DARTBROOK MINE

SITE WATER MANAGEMENT PLAN

for Dartbrook Operations Pty Ltd

30 October 2023

DOCUMENT CONTROL

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1. INTRODUCTION

1.1 BACKGROUND

Dartbrook Mine is owned by an unincorporated Joint Venture (Dartbrook Joint Venture) between Australian Pacific Coal (AQC) and Tetra Resources Pty Ltd (Tetra). Dartbrook Operations Pty Ltd (Dartbrook Operations) is the appointed operating management company and the Mine Operator under Section 5 of the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2022*. The Dartbrook Joint Venture will acquire AQC Dartbrook Management Pty Ltd (ABN 62 007 377 577) which is the holder of the Development Consent and Environment Protection Licence), and AQC Dartbrook Pty Ltd (ABN 46 000 012 813) which is the holder of the relevant mining and coal authorities.

Dartbrook Mine is located approximately 10 km north-west of Muswellbrook and 4.5 km south-west of the village of Aberdeen in New South Wales (see **Figure 1**). Dartbrook Mine operated as an underground longwall coal mine from 1993 until December 2006, when it was placed in care and maintenance by the previous owner, Anglo Coal (Dartbrook Management) Pty Ltd. The mine was acquired by AQC in 2017 and remained in care and maintenance throughout AQC's period of ownership.

Dartbrook Mine is authorised by Development Consent DA 231-07-2000 granted under the *Environmental Planning and Assessment Act 1979* (EP&A Act). DA 231-07-2000 was granted on 28 August 2001 and has been modified on seven occasions (as summarised in **Table 1**). DA 231-07-2000 enables mining operations to be carried out until 5 December 2027.

Table 1 Modifications to DA 231-07-2000

Modification	Approval Date	Activities
MOD 1	19 June 2002	MOD1 was an administrative modification to DA 231-07-2000 that altered the conditions regarding blasting notifications and structural inspections.
MOD 2	16 June 2003	MOD2 approved the construction and operation of an additional emergency tailings storage cell at the Coal Handling and Processing Plant (CHPP).
MOD 3	4 November 2003	MOD3 proposed the following changes to the site access arrangements: • Continued use of Dartbrook Road to provide access to the West Site; and • Use of local public roads by traffic associated with Dartbrook Mine. Prior to construction of the Kayuga Mine Access Road, access to the West Site was via Dartbrook Road. It was envisaged that Kayuga Mine Access Road would replace Dartbrook Mine as the primary access to the West Site. However, the Kayuga Mine Access Road was being used by trucks to haul coal to the CHPP. To avoid interactions between haul trucks and private vehicles, MOD3 proposed that Dartbrook Road should continue to be used as the primary access road for mine personnel. MOD3 also sought approval for locally based employees to access the West Site via local roads (Kayuga Road, Dartbrook Road and Blairmore Lane). For employees residing in the surrounding areas, these local roads provide more convenient access than the Western Access Road.
MOD 4	30 March 2004	DA 231-07-2000 allowed for truck haulage of coal to the CHPP over an 18-month period. Truck haulage was to be discontinued upon completion of the conveyor system for the Kayuga Seam, which would enable coal to be transferred to the CHPP via the Hunter Tunnel. MOD 4 extended the duration of truck haulage by 3 months to allow for haulage to continue until the completion of the Kayuga Seam conveyor system.

Modification	Approval Date	Activities
MOD 5	4 May 2005	MOD 5 facilitated changes to the rejects disposal system at Dartbrook Mine. The approved rejects disposal system involved the commissioning of a pipeline and pumping system for the transportation and disposal of reject materials. Engineering studies indicated that this method would pose significant technical risks due to the variability in relative quantities of coarse and fine rejects produced by the CHPP. MOD5 obtained approval for rejects to be transported to the Rejects Emplacement Area (REA) using trucks.
MOD 6	16 November 2005	MOD 6 provided approval for the following activities: • Establishment of four new Run of Mine (ROM) coal stockpiles and expansion of the existing emergency ROM coal stockpile at the CHPP; • Disposal of tailings within the Wynn Seam goaf; and • Operation of a Nitrogen Injection Plant to prevent the oxidation of coal.
MOD 7	11 March 2022	MOD 7 was determined by the NSW Independent Planning Commission (IPCN) on 9 August 2019. The IPCN approved the alternate mining method (bord and pillar mining) but not the proposed five-year extension to the duration of mining operations. Without the extension to operate under DA 231-07-2000 for a further five years, it was impractical to recommence mining at Dartbrook. In November 2019, an appeal was lodged against the IPCN's determination in the NSW Land and Environment Court. The court proceedings were resolved on 11 March 2022, with the proposed five-year extension of mining being approved. As a result, DA 231-07-2000 currently enables mining operations to be undertaken until 5 December 2027.

Dartbrook Operations is preparing to recommence mining activities in 2023, thereby transitioning Dartbrook Mine from care and maintenance back to an operational phase.

This Site Water Management Plan (SWMP) has been prepared to satisfy the requirements under Schedule 2, Condition 4.1(a) of DA 231-07-2000. This SWMP outlines the water management strategies to be implemented for future mining operations at the site. A separate Erosion and Sediment Control Plan has been prepared in accordance with Schedule 2, Condition 3.6 of DA 231-07-2000. Accordingly, erosion and sediment controls are not discussed in this SWMP.

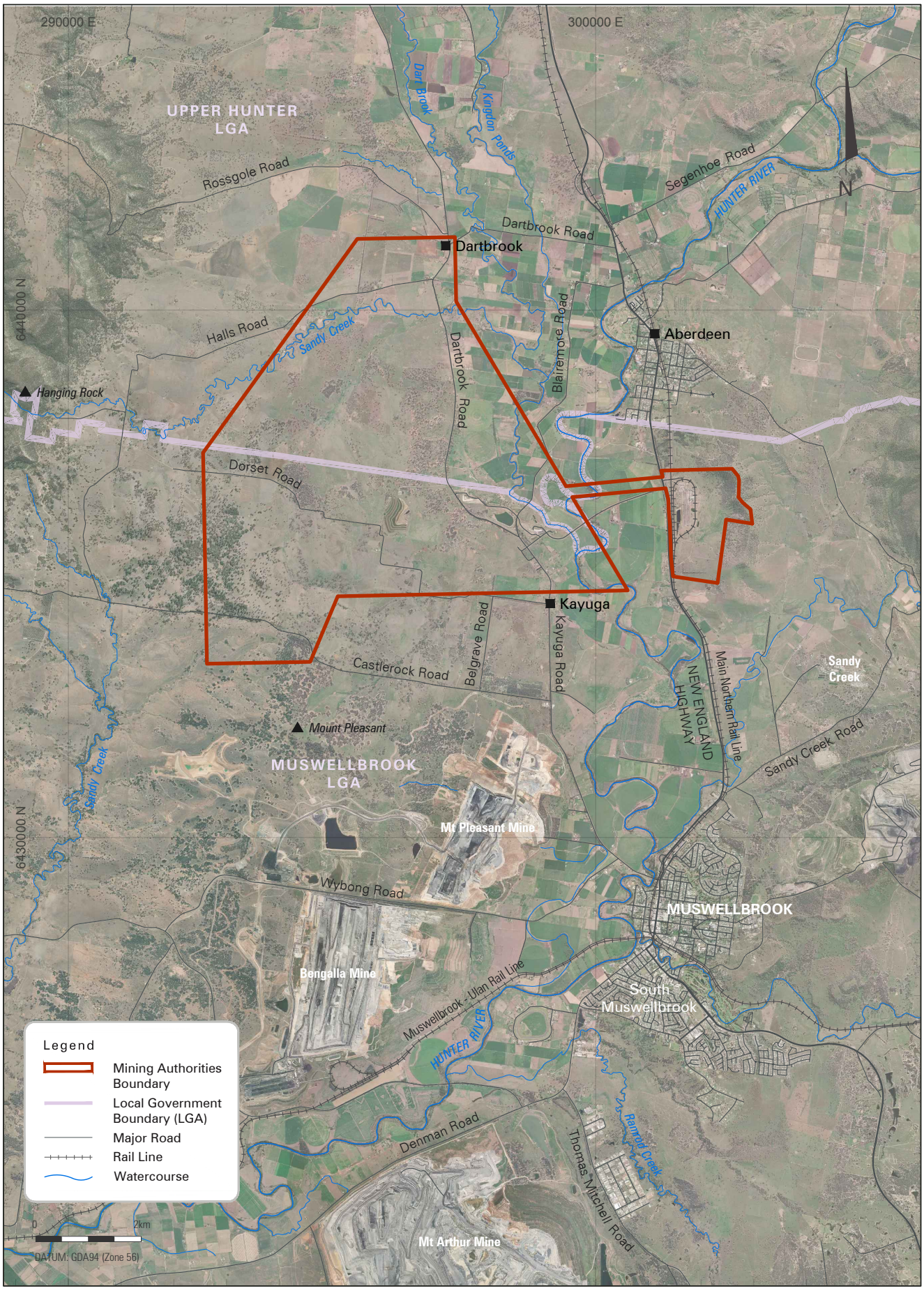
1.2 SITE LAYOUT

This SWMP includes management measures for all potential impacts to surface water and groundwater resources that are relevant to operational activities.

The Dartbrook Mine generally consists of the following main components:

- West Site surface facilities including workshop and maintenance facilities, administration building, underground mine portals and water management infrastructure;
- East Site surface facilities including the Coal Handling and Preparation Plant (CHPP), rail loop, train loadout facility, Rejects Emplacement Area (REA) and water management infrastructure;
- Wynn Seam underground mine workings which are decommissioned and currently used for mine water storage;
- Kayuga Seam underground mine workings, which will be active mining domain upon recommencement; and
- Hunter Tunnel which connects the underground mine workings to the East Site.

Figure 1 shows the location of these features of the Dartbrook Mine.



JBA 2188 DAR - F 01 SITE LOCALITY (14/03/2022)

DARTBROOK MINE

DARTBROOK

JAMES BAILEY & ASSOCIATES
Environmental and Planning Consultants

Regional Locality

FIGURE 1

1.3 MANAGEMENT PLAN REQUIREMENTS

This SWMP prescribes water management and monitoring measures for the approved mining operations at Dartbrook Mine. The primary objective of the SWMP is to manage and minimise the impact of the mine on the surrounding surface water and groundwater resources. These objectives will be met through the implementation of the management strategies specified in **Section 2**.

The specific requirements of the SWMP are outlined in Condition 4.1(a) under Schedule 2 of DA 231-07-2000. Additionally, Condition 4.3 of Schedule 2 of DA 231-07-2000 requires the development of a flood response plan, which has been included as a component of this SWMP.

The regulatory requirements that are relevant to this SWMP are reproduced in **Table 2**, with a reference to where each specific requirement is addressed in this SWMP.

Table 2 Management Plan Requirements Checklist

Development Consent Condition	Reference
4.1 Site Water Management Plan The Applicant must: (a) Prior to the recommencement of Mining Operations, prepare a Site Water Management Plan for the DA area, in consultation with DPIE Water and NRAR, MSC and to the satisfaction of the Secretary, which must include, but not be limited to, the following matters:	**Appendix A**
i. management of the quality and quantity of surface and groundwater to comply with the water performance measures in Table 4, including: 1) surface and groundwater impact assessment criteria; and 2) a description of the water management system and water balance;	**Sections 2, 3 & 6**
ii. management of storm water and general surface runoff diversion to ensure separate effective management of clean and mine water; including details of temporary surface drainage works to minimise the flow of surface water onto the rejects emplacement area and details of drainage works to direct runoff from the active rejects emplacement areas to onsite storage dams;	**Section 2.3**
iii. measures to prevent the degradation of downstream surface water quality below the pre-mining ANZECC beneficial water use classification due to mining operations, particularly in the Hunter River;	**Sections 2.3 & 3.2**
iv. measures to determine whether any groundwater from the Hunter River alluvium aquifers is captured by the mine including a response plan in the event that monitoring shows evidence of a dilution of salinity or change in water chemistry, or increase in inflow rate that may indicate leakage from the alluvium to the Hunter Tunnel;	**Section 6.1**

Development Consent Condition		Reference
v.	measures to be implemented in the event that the continued operation of the Hunter Tunnel leads to a significant increase in groundwater salinity in the alluvial aquifer system;	**Section 6.1**
vi.	contingency plans for managing adverse impacts of the development on surface and groundwater quality which must include: 1) contingency arrangements to manage excess saline water if the storage of the mine water management system is exceeded; and 2) contingency measures to manage any impacts identified by monitoring that the management strategies have failed to predict or control, particularly relating to groundwaters associated with the alluvial aquifer of the Hunter River, in consultation with DPIE-Water.	**Sections 6.1 & 6.3**
viii.	measures to ensure that waters of poorer quality are effectively segregated and reused on the site.	**Section 2.3**
ix.	details of a strategy for the decommissioning of water management structures, including mine water dams and clean water diversion dams	This SWMP addresses Dartbrook Mine activities during site operations. Decommissioning of the site, including water management infrastructure, will be conducted in accordance with the Mine Closure Plan prepared in accordance with Condition 2.1(e) under Schedule 2 of DA 231-07-2000.
x.	measures to isolate heavily contaminated waters, including waters containing oil and grease, or other pollutants, operation chemical residues or other criteria, to avoid mixing with reuse or discharge waters;	**Section 2.6**
xi.	measures for assessing chemical water quality impacts of the mining operation above and below the mine site;	**Section 5**
xii.	projection of potential groundwater changes during mining (short term) and post-mining (long term) with particular attention given to the effect of changes to groundwater quality and mobilisation of salts including down gradient of the rejects emplacement area;	**Sections 2.4** and **4**
xiii.	details of consultation with landholders who use water from the proposed longwall mining area and adjacent area and those parts of Dart Brook and Sandy Creek alluvia immediately adjacent to the mining areas, in relation to their requirements for and the availability of, water and must consider those water uses in the formulation of the management plan;	**Section 4.3**

Development Consent Condition			Reference
	xiv.	details of a surface water and groundwater monitoring program (refer to clause 4.2(a)(ii)); and	**Section 5**
	xv.	a program for reporting on the effectiveness of the water management systems and performance against objectives contained in the approved site water management plans, and EIS.	**Section 7**
	xvi.	measures to minimise the demand for external water supplies, including the reuse of mine waters for operational activities where possible.	**Sections 2.2** and **6.3**
(b)		The Applicant must undertake annual assessments of the accuracy of the groundwater model predictions outlined in the EIS compared with monitored groundwater impacts in consultation with DPIE Water and NRAR. Details of the assessments must be reported in the Annual Review and the scope of the assessment must be determined in consultation with DPIE Water and NRAR. Should the assessment identify significant differences between the EIS model predictions and monitored impacts, the Applicant must revise the assessment of the potential impacts on groundwater systems in consultation with DPIE Water and NRAR and implement any further mitigation measures in consultation with DPIE Water and NRAR.	**Section 7.1**
(b1)		The Applicant must ensure that the development complies with the performance measures in Table 4.	**Section 2.1**
(b2)		The performance measures in Table 4 do not apply to water management structures constructed prior to the approval of Modification 7.	Noted
(c)		The Applicant must provide a compensatory water supply to any landowner of privately-owned land whose rightful water supply is adversely and directly impacted (other than an impact that is minor or negligible) as a result of the development, in consultation with DPIE-Water, and to the satisfaction of the Secretary.	**Section 4.3**
(c1)		The compensatory water supply measures must provide an alternative long-term supply of water that is equivalent, in quality and volume, to the loss attributable to the development. Equivalent water supply should be provided (at least on an interim basis) as soon as practicable after the loss is identified, unless otherwise agreed with the landowner.	**Section 4.3**
(c2)		If the Applicant and the landowner cannot agree on whether the loss of water is to be attributed to the development or the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.	**Section 4.3**
(c3)		If the Applicant is unable to provide an alternative long-term supply of water, then the Applicant must provide compensation, to the satisfaction of the Secretary.	**Section 4.3**

Development Consent Condition	Reference
***Notes**:* • *The Water Management Plan (see Condition 4.2(a)) is required to include trigger levels for investigating potentially adverse impacts on water supplies.* • *The burden of proof that any loss of surface water or groundwater access is not due to mining impacts rests with the Applicant.*	
Water Supply (d) The Applicant must i. ensure that it has sufficient water for all stages of the development, ii. implement efficiency and best practice measures to minimise and conserve the use of water; and iii. if necessary, adjust the scale of the development to match its available water supply.	**Sections 2.5** and **3.2**
(d1) The Applicant must report on water extracted from the site each year (direct and indirect) in the Annual Review, including water taken under each water licence. ***Note:*** *Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain all necessary water licences for the development, including during rehabilitation and following mine closure.*	**Section 7.1**
4.3* Flood Response Plan** (a) The Applicant must, prepare and implement a Flood Response Plan, to the satisfaction of the Secretary. The Plan must identify flood risks and describe the mitigation measures and management procedures to mitigate these risks and ensure the safety of personnel on the site during flood events. ***Notes: • *In this condition, "flood" is considered to be any event exceeding the 20% Annual Exceedance Probability (AEP) up to and including the Probably Maximum Flood (PMF) event.* • *Under the Work Health and Safety Act 2011 and the Work Health and Safety (Mines and Petroleum Sites) Act 2013, the Applicant is responsible for ensuring the safety of its workers and contractors.*	**Section 6.4**

1.4 STAKEHOLDER ENGAGEMENT

DPIE-Water (as it was then) and MSC were provided with a previous draft of the SWMP for comment on 5 March 2020. MSC provided comments on 12 March 2020 and recommended that regular monitoring of streams should recommence at least 3 months prior to recommencement of mining activities. DPIE-Water responded on 24 March 2020 and did not request any amendments other than finalisation of the SWMP with all appendices.

This version of the SWMP was distributed to MSC and DPE-Water for comment on 16 May 2023 via the NSW Planning Portal. Comments were received from MSC and DPE-Water on 7 June and 26 June, respectively. **Table 3** lists the matters raised by these authorities and identifies where those matters are addressed in this SWMP.

This version of the SWMP was approved by DPE on 16 August 2023. All correspondence from regulatory authorities related to this SWMP is included in **Appendix A**.

Table 3 Matters raised by Regulatory Authorities

Stakeholder	Matter Raised	Relevant Sections
MSC	Frequency of surface water quality monitoring and the analytes considered	**Section 5.1**
	Monitoring of Sandy Creek alluvium, particularly the loss of access to monitoring bore BRO3	**Section 5.3**
	Rising EC trend at monitoring bore RDH510	**Section 4.1**
	Depths of groundwater monitoring bores	**Section 5.3**
	Protocol for update of SWMP in response to incidents	**Section 9**
DPE-Water	Quantification of water take and confirmation that water licensing entitlements are sufficient	**Section 2.5**
	Baseline groundwater monitoring data	**Section 4.1**
	Analytes considered in groundwater quality monitoring	**Section 5.3**
	Predicted deficit in the water balance	**Section 3.2**
	Inclusion of triggers for mine inflow volumes in the Trigger Action Response Plan	**Section 6.1.3**
	Scope of investigations into trigger exceedances	**Section 6.1.5**
	Quality assurance and quality control of groundwater data in accordance with the 'Draft National Minimum Groundwater Monitoring Guidelines for Groundwater'	**Section 5.4**
	Recalibration and validation of the groundwater model	**Section 6.1.3**

1.5 DOCUMENT STRUCTURE

This document is structured as follows:

- **Section 2** provides an overview of the general water management strategies implemented at Dartbrook Mine;
- **Section 3** includes a water balance for Dartbrook Mine;
- **Section 4** provides an overview of the erosion and sediment control management measures at Dartbrook Mine;
- **Section 5** describes the surface water, groundwater and erosion and sediment monitoring programs in place at Dartbrook Mine;
- **Section 6** includes a discussion on measures for the management of water impacts, including contingency response measures and triggers for impact investigations;
- **Section 7** describes reporting requirements for water monitoring and management at Dartbrook Mine;
- **Section 8** outlines responsibilities for key personnel involved in the management of water on site;
- **Section 9** confirms the requirements for the ongoing review of this SWMP; and
- **Section 10** and **Section 11** provide a list of abbreviations and information sources referred to in this SWMP, respectively.

2. WATER MANAGEMENT

2.1 PERFORMANCE MEASURES

Schedule 2, Condition 4.1(b1) of DA 231-07-2000 prescribes performance measures for evaluating the effectiveness of water management at Dartbrook Mine. **Table 4** lists these performance measures and explains Dartbrook Mine's approach to maintaining compliance.

Schedule 2, Condition 4.1(b2) of DA 231-07-2000 explains that the water performance measures in **Table 4** do not apply to water management structures constructed prior to MOD 7. All existing mine water dams were constructed prior to MOD 7 and no additional mine water storages are proposed. The existing clean water and sediment dams were also constructed prior to MOD 7. These structures will be retained for the remainder of the mine life and additional diversion structures and/or sediment dams may be required as the REA is further developed.

2.2 WATER MANAGEMENT SUMMARY

The key principles of the water management strategy at Dartbrook Mine are:

- Diversion of rainfall runoff from undisturbed catchments away from mine infrastructure areas;
- Capture and treatment of runoff from disturbed catchments in accordance with the Erosion and Sediment Control Plan;
- Management of mine inflows and other coal-affect water within mine water dams and underground storages;
- Reuse of accumulated mine water for operational demands (both underground and at the surface facilities); and
- Passive release of excess mine water through evaporation.

The key water management areas at Dartbrook Mine include the following:

- The Staged Discharge Dam (SDD) and Western Holding Dam (WHD) at the West Site;
- The Eastern Holding Dam (EHD) and REA at the East Site;
- The Hunter Tunnel and Wynn Seam goaf water storage;
- The Evaporation Ponds overlying the underground mining area; and
- Ventilation shafts and other minor infrastructure areas.

The Dartbrook Mine Evaporation Ponds (**Figure 2**) were re-commissioned in 2011 and are currently used for passive disposal of excess mine water. The storage capacity is approximately 124 ML. The estimated rate of evaporation is in the order of 100 to 150 ML per annum (depending on climatic conditions).

A schematic diagram of the water management system is provided in **Appendix B**.

Table 4 Water Management Performance Measures

Feature	Performance Measure	Management Approach	Relevant Sections
Water management – General	Maintain separation between clean and mine water management systems	Runoff from undisturbed catchments is diverted around the site using drains and catch dams (wherever practicable).	**Section 2.3**
	Minimise the use of clean and potable water on the site	Mine water is reused for operational purposes (other than those that require potable quality water)	**Section 2.2**
	Minimise the use of make-up water from external sources	Mine water is reused for operational purposes (other than those that require potable quality water)	**Section 2.2**
	Design, install, operate and maintain water management infrastructure in a proper and efficient manner	The existing water management structures were constructed prior to MOD 7 and are therefore not subject to this measure. Notwithstanding, the existing structures are routinely inspected and maintained to ensure their effective operation.	**Sections 2.3** & **5.2**
Erosion and sediment control works	Design, install and maintain erosion and sediment controls in accordance with the guidance series *Managing Urban Stormwater: Soils and Construction* including *Volume 1: Blue Book (Landcom, 2004), Volume 2A: Installation of Services (DECC, 2008), Volume 2C: Unsealed Roads (DECC,2008) and Volume 2E: Mines and Quarries (DECC, 2008)*	Runoff from disturbed areas is managed in accordance with the Erosion and Sediment Control Plan, which is a separately document.	**Erosion and Sediment Control Plan**
	Design, install and maintain any infrastructure within 40 metres of watercourses in accordance with the guidance series for *Controlled Activities on Waterfront Land* (DPI Water, 2012)		
	Design, install and maintain any creek crossings generally in accordance with the *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management* (DPI, 2013) and *Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries 2003)	The Western Access Road includes bridges over the Hunter River and Dart Brook. These bridges were constructed prior to MOD 7. No creek crossings are required.	**Not applicable**

Feature	Performance Measure	Management Approach	Relevant Sections
Clean water diversions and storage infrastructure	Design, install and maintain the clean water system to capture and convey the 100 year Annual Recurrence Interval (ARI) flood	Existing clean water diversions were constructed prior to MOD7. These structures may need to be modified to accommodate future reject emplacement. Any modifications or additional diversion structures will be designed consistent with this design storm event.	**Section 2.3**
	Maximise as far as reasonable the diversion of clean water around disturbed areas on the site, except where clean water is captured for use on the site	Runoff from undisturbed catchments is diverted around the site using drains and catch dams (wherever practicable).	**Section 2.3**
Sediment dams	Design, install and maintain sediment dams in accordance with the guidance series *Managing Urban Stormwater: Soils and Construction* including *Volume 1: Blue Book (Landcom, 2004) and Volume 2E: Mines and Quarries (DECC, 2008)*	Sediment-laden water is managed in accordance with the Erosion and Sediment Control Plan, which is a separately document.	**Erosion and Sediment Control Plan**
Mine water storages	Design, install and maintain mine water storage infrastructure to avoid unlicensed or uncontrolled discharges to surface waters as far as reasonable and practicable	All mine water dams were constructed prior to MOD 7. Mine water dams are operated with at least 50% freeboard to minimise the risk of overflows. Mine water can be transferred from dams to underground storages to achieve the target freeboard.	**Sections 2.3 & 5.2**
Mine water discharges	No discharges to surface waters except in accordance with an Environment Protection Licence, section 120 of the *Protection of the Environment Operations Act 1997* or *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*	AQC currently does not hold the entitlements required to discharge water. Surplus water is either released via the Evaporation Ponds or stored within the Wynn Seam Goaf.	**Section 6.3**
Chemical and hydrocarbon storage	Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standard	Chemicals and hydrocarbon products are stored in accordance with the relevant Australian Standards.	**Section 2.6**
Tailings storage	Design and maintain tailings storage areas to encapsulate and prevent the release of tailings seepage/leachate	Tailings will be stored within designated cells within the REA. These cells will be designed by appropriately qualified persons.	**Section 2.3.2**

2.3 WATER MANAGEMENT STRATEGIES

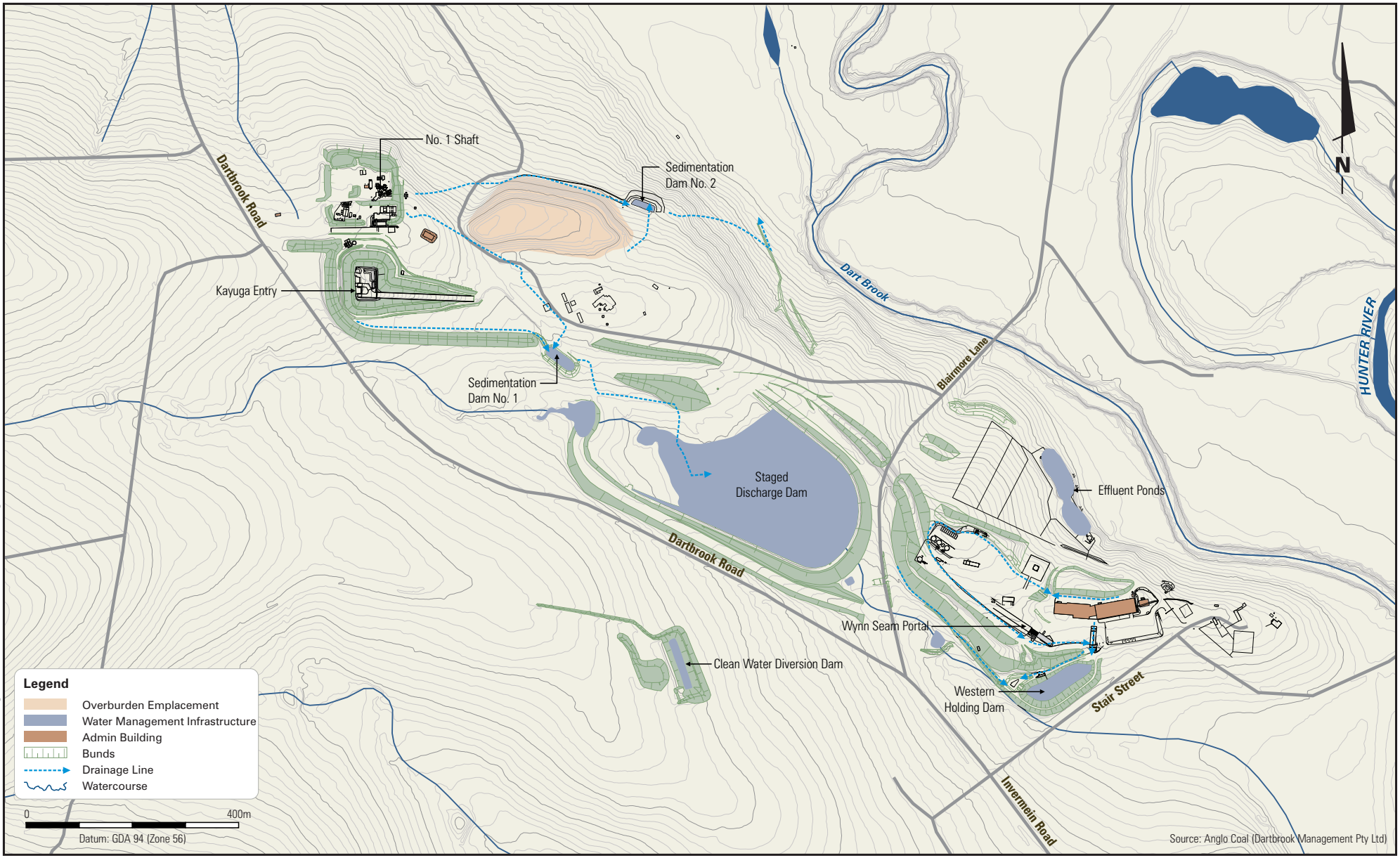
2.3.1 West Site Surface Runoff

The West Site drainage management plan is shown in **Figure 2**. The West Site is located within an isolated catchment (approximately 22 ha) formed by a ridge line and perimeter bunds. Site runoff is collected in perimeter drains and directed to the WHD (15 ML). WHD water is contained on site and re-used for mine water supply. In 2011 the WHD was desilted and restored to full design capacity.

Runoff is diverted away from the Kayuga Entry by a drain to the north, and the visual bund to the west. The diverted runoff is captured by Sedimentation Dam No. 1, located south-east of the Kayuga Entry. The retained water can be pumped to the underground workings for storage. Any overflow from this dam is captured in the SDD (approximately 450 ML). Water captured by the SDD is stored for re-use as a mine water supply or discharged to the Hunter River in accordance with Environment Protection Licence (EPL) 4885. At the time of this SWMP, Dartbrook Mine does not hold any discharge credits under the Hunter River Salinity Trading Scheme (HRSTS). Nevertheless, EPL 4885 provides authority to discharge if Dartbrook Mine acquires discharge credits in the future.

Runoff from the overburden emplacement is collected in a catch drain along the northern toe of the dump and directed to Sedimentation Dam No. 2.

Runoff from the Access Road cutting in the vicinity of Blairmore Lane collects in sumps and drains to the WHD.



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DARTBROOK MINE

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Australian Pacific Coal

West Site Water Management Structures

FIGURE 2

The SDD and the WHD have more than sufficient capacity to contain runoff from these small catchments and are not predicted to overflow (see **Section 3**). The water levels in these dams are monitored monthly, after significant runoff events and continuously (using CITECT). If necessary, following prolonged rainfall, water from these dams can be transferred to the Wynn Seam Goaf to enable the maintenance of 50% freeboard capacity in these dams, which is sufficient to contain a 2% Annual Exceedance Probability (AEP) flood event. The Wynn Seam Goaf has a storage capacity of approximately 4,356 ML.

2.3.2 East Site Surface Runoff

The East Site drainage management plan is shown in **Figure 3**. The crest of Browns Mountain forms a catchment boundary and water in the catchment drains towards the west.

Reject Emplacement Area

Only a relatively small portion of the approved REA was developed during previous operations (i.e. prior to 2007). A network of drains, bunds and clean water dams currently diverts clean runoff around the previously developed REA. As shown in **Figure 3**, drainage from the northern and southern parts of the upslope Browns Mountain catchment are diverted to the north and south respectively.

The previously developed portion of the REA was rehabilitated during the previous period of care and maintenance. Runoff from the rehabilitated catchment drains through a series of smaller sediment control dams and around the EHD (current catchment of approx. 40 ha).

Further development of the REA will be required to dispose of the reject materials generated by future mining operations. It is anticipated that REA development will progress southwards from the previously developed portion, and will intercept the existing water diversion structures. These diversion structures will be realigned prior to being intercepted by reject emplacement activities, to ensure that clean water continues to be directed away from disturbed areas.

It is proposed that future tailings will be dried and emplaced in dedicated tailings cells within the REA. The rehabilitation risk assessment conducted in 2022 determined that tailings leachate would be similar in quality to the natural Permian groundwater. As such, seepage from tailings emplacements is not expected to negatively affect groundwater quality. Notwithstanding, tailings cells will be designed by suitably qualified persons.

CHPP Area

Runoff from within the CHPP area is directed to the EHD (approximately 85 ML). The contained catchment area at the East Site (including the rehabilitated REA) is approximately 90 ha. Water from the EHD is contained on site and re-used for onsite activities. Excess water can be transferred to the WHD, SDD or the Wynn Seam goaf.

Runoff from undisturbed catchments to the east of the CHPP is diverted around the disturbed catchment area and directed to sedimentation dams (the Northern and Southern Sediment Dams) prior to discharging from the site.

To minimise the risk of overflows, the EHD is inspected weekly and continuously monitored using Dartbrook Mine's CITECT system. If necessary, following prolonged rainfall, water from the EHD is transferred to the Wynn Seam Goaf to maintain 50% freeboard capacity, which is sufficient to contain a 2% AEP flood event.

Water will be drawn from the EHD for CHPP use and dust suppression. If there is insufficient water in the EHD for these purposes, water can be sourced from the Wynn Seam Goaf storage area. There is also the ability to transfer water between the EHD and the WHD as the need arises.

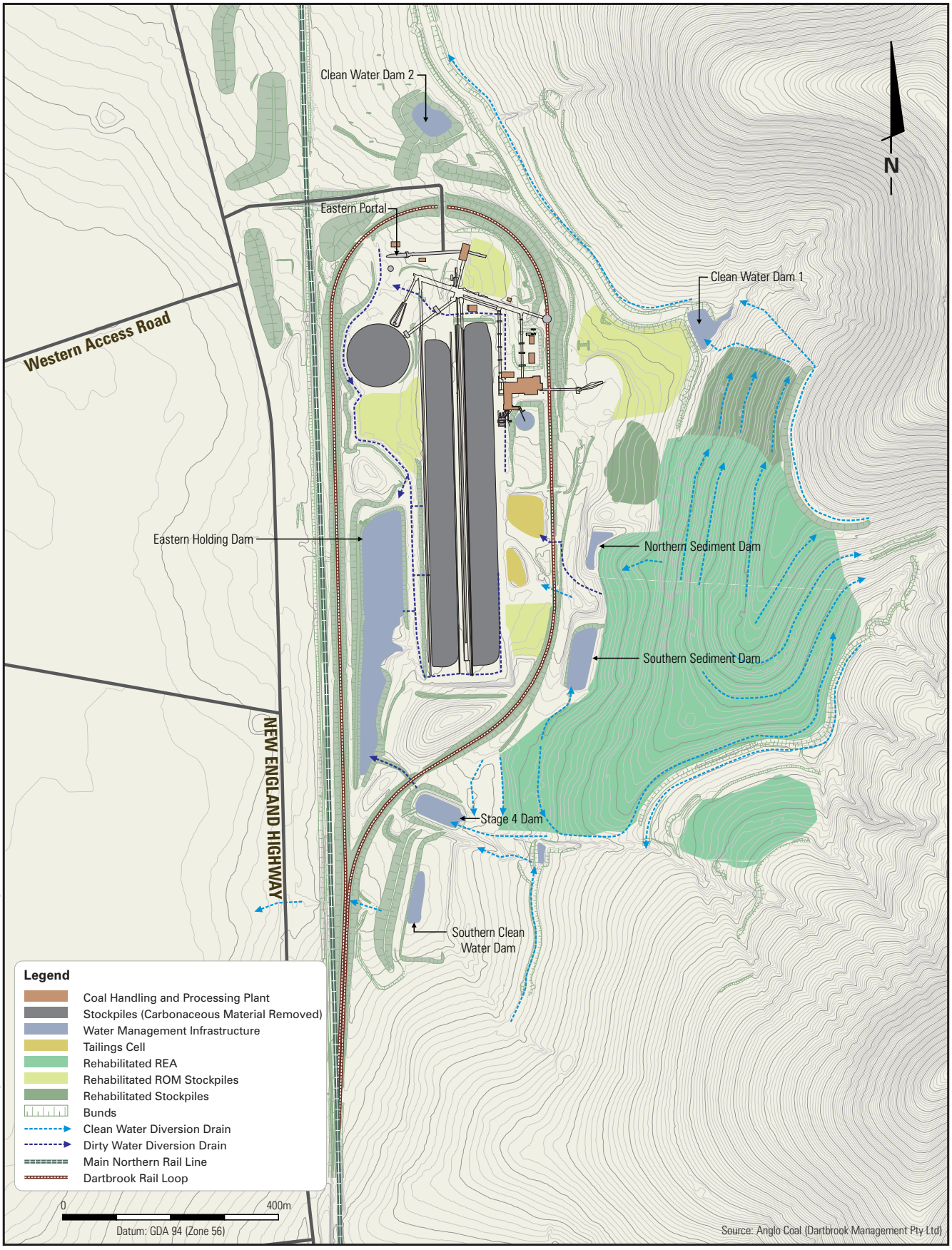

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FIGURE 3

2.4 GROUNDWATER MANAGEMENT STRATEGIES

2.4.1 Hunter Tunnel Dewatering

The Hunter Tunnel will be actively dewatered during mining operations to maintain the integrity of the tunnel and facilitate transportation of coal from the underground workings to the East Site. Water that collects in the Hunter Tunnel will continue to be pumped to the Wynn Seam Goaf storage area. Long term monitoring records indicate that the rate of inflow to the Hunter Tunnel has generally been in the order of 182 ML/year.

The Hunter Tunnel inflow rate and water quality will continue to be monitored monthly in accordance with the site water monitoring program specified in **Section 4**. Any monitoring results that may indicate an unanticipated impact, such as an increase in seepage rate or change in water quality, will trigger an investigation. Depending on the findings of any investigation, appropriate mitigation measures would be developed and implemented in consultation with DPE-Water.

2.4.2 Wynn Seam Goaf

The Wynn Seam Goaf is an approved tailings and mine water storage area. A detailed assessment of the potential groundwater impacts of tailings and mine water storage in the goaf area was included in the Statement of Environmental Effects (Hansen Consulting, 2005) that supported Modification 6 to DA 231-07-2000. The assessment concluded that there will be no significant adverse groundwater impacts. The groundwater monitoring program discussed in **Section 5.2** is designed to detect any unexpected groundwater impacts. No tailings disposal has occurred on site since 2007.

The storage of water in the Wynn Seam Goaf is a key water management strategy for the site. Water can be pumped into the Wynn Seam Goaf from the Hunter Tunnel and surface dams (e.g. to maintain freeboard). Conversely, water can be pumped from the goaf to the surface using pleuger pumps. Pumping is generally managed so that rate of outflow is similar to the rate of incoming water.

Storage volumes in the Wynn Seam Goaf will be managed preferentially by reusing the water for operational demands. Accumulated mine water will be suitable for most underground uses, dust suppression and coal processing.

The Trigger Action Response Plan (TARP) for the Wynn Seam Goaf (see **Section 6.1**) aims to maintain the water level at less than -66 mAHD at the pleuger pump monitoring site. If the water level reaches this trigger value, the pleuger pumps will be activated to reduce the storage volume in the goaf. At the trigger level of -66 mAHD, the storage volume in the goaf is approximately 2,915 ML.

2.4.3 Kayuga Seam Workings

The groundwater assessment undertaken for MOD 7 (AGE, 2018) predicted that rates of groundwater seepage into the underground workings will be very low (< 20 ML/year). Notwithstanding, the Kayuga Seam workings will be dewatered as needed to allow underground mining to occur. Groundwater may be pumped from the Kayuga Seam workings to the Wynn Seam goaf or surface mine water dams.

2.5 WATER LICENCES

There are three Water Sharing Plans (WSPs) that apply to the water sources in the vicinity of Dartbrook Mine, namely:

- *Water Sharing Plan for the Hunter Regulated River Water Source 2016* (Hunter Regulated WSP);
- *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* (Hunter Unregulated WSP); and
- *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2009* (North Coast WSP).

Given that the relevant water sources are all subject to WSPs, the licensing regime under the *Water Management Act 2000* (WM Act) is applicable to Dartbrook Mine.

Groundwater inflows to the underground mine workings (excluding the Hunter Tunnel) are deemed to be taken from the Permian aquifer, which includes the coal seams and surrounding rock strata. The Permian aquifer falls within the Sydney Basin-North Coast Groundwater Source under the North Coast WSP. As explained in **Section 4.2**, inflows to the underground workings are predicted to be less than 20 ML/year. AQC Dartbrook holds WALs in this water source with a total entitlement of 180 units, which is sufficient to account for the predicted mine inflows.

Groundwater inflows to the Hunter Tunnel are deemed to be taken from the Hunter River alluvial aquifer. This aquifer is referred to as the Hunter Regulated River Alluvial Water Source under the Hunter Unregulated WSP. Long-term monitoring data indicates that Hunter Tunnel inflows are generally in the order of 182 ML/year. AQC Dartbrook holds WALs in this water source with a total entitlement of 1,249 units, which is sufficient to account for Hunter Tunnel inflows.

The East Site and West Site capture rainfall runoff from the catchments of the Hunter River and Dart Brook. These catchments form part of the Dart Brook Water Source under the Hunter Unregulated WSP. The water balance model predicts that the East Site and West Site may capture up to 262 ML/year of runoff in a wet year (10% AEP). AQC Dartbrook holds WALs in this water source with a total entitlement of 328 units.

Table 5 provides a summary of the predicted water takes, the water sources that are affected, and AQC Dartbrook's licensed entitlements for those water sources. A list of AQC Dartbrook's WALs and associated works approvals is provided in **Appendix C**.

Table 5 Water Licences

Nature of Take	Quantity of Take (ML/year)	Water Source	WSP	Total Entitlements (Units)
Mine inflows	20	Sydney Basin-North Coast Groundwater Source	North Coast WSP	180
Hunter Tunnel inflows	182	Hunter Regulated River Alluvial Water Source	Hunter Unregulated WSP	1,249
Containment of surface runoff	262*	Dartbrook Water Source	Hunter Unregulated WSP	328

** Quantity under wet conditions (10% AEP)*

2.6 HYDROCARBON MANAGEMENT

The use of hydrocarbon products (such as oils and diesel fuel) occurs predominantly at the West Site workshop, although small quantities may be stored at the CHPP. Hydrocarbon products are stored within bunded areas to prevent spills off-site. Both the East Site and West Site are equipped with spill kits containing absorbent materials.

Runoff from the West Site workshop is captured by an oil separator for clarification. Overflows from the oil separator drain to the Western Holding Dam. Therefore, all water that is potentially contaminated by hydrocarbons is treated and then retained within the mine water management system.

3. MINE WATER BALANCE

3.1 ASSESSMENT METHODOLOGY

A numerical water balance model was developed by Alluvium Consulting to assess the performance of the Dartbrook water management system (WMS) under a wide range of climate scenarios. The modelling was conducted using the GoldSim software, which is best practice for mine water balances. The objectives of the water balance modelling were to determine:

- Demands on external water sources (i.e. raw water from the Hunter River) and whether these are accounted for by AQC's existing water licences; and
- Potential discharges from mine water storages.

Daily precipitation and evapotranspiration data for the model were sourced from the SILO database. Separate rainfall and evaporation time series were used for the East Site and West Site due to these catchments falling under different grids in the SILO database. The GoldSim model utilised 120 years of climate data (from 1900 to 2020), thus ensuring that a comprehensive range of scenarios have been assessed. Rainfall runoff from the contributing catchments was calculated using the Australian Water Balance Model (AWBM). The local parameters adopted for the AWBM were consistent with those presented in 'Mount Pleasant Operation Mine Optimisation Modification Site Water Balance Review' (Hydro Engineering and Consulting, 2017) conducted for the neighbouring site.

The Hunter Tunnel was actively dewatered during previous mining operations and most of the care and maintenance phase. Water that accumulates in the Hunter Tunnel is pumped to and stored in the Wynn Seam Goaf. These volumes have historically been monitored using flow meters, which provide empirical data on the quantity of inflows to the Hunter Tunnel. These long-term pumping records indicate that the Hunter Tunnel typically receives inflows in the order of 182 ML/year.

Groundwater inflows to the underground workings were based on the predictions of the MOD7 groundwater assessment (AGE, 2018).

The water balance model was run on a daily timestep for the remainder of the approved mining period (i.e. 2023 to 2027, inclusive). As is typical of an underground mine, the catchment of the WMS will not change during the remaining mining period. As such, differences in the water balance from year to year are due primarily to differences in operational water use (e.g. dust suppression, coal processing and underground re-use).

3.2 RESULTS

The predicted water balances for Year 1 (2023) and Year 5 (2027) are presented in **Table 6** and **Table 7**, respectively. Years 1 and 5 are presented as the representative model years, as these years correspond the minimum and maximum coal production during the remaining mining period.

Model results are presented for an average year (589 mm of rainfall), dry year (402 mm) and wet year (802 mm).

Table 6 Modelled Water Balance for 2023 (Year 1)

Mine Water Sources and Demands	Annual Volume (ML)		
	Dry Year (90% AEP)	Average Year (50% AEP)	Wet Year (10% AEP)
Inflows			
Seepage into Hunter Tunnel	182	182	182
Seepage into mine workings	20	20	20

Mine Water Sources and Demands	Annual Volume (ML)		
	Dry Year (90% AEP)	Average Year (50% AEP)	Wet Year (10% AEP)
East Site surface runoff	11	22	184
West Site surface runoff	4	8	65
Raw water extracted from the Hunter River	0	0	0
Sub-Total	***217***	***232***	***451***
Outflows			
Evaporation	121	140	195
Loss to coal seam	68	68	68
Water usage for surface operations	100	100	100
Water usage for underground operations	300	300	300
Spill	0	0	0
Sub-Total	***589***	***608***	***663***
NET WATER BALANCE	***-372***	***-376***	***-212***

Table 7 Modelled Water Balance for 2027 (Year 5)

Mine Water Sources and Demands	Annual Volume (ML)		
	Dry Year (90% AEP)	Average Year (50% AEP)	Wet Year (10% AEP)
Inflows			
Seepage into Hunter Tunnel	182	182	182
Seepage into mine workings	20	20	20
East Site surface runoff	11	21	194
West Site surface runoff	4	8	68
Raw water extracted from the Hunter River	0	0	0
Sub-Total	***217***	***231***	***464***
Outflows			
Evaporation	4	4	15
Loss to coal seam	68	68	68
Water usage for surface operations	300	300	300
Water usage for underground operations	899	899	899
Spill	0	0	0
Sub-Total	***1271***	***1271***	***1282***
NET WATER BALANCE	***-1054***	***-1040***	***-818***

Demand for External Water Supplies

As indicated by the model results, outflows from the WMS are predicted to exceed inflows, thus resulting in a net water deficit. This deficit will be addressed by re-using the accumulated water in the Wynn Seam Goaf. As at December 2022, there was more than 3 GL of water stored in the Wynn Seam Goaf. The accumulated water is the culmination of past inflows and as such, re-using this water has not been characterised as an inflow (to avoid double counting).

As shown in **Table 6** and **Table 7**, Dartbrook Mine is not expected to require external raw water under any climate scenarios. That is, the existing site inventory (particularly the Wynn Seam Goaf storage) and passive inflows in the future will be sufficient to meet operational demands.

The GoldSim model did not consider potable water demands, as the potable water system is completely independent of the mine water management system. Potable water is sourced from the Aberdeen municipal supply or Blairemore bores as required to meet demands.

Discharges

The GoldSim model predicts that there will be no spills from mine water dams, even under the wettest historical conditions. This indicates that Dartbrook Mine can continue to operate without discharging under the HRSTS.

4. GROUNDWATER STUDIES

4.1 BASELINE GROUNDWATER CONDITIONS

The groundwater monitoring program (described in **Section 5.3**) was initiated in 1997 and implemented throughout the previous mining operations and the care and maintenance phase. Accordingly, there is an extensive monitoring dataset to assess the impacts of previous longwall mining as well as recovery during care and maintenance. The long-term trends in water levels and quality are illustrated in **Appendix D**.

The following observations can be made from the available long-term data:

- No long-term decline in water levels has been observed in the Hunter River alluvial monitoring bores, either during or after previous mining operations;
- The Dart Brook and Sandy Creek alluvial monitoring bores recorded declining water levels during previous mining operations. This decline coincided with the falling trend in the cumulative rainfall departure (CRD) from mid-2001 to mid-2007. Water levels in these alluvial aquifers recovered during the care and maintenance phase, consistent with the rising trend in the CRD during this period. Due to the correlation between measured water levels and the CRD, it is likely that trends in water levels are more influenced by climatic conditions than activities at Dartbrook Mine;
- The regolith monitoring bores recorded declining water levels during longwall mining of the Kayuga Seam from 2004 to 2006. Groundwater levels have since stabilised in bores CAS4 and TLON1 but remain below pre-mining conditions. Bore CAS2 continued to record declining water levels for a significant period after cessation of mining. The regolith monitoring bores indicate that long-term depressurisation of the regolith (shallow weathered bedrock) has occurred in the vicinity of the completed Kayuga longwall panels;
- The coal seam monitoring bores recorded declining water levels during previous longwall mining, as would be expected for the coal seam aquifer. Coal seam water levels have recovered during care and maintenance, consistent with the rising CRD; and
- The REA monitoring bores (which are screened in the Permian) have not recorded any long-term water level trends during previous mining or the care and maintenance phase. Bore RDH510 has exhibited a steady increase in EC since 2008. Given that Dartbrook Mine has not operated whilst this rising trend has been observed and the absence of rising EC levels in the other REA bores, the rising EC at RDH510 is more likely to be due to local factors rather than an impact of Dartbrook Mine. Notwithstanding, this trend will continue to be monitored following recommencement of mining and investigated if further EC increases trigger the TARP (see **Section 6.1**).

4.2 ANALYTICAL GROUNDWATER MODEL

AGE (2018) conducted the groundwater assessment that supported the MOD7 application for bord and pillar mining of the Kayuga Seam. This assessment included a water balance for the Wynn Seam Goaf to predict potential inflow volumes. The Wynn Seam Goaf receives pumped inflows from the Hunter Tunnel and other storages, as well as passive inflows from the Permian aquifer. The primary outflow from the Wynn Seam Goaf is dewatering by the Pleuger pump to manage goaf water levels. All pumped inflows and outflows are measured by flow meters or calculated from pumping hours. The storage volume in the goaf is calculated based on the surveyed water level. Given that pumped inflows, outflows and the storage volume are measured, it was possible to calculate the passive seepage (as this was the only unmeasured variable in the water balance). AGE (2018) determined that Hunter Tunnel inflows account for almost all inflow to the Wynn Seam Goaf, and that seepage from the Permian aquifer is negligible. The take from the Permian aquifer was conservatively assumed to be <20 ML/year. As would be expected, the predicted takes associated with bord and pillar mining are substantially lower than those predicted by the Mackie Environmental Research (2000) model for longwall mining.

The majority of inflows to the Hunter Tunnel are concluded to be taken from the Hunter River alluvial aquifer. For licensing purposes, these inflows are assumed to be taken from the Hunter Regulated River Alluvial Water Source. Long-term water level monitoring indicates that this take has not resulted in any decline in alluvial water levels, as the rate of rainfall recharge is greater than the rate of seepage.

The groundwater monitoring program, as described in **Section 5.3,** includes monitoring of all aquifers that may be influenced by Dartbrook Mine. Monitoring data will be used to validate the predictions of the analytical groundwater model.

4.3 IMPACTS ON PRIVATELY OWNED GROUNDWATER BORES

Previous longwall mining at Dartbrook Mine was suspended in December 2006. Groundwater monitoring is undertaken at two privately owned groundwater bores (named Belgrave and GW038582) which may have been affected by previous mining activities. The locations of these bores are shown on **Figure 5**.

Monitoring and management measures for these bores were included in the relevant property subsidence management plans (PSMPs) for these properties. The PSMPs have been approved by the Resources Regulator (previously the Department of Resources and Geoscience) and were prepared in accordance with DA 231-07-2000 and in consultation with the relevant property owners.

The management strategy specified for potential impacts on privately owned bores now includes the following components:

- Monitoring of groundwater for water level, pH and salinity as per **Table 10**;
- Investigation of material changes in groundwater levels or quality in accordance with the TARP (see **Section 6.1**);
- Investigations in response to complaints from land owners (regardless of whether a trigger exceedance has occurred);
- If an investigation concludes that a privately owned bore has been adversely impacted by AQC Dartbrook's mining activities, AQC Dartbrook will reinstate or provide alternative water supplies for the landholder in accordance with Condition 4.1(c) of DA 231-07-2000; and
- Any disputes in relation to whether or not damage to a bore has occurred due to mining will be referred to DPE for resolution in accordance with the dispute resolution procedure in Schedule C of DA 231-07-2000.

AGE (2018) conducted an assessment of the bord and pillar mining that was subsequently approved through MOD7. This assessment determined that the Kayuga Seam has already been substantially depressurised by previous mining activities and that the bord and pillar mining approved under MOD7 is unlikely to result in further impacts. As such, recommencement of mining is not expected to result in further impacts to private bores, particularly bores that have previously been affected by longwall mining completed prior to 2007.

5. MONITORING PROGRAM

5.1 SURFACE WATER QUALITY MONITORING

Given that the water balance model predicts no off-site discharges from mine water storages, it is unlikely that impacts on the water quality of the surrounding watercourses will occur. Notwithstanding, Dartbrook Mine will continue to implement surface water quality monitoring in accordance with Condition 4.1 under Schedule 2 of DA 231-07-2000 and existing practices.

The surface water monitoring program is designed to the monitor the quality of surface water within the WMS and surrounding watercourses, including:

- Runoff from the East Site, including the infrastructure areas, which is collected in the EHD and the REA Stage 4 Dam;
- Underdrainage water from the REA;
- Runoff from the West Site, which collects in the WHD and SDD;
- Any licensed discharges from the SDD; and
- Water quality in the Hunter River and Dart Brook at locations upstream and downstream of the licensed discharge point.

The surface water monitoring network consists of four stream monitoring sites and eight water storage monitoring sites, as shown in **Figure 4**. There are also two discharge monitoring locations required by EPL 4885; however, these are currently not applicable due to Dartbrook not holding any discharge credits.

Routine water quality monitoring is conducted monthly at water storage monitoring sites and every two months at stream monitoring sites. Routine monitoring includes field measurements of EC, pH, turbidity and TSS, and calculation of TDS. In addition to routine monitoring, laboratory analysis for the full suite of water quality analytes is conducted on an annual basis. The surface water quality monitoring program is summarised in **Table 9**. All surface water samples will be tested in accordance with the relevant Australian Standards.

The outcomes of the HRSTS discharge monitoring program are used to determine whether action is required under the TARP (see **Section 6.1**).

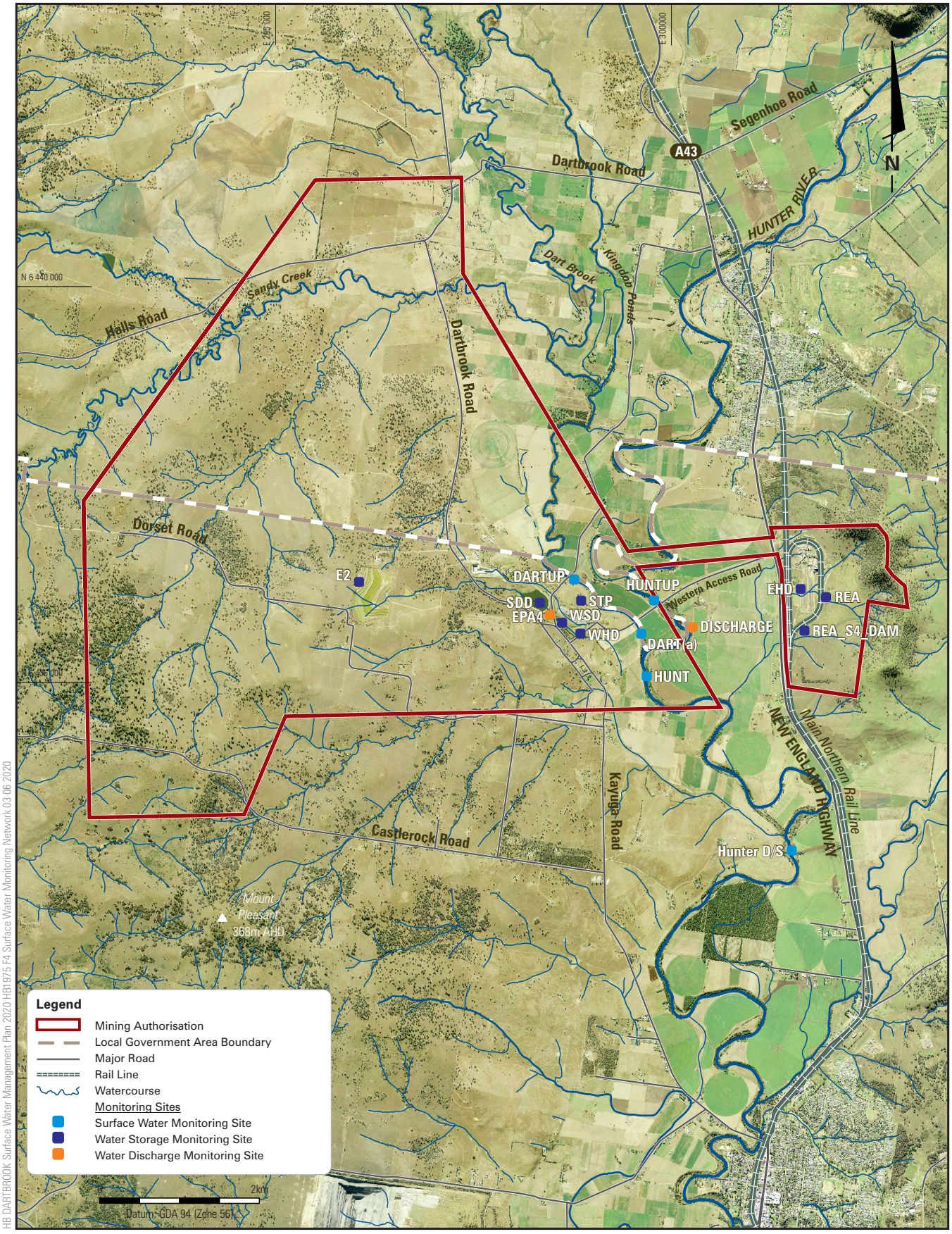
5.2 WATER VOLUME MONITORING

The surface water monitoring program includes the monitoring of water levels in all relevant water storages. Storage water levels are monitored monthly and following any significant runoff events. The major storages to be monitored (as shown on **Figure 2** and **Figure 3**) include:

- EHD;
- WHD;
- SDD; and
- Wynn Seam Goaf storage.

Water transfers between the water storages and dewatering of the Hunter Tunnel are monitored using flow meters and by recording pumping hours. The storage level and flow monitoring data are used to monitor and confirm the site water balance as required by Condition 4.2(a)(iii)3) of DA 231-07-2000. An annual reconciliation of the site water balance is reported in the Annual Review.

Visual inspections of smaller dams (including sediment dams) are conducted monthly to provide an estimate of the storage volume in these dams.



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DARTBROOK MINE

Surface Water Monitoring Network

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Australian Pacific Coal

FIGURE 4

Table 8 Surface Water Monitoring - Analysis Matrix

Site Type	Site Names	Routine Monitoring		Full Suite Analysis	
		Frequency	Analytes Considered	Frequency	Analytes Considered
Stream monitoring site	DART(a) DARTUP HUNT HUNT UP	Two monthly	EC, pH, TSS, turbidity, TDS	Annual	**Basic parameters:** EC, pH, TSS, turbidity, TDS **Alkalinity:** hydroxide, carbonate, bicarbonate and total alkalinity **Ions:** Sulfate, Chloride, dissolved major cations (Ca, Mg, Na, K), total cations, total anions, ionic balance **Metals and metalloids:** As, B, Be, Ba, Cd, Cr, Co, Cu, Hg, Pb, Mn, Ni, Se, V, Zn **Nutrients:** Total nitrogen, nitrate, nitrite, total Kjeldahl nitrogen, ammonia, total phosphorous
Water storage monitoring site	E2 EHD REA REA S44 Dam SDD WHD WSD	Monthly	EC, pH, TSS, turbidity, TDS	Annual	**Basic parameters:** EC, pH, TSS, turbidity, TDS **Alkalinity:** hydroxide, carbonate, bicarbonate and total alkalinity **Ions:** Sulfate, Chloride, dissolved major cations (Ca, Mg, Na, K), total cations, total anions, ionic balance **Metals and metalloids:** As, B, Be, Ba, Cd, Cr, Co, Cu, Hg, Pb, Mn, Ni, Se, V, Zn **Nutrients:** Total nitrogen, nitrate, nitrite, total Kjeldahl nitrogen, ammonia, total phosphorous
	STP	Monthly	EC, pH, TSS, turbidity, TDS	Annual	All analytes above plus the following: Faecal coliforms, Methylene Blue Active Substances (MBAS), biochemical oxygen demand, cyanophyta, oil and grease

5.3 GROUNDWATER MONITORING

The groundwater monitoring network consists of compliance monitoring sites as listed in **Table 9** and shown in **Figure 5**.

The previous approved version of the SWMP included bores named JOR1 and BRO3. Due to changes in land ownership, these bores are now located on private land and are no longer accessible for monitoring. JOR1 and BRO3 were located within the Hunter River alluvium and Sandy Creek alluvium, respectively. These aquifers will continue to be monitored through other bores in the monitoring network.

Consideration was given to whether substitute bores for JOR1 and BRO3 are necessary. JOR1 and BRO3 were implemented during the previous owner's longwall mining operations prior to 2007. As explained in **Section 4.3**, AGE (2018) assessed the potential impacts of bord and pillar mining in the Kayuga Seam. This assessment found that the Kayuga Seam has already been substantially depressurised by previous longwall mining and that bord and pillar mining is unlikely to result in further impacts. Due to the low potential for impacts at JOR1 and BRO3, as well as the availability of other bores to monitor these aquifers, substitute bores are not considered necessary.

All bores are monitored quarterly for water level (depth to water) and the basic suite of water quality analytes (pH, EC, TSS, turbidity and TDS). In addition, sampling for the full suite of water quality analytes is conducted six-monthly. The full monitoring suite includes the following analytes:

- Alkalinity – hydroxide, carbonate, bicarbonate and total alkalinity;
- Ions – Sulfate, Chloride, dissolved major cations (Ca, Mg, Na, K), total cations, total anions, ionic balance;
- Metals and metalloids – As, B, Be, Ba, Cd, Cr, Co, Cu, Hg, Pb, Mn, Ni, Se, V, Zn; and
- Nutrients – Total nitrogen, nitrate, nitrite, total Kjeldahl nitrogen, ammonia, total phosphorous.

Table 9 Dartbrook Groundwater Monitoring Sites

Bore Category	Site	Easting	Northing	Depth (mbgl)[1]
Hunter River alluvial bores	FRA1	300639	6436419	
	KAI1	299936	6436227	13.15
	WAL2	299269	6436098	
Dart Brook alluvial bores	ADN1	298159	6437724	
	DAN2	297982	6438959	
	WM1A	297696	6438335	15.66
Sandy Creek alluvial bores	COR3	293688	6439181	
	GW038412	291495	6437735	6.7
	WM3	294773	6439840	8.37
Staged Discharge Dam bore	RDH505	298504	6435779	
Coal seam bores	DDH183	296105	6434609	108.95
	DDH193	293096	6435799	185.06
	DDH212a	293555	6437311	75.76
	Kayuga 1	297615	6434637	20.53
Regolith bores	CAS2	295913	6435416	65.34
	CAS4	294927	6435956	34.36

Bore Category	Site	Easting	Northing	Depth (mbgl)[1]
	JLON1	298195	6434788	5.44
	TLON1	294058	6436689	
Reject emplacement area bores	RDH508	301159	6436954	21.91
	RDH508a	301159	6436954	33.89
	RDH509	301251	6436535	17.07
	RDH509a	301251	6436535	14.9
	RDH510	301344	6435736	16.84
	RDH510a	301344	6435736	19.53
	RDH511	301144	6435233	15.8
	RDH511a	301144	6435233	15.38
Property subsidence management plan bores	Belgrave	295027	6434536	23.71
	GW038582	295822	6434159	27.1
Other	Athlone	295828	6434161	20.38
	BEL1	297114	6434566	10.6
	CAD2	294132	6439790	14.22
	DDH124	297225	6435756	14.18
	DDH212b	293555	6437311	280.87
	DDH212c	293555	6437311	341.83
	RDH271	296824	6436248	88.99

[1] *Bore depths are unknown for some bores due to the significant time that has passed since they were drilled.*

The monitoring program is designed to monitor all potential groundwater impacts including:

- Impacts on alluvial aquifers including the Hunter River alluvium, Dart Brook alluvium and Sandy Creek alluvium;
- Impacts from the storage of tailings and mine water in the Wynn Seam Goaf;
- Leakage from the SDD;
- Seepage from the rehabilitated Reject Emplacement Area (REA); and
- Groundwater levels in the coal seams and privately owned stock watering bores.

Monitoring of DPE-Water designated boreholes is conducted 6 monthly and will include monitoring of pH and EC.

In accordance with Condition 4.1(b) of DA 231-07-2000, AQC Dartbrook will continue to undertake annual assessments of the accuracy of the groundwater model predictions outlined in the Dartbrook Extended EIS compared with monitored groundwater impacts in consultation with DPE-Water. The results of the assessments will be reported in the Annual Review. Should the assessment identify significant differences between the EIS model predictions and monitored impacts, AQC Dartbrook will revise the assessment of the potential impacts on groundwater systems in consultation with DPE-Water and implement any further mitigation measures necessary.

Monitoring of the water level in the Wynn Seam is carried out monthly. The TARP for the Wynn Seam Goaf water level is triggered at -66 mAHD, as discussed in **Section 6.3**.

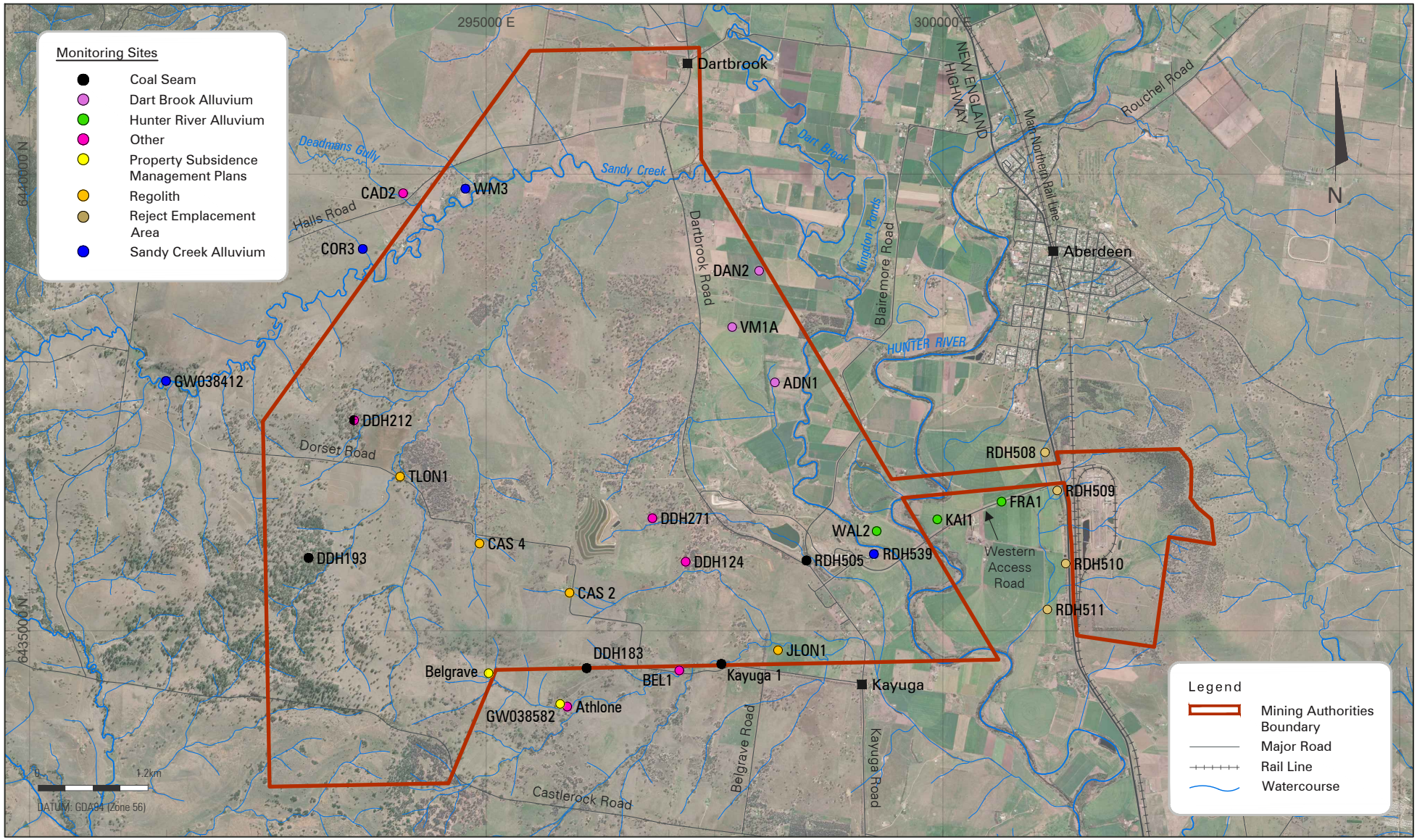
The TARP trigger levels for groundwater quality have been calculated from the available monitoring data. The 5th and 95th percentile values for EC and pH have been adopted as the water quality triggers for groundwater bores (see **Section 6.1.1**). Exceedances of trigger values on two consecutive monitoring rounds will trigger further investigation to determine the cause of the exceedances and whether there is the potential for material environmental harm as a result of Dartbrook operations.

5.4 QUALITY ASSURANCE

Sampling and analysis will be undertaken by suitably qualified and experienced persons with best practice standards of diligence, care and efficiency.

All aspects of monitoring including collection, sampling, transport, analysis and reporting will be subject to a Quality Control System. The Quality Control System will generally:

- Meet the requirements of AS/NZS ISO 14001:2004;
- Use a NATA accredited laboratory for the analysis of samples (where laboratory analysis is required); and
- Comply with any other relevant government guidelines that are enacted in the future.



JBA 2314 002 DBK - GW MONITORING (10/05/2023)

DARTBROOK MINE

DARTBROOK

JAMES BAILEY & ASSOCIATES
Environmental and Planning Consultants

Groundwater Monitoring Locations

FIGURE 5

6. CONTINGENCY MEASURES

6.1 TRIGGER ACTION RESPONSE PLAN

Although significant impacts to the surrounding water resources have not been predicted by the relevant impact assessments, a Trigger Action Response Plan (TARP) has been developed to manage any unexpected impacts.

6.1.1 Groundwater Quality

The groundwater TARP includes triggers for both water quality and water levels. The triggers for groundwater quality were defined through a statistical analysis of the available bore monitoring data.

The 5th and 95th percentile pH values were adopted as the upper and lower triggers, respectively. The pH triggers for groundwater bores are specified in **Table 10**. An investigation will be undertaken if the recorded pH is outside of the triggers for two consecutive readings.

With respect to EC, the TARP includes two triggers for each bore:

- Stage 1 trigger is the 95th percentile EC; and
- Stage 2 trigger is the maximum EC that has previously been recorded.

The Stage 1 and 2 EC triggers for groundwater bores are specified in **Table 10**. If the EC for a particular bore exceeds the Stage 1 trigger on two consecutive measurements or exceeds the Stage 2 trigger on any measurement, an investigation will be undertaken.

A groundwater investigation undertaken in response to exceedances of the pH or EC triggers will consider the following:

- Whether activities associated with Dartbrook Mine may have contributed to the trigger exceedance; and
- Determining whether the trigger exceedances have or may cause exceedances of the minimal impact considerations for water quality under the '*NSW Aquifer Interference Policy*' (DPI, 2012) (AIP).

If both criteria are answered in the affirmative, the relevant trigger exceedances will be reported as an incident in accordance with **Section 7.2**. If either criteria is not satisfied, no further action is required and routine monitoring will continue.

Table 10 Water Quality Triggers for Groundwater Bores

Site	pH Triggers		EC Triggers	
	Lower Trigger – 5th percentile	Upper Trigger – 95th percentile	Stage 1 Trigger – 95th percentile (µS/cm)	Stage 2 Trigger – Maximum value (µS/cm)
Hunter River Alluvium				
FRA1[1]	6.9	7.8	1794	4990
KAl1	6.4	7.5	609	960
WAL2	6.8	7.6	2475	2929
Dart Brook Alluvium				
ADN1	6.6	7.4	3412	4170
DAN2	6.7	7.9	2736	7210

Site	pH Triggers		EC Triggers	
	Lower Trigger – 5th percentile	Upper Trigger – 95th percentile	Stage 1 Trigger – 95th percentile (µS/cm)	Stage 2 Trigger – Maximum value (µS/cm)
WM1A	6.9	7.6	3651	3920
Sandy Creek Alluvium				
COR3	7.1	8.2	3263	3690
GW038412	6.8	7.6	3078	3690
WM3	6.6	7.0	6050	8110
Staged Discharge Dam				
RDH505	6.7	7.4	13619	14760
Coal Seams				
DDH183	6.7	7.2	8067	8560
DDH193	6.7	7.1	7327	8170
DDH212(a)	7.7	8.4	4165	4720
Kayuga 1	6.7	7.2	11066	11520
Regolith over Kayuga LW				
CAS2	6.6	7.1	15706	16720
CAS4	6.7	7.4	13714	14330
Tlon1	6.6	8.4	12909	15000
REA				
RDH508	6.7	7.3	8606	8750
RDH508a	6.9	7.3	6159	8510
RDH509	7.2	7.5	6600	7020
RDH509a	7.0	7.4	4146	4790
RDH510	6.8	7.7	9951	10330
RDH510a	6.9	7.3	10501	10930
RDH511	7.2	8.0	7272	7520
RDH511a	7.0	7.6	7530	7610
Property Subsidence Management Plans				
GW038582	6.8	8.2	9848	10510
Other Monitoring Bores				
CAD2	4.4	7.4	9246	14460
BEL1	6.9	7.9	11071	11460
Athlone[1]	6.7	7.8	10662	11280
DDH212b	8.1	8.5	4730	9320
DDH212c	8.0	8.4	4157	4810

Site	pH Triggers		EC Triggers	
	Lower Trigger – 5th percentile	Upper Trigger – 95th percentile	Stage 1 Trigger – 95th percentile (µS/cm)	Stage 2 Trigger – Maximum value (µS/cm)
RDH271	7.1	7.7	7052	7100

6.1.2 Groundwater Levels

The groundwater TARP also includes water level triggers for the relevant bores. Groundwater modelling was previously undertaken by Mackie Environmental Research (MER, 2000). Water level triggers for the regolith monitoring bores (other than the REA monitoring bores) were derived based on the drawdowns predicted by the groundwater model.

The groundwater model predicted that there will be no measurable drawdown of the alluvium. This prediction has been confirmed by monitoring data during both previous mining operations and the period of care and maintenance. In the absence of expected alluvial drawdowns, the water level triggers for alluvial monitoring bores were determined by applying a 10% buffer to the minimum recorded water level. For example, if the minimum recorded water level was 8 metres below top of collar (mTOC), the trigger would be 8.8 mTOC. The adopted triggers are specified in **Table 11**.

Table 11 Water Level Triggers for Groundwater Bores

Site	Standing Water Level - mTOC	Standing Water Level - mAHD
Hunter River Alluvium		
FRA1	13.6	147.3
KAl1	12.5	148.7
WAL2	11.7	148.7
Dart Brook Alluvium		
ADN1	10.5	151.1
DAN2	12.1	151.4
WM1A	11.1	151.9
Sandy Creek Alluvium		
COR3	12	187.6
GW038412	8.7	220.12
WM3	8.8	182.9
Staged Discharge Dam		
RDH505[2]	15.86	156.68
Coal Seams		
DDH183	81.6	144.4
DDH193	128.1	106.07
DDH212(a)[3]	-	-
Kayuga 1[4]	11.8	167.78

Site	Standing Water Level - mTOC	Standing Water Level - mAHD
Regolith over Kayuga LWs		
CAS2[1]	82	156.6
CAS4[1]	77	172.8
Tlon1[1]	82.3	139.2
Property Subsidence Management Plans		
GW038582[1]	30.4	177.4
Other Monitoring Bores		
Athlone[1]	26.8	181
BEL1[1]	12.5	166.9
CAD2[1]	19	187
DDH124	-	-
DDH212b[2]	87.92	145.08
DDH212 (c)[2]	87.73	145.27
RDH271[1,2]	122.07	91.1
Wynn Seam at Pleuger Pump Site		
Plueger	269	-66

Notes: [1] Calculated trigger below base of bore.
[2] First available water level post Kayuga Seam mining.
[3] Not able to be determined using current approach.
[4] Bore exceeds MER (2000) predictions and may often trigger the TARP.
5 Outside available data extents.

The water level triggers for the REA monitoring bores were not able to be verified due to these bores being located outside of the model extent. Triggers for these bores were provided in the previous edition of this SWMP (Anglo American, 2015) and have been retained (see **Table 12**).

Table 12 Water Level Triggers for REA Bores

Bore	Water Level – Depth below ground (m)
RDH508	10.9
RDH508(a)	18.0
RDH508a	17.9
RDH509	11.5
RDH510	12.2
RDH510(a)	12.3
RDH510a	11.0
RDH511	9.0
RDH511a	10.8

A groundwater investigation undertaken in response to exceedances of the groundwater level triggers will consider the following:

- Whether activities associated with Dartbrook Mine may have contributed to the trigger exceedance; and
- Whether the trigger exceedances have or may cause exceedances of the minimal impact considerations for water level or water pressure under the '*NSW Aquifer Interference Policy*' (DPI, 2012) (AIP).

If both criteria are answered in the affirmative, the relevant trigger exceedances will be reported as an incident in accordance with **Section 7.2**. If either criteria is not satisfied, no further action is required and routine monitoring will continue.

6.1.3 Inflow Volumes

During mining operations, the Hunter Tunnel will be actively dewatered to ensure safe operations. Inflows to the Hunter Tunnel can therefore be determined by measuring the volumes dewatered to other storages (generally the Wynn Seam Goaf).

The methodology used by AGE (2018) to predict mine inflows (explained in **Section 4.2**) can also be used to calculate actual inflows once mining operations recommence. An analytical water balance for the Wynn Seam Goaf will be conducted annually (following the calendar year) to estimate inflows to the Hunter Tunnel and mine workings. These results will be used to validate the findings of the analytical groundwater model in relation to bord and pillar mining.

The triggers for inflow volumes will be the rates predicted by the analytical groundwater model, namely:

- Hunter Tunnel inflow exceeds 182 ML/year; and
- Mine inflows (i.e. seepage from Permian) exceeds 20 ML/year.

Exceedances of the inflow triggers do not necessarily represent environmental harm unless there is a resultant impact on groundwater levels or quality. The triggers for groundwater level and quality are more appropriate for managing impacts to aquifers. However, the inflow triggers are relevant from a water licensing perspective.

If the annual validation exercise determines that the triggers for inflow volume have been exceeded, the following response actions will be undertaken:

- The analytical groundwater model will be updated to provide revised predictions of future water take;
- Revised water takes will be considered against AQC Dartbrook's water licensing entitlements; and
- DPE-Water will be consulted if AQC Dartbrook's water licensing entitlements have been exceeded.

6.1.4 Surface Water Triggers

Water quality triggers have been developed for the external monitoring sites on Dart Brook and Hunter River. The surface water monitoring network includes two sites (DARTUP and HUNTUP) located upstream of the discharge point licenced under EPL 4885. The water quality at these sites is independent of activities at Dartbrook Mine. Accordingly, water quality triggers based on absolute values is not appropriate. Instead, the triggers for the Hunter River and Dart Brook in **Table 13** are based on the relative variations in water qualities from the upstream sites to the downstream sites. If the water quality triggers are exceeded, an investigation will be undertaken to determine whether the discrepancy in water quality is due to activities at Dartbrook Mine.

The extensive monitoring dataset collected during care and maintenance indicates that the difference between upstream and downstream water quality can exceed the triggers in **Table 13** due to external factors alone. Accordingly, investigations are required to determine whether Dartbrook Mine has contributed to the variance in water quality.

Triggers for on-site water storages are based on volume/freeboard rather than water quality. This is appropriate because the objective of water management is to prevent uncontrolled spills from dams.

The triggers for water storages and surrounding streams are outlined in **Table 13**.

Table 13 Surface Water Triggers

Monitoring Points	Analytes	Trigger
On-site storages	N/A	Freeboard is reduced to less than 50%
Dart Brook monitoring sites	pH, EC, TSS	• The pH at DART(a) differs from the corresponding pH at DARTUP by more than 10%; or • The EC or TSS at DART(a) exceeds the corresponding value at DARTUP by more than 25%.
Hunter River monitoring sites	pH, EC, TSS	• The pH at HUNT differs from the corresponding pH at HUNTUP by more than 10%; or • The EC or TSS at HUNT exceeds the corresponding value at HUNTUP by more than 25%.

6.1.5 Responses

Table 14 outlines the response actions that will be undertaken if any of the surface water or groundwater triggers are exceeded.

Table 14 Responses to TARP Exceedances

Parameter	Risk	Trigger	Response
Surface water dams	Overflow from mine water dams	<50% freeboard.	Implement the excess water management strategies described in **Section 6.3**.
Stream water quality	Decline in water quality of surrounding streams during HRSTS discharge	Water quality at downstream sites is more than 10% poorer than upstream sites (see **Table 12**).	Investigate whether the trigger exceedances are due to activities at Dartbrook Mine as described in **Section 6.1.4**. If so, treat the occurrence as an incident.
Groundwater	Reduction in bore yield	Water level falls below the trigger level for two consecutive readings.	Undertake an investigation as described in **Section 6.1.2**.
	Change in groundwater pH	Measured pH is outside of the lower and upper triggers for two consecutive readings.	Undertake an investigation as described in **Section 6.1.1**.
	Change in groundwater EC	Measured EC exceeds the Stage 1 trigger on two consecutive readings or exceeds the Stage 2 trigger on any given reading	Undertake an investigation as described in **Section 6.1.1**.
	Greater than predicted inflows	Hunter Tunnel inflows exceeds 182 ML/year. Inflows to mine workings exceed 20 ML/year.	Update the analytical groundwater model with the higher than predicted inflow volumes. Consider whether current water licences are sufficient and consult with DPE-Water as required.

Parameter	Risk	Trigger	Response
Groundwater – Wynn Seam Goaf	Excessive storage volume in the goaf, with potential impacts on essential underground infrastructure.	Water level reaches or exceeds -66 mAHD.	Transfer water to surface storages or implement management strategies described in **Section 6.3**.

Investigations required by the TARP will be commenced as soon as practicable and ideally completed within 20 business days of the exceedance. However, it is noted that this timeframe may not be feasible for complex investigations that require a specialist hydrogeologist.

The methodology to be utilised in an investigation will be determined on a case-by-case basis. Generally, the following factors will be considered when assessing whether Dartbrook Mine may have contributed to the trigger exceedance:

- The accuracy and reliability of the monitoring result;
- Long-term trends for the relevant monitoring sites;
- Dartbrook Mine's activities around the time of the exceedance;
- Third party activities around the time of the exceedance; and
- Meteorological conditions.

If the investigation determines that the trigger exceedance constitutes an incident, the exceedance will be reported in accordance with **Section 7.2** and a written report on the investigation will be provided.

6.2 INCIDENTS

An "*incident*" is defined under DA 231-07-2000 as "*an occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance*".

If an incident occurs at Dartbrook Mine, it will be reported to the relevant regulators in accordance with Condition 9.3(a) under Schedule 2 of DA 231-07-2000. This condition states:

> *Incident Notification*
>
> *(a) The Applicant must immediately notify the Department and any other relevant agencies immediately after it becomes aware of an incident. The notification must be in writing to compliance@planning.nsw.gov.au and identify the development (including the development application number and name) and set out the location and nature of the incident.*

The triggering of a TARP is not necessarily a pollution incident. However, the internal investigation undertaken in accordance with the TARP may find that the trigger exceedance does meet the definition of 'incident' under DA 231-07-2000. **Section 7** outlines the process for the identification, reporting and notification of incidents.

6.3 EXCESS MINE WATER MANAGEMENT

The Dartbrook Mine has significant mine water storage capacity, including approximately 4,356 ML of storage within the Wynn Seam Goaf. As explained in **Section 3.2**, the water balance model predicted that Dartbrook Mine is unlikely to accumulate mine water volumes in excess of site storage capacity.

The TARP for the Wynn Seam Goaf (see **Section 6.1**) requires dewatering to be undertaken when the water level reaches -66 mAHD, or 269 m (depth below surface) at the pleuger pump monitoring site. At the trigger water level, the storage volume is approximately 2,915 ML. The excess mine water can be used for onsite activities or released via evaporation or licensed discharge.

Strategies for managing mine water volumes include use of the Evaporation Ponds (as shown on **Figure 2**), maximising the water surface areas (to increase evaporation) and utilising the HRSTS discharge system in accordance with the Dartbrook's EPL 4885 discharge conditions (L2.1 to L3.1).

6.4 FLOOD RESPONSE PLAN

The Aberdeen Flood Study predicted the flood extent of the Hunter River and its tributaries in the vicinity of Dartbrook Mine. The East Site and West Site facilities are located outside the 1% AEP flood extent of the Hunter River.

Even under a probable maximum flood (PMF), the entire East Site would remain outside the flood affected region. The buildings at the West Site would also remain beyond the extent of a PMF, although there may be open areas at the West Site which become inundated. In the event of extreme flooding, Dartbrook will implement its emergency evacuation procedure which includes the following:

- Broadcasting of a continuous alarm over the internal radio network;
- Evacuation of personnel to the designated muster points at the East Site and West Site (which are located outside of the flood extent);
- Performing a roll call of personnel at the muster point; and
- Notification of the State Emergency Service (SES) and emergency services (i.e. fire brigade, ambulance and police).

Importantly, all mine entries (Kayuga Entry, Western Drift and Eastern Drift) and ventilation shafts are located outside of the PMF extent. MOD 7 originally included a proposal to construct a materials delivery shaft within the floodplain. This shaft was removed from the MOD 7 application prior to its approval. As such, there is no potential for floodwaters to enter the underground mine and pose a risk to personnel working underground.

7. REPORTING

7.1 ANNUAL REPORTING

Environmental reporting during site operations is via the Annual Review. The Annual Review is required to be provided to DPE, the Resources Regulator, DPE-Water, EPA, Muswellbrook Shire Council (MSC), Upper Hunter Shire Council (UHSC) and the Dartbrook CCC. The Annual Review is also to be made available for public inspection at the MSC and UHSC offices.

In accordance with Condition 4.2(a)(iii) of DA 231-07-2000, the Annual Reviews will present water monitoring results, including:

> *"1. a basic statistical analysis (mean, range, variance, standard deviation) or the results for the parameters measures in individual bores / wells and as a subset of the aquifer;*
>
> *2. an interpretation of the water quality results and changes in time for water quality and water levels (supported with graphs and contour plots showing changes in aquifer pressure levels);*
>
> *3. an interpretation of the water balance identifying the volume of water and comparing this to predictions made in the EIS or the previous Annual Review; and*
>
> *4. provide an electronic copy of the data forwarded to DPIE Water".*

In relation to water management, Annual Reviews are also required to include:

- A review of the site water balance for the year, the quantity of water used from water storages and details of discharge of any water from the site (NSW Government, 2015);
- Annual assessment of groundwater monitoring results and comparison with EIS groundwater impact predictions (DA 231-07-2000 Condition 4.1(b), see **Table 2**);
- An assessment of the effectiveness of the water management system against the objectives and TARPs specified in this SWMP;
- A review of erosion and sediment management activities on site for the year; and
- Any incidents and corrective actions.

7.2 INCIDENT REPORTING

In accordance with the conditions of EPL 4885 and DA 231-07-2000, AQC Dartbrook will notify the EPA and DPIE as soon as practicable after an incident occurs. An 'incident' is defined under DA 231-07-2000 as:

> *"An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance".*

The site Pollution Incident Response Management Plan (Hansen Bailey, 2018) requires the reporting of "*pollution incidents immediately to the EPA*", DPIE and neighbours (if relevant) where there is actual or potential for material harm to the health or safety of human beings or the environment. A summary of all incidents is also provided in the Annual Review.

8. RESPONSIBILITIES

Table 15 provides a summary of responsibilities as described in this SWMP. These responsibilities may be delegated, as required.

Table 15 Responsibilities Summary

No.	Activity	Responsibility	Timing
1.	Ensure adequate resourcing is available for the monitoring and management of water on site.	AQC Dartbrook	Ongoing
2.	Ensure that all relevant personnel and contractors are given adequate training in water management measures, reporting and regulatory obligations.	AQC Dartbrook	Ongoing
3.	Co-ordinate the Dartbrook surface water and groundwater monitoring program in accordance with **Section 4**.	Environment Officer	Ongoing
4.	Inspect dams and sediment and erosion control structures.	Environment Officer	Monthly and following high rainfall events.
5.	Review the content of this SWMP on an annual basis and update, if required.	Environment Officer	Annual
6.	Complete annual reporting in accordance with the requirements described in **Section 7.1.**	Environment Officer	Annual
7.	Respond to water TARPs, conduct investigations and/or implement contingency measures in accordance with **Section 6**.	Environment Officer	As required
8.	Controlled release of water from site must be undertaken in accordance with the EPL and HRSTS.	Environment Officer	As required

9. REVIEW REQUIREMENTS

In accordance with Condition 3.2(k) of DA 231-07-2000, this SWMP will be reviewed within three months of the following:

- Notification of an incident (refer to **Section 7.2**);
- Submission of an annual review;
- Submission of an independent environmental audit required by DA 231-07-2000; and
- Approval of a modification to the conditions of DA 231-07-2000.

If the review determines that revisions to the SWMP are required, the revised document will be submitted to the Planning Secretary for approval in accordance with Condition 3.2(l) of DA 231-07-2000.

10. ABBREVIATIONS

Term	Definition
µS/cm	Micro siemens per centimetre
AEP	Annual Exceedance Probability
AGE	Australasian Groundwater and Environmental Consultants
ANZECC	Australian and New Zealand Conservation Council
AQC	Australian Pacific Coal Limited
AQC Dartbrook	AQC Dartbrook Management Pty Limited
CCC	Community Consultative Committee
CHPP	Coal Handling and Preparation Plant
D/S	Downstream
DA	Development Consent
DPE	Department of Planning and Environment
DPE-Water	Department of Planning and Environment, Water Group
DPIE	Department of Planning, Industry and Environment (now DPE)
EC	Electrical conductivity
EHD	Eastern Holding Dam
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	Environmental Protection Authority
EPL	Environment Protection Licence
GIS	Geographic Information System
Ha	Hectares
HRSTS	Hunter River Salinity Trading Scheme
Mg/L	Milligrams per litre
ML	Megalitre
MSC	Muswellbrook Shire Council
NATA	National Association of Testing Authorities Australia
NRAR	Natural Resources Access Regulator
POEA Act	*Protection of the Environment Operations Act 1997*
PSMP	Property Subsidence Management Plan
REA	Rejects Emplacement Area
RL	Reduced Level
SDD	Staged Discharge Dam
STP	Sewerage Treatment Plant
SWMP	Site Water Management Plan

Term	Definition
TARP	Target Action Response Plan
TDS	Total Dissolved Solids
UHSC	Upper Hunter Shire Council
U/S	Upstream
WHD	Western Holding Dam
WM Act	*Water Management Act 2000*
WSP	Water Sharing Plan

11. REFERENCES

- Anglo American (2015), *Dartbrook Mine Site Water Management Plan*.
- Hansen Bailey (2017), *Dartbrook Underground Mining Operations Plan, Continuation of Care and Maintenance January 2018 – December 2020*.
- Hansen Bailey (2018), *Dartbrook Mine Pollution Incident Response Management Plan*.
- Hansen Consulting (2005), *Dartbrook Coal Mine Statement of Environmental Effects for New ROM Stockpiles, Underground Tailings Disposal & Nitrogen Injection Plant (MOD5)*.
- Hydro Engineering and Consulting (2017), *Mount Pleasant Operations Mine Optimisation Modification Site Water Balance Review*.
- HLA-Envirosciences P/L (2000), *Dartbrook Extended EIS*.
- NSW Government (2015), *Annual Review Guideline; Post-approval requirements for State significant mining developments*.

APPENDIX A

STAKEHOLDER CONSULTATION

Department of Planning and Environment

Our ref: DA231-07-200-PA-16

Jeff Beatty
Non-executive Director
AQC Dartbrook Management Pty Ltd
6 Stair Street
Kayuga NSW 2333

16/08/2023

Subject: Approval of Water Management Plan

Dear Mr Beatty

I refer to the Dartbrook Water Management Plan (Version 2, dated 30 June 2023), which has been prepared in accordance with condition 4.1 of DA231-07-2000.

The Department has carefully reviewed the Water Management Plan and is satisfied that it addresses the relevant requirements of the development consent.

Accordingly, the Planning Secretary has approved the Water Management Plan (Version 2, dated 30 June 2023).

You are reminded that if there are any inconsistencies between the Water Management Plan and the conditions of approval, the conditions prevail.

Please ensure you make the document publicly available on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Joe Fittell on 02 4908 6896.

Yours sincerely

Stephen O'Donoghue
Director
Resource Assessments
As nominee of the Planning Secretary

Enquiries
Please ask for Theresa Folpp
Direct 02 6549 3700
Our reference Dartbrook

07 June 2023

Jeff Beaty
Dartbrook Mine
Tetra Resources

Dear Jeff

Dartbrook Mine – Council Comments on Water Management Plan

Reference is made to the *'Dartbrook Mine Site Water Management Plan'* dated 16/05/23 (WMP). Consultation with Muswellbrook Shire Council is required under Cond 4.1(a) of DA 231-07-2000 (as modified).

Council staff appreciate the opportunity to provide comment and feedback is provided below.

01. During consultation in 2020, staff recommended that background water quality in the Hunter River, Dart Brook, Sandy Creek continue during Care and Maintenance (C&M), if supported by the Department of Planning and Environment (DPE). Staff also recommended that monitoring recommence three months prior to construction works / mining recommencement at the site.

    It is noted that surface water samples were collected and analysed every two months during 2022 (source: 2022 Annual Review).

02. The frequency of surface water quality monitoring is not stipulated in the WMP.

03. Bore BRO3, previously situated within the Sandy Creek alluvium, has been removed due to changes in land ownership, rendering it inaccessible. It was positioned east of the mining area and represented the most eastern bore along Sandy Creek before its confluence with the Hunter River. The remaining bores in the alluvium are located west of the mining area.

    Staff recommends the installation of a new bore in the Sandy Creek alluvium, specifically east of the mining area to enable monitoring and assessment of any potential changes induced by mining activities. Alternatively, if there are valid reasons why this is not necessary, a reasonable justification should be provided.

04. Staff are concerned that the electrical conductivity (EC) at RDH510 for the Reject Emplacement Area bore has been trending upwards since 2013 (which is not occurring at the neighbouring bores) and that trigger levels have been adjusted to suit this trend.

05. It is not clear whether there is monitoring for metals or other relevant compounds or whether investigations include assessment against metals or other relevant compounds to determine whether impacts are caused from mining.

06. Recommend adding a table in the WMP that shows bore depth. Staff had to refer to approval documents to ascertain this information.

07. Recommend the WMP be reviewed and updated (if required), in response to an incident as defined under DA 231-07-2000.

Council staff appreciates the opportunity to comment and would be pleased to provide additional information if requested. Should you need to discuss the above, please contact the undersigned on 02 6549 3700 or email council@muswellbrook.nsw.gov.au.

Yours faithfully

Theresa Folpp
Development Compliance Officer

Department of Planning and Environment

Our ref: OUT23/9639

Jeff Beatty
Tetra Resources Pty Ltd
Email: jeff.beatty@tetraresources.com.au

26 June 2023

Subject: **Dartbrook Coal Mine (DA231-07-2000)– Site Water Management Plan**

Dear Jeff Beatty

I refer to your request for advice sent on 16 May 2023 to the Department of Planning and Environment (DPE) Water about the above matter.

DPE Water has reviewed the Dartbrook Site Water Management Plan (SWMP) and makes recommendations regarding groundwater monitoring, management, data presentation and water licensing. DPE Water notes the content of the SWMP requires improvement to adequately address several of the conditions of consent, and contemporary reporting standards which includes consistency with the DPE Water guideline, *Guidelines for Groundwater documentation for SSD/SSI Projects. Technical Guidelines* (DPE Water 2023). Please see our more detailed advice in Attachment A.

Should you have any further queries in relation to this submission please do not hesitate to contact DPE Water Assessments at water.assessments@dpie.nsw.gov.au

Yours sincerely,

Liz Rogers
Manager Assessments, Knowledge Division
Department of Planning and Environment: Water

Attachment A

Detailed advice regarding the Dartbrook Coal Mine (DA231-07-2000) – Site Water Management Plan

1.0 Water take and licensing

1.1 Recommendation prior to approval

That the plan be updated to quantify water take in each water source and ensure sufficient water entitlement is held.

Explanation

It is unclear from the Site Water Management Plan (SWMP) which water source take is occurring for aquifer interference. Based on the Mod 7 assessment there was reference to water take from multiple sources for the mine workings and tunnels, but clear quantification of the volumes and the relevant water source could not be confirmed. This needs to be addressed by updating the plan with the maximum take in each water source.

1.2 Recommendation prior to approval

That the SWMP be updated with the relevant water access licences (WAL) and approvals under the *Water Management Act 2000* that are used for water take.

Explanation

The SWMP should include the WAL references which will be used to account for the proposed water take and confirm these licences are linked to the relevant work approval for water extraction.

2.0 Groundwater monitoring, reporting and management

2.1 Recommendation prior to approval

That the SWMP be updated to include relevant baseline data for ease of interpretation of the document.

Explanation

The SWMP is limited in its display of baseline data and refers the reader to search for relevant documentation. To enable the SWMP to function as a standalone document it is recommended the SWMP includes a summary of relevant baseline data with data tabulated where possible.

The SWMP water quality monitoring data is limited to EC, pH and TDS. It is recommended a comprehensive analytical suite be included at specified periodic intervals and be designed in a way that allows identification of drivers for future investigations in the event of changes in water quality or/and quantity.

2.2 Recommendation prior to approval

That the water balance be revised to include:

- pumped water meter records to aid in determining the groundwater take from the Kayuga Seam and the Hunter Tunnel.
- a revision of the water budget presented in Table 4 and Table 5 to balance the inflow and outflow.

- an explanation of how the water deficit presented in the water balance would be addressed, and, where relevant, how it is to be accounted for through water access licences.

Explanation

The pumped water from the mine workings and Hunter Tunnel should be metered, monitored, and reported to inform the groundwater take estimates, site water balance and validate model predictions.

Section 5.2. of the SWMP states: "*Water transfers between the water storages and dewatering of the Hunter Tunnel are monitored using flow meters and by recording pumping hours.*" A check of the Annual Review 2022 could not find information showing metered pumps are in place for dewatering of groundwater to surface or the volumes transferred to historical workings.

There is a significant difference in water inflow and outflow in Table 5 (1271ML outflow vs 231ML inflow for the average-year scenario) which shows there is a water deficit. This water deficit (1271ML – 231ML = 1040ML) has remained unexplained in the SWMP. The proponent is required to ensure it has sufficient water for all stages of the development and hold necessary water licences to account for the take of water. This needs to be demonstrated in the SWMP.

Whilst the SWMP site water balance reports a significant deficit between inflows to outflows, which suggests a water supply shortage, in contrast the annual site water balance figures presented in the Dartbrook Mine Annual Review 2022 reports a surplus of inflow water. The differences in water balance reporting highlights uncertainty in the robustness of the data.

2.3 Recommendation prior to approval

That the Trigger Action Response Plan (TARP) be updated to include:

- an acceptable timeframe to complete further investigation in the event of exceeding the performance measures.
- a clear process for an investigation into a performance measure exceedance.
- the statistical means/methods to assess measurable changes to identify long-term trends. Statistical approaches such as the Mann Kendal and/or before- after-control-impact (BACI) methods are suggested options. Including a comprehensive analytical suite of water quality parameters in the groundwater quality monitoring plan is necessary to capture sufficient background information for identifying the drivers in the event of changes in water quality and/or quantity.
- mine inflows as a performance target in the TARP and compare measured inflows with predicted modelled inflows annually as required under the consent conditions.
- a commitment to re-evaluate the risk to water dependent assets to determine any required change/update of mitigation plans if the result of an investigation revealed that the drivers of exceedance are mining related.
- a commitment to provide DPE Water and other relevant agencies with the result of any investigations.
- where a TARP trigger exceedance occurs, the statement to reconcile accountability as to the driver for an incident being "*Whether the trigger exceedances were caused by activities associated with Dartbrook Mine*"; should be modified to state "*Whether activities associated with Dartbrook Mine* can be excluded from the trigger exceedance(s). Where mining activities are not excluded then the extent to which mining activities have contributed should be presented and any change in the risk to water dependent assets discussed.

Explanation

Insufficient information was included to understand implementation of the TARP and how it addresses DPE Water's related guideline, "*Guidelines for Groundwater documentation for SSD/SSI Projects. Technical Guideline* (DPE Water 2022)".

2.4 Recommendation prior to approval

That the SWMP be updated to include additional detail on the quality assurance and quality control of collected data.

Explanation

The Independent Expert Scientific Committee (IESC) have recently released the document, 'Draft National Minimum Groundwater Monitoring Guidelines for Groundwater (2023)' which contains appropriate content for consideration. The SWMP should include a system of documented procedures and plans to ensure that the water monitoring program produces data of known precision and bias. The SWMP should also consider operational activities that confirm the quality assurance methods are functional and that information collected is accurate, precise, and properly recorded.

2.5 Recommendation prior to approval

That the groundwater modelling and associated impact/water take predictions be updated based on the following commitments:

- the inclusion of a nominated timeframe and/or trigger response action to update and re-calibrate the model using the collected contemporary monitoring data. It is recommended a recalibration of the model take place a minimum every 5 years and this be reduced when a TARP exceedance occurs that is associated with mining to enable re-evaluation of any change against the EIS predictions, NSW Aquifer Interference Policy impact considerations and licensing requirements.
- use the updated groundwater model to calculate direct and indirect water take, changes to impact predictions and to report on uncertainty.
- annual evaluation of the measurable groundwater pressure changes and mine inflows against the modelled predictions.

Explanation

The groundwater assessment undertaken for Mod 7 (AGE, 2018) predicted that rates of groundwater seepage into the underground workings would be very low (< 20 ML/year). This figure is considerably different to that presented in the 2022 Annual Report which states: "*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 to receive 73 ML/year. Inflows to both the Wynn and Kayuga seam workings are passively taken from the Sydney Basin North Coast Groundwater Source.*"

The SWMP states *"a reconciliation of groundwater monitoring results against groundwater impact predictions for the Dartbrook Mine was conducted back in 2006 by Australasian Groundwater and Environmental Consultants (AGE)*". Since then, there were multiple records of exceeding the groundwater level predictions in the Dartbrook EIS and EC trigger values in a number of bores (refer to *Dartbrook Mine Annual Report, 2020*). It is therefore important to update and validate the model and assess the impacts of the proposed mining operations regularly.

End Attachment A

Dorian Walsh

From: Sharon Pope <Sharon.Pope@muswellbrook.nsw.gov.au>
Sent: Thursday, 12 March 2020 12:02 PM
To: Dorian Walsh
Subject: RE: Dartbrook Site Water Management Plan

Hello Dorian

I have reviewed the updated draft of the Site Water Management Plan for care and maintenance at Dartbrook Mine, provided on 5 March 2020.

The changes are noted and I generally have no concerns regarding the changes. I do note that you intend to stop doing background water quality monitoring in the Hunter River, Dart Brook, Sandy Creek and Kingdon Ponds (p 24). I also note that what is being put forward instead, is that the SWMP will be reviewed and updated prior to any future recommencement of mining operations on site.

I would prefer that background water quality in the Hunter River, Dart Brook, Sandy Creek continue to be monitored as it builds a useful picture of the background water quality and how it changes in relation to weather, climate events and man-made events in the immediate catchment. This in turn is useful for management of mining operations, if they recommence on site. However, if the change is supported by DPIE, there should be a timeframe for reviewing the SWMP prior to recommencing mining on site. I recommend that regular monitoring in streams in the vicinity of the site recommence 3 months prior to construction works /mining recommencing on site.

Thank you for the opportunity to comment.

Regards

Sharon Pope| Executive Manager Environmental and Planning Services
muswellbrook shire council
P: (02) 6549 3868
PO Box 122, Muswellbrook NSW 2333
Sharon.Pope@muswellbrook.nsw.gov.au
www.muswellbrook.nsw.gov.au

From: Dorian Walsh [mailto:DWalsh@hansenbailey.com.au]
Sent: Thursday, 5 March 2020 3:58 PM
To: Sharon Pope
Cc: James Bailey
Subject: Dartbrook Site Water Management Plan

Hi Sharon,

Please find attached an updated draft of the Site Water Management Plan for care and maintenance at Dartbrook Mine. This plan has been prepared to address the requirements of Condition 4.1(a) of Schedule 2 of DA 231-07-2000. In accordance with this condition, the updated draft is attached for your review. Please note that the sections of

the plan highlighted in yellow are those that were updated in the previous draft plan provided for review in November 2019. The changes highlighted in green are further proposed amendments to the plan.

It would be appreciated if you could provide any comments by 27 March 2020. Please let me know if you have any questions.

Regards,
Dorian

Dorian Walsh
Senior Environmental Scientist

HANSEN BAILEY
Tel: (02) 6575 2000
Mobile: 0407 129 577
Email: dwalsh@hansenbailey.com.au

Contact: Ellie Randall
Email: ellie.randall@nrar.nsw.gov.au

Dorian Walsh
Senior Environmental Scientist
Hansen Bailey

email: dwalsh@hansenbailey.com.au

Our ref: OUT20/4741

Dear Dorian,

24 April 2020

Dartbrook – Site Water Management Plan

Thank you for giving the Department of Planning, Industry and Environment – Water (DPIE-Water) the opportunity to review the Site Water Management Plan. DPIE-Water has reviewed the plan and provides the following comments:

1. The Site Water Management Plan must be updated to a final draft with all amendments and to include Appendix A (currently missing).

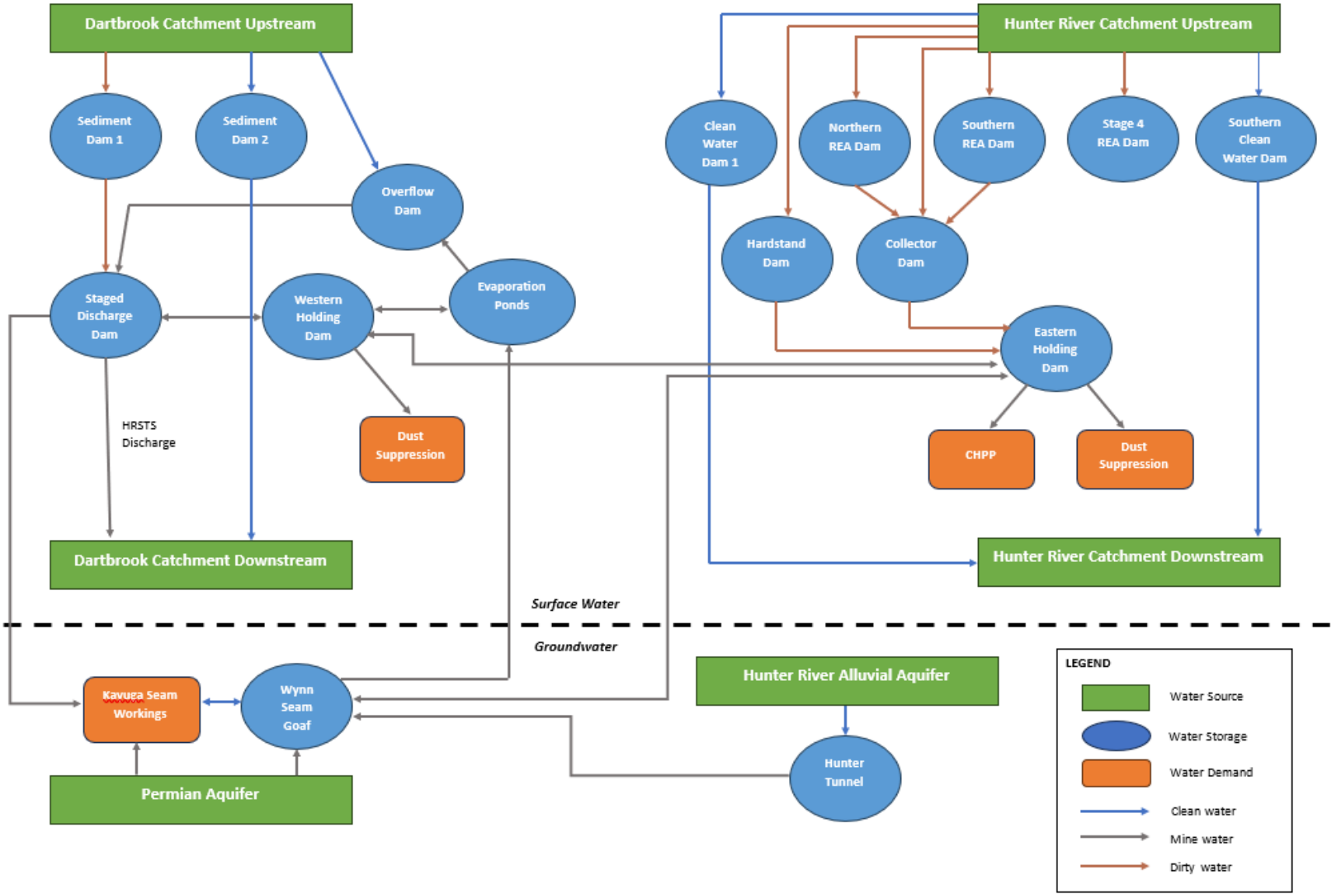
Should you have any further queries in relation to this submission please do not hesitate to contact the Natural Resources Access Regulator's Service Support Team at nrar.servicedesk@industry.nsw.gov.au.

Yours sincerely

Alison Collaros
Licensing and Approvals Manager (East)
Natural Resources Access Regulator
Department of Planning, Industry and Environment

APPENDIX B

WATER MANAGEMENT SYSTEM SCHEMATIC DIAGRAM

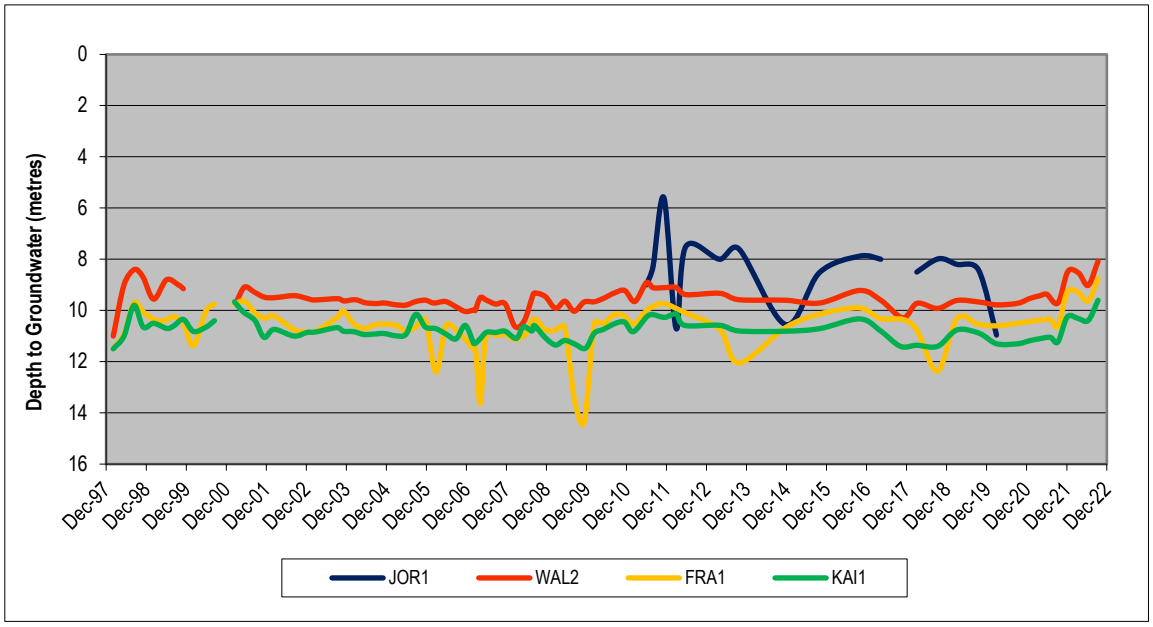

Dartbrook Catchment Upstream
Sediment Dam 1
Sediment Dam 2
Overflow Dam
Staged Discharge Dam
Western Holding Dam
Evaporation Ponds
HRSTS Discharge
Dust Suppression
Dartbrook Catchment Downstream
Hunter River Catchment Upstream
Clean Water Dam 1
Northern REA Dam
Southern REA Dam
Stage 4 REA Dam
Southern Clean Water Dam
Hardstand Dam
Collector Dam
Eastern Holding Dam
CHPP
Dust Suppression
Hunter River Catchment Downstream
Surface Water
Groundwater
Kavuga Seam Workings
Wynn Seam Goaf
Permian Aquifer
Hunter River Alluvial Aquifer
Hunter Tunnel
LEGEND
Water Source
Water Storage
Water Demand
Clean water
Mine water
Dirty water

APPENDIX C
WATER LICENCES

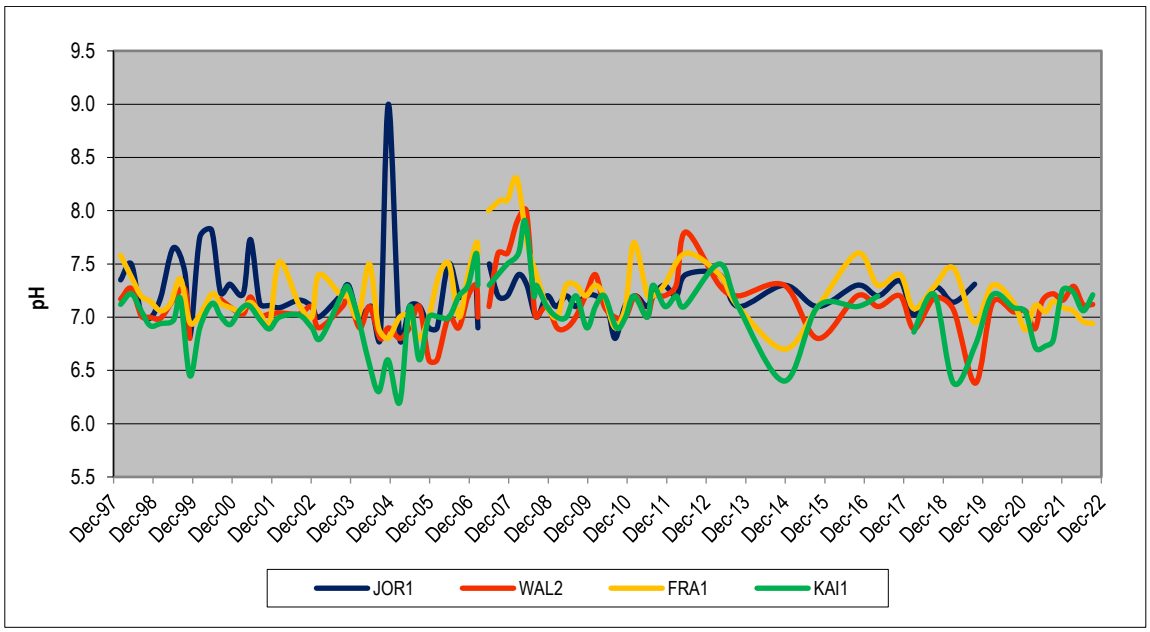
Table C-1 Water Access Licences

WAL Number	Water Source	Licence Category	Share Component (units)	Works Approval
WAL 17781	Dartbrook Water Source	Aquifer	278	20CA206894
WAL 23875	Dartbrook Water Source	Aquifer	50	20WA211403
WAL 18134	Hunter Regulated River Alluvial Water Source	Aquifer	297	20CA208003
WAL 18174	Hunter Regulated River Alluvial Water Source	Aquifer	37	20CA207915
WAL 18210	Hunter Regulated River Alluvial Water Source	Aquifer	235	
WAL 18225	Hunter Regulated River Alluvial Water Source	Aquifer	121	20CA207907
WAL 18228	Hunter Regulated River Alluvial Water Source	Aquifer	90	20CA208045
WAL 18239	Hunter Regulated River Alluvial Water Source	Aquifer	371	20CA207979
WAL 18126	Hunter Regulated River Alluvial Water Source	Aquifer	98	20CA207969
WAL 41523	Sydney Basin-North Coast Groundwater Source	Aquifer	30	20WA218982
WAL 41524	Sydney Basin-North Coast Groundwater Source	Aquifer	150	20WA218984

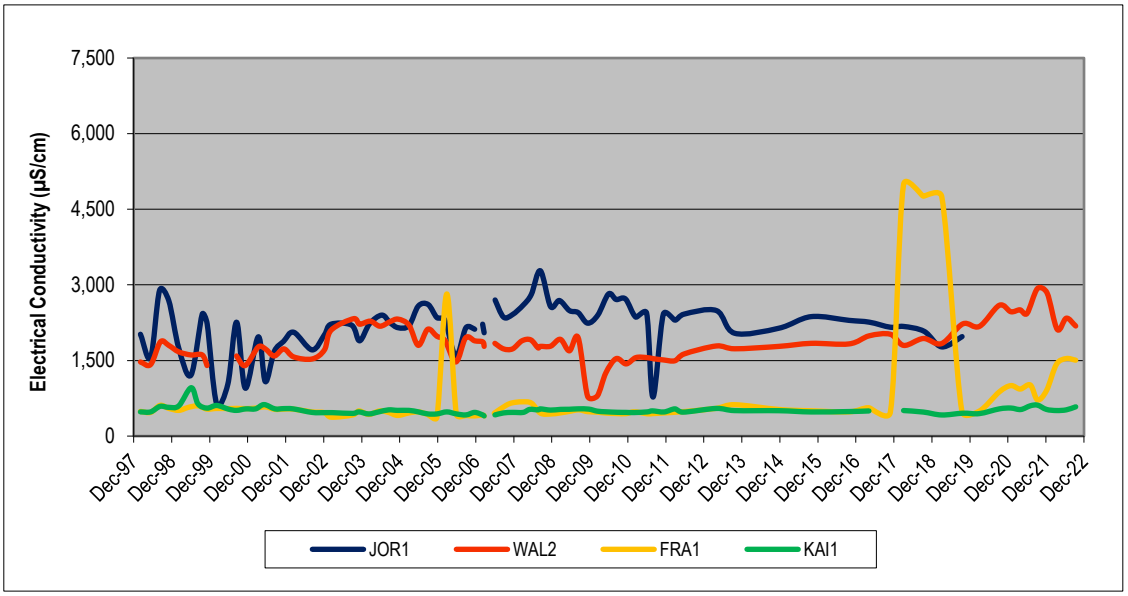
APPENDIX D
BASELINE GROUNDWATER MONITORING DATA



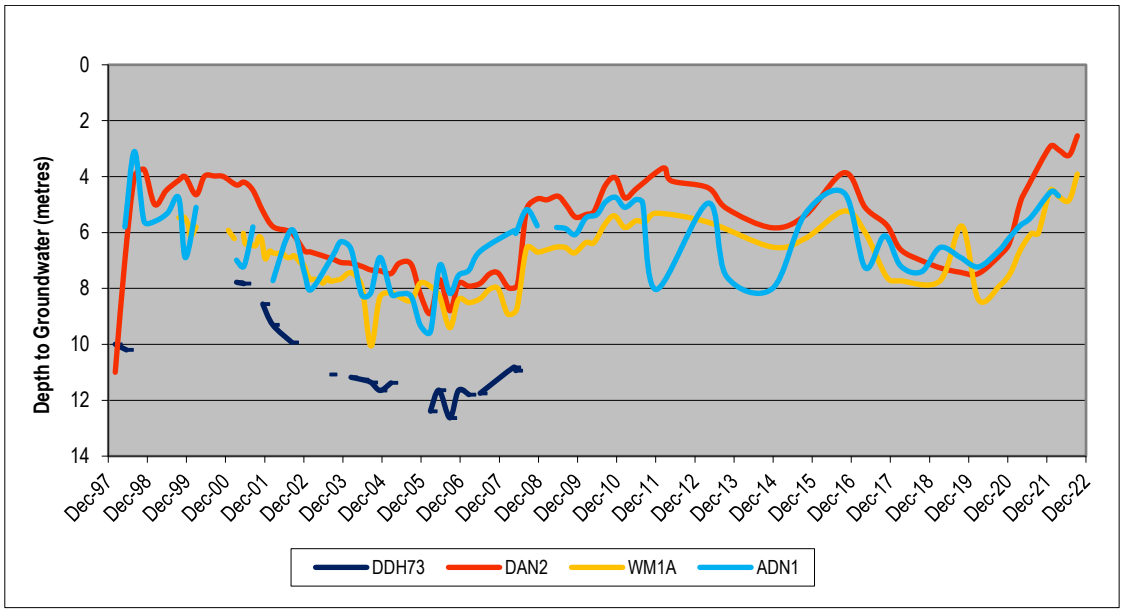
Graph B-1
Groundwater Level for Hunter River Alluvium Bores (1998-2022)



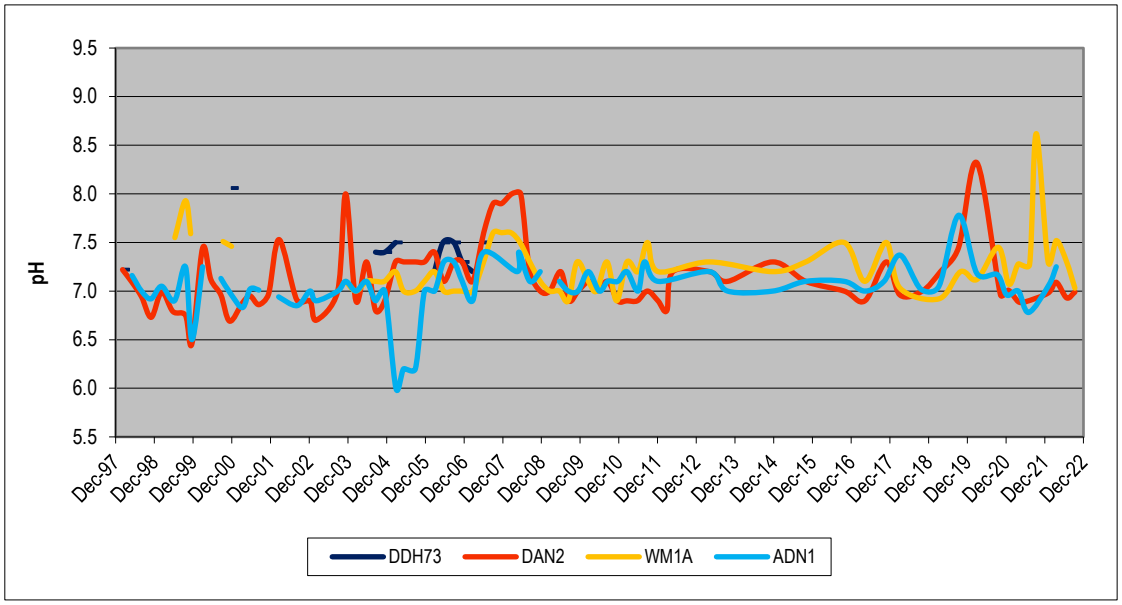
Graph B-2
pH for Hunter River Alluvium Bores (1998-2022)



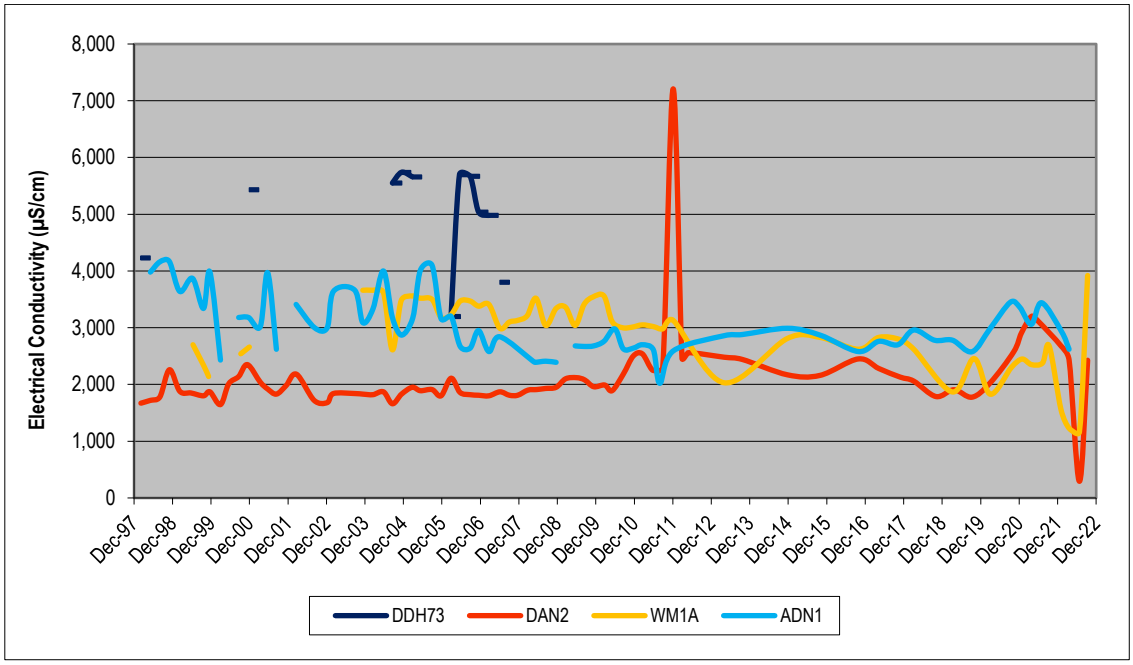
Graph B-3
Electrical Conductivity for Hunter River Alluvium Bores (1998-2022)



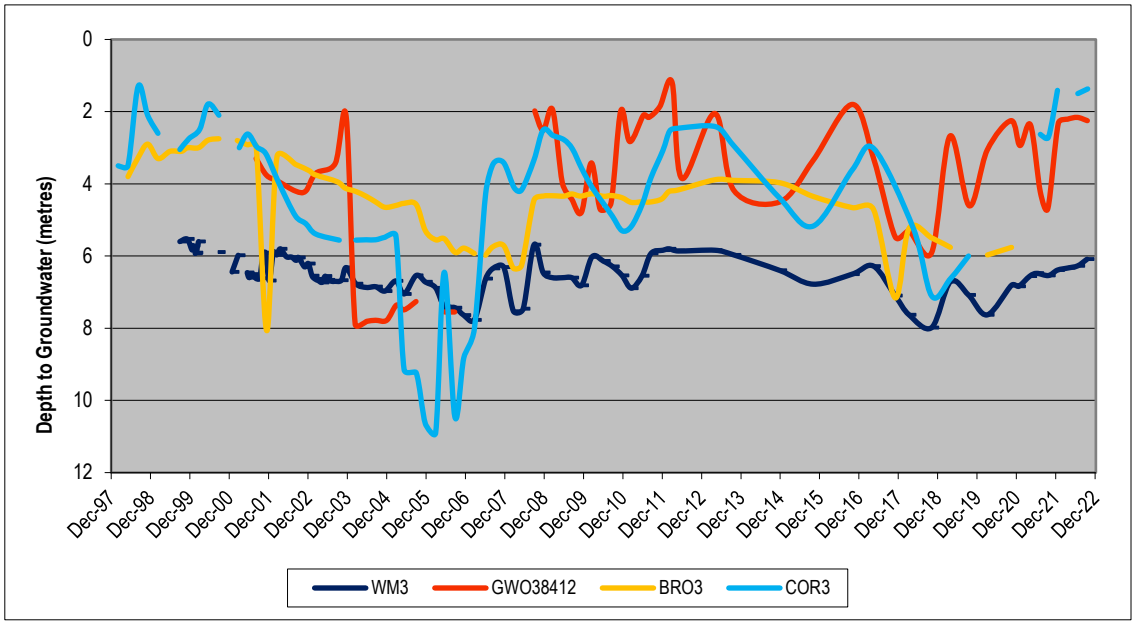
Graph B-4
Groundwater Level for Dart Brook Alluvium Bores (1998-2022)



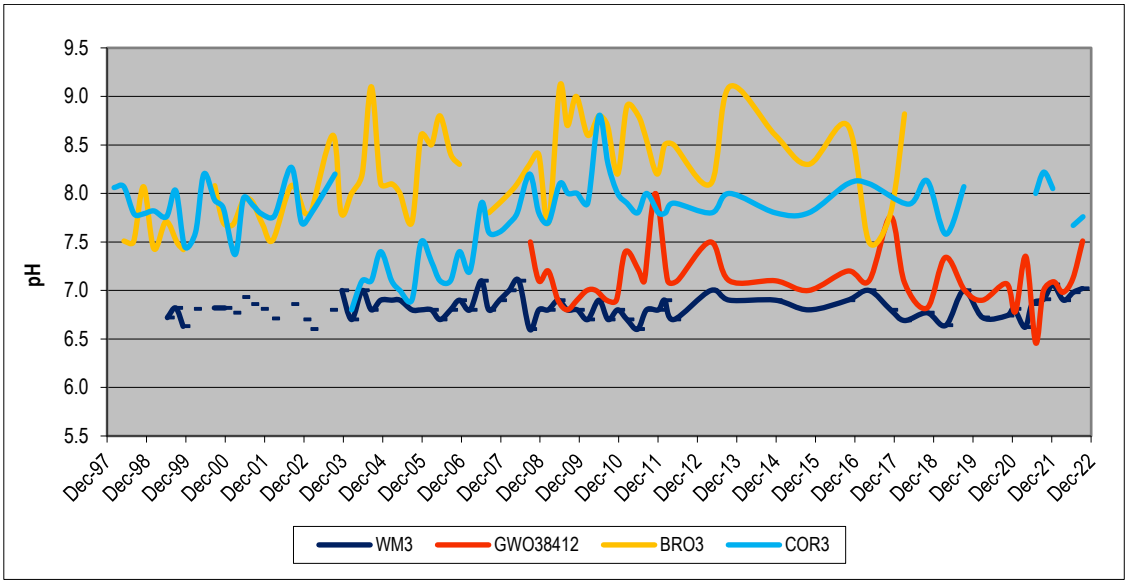
Graph B-5
pH for Dart Brook Alluvium Bores (1998-2022)



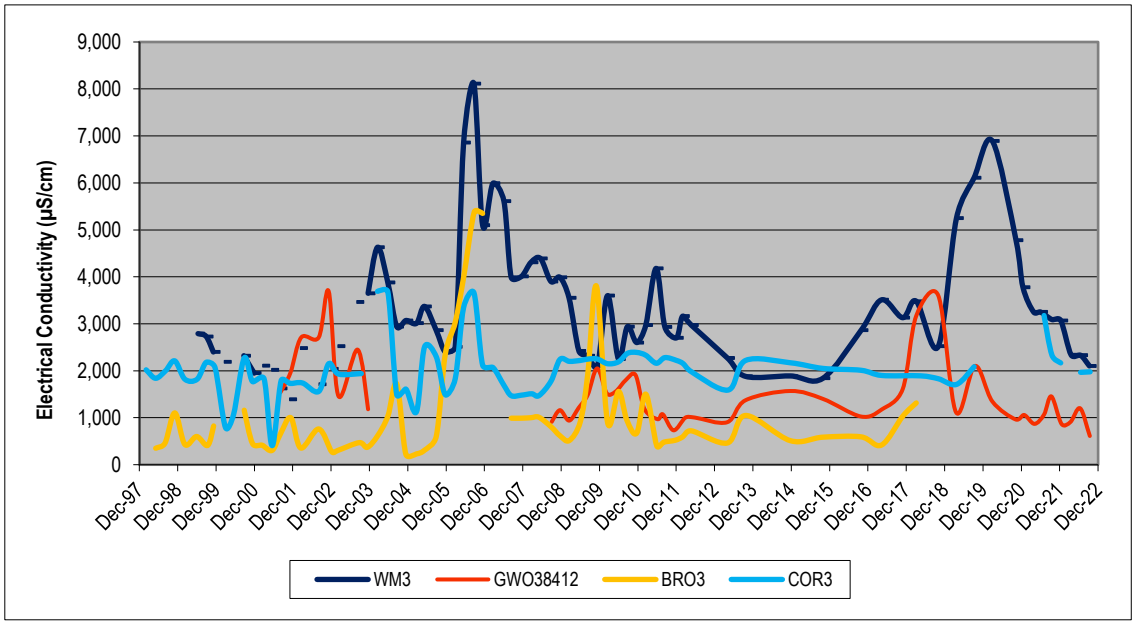
Graph B-6
Electrical Conductivity for Dart Brook Alluvium Bores (1998-2022)



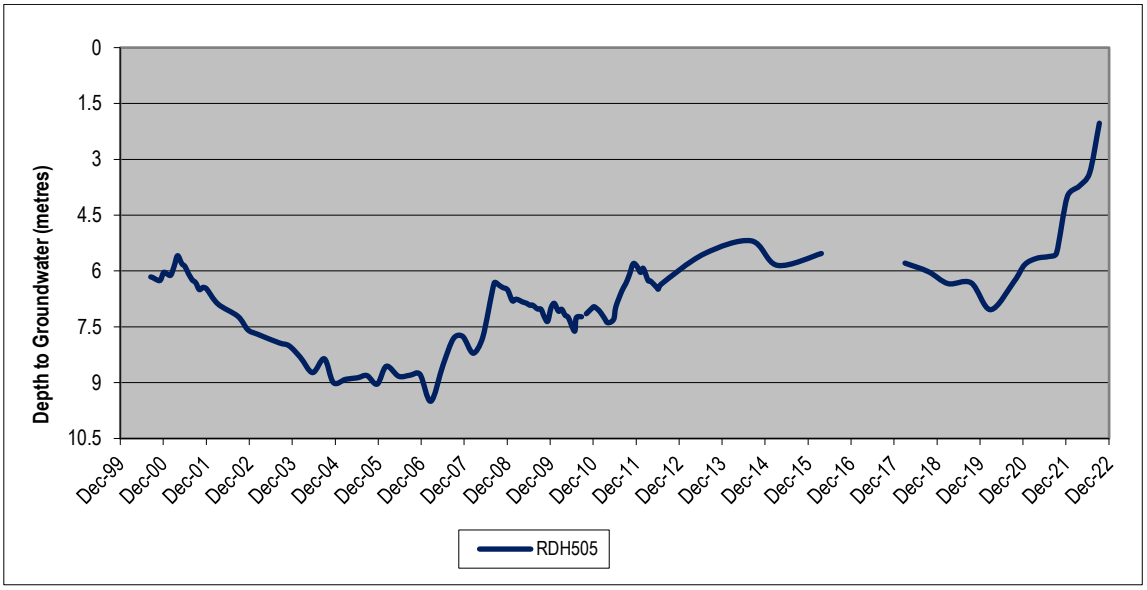
Graph B-7
Groundwater Level for Sandy Creek Alluvium Bores (1998-2022)



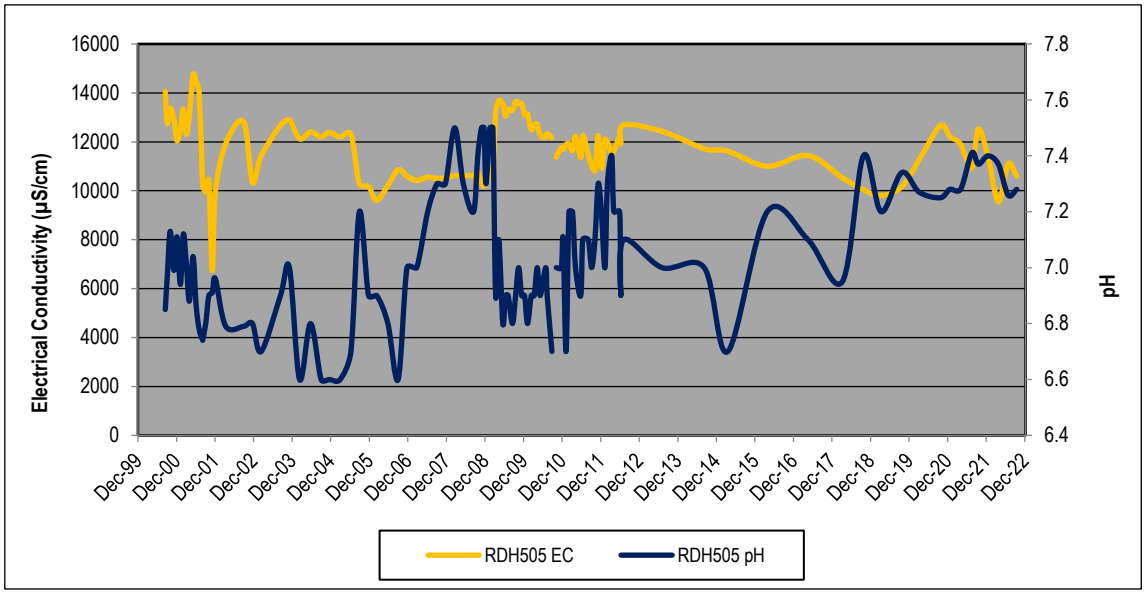
Graph B-8
pH for Sandy Creek Alluvium Bores (1998-2022)



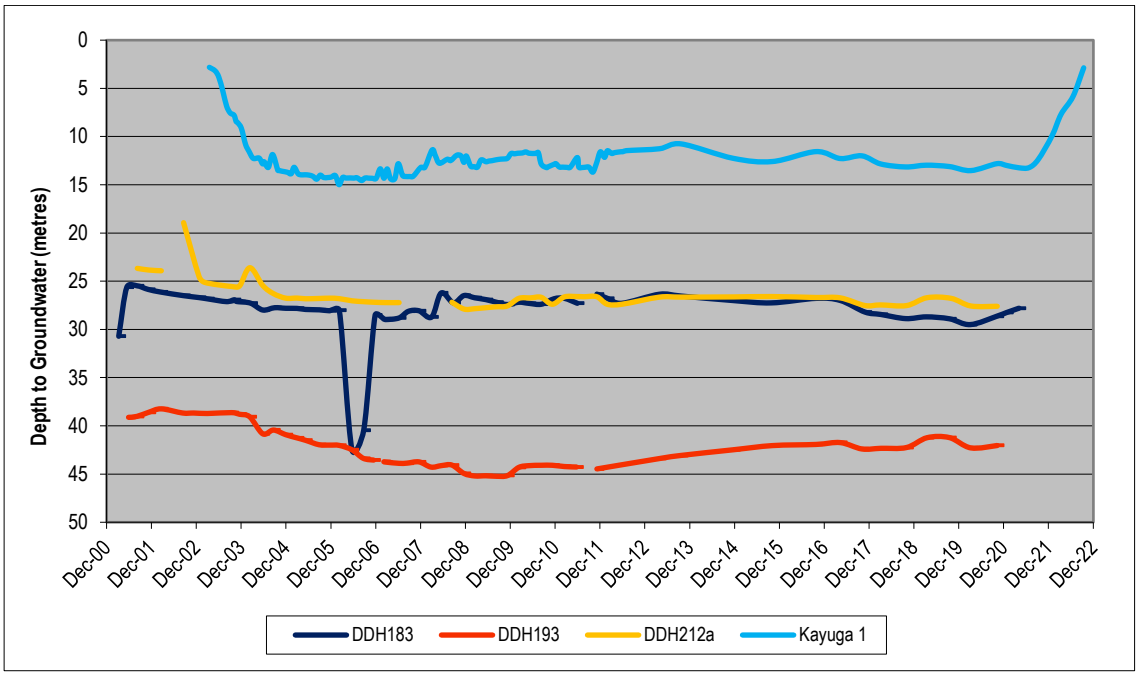
Graph B-9
Electrical Conductivity for Sandy Creek Alluvium Bores (1998-2022)



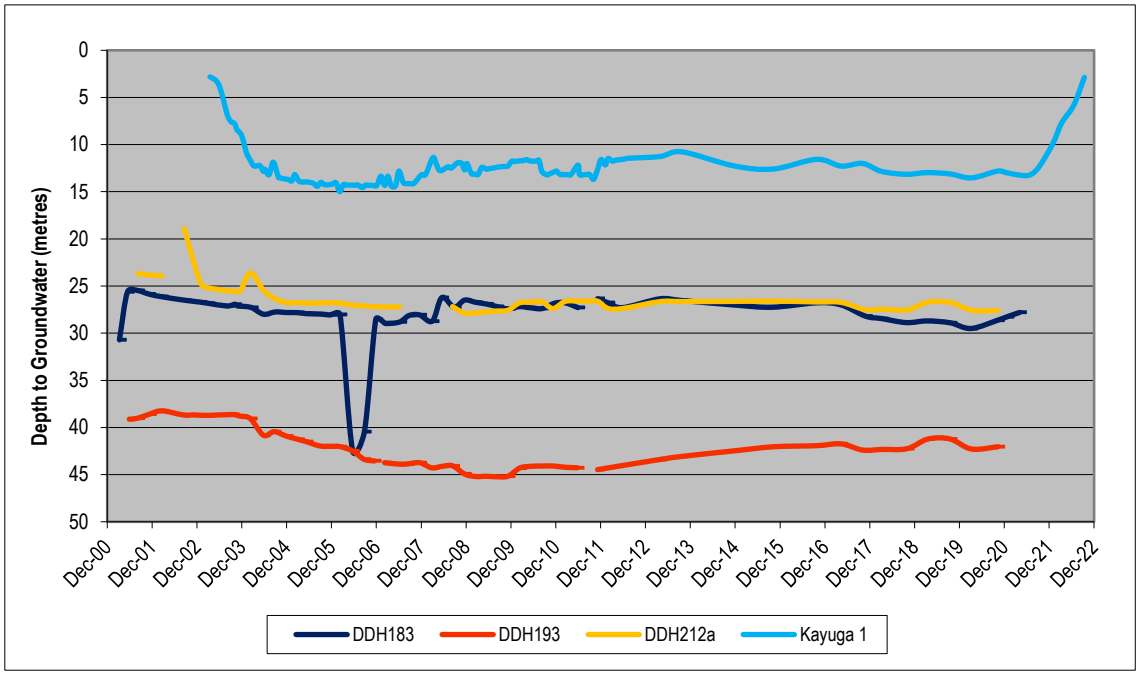
Graph B-10
Groundwater Level for Staged Discharge Dam Bore (2000-2022)



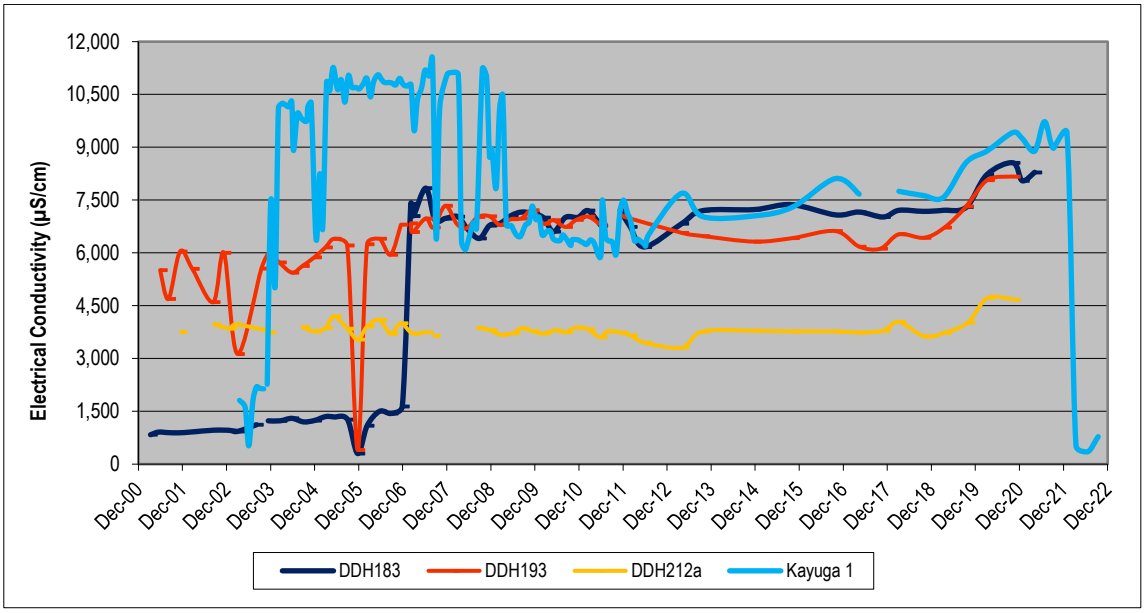
Graph B-11
pH and Electrical Conductivity for Staged Discharge Dam Bore (2000-2022)



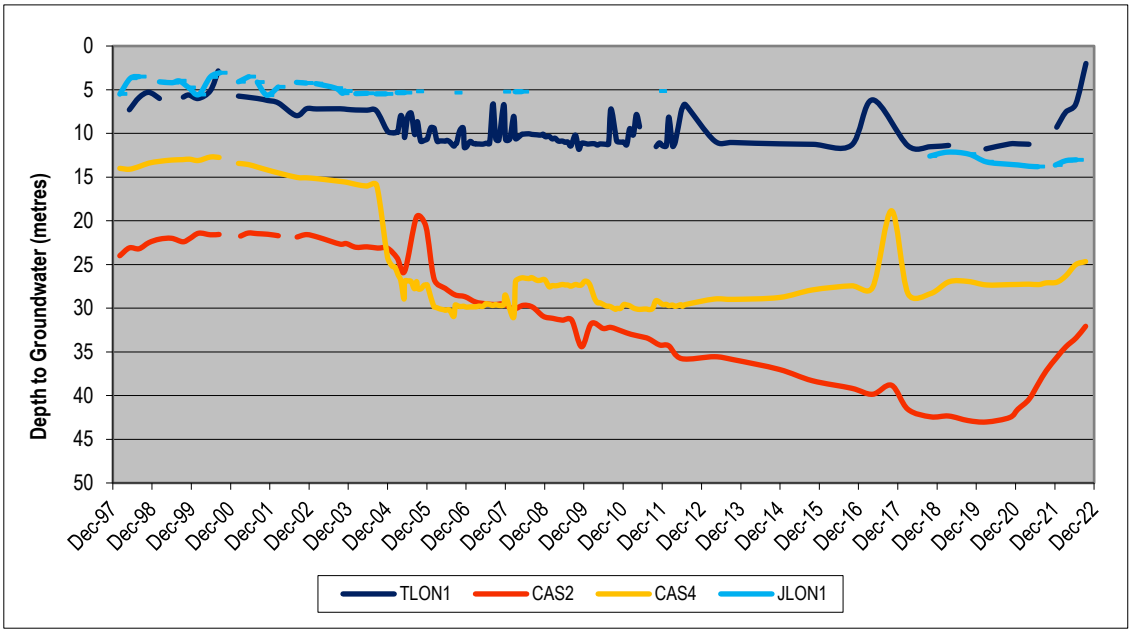
Graph B-12
Groundwater Level for Coal Seam Bores (2001-2022)



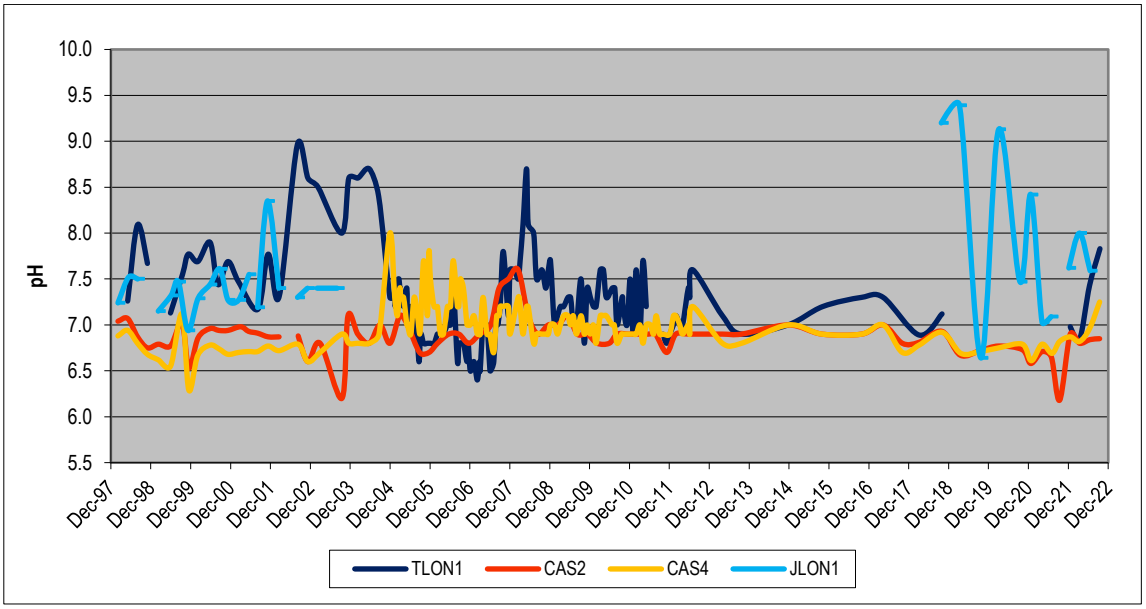
Graph B-13
pH for Coal Seam Bores (2001-2022)



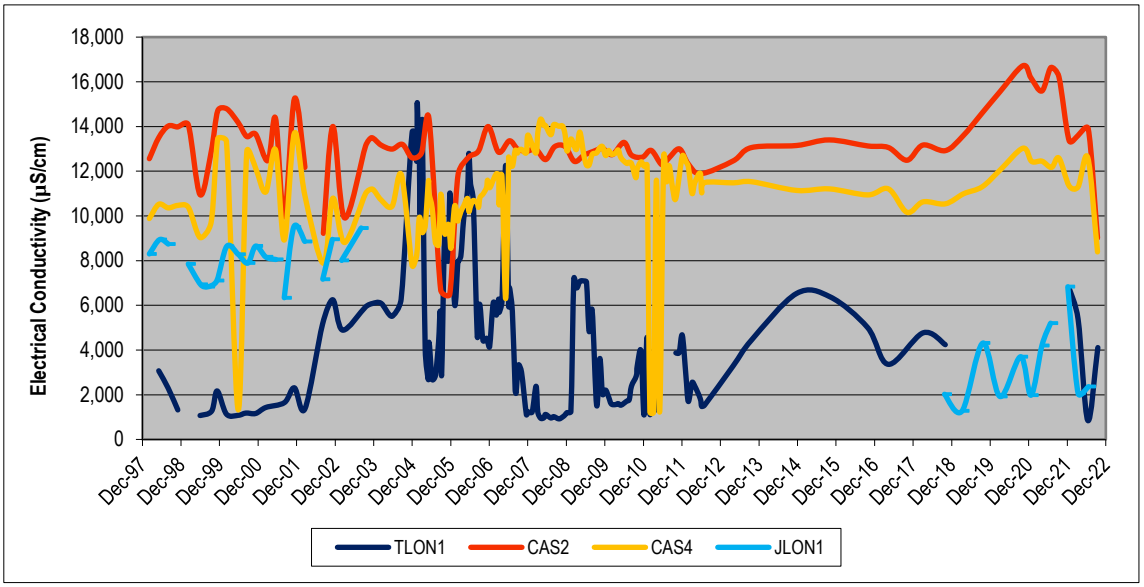
Graph B-14
Electrical Conductivity for Coal Seam Bores (2001-2022)



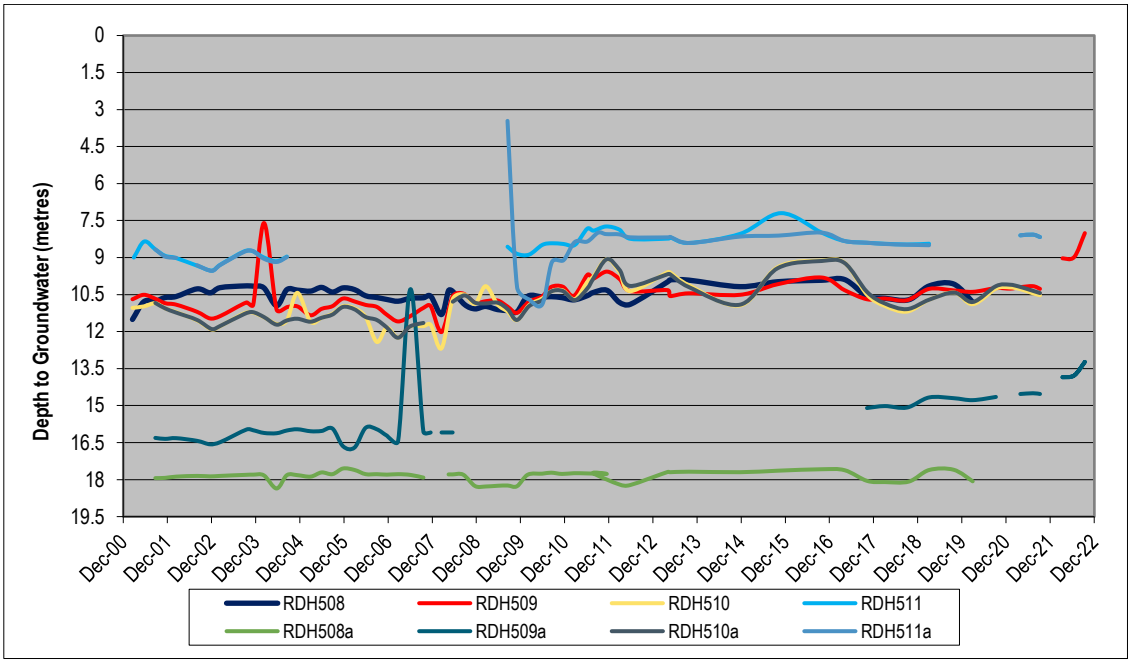
Graph B-15
Groundwater Levels for Regolith Bores (1998-2022)



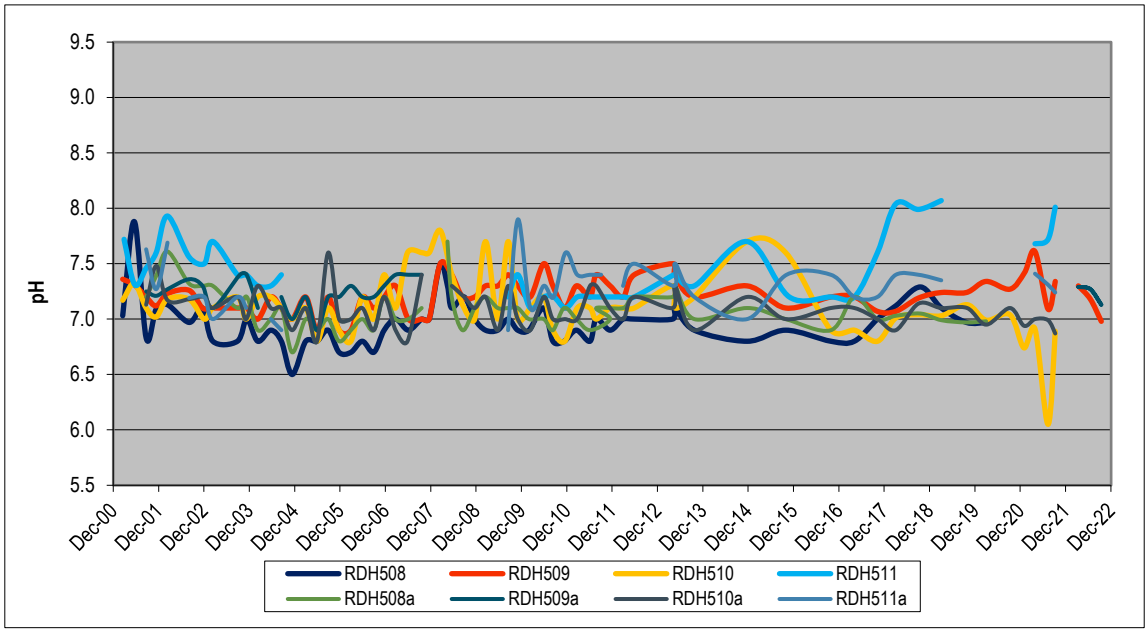
Graph B-16
pH for Regolith Bores (1998-2022)



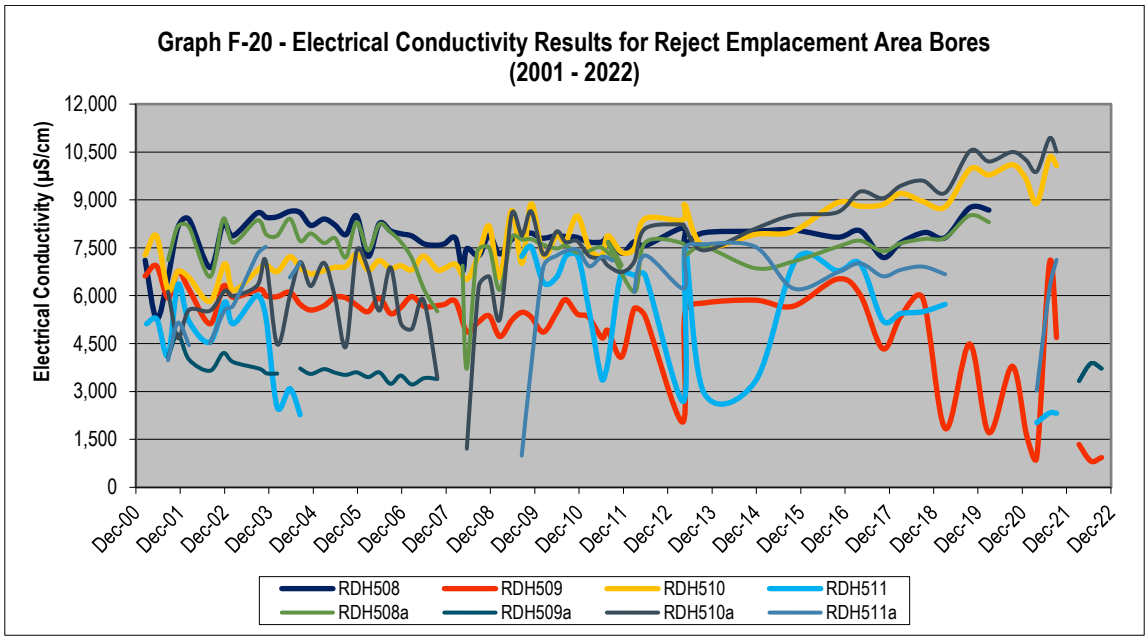
Graph B-17
Electrical Conductivity for Regolith Bores (1998-2022)



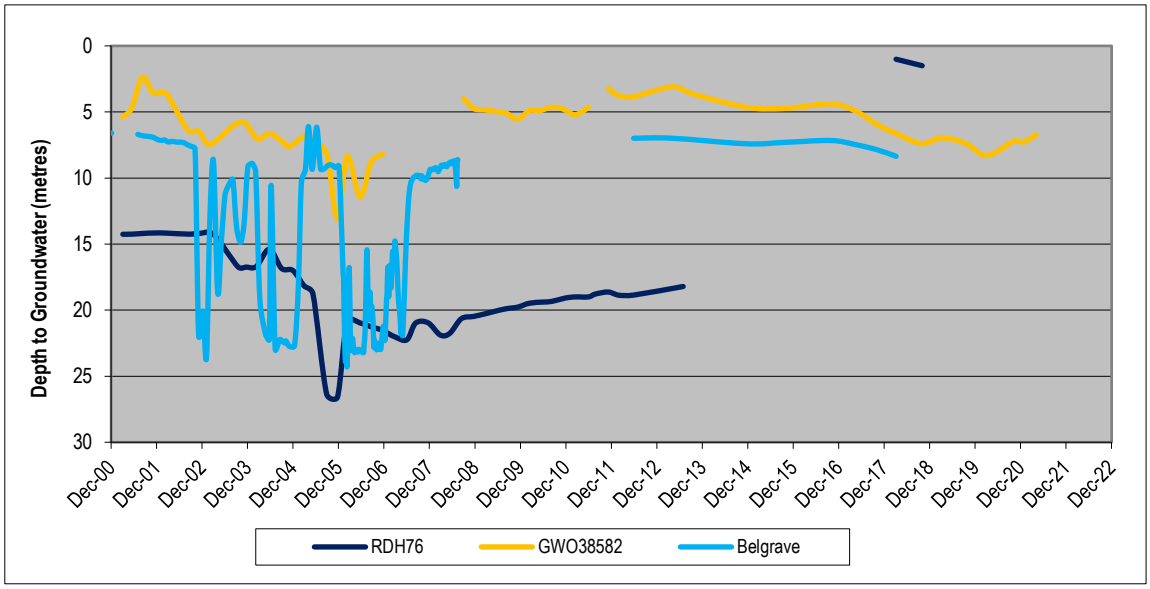
Graph B-18
Groundwater Level for Rejects Emplacement Area Bores (2001-2022)



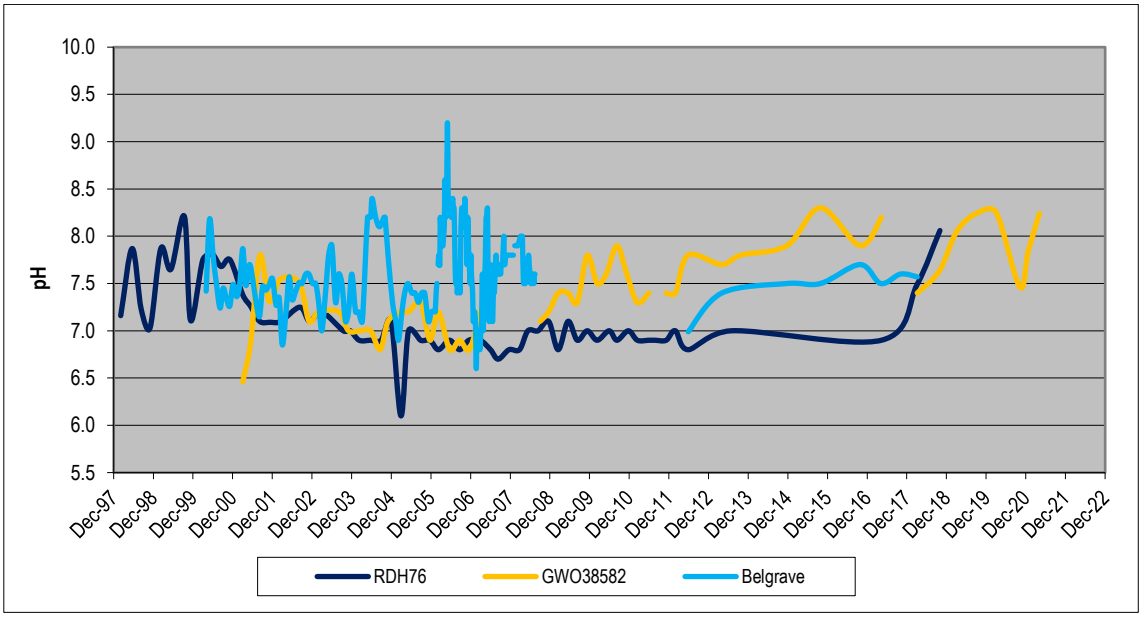
Graph B-19
pH for Rejects Emplacement Area Bores (2001-2022)



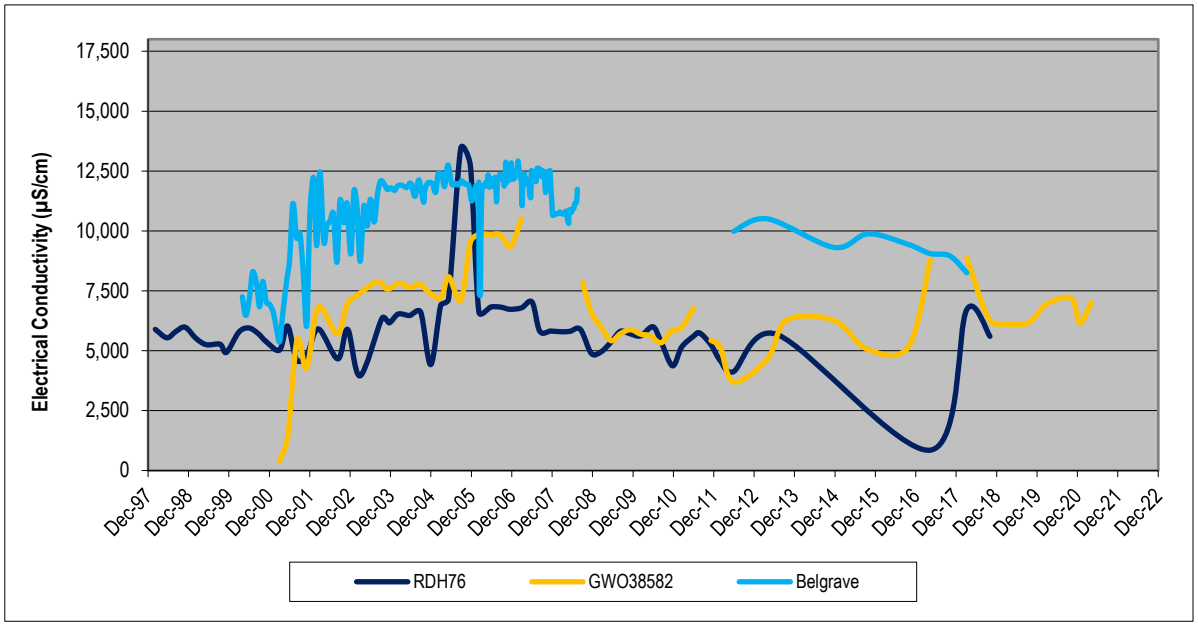
Graph B-20
Electrical Conductivity for Rejects Emplacement Area Bores (2001-2022)



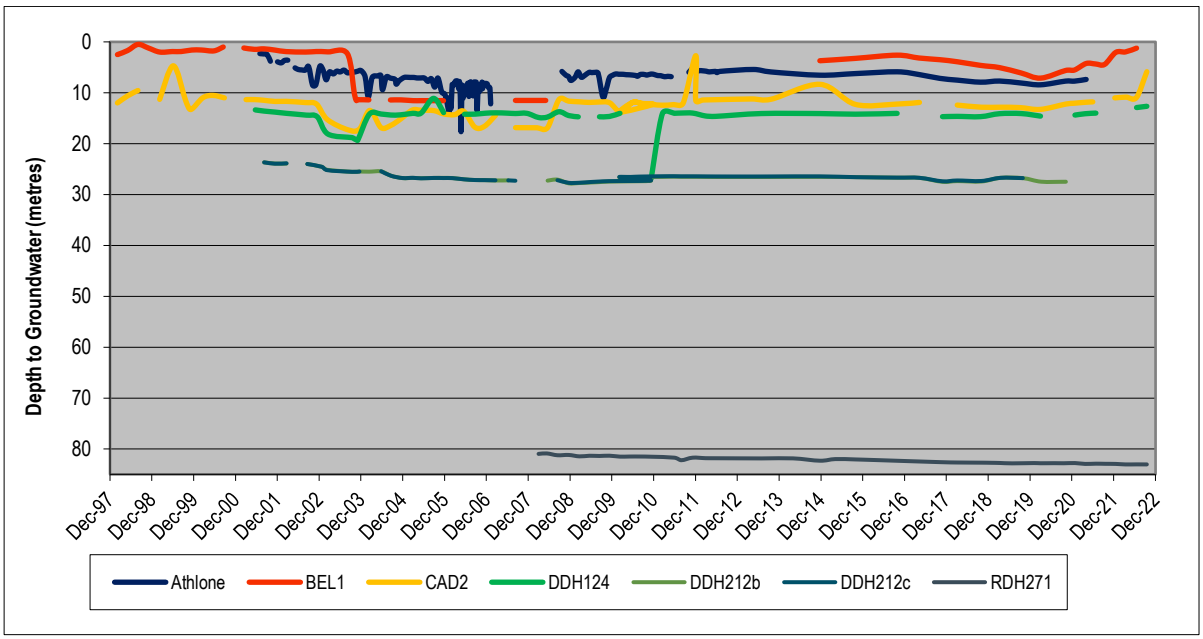
Graph B-21
Groundwater Level for Landowner Property Bores (2001-2022)



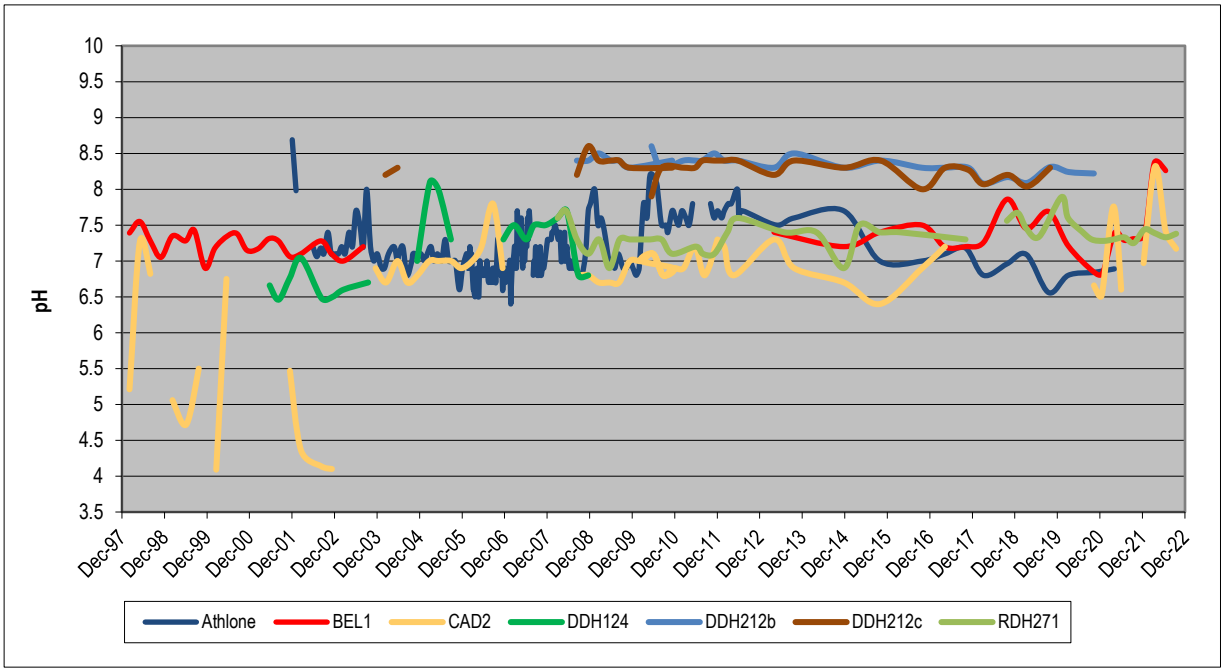
Graph B-22
pH for Landowner Property Bores (1998-2022)



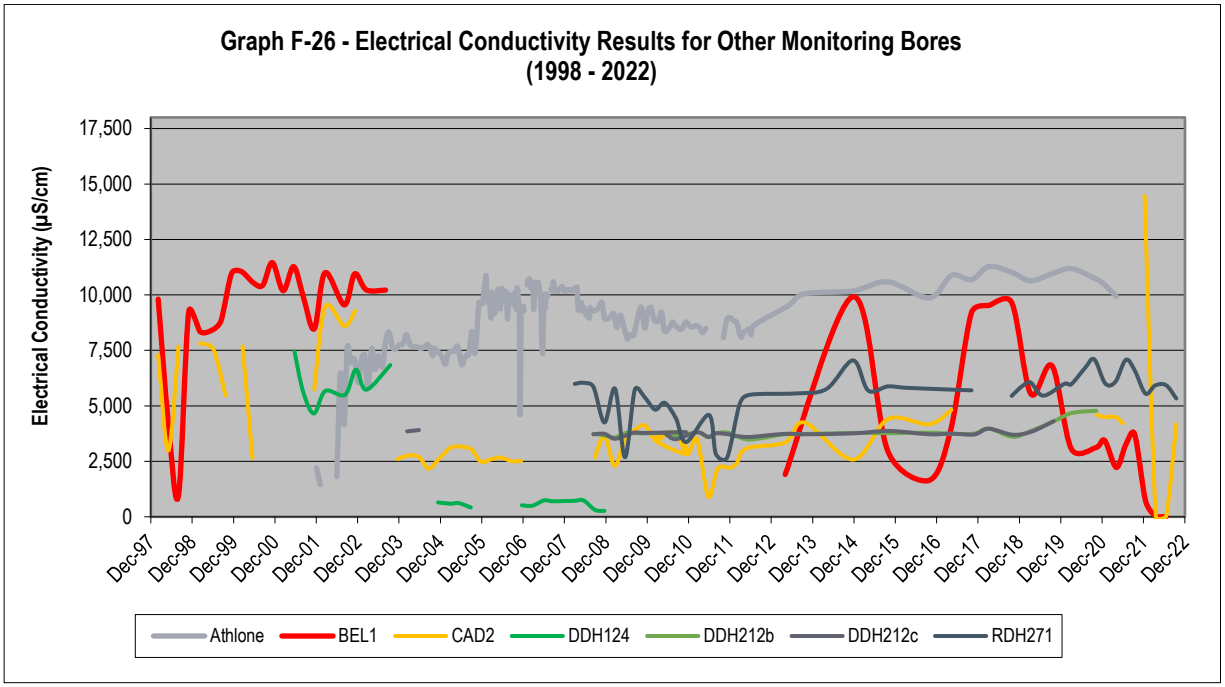
Graph B-23
Electrical Conductivity for Landowner Property Bores (1998-2022)



Graph B-24
Groundwater level for Other Monitoring Bores (1998-2022)



Graph B-25
pH for Other Monitoring Bores (1998-2022)



Graph B-26
Electrical Conductivity for Other Monitoring Bores (1998-2022)