13/02/17	4.8c	3.5	1.2	Insects & Bird Droppings
Jlonwest	13/06/17	4.2c	2.7	1.5	Insects & Bird Droppings
Jlonwest	10/11/17	4.5c	3	1.5	Insects, Vegetation & Bird Droppings
Jlonwest	11/12/2017	4.5c	3	1.5	Insects, Vegetation & Bird Droppings

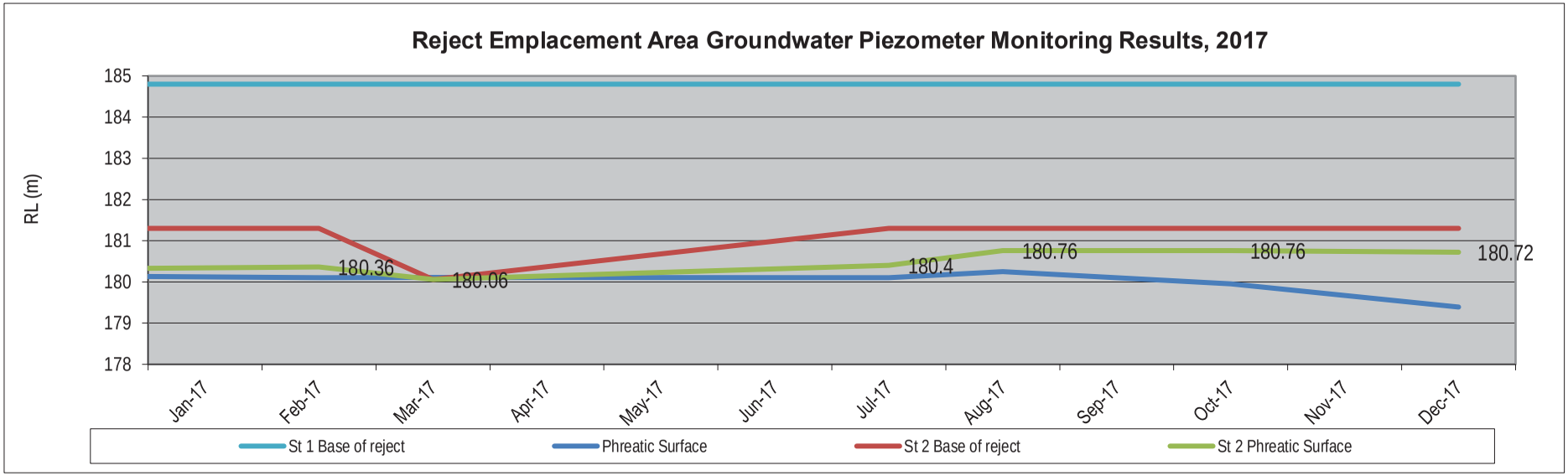
Site	Date	Insoluble Solids (g/m2/month)	Combustible Matter (g/m2/month)	Ash Component (g/m2/month)	Reason for high reading
Macairstrip	13/02/2017	9.0c	7.3	1.7	Insects & Bird Droppings
Macairstrip	15/03/2017	20c	14.1	5.9	Insects & Bird Droppings
Macairstrip	13/04/2017	10.8c	6.1	4.7	Insects & Bird Droppings
Macairstrip	13/06/2017	9.1c	5.7	3.4	Insects, Vegetation & Bird Droppings
Macairstrip	13/07/2017	4.8c	2.7	2.1	Insects, Vegetation & Bird Droppings
Macairstrip	12/09/2017	4.6c	3	1.6	Insects, Vegetation & Bird Droppings
Macairstrip	13/10/2017	10.8c	5	5.8	Insects, Vegetation & Bird Droppings
Macairstrip	10/11/2017	6.7c	3	3.7	Insects, Vegetation & Bird Droppings
Macairstrip	11/12/2017	6.7c	3	4.7	Insects, Vegetation & Bird Droppings
Wattus	12/01/17	5.1c	3.1	2.0	Insects & Bird Droppings
Wattus	15/05/17	4.6c	1.7	2.9	Insects & Bird Droppings
Wattus	14/08/17	10.9c	4.1	7.8	Insects & Bird Droppings
Wattus	13/10/17	5.6c	2.6	3.0	Insects & Vegetation

Note: c = contaminated sample

APPENDIX D

REA Monitoring Summary

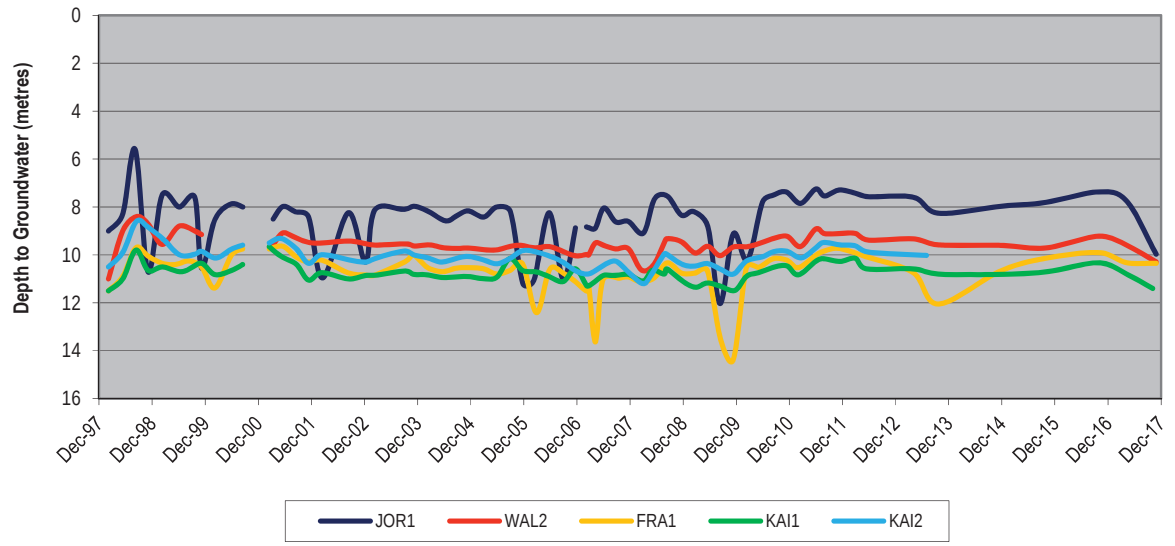

Reject Emplacement Area Average Temperature Monitoring Results (2001 - 2017)
Temperature (ºC)
100
90
80
70
60
50
40
30
20
10
0
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Jan-05
Jul-05
Jan-06
Jul-06
Jan-07
Jul-07
Jan-08
Jul-08
Jan-09
Jul-09
Jan-10
Jul-10
Jan-11
Jul-11
Jan-12
Jul-12
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Stage 1
Stage 2
Stage 3
Stage 4 Bore 9
Ambient Temp
Stage 5 Bore 10


Reject Emplacement Area Groundwater Piezometer Monitoring Results, 2017
RL (m)
185
184
183
182
181
180
179
178
180.36
180.06
180.4
180.76
180.76
180.72
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
St 1 Base of reject
Phreatic Surface
St 2 Base of reject
St 2 Phreatic Surface

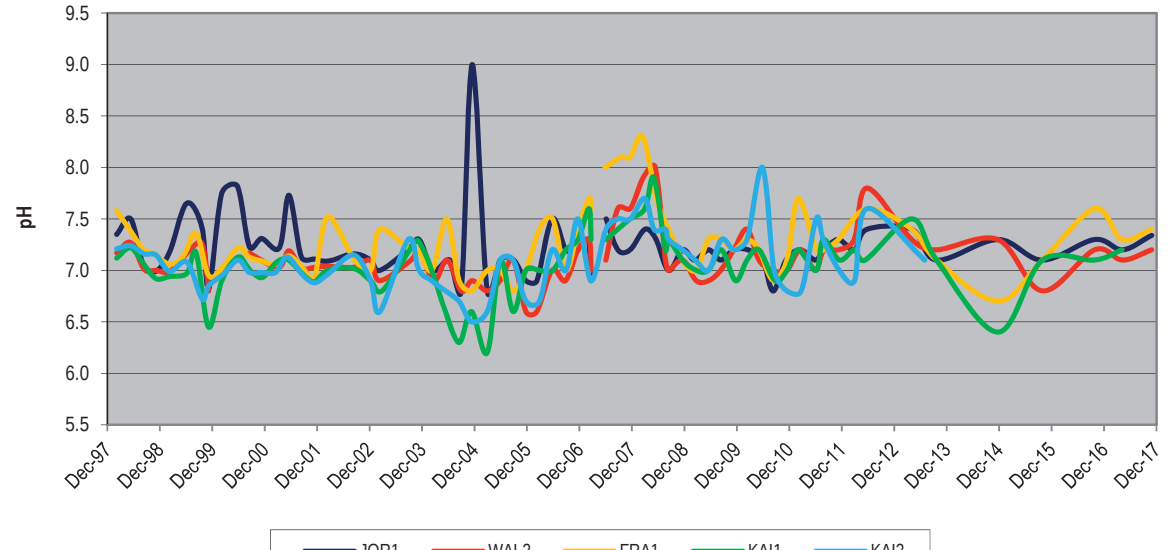
APPENDIX E

Groundwater Monitoring Summary

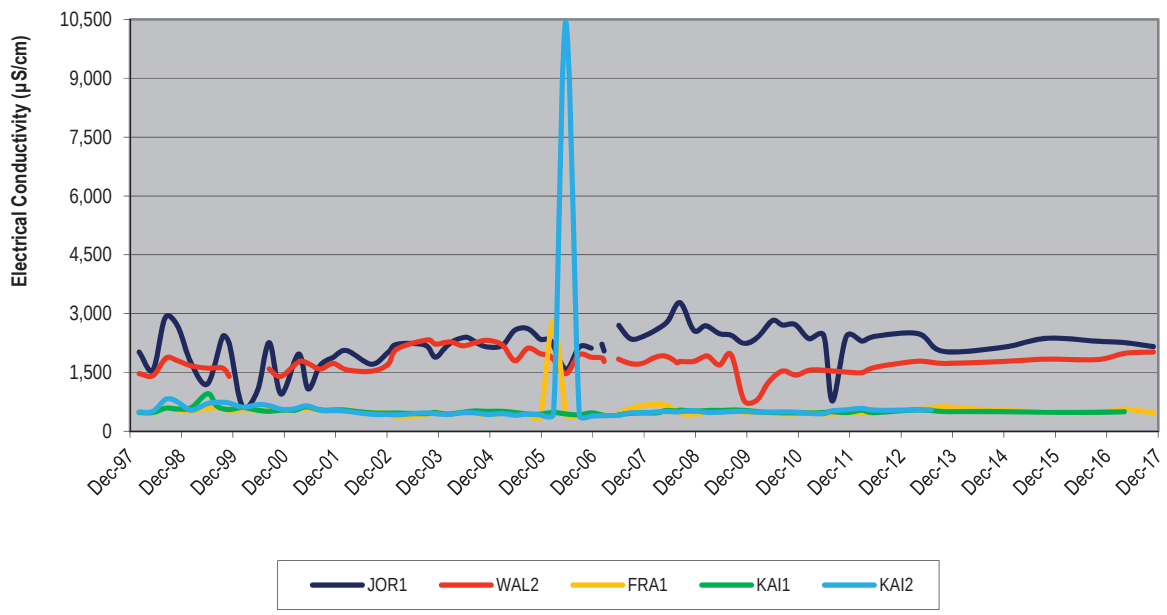
Graph E-1 - Groundwater Level Results for Hunter River Alluvium Bores (1998 - 2017)



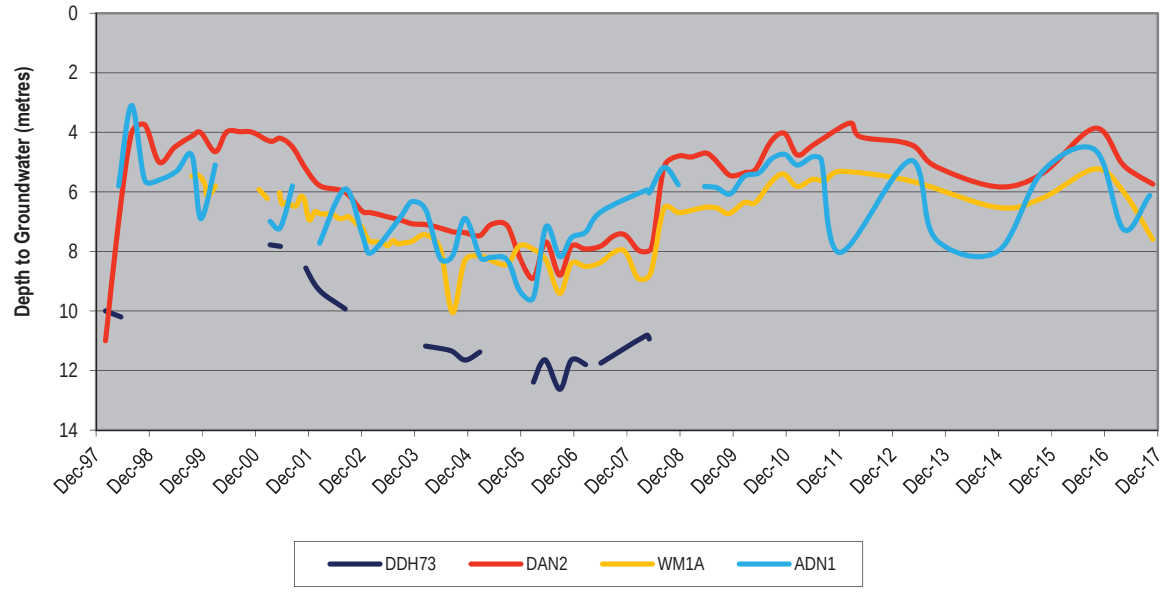
Graph E-2 - pH Results for Hunter River Alluvium Bores (1998 - 2017)



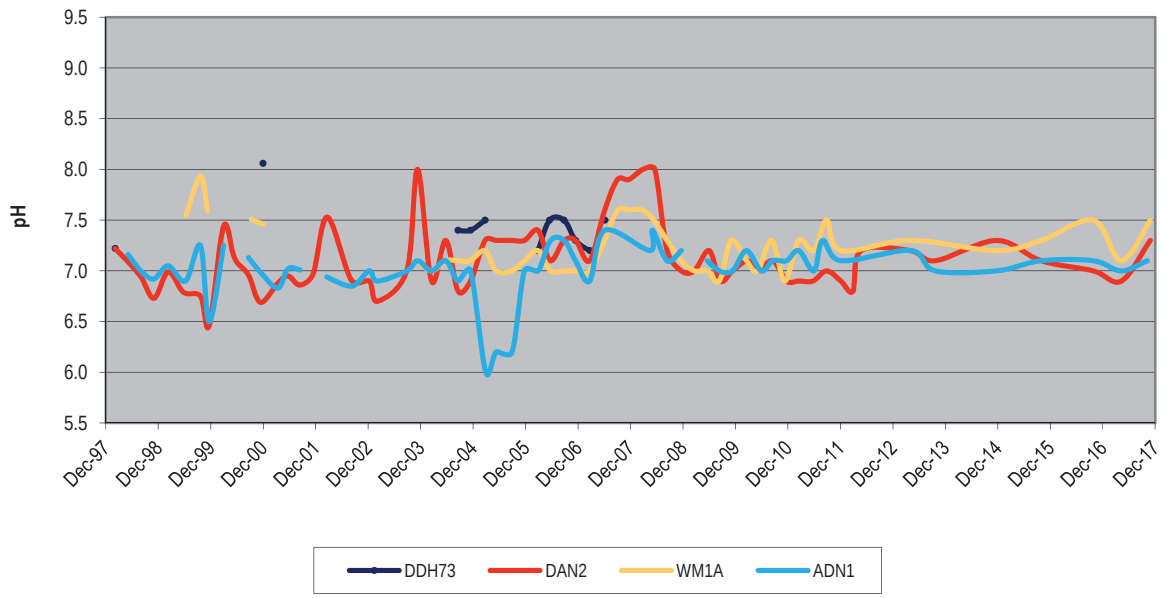
Graph E-3 - Electrical Conductivity Results for Hunter River Alluvium Bores (1998 - 2017)



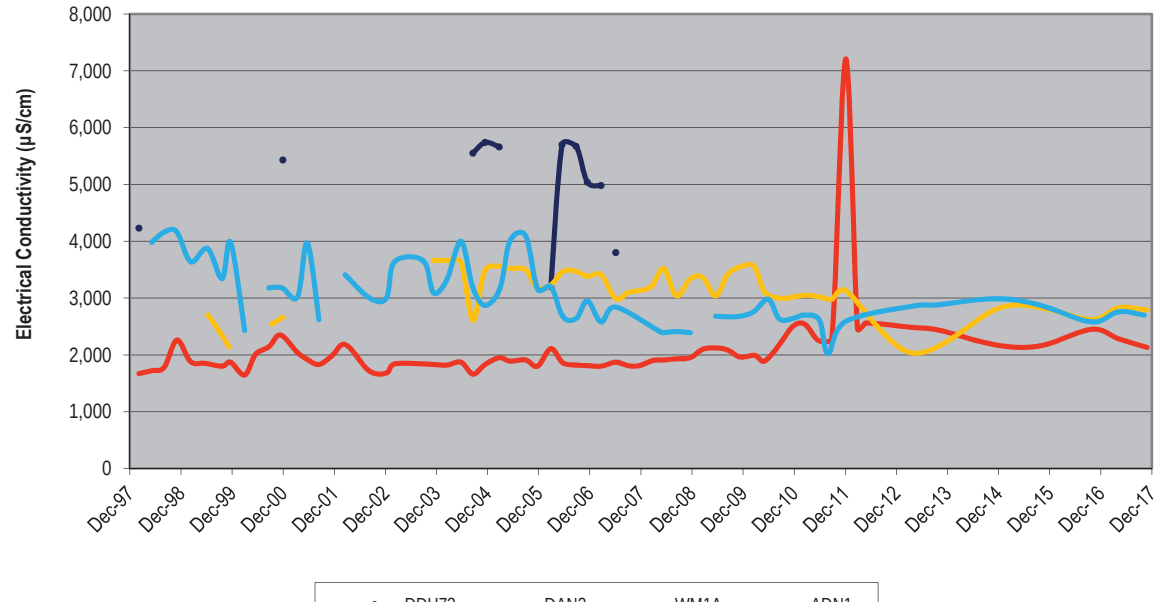
Graph E-4 - Groundwater Level Results for Dartbrook Alluvium Bores (1998 - 2017)



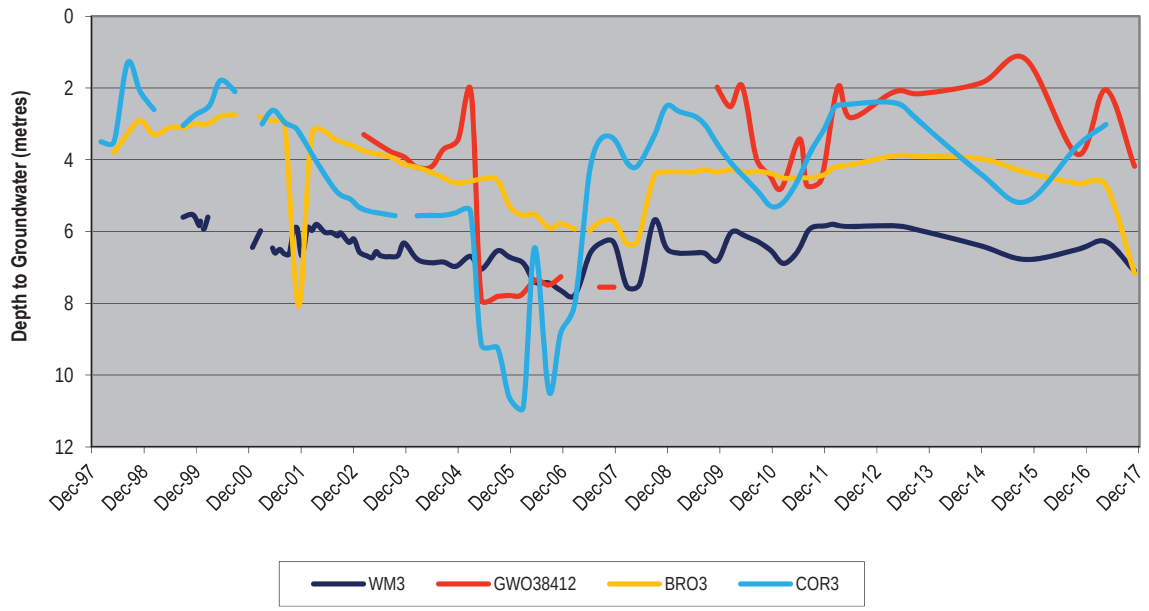
Graph E-5 - pH Results for Dart Brook Alluvium Bores (1998 - 2017)



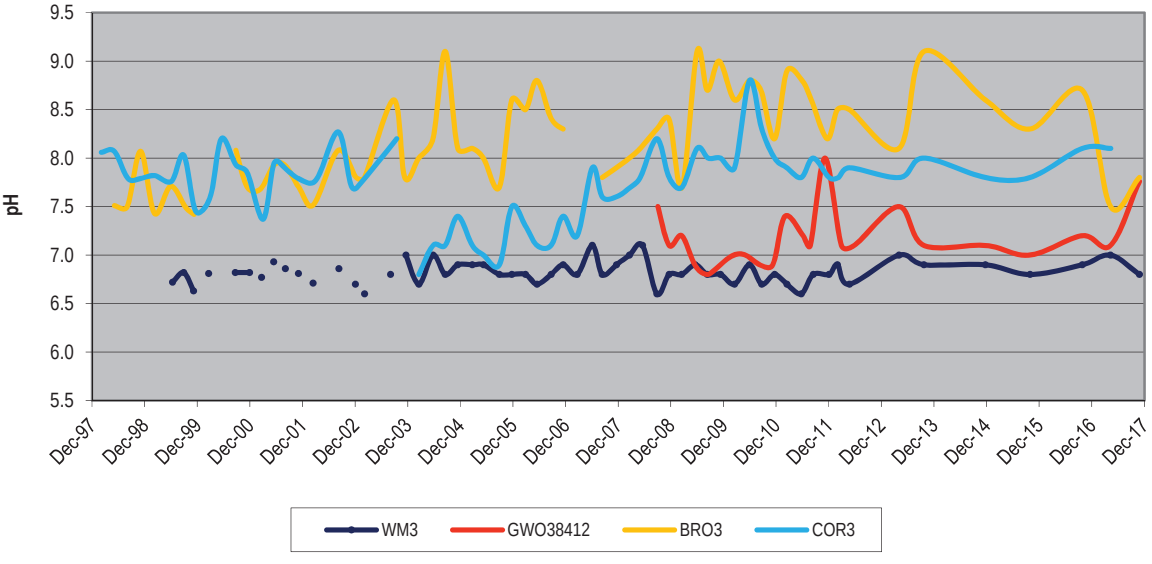
Graph E-6 - Electrical Conductivity Results for Dart Brook Alluvium Bores (1998 - 2017)



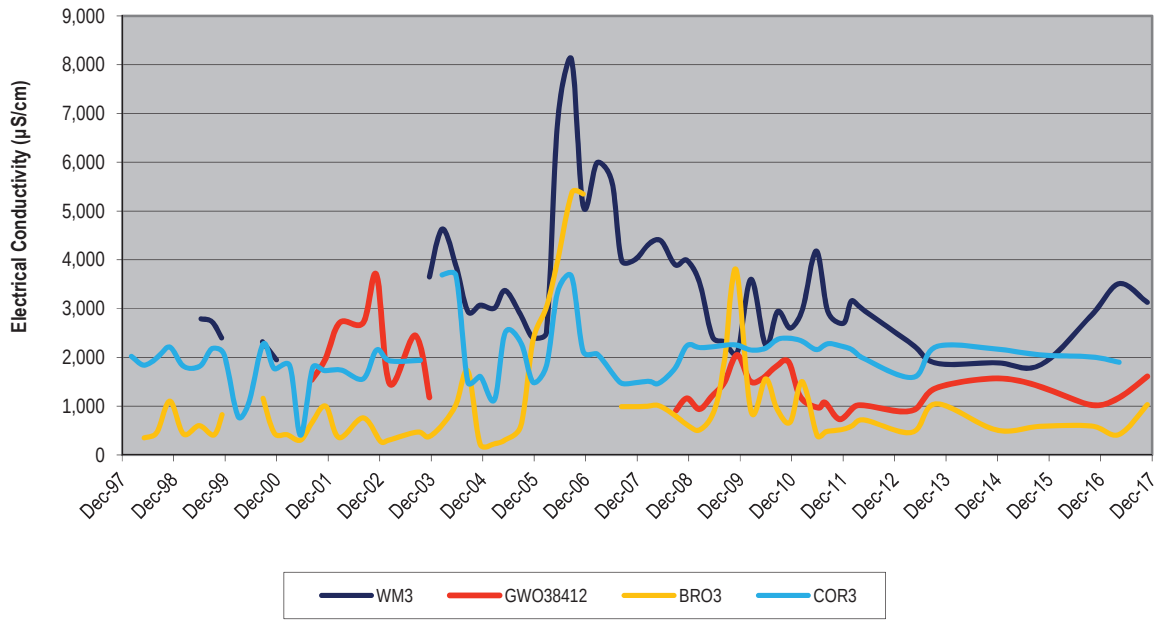
Graph E-7 - Groundwater Level Results for Sandy Creek Alluvium Bores (1998 - 2017)



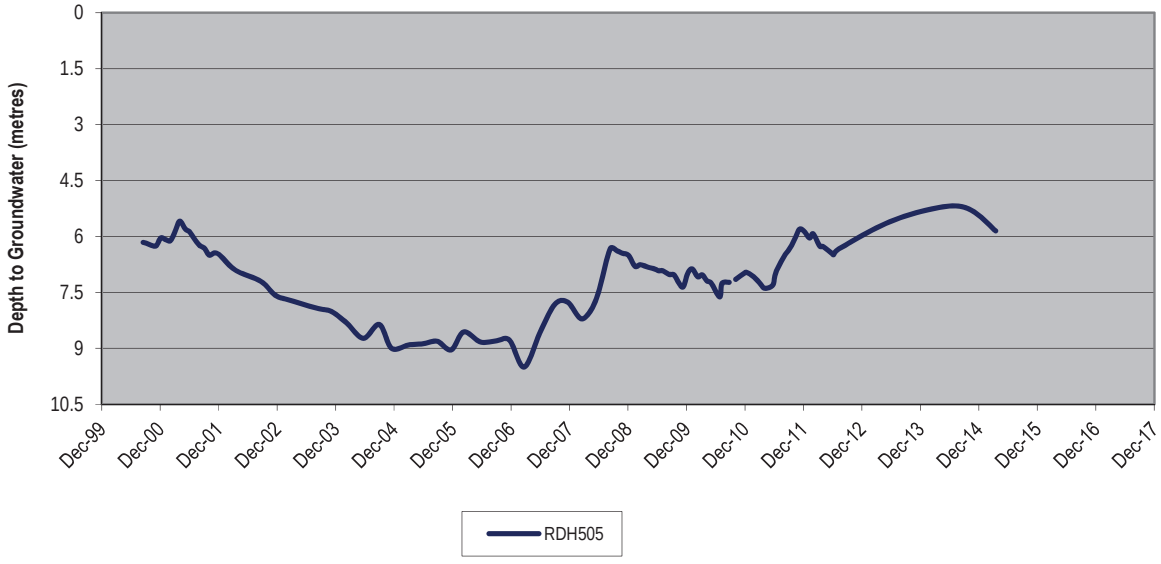
Graph E-8 - pH Results for Sandy Creek Alluvium Bores (1998 - 2017)



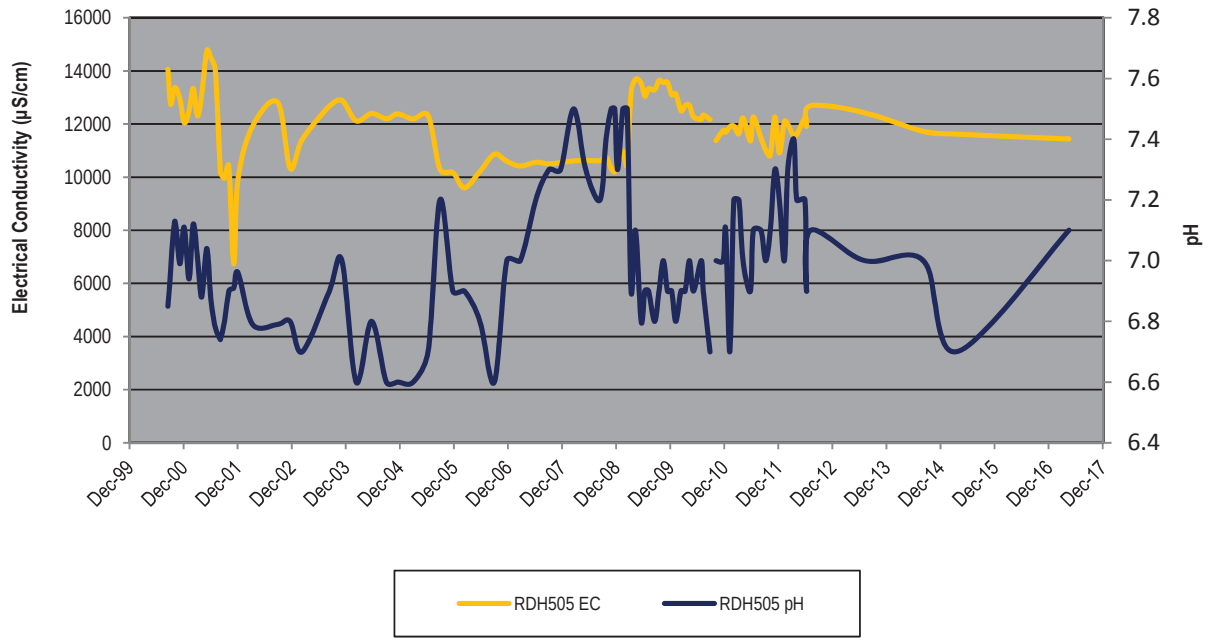
Graph E-9 - Electrical Conductivity Results for Sandy Creek Alluvium Bores (1998 - 2017)



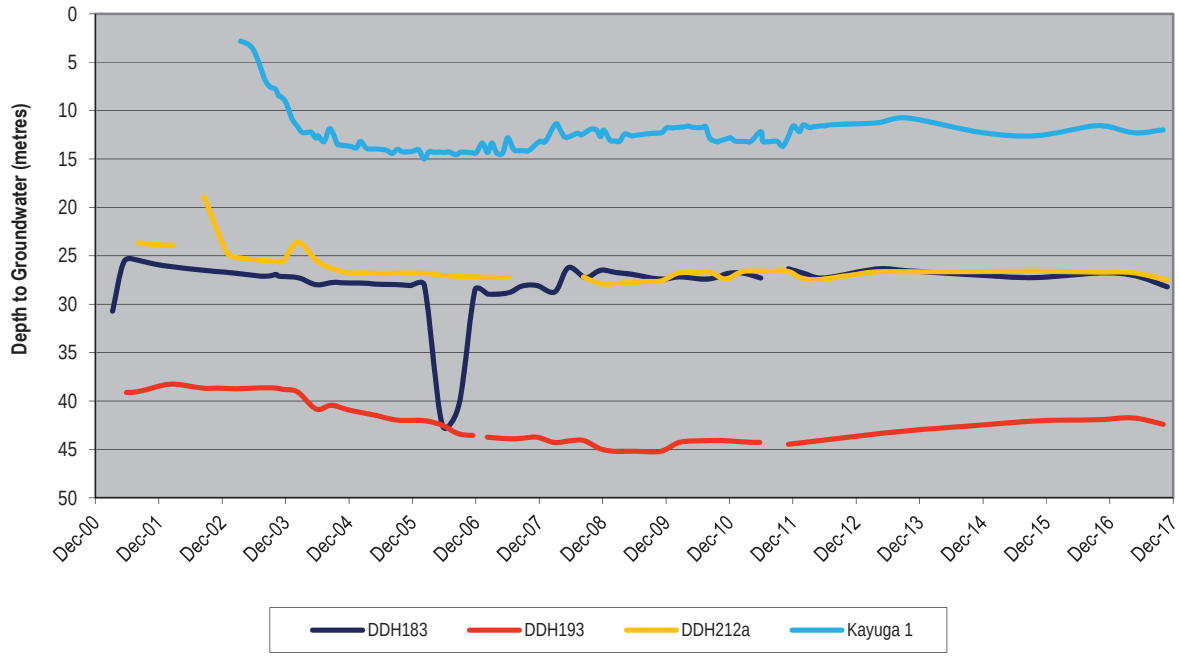
Graph E-10 - Groundwater Level Results for Staged Discharge Dam Bore (2000 - 2017)



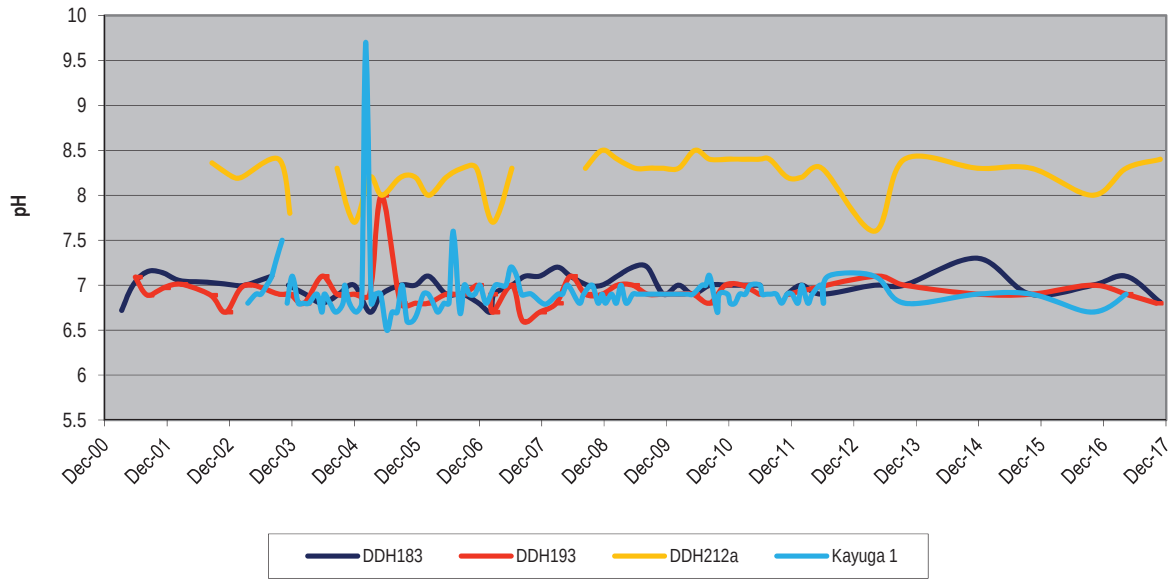
Graph F-11 - pH and Electrical Conductivity Results for Staged Discharge Dam Bore (2000 - 2017)



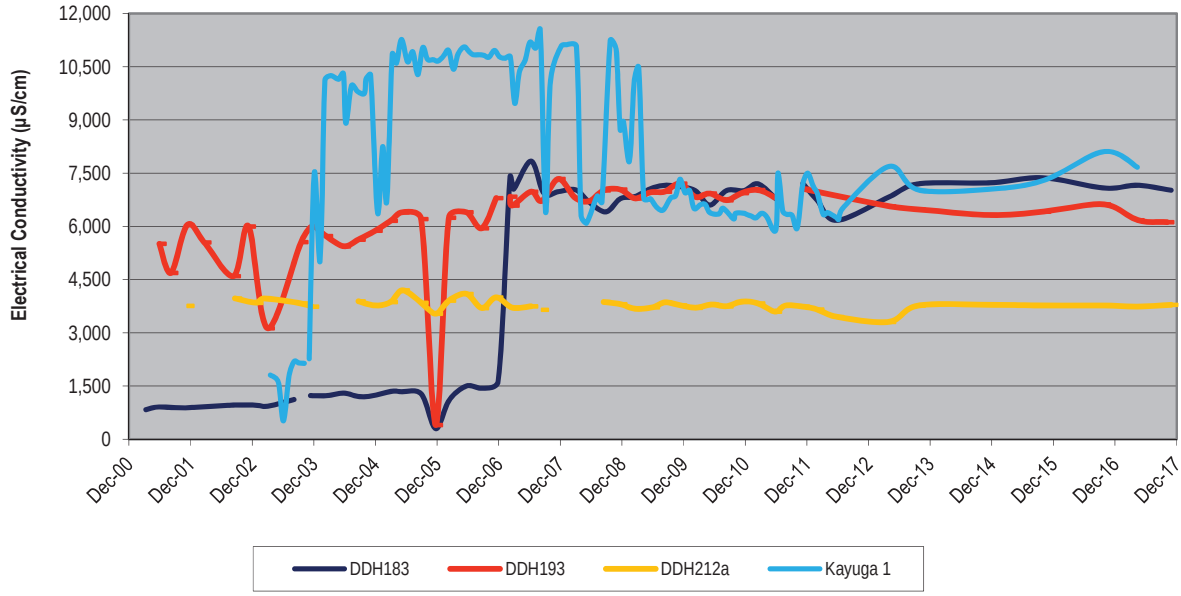
Graph E-12 - Groundwater Level Results for Coal Seam Bores (2001 - 2017)



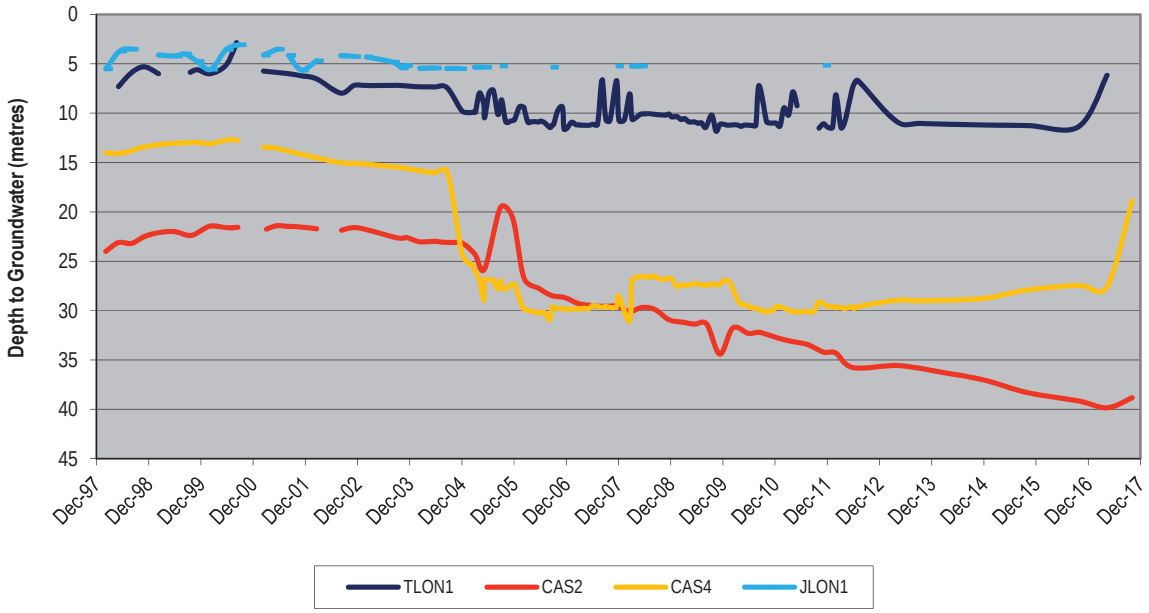
Graph E-13 - pH Results for Coal Seam Bores (2001 - 2017)



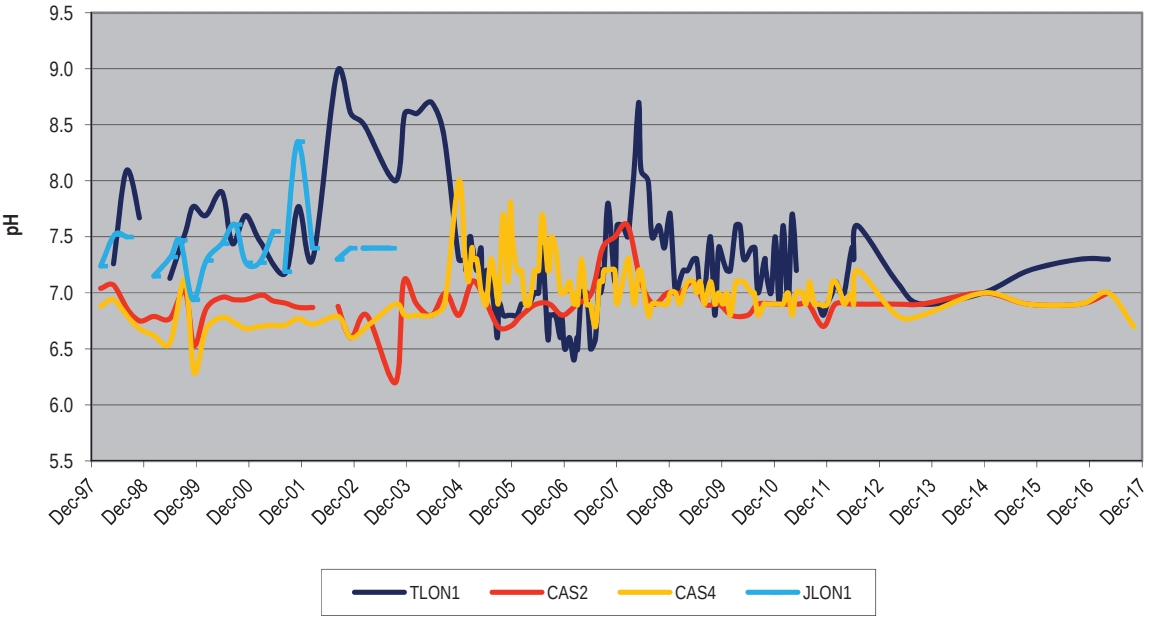
Graph E-14 - Electrical Conductivity Results for Coal Seam Bores (2001 - 2017)



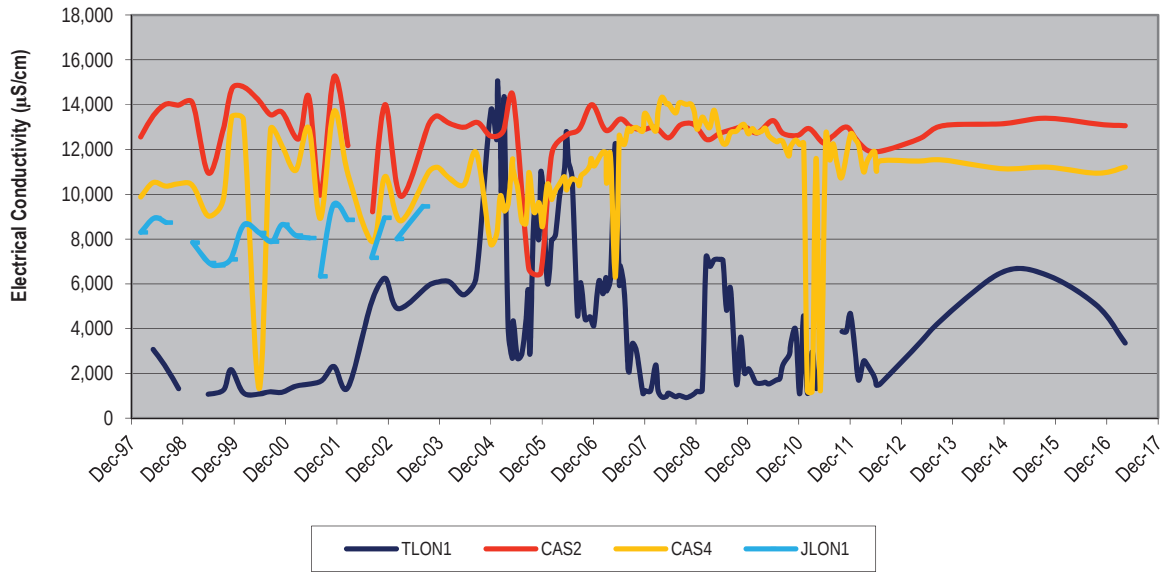
Graph E-15 - Groundwater Level Results for Regolith Bores (1998 - 2017)



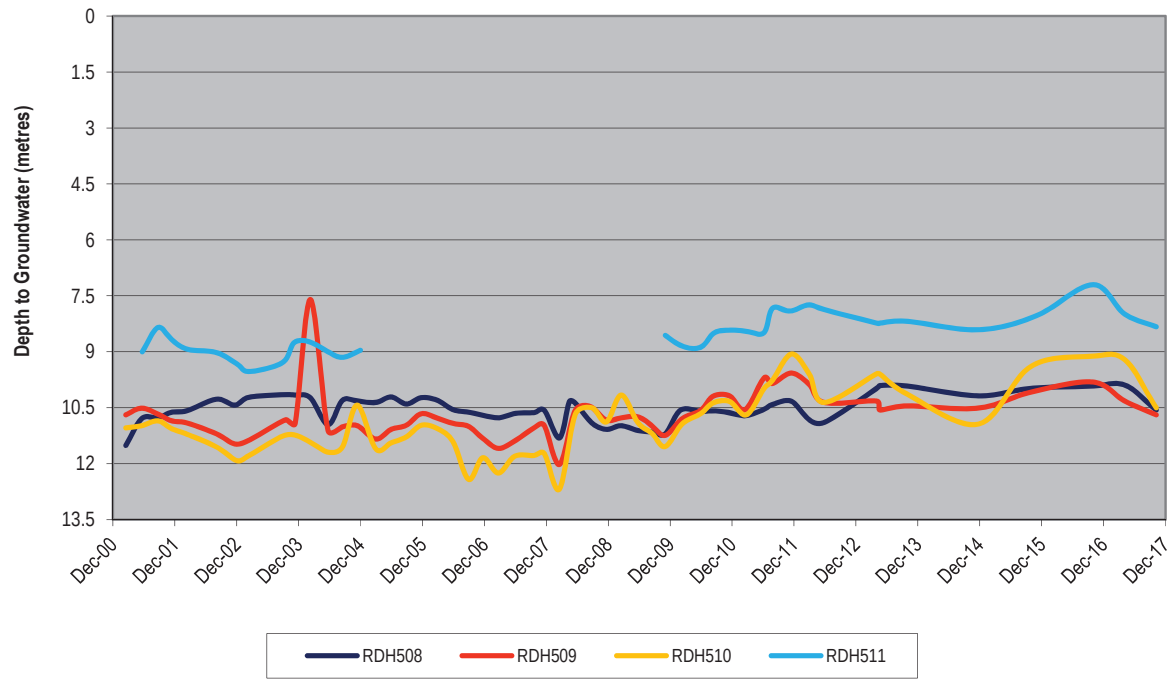
Graph E-16 - pH Results for Regolith Groundwater Bores (1998 - 2017)



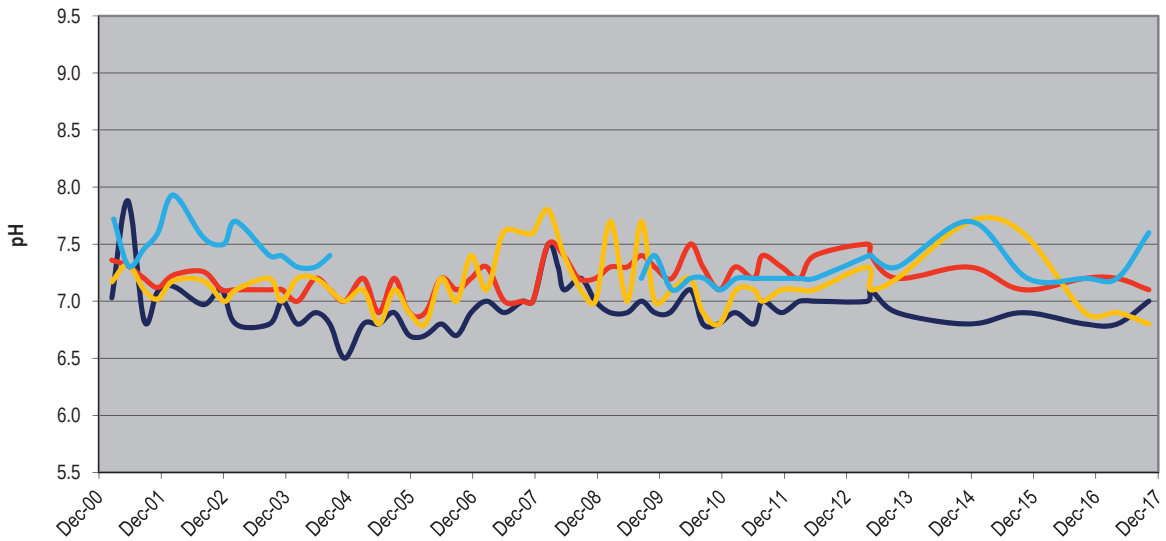
Graph E-17 - Electrical Conductivity Results for Regolith Groundwater Bores (1998 - 2017)



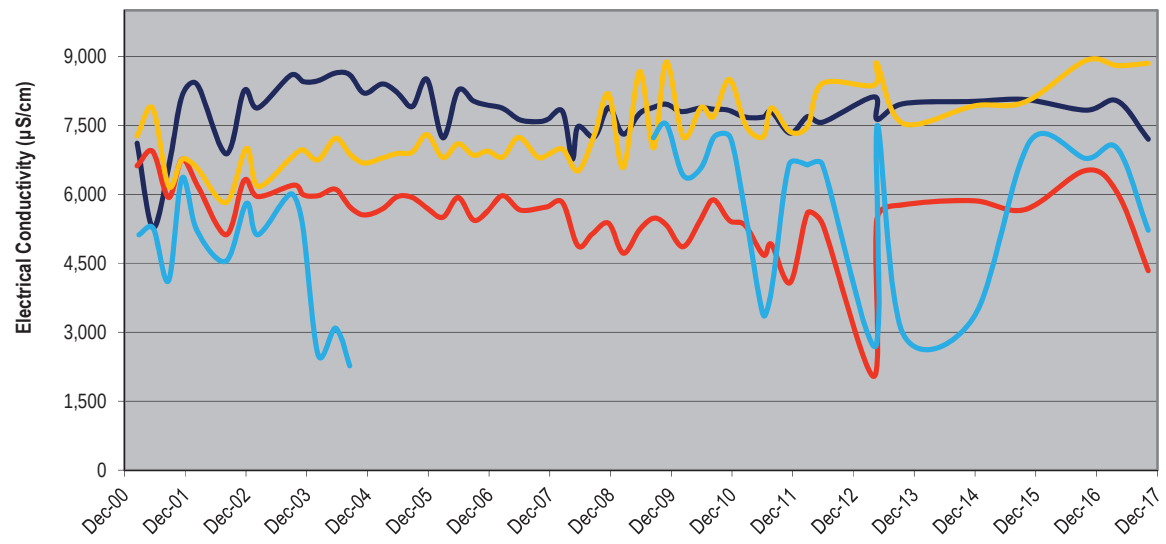
Graph E-18 - Groundwater Level Results for Reject Emplacement Area Bores (2001 - 2017)



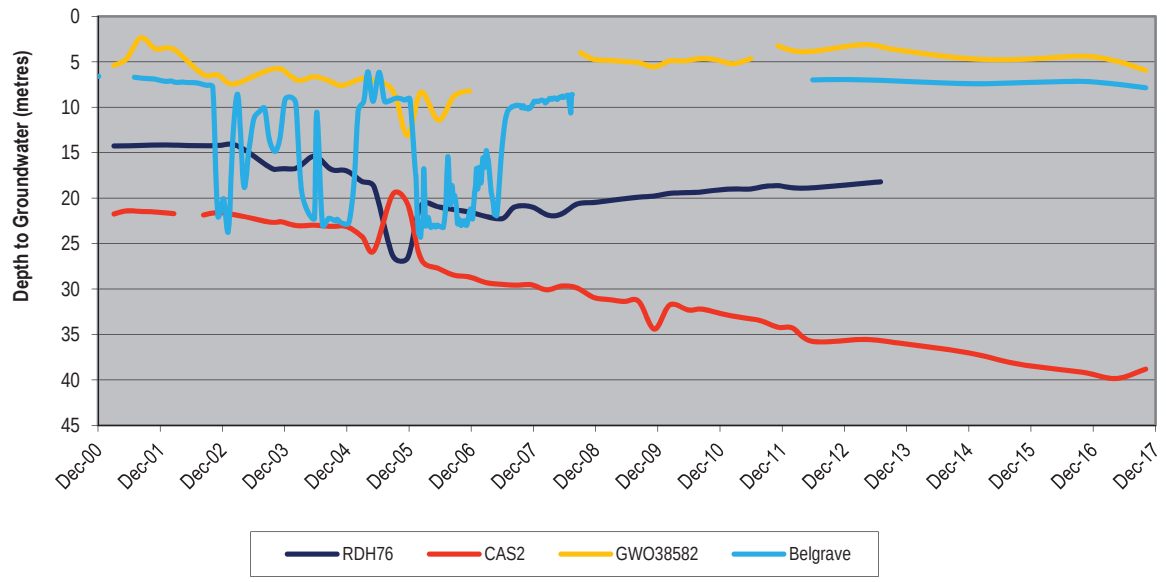
Graph E-19 - pH Results for Reject Emplacement Area Bores (2001 - 2017)



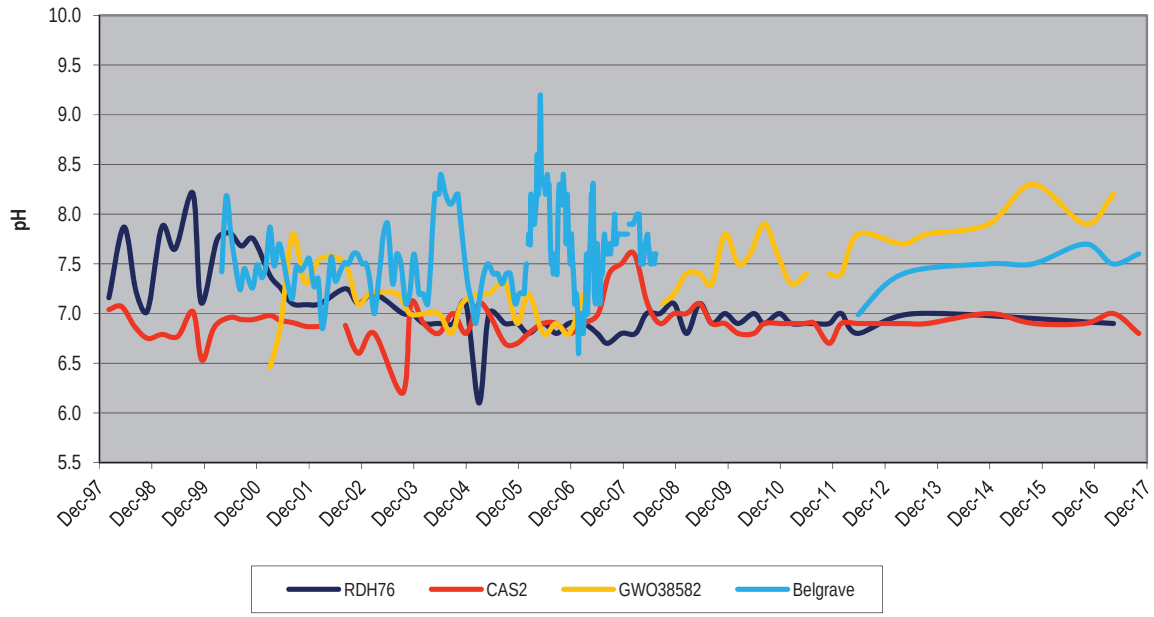
Graph E-20 - Electrical Conductivity Results for Reject Emplacement Area Bores (2001 - 2017)



Graph E-21 - Groundwater Level Results for Landowner Property Bores (2001 - 2017)



Graph E-22 - pH Results for Landowner Property Groundwater Bores (1998 - 2017)



Graph E-23 - Electrical Conductivity Results for Landowner Property Bores (1998 - 2017)

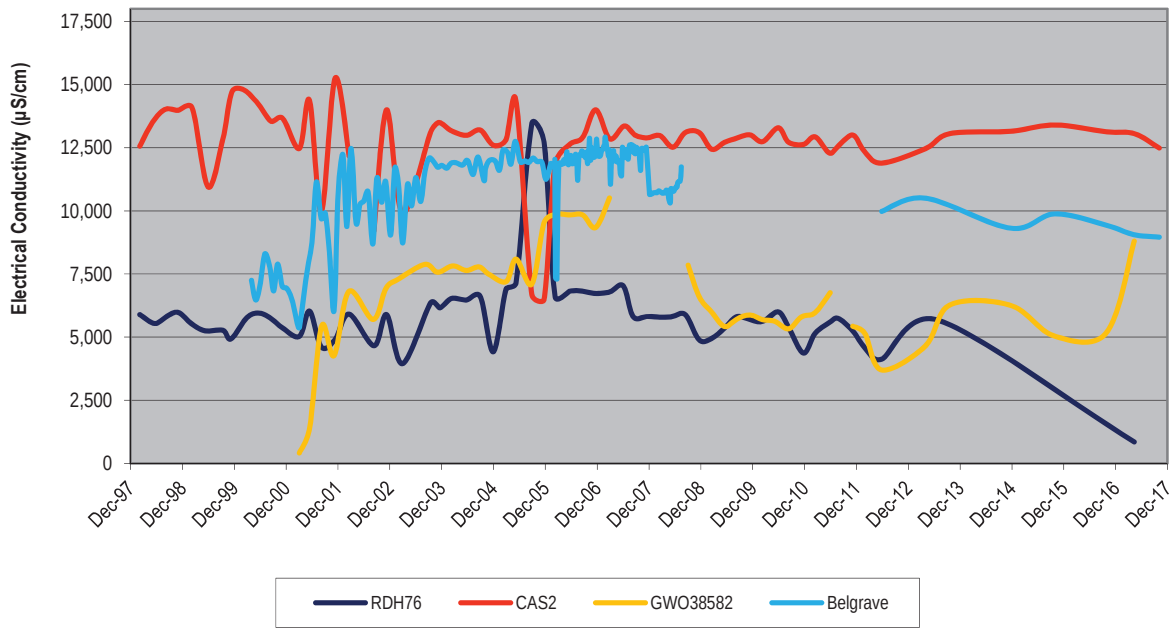


Table E-1 – Groundwater Monitoring Summary

Sample Location	Sample Date	Field EC (µS/cm)	Field pH	Depth to Ground (m)	Depth to Standpipe (m)
Hunter River Alluvium					
FRA1	05-May-17	563	7.3	10.32	10.68
FRA1	27-Nov-17	475	7.4	10.35	10.75
JOR1	09-May-17	2260	7.2	7.76	8.37
JOR1	27-Nov-17	2160	7.3	9.97	9.97
KAI1	05-May-17	499	7.2	10.79	11.35
KAI1	03-Nov-17	No Data	No Data	11.4	11.40
WAL2	09-May-17	1990	7.1	9.6	9.73
WAL2	27-Nov-17	2020	7.2	10.29	10.29
Dart Brook Alluvium					
ADN1	09-May-17	2760	7.0	7.26	7.88
ADN1	06-Nov-17	2700	7.1	6.12	7.12
DAN2	10-May-17	2280	6.9	5.11	5.26
DAN2	27-Nov-17	2130	7.3	5.74	5.74
WM1A	09-May-17	2830	7.1	6	6.54
WM1A	27-Nov-17	2790	7.5	7.6	8.20
Sandy Creek Alluvium					
BRO3	10-May-17	419	7.5	4.71	4.74
BRO3	27-Nov-17	1031	7.8	7.16	7.16
COR3	11-May-17	1900	8.1	3.02	3.40
COR3	27-Nov-17	*	*	*	*
GWO38412	11-May-17	1175	7.1	3.3	3.30
GWO38412	27-Nov-17	1610	7.8	5.47	5.47
WM3	10-May-17	3510	7.0	6.28	6.97
WM3	27-Nov-17	3130	6.8	7.1	8.10
Coal Seams					
DDH183	11-May-17	7160	7.1	27	27.52
DDH183	27-Nov-17	7020	6.8	28.2	28.70
DDH193	11-May-17	6180	6.9	41.74	42.65
DDH193	03-Nov-17	6120	6.8	42.4	43.30
DDH212a	11-May-17	3740	8.3	26.73	27.53
DDH212a	27-Nov-17	3790	8.4	27.5	38.00
Kayuga 1	11-May-17	7670	6.9	12.28	12.78
Kayuga 1	03-Nov-17	No Data	No Data	12	12.30
Regolith over Kayuga LW					
CAS2	11-May-17	13060	7.0	39.85	40.40
CAS2	03-Nov-17	12490	6.8	38.82	39.32
CAS4	11-May-17	11210	7.0	27.61	28.06
CAS4	03-Nov-17	10160	6.7	18.85	19.45
JLON1	05-May-17	No Data	No Data	No Data	No Data
JLON1	03-Nov-17	No Data	No Data	No Data	No Data
TLON1	11-May-17	3360	7.3	6.16	6.41
TLON1	27-Nov-17	*	*	*	*

Sample Location	Sample Date	Field EC (µS/cm)	Field pH	Depth to Ground (m)	Depth to Standpipe (m)
Rejects Emplacement Area					
RDH508	04-May-17	8030	6.8	9.89	10.44
RDH508	06-Nov-17	7200	7.0	10.56	11.26
RDH508a	05-May-17	7720	7.2	17.62	18.10
RDH508a	06-Nov-17	7390	7.0	18.05	18.65
RDH509	04-May-17	6030	7.2	10.32	10.57
RDH509	06-Nov-17	4340	7.1	10.69	10.71
RDH509a	04-May-17	No Data	No Data	No Data	15.05
RDH509a	06-Nov-17	No Data	No Data	15.1	15.30
RDH510	04-May-17	8800	6.9	9.21	9.72
RDH510	06-Nov-17	8850	6.8	10.5	10.90
RDH510a	04-May-17	9260	7.1	9.22	9.62
RDH510a	06-Nov-17	9050	7.0	10.39	10.69
RDH511	04-May-17	7000	7.2	8.33	8.33
RDH511	06-Nov-17	5220	7.6	8.4	8.40
RDH511a	04-May-17	7010	7.2	8.33	8.33
RDH511a	06-Nov-17	6610	7.2	8.4	8.40
Property Subsidence Management Plans					
Belgrave	05-May-17	9060	7.5	7.45	7.45
Belgrave	03-Nov-17	8960	7.6	7.86	7.86
GWO38582	11-May-17	8800	8.2	4.91	5.25
GWO38582	03-Nov-17	No Data	No Data	5.95	28.55
Other Monitoring Bores					
Athlone	11-May-17	10880	7.1	6.44	6.78
Athlone	03-Nov-17	10690	7.2	7.17	7.17
Bel1	05-May-17	3950	7.2	3.17	3.17
Bel1	03-Nov-17	9200	7.2	3.5	3.90
CAD2	10-May-17	4820	7.2	11.9	12.14
CAD2	27-Nov-17	*	*	*	*
DDH124	10-May-17	No Data	No Data	No Data	14.64
DDH124	27-Nov-17	No Data	No Data	14.7	15.20
DDH212b	11-May-17	3740	8.3	26.73	27.43
DDH212b	27-Nov-17	3750	8.3	27.5	28.00
DDH212c	11-May-17	3750	8.3	26.72	27.33
DDH212c	27-Nov-17	3711	8.3	27.4	27.80

** Dry or unable to be monitored in 2017*
No Data: Parameter not monitored

Table E-2 – Statistical Analysis of Groundwater Quality Monitoring Data

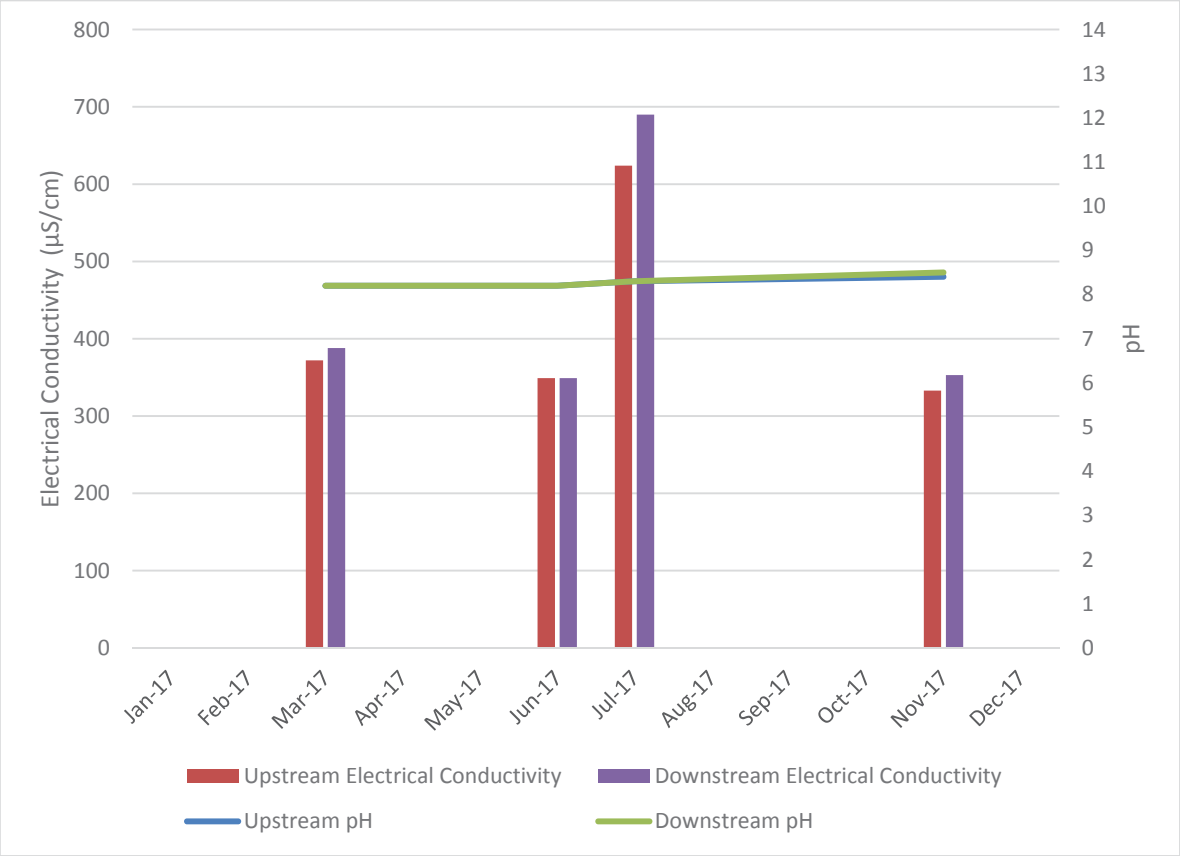
Sample Location	Parameter	Minimum	Mean	Maximum	Variance
Hunter River Alluvium					
JOR1	pH	7.2	7.25	7.3	0.1
JOR1	EC (µg/cm)	2160.0	2210.0	2260.0	100
WAL2	pH	7.1	7.15	7.2	0.1
WAL2	EC (µg/cm)	1990.0	2005.0	2020.0	30
KAI1**	pH	7.2	7.2	7.2	0
KAI1**	EC (µg/cm)	499.0	499.0	499.0	0
FRA1	pH	7.3	7.35	7.4	0.1
FRA1	EC (µg/cm)	475.0	519.0	563.0	88
Dart Brook Alluvium					
DAN2	pH	6.9	7.1	7.3	0.4
DAN2	EC (µg/cm)	2130.0	2205.0	2280.0	150
WM1A	pH	7.1	7.3	7.5	0.4
WM1A	EC (µg/cm)	2790.0	2810.0	2830.0	40
ADN1	pH	7.0	7.05	7.1	0.1
ADN1	EC (µg/cm)	2700.0	2730.0	2760.0	60
Sandy Creek					
GWO38412	pH	7.1	7.5	7.8	0.7
GWO38412	EC (µg/cm)	1175.0	1392.5	1610.0	435
BRO3	pH	7.5	7.7	7.8	0.3
BRO3	EC (µg/cm)	419.0	725.0	1031.0	612
COR3**	pH	8.1	8.1	8.1	0
COR3**	EC (µg/cm)	1900.0	1900.0	1900.0	0
WM3	pH	6.8	6.9	7.0	0.2
WM3	EC (µg/cm)	3130.0	3320.0	3510.0	380
Coal Seams					
DDH183	pH	6.8	7.0	7.1	0.3
DDH183	EC (µg/cm)	7020.0	7090.0	7160.0	140
DDH193	pH	6.8	6.85	6.9	0.1
DDH193	EC (µg/cm)	6120.0	6150.0	6180.0	60
Kayuga 1**	pH	6.9	6.9	6.9	0
Kayuga 1**	EC (µg/cm)	7670.0	7670.0	7670.0	0
DDH212(a)	pH	8.3	8.35	8.4	0.1
DDH212(a)	EC (µg/cm)	3740.0	3765.0	3790.0	50
Regolith					
CAS2	pH	6.8	6.9	7.0	0.2
CAS2	EC (µg/cm)	12490.0	12775.0	13060.0	570
CAS4	pH	6.7	6.9	7.0	0.3
CAS4	EC (µg/cm)	10160.0	10685.0	11210.0	1,050
TLON1*	pH	7.3	7.3	7.3	0
TLON1*	EC (µg/cm)	3360.0	3360.0	3360.0	0
Rejects Emplacement Area					
RDH508	pH	6.8	6.9	7.0	0.2
RDH508	EC (µg/cm)	7200.0	7615.0	8030.0	830
RDH508(a)	pH	7.0	7.1	7.2	0.2

Sample Location	Parameter	Minimum	Mean	Maximum	Variance
RDH508(a)	EC (µg/cm)	7390.0	7555.0	7720.0	330
RDH509	pH	7.1	7.15	7.2	0.1
RDH509	EC (µg/cm)	4340.0	5185.0	6030.0	1,690
RDH510	pH	6.8	6.85	6.9	0.1
RDH510	EC (µg/cm)	8800.0	8825.0	8850.0	50
RDH510a	pH	7.0	7.05	7.1	0.1
RDH510a	EC (µg/cm)	9050.0	9155.0	9260.0	210
RDH511	pH	7.2	7.4	7.6	0.4
RDH511	EC (µg/cm)	5220.0	6110.0	7000.0	1,780
RDH511a	pH	7.2	7.2	7.2	0
RDH511a	EC (µg/cm)	6610.0	6810.0	7010.0	400
Property Subsidence Management Plans					
GWO38582**	pH	8.2	8.2	8.2	0
GWO38582**	EC (µg/cm)	8800.0	8800.0	8800.0	0
Belgrave	pH	7.5	7.55	7.6	0.1
Belgrave	EC (µg/cm)	8960.0	9010.0	9060.0	100
Other Bore Holes					
Athlone	pH	7.1	7.15	7.2	0.1
Athlone	EC (µg/cm)	10690.0	10785.0	10880.0	190
Bel 1	pH	7.2	7.2	7.2	0
Bel 1	EC (µg/cm)	3950.0	6575.0	9200.0	5,250
CAD2**	pH	7.2	7.2	7.2	0
CAD2**	EC (µg/cm)	4820.0	4820.0	4820.0	0
DDH124	pH	*	*	*	*
DDH124	EC (µg/cm)	*	*	*	*
DDH212b	pH	8.3	8.3	8.3	0
DDH212b	EC (µg/cm)	3740.0	3745.0	3750.0	10
DDH212c	pH	8.3	8.3	8.3	0
DDH212c	EC (µg/cm)	3711.0	3730.5	3750.0	39

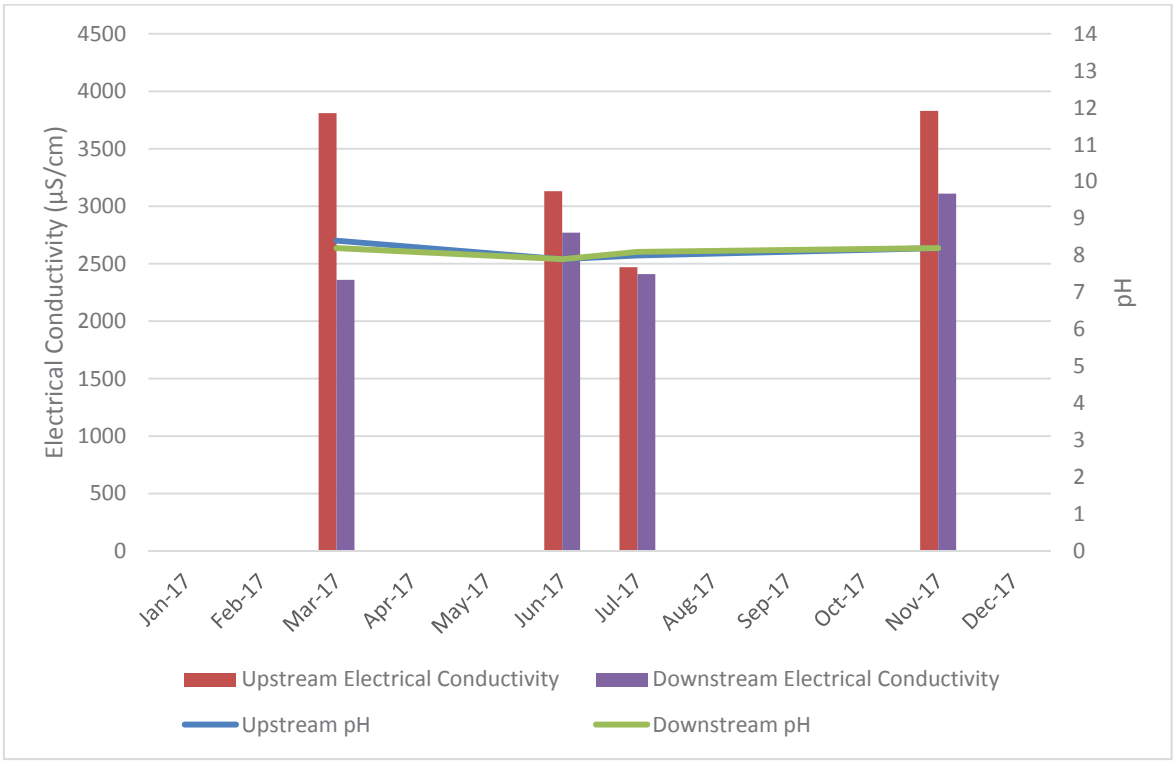
** Dry or unable to be monitored in 2017*
*** One record available*
Note: Standard Deviation Calculations not undertaken due to reduced number of samples collected during the reporting period

APPENDIX F

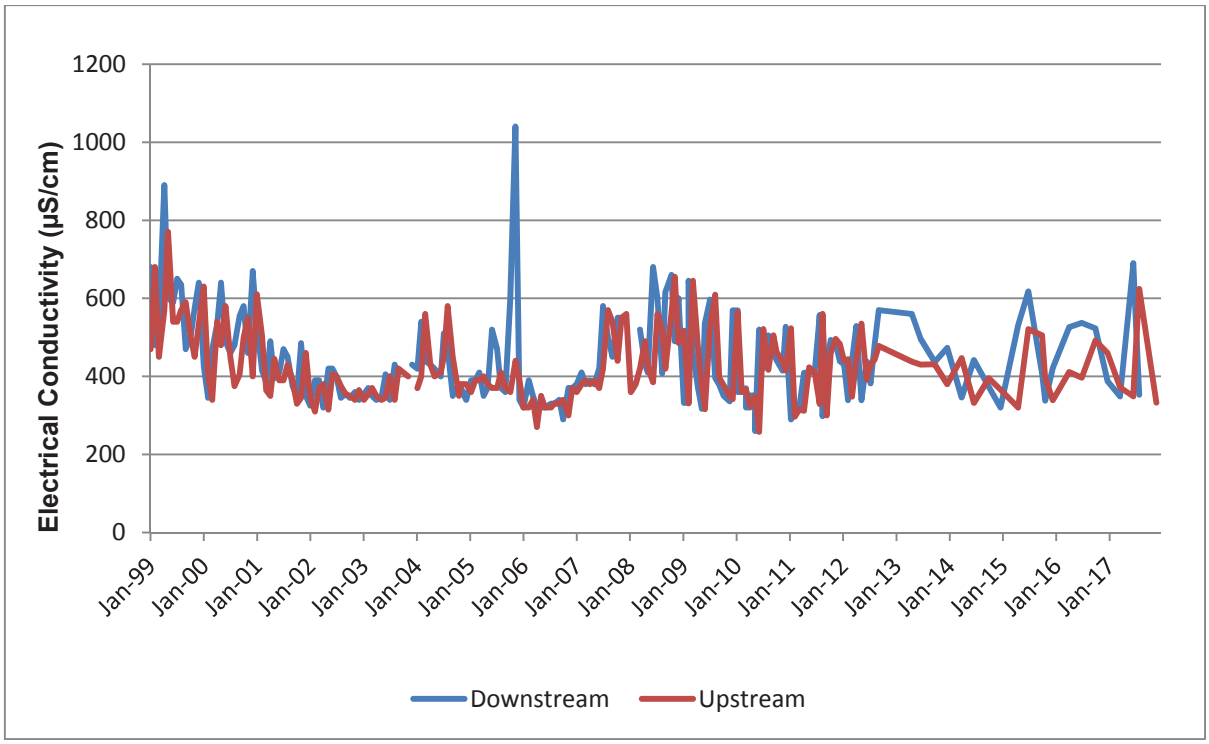
Surface Water Monitoring Summary



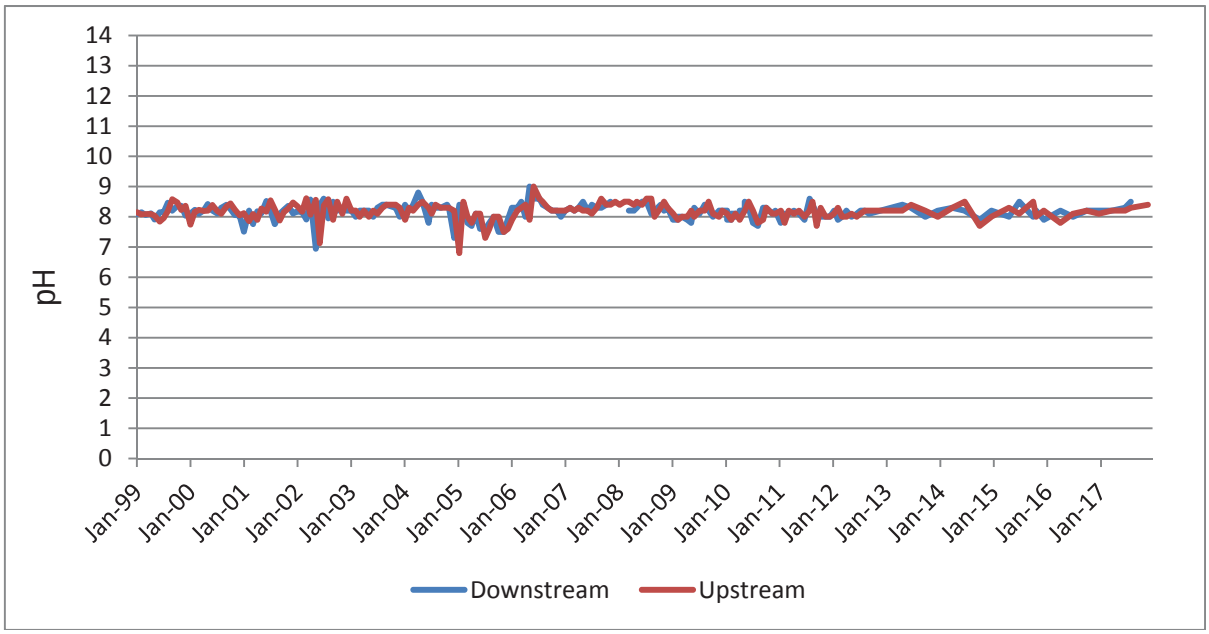
Graph F-1
Quarterly Hunter River EC and pH Results



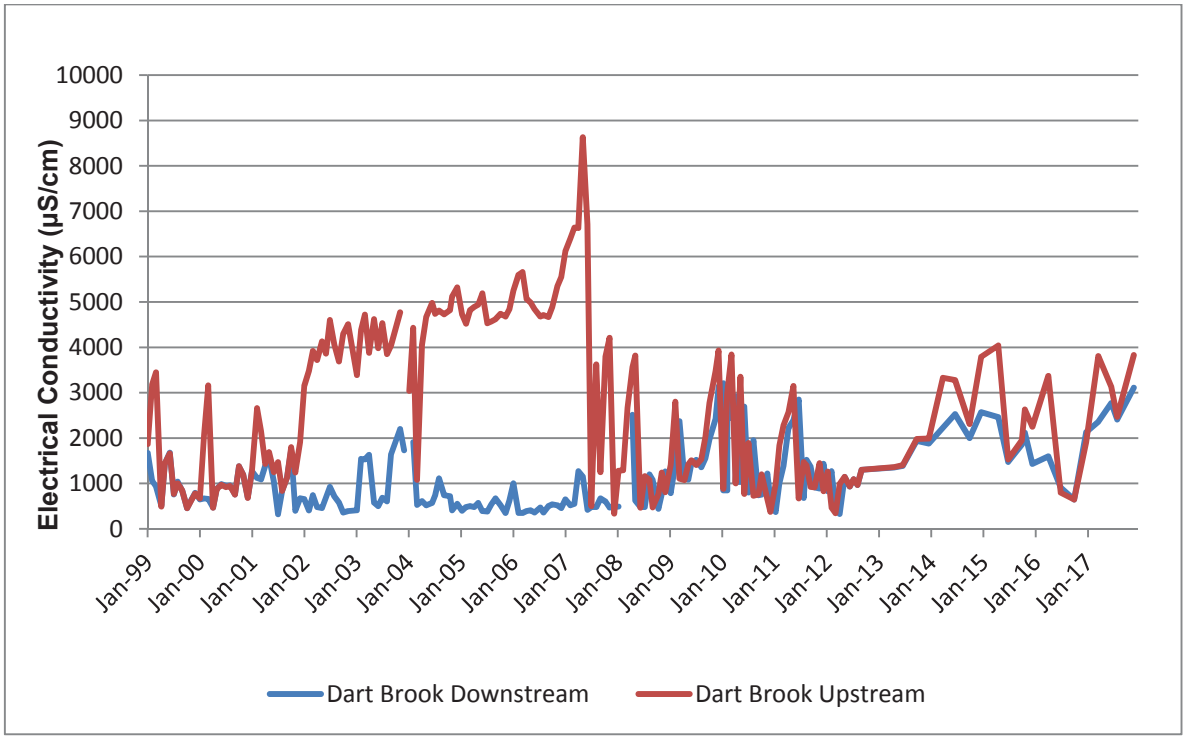
Graph F-2
Quarterly Dart Brook EC and pH Results



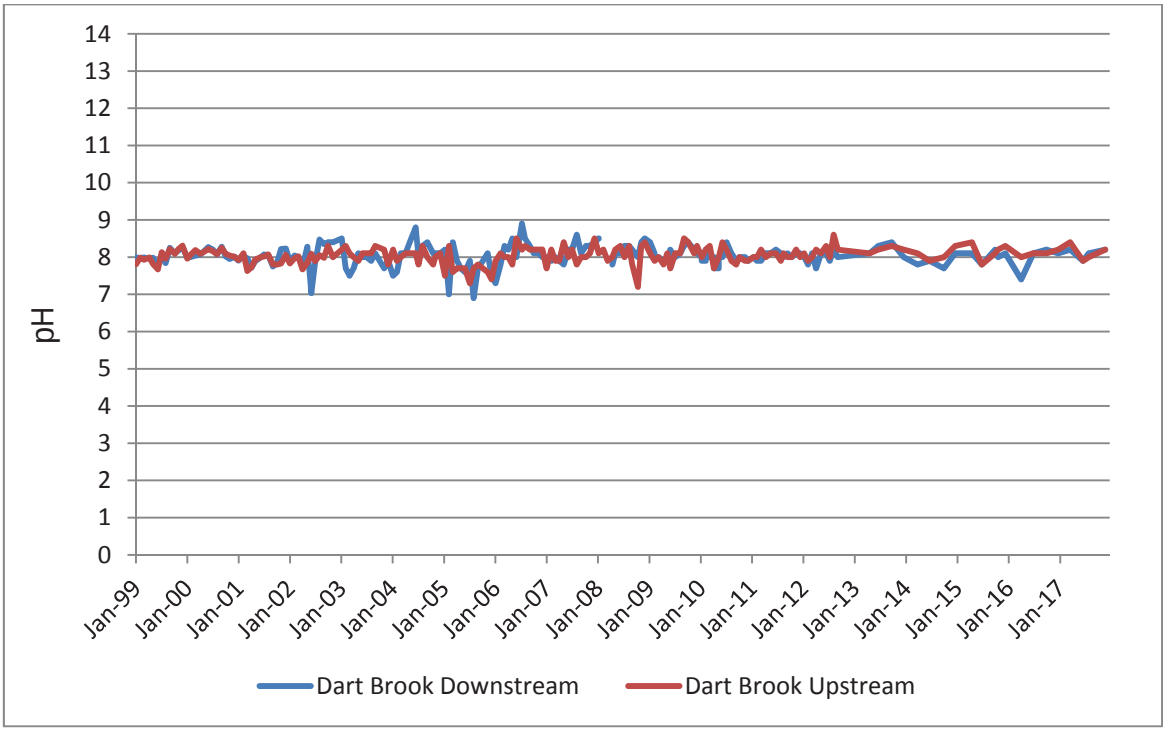
Graph F-3
Hunter River Long Term EC (1999-2017) Hunter River EC and pH Results



Graph F-4
Hunter River Long Term pH (1999-2017)



Graph F-5
Dart Brook Long Term EC (1999-2017)



Graph F-6
Dart Brook Long Term pH (1999-2017)

Table F-1 Annual Surface Water Monitoring Results (20 November 2017)

	Alkalinity - Bicarbonate mg CaCO3/L	Alkalinity - Carbonate mg CaCO3/L	Alkalinity - Hydroxide mg CaCO3/L	Biochemical Oxygen Demand mg/O2/L	Calcium - total mg/L	Chloride mg/L	Electrical Conductivity µS/cm - field	Faecal Coliforms cols/100mL	Magnesium - total mg/L	MBAS mg/L	Nitrates mg N/L	pH - field	Phosphorus - reactive mg/L	Potassium - total mg/L	Sodium - total mg/L	Sulfates mg/L	Total Dissolved Solids - calculation mg/L	Total Suspended Solids @105C mg/L
Dartbrook Downstream	**578**	<1	<1	N/A	N/A	**697**	N/A	73	N/A	N/A	<0.01	8.2	0.21	3	**359**	**101**	**2080**	24
Dartbrook Upstream	634	<1	<1	N/A	N/A	673	N/A	<9	N/A	N/A	<0.01	8.2	0.15	3	**503**	**83**	**2570**	19
E2	**6470**	**20100**	N/A	N/A	13	809	**43500**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Eastern Holding Dam	429	103	N/A	N/A	4	104	1284	N/A	**20**	<0.1	N/A	9.2	0.02	5	315	24	860	13
Hunter Downstream	146	<1	<1	N/A	N/A	18	N/A	170	N/A	N/A	0.02	**8.5**	<0.01	1	22	14	240	17
Hunter Upstream	141	<1	<1	N/A	N/A	16	N/A	160	N/A	N/A	**0.70**	8.4	<0.01	1	21	14.	220	14
REA	Dry	Dry	N/A	N/A	Dry	Dry	Dry	N/A	Dry	N/A	N/A	Dry	N/A	Dry	Dry	Dry	Dry	Dry
REA Stg 4 Dam	Dry	Dry	N/A	N/A	Dry	Dry	Dry	N/A	Dry	N/A	N/A	Dry	N/A	Dry	Dry	Dry	Dry	Dry
Staged Discharge Dam	2690	**3610**	N/A	*	*	**988**	**12700**	N/A	N/A	<0.1	N/A	9.5	<0.01	**40**	**3800**	<1	**8510**	10
Sewage Treatment Plant	*	*	N/A	28	*	*	**3630**	N/A	N/A	N/A	N/A	9.5	N/A	N/A	N/A	N/A	**2430**	N/A
Western Holding Dam	766	**726**	N/A	N/A	*	290	3370	N/A	10	<0.1	N/A	9.6	0.15	8	845	16	2260	48
WSD	Dry	Dry	N/A	N/A	Dry	Dry	Dry	N/A	Dry	N/A	N/A	Dry	N/A	Dry	Dry	Dry	Dry	Dry
Evaporation Tailing Dam	N/A	N/A	N/A	N/A	N/A	N/A	**2390**	N/A	3	N/A	N/A	9.2	N/A	N/A	N/A	N/A	N/A	N/A

N/A: Monitoring parameter not required
**Monitoring for parameter not undertaken in 2017*
Bold: Monitoring result exceeded SWMP Trigger Level

APPENDIX G

Water Balance Schematic

Water Balance Schematic