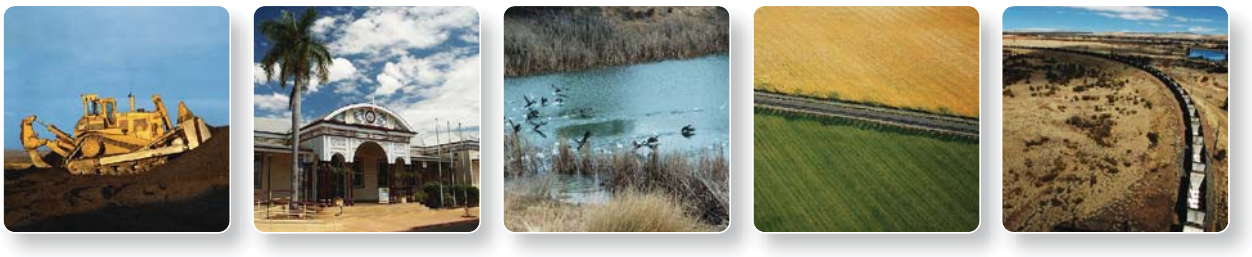


DARTBROOK MINE

ANNUAL REVIEW 2019

for

AQC DARTBROOK MANAGEMENT PTY LIMITED

March 2020

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

DARTBROOK MINE

ANNUAL REVIEW 2019

Prepared by:

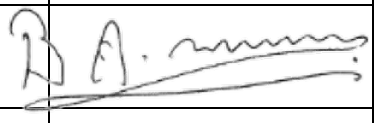
HANSEN BAILEY
127-129 John Street
SINGLETON NSW 2330

March 2020

For:

AQC DARTBROOK MANAGEMENT PTY LIMITED
PO Box 517
MUSWELLBROOK NSW 2333

Annual Review Title Block

Name of operation	Dartbrook Mine
Name of operator	AQC Dartbrook Management Pty Limited
Development consent	DA 231-07-2000
Name of holder of development consent	Dartbrook Coal Pty Limited
Mining Leases	CL 386, MLs 1497, 1381, 1456
Name of holder of mining leases	AQC Dartbrook Pty Ltd
Water licences	See **Table 22**
Name of holder of water licences	AQC Dartbrook Pty Ltd, AQC Dartbrook Management Pty Limited
MOP start date	1 January 2018
MOP end date	31 December 2020
Annual Review start date	1 January 2019
Annual Review end date	31 December 2019
I, Bruce Munro, certify that this audit report is a true and accurate record of the compliance status of AQC Dartbrook Management Pty Limited for the period (CY2019) and that I am authorised to make this statement on behalf of AQC Dartbrook Management Pty Limited. *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	Bruce Munro
Title of authorised reporting officer	CEO
Signature of authorised reporting officer	
Date	30 March 2020

Annual Review Distribution

Distribution List
NSW Department of Planning, Industry and Environment (DPIE)
NSW Department of Planning, Industry and Environment – Resources Regulator (DPIE-RR)
Muswellbrook Shire Council (MSC)
Upper Hunter Shire Council (UHSC)
Dartbrook Community Consultative Committee (CCC) Members

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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 period 1 January – 31 December 2019 (the reporting period).

The compliance status of Dartbrook against relevant approvals is summarised in **Table 1**, with a summary on non-compliances provided in **Table 2**.

The air quality non-compliances identified in **Table 2** relate to exceedances of deposition dust, 24-hour PM_{10} and Annual Average PM_{10} criteria from DA 231-07-2000 recorded during the reporting period. A review of these results has confirmed that the exceedances monitored were not related to any minor Care and Maintenance activities conducted from time to time Dartbrook Mine.

The surface and groundwater non-compliances in **Table 2** relate to the exceedance of historic monitoring trigger levels included in the Site Water Management Plan (SWMP) required under DA 231-07-2000. A review of the monitoring results has confirmed that neither historic or current Care and Maintenance activities are causing unacceptable impacts to surface or groundwater bodies. The Care and Maintenance SWMP and associated surface and groundwater trigger levels were reviewed and updated during the reporting period following the determination of DA 231-07-2000 (MOD7). The revised SWMP has been provided to regulatory agencies for review and comment (see **Section 7.2.3** and **Section 7.3.3**).

Table 1
Statement of Compliance

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

Table 2
Summary of Non-compliances

Approval	Approval Condition	Compliance Status	Comment	Where addressed in Annual Review
DA 231-07-2000	6.1	Non-compliant	Exceedances of DA 231-07-2000 (MOD7) air quality criteria for Annual Average PM_{10}.	**6.3.2**
DA 231-07-2000	6.1	Non-compliant	Exceedances of DA 231-07-2000 (MOD7) air quality criteria for 24-hour PM_{10} in February, October, November and December 2019 (all HVAS sites).	**6.3.2**
DA 231-07-2000	6.1	Non-compliant	Exceedances of DA 231-07-2000 air quality criteria for deposition dust (annual) at site 885.	**6.3.2**
DA 231-07-2000	4.1(a)	Non-compliant	Groundwater and surface water monitoring results in exceedance of trigger levels identified in the currently approved SWMP.	**Section 7.2.3** and **Section 7.3.3**

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 is owned and managed by AQC Dartbrook Management Pty Limited (AQC). Dartbrook is located 10 kilometres (km) north-west 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 operated as an underground longwall coal mine.

Former owners of the mine elected to suspend mining 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 is located west of the New England Highway and comprises the administration office, a small workshop, and Wynn and Kayuga mine entrances to the underground mine (see **Figure 3**); and
- The Eastern Facilities (East Site), which is located east of the New England Highway and comprises the Coal Handling and Preparation Plant (CHPP), rail load out facilities, cleared coal stockpiles and the rehabilitated Reject Emplacement Area (REA) (see **Figure 4**).

2.2 PURPOSE

This Annual Review summarises the environmental performance of Dartbrook Mine for the reporting period and has been prepared to meet the requirements of Condition 9.2 of DA 231-07-2000 (as modified) and Condition 3(f) of Coal Lease (CL) 386 and Mining Lease (ML) 1381, ML 1456 and ML 1497.

It has also been prepared generally in accordance with its approvals including:

- DA 231-01-2000;
- ML and Exploration Licence (EL) conditions;
- Environment Protection Licence (EPL) 4885; and
- Continuation of Care and Maintenance Mining Operations Plan (MOP) 2018-2020.

A summary of where the relevant requirements from DA 231-7-2000 and Dartbrook mining authorities has been addressed in this document is provided in **Table 3**. **Figure 5** shows the location of mining authorities held at Dartbrook.

Table 3
Development Consent and Mining Lease requirements for Annual Review

Document	Where Addressed
DA 231-07-2000, Condition 9.2 Environmental Reporting	
Annual Review (a) By the end of March in each year after the commencement of the development, or other timeframe agreed by the Secretary, a report must be submitted to the Department reviewing the environmental performance of the development, to the satisfaction of the Secretary. This review must:	**This document**
(i) describe the development (including any rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;	**This document**
(ii) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, including a comparison of these results against the: • relevant statutory requirements, limits or performance measures/criteria; • requirements of any plan or program required under this consent; • monitoring results of previous years; and • relevant predictions in the documents referred to in Condition 1.1(a);	**Sections 1**, **6 - 11**
(iii) identify any non-compliance or incident which occurred in the previous calendar year, and describe what actions were (or are being) taken to rectify the non-compliance or incident and avoid reoccurrence;	**Sections 1**, **6 - 11** **Appendix B - F**
(iv) evaluate and report on: • the effectiveness of the noise, air quality and greenhouse gas management systems; - socio-economic impact of the development including the workforce characteristics of the previous calendar year; and - the surveillance of any prescribed dam on the site to the satisfaction of the DSC; • the outcome of the water budget for the year, the quantity of water used from water storages and details of discharge of any water from the site; and • compliance with the performance measures, criteria and operating conditions in this consent;	**Sections 6 - 9** **Appendix B - F**
(v) identify any trends in the monitoring data over the life of the development;	**Sections 1**, **6 - 9**
(vi) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and	**Sections 6 - 9**
(vii) describe what measures will be implemented over the next calendar year to improve the environmental performance of the development.	**Section 6**, **7** and **12**

Document	Where Addressed
(b) Copies of the Annual Review must be submitted to the Department, MSC, UHSC and made available to the CCC and any interested person upon request.	**Section 9**
Mining Lease 1381, 1456 and 1497, Condition 3 Mining Operations Plan and Annual Rehabilitation Report	
(f) The lease holder must prepare a Rehabilitation Report to the satisfaction of the Minister. The report must:	
(i) provide a detailed review of the progress of rehabilitation against the performance measures and criteria established in the approved MOP;	**Section 8**
(ii) be submitted annually on the grant anniversary date (or at such other times as agreed by the Minister); and	**This document**
(iii) be prepared in accordance with any relevant annual reporting guidelines published on the Department's website at www.resourcesandenergy.nsw.gov.au/miners-and-explorers/rules-and-forms/pgf/environmental-guidelines.	**This document**

Note: The Rehabilitation Report replaces the Annual Environmental Management Report.

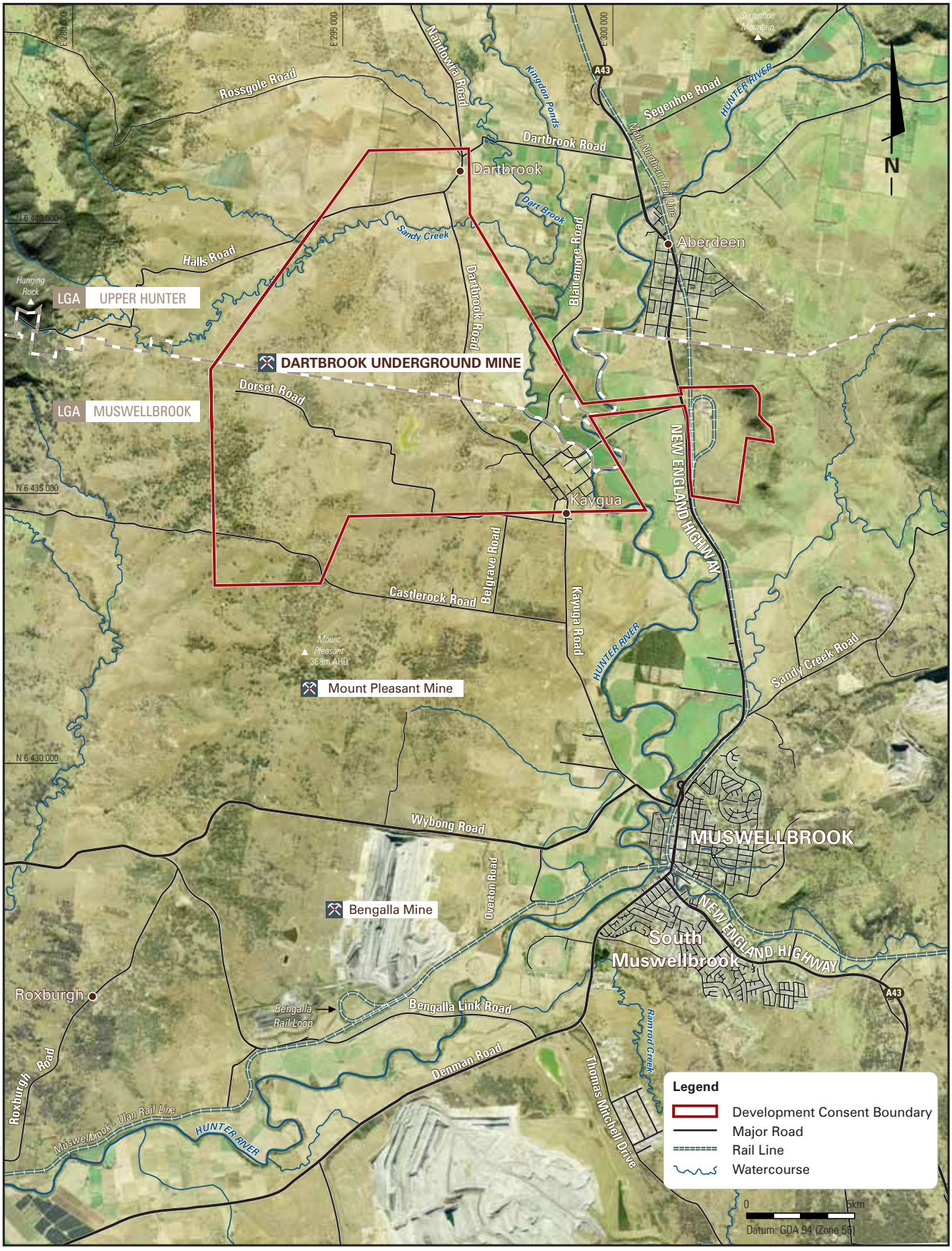
2.3 PERFORMANCE SUMMARY

No coal mining or coal processing activities were undertaken at Dartbrook Mine during the reporting period. The specific aspects of Dartbrook Mine environmental performance for the reporting period are described further in **Section 6** to **Section 8**.

In February 2018, AQC lodged an application to modify DA 231-7-2000 (MOD7) to provide further operational options for Dartbrook (in addition to those already approved) to recommence mining via limited bord and pillar underground mining within the Kayuga Seam and to extend the approval period under DA 231-7-2000 by 5 years (to 5 December 2027).

DA 231-07-2000 (MOD7) was determined by the NSW Independent Planning Commission (IPCN) on 9 August 2019. The IPCN approved the proposed recommencement of mining activities but rejected the proposed five-year extension to the consent approval period. Without the extension to operate under DA 231-7-2000 for a further five years it is impractical to recommence mining at Dartbrook. In November 2019, AQC announced its decision to lodge an appeal against the IPCN determination in the NSW Land and Environment Court. An update on this process will be provided in the next Annual Review.

Other consultation with neighbours and community stakeholders continued during 2019 as discussed in **Section 9**. The Dartbrook Mine Community Consultative Committee (CCC) continued to meet throughout the year, with meetings held in February, May, August and November 2019. As noted in **Section 9.1**, two environmental complaints were received during reporting period. Both complaints were investigated and confirmed to not be related to ongoing Care and Maintenance activities at Dartbrook Mine.



HB DARTBROOK Underground 2019 Annual Review HB1986 F1 Site Locality 25 02 2020

DARTBROOK MINE

Site Locality

FIGURE 1

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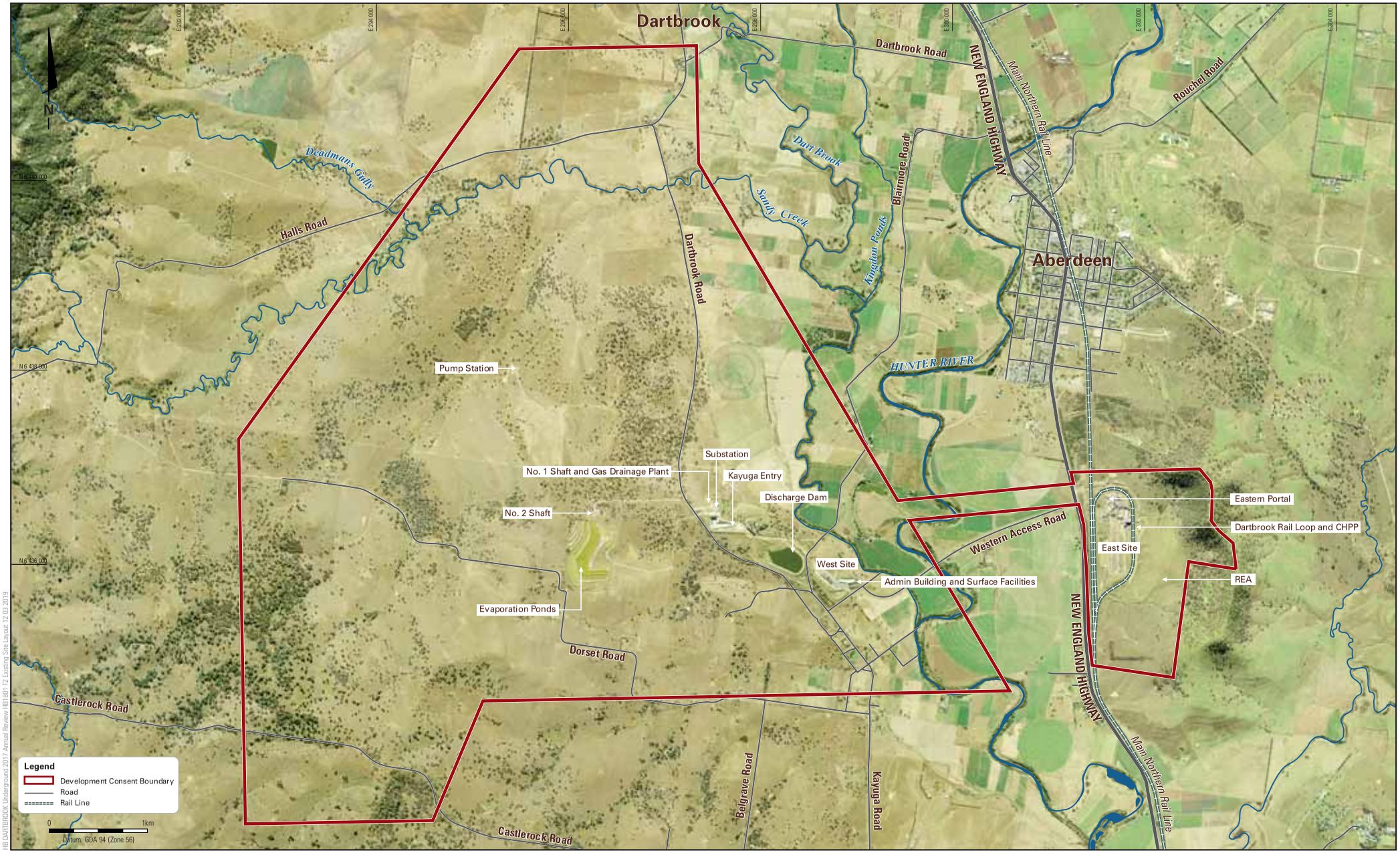
Australian Pacific Coal



HB DARTBROOK Underground 2017 Annual Review HB1801 F2 Existing Site Layout 12 03 2019

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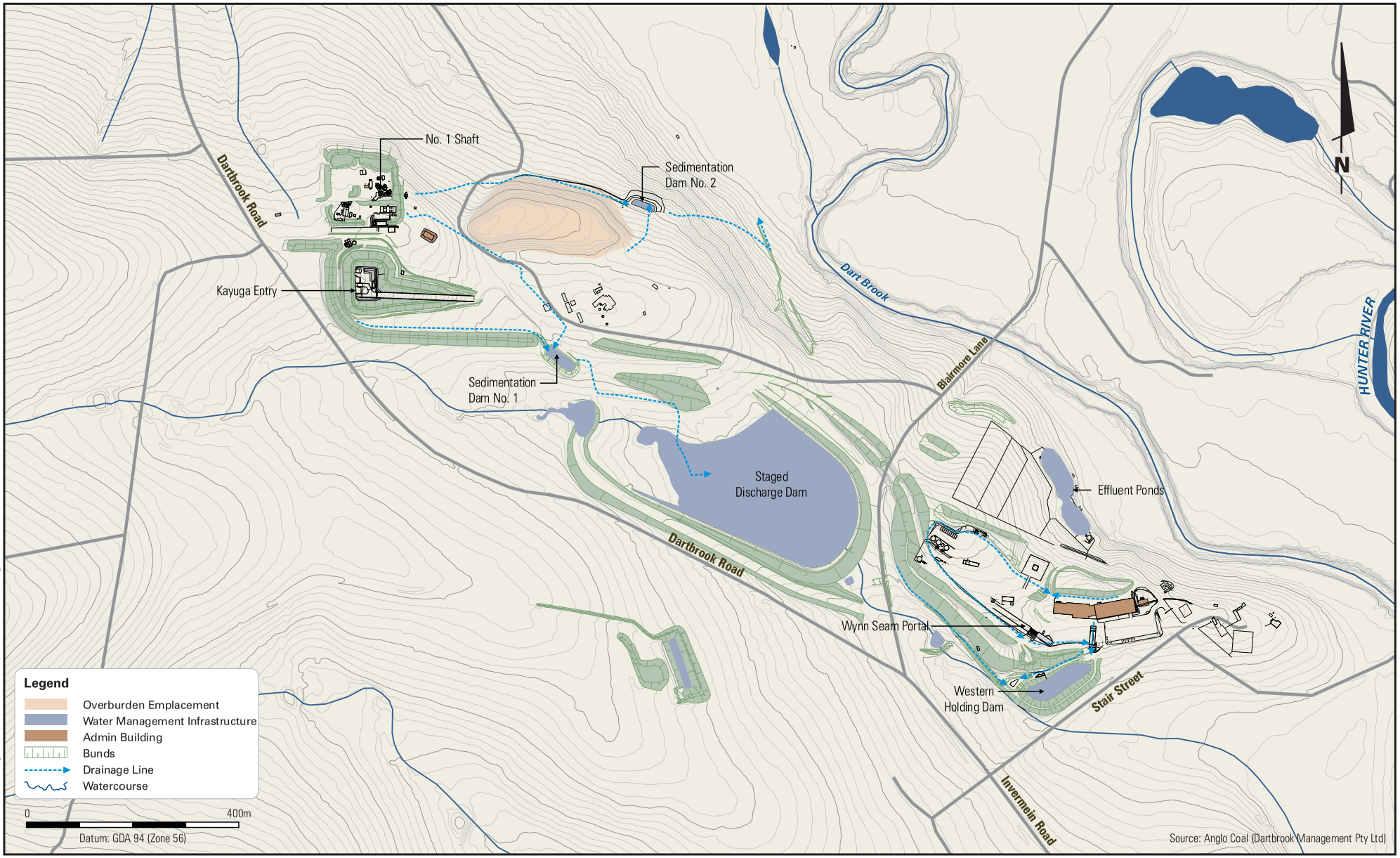
Australian Pacific Coal

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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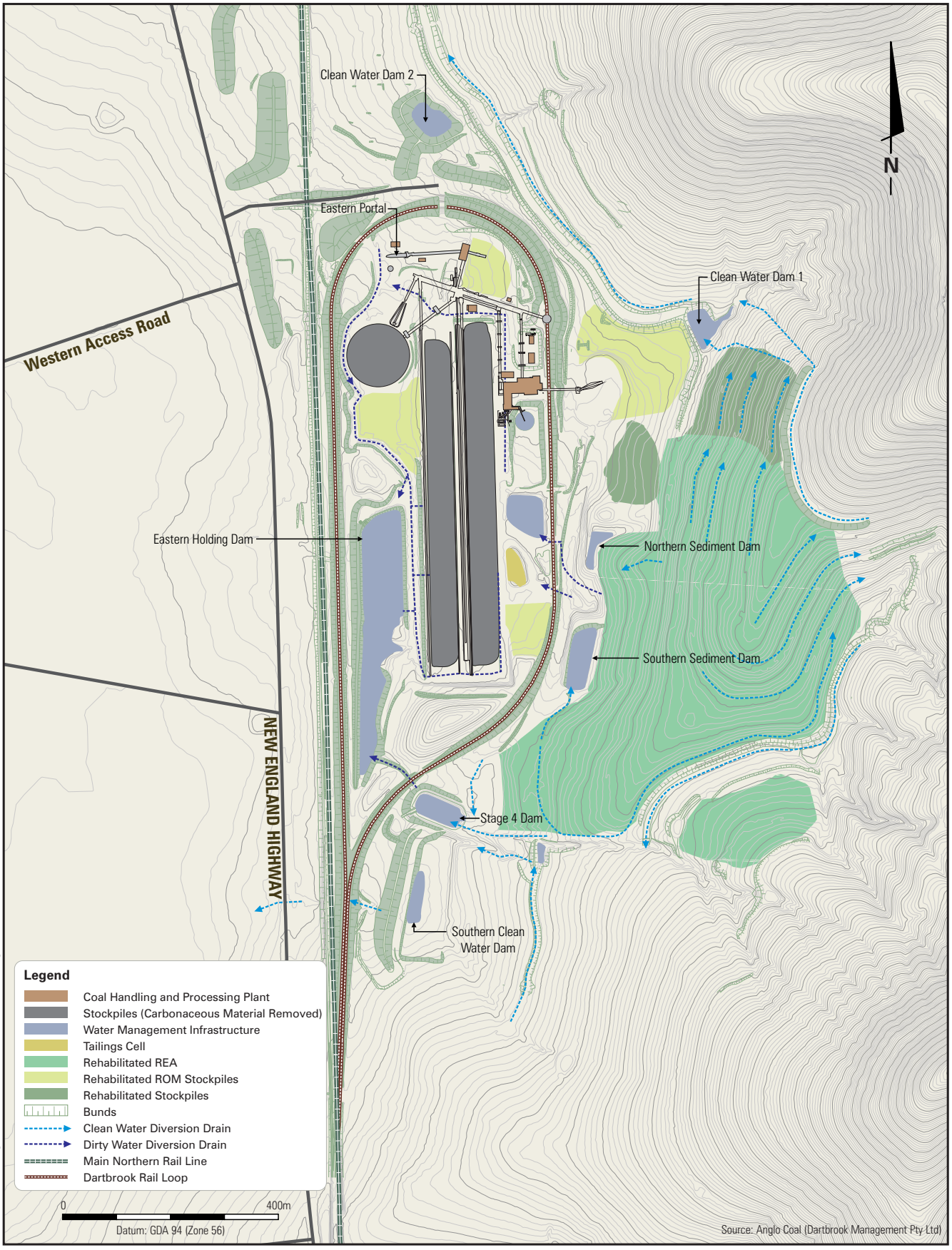
Australian Pacific Coal



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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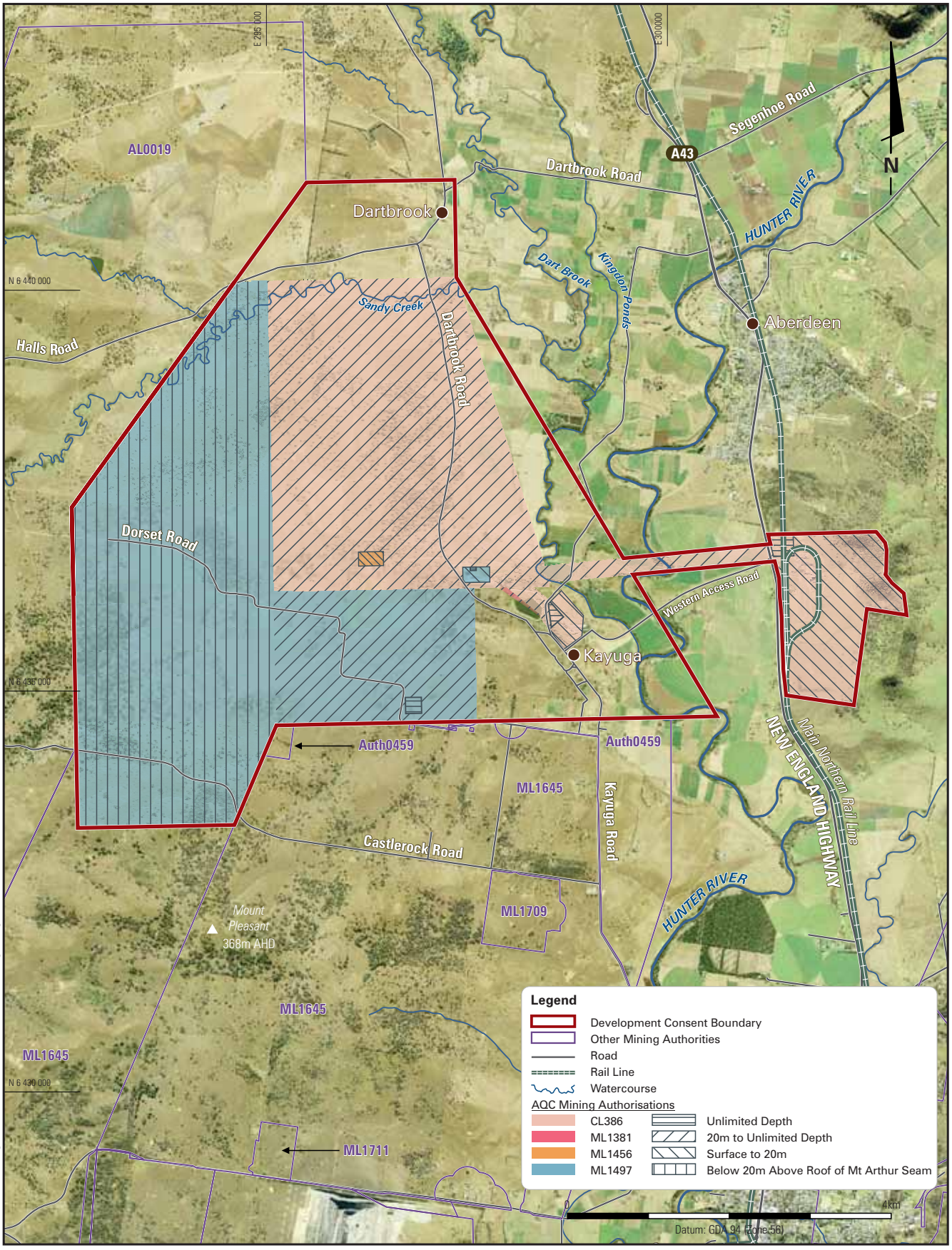
FIGURE 4



HB DARTBROOK Underground 2019 Annual Review HB1986 F5 Existing Mining Leases 25 02 2020

DARTBROOK MINE

Existing Mining Leases

FIGURE 5

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Australian Pacific Coal

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

2.4 DARTBROOK MINE CONTACTS

AQC has a team of environmental personnel that provide advice relating to environmental standards and procedures at Dartbrook Mine. The relevant contacts for environmental management at Dartbrook Mine are outlined in **Table 4**.

Table 4
Dartbrook Mine Contacts

Australian Pacific Coal Contacts	
CEO	Bruce Munro
CFO & Company Secretary	Craig McPherson
Environmental Officer (under secondment from Hansen Bailey)	Dorian Walsh
Statutory Mine Manager (Terrequip)	John Swan
Site Contact Details	
Dartbrook Mine Address	Dartbrook Mine Stair St, Kayuga NSW 2333
Dartbrook Postal Address	AQC Dartbrook Management Pty Limited PO Box 517, Muswellbrook NSW 2333
Phone Number	02 6540 8875
Facsimile Number	02 6541 1935
Dartbrook Care and Maintenance Contractor Phone Number	02 6540 8950
Dartbrook 24-hour Environment & Community Hotline	1300 131 058

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 Development Consent, Leases & Licences summarised in **Table 5**. A summary of minor amendments to DA-231-07-2000 that apply while Dartbrook Mine is on Care and Maintenance is provided in **Appendix A**.

The current MOP covers the period of ongoing Care and Maintenance activities from 1 January 2018 to 31 December 2020.

3.2 STATUS OF MANAGEMENT PLANS

Dartbrook Mine is required to develop and implement several Management Plans under DA 231-07-2000. **Table 6** outlines the environmental management plans utilised onsite and the approval date for each.

Table 5
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 02/04/2015	DPIE-RR
Coal Lease (CL) 386	19/12/1991	19/12/2033	Due 19/12/2032	DPIE-RR
Mining Lease (ML) 1381	23/10/1995	23/10/2016*	Lodged 23/10/2015	DPIE-RR
ML 1456	27/09/1999	26/09/2020*	Lodged 19/09/2019	DPIE-RR
ML 1497	06/12/2001	05/12/2022	Due 5/12/2021	DPIE-RR
Exploration Licence (EL) 4574	13/08/1993	07/04/2015*	Lodged 7/04/2015	DPIE-RR
EL 4575	13/08/1993	23/05/2016*	Lodged 23/05/2016	DPIE-RR
EL 5525	22/09/1998	21/09/2016*	Lodged 29/09/2016	DPIE-RR
Development Consent				
DA 231-07-2000 (as modified)	28/08/2001	05/12/2022	Active	DPIE

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	DPIE
Stage 4 Reject Emplacement Approval C95/2265 (s126 approval)	02/01/2000	N/A	Active	DPIE
Approval for 14° slopes in the REA Stage 4 (s126 approval)	18/12/2003	N/A	Active	DPIE
Application for Discontinuance of Use of Emplacement Areas (s101 approval)	13/08/2007	Ongoing	Active	DPIE
Licences				
Environmental Protection Licence 4885	Granted 30/11/2000	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	14/08/2020	Active	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	31/08/2018*	Lodged 31/08/2018	DPIE-RR
MOP for Care and Maintenance – Extension	18/12/2017	31/12/2020	Active	DPIE-RR

*Note: * Application lodged with DPIE-RR*

Table 6
Dartbrook Mine Underground Management Plans and Strategies

Management Plan/Program	Approval Date
Environmental Management Strategy	15/04/2002
Archaeology and Cultural Management Plan	09/12/2002
Blast Management Plan*	09/12/2002
Bushfire Management Plan	19/05/2011
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	02/11/2011
Land Management Plan	27/01/2002
Landowner Communication and Consultation Plan	09/12/2002
Landscape and Lighting Management Plan	02/11/2011
Longwall Subsidence Management Plan(s)*	22/13/2003
Noise Management Plan*	08/11/2007
Property Subsidence Management Plans*	22/12/2003
Site Water Management Plan (SWMP)	15/09/2015
Soil Stripping Management Plan*	31/05/2005
Spontaneous Combustion Management Plan	1/11/2016
Waste Management Plan	09/12/2002
Vibration Management Plan*	09/12/2002

** Generally not applicable during Care and Maintenance operations*

4 OPERATIONS SUMMARY

This section provides a summary of the operations undertaken during the reporting period.

4.1 EXPLORATION

No exploration activities were undertaken during the reporting period.

4.2 MINING OPERATIONS

As noted in **Table 5**, an application to extend the suspension of the labour and expenditure conditions of Dartbrook Mine's Coal and Mining Leases was lodged in August 2018. The renewal of Dartbrook mining authority ML 1456 was also sought during the reporting period.

Table 7 confirms that coal was not processed or transported under Care and Maintenance activities during the reporting period.

4.2.1 Land Preparation

Under Care and Maintenance, land preparation has been restricted to minor works for general maintenance of the site. A Permit to Disturb is obtained prior to the commencement of any 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.

Limited land preparation work was undertaken in the reporting period. Permits to Disturb were prepared before these works commenced to ensure appropriate environmental controls were in place.

No topsoil was stripped for mining purposes in 2019. Topsoil and overburden continue to be stockpiled at suitable locations onsite. No topsoil or overburden was moved or actively used in 2019.

Table 8 provides an estimate of the quantity of topsoil available to be used for future rehabilitation works.

Table 7
Production Summary

Material	Unit	Approved Limit	Actual Quantity (2018)	Actual Quantity (2019)	Forecast Quantity (2020)
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

Table 8
Topsoil and Overburden Stockpile Status

Activity / Area	Cumulative Production (t)		
	Start of Period 01/01/2019	End of Period 31/12/2019	End of next period 31/12/2020
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

4.2.2 Operations Summary

Operations were conducted generally in accordance with the existing Care and Maintenance MOP and as a result, no coal was processed in 2019.

Head contractor Terrequip were responsible for Dartbrook Mine's Care and Maintenance operations during the reporting period. Terrequip are the current Statutory Managers responsible for Care and Maintenance operations at Dartbrook Mine in relation to AQC's obligations under the *Mining Act 1992.*

Terrequip conducted daily tasks required to maintain the site. These included (but were 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 during the reporting period, which involved minor repairs to structural items.

Other routine tasks included road works, housekeeping, inspections, monitoring and reporting associated with the maintenance of 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 of the underground workings were conducted during the reporting period by Terrequip.

4.3 WASTE MANAGEMENT

4.3.1 Process Mineral Waste

Dartbrook Mine did not process any mineral waste during the reporting period.

Mineral waste at Dartbrook Mine is confined to the REA, the footprint of which 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 monitoring and inspections of the REA are conducted regularly to check for spontaneous combustion potential. Temperature monitoring results for the REA are provided in **Section 6.10**. No elevated results were recorded during the reporting period.

There was no disposal of coarse reject materials in the REA or tailings or fines in the mine goaf during the reporting period.

REA drainage was maintained in 2019. 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.

A geotechnical inspection of the REA was undertaken by Douglas Partners in February 2019. The inspection reviewed current monitoring and management arrangements in place for the REA and found that overall, the risk of slope failure of the REA under static conditions was very low. The next independent assessment of the REA is planned to be undertaken in 2022.

Internal environmental / rehabilitation inspections of the REA were conducted regularly throughout the year. These inspections confirmed that rehabilitated areas of the REA were generally in good condition throughout the reporting period, despite the prevailing drought conditions.

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 are 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.

Table 9 provides a summary of waste tracked at Dartbrook Mine during the reporting period.

4.3.3 Hazardous Materials Management

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

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 at the CHPP.

4.4 ROM & PRODUCT COAL STOCKPILES

The capacity and current status of the coal stockpile areas is listed in **Table 10**. No coal was stored on any stockpile in 2019.

4.5 CONSTRUCTION & DEMOLITION

No construction or demolition activities were undertaken during the reporting period.

4.6 NEXT REPORTING PERIOD

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

As noted in **Section 2.3**, AQC announced in November 2019 that an appeal had been lodged in the NSW Land and Environment Court over the determination of the DA 231-07-2000 (MOD7). An update on the appeal and any recommencement of mining activities on site will be included in the next Annual Review.

Table 9
Waste Generation

Waste Type	Disposal	Quantity in 2018	Quantity in 2019
General Waste - Non-hazardous (t)	Landfill	17.8	3.1
Scrap Metal (t)	Recycled	8.3	2.8
Office Paper and Co-mingled Recyclables (t)	Recycled	0.6	0.2
Hazardous Waste – Sewage Sludge (Litres)	Treatment	0	0
Waste Oil (Litres)	Recycled / Treatment	31.7	0
Hazardous Waste - Chemical Anchors / Resins (t)	Treatment	0	0
	Approved Landfill	0	0

Table 10
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**	

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

This section includes a list of actions requested by regulatory agencies following lodgement of the previous Annual Review and a summary of where each is addressed in this document.

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

Table 11 lists the relevant issues raised by regulatory authorities in the previous reporting period and indicates where these issues are addressed in this Annual Review. Correspondence relevant to the preparation of this Annual Review was provided by DPIE on 13 May 2019.

DPIE-RR did not raise any specific issues to be addressed following their review of the previous Annual Review document.

Table 11
Issues Raised by Regulatory Authorities in 2019

ID	Issue	Where Addressed	Status
DPIE Requests (13/05/19)			
1	For future Annual Reviews, the Department requests, under the provisions of Schedule 2, condition 4 of the approval, the following: 1. Incidents and non-compliances – expand on the non-compliances identified in the Statement of Compliance, as per Section 11 of the guideline. The above Department request should be tabulated within the next Annual Review, with specific references as to where it has been addressed within the document.	**Section 1**	Complete

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 2020 are also described, as required.

6.1 OVERVIEW

An internal Environment Management System (EMS) has been developed and implemented for Dartbrook Mine. The EMS provides a systematic risk-based approach to the management of safety, health, and environmental aspects associated with the environment.

The EMS reflects the Care and Maintenance status of the mine and accommodates the relevant procedures for the Statutory Mine Area. Internal operational inspections of rehabilitation, water, biodiversity and hydrocarbon management components of the EMS were undertaken regularly in 2019. These inspections did not identify any operational non-compliances.

Table 12 provides a summary of the environmental management actions undertaken during 2019.

Table 12
Environmental Management Overview

Aspect	Performance during 2019	Trends	Management Actions
Air Quality	• Elevated depositional dust measurements recorded at monitoring site 885 (see **Section 6.3.2**). • Elevated 24-hour PM_{10} concentrations at all five HVAS sites (see **Section 6.3.2**). • Elevated annual average PM_{10} concentrations at all five HVAS sites (see **Section 6.3.2**).	• The site has been in Care and Maintenance since 2007. Elevated air quality monitoring results were reviewed and confirmed to be a result of external influences and not Dartbrook activities.	• Monitoring of PM_{10} and dust deposition (see **Section 6.3**).
Greenhouse	• 104,260 tonnes of CO_2 equivalent gas (CO2-e) was emitted (Scope 1 – 3) during the 2018/19 reporting period.	• Increase in monitored CO2-e emissions on site compared to 2017/18 reporting period.	• Methane and CO_2 from the underground workings are released via Ventilation Shaft No. 1 (see **Section 6.14**)

Aspect	Performance during 2019	Trends	Management Actions
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 adjacent the New England Highway continued to develop satisfactorily despite ongoing dry conditions.	• The tree screen has steadily developed since it was planted in 2011	• Ongoing monitoring of tree screen performance.
Biodiversity	• River Red Gum restoration areas and the Forestry Plantation continued to develop	• These areas continue to progress	• Inspections of the River Restoration and Forestry Plantation areas. • Weed and feral animal control (see **Section 6.5**).
Heritage	• No additional impacts to Aboriginal or European heritage items	• No impacts to heritage items have occurred during the Care and Maintenance period	• General maintenance of European Heritage sites
Subsidence	• No additional subsidence • Previously remediated areas have remained stable	• No changes in trends. Additional subsidence impacts were not observed during the reporting period	• Annual visual inspections of previously subsided areas (see **Section 6.12**)

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

For reporting purposes (and discussion in thus Annual Review), Dartbrook Mine generally uses data from Met-02 due to the availability of long-term data (from 1995 to the present).

6.2.2 Environmental Performance

Rainfall

During the reporting period, a total of 380.2 mm of rainfall was recorded over 67 rain days. These results continued the trend of prevailing dry conditions from 2018, with annual rainfall during the reporting period being significantly lower than the long-term average annual rainfall of 576 mm. An annual rainfall summary is provided in **Table 13**, with a further comparison to long-term monthly averages included in **Appendix B**).

Temperature

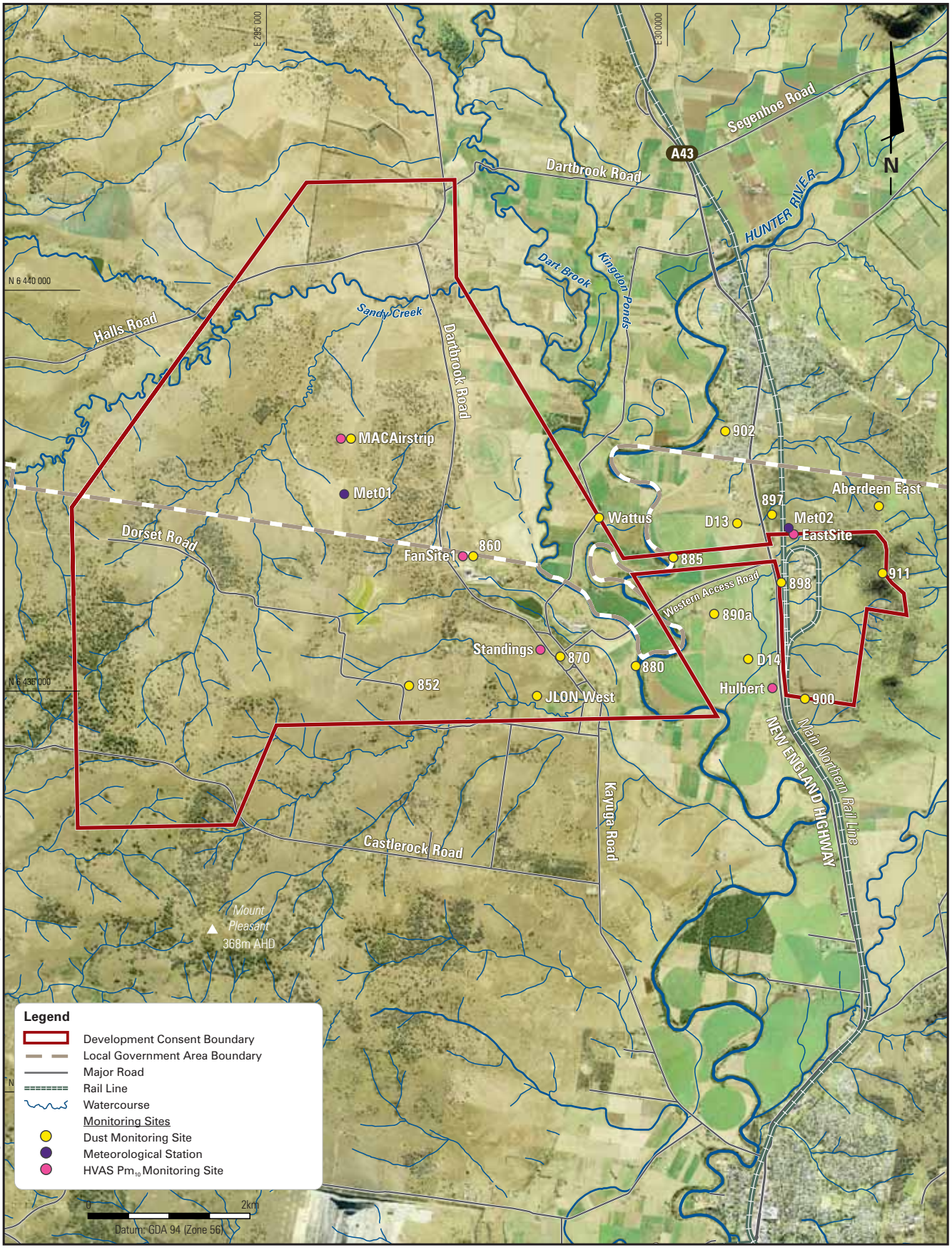
Monthly maximum, average and minimum temperatures recorded at Dartbrook Mine are presented in **Table 14**. January was the warmest month in 2019 with an average daily temperature of 29.1 ºC. June was the coldest month with an average daily temperature of 11.8 ºC.

Table 13
Rainfall Summary 2019

Month	Rainfall (mm)	Cumulative Rainfall (mm)
January	31.8	31.8
February	41.6	73.4
March	175.8	249.2
April	0.4	249.6
May	27.2	276.8
June	7.6	284.4
July	5.2	289.6
August	21.8	311.4
September	26.6	338.0
October	13.4	351.4
November	25.8	377.2
December	3.0	380.2

Table 14
Monthly Temperature Summary 2019

Month	Min Temperature (°C)	Avg Temperature (°C)	Max Temperature (°C)
January	19.0	29.1	43.6
February	13.1	24.7	38.8
March	11.6	22.9	35.7
April	6.0	19.2	31.7
May	3.3	14.7	26.3
June	-2.4	11.8	24.1
July	-0.2	12.5	22.6
August	-0.6	13.0	26.2
September	3.8	16.4	32.3
October	6.1	20.3	36.7
November	9.0	23.5	38.8
December	13.6	25.7	43.8
Average	**6.9**	**19.5**	**33.4**



HB DARTBROOK Underground 2017 Annual Review HB1801 F6 Meteorological and Air Quality Monitoring Network 12 03 2019

DARTBROOK MINE

Meteorological and Dust Monitoring Locations

FIGURE 6

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Australian Pacific Coal

Wind Speed & Direction

In 2019, prevailing winds were generally consistent with long term regional trends.

Table 15 provides a summary of the data captured at Dartbrook Mine in 2019. Monthly wind roses compiled from Met-02 are provided in **Appendix B**.

Table 15
Wind Summary 2019

Month	% Period with Wind Speed <3.0 m/s	% Period with Wind Speed >3.0 m/s	Predominant Wind Direction
January	55.5	44.5	SSE
February	46.7	53.3	SSE
March	62.8	37.2	SSE
April	70.3	29.7	SSE
May	73.4	26.6	N/NE
June	80.0	20.0	NNE/S
July	57.9	42.1	N
August	59.3	40.7	N/NW
September	61.8	38.2	N/NW
October	61.4	38.6	N/S
November	47.5	52.5	NW/S
December	42.9	57.1	SSE

6.2.3 Next Reporting Period

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

No upgrades to the existing meteorological monitoring infrastructure are planned.

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 EMS, DA 231-07-2000 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 does not generally undertake activities that generate visible dust during Care and Maintenance.

Dust Monitoring Criteria

The air quality standards and goals specified in Condition 6.1 of DA 231-07-2000 are presented in **Table 16**. Dust goals from DA 231-07-2000 (MOD6) are included this document as required as these criteria were relevant to much of the 2019 reporting period.

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**).

Table 16
Dartbrook Mine Air Quality Criteria

Pollutant	Averaging Period	Criterion
Particulate Matter < 10 µm (PM_{10})	Annual	[a, c] 25 µg/m3
	24 hour	[b] 50 µg/m3
Particulate Matter < 2.5 µm ($PM_{2.5}$)	Annual	[a, c] 25 µg/m3
	24 hour	[b] 50 µg/m3
Total suspended particulate (TSP) matter	Annual	[a, c] 25 µg/m3
Depositional Dust (g/m2/month)	Annual (total)	4 (g/m2/month)
	Annual (increase over existing levels)	2 (g/m2/month)

Notes:

a Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

b Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

c Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

6.3.2 Environmental Performance

Dust Deposition

During the reporting period, dust monitoring continued at 17 dust deposition monitoring sites located throughout the area.

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 for depositional dust are reported in g/m^2/month. Most insoluble solid results that are above 4 g/m^2/month undergo an 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 17 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.

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 the reporting period ranged from 1.24 g/m^2/month (at Site 911, Browns Mountain) to 5.16 g/m^2/month (at Site 885, Frazer farm paddock).

In 2019, all sites with the exception of Site 885 recorded annual average dust deposition rates below the limit of 4 g/m^2/month. While the annual average result for Site 885 was an exceedance of DA 231-07-2000 criteria for depositional dust, the limited Care and Maintenance activities undertaken on site during the year were not considered to be a contributor to this elevated result.

Table 17
Annual Rolling Average Dust Deposition for 2019

Site	Location Description	Insoluble Solids (g/m^2/month)	Ash Component (g/m^2/month)	Number of Samples
852	Dorset Road	1.45	1.01	12
860	No. 1 Vent Shaft	1.89	1.23	12
870	Kayuga Village	1.47	1.01	12
880	Hunter River / Dart Brook Junction	2.05	1.40	12
885	Frazer Farm paddock near Hunter River	**5.16**	3.67	12
897	Eastern Site North	3.24	2.04	12
898	Eastern Site West	1.81	1.17	12
900	Eastern Site South	1.49	0.83	12
902	Aberdeen Tree Screen	1.36	0.95	12
911	Browns Mountain	1.24	0.85	12
890a	Garoka Dairy	1.80	1.23	12
Aberdeen East	South east of Aberdeen	1.28	0.81	12
D13	Residence northwest of CHPP	1.61	1.01	12
D14	Southwest of CHPP	1.54	1.00	12
JLON West	Residence south of West Site	2.72	1.62	12
Macairstrip	Northwest of West site	2.17	1.93	12
Wattus	Between Dart Brook and Hunter River	3.37	2.20	12

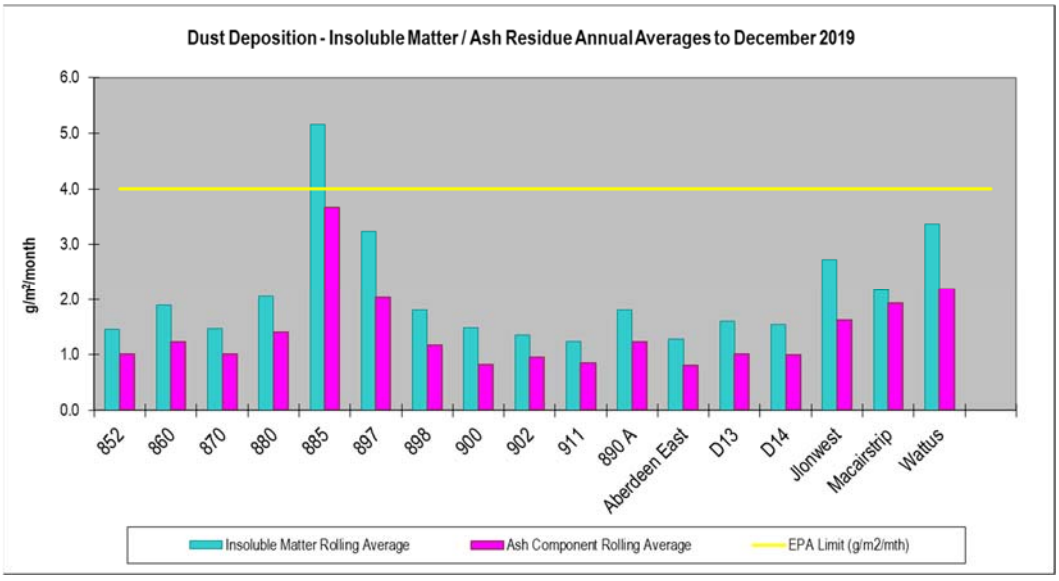


Figure 7
Depositional Dust Annual Averages 2019

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 with the monitors, 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 18**.

The data recovery rate was 100% for all HVAS sites in 2019. There were no program re-run's undertaken during the reporting period. All sites were compliant with the NEPC standard for data capture, which requires recovery of data to be greater than 75%.

As shown on **Figure 8**, elevated 24-hour annual average PM_{10} results for the HVAS in exceedance of the DA 231-07-2000 criteria of 50 µg/m^3 were recorded at all five monitors in February, October, November and December 2019. A summary of these elevated 24-hour PM_{10} results is provided in **Table 19**. These elevated 24-hour PM_{10} results were investigated and found to not be related to Dartbrook Care and Maintenance activities. It is noted that these elevated results were likely associated with:

- Agricultural or other activities on neighbouring properties in the vicinity of monitoring sites; or
- Wider-scale dust and bushfire events prevailing in the region at the times of monitoring in the period from October to December 2019.

Table 20 presents the Annual Average PM_{10} concentrations at the five HVAS during the reporting period and compares these with the predictions in the EIS and subsequent modifications. As shown by the table, PM_{10} concentrations recorded in the Dartbrook Mine HVAS sites were greater than the levels predicted in the EIS and the relevant DA 231-07-2000 annual criteria of 25 µg/m^3 at all sites during the reporting period. A review 2019 PM_{10} data for all sites found that Dartbrook Care and Maintenance activities during the reporting period were not a significant influence on the elevated annual monitoring results. The exceedance of DA 231-07-2000 annual average PM_{10} criteria and the relative increase in PM_{10} levels compared to 2018 were found to be largely influenced by the extensive bushfires in the region in late 2019 and the ongoing drought conditions experienced throughout the year.

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 the reporting period did not exceed the relevant air quality goals for TSP from DA 231-07-2000.

6.3.3 Next Reporting Period

Dust mitigation and control activities will continue to be employed as required. Air quality monitoring will continue in accordance with the DMP.

Table 18
HVAS Monitoring Sites for PM_{10} and 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 19
Elevated 24-hour PM_{10} Monitoring Results 2019

Monitoring Date	Location	24-hour PM_{10} Result ($\mu g/m^3$)
13/02/19	ESMS	101
	Fan site 1	99
	Hulbert	94
	Standings	103
	Macairstrip	117
19/02/19	Fan site 1	60
	Hulbert	56
	Standings	66
	Macairstrip	85
17/10/19	Fan site 1	53
	Macairstrip	63
29/10/19	ESMS	56
	Fan site 1	61
	Hulbert	53
	Standings	56
	Macairstrip	66
16/11/19	ESMS	66
	Fan site 1	65

Monitoring Date	Location	24-hour PM_{10} Result ($\mu g/m^3$)
	Hulbert	78
	Standings	56
	Macairstrip	86
22/11/19	ESMS	99
	Fan site 1	93
	Hulbert	83
	Standings	83
	Macairstrip	117
28/11/19	ESMS	64
	Fan site 1	84
	Hulbert	59
	Standings	75
	Macairstrip	99
10/12/19	ESMS	140
	Fan site 1	106
	Hulbert	86
	Standings	116
	Macairstrip	100
16/12/19	ESMS	81
	Fan site 1	87
	Hulbert	76
	Standings	86
	Macairstrip	76
22/12/19	ESMS	66
	Fan site 1	58
	Hulbert	54
	Standings	67
28/12/19	Fan site 1	54
	Standings	52

Table 20

Comparison of Measured Annual Average PM_{10} Concentrations with EIS Predictions

Location	Units	EIS Predicted Annual Average PM_{10}	Annual Average PM_{10} Results 2019
ESMS	µg/m^3	20.1	**26.1**
Fan site 1	µg/m^3	18.7	**28.2**
Hulbert	µg/m^3	17.4	**27.0**
Standings	µg/m^3	17.3	**27.8**
Macairstrip	µg/m^3	17.0	**30.2**

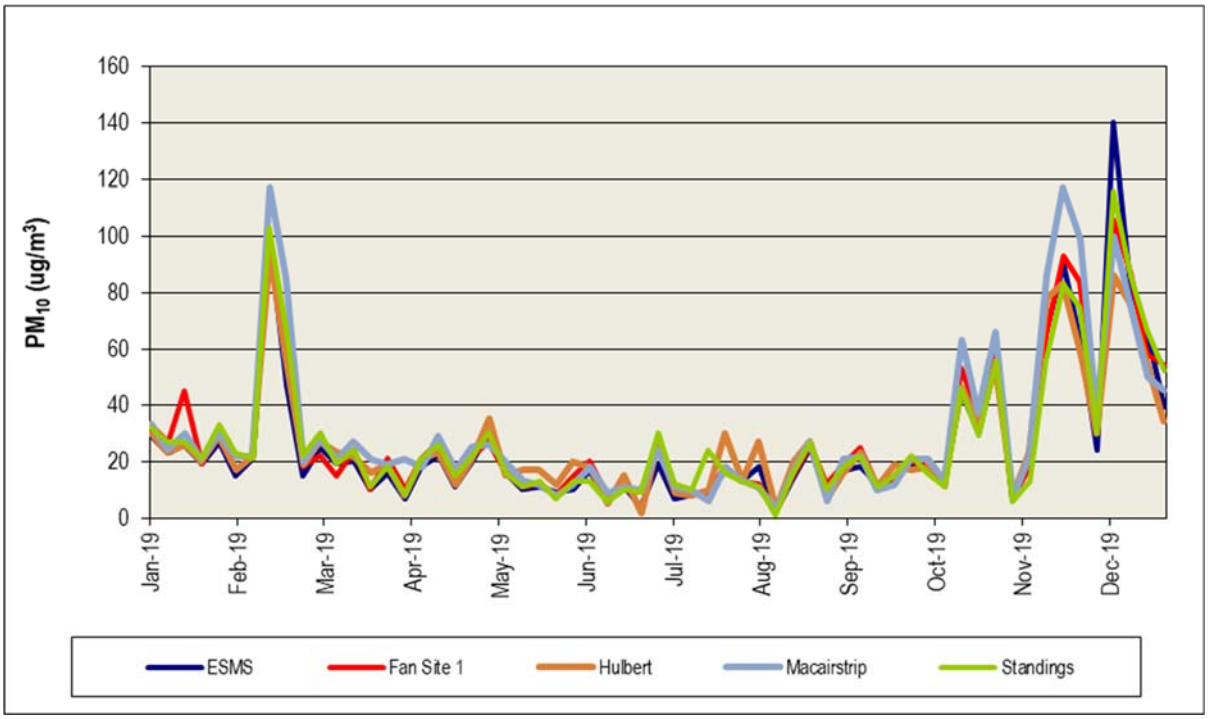


Figure 8

HVAS 24-hr Average PM_{10} Results 2019

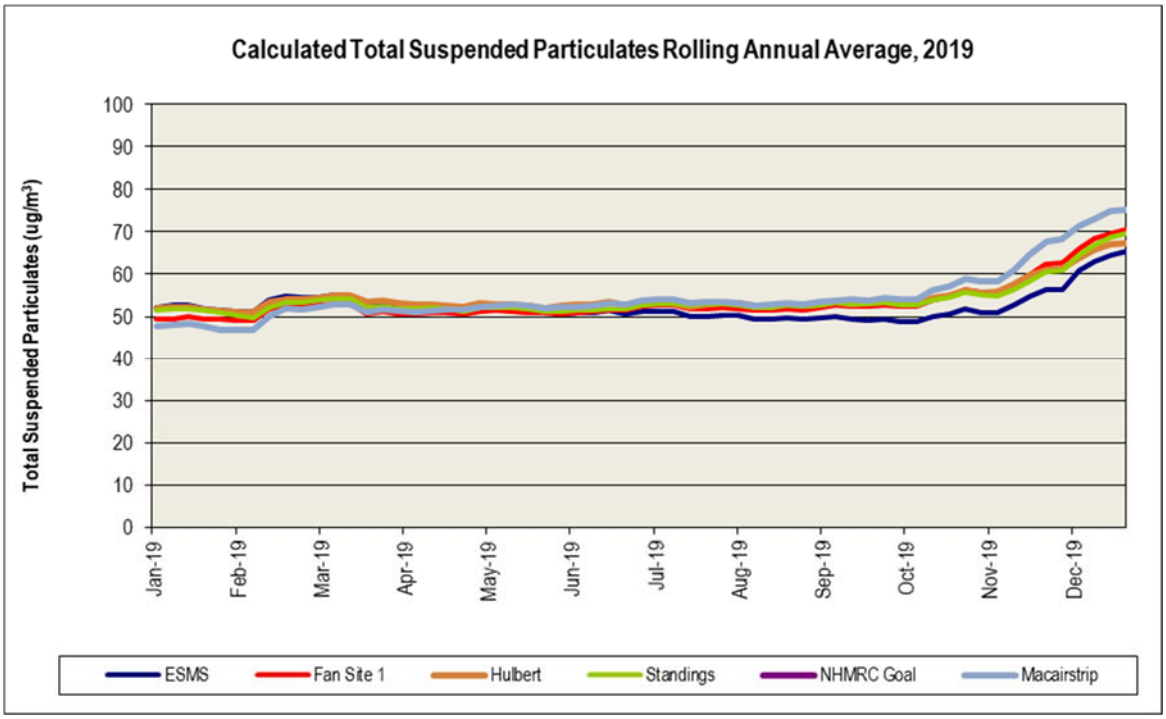


Figure 9
Calculated Rolling Annual Average TSP Concentrations 2019

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

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 completed and appropriate pre-clearing surveys will continue to be undertaken by qualified ecologists.

The native forest tree screen along the New England Highway and the area north of the CHPP, which is planted with native forest will continue to be monitored and maintained. Inspections of the River Red Gum and Forestry Plantation Project areas will also continue.

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 during the reporting period.

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 their leaseholders to manage weed outbreaks in these areas.

Dartbrook Mine maintains a register which outlines the location of the weeds identified, method for control of the weeds and the control works undertaken across the site.

Weed management activities undertaken in 2019 included targeted spraying of African Boxthorn, Prickly Pear, Green Cestrum and Blue Heliotrope. In addition, Dartbrook Mine's leaseholders continued to manage weeds on AQC owned lands used for agricultural purposes.

Feral and Pest Animal Management

Feral and pest animal control at Dartbrook Mine continued during 2019 and was largely focused on kangaroos, feral dogs and pigs.

6.5.2 Next Reporting Period

Site personnel and will continue to undertake weed and feral animal inspections and management across the Dartbrook Mine lands in the next reporting period.

6.6 OPERATIONAL NOISE

6.6.1 Environmental Management

In 2012, the DPIE 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 8.4**. As the trees continue to mature, they will provide additional screening of the township of Aberdeen from views of the CHPP.

In 2010, a Tree Screen was developed along the Western Side of the New England Highway in the vicinity of the CHPP to provide a visual buffer for motorists. The tree screen is surveyed

on an annual basis and continued to develop during the reporting period, despite the prevailing drought conditions.

6.7.2 Next Reporting Period

Maintenance of the tree screening areas will continue as required, subject to the prevailing weather conditions. A review of the screens will be undertaken during the next reporting period and replacement trees established if significant mortality of plantings occurs.

6.8 ABORIGINAL HERITAGE

6.8.1 Environmental Management and Performance

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

As described in **Section 4.2**, AQC has a Permit to Disturb system in place for planned disturbance activities on site. Part of the permit process 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.

6.8.2 Next Reporting Period

The existing Permit to Disturb process will continue to be used prior to any surface disturbance to minimise the potential for disturbance to Aboriginal heritage items.

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 property maintenance works, such as mowing, slashing and fence repairs were carried out in 2019 to protect the European heritage items under the control of AQC. Such areas include continued work around the Riverview Homestead, Kayuga Homestead and the Dartbrook and Kayuga Cemeteries.

6.9.2 Next Reporting Period

AQC will continue existing efforts for the upkeep of the various European heritage sites on AQC lands.

6.10 SPONTANEOUS COMBUSTION

6.10.1 Environmental Management

The REA remained stable during the reporting period. 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 from the reporting period.

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 8**).

There were no incidents of spontaneous combustion during the reporting period. All temperature monitoring probes read satisfactorily. Temperatures remained generally stable 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. The REA is also monitored for sub-surface water level movements, which have remained relatively 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 in the next reporting period.

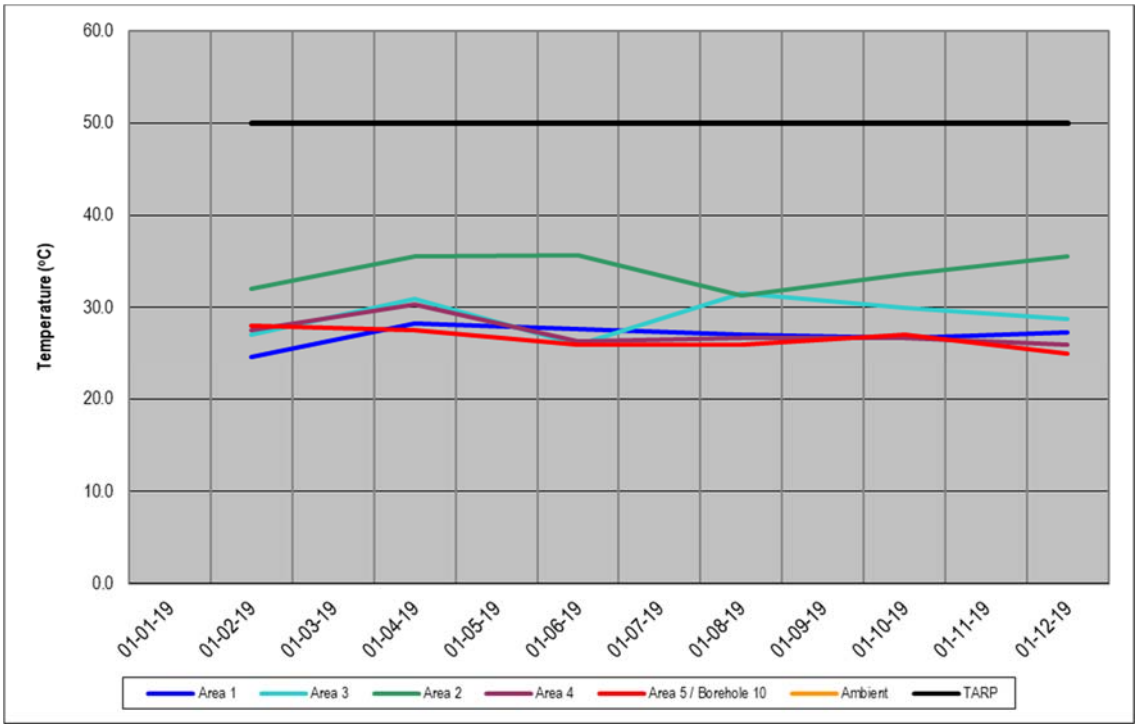


Figure 10
REA Thermocouple Temperature Monitoring Results 2019

6.11 BUSHFIRE

6.11.1 Environmental Management and Performance

As outlined in the Bushfire Management Plan, fire prevention is the primary management objective at Dartbrook Mine.

All surface facilities with the potential to create a fire hazard during Care and Maintenance are kept clear of combustible materials to minimise the risk of a fire within these areas.

The Site Access Road is slashed on a regular basis and most surface areas managed by AQC are also grazed by cattle, which assists in the control of the build-up of fuel loads.

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

6.11.2 Next Reporting Period

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

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.

Current management generally involves an annual inspection of previously mined areas 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. The annual subsidence inspection included a review of areas previously subsided during mining of the Kayuga Seam longwall panels KA101 - KA103. The purpose of this inspection 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.

6.12.3 Next Reporting Period

Annual inspections of previous subsidence areas will continue to be undertaken. Should any new areas be identified as requiring surface repair, remedial actions will be undertaken as soon as practicable. As part of the inspection process, previously remediated sites will be re-inspected to determine if additional repairs are 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 workshop are ongoing to ensure good housekeeping standards are maintained.

Environmental training, which included spill response, water management and hydrocarbon management continued to be provided 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 West Site hardstand area also has controlled drainage, eventually reaching the WHD through the oil separation system.

During the reporting period, no new indications of contamination by petroleum hydrocarbons, polycyclic aromatic hydrocarbons, or heavy metals were identified.

6.13.2 Next Reporting Period

Environmental spill response training will continue to be provided to new staff and contractors.

6.14 GAS DRAINAGE & VENTILATION

6.14.1 Environmental Management and Performance

The majority of gas from the underground mine workings 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 21**.

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

As shown in **Table 21**, a total of 104,260 tonnes of CO_2 equivalent gas (CO_2-e) was emitted during the 2018/19 National Greenhouse and Energy Reporting (NGER) period. The main contributor to total emissions was CH_4 gas emitted from the underground mine (89,646 tonnes CO_2-e). The total greenhouse gas emissions value for the 2018/19 NGER period is higher than the 94,343 tonnes CO_2-e reported in the 2018 Annual Review.

6.14.2 Next Reporting Period

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

Table 21
Greenhouse Gas Emissions during 2018/19 NGER period

Month	Scope 1 Emissions			Scope 2 Emissions	Total Emissions (t CO_2-e)
	Carbon Dioxide (t CO_2-e)	Methane (t CO_2-e)	Nitrous Oxide (t CO_2-e)	Carbon Dioxide (t CO_2-e)	
Jul-18	941	8,165	0.011	360	9,466
Aug-18	916	10,776	0.020	369	12,062
Sep-18	883	8,260	0.021	382	9,525
Oct-18	949	6,817	0.019	415	8,181
Nov-18	978	5,381	0.019	395	6,753
Dec-18	988	6,801	0.008	359	8,148
Jan-19	979	7,462	0.021	355	8,796
Feb-19	835	9,131	0.010	352	10,317
Mar-19	461	7,157	0.014	357	7,974
Apr-19	754	4,962	0.025	359	6,075
May-19	782	5,991	0.021	344	7,117
Jun-19	772	8,743	0.013	331	9,846
FY 18/19 Total	**10,238**	**89,646**	**0.202**	**4,377**	**104,260**

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 during the reporting period. 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.

6.15.2 Next Reporting Period

Regular patrols by site personnel will continue. Full-time caretakers will remain on-site, fences will be maintained and gates will remain locked and secured.

Vegetation slashing of the site access road and other areas will continue, as required.

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**.

During the reporting period, 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.

7.1.1 Fresh Water Use

Approximately 2.0 megalitres (ML) of potable water was sourced from the Aberdeen town water supply. Approximately 19.5 ML of groundwater was extracted from two bores (Blairemore bores) adjacent to the West Site.

7.1.2 Water Take

Water take under the Dartbrook Mine water licences during the reporting period is provided in **Table 22**.

The passive take of 150 ML from the Hunter Regulated River Alluvial Water Source in 2019 accounts for the seepage of groundwater flowing into the Hunter Tunnel.

Groundwater seepage to the Wynn and Kayuga Seam workings was estimated based on the groundwater modelling undertaken for the EIS. Seepage to the Wynn seam goaf is estimated at 106 ML/year, whereas the Kayuga seam goaf is estimated receive 73 ML/year.

The remaining licences in **Table 22** are those that are held by AQC for agricultural use by leaseholders operating on AQC owned land. These licences are not reported upon in this Annual Review as they are not related to Dartbrook Mine Care and Maintenance activities. 1804a4

Table 22
Dartbrook Mine Water Take

Water Licence	Water Sharing plan, source and management zone (as applicable)	Entitlement	Passive Take/inflows	2019 Active Pumping (ML)**	Total Entitlement
WSP for Hunter Unregulated and Alluvial Water Sources 2009					
WAL 17739	Dartbrook Alluvial Water Source	30	-	19.5	950
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	-	0	85
WAL 17797		68			
WAL 18134	Hunter Alluvial Water Source	297	150	0	1,249
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	-	0	2,811
WAL 759		24			
WAL 838		8			
WAL 956		176			
WAL 996		120			
WAL 1005		171			
WAL 1021		480			
WAL 1022		264			
WAL 1024		228			
WAL 1025		3			
WAL 1026		5			
WAL 1027		63			
WAL 1235		270			
WAL 13386		270			
WAL 14607		328			
WAL 14609		5			
WAL 9048		135			
WAL 955	High Security	3	-	0	6
WAL 1023		3			
WAL 1267	Supplementary Water	6	-	0	254.8
WAL 1313		30.2			
WAL 1316		10			

Water Licence	Water Sharing plan, source and management zone (as applicable)	Entitlement	Passive Take/inflows	2019 Active Pumping (ML)**	Total Entitlement
WAL 1317		42			
WAL 1318		23.8			
WAL 13336		18.7			
WAL 14605		89			
WAL 9055		35			
WSP for Sydney Basin North Coast Groundwater Source					
WAL 41523	Sydney Basin North Coast Groundwater Source*	30	179***	0	180
WAL 41524		150			

** Updated to correct Water Source by DoI-Water in 2018*
*** Calculated from NSW Water Accounting System Reporting*
****Estimated seepage into Wynn Seam goaf*

7.1.3 Sewage

There was no irrigation of land using treated effluent during the reporting period.

7.1.4 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 2019 which resulted in reduced surface water storage volumes being maintained. Despite the reduced rainfall throughout the year, water levels in the Evaporation Ponds and SDD were maintained to maximise water losses to evaporation.

Dam storage volumes during the reporting period are shown in **Table 23**.

Table 23
Dartbrook Mine Stored Water Summary

Storage	Location	Volume Held (m^3)		
		Start of Period Jan 2019	End of Period Dec 2019	Storage Capacity
Clean Water				
Clean Water Dam 1	East Site	0	2,000	10,000
Clean Water Dam 2	East Site	500	1,000	10,000
Clean Water Dam 3	East Site	0	0	10,000
Southern Clean Water Dam	East Site	0	2,650	53,000
Dirty Water (runoff)				
Sediment Dam 1	West Site	50	150	1,000
Sediment Dam 2	West Site	0	0	400
Northern Dam REA	East Site	0	230	2,300
Southern Dam REA	East Site	1,600	0	8,000
Stage 4 REA Dam	East Site	0	0	7,900
Controlled Discharge Water				
SDD	West Site	254,000	228,000	400,000
Contaminated Water				
Western Holding Dam *	West Site	3,542	462	15,400
Eastern Holding Dam *	East Site	35,200	26,400	88,000
Evaporation Ponds	West Site	66,000	46,200	132,000
Wynn Seam Goaf	Underground	~3,003,000	~2,948,000	~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 60% capacity during the reporting period.

AQC did not discharge under the HRSTS during the reporting period.

Groundwater

There was an estimated 150 ML of groundwater inflow into the Hunter Tunnel during the reporting period (see **Table 24**). This water was pumped directly into the Wynn Seam Goaf for storage. Groundwater seepage in the Wynn Seam goaf was estimated at 106 ML for the reporting period. These volumes equate to total modelled inflows of 256 ML during the reporting period (see **Table 24**).

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 if required, consistent with those identified in the SWMP. The revised TARP depth of 275m will be reflected in future revisions of the SWMP.

Site Inventory

Measured site inventory based on monthly dam observations decreased from 3,364 ML to 3,255 ML during 2019. This represents a net loss of 109 ML, which continues the trend of net losses in 2017 and 2018.

Table 24
Estimated Dartbrook Mine Water Balance Components

Water Stream	2019 Volumes (ML)
Inputs	
Fresh Water (Blairemore bore)	19.5
Groundwater Seepage In (including Hunter Tunnel)	256
Rainfall Runoff	93
Recycled to CHPP from Tails & Storage (not included in total)	0
Imported Potable (Aberdeen)	2.0
Total Inputs	**370.5**
Outputs	
Groundwater Seepage Out	50
Dust Suppression	0
Evaporation – Mine Water	408
Entrained in Process Waste	0
Discharged (HRSTS)	0
Potable Usage	21.5
Total Outputs	**479.5**
Estimated Change in Total Storage	**-109**

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 231-07-2000.

The primary objective of the groundwater monitoring program, as prescribed by Condition 4.2 (a) (ii) of DA 231-07-2000 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 DPIE-Water (formerly DLWC).

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

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

Details of the groundwater bores currently included in the groundwater monitoring program are provided in **Table 25**. The scope of the groundwater monitoring program has been reduced since 2006 when the mine was placed under Care and Maintenance.

As noted in **Table 25**, monitoring of groundwater bores is undertaken on a six-monthly basis during Care and Maintenance. **Figure 11** shows the locations of all groundwater monitoring bores sampled during the reporting period.

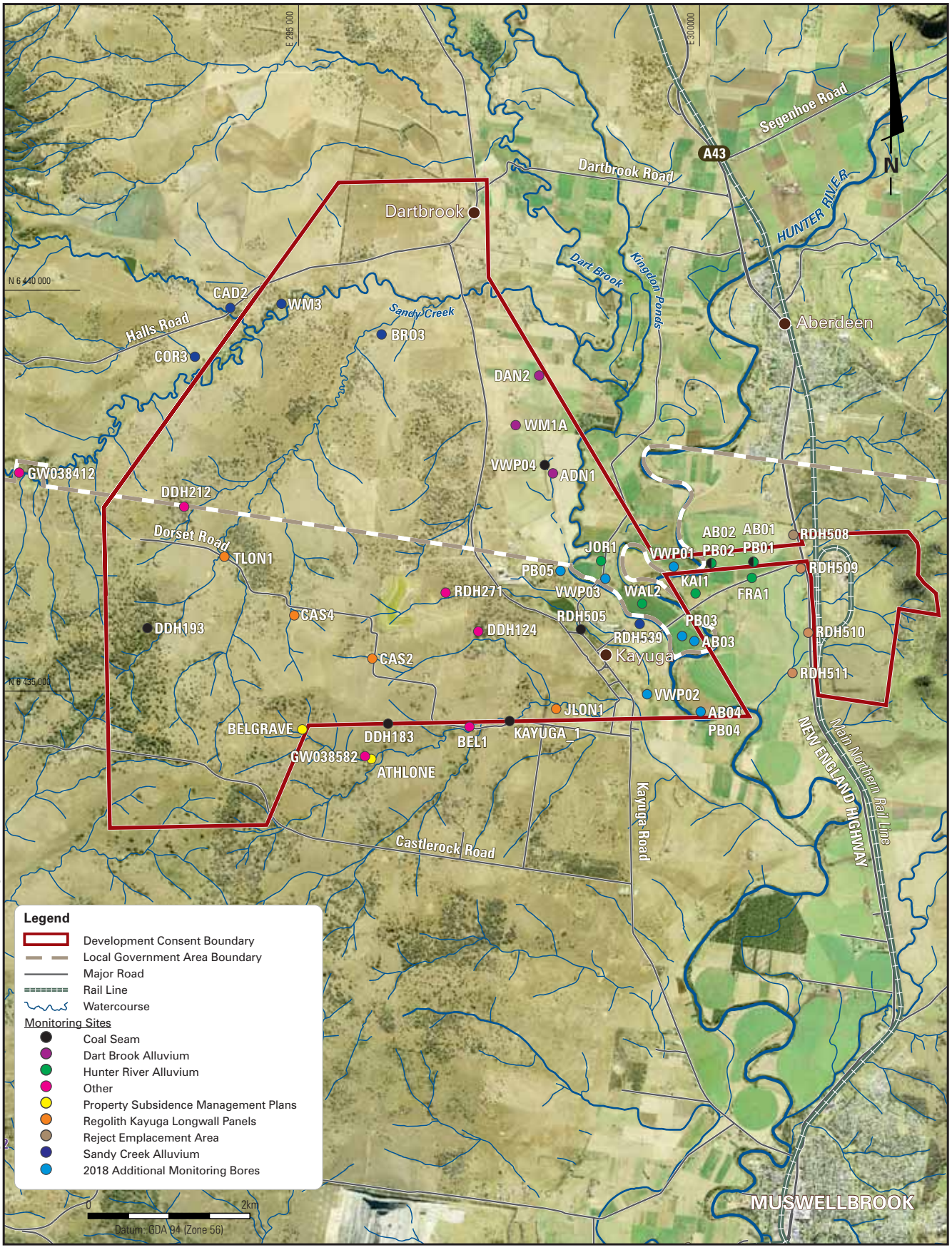
Graphs of the measured groundwater, pH and EC levels at Dartbrook Mine bores during the reporting period are included in **Appendix E**.

Table 25
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			
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				

Bore	Bore Type	Aquifer Monitored	Details	Parameter / Frequency
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			
JLON1	Windmill			
Staged Discharge Dam Bore				
RDH505	Bore	Regolith – shallow overburden	Monitors the regolith near the Staged Discharge Dam.	Monitored on a six-monthly basis for water depth, pH, EC & additional suite parameters.
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			
Property Subsidence Management Plan Bores				
Belgrave	Bore	Regolith – shallow overburden	Located on private properties near the southern extent of the site.	Monitored on a six-monthly basis for water depth, pH, EC & additional suite parameters.
GW038582	Bore			
Other Monitoring Bores				
Athlone	Bore	Regolith – shallow overburden	Athlone and BEL1 are located south of the Dartbrook mining leases.	Monitored on a six-monthly basis for water depth, pH, EC & additional suite parameters.
BEL1	Well			
CAD2	Bore	Sandy Creek alluvium	Located along a tributary of Sandy Creek	
DDH124	Bore	Wynn Seam	DDH124 is located above completed Wynn Seam workings. DDH212 is located west of the completed mine workings.	
DDH212b	Bore			
DDH212c	Bore			

Note: Bore = Monitoring bore and not a current water supply. See SWMP for additional suite of parameters.



HB DARTBROOK Underground 2019 Annual Review HB1849 F11 Groundwater Monitoring Network 28 03 2019 Rev A

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 are generally highly dependent on rainfall recharge and can rise or decline quite rapidly in response to rainfall events.

Cumulative rainfall departure (CRD) is a technique for assessing groundwater level trends in unconfined alluvial aquifers and provides a summary of the monthly departure of rainfall from the long-term average. A rising trend in the CRD plot indicates periods of above long-term average rainfall, whilst a falling trend indicates periods when rainfall is below the long-term average.

Monthly rainfall data was sourced from the Met02 station at Dartbrook Mine. This meteorological station has been operating since the commencement of longwall mining. The recorded monthly rainfall was used to calculate the CRD (shown in **Table 13**).

As reported in **Section 6.2**, Dartbrook experienced below average rainfall in 2019 which has resulted in a sharp decline in the CRD as shown in **Figure 12**.

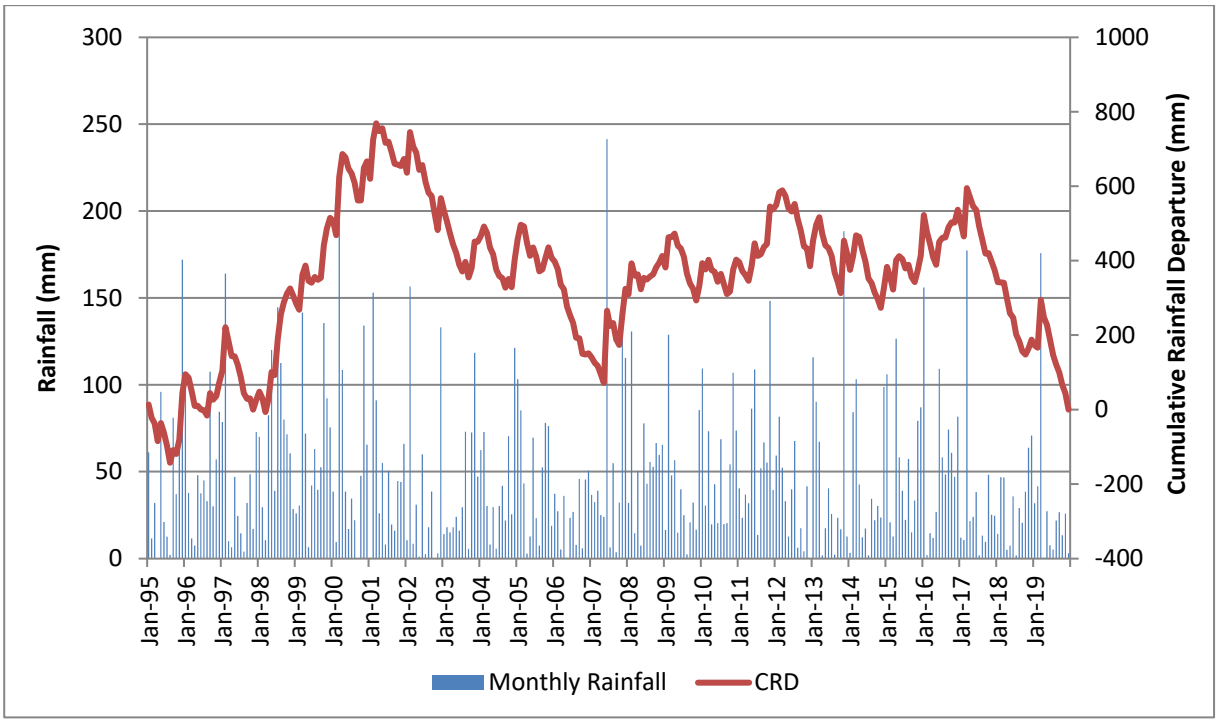


Figure 12
Cumulative Rainfall Departure

7.2.3 Hunter River Alluvium

Water Levels

Graph E-1 in **Appendix E** shows groundwater levels for Hunter River alluvium monitoring bores JOR1, FRA1, KAI1 and WAL2. All four of these bores experienced a recovery water level from the values measured in October 2018. Water levels then declined slightly from April 2019 to October 2019. This decline corresponds with the downward trend in the CRD. The water level fluctuations experienced in 2019 were within historical variability for these bores.

None of the water level measurements for the Hunter River alluvium monitoring bores exceeded the impact assessment criteria (IAC) specified in the SWMP.

Water Quality

Graphs E-2 and E-3 in **Appendix E** show water quality measurements for Hunter River alluvium monitoring bores JOR1, FRA1, KAI1, and WAL2.

The recorded pH levels at FRA1, KAI1 and WAL2 decreased slightly from the previous year, whereas the pH at bore JOR3 remained relatively stable. These changes in pH were within historical ranges. The pH of the Hunter River alluvium is generally neutral, with values ranging from 6.4 to 7.5 during the reporting period. None of the recorded pH levels exceeded the IAC under the SWMP.

Electrical Conductivity (EC) remained relatively stable in bores JOR1 and KAI, and increased slightly in bore WAL2. The EC in bore FRA1 decreased significantly from 4,750 µS/cm in April 2019 to 486 µS/cm in October 2019. FRA1 experienced elevated EC from April 2018 to April 2019. The lower EC recorded in October 2019 represents a return to the historical range for this bore.

There were two exceedances of the IAC for EC:

- The EC measured at FRA1 in April 2019 was 4,750 µS/cm, which exceeded the trigger level of 659 µS/cm; and
- The EC measured at WAL2 in October 2019 was 2,226 µS/cm, which exceeded the trigger of 1,917 µS/cm.

7.2.4 Dart Brook Alluvium

Water Levels

Graph E-4 in **Appendix E** shows groundwater levels for Dart Brook alluvium monitoring bores ADN1, DAN2 and WM1A in 2019.

During the reporting period, bores ADN1 and DAN2 experienced small variations (<0.5 m) in water levels. Bore WM1A experienced an increase in water level of approximately 2 m from April to October. There were no exceedances of the IAC under the SWMP.

Water Quality

Graphs E-5 and E-6 in **Appendix E** show water quality measurements for Dart Brook alluvium monitoring bores ADN1, DAN2 and WMA1.

Bores DAN2 and WMA1 recorded small increases (<0.5) in pH during the reporting period. These increases were within the historical variation for these bores. From April to October, the pH for ADN1 increased from 7.1 to 7.8, which is a new maximum record for this bore. This also represents an exceedance of the IAC for this bore (pH 7.4). The pH levels for the other bores were within the IAC under the SWMP.

All three Dart Brook alluvium bores recorded small declines in EC from the previous reporting period. These fluctuations were within the historical ranges for these bores. There were no exceedances of the IAC for EC during the reporting period.

7.2.5 Sandy Creek Alluvium

Water Levels

Graph E-7 in **Appendix E** shows groundwater levels for Sandy Creek alluvium monitoring bores COR3, WM3, BRO3 and GW038412. These bores have historically exhibited wide variability in their water levels.

During the reporting period, bores COR3, WM3 and GW038412 recorded increases in water level, whereas BRO3 recorded a slight decrease in water level. All of these variations were within the historical ranges for these bores.

Both water level measurements for COR3 during the reporting period were outside of the IAC of 5.3 mbgl. The IAC for the other bores were not exceeded during the reporting period.

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.

No water quality data was collected for BRO3 during the reporting period as there was insufficient water to sample.

The pH measurements for COR3, WM3 and GW038412 deviated by up to 0.5, which is consistent with the historical variability for these bores. There were no exceedances of the IAC for pH.

The Sandy Creek alluvium bores have historically exhibited high levels of variability in EC (see Graph E-9) in **Appendix E**. During the reporting period, EC levels for bore WM3 more than doubled compared to the previous year's value. EC levels declined for GW038412 and remained relatively stable for COR3. The fluctuations during the reporting period, despite being substantial relative to results recorded in 2018, were within the historical ranges for these bores.

There were two exceedances of the IAC for EC at Sandy Creek Alluvium bores during the reporting period:

- The October 2019 measurement for GW038412 (2,102 µS/cm) narrowly exceeded the IAC of 1,917 µS/cm; and
- The October measurement for WM3 (6,110 µS/cm) exceeded the IAC of 5,366 µS/cm.

7.2.6 Staged Discharge Dam

Water Levels

Graph E-10 in **Appendix E** shows groundwater levels for the Staged Discharge Dam bore RDH505. The water level for RDH505 declined by approximately 0,3 m during the reporting period. There were no exceedances of the IAC under the SWMP.

Water Quality

Graph E-11 in **Appendix E** shows the water quality measurements for the Staged Discharge Dam bore RDH505.

EC and pH levels for RDH505 remained relatively stable during the reporting period. These fluctuations were within the historical range and IAC for this bore.

7.2.7 Coal Seams

Water Levels

Graph E-12 in **Appendix E** shows groundwater levels from Kayuga Coal Seam monitoring bores, Kayuga-1, DDH183, DDH193 and DDH212a.

These bores have maintained relatively stable water levels during Care and Maintenance. This trend continued during the reporting period, with only negligible fluctuations in water level between April and October 2019. There were no exceedances of the IAC for water levels recorded at these bores.

Water Quality

Graphs E-13 and E-14 in **Appendix E** shows water quality measurements from Kayuga Seam monitoring bores Kayuga-1, DDH212a, DDH183 and DDH193.

These bores recorded substantial deviations in pH during mining operations but have remained relatively stable during Care and Maintenance. This trend continued during the reporting period. There were no exceedances of the IAC during the reporting period, although the October measurement for DDH193 equalled the pH IAC of 7.1 for that bore.

EC levels have remained relatively stable for all coal seam bores since 2009. During the reporting period, EC measurements for DDH183, DDH193 and DDH212a remained within the ranges observed during Care and Maintenance. The Kayuga-1 bore recorded an increase in EC of approximately 1,000 µS/cm. This continues a slight upward trend in EC since late 2013.

However, EC levels at Kayuga-1 remain within the range observed during previous mining operations.

Although the fluctuations in EC for DDH193 and DDH212a were small, the October 2019 measurements for these bores exceeded the IAC under the SWMP.

7.2.8 Regolith

Water Levels

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

Monitored groundwater levels in CAS4 and TLON1 have remained relatively stable during the Care and Maintenance phase. In contrast, CAS2 has experienced a steady decline in water level since 2002.

The groundwater level in CAS4 increased by approximately 1.5 m compared to the previous reporting period. The water levels in JLON1 and TLON1 remained relatively stable (<0.5 m fluctuation). CAS2 continued to decline consistent with its long-term trend.

The recorded water levels for CAS2 and TLON1 during the reporting period were below the IAC for these bores. These bores have frequently exceeded the water level IAC prescribed by the SWMP. These trigger values will be evaluated in the next reporting period and if changes to the IAC are required, the SWMP will be amended in consultation with relevant regulatory authorities.

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 recommenced in 2018 and as such, there is insufficient data to draw long-term trends.

During Care and Maintenance, pH levels for CAS2, CAS4 and TLON1 have generally been in the range of 6.5 to 7.5. The pH measurements during the reporting period were within this range and did not exceed the IAC for pH.

CAS2, CAS4 and TLON1 have historically exhibited large variability in EC. CAS2 and CAS4 recorded increases in EC during the reporting period. The two EC measurements for CAS2 (13,580 µS/cm in April and 14,600 µS/cm in October) exceeded the IAC of 13,255 µS/cm.

No water quality data was available for TLON1 during the reporting period due to water levels being too low to sample.

7.2.9 Rejects Emplacement Area

Water Levels

Graph E-18 in **Appendix E** shows water level measurements for REA monitoring bores, RDH508, RDH509, RDH510 and RDH511.

Water levels for RDH511 have generally been within the range of 7-9 mbgl, whereas levels for RDH508, RDH509 and RDH510 have generally been between 9-12 mbgl. During the reporting period, these bores recorded small increases (<1 m) in groundwater level. These water levels remained within the historical ranges and IAC for these bores.

Water Quality

Graph E-19 and E-20 in **Appendix E** show water quality measurements for REA monitoring bores RDH508, RDH509, RDH510 and RDH511.

The pH levels for these bores generally range from slightly acidic to slightly alkaline (pH 6.5 to 8.0). During the reporting period, pH levels for RDH508, RDH509 and RDH510 remained consistent with the long-term trends. The April measurement for RDH511 was 8.1, which is a new maximum record for this bore. RDH511 was unable to be sampled in October. The April measurement for RDH511 pH was an exceedance of the IAC of 7.4.

The REA monitoring bores have historically exhibited large variability in EC. During the reporting period, increases in EC were measured by RDH508, RDH510 and RDH511. The October measurement for RDH508 was 8,750 μS/cm, which is a new maximum EC for this bore and an exceedance of the IAC (8,003 μS/cm).

The increasing EC for RDH510 is consistent with the long-term trend for this bore. Both EC measurements for RDH510 exceeded the IAC of 8,744 μS/cm.

The April measurement for RDH509 (1,843 μS/cm) was significantly less than the long-term average for this bore. The October measurement returned to the historical range for this bore. The EC for RDH511 increased slightly and remained within historical ranges. There were no exceedances of the IAC for bores RDH509 and RDH511.

7.2.10 Landowner Bores

Water Levels

Graph E-21 in **Appendix E** shows water levels at private landowner monitoring bores, GW038582 and Belgrave.

Groundwater levels at GW038582 remained relatively stable during the reporting period. This bore has exhibited a steady decline in water level since 2011. Both water level measurements during the reporting period were below the IAC of 5 mbgl. Although these two levels are within the historical range for this bore, the IAC for GW038582 has been exceeded since 2017. The IAC for GW038582 will be evaluated in the next reporting period and if changes are required, the SWMP will be amended in consultation with relevant regulatory authorities.

Belgrave was unable to be accessed for monitoring during the reporting period.

Water Quality

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

The pH for bore GW038582 increased by 0.7 from the previous reporting period. The October measurement was 8.3, which equals the historical maximum pH record for this bore. Both pH measurements for GW038582 were greater than the IAC of 7.9.

GW038582 has historically exhibited significant variability in EC. During the reporting period, the EC for GW038582 remained relatively stable and within historical variability. There were no exceedances of the IAC for EC.

7.2.11 Annual Groundwater Assessment

Condition 4.1(b) of DA 231-07-2000 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 the predictions in the Dartbrook EIS.

Based on the water level measurements during the monitoring period and historical data, the following conclusions can be made:

- There has been no long-term decline in the water levels in the locality of the Hunter River alluvial monitoring bores, either during mining operations or care and maintenance. This observation is consistent with the groundwater assessment in the Dartbrook EIS, which predicted that "*existing bores and wells in the alluvial lands will remain unaffected by depressurisation within the coal measures"* (MER, 2000);
- Water levels in the Dart Brook and Sandy Creek alluvial monitoring bores declined during previous mining operations but recovered during the Care and Maintenance phase;
- Variations in groundwater levels are largely attributed to changes in climatic conditions. Declining water levels during previous mining operations at Dartbrook coincided with the falling trend in the CRD from mid-2001 to mid-2007. Similarly, rising water levels during Care and Maintenance correlated with the prolonged rising trend in the CRD. The CRD has fallen sharply since 2017, accounting for declining water levels observed in some bores over the past few years;
- Regolith monitoring bores CAS2, CAS4 and TLON1 are located directly above and near the completed Kayuga seam longwall panels. These bores recorded a decline in groundwater levels in response to mining between 2004 and 2006. During Care and Maintenance, groundwater levels have stabilised in bores CAS4 and TLON1, albeit at a lower level than pre-mining conditions. The water level in CAS2 has continued to decline during Care and Maintenance. This trend is attributed to connective cracking induced by previous longwall mining activities. The Dartbrook EIS predicted enhanced hydraulic connectivity up to 100 m above the Kayuga seam goaf. CAS2 is located within this region and the slowly declining water level is consistent with the predictions in the Dartbrook EIS;
- The Belgrave and GW038582 bores monitor the regolith to the south of the completed longwall panels. The bores recorded a decline in groundwater levels in response to mining between 2004 and 2006. Water levels in these bores have recovered to pre-

mining levels 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 Dartbrook EIS;

- Groundwater levels in the coal seam monitoring bores declined during previous mining operations. However, the magnitude of the depressurisation 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 2018, groundwater level recovery within these bores has stabilised to a level which corresponds with the water level in the flooded Wynn Seam goaf; and
- The depressurisation recorded by the Kayuga 1 bore exceeded the predictions in the Dartbrook EIS. This bore recorded a decline in water level of 11.78 m during previous mining, which exceeded the prediction of 8 m. The groundwater modelling undertaken by MER (2000) did not account for mining of the Wynn Seam in this location, which resulted in an underestimation of the drawdown at Kayuga 1.

The following observations were made regarding groundwater quality:

- pH levels during the reporting period were generally within the ranges historically observed during care and maintenance. The exception is bore ADN1 which recorded an exceedance of its IAC for pH; and
- Several bores recorded increases in EC during the reporting period. This increase is attributed to significantly below average rainfall.

7.2.12 Next Reporting Period

No underground mining activities are anticipated to be undertaken during the next reporting period. The SWMP will be reviewed to ensure that it remains appropriate for the ongoing phase of Care and Maintenance. Revisions to the SWMP from this review may include:

- Discontinuation of monitoring at groundwater bores that are no longer accessible or have been dry for an extended period; and
- Revisions to IAC for particular bores.

The updated SWMP will be implemented in 2020 following the completion of the regulatory reviews required under the conditions of DA 231-07-2000.

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;
- 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.

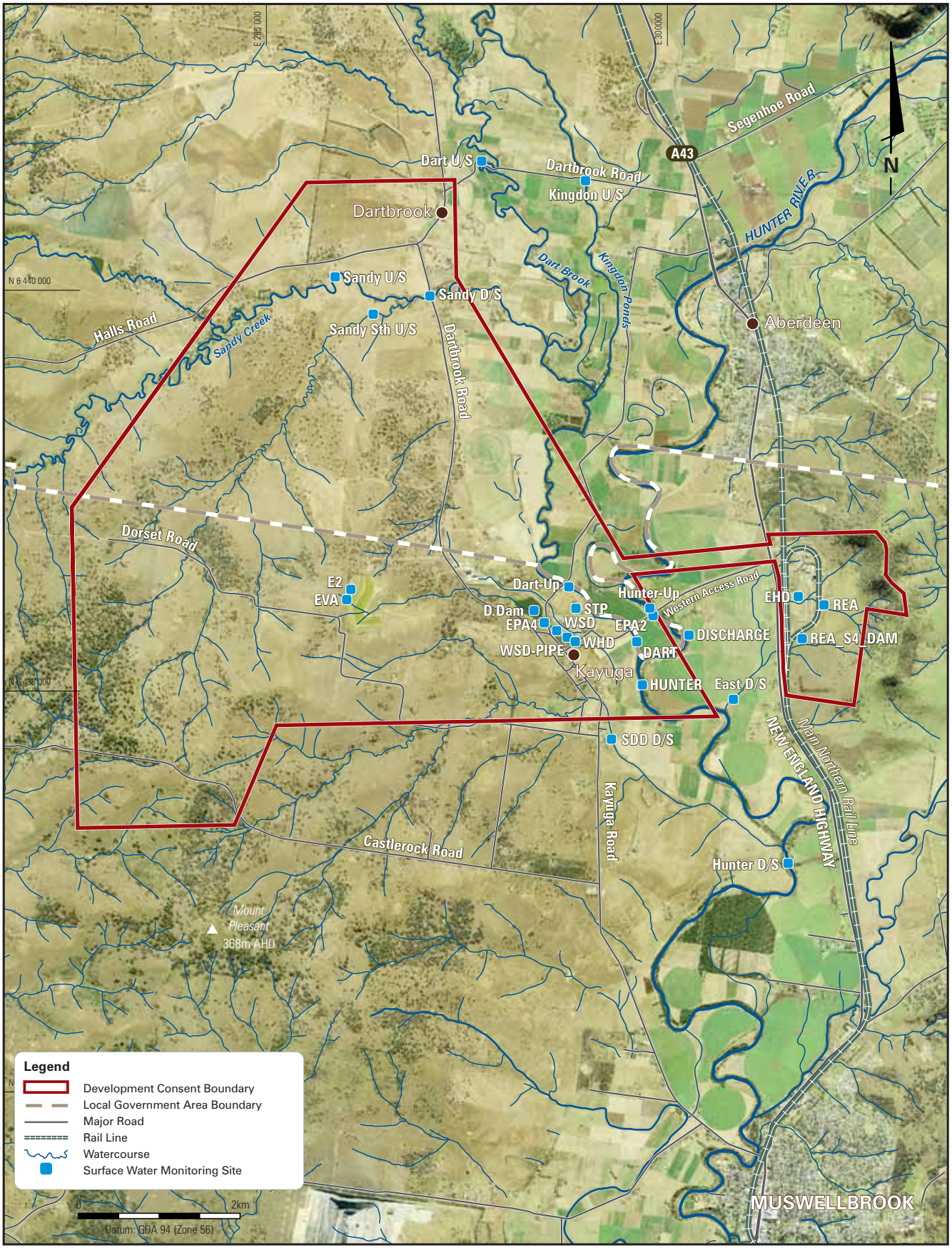
The water analyses include measurement of pH, EC, Alkalinity, Calcium, Chloride, Magnesium, Potassium, Sodium, Sulphates, Total Dissolved Solids (TDS) and Total Suspended Solids (TSS). Selected mine water dams are also tested for reactive phosphorus, Methylene Blue Active Substances (foaming agents),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

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

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.

All runoff from the East Site CHPP and disturbed surrounds eventually flows into the EHD. Water from the EHD is pumped onto 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 inspections. Inspections during the reporting period did not identify any non-compliances.



HB DARTBROOK Underground 2019 Annual Review HB1986 F11 Surface Water Monitoring Network 30 03 2020

DARTBROOK MINE

Surface Water Monitoring Network

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Australian Pacific Coal

FIGURE 13

7.3.2 Environmental Performance

The water quality results in **Appendix F** show that most of the on-site dams and storages recorded EC and TDS levels (and the associated anions and cations) that exceeded the relevant trigger levels in the SWMP. A review of the exceedances of SWMP investigation triggers in accordance with the contingency measures in the approved plan found that the surface water quality results generally reflects the quality of the dewatered groundwater or of surface runoff that has concentrated due to evaporation and low surface runoff. Given the ongoing dry conditions during the reporting period, there was very little surface runoff to dilute the water stored in these dams. These storages were operated to maximise the evaporation potential whilst maintaining a 50% to 70% freeboard to prevent spills in accordance with the SWMP.

As noted in **Section 7.1**, Dartbrook Mine did not discharge under the HRSTS during the reporting period. As a result, no monitoring at the discharge point was undertaken. All HRSTS monitoring and communications equipment continues to be maintained to ensure compliance with the relevant conditions of Dartbrook Mine's EPL.

Table 26 presents a summary of the water quality results for the Hunter River and Dart Brook for the reporting period.

Graph F1 and F3 in **Appendix F** shows that surface water monitoring results for EC, TDS (and their associated anions and cations) in the Hunter River were generally similar at both upstream and downstream sites and within the range of long-term data gathered for Dartbrook Mine. Hunter River monitoring results during the reporting period were within the trigger values specified in the SWMP.

For the Dart Brook, the upstream (DARTUP site) results for EC and TDS (and their associated anions and cations) were found to exceed the SWMP trigger levels during the reporting period. A review of these results found that the exceedances observed in 2019 were likely due to the ongoing low flow in the Dart Brook. The downstream (Dart(a) site) monitoring location in the Dart Brook is located within the vicinity of the Hunter River confluence, meaning that this site's recordings can be influenced by backflow from the Hunter River, hence the lower EC and TDS results observed in comparison to those recorded upstream. The pH levels for the Dart Brook upstream monitoring location were slightly higher than the downstream readings, but both stations recorded values consistent with historical levels and the respective trigger levels included in the SWMP.

7.3.3 Next Reporting Period

It is noted that there has been no underground mining activity at Dartbrook Mine during the reporting period and that drought conditions have prevailed in the region. The updated SWMP will be implemented in 2020 following the completion of the regulatory reviews required under the conditions of DA 231-07-2000.

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

Table 26
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	326 - 439	210 - 320	7.1 – 8.1
Hunter River Downstream	332 - 419	220 - 280	7.1 – 8.4
Dart Brook Upstream	1,663 – 5,640	1,110 – 3,780	7.6 – 8.5
Dart Brook Downstream	395 – 2,054	260 – 1,380	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 controls are 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 during the reporting period.

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 2019, only minor works for site erosion control and drainage structures were required to ensure that these continued to operate effectively. The pipe drainage system servicing the REA continued to function satisfactorily during the reporting period, with only minor maintenance required.

7.4.3 Next Reporting Period

Sediment structures will continue to be monitored during the next reporting period, and maintenance works carried out if required. Water runoff from disturbed areas will continue to be directed into sediment dams until areas are adequately revegetated with grass cover.

The requirements for the Erosions and Sediment Control Plan in DA 231-07-2000 were incorporated into the Site Water Management Plan for Care and Maintenance, which was updated for regulatory review in 2019. The updated SWMP will be implemented in 2020 following the completion of the regulatory reviews required under the conditions of DA 231-07-2000.

8 REHABILITATION

This section provides a summary of the rehabilitation activities and performance at Dartbrook Mine during the reporting period.

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 27**. No additional rehabilitation was undertaken during the reporting period. The rehabilitation maintenance activities undertaken during the reporting period are outlined in **Table 28**.

The REA was covered, topsoiled and seeded in 2007. The REA continued to be monitored during the reporting period. Since establishment, the REA rehabilitation area has developed land capability characteristics similar to open grassland, suitable for cattle grazing.

During the reporting period, no surface rehabilitation works were required above previously mined longwalls and no subsidence issues were identified (see **Section 6.12**).

8.3 OTHER INFRASTRUCTURE

No structural rehabilitation work was undertaken in 2019.

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. 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.

Monitoring and maintenance activities of the River Restoration Project area continued during the reporting period. The main maintenance activities included weed spraying within the River Restoration Project areas.

Monitoring and maintenance of the River Restoration Project area will continue in the next reporting period.

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.

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, which allows native and naturalised grasses to dominate. Grazing in these areas in 2019 was limited due to the drought conditions that prevailed during the reporting period.

8.4.3 River Red Gum Restoration

An experimental study was established in 2007 by the Hunter Central Rivers Catchment Management Authority (HCRCMA) and Dartbrook Mine on a remnant patch of River Red Gum woodland present on the floodplain of the Hunter River.

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 Gum woodland within the restoration area continued to develop during the reporting period, despite the prevailing drought conditions over much of the year. Regular inspections of the River Red Gum Restoration will continue in 2020.

Table 27

Rehabilitation Status

Mine Area Type	Area Affected / Rehabilitated (ha)		
	Prev Reporting Period (End 2018)	This Reporting Period (End 2019)	Next Reporting Period (End 2020)
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)	1	0	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

Mine Area Type	Area Affected / Rehabilitated (ha)		
	Prev Reporting Period (End 2018)	This Reporting Period (End 2019)	Next Reporting Period (End 2020)
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 28

Maintenance Activities on Rehabilitated Land

Nature of Treatment	Area Treated (ha)		Comment / control strategies / treatment detail
	Report period (2019)	Next period (2020)	
Additional erosion control works (drains re-contouring, rock protection)	<1-20		Maintenance works may be required if settlement or erosion has occurred.
Re-covering (detail - further topsoil, subsoil sealing etc.)	0		No re-covering of the REA erosion control contour banks was required during the reporting period.
Soil treatment (detail - fertiliser, lime, gypsum etc.)	0		No additional gypsum and fertilizer to the REA erosion control contour banks during the reporting period.
Treatment/management (detail - grazing, cropping, slashing etc.)	0		Continued controlled grazing of Wattus Ponds area. Grazing was not undertaken on the REA in 2019 due to drought conditions.
Re-seeding/replanting (detail - species density, season etc.)	<1		Minor maintenance of disturbed REA erosion control contour banks areas was required during the reporting period.

Nature of Treatment	Area Treated (ha)		Comment / control strategies / treatment detail
	Report period (2019)	Next period (2020)	
Adversely affected by weeds (detail - type and treatment)	~20		The following weeds were controlled by spraying or slashing during reporting period: African Boxthorn, Liverseed Grass, Prickly Pear, Green Cestrum and Galenia. The weed control program will continue in the next reporting period.
Feral animal control (detail - fencing, trapping, baiting etc.)	10		Kangaroo culling was undertaken (with the approval of the National Parks and Wildlife Service) in 2019 and will continue in the next reporting period.

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 area has also been successful at achieving the additional objectives of establishing a biodiversity corridor, providing fauna habitat and stabilising the soil however, long term trends cannot be determined at this point.

Monitoring of the plantation will continue to be undertaken in 2020.

8.4.5 Sustainable Cattle Grazing Trial

Grazing of cattle on the REA was not carried out due to the ongoing drought conditions in 2019. AQC will review opportunities to recommence grazing in this area the next reporting period once pasture conditions improve.

8.5 NEXT REPORTING PERIOD

Dartbrook Mine will continue to undertake rehabilitation maintenance activities as required. These activities may include weed control, feral animal control and erosion management works.

Dartbrook Mine will also continue regular inspections of the areas associated with the River Restoration Project, River Red Gum Restoration Project and Forestry Plantation.

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.

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 contact number continues to be advertised on the AQC website and provided to CCC members during meetings.

9.1.2 Complaints

Two environmental complaints were received during the reporting period. These complaints were received in relation to water (reported loss of water inflows at a private bore) and night lighting (reported impacts to a landholder located to the east of the CHPP). Both complaints were followed up with the complainant and investigated. In both cases, the reported impacts were confirmed as not being related to Dartbrook Mine Care and Maintenance activities.

9.2 COMMUNITY LIAISON

9.2.1 Dartbrook Community Consultative Committee

Since 2006, three CCC meetings per year have been held. Due to the assessment and determination of MOD7 during the reporting period, four CCC meetings were held in 2019.

CCC members comprise of community representatives from MSC and UHSC, council staff and community representatives.

The council representatives for 2019 were Cnr Kiwa Fisher (UHSC representative), Paul Smith (UHSC staff representative) and Sharon Pope (MSC staff representative).

The 2019 community representatives on the CCC were Arthur Mitchell, Annette Rahn, Tony Lonergan, Jennifer Lecky and Noel Downs (also representing the Wanaruah Local Aboriginal Land Council).

Table 29 lists the dates of meetings held during 2019 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 provided to the CCC at each meeting.

A copy of this Annual Review will be provided to all CCC representatives following distribution to regulatory agencies.

Table 29
Summary of Topics Discussed During CCC Meetings in 2019

Date	Topics Discussed
13/02/2019	• Progress update on the Underground Modification (MOD7) proposal, including: o Confirmation on the scope and layout of activities proposed o Discussion on the findings of the DPIE Assessment Report o Process and anticipated timing for the Independent Planning Commission panel assessment of the MOD7 • Update on AQC strategic partnership with SNR • Endorsement by DoI-Water of surface water monitoring locations proposed in 2018
15/05/2019	• Distribution of latest Dartbrook community newsletter in March 2019 • Investigation of two community complaints received since the previous CCC meeting • Formal change to MSC representation on the CCC • Discussion on the Underground Modification (MOD7) proposal, including: o General discussion on the assessment of MOD7 by the IPC o IPC consultation with MSC over Hunter River flood levels in the vicinity of infrastructure proposed for MOD7 o Consideration of Scope 3 GHG impacts from MOD7 o AQC response to questions raised by Friends of the Upper Hunter • Update on AQC strategic partnership with SNR • Management of stocking rates, weeds and feral animals on AQC land held by lessees • Review of the Mine Affected Roads Strategy by MSC
14/08/2019	• Scope and pre-audit consultation requirements for the upcoming Dartbrook Independent Environmental Audit • Termination of the proposed strategic partnership between AQC and SNR • Questions regarding the financial performance and viability of AQC • Discussion on the Underground Modification (MOD7) proposal, including: o Implications of the IPC determination of MOD7, including the refusal of the proposed five-year extension to the life of the development o Potential avenues available to AQC for appeal against the determination
13/11/2019	• Responses to questions on AQC the financial performance and viability raised at the previous CCC meeting • Discussion on AQC announcement of an appeal against the IPC determination of MOD7 and general process likely for such an appeal • The potential for AQC to lodge a further Modification in light of the key element of MOD7 being refused by the IPC • Questions on future use of AQC landholdings if further mining did not take place. • Development of a Mine Closure Plan • Completion of the 2019 Independent Environmental Audit

9.2.2 Community Participation

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

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.

No significant changes to workforce characteristics are expected for the continuation of Care and Maintenance into the next reporting period.

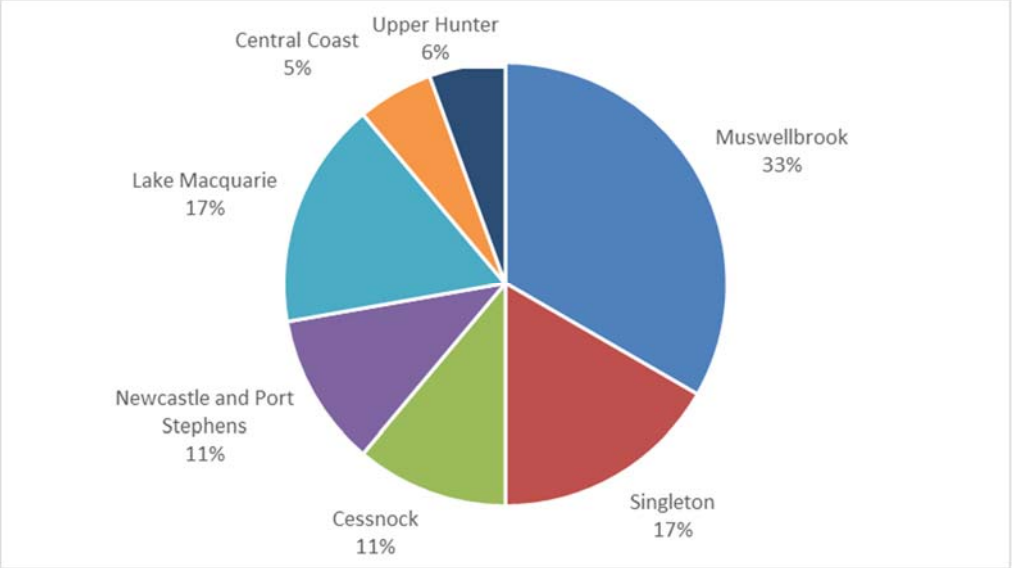


Figure 14
Breakdown of Current Workforce by Place of Residence

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 a number of tenants who occupy residences on AQC land surrounding the mine site.

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 can currently support up to 700 head of cattle.

10 INDEPENDENT ENVIRONMENTAL AUDIT

In accordance with the requirements of DA 231-07-2000 (MOD6), an Independent Environmental Audit (IEA) was undertaken during the reporting period by SLR Consulting. The IEA reviewed the compliance of Dartbrook Care and Maintenance activities against key site approvals, leases and licences over the period from 13 July 2016 to 9 August 2019. The site review component of the audit was undertaken in August 2019 and the IEA Report provided to DPIE on 18 October 2019. The IEA Report noted the following:

- Two low risk non-compliances (related to air quality and groundwater issues);
- Six administrative level non-compliances;
- Recommendations for future management of the site, based on a field review of the site and auditing of compliance records for the audit period;
- Overall, the site had a high degree of compliance with key statutory approvals which were assessed as part of the IEA;
- The majority of non-compliances were administrative non-compliances, which were minor in nature; and
- The site has been well maintained during Care and Maintenance, with record keeping at the site being of a high standard.

The IEA Report and AQC Response Plan prepared to respond to the non-compliances and recommendations identified by the auditors is available on the on the Dartbrook website. An update on the progress made against the actions identified in the AQC Response Plan will be included in the next Annual Review.

Under the conditions of DA 231-07-2000 approved for MOD7, the next IEA is required to be undertaken within one year of the recommencement of mining operations on site.

11 ENVIRONMENTAL INCIDENTS & NON-COMPLIANCES

This section describes any environmental incidents or non-compliances that occurred during the reporting period.

11.1 ENVIRONMENTAL INCIDENTS

There were no reportable environmental incidents during the reporting period.

11.2 ENVIRONMENTAL NON-COMPLIANCES

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

A summary of the environmental non-compliances identified during the reporting period and where they have been discussed in this document is provided in **Section 1**.

12 ACTIVITIES PROPOSED IN THE NEXT REPORTING PERIOD

The activities proposed to be undertaken in 2020 are summarised in **Table 30**. Further details on the proposed activities are provided in **Section 6** and **Section 7**.

Table 30
Dartbrook Mine Environmental Management Activities Proposed for 2020

Area	Proposed Activity
Operational	• AQC will continue to consult with NSW regulatory agencies on the appeal over the determination of DA 231-07-200 (MOD7) determination; • AQC will review and update the Dartbrook EMS prior to any recommencement of mining operations.
Air Quality	• Dust mitigation and control activities will be employed onsite, where required; • Air Quality monitoring will continue onsite in accordance with the DMP.
Erosion and Sediment	• Sediment structures will continue to be inspected and maintained where required; • Water runoff from previously disturbed areas will continue to be directed into sediment dams; • Implementation of the revised SWMP following regulatory review and approval.
Surface Water Management	• Monitoring will continue in accordance with the SWMP; • Implementation of the revised SWMP following regulatory review and approval.
Ground Water Management	• Groundwater monitoring will continue in accordance with the frequencies and parameters listed in the SWMP; • Implementation of the revised SWMP following regulatory review and approval.
Rehabilitation	• Ongoing monitoring of rehabilitation areas on site, with maintenance work as required; • Commence review of Dartbrook Mine Closure Plan.
Threatened Flora and Fauna	• Fauna and flora communities will be managed in accordance with the approved Flora and Fauna Management Plan; • In circumstances where clearing is required, the Permit to Disturb system will continue to be implemented; • Inspections of the River Restoration, River Red Gum and Forestry Plantation areas will continue in 2020.
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).

Area	Proposed Activity
Aboriginal Heritage	• The existing Permit to Disturb system will continue to be implemented prior to commencing ground disturbance activities such as exploration and rehabilitation.
European Heritage	• Ongoing maintenance of European heritage items as required, in consultation with regulatory agencies.
Spontaneous Combustion	• REA thermocouple temperatures will continue to be monitored.
Bushfire	• Fuel loads across the site will continue to be monitored and managed as required.
Mine Subsidence	• Surface inspections of previous mine subsidence areas will continue to determine if further remediation actions are 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	• Ongoing management and monitoring of waste generated on site.
Gas drainage / Ventilation	• Monitoring of gas emissions from the mine will continue.
Public Safety	• Full-time onsite caretakers will remain on site; • Fences will be maintained and gates will remain locked and secured, as required; • Vegetation slashing on the mine access road will continue, as required.
REA Rehabilitation	• Investigate reintroduction of cattle grazing on Rehabilitated REA, weather conditions permitting.

APPENDIX A

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

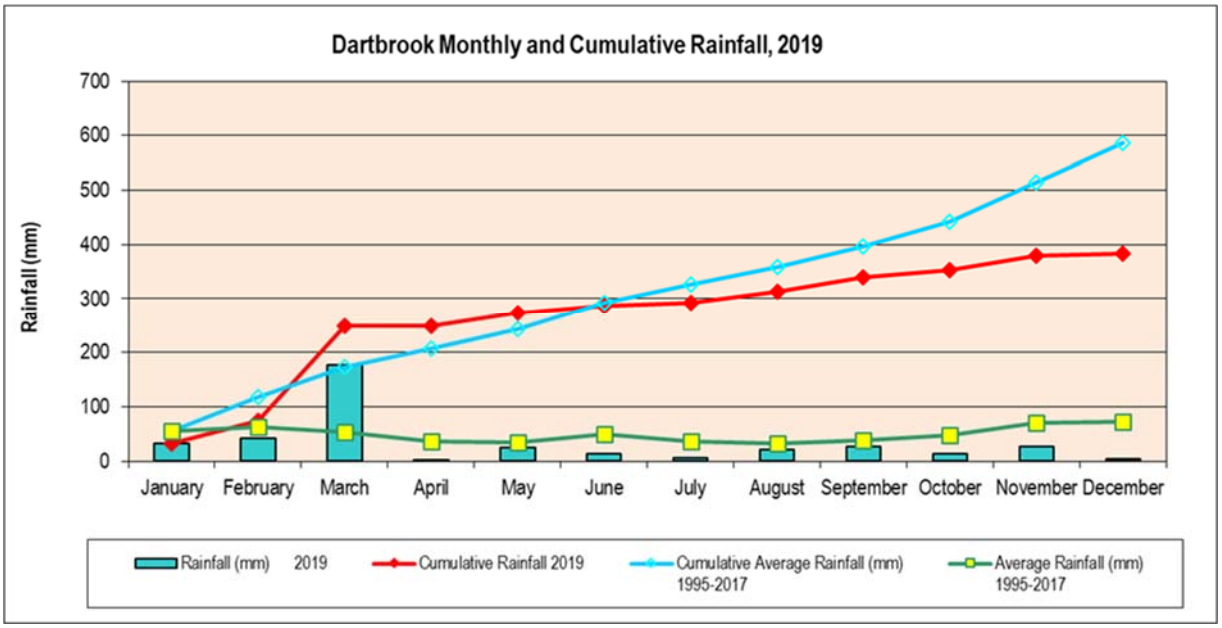
Table 1
Summary of minor amendments to Development Consent conditions during Care and Maintenance

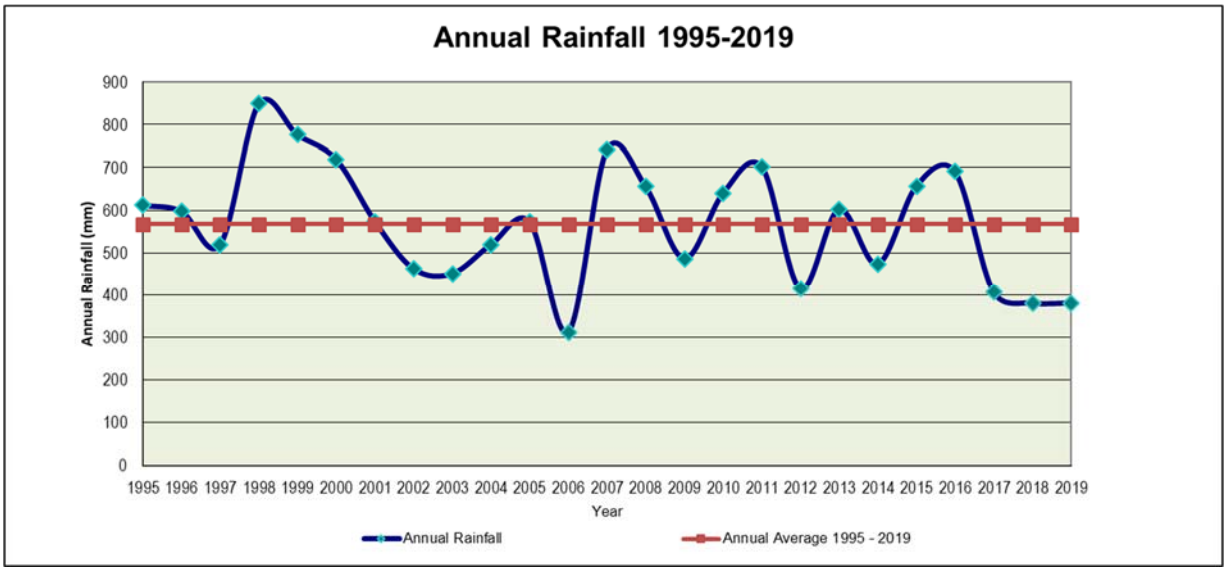
Approval Document Reference	Development Consent No. Reference	Existing Requirement	Requirement During Care & Maintenance
Complaints protocol & Environmental Management Strategy	10.2a (ii)	6 monthly complaints report to DoP (now DPE), MSC, UHSC, EPA, DPI-MR (now DRG) and Dartbrook Community Consultative 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.

Approval Document Reference	Development Consent No. Reference	Existing Requirement	Requirement During 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.
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.

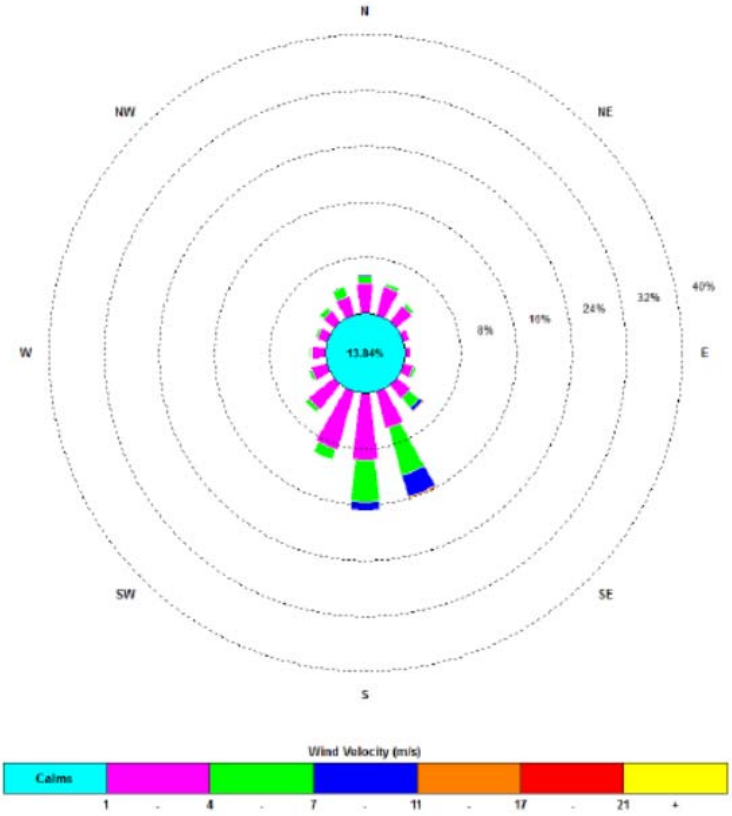
APPENDIX B

Meteorological Summary

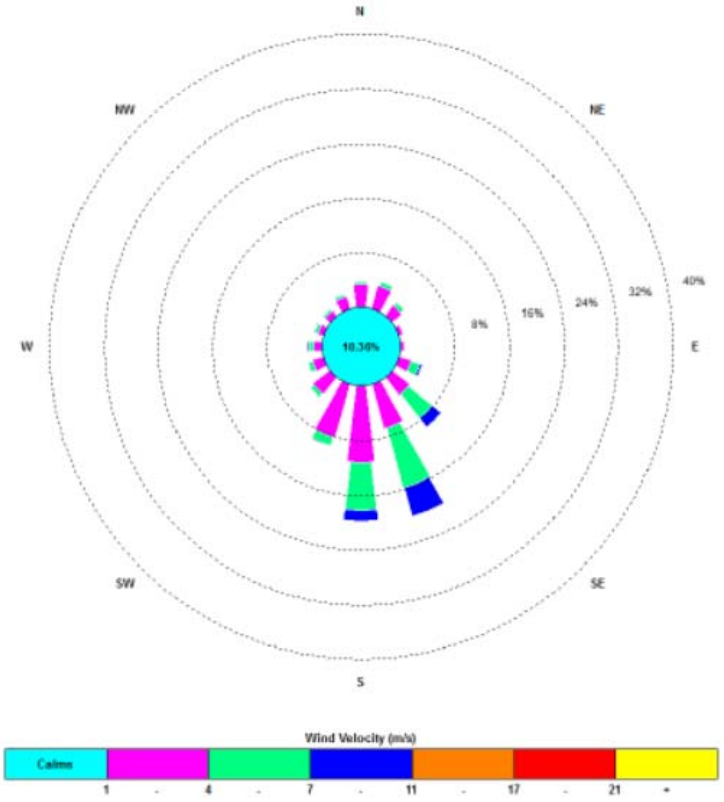

Dartbrook Monthly and Cumulative Rainfall, 2019
Rainfall (mm)
700
600
500
400
300
200
100
0
January
February
March
April
May
June
July
August
September
October
November
December
Rainfall (mm) 2019
Cumulative Rainfall 2019
Cumulative Average Rainfall (mm) 1995-2017
Average Rainfall (mm) 1995-2017


Annual Rainfall 1995-2019
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 2018 2019
Year
Annual Rainfall
Annual Average 1995 - 2019

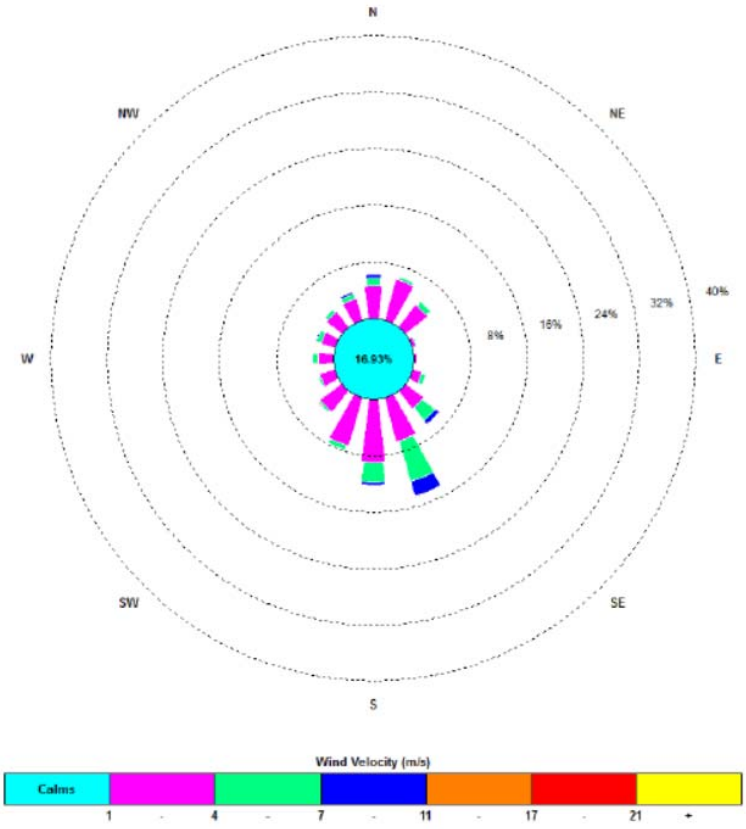
January 2019



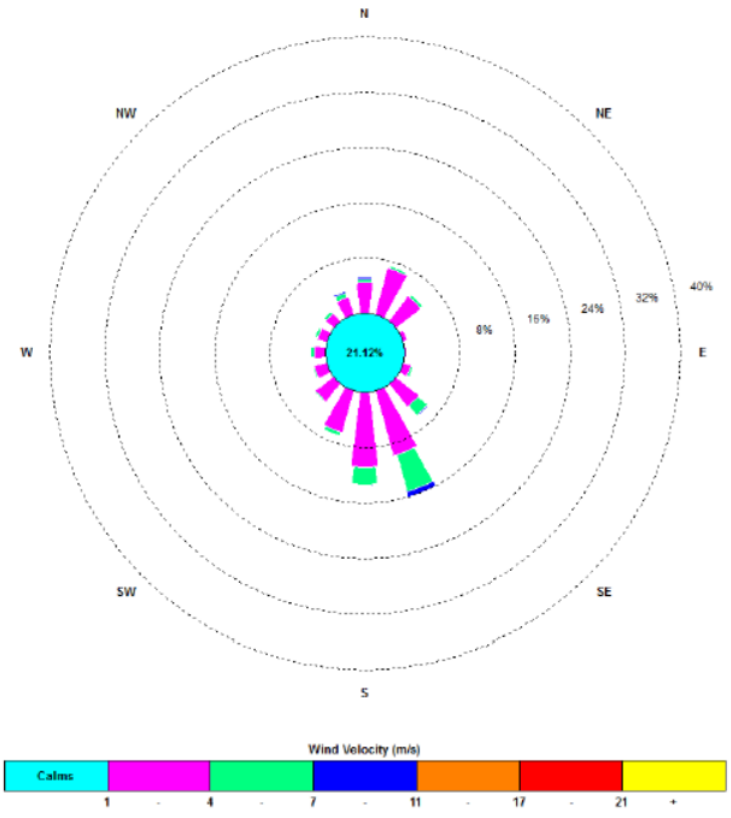
February 2019



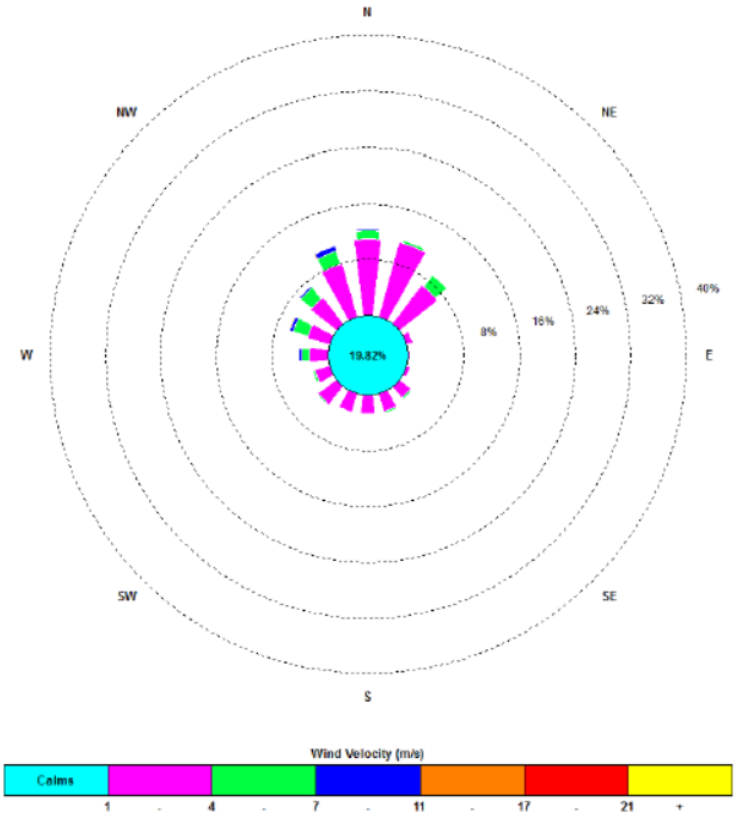
March 2019



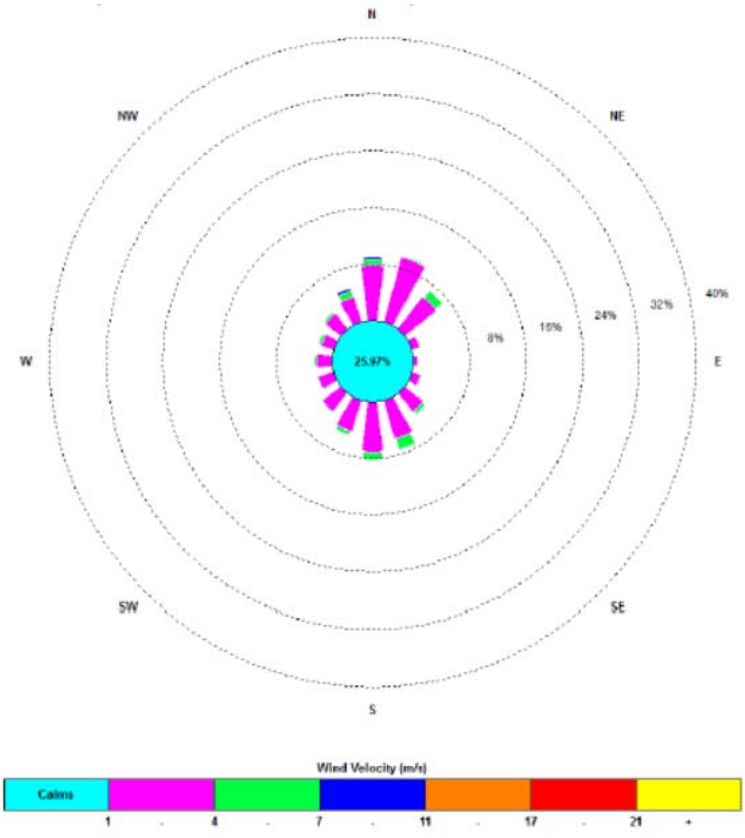
April 2019



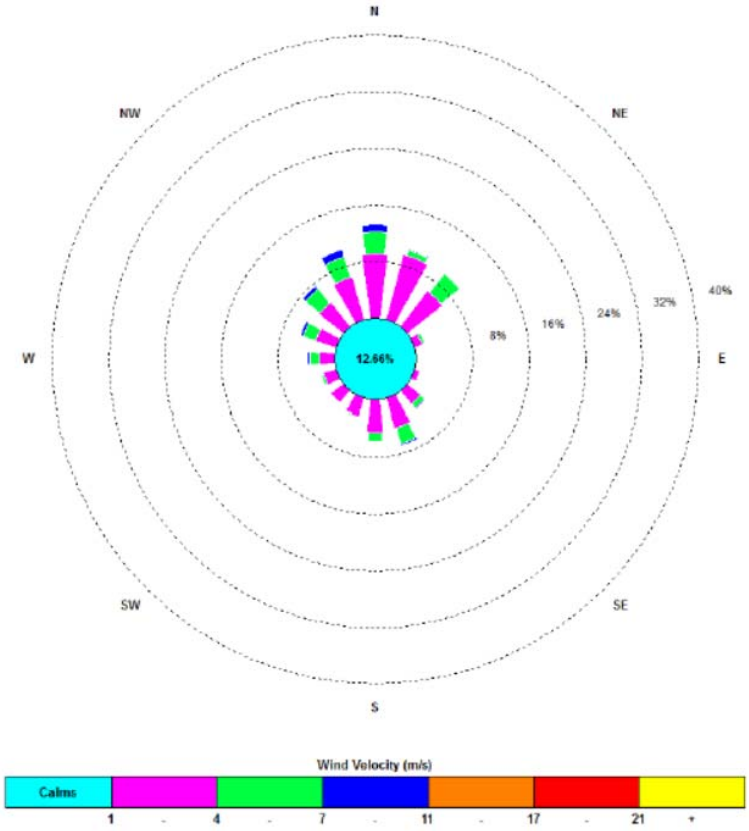
May 2019



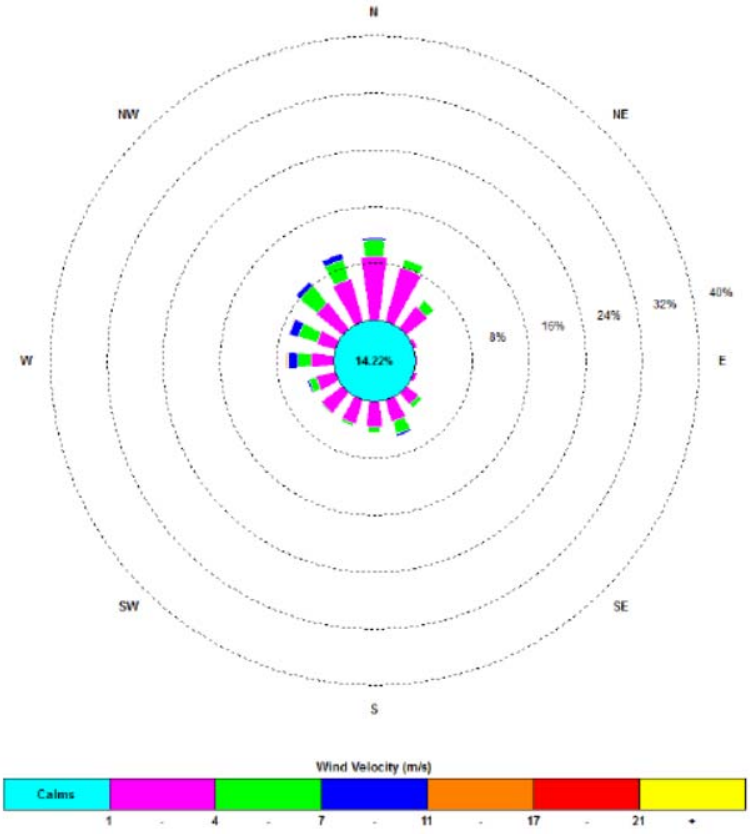
June 2019



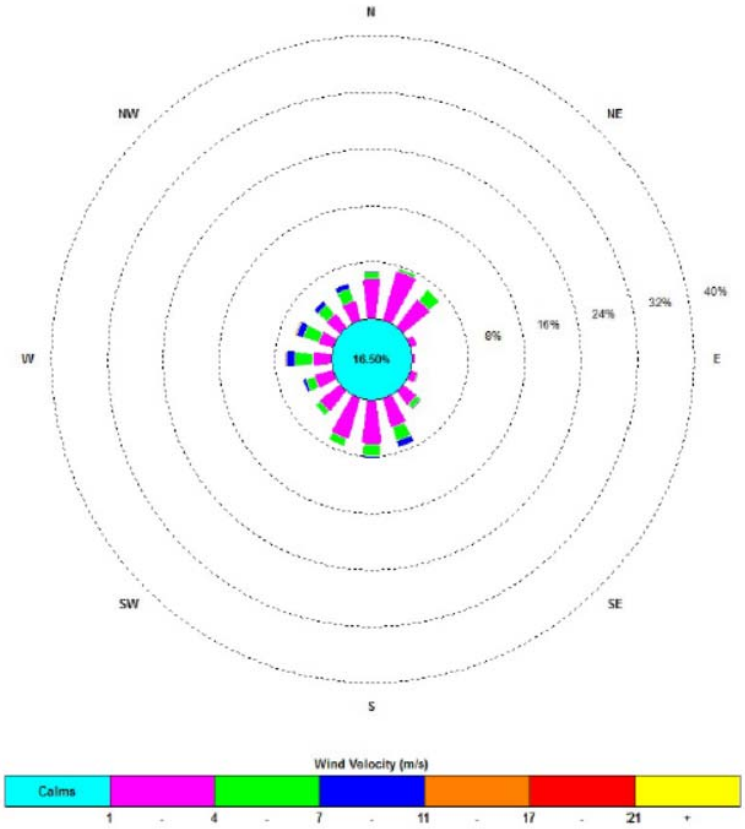
July 2019



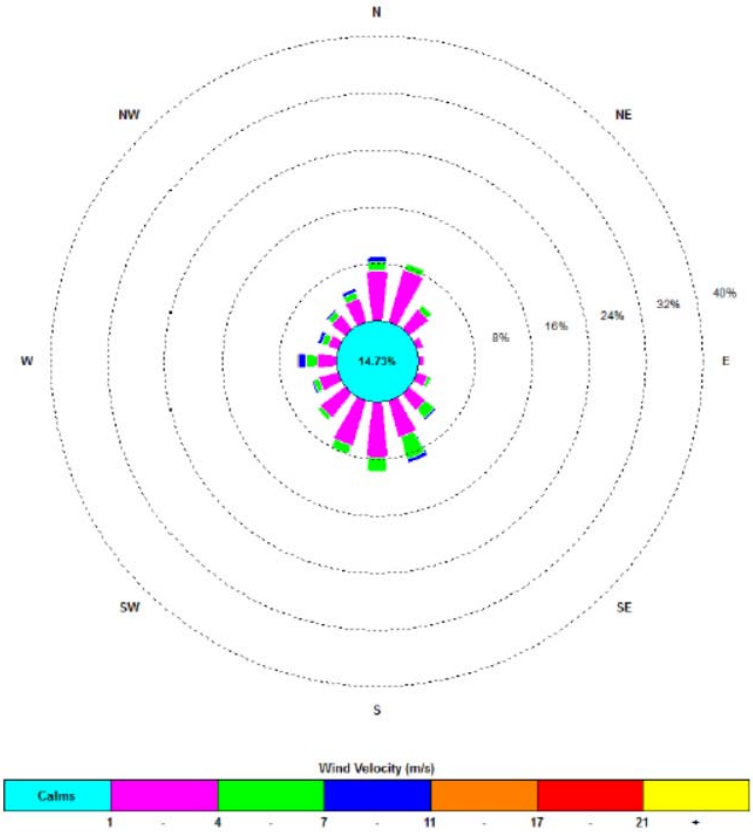
August 2019



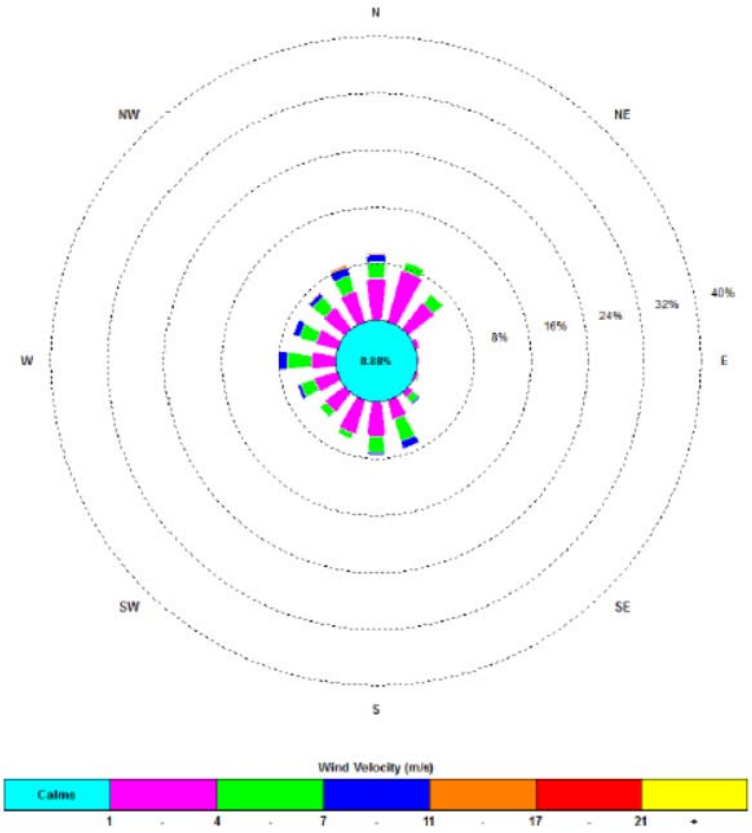
September 2019



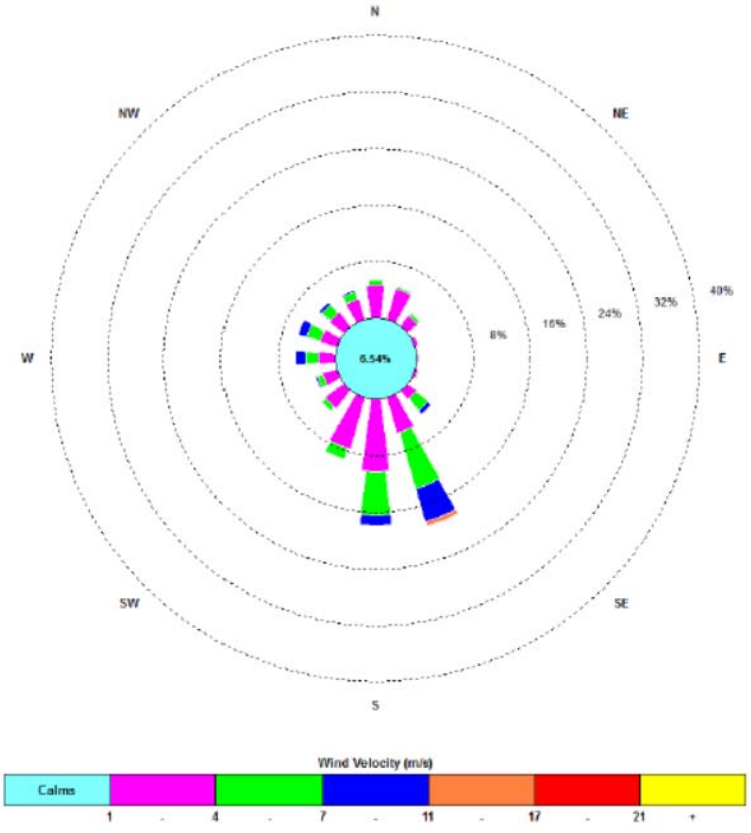
October 2019



November 2019

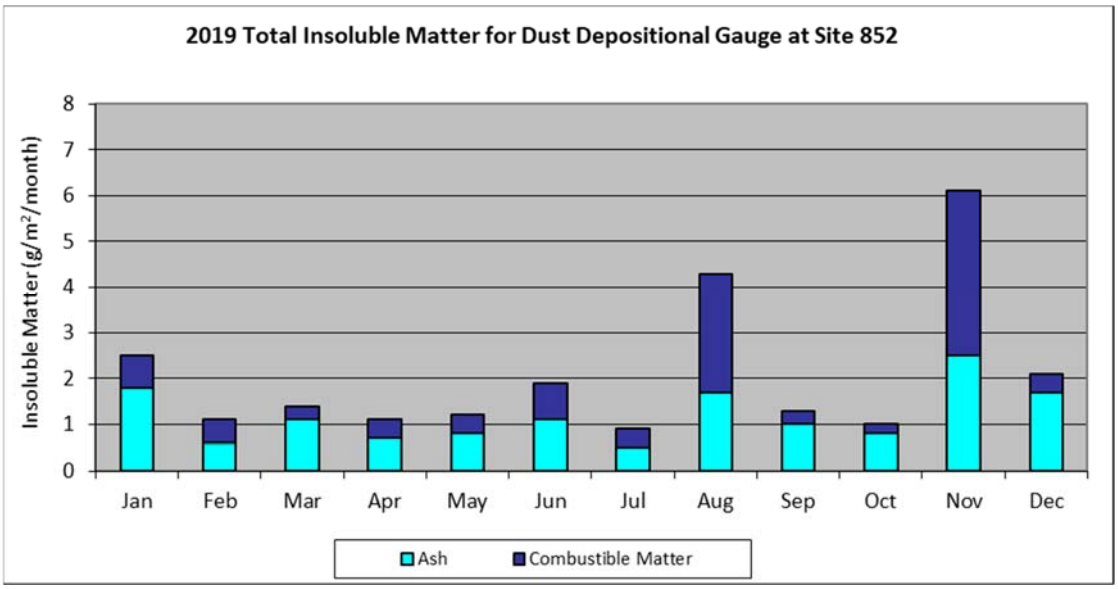


December 2019

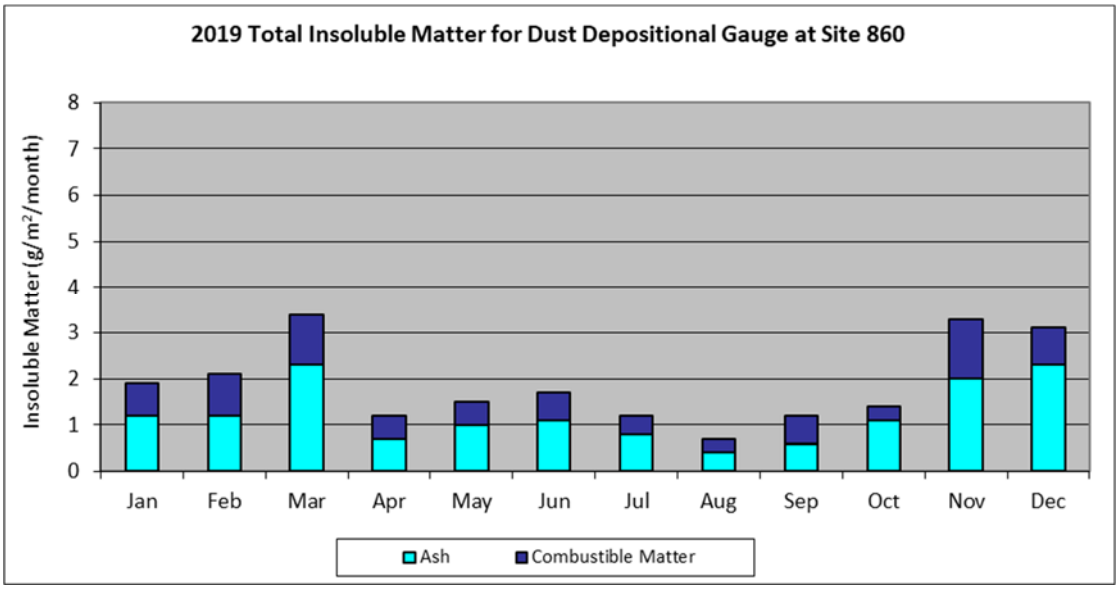


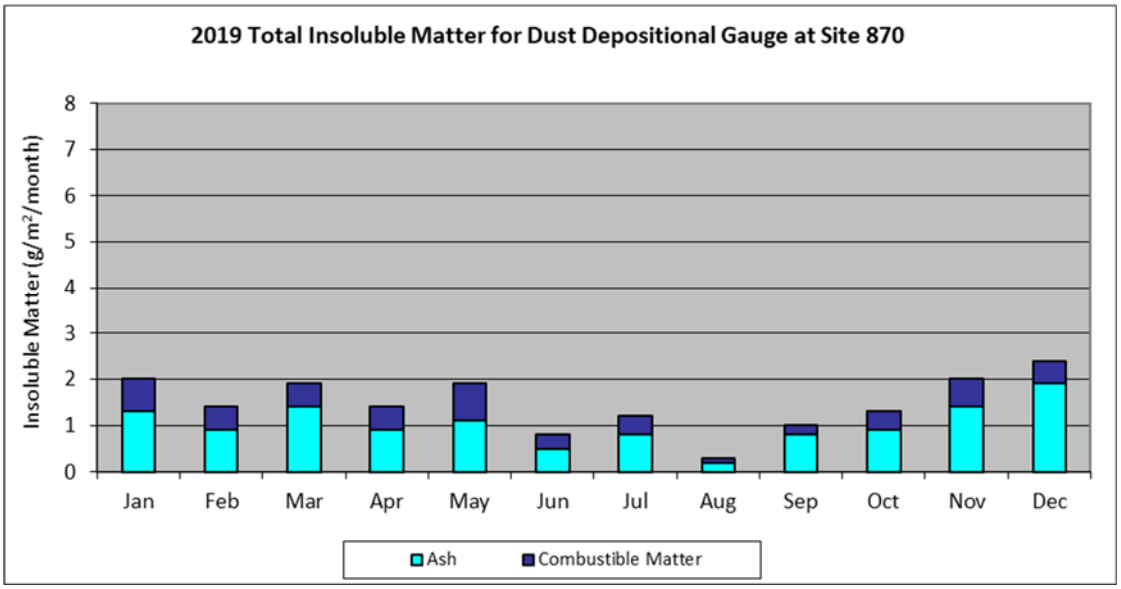
APPENDIX C

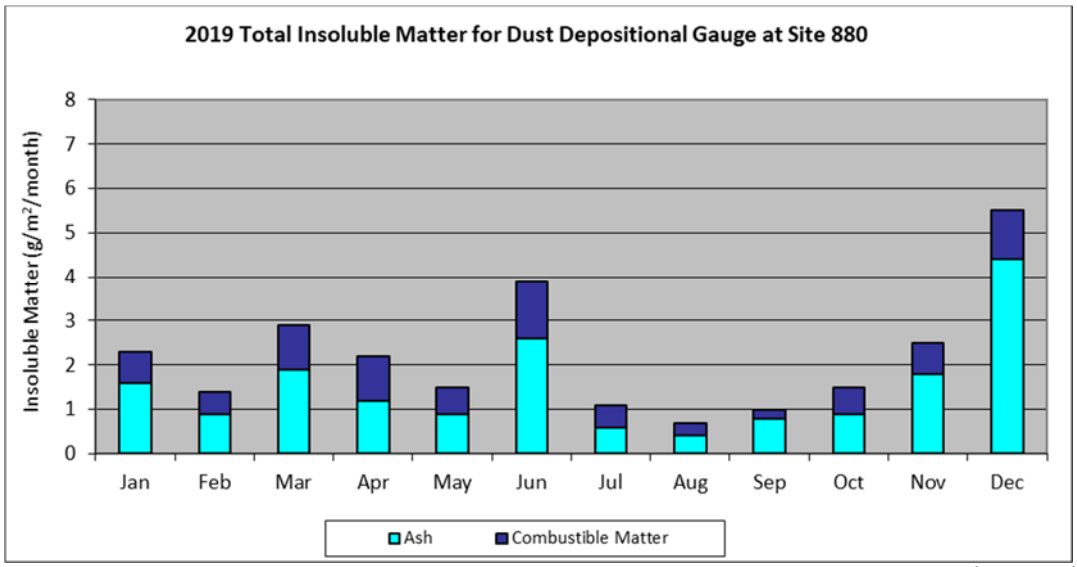
Air Quality Monitoring Summary



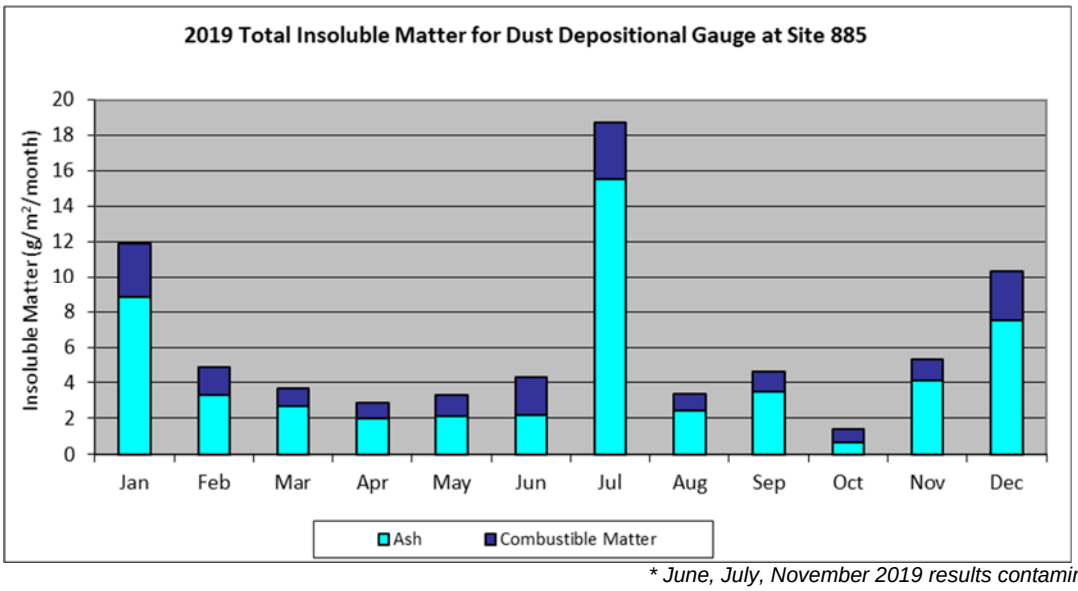
** August, November 2019 results contaminated*



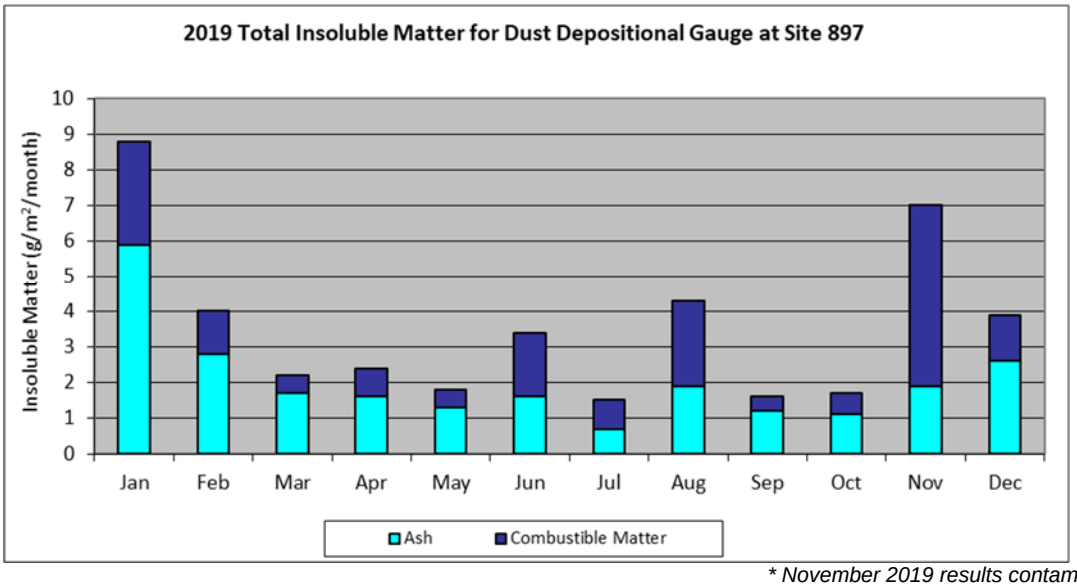




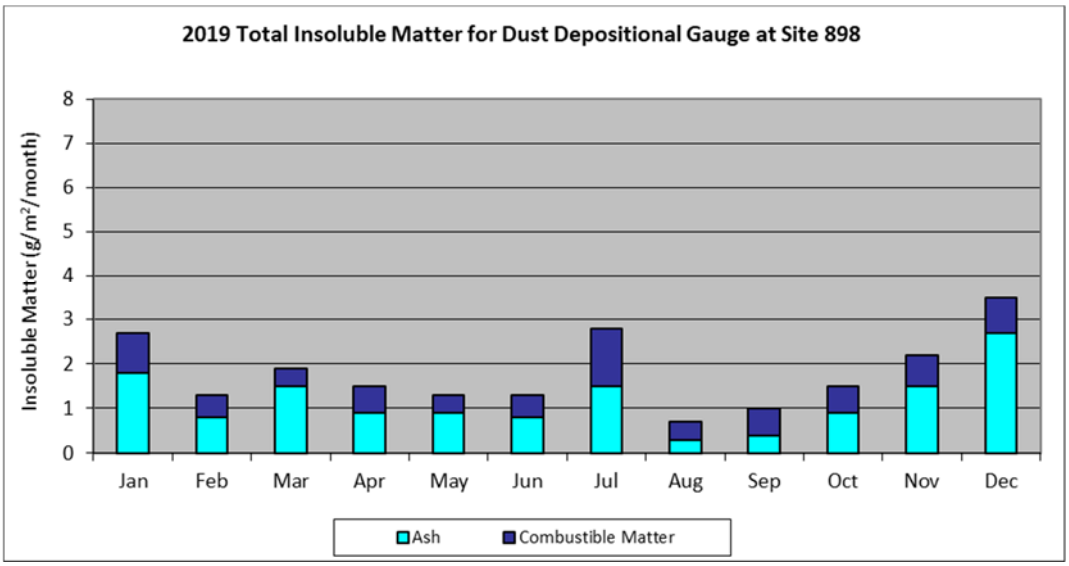
** June 2019 results contaminated*

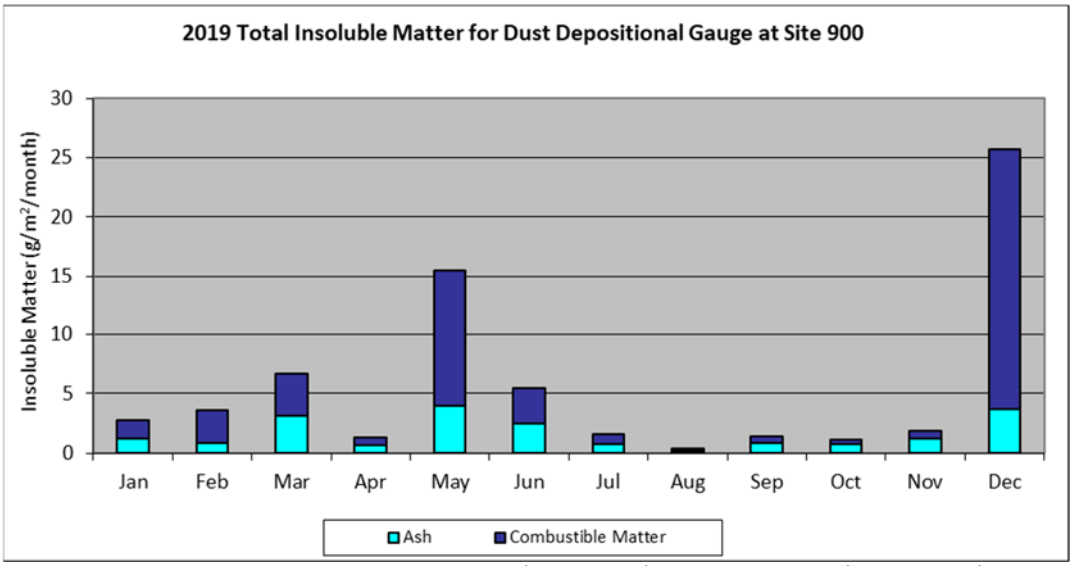


** June, July, November 2019 results contaminated*

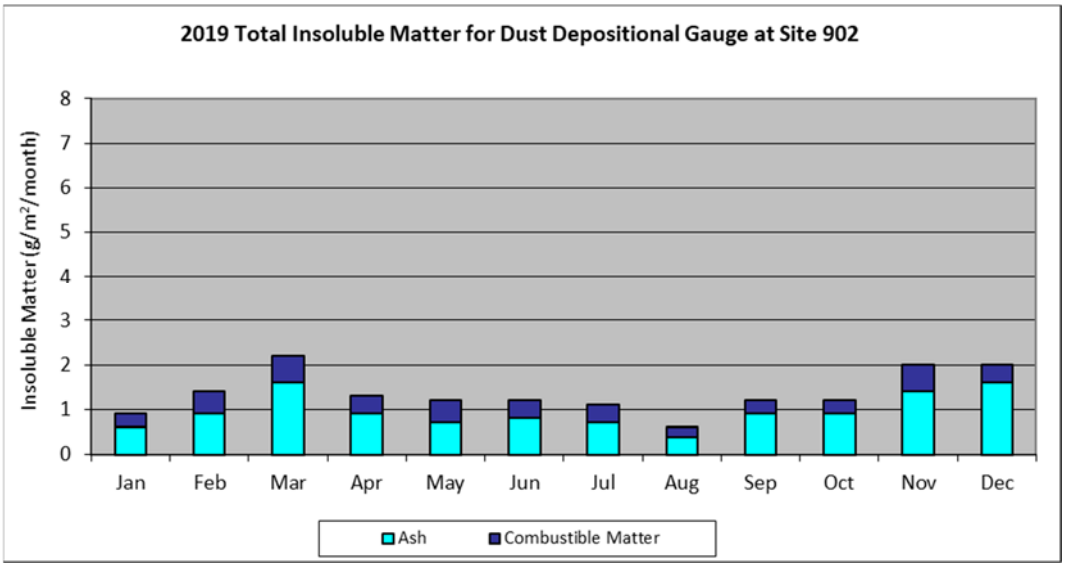


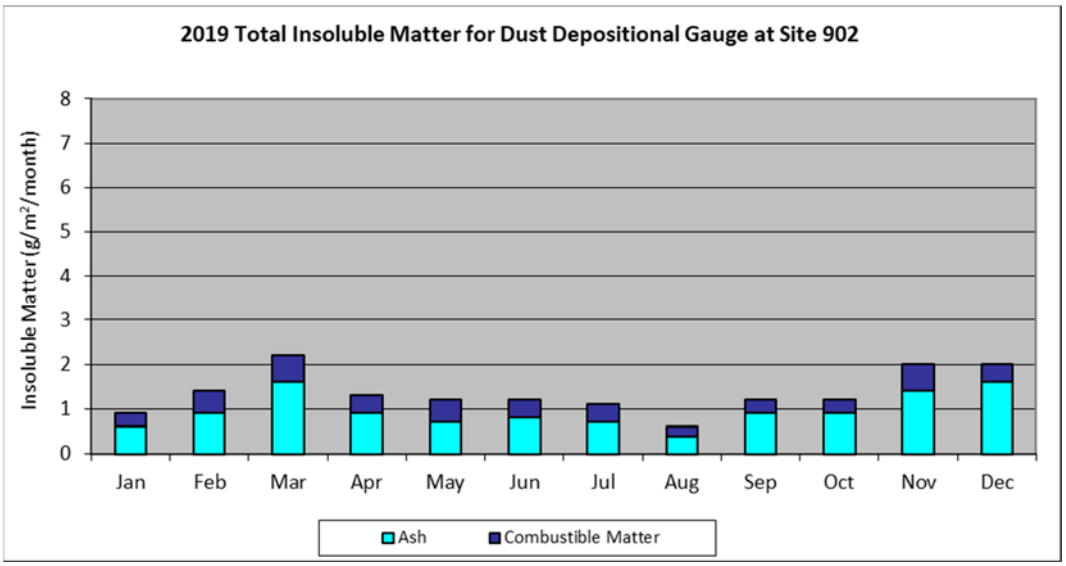
** November 2019 results contaminated*

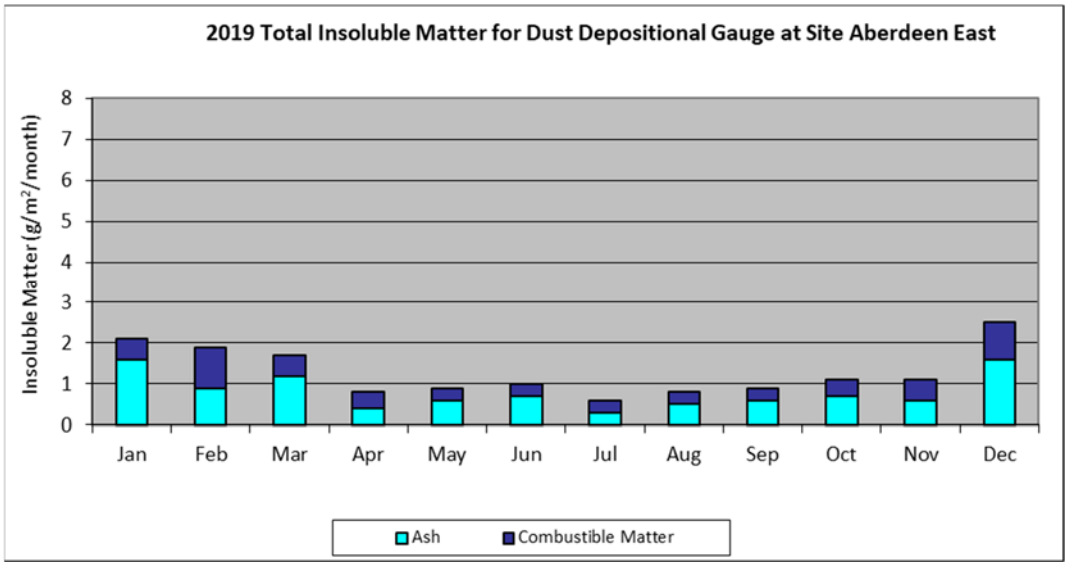


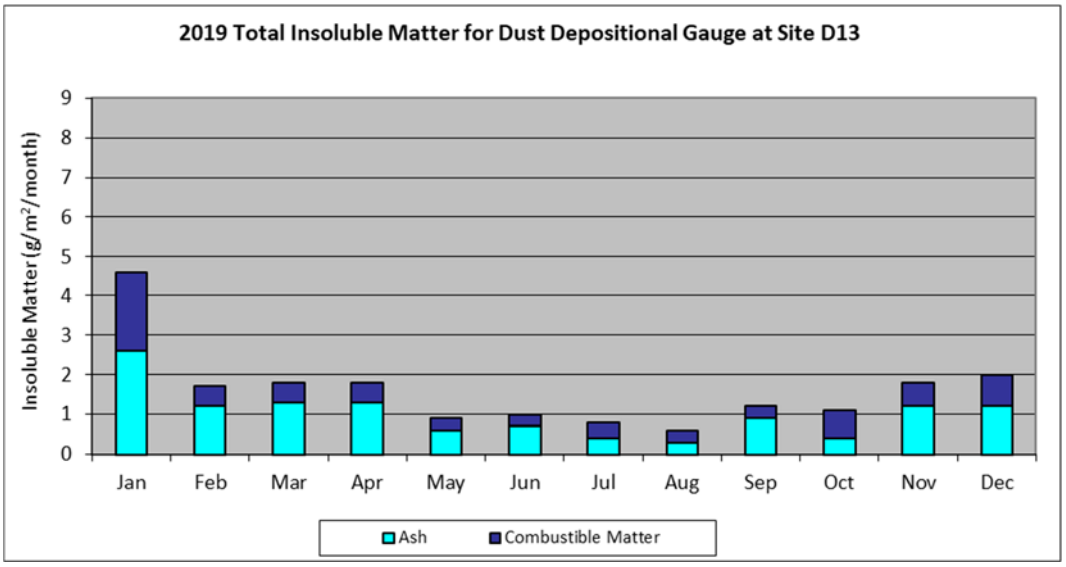


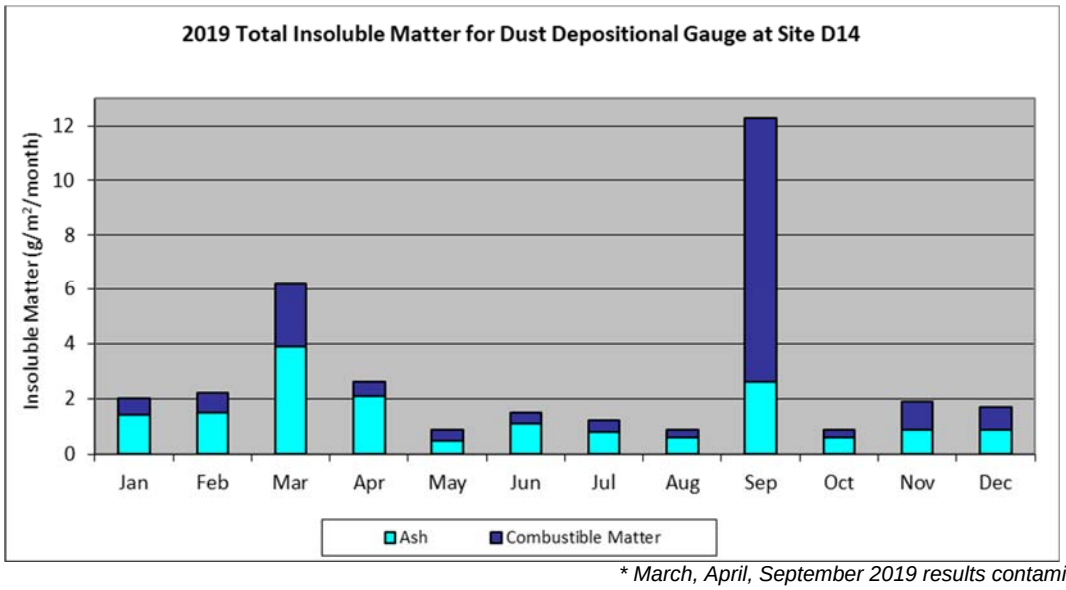
** February, March, May, June, December 2019 results contaminated*



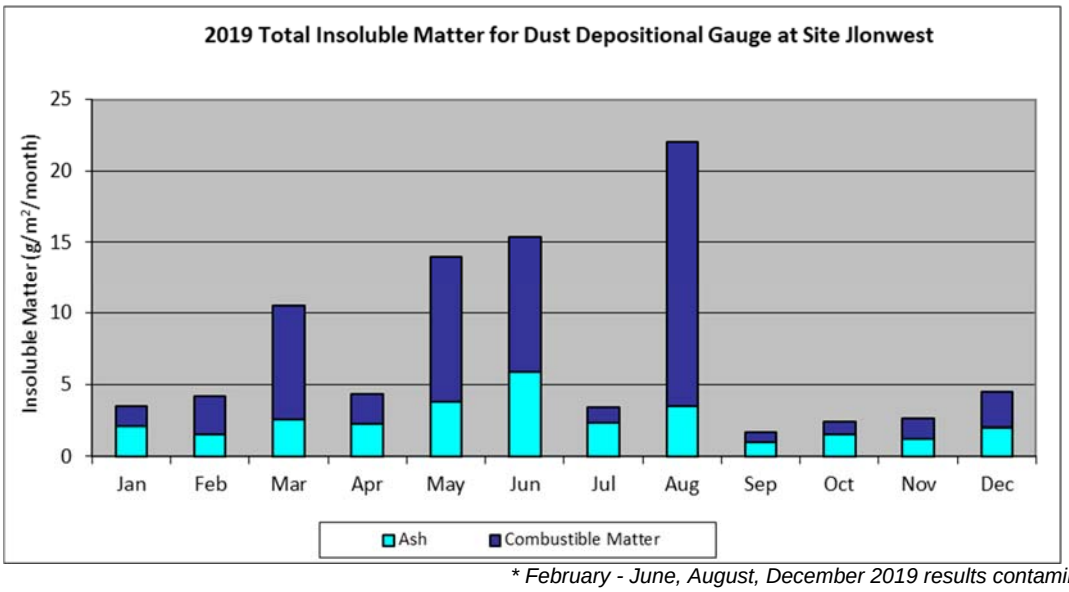

2019 Total Insoluble Matter for Dust Depositional Gauge at Site 902
Insoluble Matter (g/m²/month)
0
1
2
3
4
5
6
7
8
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Ash
Combustible Matter


2019 Total Insoluble Matter for Dust Depositional Gauge at Site Aberdeen East
Insoluble Matter (g/m²/month)
0
1
2
3
4
5
6
7
8
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Ash
Combustible Matter

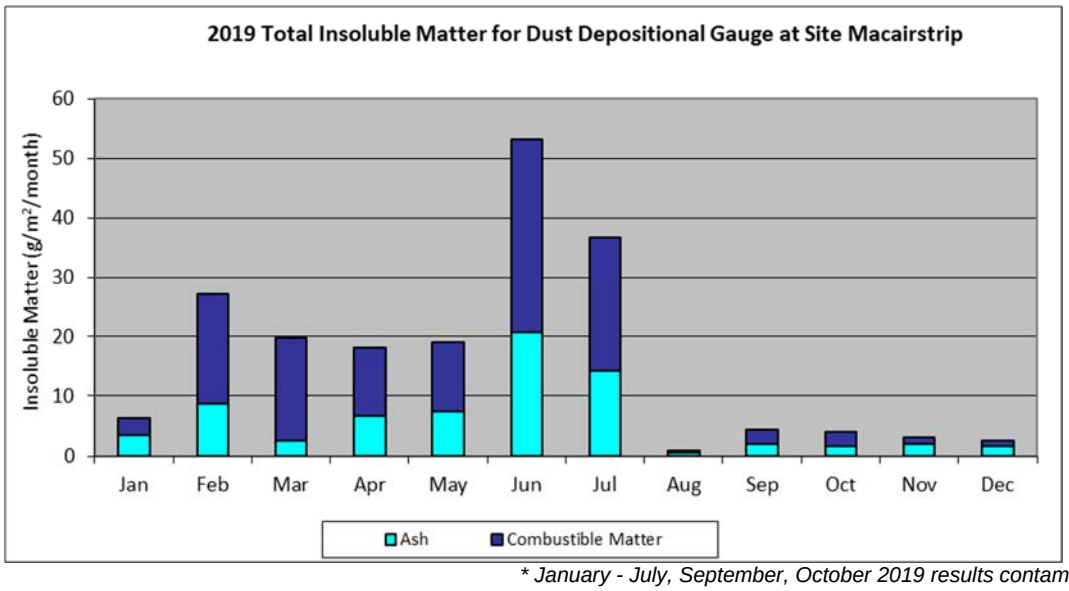

2019 Total Insoluble Matter for Dust Depositional Gauge at Site D13
Insoluble Matter (g/m²/month)
0
1
2
3
4
5
6
7
8
9
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Ash
Combustible Matter



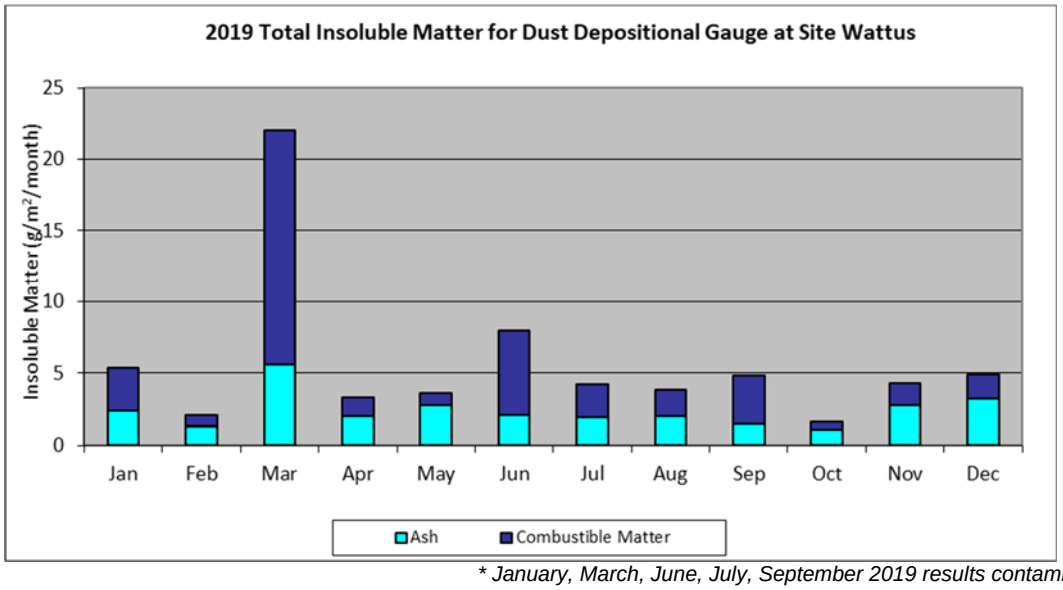
** March, April, September 2019 results contaminated*



** February - June, August, December 2019 results contaminated*



** January - July, September, October 2019 results contaminated*



** January, March, June, July, September 2019 results contaminated*

Table C1
Elevated & Contaminated Monthly Depositional Dust Results in 2019

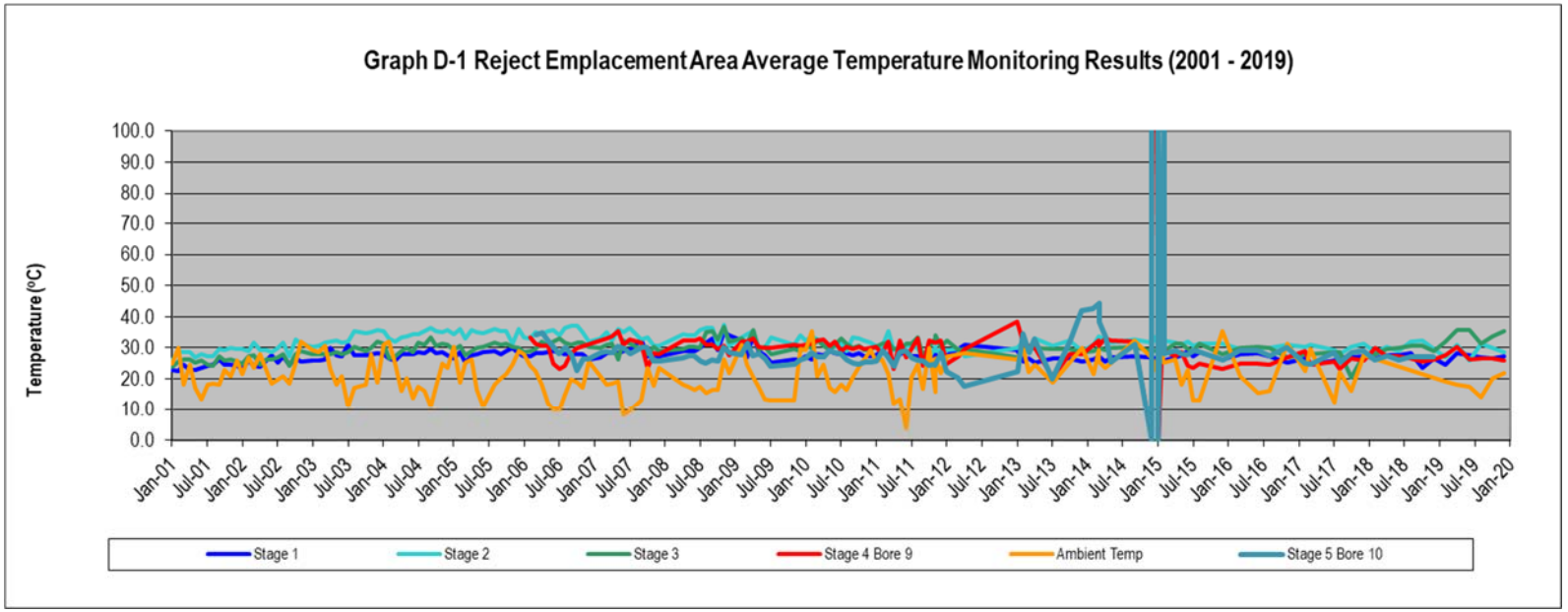
Site	Date	Insoluble Solids (g/m2/month)	Combustible Matter (g/m2/month)	Ash Component (g/m2/month)	Reason for high reading
852	5/08/19	4.3c	2.6	1.7c	Insects and vegetation
	5/11/19	6.1c	3.6	2.5c	Insects and bird droppings
880	7/06/19	3.9c	1.3	2.6c	Insects, oily film and granular substance in gauge
	5/12/19	5.5	1.1	4.4	Insects
885	9/01/19	11.9	8.8	3.1	Insects and bird droppings
	08/02/19	4.9	3.3	1.6	Insects
	07/06/19	4.3c	21.	2.2c	Insects and vegetation
	05/07/19	18.7c	3.2	15.5c	Non-organic contamination
	6/09/19	4.6	3.5	1.1	Insects
	05/11/19	5.3c	1.2	4.1c	Insects
	05/12/19	10.3	2.8	7.5	Insects
897	9/01/19	8.8	2.9	5.9	Insects and vegetation
	5/08/19	4.3	1.9	2.4	Insects, bird droppings and vegetation
	05/11/19	7.0c	5.1	1.9c	Insects and bird droppings
900	08/02/19	3.6c	2.7	0.9c	Insects and bird droppings
	11/03/19	6.7c	3.6	3.1c	Insects and bird droppings
	10/05/19	15.5c	11.5	4.0c	Insects and bird droppings
	07/06/19	5.5c	3.0	2.5c	Insects and bird droppings
	05/12/19	25.7c	22.0	3.7c	Insects
D13	9/01/19	4.6	2.6	2.0	Insects
D14	06/09/19	12.3c	9.7	2.6c	Insects and bird droppings
JLON West	8/02/19	4.2c	2.7	1.5c	Insects and bird droppings
	11/03/19	10.5c	8	2.5c	Insects and bird droppings
	12/04/19	4.3c	2.1	2.2c	Bird droppings and vegetation
	10/05/19	14c	10.2	3.8c	Insects and bird droppings
	7/06/19	15.4c	9.5	5.9c	Insects and bird droppings
	05/08/19	22.0c	18.5	3.5c	Insects and bird droppings
	05/12/19	4.5c	2.5	2.0c	Insects and bird droppings

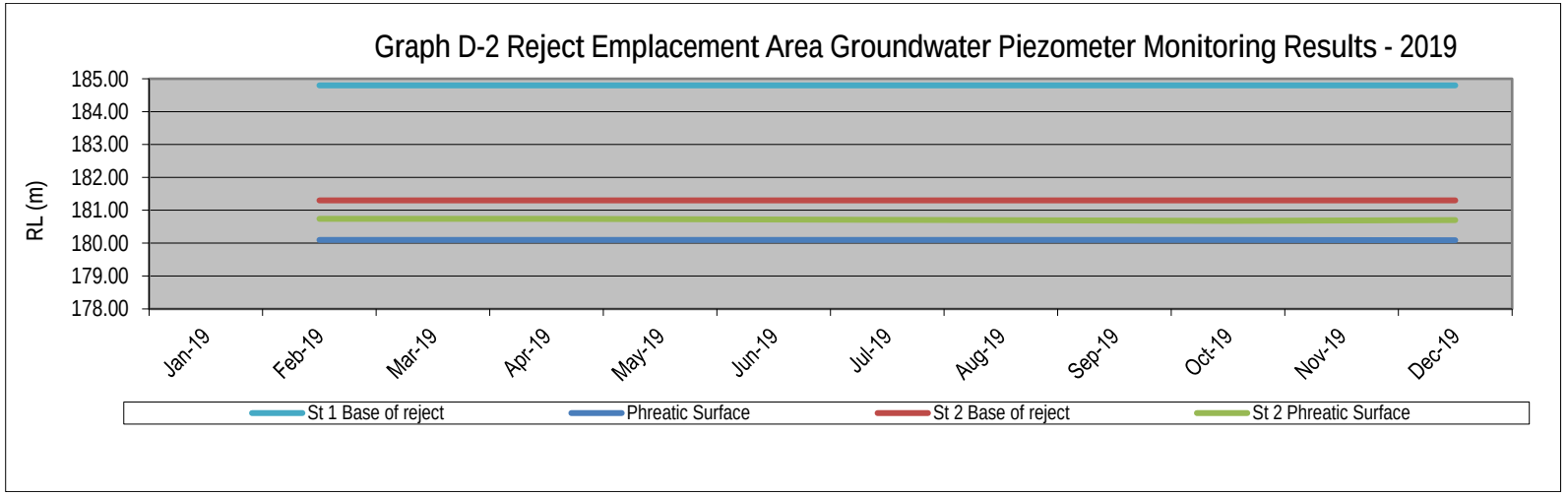
Site	Date	Insoluble Solids (g/m2/month)	Combustible Matter (g/m2/month)	Ash Component (g/m2/month)	Reason for high reading
Macairstrip	9/01/19	6.2c	2.7	3.5c	Insects and bird droppings
	8/02/19	27.1c	18.5	8.6c	Insects and bird droppings
	11/03/19	19.8c	17.2	2.6c	Insects and bird droppings
	12/04/19	18.1c	11.5	6.6c	Bird droppings
	10/05/19	19.1c	11.7	7.4c	Bird droppings
	7/06/19	53.1c	32.5	20.6c	Insects and bird droppings
	5/07/19	36.7c	22.4	14.3c	Insects and bird droppings
	6/09/19	4.5c	2.5	2.0c	Insects and bird droppings
	4/10/19	4.0c	2.4	1.6c	Insects and bird droppings
Wattus	09/01/19	5.4c	3.0	2.4c	Insects and bird droppings
	11/03/19	22.0c	16.4	5.6c	Insects
	7/06/19	8.0c	5.9	2.1c	Insects and bird droppings
	5/07/19	4.2c	2.3	1.9c	Insects, bird droppings and vegetation
	06/09/19	4.8c	3.3	1.5c	Insects and bird droppings
	5/11/19	4.3	2.8	1.5	Insects
	5/12/19	4.9	3.2	1.7	Insects and bird droppings

Note: c = contaminated sample

APPENDIX D

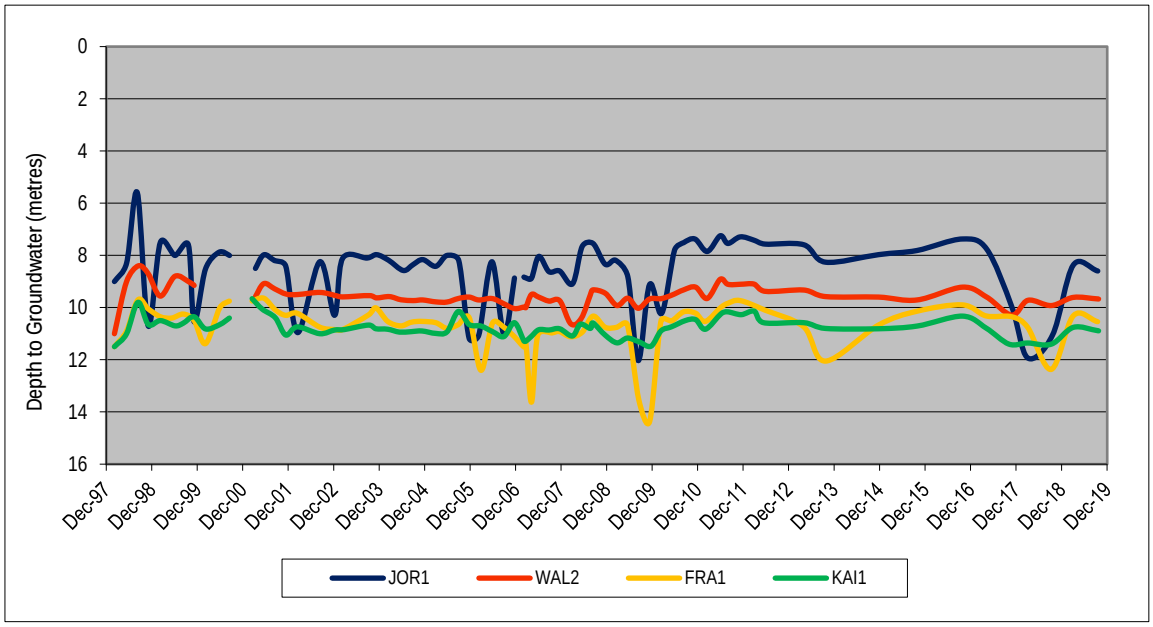
REA Monitoring Summary


Graph D-1 Reject Emplacement Area Average Temperature Monitoring Results (2001 - 2019)
Temperature (°C)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
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 Jul-18 Jan-19 Jul-19 Jan-20
Stage 1
Stage 2
Stage 3
Stage 4 Bore 9
Ambient Temp
Stage 5 Bore 10

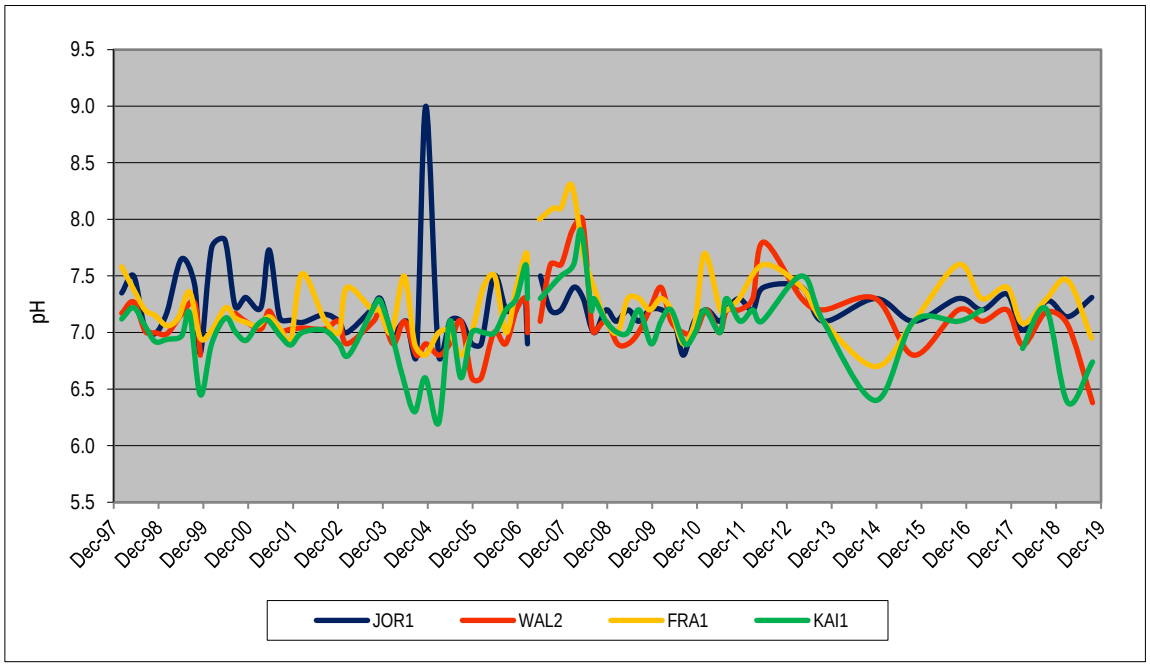

Graph D-2 Reject Emplacement Area Groundwater Piezometer Monitoring Results - 2019
RL (m)
185.00
184.00
183.00
182.00
181.00
180.00
179.00
178.00
Jan-19 Feb-19 Mar-19 Apr-19 May-19 Jun-19 Jul-19 Aug-19 Sep-19 Oct-19 Nov-19 Dec-19
St 1 Base of reject
Phreatic Surface
St 2 Base of reject
St 2 Phreatic Surface

APPENDIX E

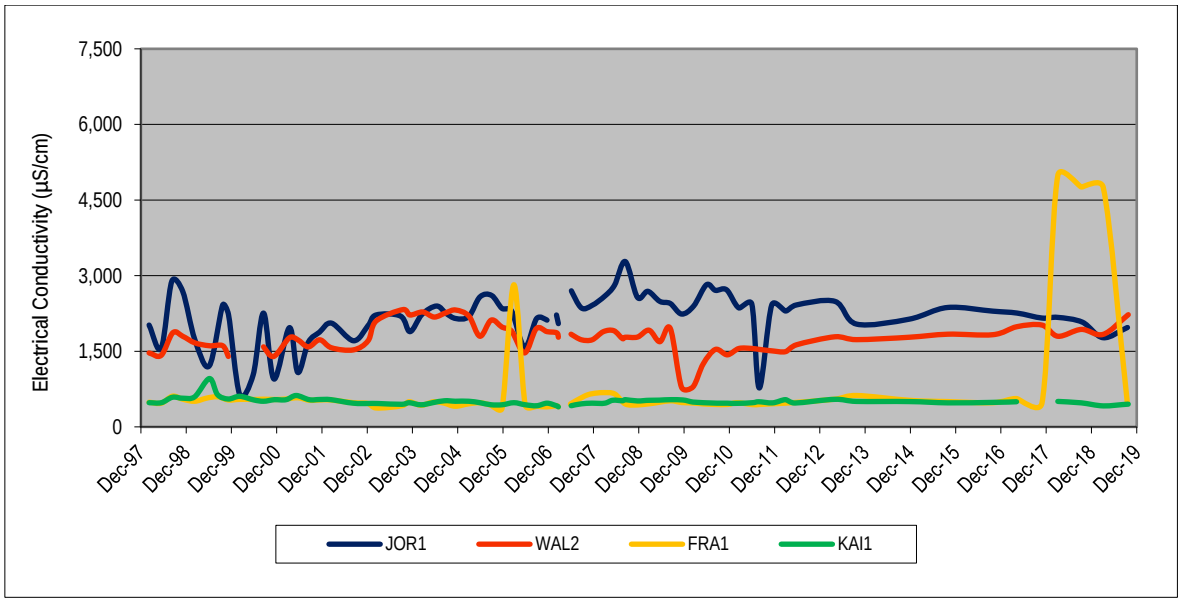
Groundwater Monitoring Summary



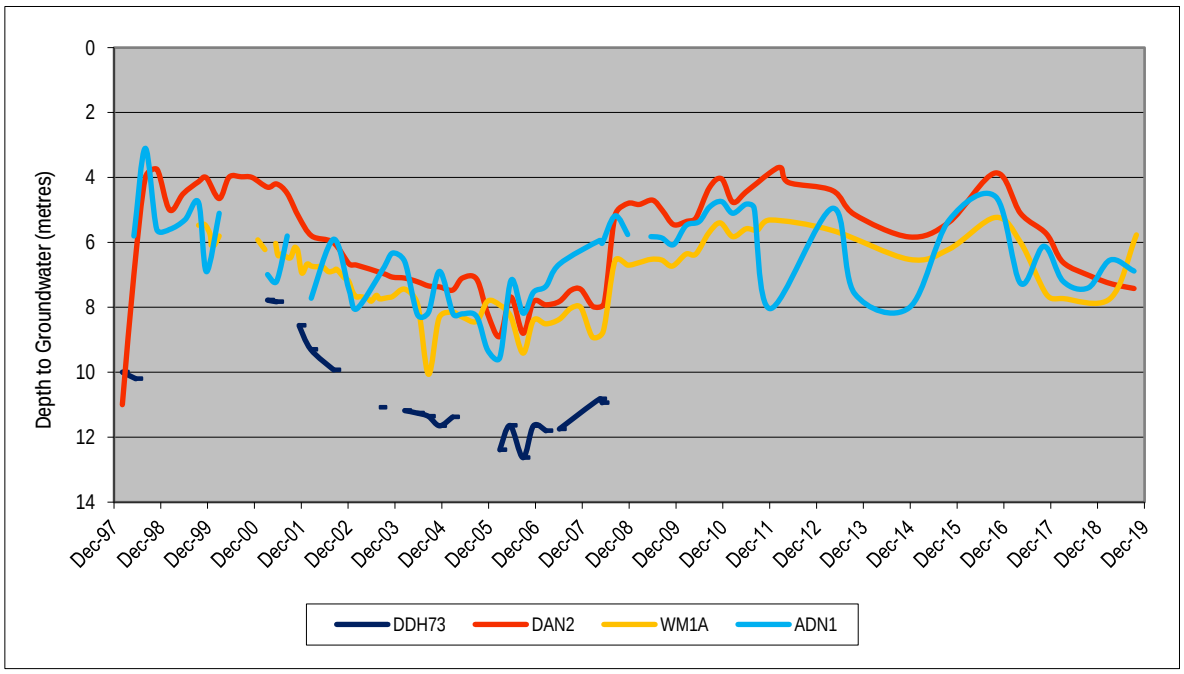
Graph E-1
Groundwater Level for Hunter River Alluvium Bores (1998-2019)



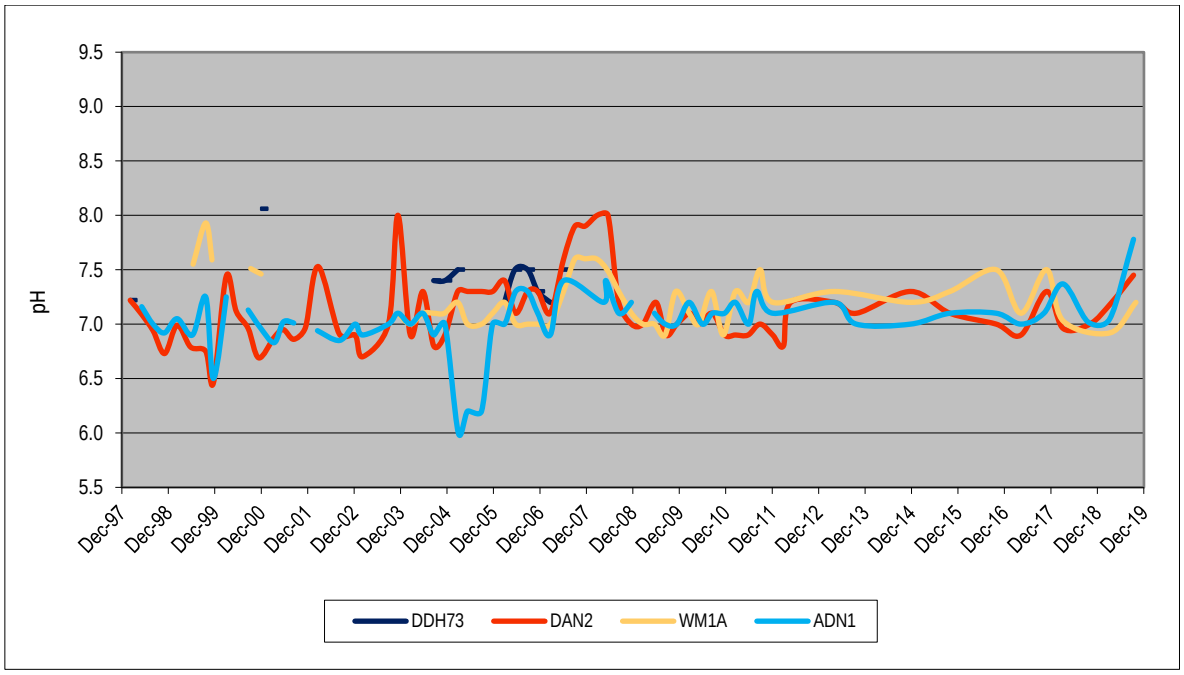
Graph E-2
pH for Hunter River Alluvium Bores (1998-2019)



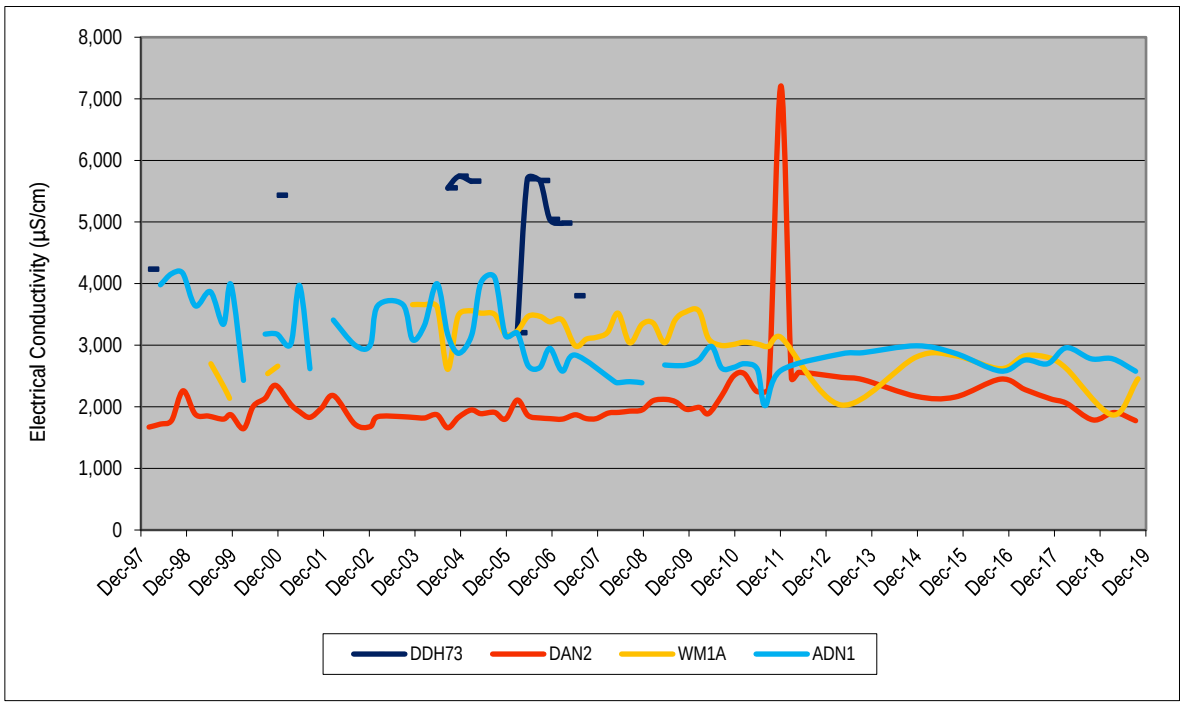
Graph E-3
Electrical Conductivity for Hunter River Alluvium Bores (1998-2019)



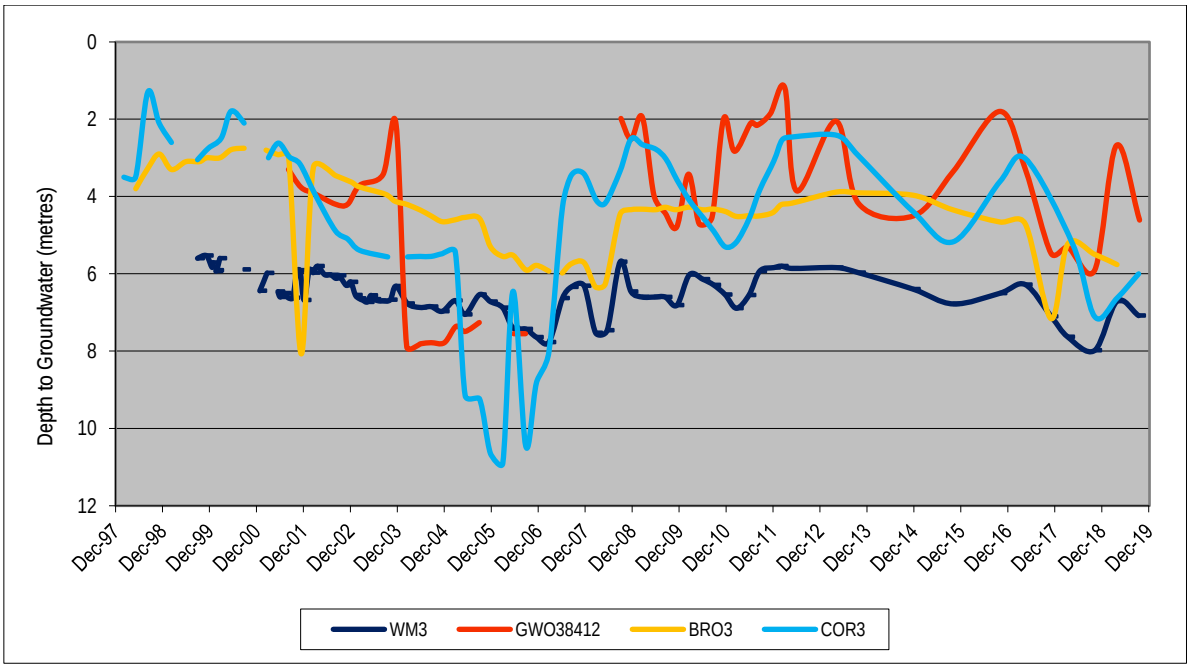
Graph E-4
Groundwater Level for Dart Brook Alluvium Bores (1998-2019)



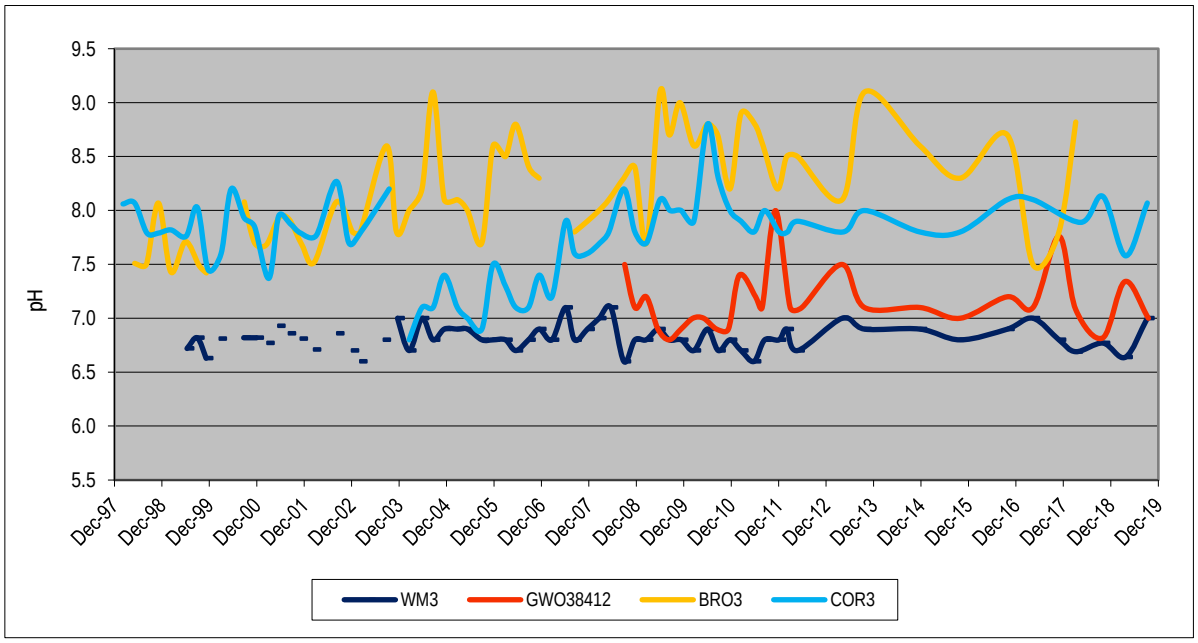
Graph E-5
pH for Dart Brook Alluvium Bores (1998-2019)



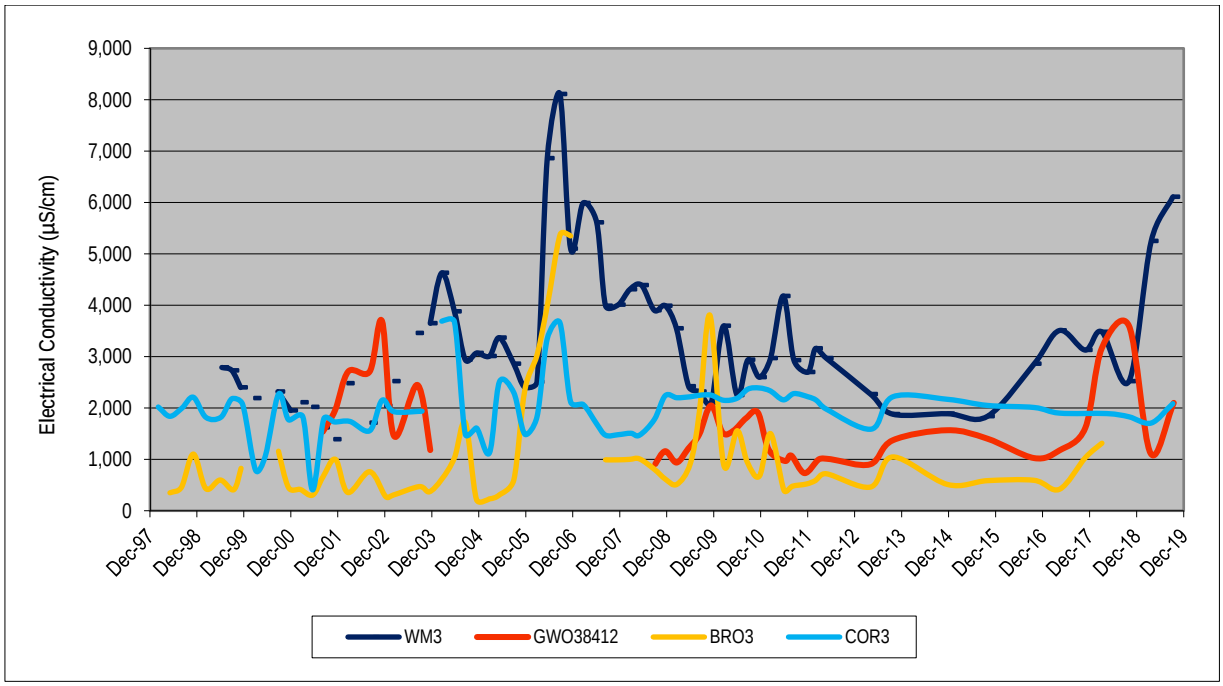
Graph E-6
Electrical Conductivity for Dart Brook Alluvium Bores (1998-2019)



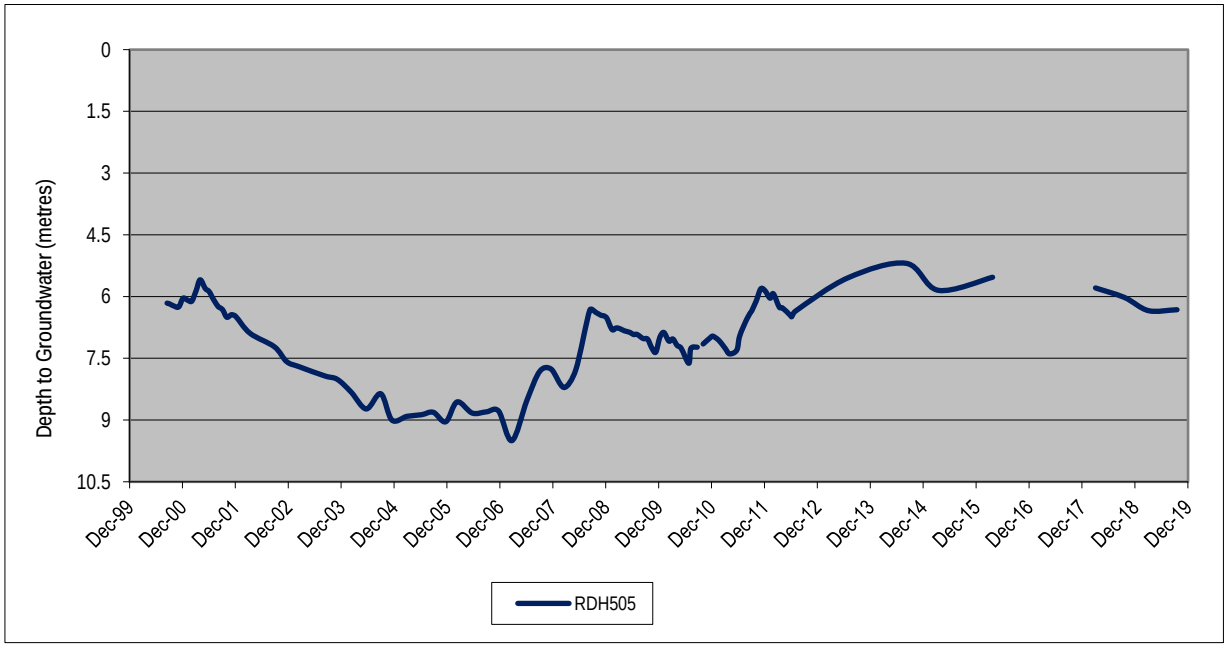
Graph E-7
Groundwater Level for Sandy Creek Alluvium Bores (1998-2019)



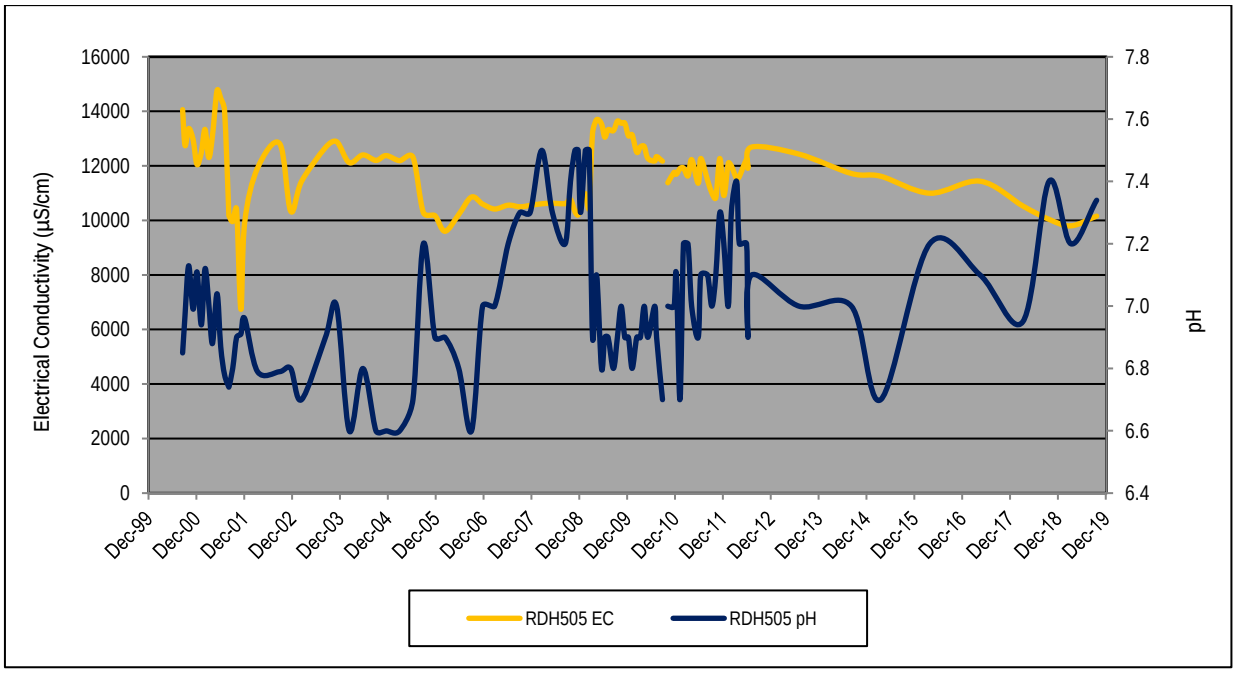
Graph E-8
pH for Sandy Creek Alluvium Bores (1998-2019)



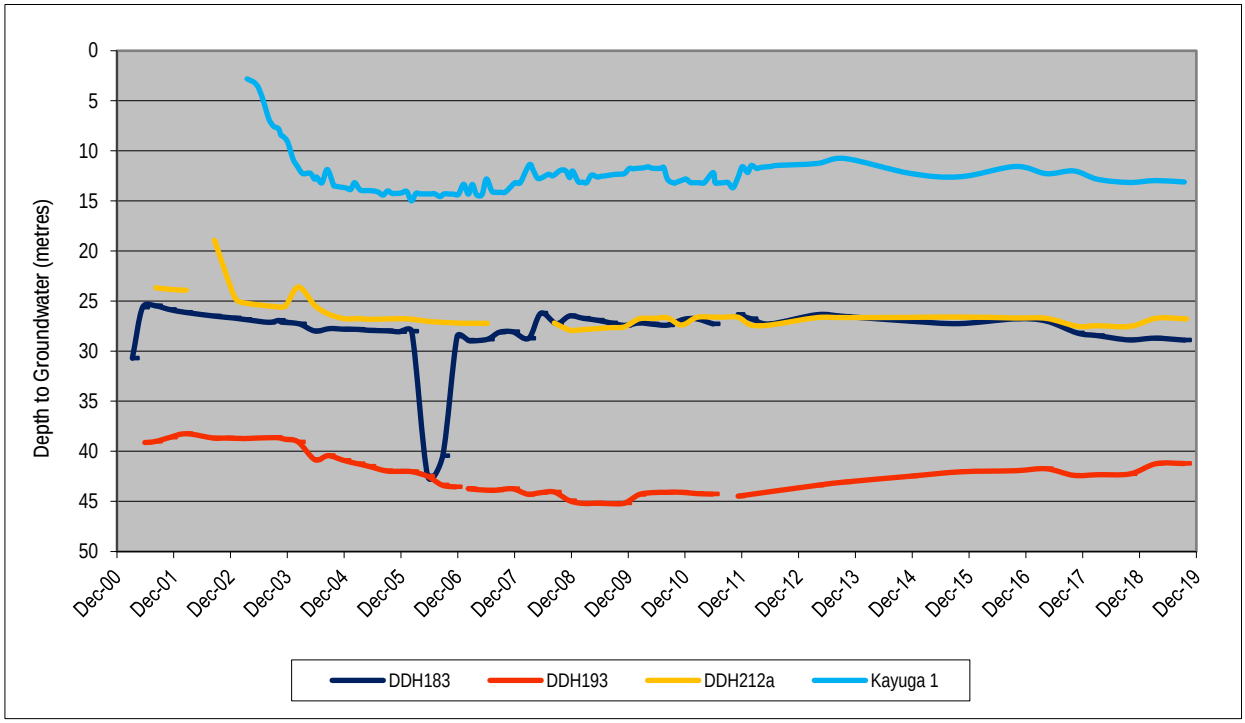
Graph E-9
Electrical Conductivity for Sandy Creek Alluvium Bores (1998-2019)



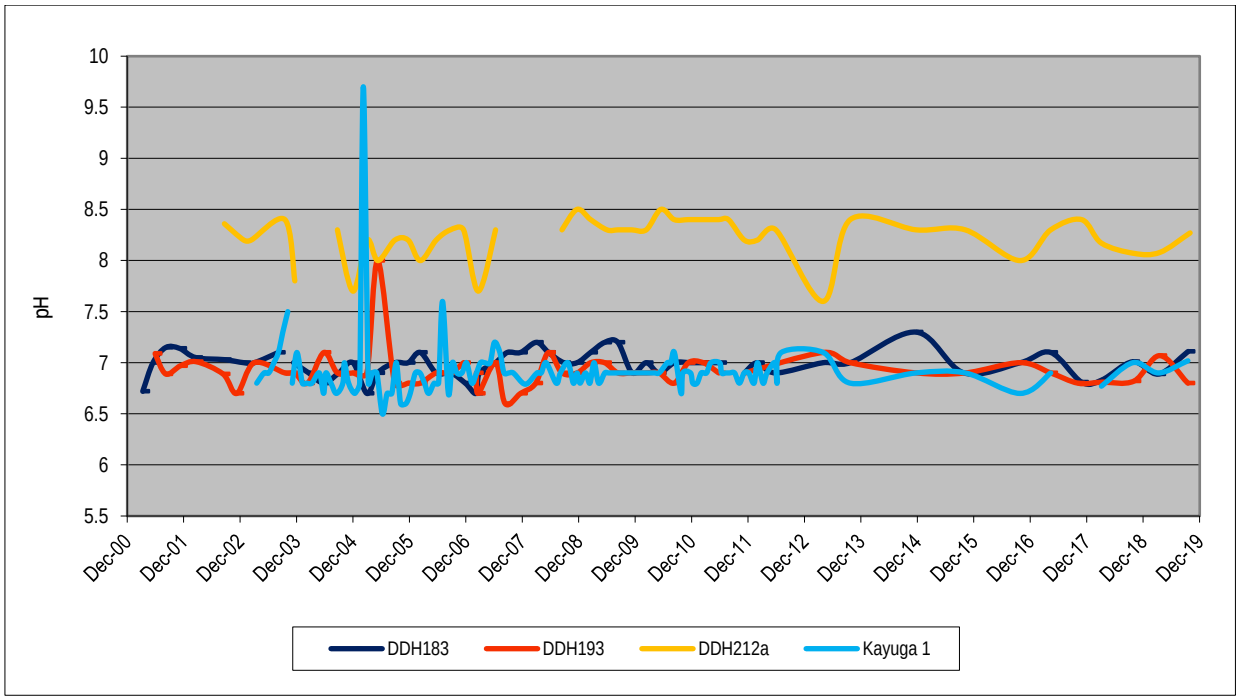
Graph E-10
Groundwater Level for Staged Discharge Dam Bore (2000-2019)



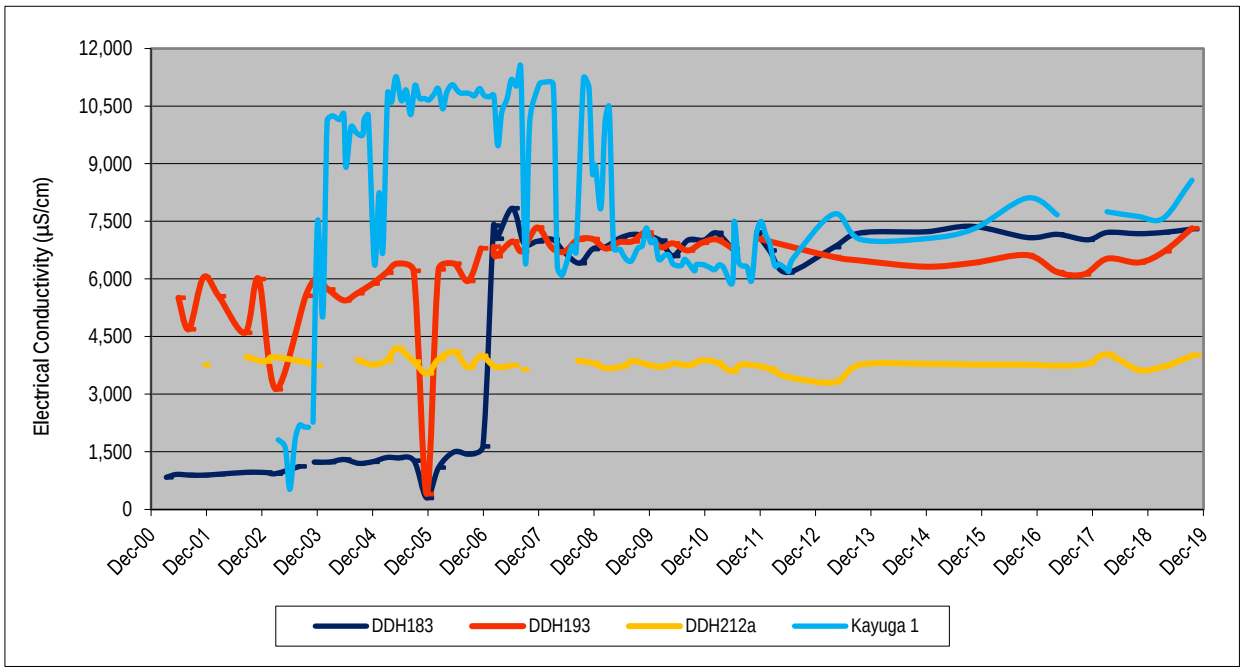
Graph E-11
pH and Electrical Conductivity for Staged Discharge Dam Bore (2000-2019)



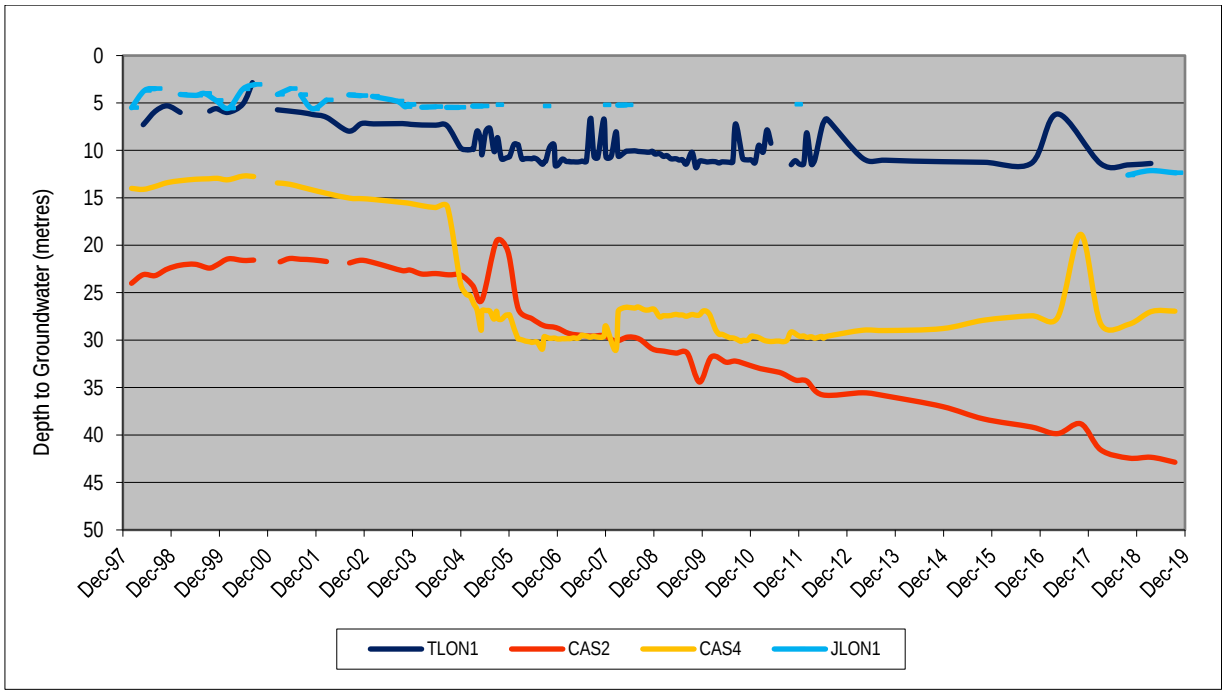
Graph E-12
Groundwater Level for Coal Seam Bores (2001-2019)



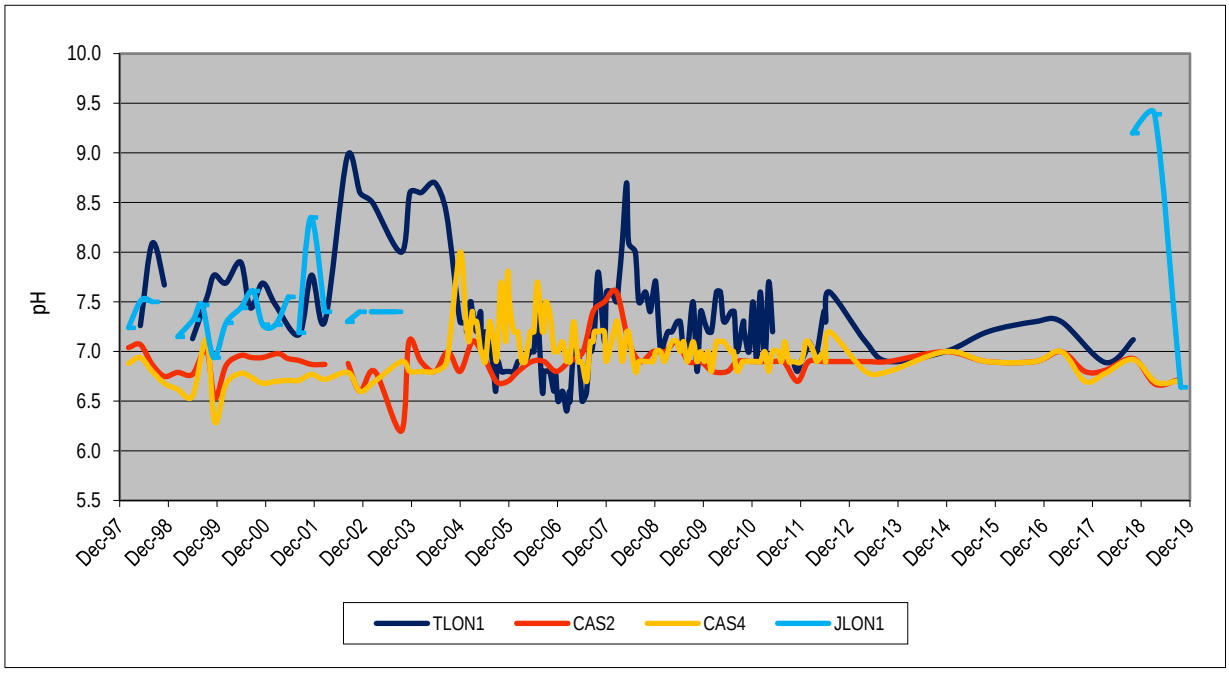
Graph E-13
pH for Coal Seam Bores (2001-2019)



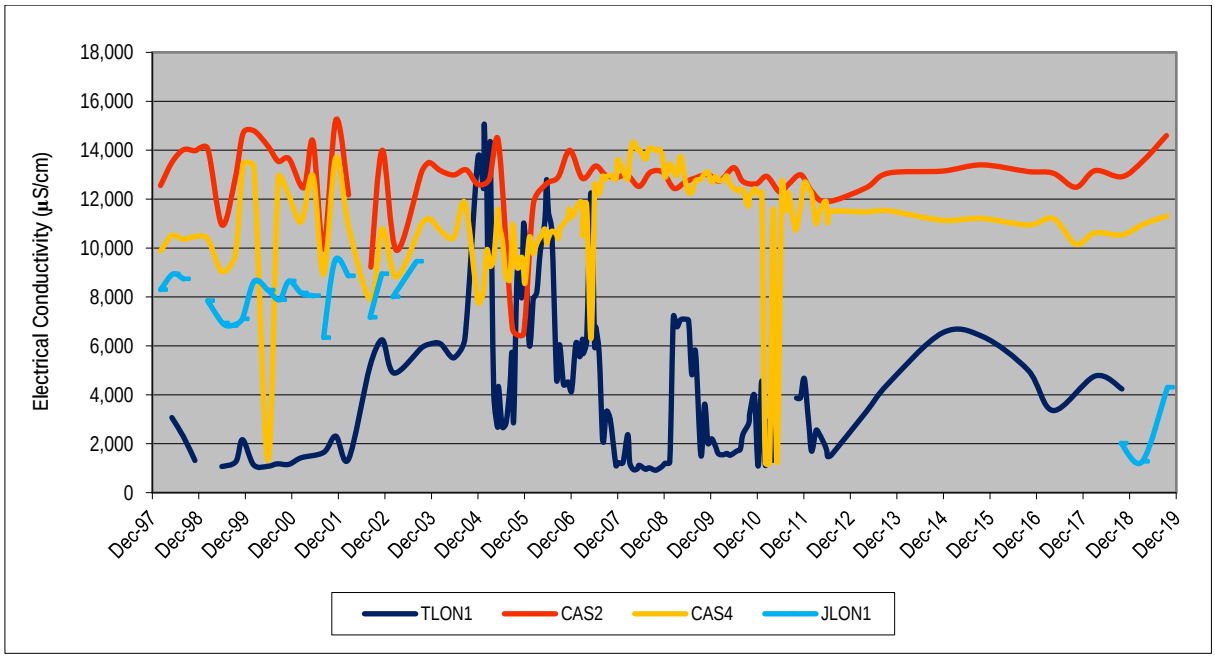
Graph E-14
Electrical Conductivity for Coal Seam Bores (2001-2019)



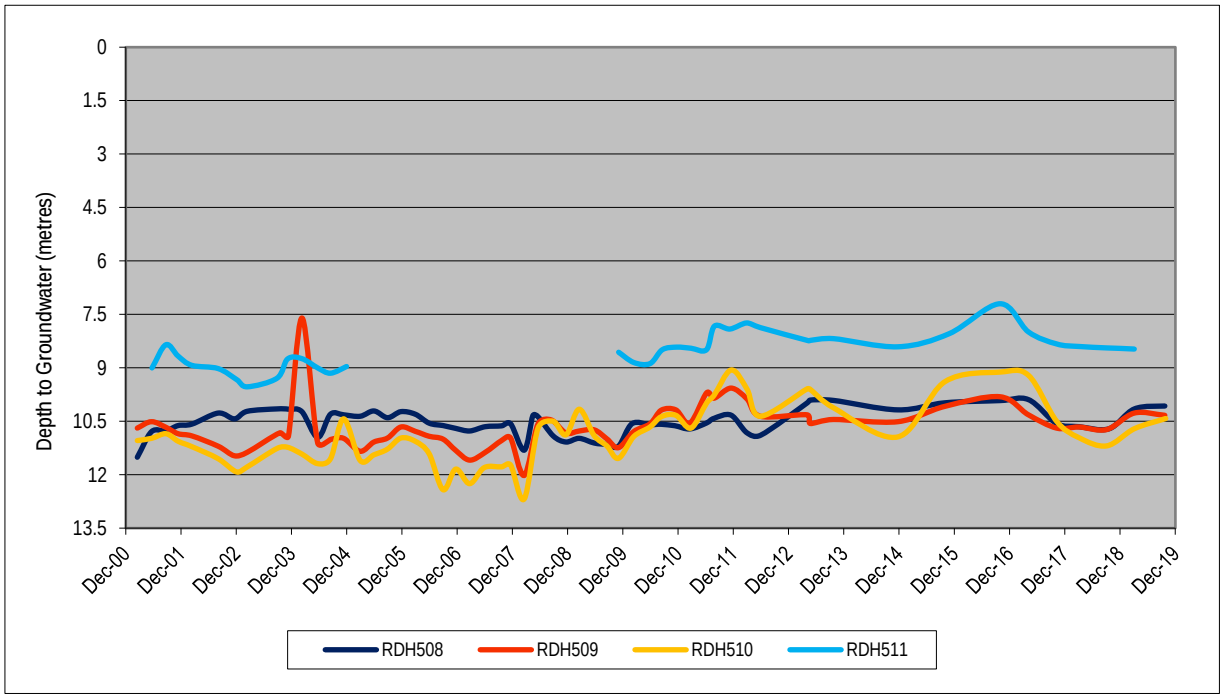
Graph E-15
Groundwater Levels for Regolith Bores (1998-2019)



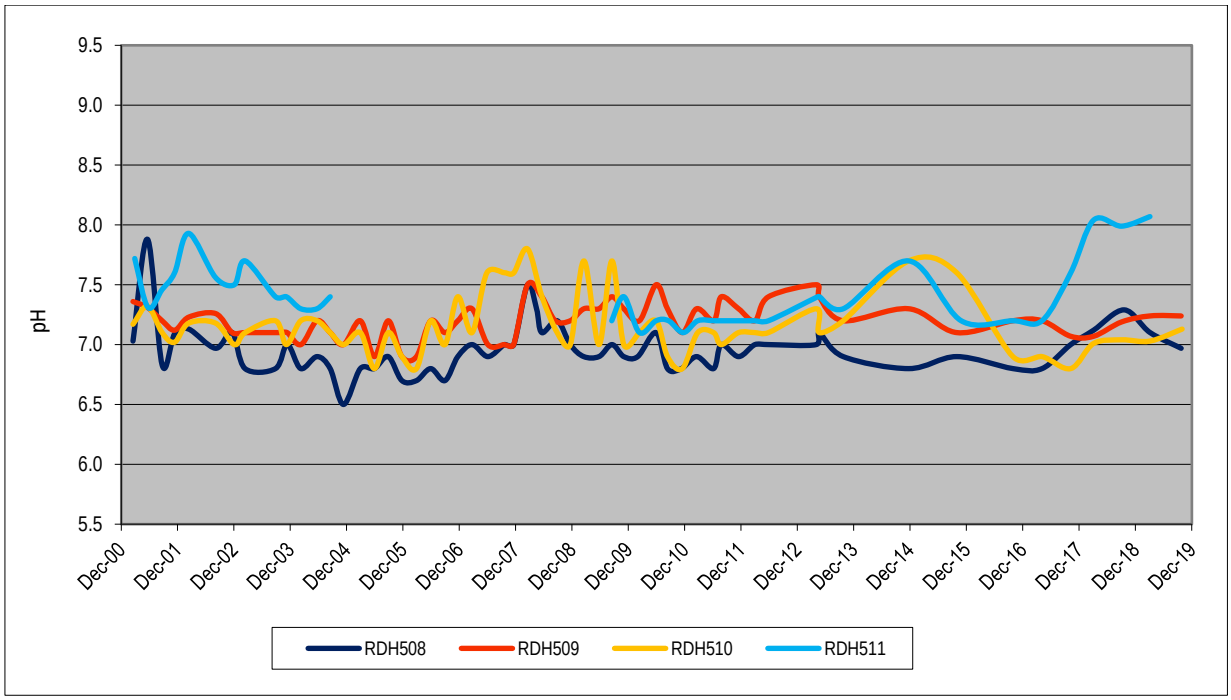
Graph E-16
pH for Regolith Bores (1998-2019)



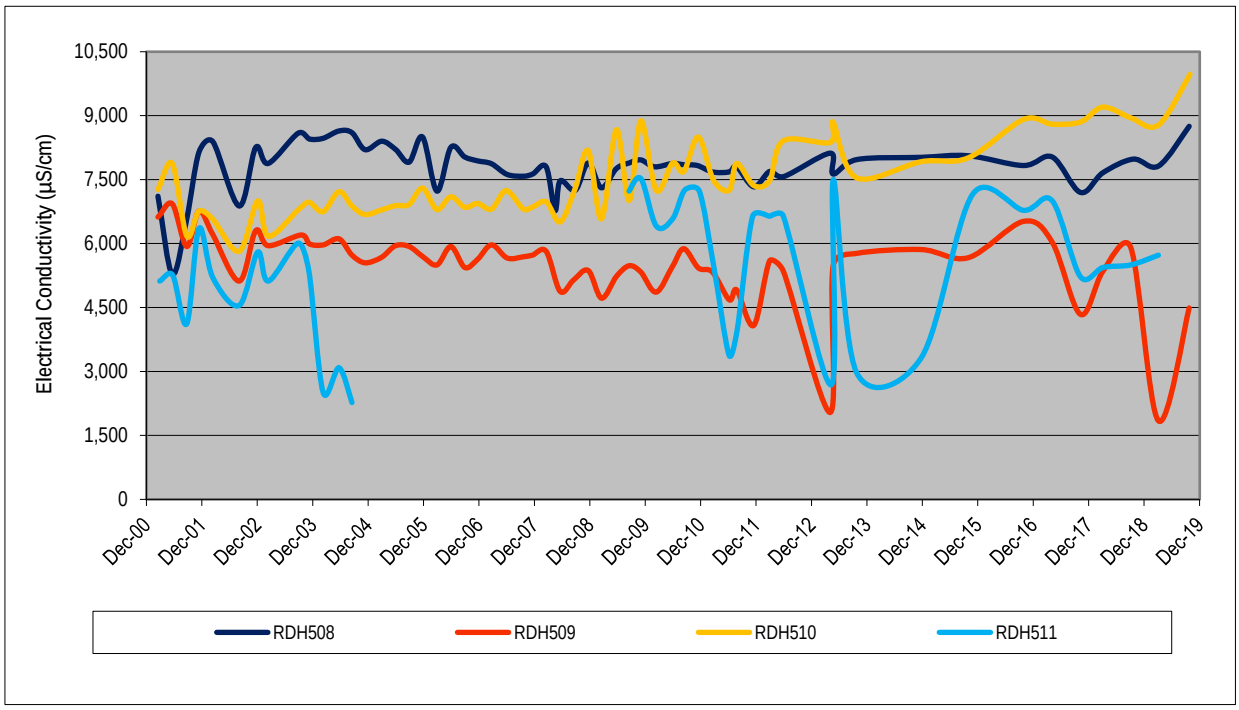
Graph E-17
Electrical Conductivity for Regolith Bores (1998-2019)



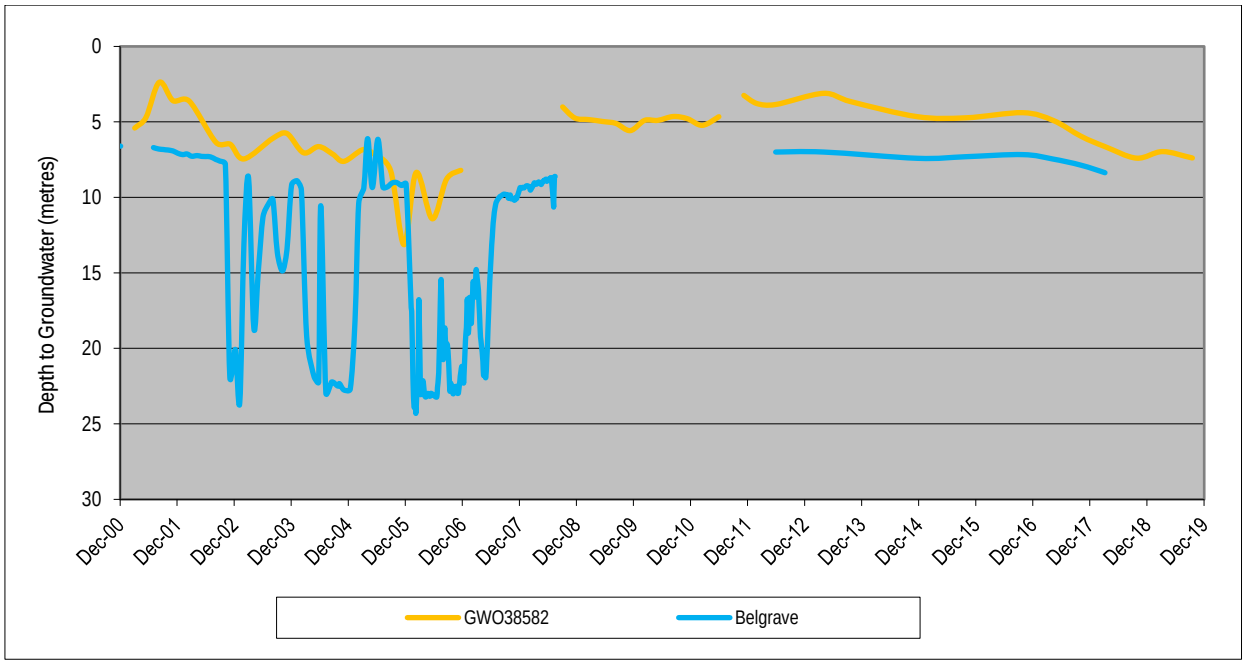
Graph E-18
Groundwater Level for Rejects Emplacement Area Bores (2001-2019)



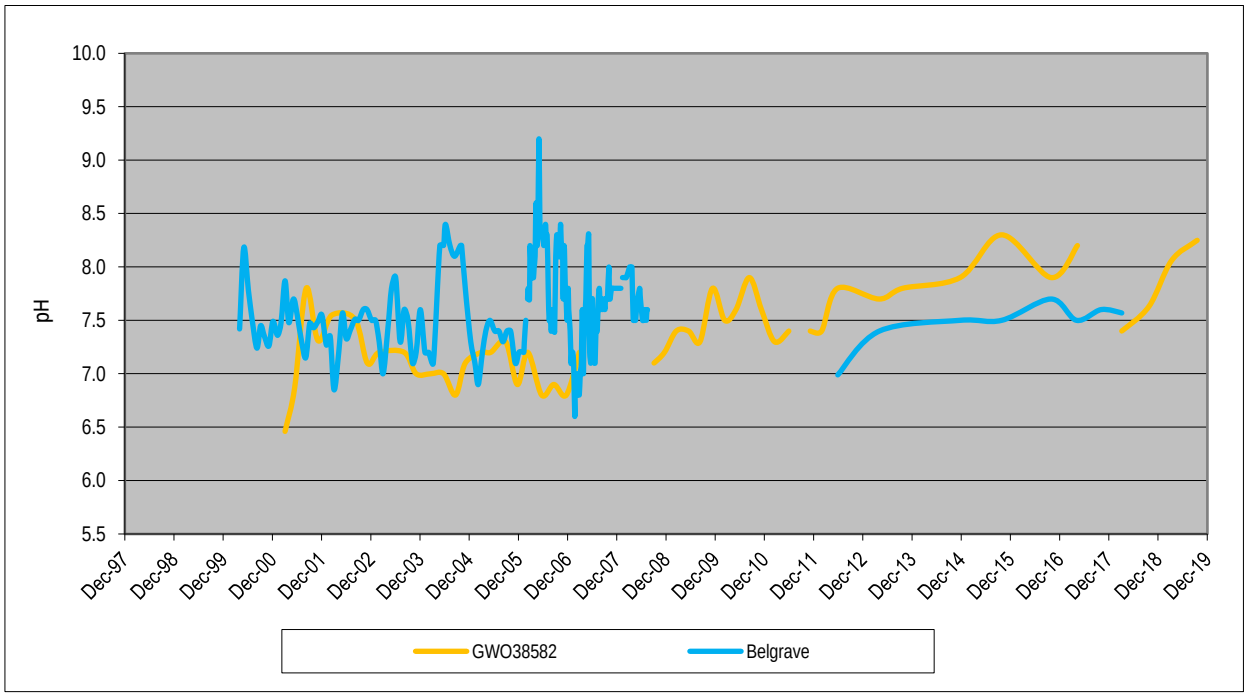
Graph E-19
pH for Rejects Emplacement Area Bores (2001-2019)



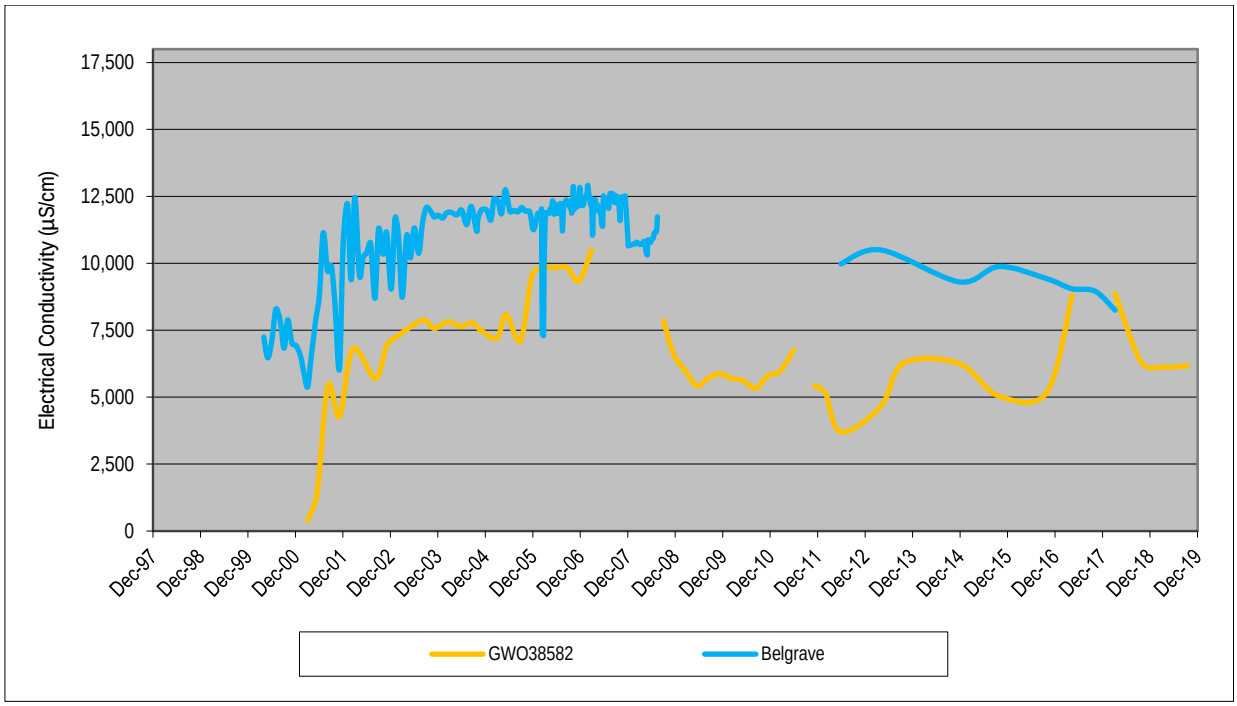
Graph E-20
Electrical Conductivity for Rejects Emplacement Area Bores (2001-2019)



Graph E-21
Groundwater Level for Landowner Property Bores (2001-2019)



Graph E-22
pH for Landowner Property Bores (1998-2019)



Graph E-23
Electrical Conductivity for Landowner Property Bores (1998-2019)

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-Apr-19	4750	7.5	10.31	10.66
FRA1	16-Oct-19	486	7.0	10.54	10.89
JOR1	04-Apr-19	1770	7.1	8.37	8.87
JOR1	17-Oct-19	1974	7.3	8.6	9.1
KAI1	05-Apr-19	419	6.4	10.76	11.26
KAI1	24-Oct-19	454	6.7	10.89	11.39
WAL2	04-Apr-19	1836	7.1	9.61	9.71
WAL2	24-Oct-19	2226	6.4	9.67	9.77
Dart Brook Alluvium					
ADN1	08-Apr-19	2780	7.1	6.54	7.14
ADN1	11-Oct-19	2577	7.8	6.88	7.48
DAN2	23-Apr-19	1907	7.2	7.28	7.28
DAN2	11-Oct-19	1776	7.5	7.42	7.42
WM1A	08-Apr-19	1868	6.9	7.73	8.25
WM1A	30-Oct-19	2457	7.2	5.77	6.29
Sandy Creek Alluvium					
BRO3	23-Apr-19	No Data	No Data	5.76	5.76
BRO3	08-Oct-19	No Data	No Data	No Data	No Data
COR3	23-Apr-19	1709	7.6	6.63	6.97
COR3	08-Oct-19	2086	8.1	6.0	6.34
GWO38412	18-Apr-19	1119	7.3	2.68	3.53
GWO38412	16-Oct-19	2102	7.0	4.61	5.46
WM3	23-Apr-19	5250	6.6	6.71	7.48
WM3	08-Oct-19	6110	7.0	7.08	7.85
Staged Discharge Dam					
RDH505	04-Apr-19	9800	7.2	6.34	6.86
RDH505	17-Oct-19	10160	7.3	6.32	6.84
Coal Seams					
DDH183	10-Apr-19	7210	6.9	28.7	29.15
DDH183	17-Oct-19	7300	7.1	28.9	29.35
DDH193	18-Apr-19	6720	7.1	41.23	42.18
DDH193	16-Oct-19	7320	6.8	41.22	42.17
DDH212a	18-Apr-19	3730	8.1	26.71	27.51
DDH212a	30-Oct-19	4020	8.3	26.78	27.58
Kayuga 1	10-Apr-19	7580	6.9	12.97	13.29
Kayuga 1	16-Oct-19	8570	7.0	13.11	13.43
Regolith					
CAS2	18-Apr-19	13580	6.7	42.34	42.88
CAS2	16-Oct-19	14600	6.7	42.86	43.4
CAS4	23-Apr-19	10990	6.7	26.97	27.4
CAS4	16-Oct-19	11300	6.7	26.94	27.37
JLON1	10-Apr-19	1277	9.4	12.14	12.94
JLON1	23-Oct-19	4310	6.6	12.37	13.17
TLON1	18-Apr-19	No Data	No Data	11.37	11.47
TLON1	16-Oct-19	No Data	No Data	No Data	No Data

Sample Location	Sample Date	Field EC (µS/cm)	Field pH	Depth to Ground (m)	Depth to Standpipe (m)
Rejects Emplacement Area					
RDH508	05-Apr-19	7820	7.1	10.15	10.75
RDH508	23-Oct-19	8750	7.0	10.07	10.67
RDH508a	05-Apr-19	7810	7.0	17.61	18.11
RDH508a	23-Oct-19	8510	7.0	17.6	18.1
RDH509	04-Apr-19	1843	7.2	10.27	10.57
RDH509	23-Oct-19	4490	7.2	10.33	10.63
RDH509a	04-Apr-19	No Data	No Data	14.67	14.95
RDH509a	23-Oct-19	No Data	No Data	14.7	14.98
RDH510	04-Apr-19	8780	7.0	10.71	11.21
RDH510	29-Oct-19	9970	7.1	10.42	10.92
RDH510a	04-Apr-19	9220	7.1	10.71	11.11
RDH510a	29-Oct-19	10540	7.1	10.42	10.82
RDH511	04-Apr-19	5730	8.1	8.44	8.44
RDH511	29-Oct-19	No Data	No Data	No Data	No Data
RDH511a	04-Apr-19	6670	7.4	8.5	8.5
RDH511a	29-Oct-19	No Data	No Data	No Data	No Data
Property Subsidence Management Plans					
Belgrave	30-Apr-19	No Data	No Data	No Data	No Data
Belgrave	16-Oct-19	No Data	No Data	No Data	No Data
GWO38582	10-Apr-19	6120	8.1	6.96	7.68
GWO38582	17-Oct-19	6170	8.3	7.39	8.11
Other Monitoring Bores					
Athlone	10-Apr-19	10640	7.1	7.7	8
Athlone	17-Oct-19	10960	6.6	8.09	8.39
BEL1	10-Apr-19	5550	7.5	5.06	5.06
BEL1	16-Oct-19	6800	7.7	6.12	6.12
CAD2	23-Apr-19	No Data	No Data	12.84	13.04
CAD2	08-Oct-19	No Data	No Data	12.92	13.12
DDH124	10-Apr-19	No Data	No Data	14.11	14.69
DDH124	17-Oct-19	No Data	No Data	14.09	14.67
DDH212b	18-Apr-19	3880	8.1	26.72	27.42
DDH212b	30-Oct-19	4300	8.3	26.78	27.48
DDH212c	18-Apr-19	3840	8.0	26.72	27.32
DDH212c	30-Oct-19	4310	8.3	26.78	27.38

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

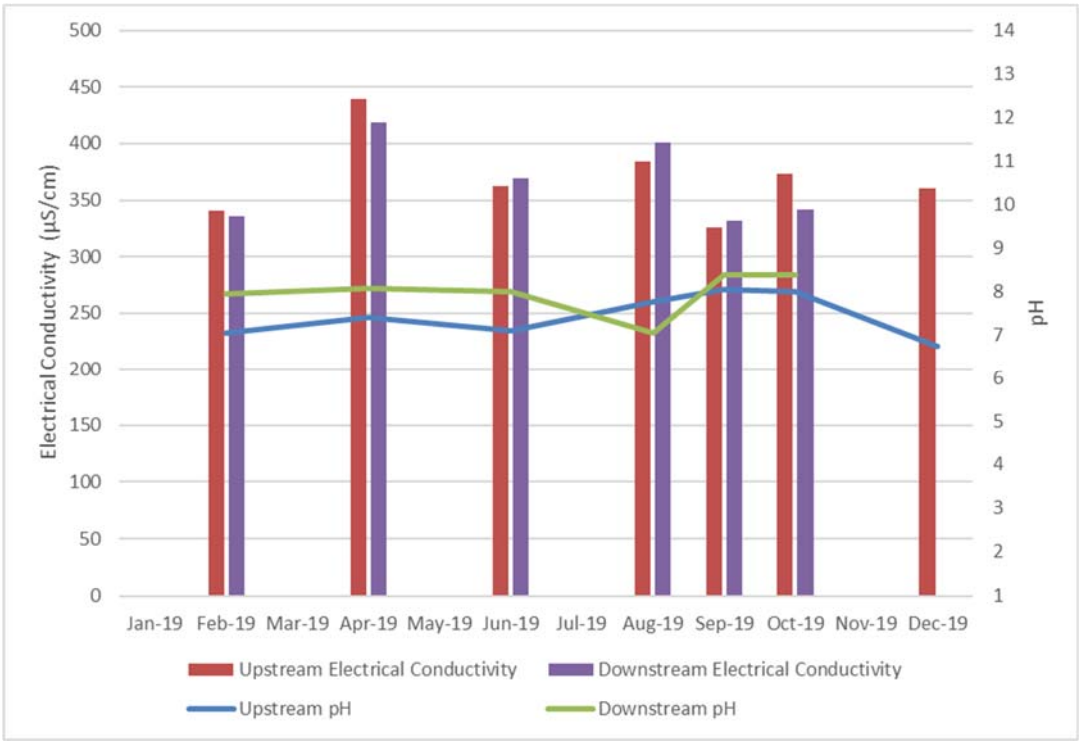
Sample Location	Parameter	Minimum	Mean	Maximum	Variance
Hunter River Alluvium					
JOR1	**pH**	7.1	7.2	7.3	0.2
JOR1	**EC**	1770	1872	1974	204
WAL2	**pH**	6.4	6.7	7.1	0.7
WAL2	**EC**	1836	2031	2226	390
KAI1	**pH**	6.4	6.6	6.7	0.4
KAI1	**EC**	419	437	454	35
FRA1	**pH**	7.0	7.2	7.5	0.5
FRA1	**EC**	486	2618	4750	4264
Dart Brook Alluvium					
DAN2	**pH**	7.2	7.3	7.5	0.3
DAN2	**EC**	1776	1842	1907	131
WM1A	**pH**	6.9	7.1	7.2	0.3
WM1A	**EC**	1868	2163	2457	589
ADN1	**pH**	7.1	7.4	7.8	0.7
ADN1	**EC**	2577	2679	2780	203
Sandy Creek Alluvium					
GWO38412	**pH**	7.0	7.2	7.3	0.3
GWO38412	**EC**	1119	1611	2102	983
BRO3	**pH**	*	*	*	*
BRO3	**EC**	*	*	*	*
COR3	**pH**	7.6	7.8	8.1	0.5
COR3	**EC**	1709	1898	2086	377
WM3	**pH**	6.6	6.8	7.0	0.4
WM3	**EC**	5250	5680	6110	860
Staged Discharge Dam					
RDH505	**pH**	7.2	7.3	7.3	0.1
RDH505	**EC**	9800	9980	10160	360
Coal Seams					
DDH183	**pH**	6.9	7.0	7.1	0.2
DDH183	**EC**	7210	7255	7300	90
DDH193	**pH**	6.8	6.9	7.1	0.3
DDH193	**EC**	6720	7020	7320	600
Kayuga 1	**pH**	6.9	7.0	7.0	0.1
Kayuga 1	**EC**	7580	8075	8570	990
DDH212(a)	**pH**	8.1	8.2	8.3	0.2
DDH212(a)	**EC**	3730	3875	4020	290
Regolith					
CAS2	**pH**	6.7	6.7	6.7	0.0
CAS2	**EC**	13580	14090	14600	1020
CAS4	**pH**	6.7	6.7	6.7	0.0
CAS4	**EC**	10990	11145	11300	310
TLON1	**pH**	*	*	*	*
TLON1	**EC**	*	*	*	*

Sample Location	Parameter	Minimum	Mean	Maximum	Variance
Rejects Emplacement Area					
RDH508	**pH**	7.0	7.0	7.1	0.1
RDH508	**EC**	7820	8285	8750	930
RDH508a	**pH**	7.0	7.0	7.0	0.0
RDH508a	**EC**	7810	8160	8510	700
RDH509	**pH**	7.2	7.2	7.2	0.0
RDH509	**EC**	1843	3167	4490	2647
RDH509a	**pH**	*	*	*	*
RDH509a	**EC**	*	*	*	*
RDH510	**pH**	7.0	7.1	7.1	0.1
RDH510	**EC**	8780	9375	9970	1190
RDH510a	**pH**	7.1	7.1	7.1	0.0
RDH510a	**EC**	9220	9880	10540	1320
RDH511**	**pH**	8.1	8.1	8.1	0.0
RDH511**	**EC**	5730	5730	5730	0
RDH511a**	**pH**	7.4	7.4	7.4	0.0
RDH511a**	**EC**	6670	6670	6670	0
Property Subsidence Management Plans					
GWO38582	**pH**	8.1	8.2	8.3	0.2
GWO38582	**EC**	6120	6145	6170	50
Belgrave	**pH**	*	*	*	*
Belgrave	**EC**	*	*	*	*
Other Bore Holes					
Athlone	**pH**	6.6	6.8	7.1	0.5
Athlone	**EC**	10640	10800	10960	320
BEL1	**pH**	7.5	7.6	7.7	0.2
BEL1	**EC**	5550	6175	6800	1250
CAD2	**pH**	*	*	*	*
CAD2	**EC**	*	*	*	*
DDH124	**pH**	*	*	*	*
DDH124	**EC**	*	*	*	*
DDH212b	**pH**	8.1	8.2	8.3	0.2
DDH212b	**EC**	3880	4090	4300	420
DDH212c	**pH**	8.0	8.2	8.3	0.3
DDH212c	**EC**	3840	4075	4310	470

** Dry or unable to be monitored in 2019*
*** Only one record during the year*
Note: Standard Deviation Calculations not undertaken due to reduced number of samples collected during the reporting period.

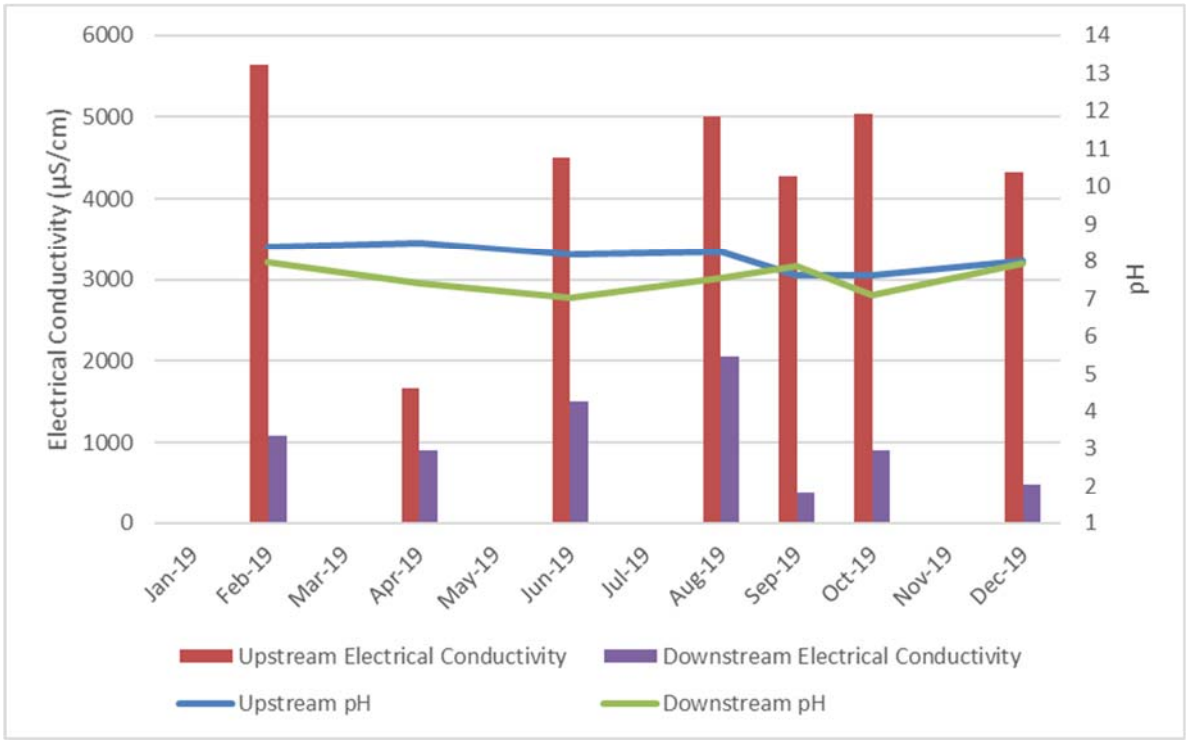
APPENDIX F

Surface Water Monitoring Summary

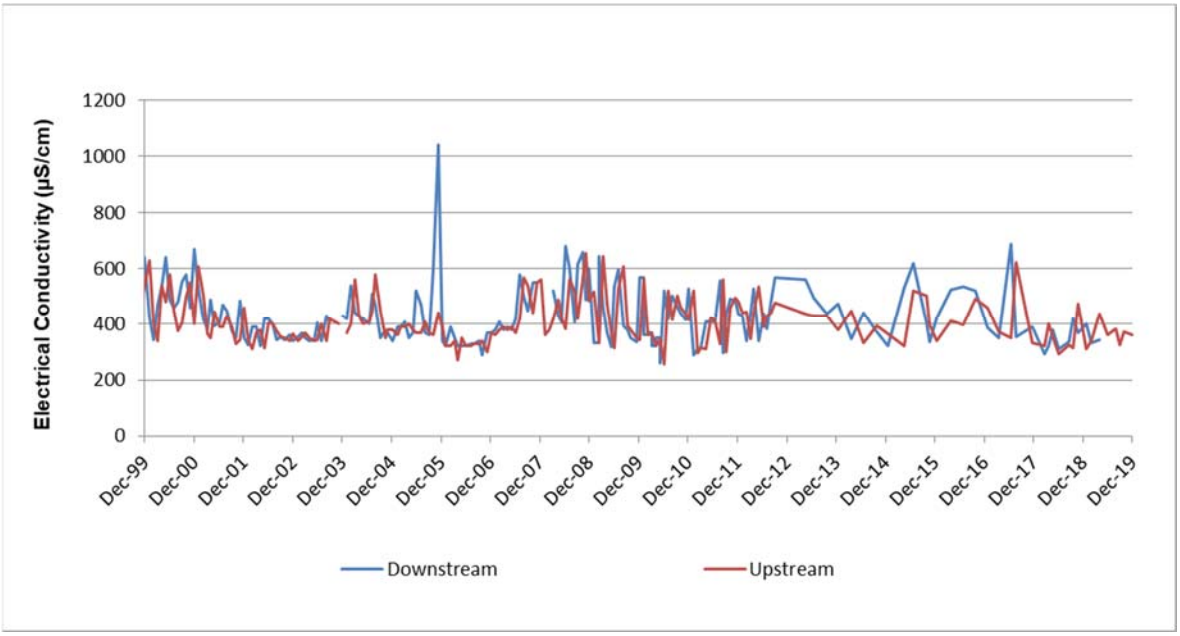


Graph F-1
Quarterly Hunter River EC and pH Results

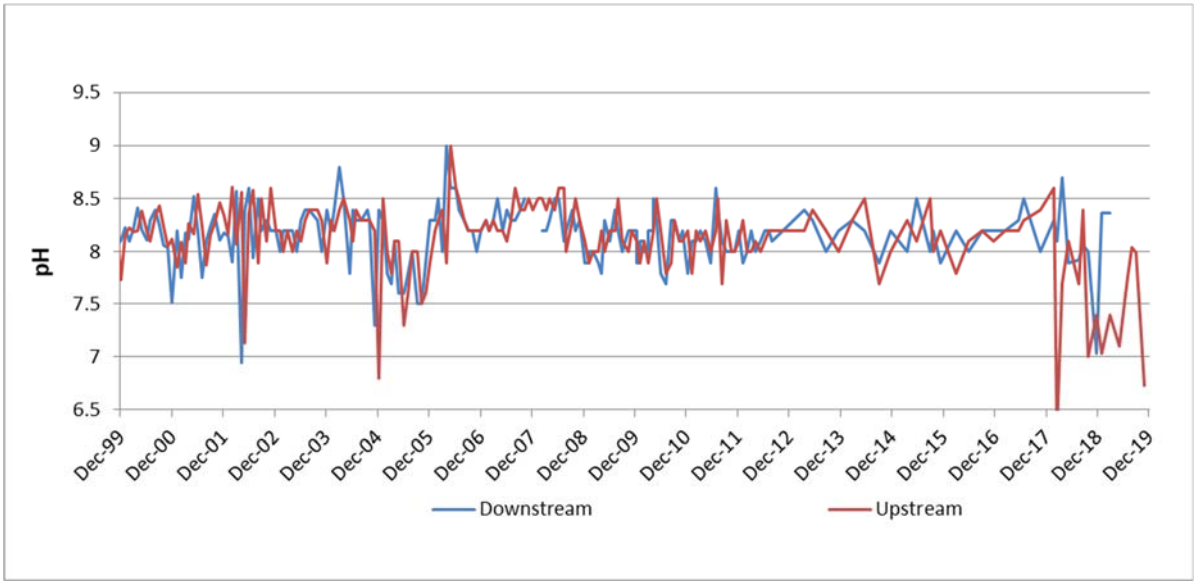
Note: Hunter River Downstream monitoring was not undertaken in December 2019



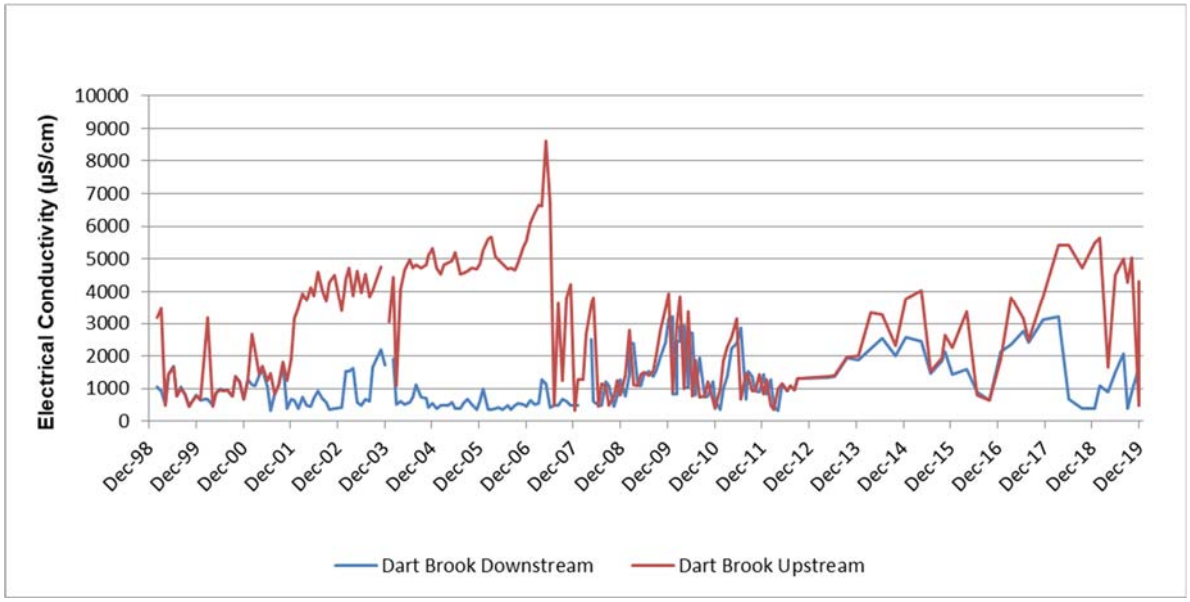
Graph F-2
Quarterly Dart Brook EC and pH Results



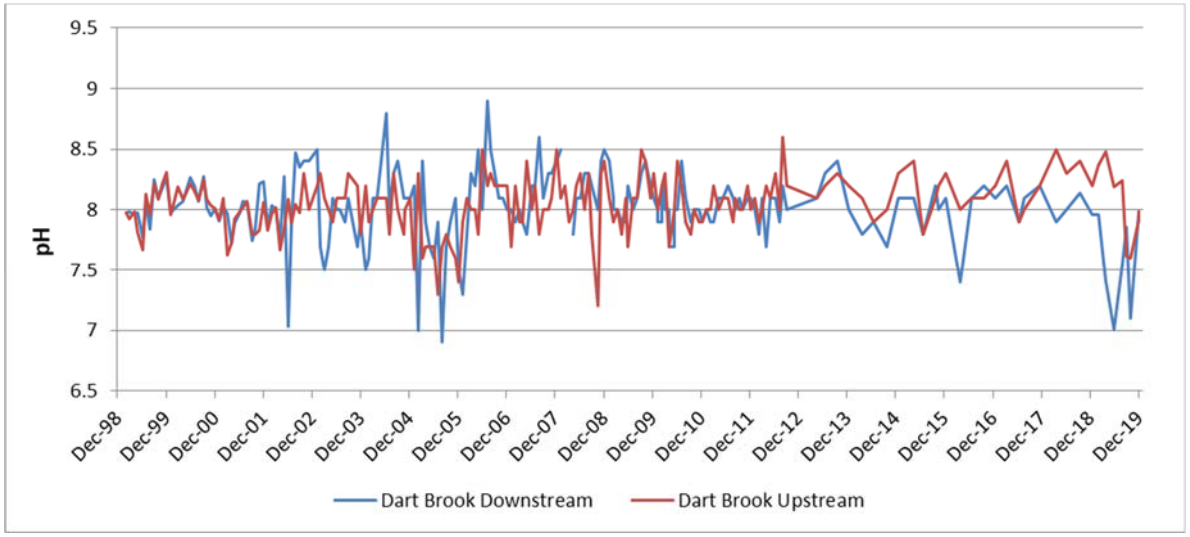
Graph F-3
Hunter River Long Term EC (1999-2019)



Graph F-4
Hunter River Long Term pH (1999-2019)



Graph F-5
Dart Brook Long Term EC (1999-2019)



Graph F-6
Dart Brook Long Term pH (1999-2019)

Table F-1 Annual Surface Water Monitoring Results (September 2019)

	Bicarbonate mg CaCO3/L	Carbonate mg CaCO3/L	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	Sulphates mg/L	Total Dissolved Solids - calculation mg/L	Total Suspended Solids @105C mg/L
Dartbrook Downstream	153	<1	<1	N/A	N/A	31	395	~91	N/A	N/A	**<0.01**	7.10	**<0.01**	2	28	17	260	5
Dartbrook Upstream	636	40	<1	N/A	N/A	**1280**	**4280**	<91	N/A	N/A	<0.01	8.15	<0.01	**4**	**776**	**136**	**2870**	48
E2	**4980**	2840	N/A	N/A	9	1200	14650	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	1080	3490	N/A	N/A	6	816	**9030**	N/A	**11**	**1.3**	N/A	**9.70**	<0.01	**19**	2600	<5	**6050**	**87**
Evaporation Tailing Dam	N/A	N/A	N/A	N/A	N/A	N/A	**1316**	N/A	N/A	N/A	N/A	**9.37**	N/A	N/A	N/A	N/A	N/A	N/A
Hunter Downstream	141	<1	<1	N/A	N/A	18	332	~180	N/A	N/A	<0.01	7.03	<0.01	2	21	16	220	5
Hunter Upstream	144	<1	<1	N/A	N/A	24	326	<91	N/A	N/A	<0.01	6.73	<0.01	2	21	16	220	<5
REA	*Dry	*Dry	N/A	N/A	*Dry	*Dry	*Dry	N/A	*Dry	N/A	N/A	*Dry	N/A	N/A	*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	N/A	*Dry	*Dry	*Dry	*Dry
Sewage Treatment Plant	N/A	N/A	N/A	**50**	N/A	N/A	**8410**	N/A	N/A	N/A	N/A	8.94	N/A	N/A	N/A	N/A	**5630**	N/A
SDD	3900	**5630**	N/A	N/A	5	**1290**	**16860**	N/A	13	0.3	N/A	9.27	0.08	**48**	**5660**	<10	**11300**	43
WHD	889	**1540**	N/A	N/A	4	**559**	**5730**	N/A	10	0.1	N/A	**9.94**	<0.01	13	**1580**	<5	**3840**	54
WSD	185	<1	N/A	N/A	**34**	31	452	N/A	10	N/A	N/A	8.65	N/A	N/A	40	<5	300	**66**

N/A - Monitoring parameter not required
** Monitoring for parameter not undertaken in 2019*
Bold: Monitoring result exceeded SWMP Trigger Level

APPENDIX G

Water Balance Schematic

Water Balance Schematic