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# SURFACE WATER MANAGEMENT PLAN FINAL REV 1

Tahmoor Coal



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# 1 Introduction

## 1.1 Background

Tahmoor Coal Pty Ltd (Tahmoor Coal) owns and operates Tahmoor Mine, an underground coal mine extracting coking coal which is an ingredient in the production of steel. The mine surface operations are located south of Tahmoor NSW, which is within the greater Sydney Basin - approximately 80 km southwest of Sydney. Tahmoor Mine is within the Wollondilly Shire Council (WSC) Local Government Area (LGA). Underground workings extend north under the town of Tahmoor and Picton with two ventilation shafts being located on the outskirts of Tahmoor. The location of Tahmoor Mine in the regional context is shown in Figure 1 and the location of the ventilation shafts is shown in Figure 2.

Tahmoor Mine surface facilities are situated adjacent to Remembrance Drive between the townships of Tahmoor and Bargo (see Figure 1). The Tahmoor Mine surface facilities are located on land owned by Tahmoor Coal with mining conducted under both crown and freehold property. Surface facilities at Tahmoor Mine include administration buildings and offices, a materials store, diesel tanks, electrical workshop, mechanical workshop, bathhouse, ventilation fan, Coal Handling Preparation Plant (CHPP), storage areas, run of mine stockpile and product stockpiles. A third party owned power station is also located on-site and utilises methane from the mines' gas drainage system to produce electricity. Extracted coal is processed on site prior to transportation via rail to the Port Kembla Coal Terminal. The general arrangement of the Tahmoor Mine surface facilities and Reject Emplacement Area (REA) are shown in Figure 2 and Figure 3 respectively.

An Environmental Impact Statement (EIS) was exhibited in early 2019 seeking approval for the extraction of up to 48 million tonnes (Mt) of ROM coal over a 13-year mine life. Tahmoor Coal subsequently revised the proposed mine design and submitted amended development applications on two occasions (in February and August 2020). In April 2021, Tahmoor Coal received Development Consent SSD 8445 (the Consent) for the Tahmoor South Project, which involves use of the existing surface infrastructure and the extension of underground longwall mining to the south of existing workings. The approved Project longwalls are shown as longwall (LW) S1A-S6A, previously referred to as LW101A-106A, and LWS1B-S6B, previously referred to as LW101B-106B, in Figure 1. Figure 1 also presents the proposed length of LWS3B and LWS4B pending Planning Secretary approval. The Project has consent to extract up to 4 Mtpa of ROM coal, with a total of up to 33 Mt of ROM coal extracted over a 10-year period until 31 December 2033.

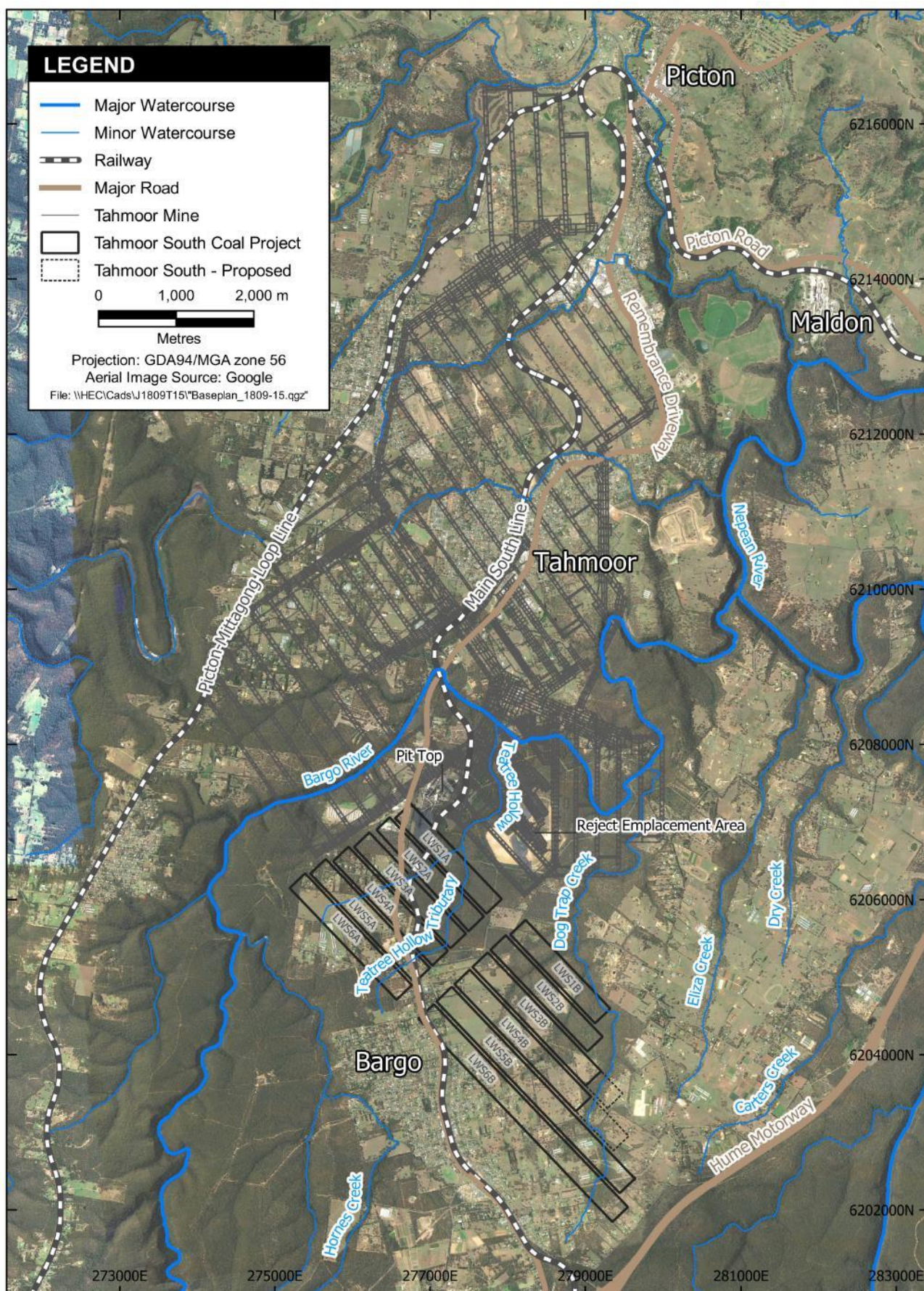
## 1.2 Purpose

The purpose of this Surface Water Management Plan (SWMP) is to provide a framework for Tahmoor Coal personnel to ensure that compliance is achieved with relevant internal and external regulatory requirements relating to surface water management at the Tahmoor Mine. The plan aims to ensure that impacts to surface water resources are controlled and managed within a structured framework.

This SWMP has been developed in accordance with the requirements of the Development Consent (SSD 8445) (the Consent) Condition B34, Schedule 2. The SWMP relates specifically to the Tahmoor Mine surface facilities, including the REA, and broadly to the development of the Project.

Predicted subsidence and other mining related effects on surface water resources associated with the development of the Project are to be addressed in the relevant Extraction Plan Water Management Plan (WMP).





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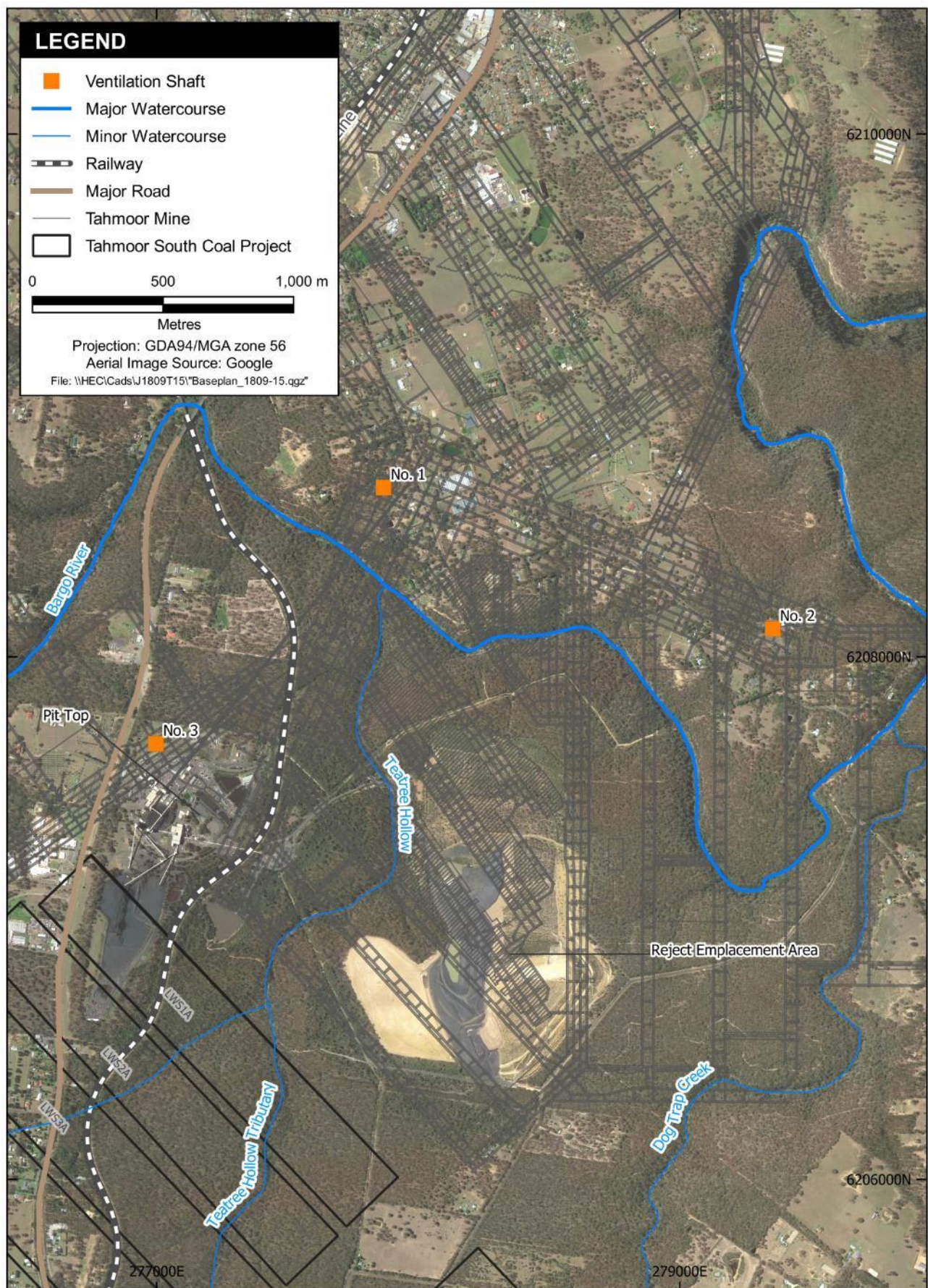
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**Figure 2 Ventilation Shaft Locations**

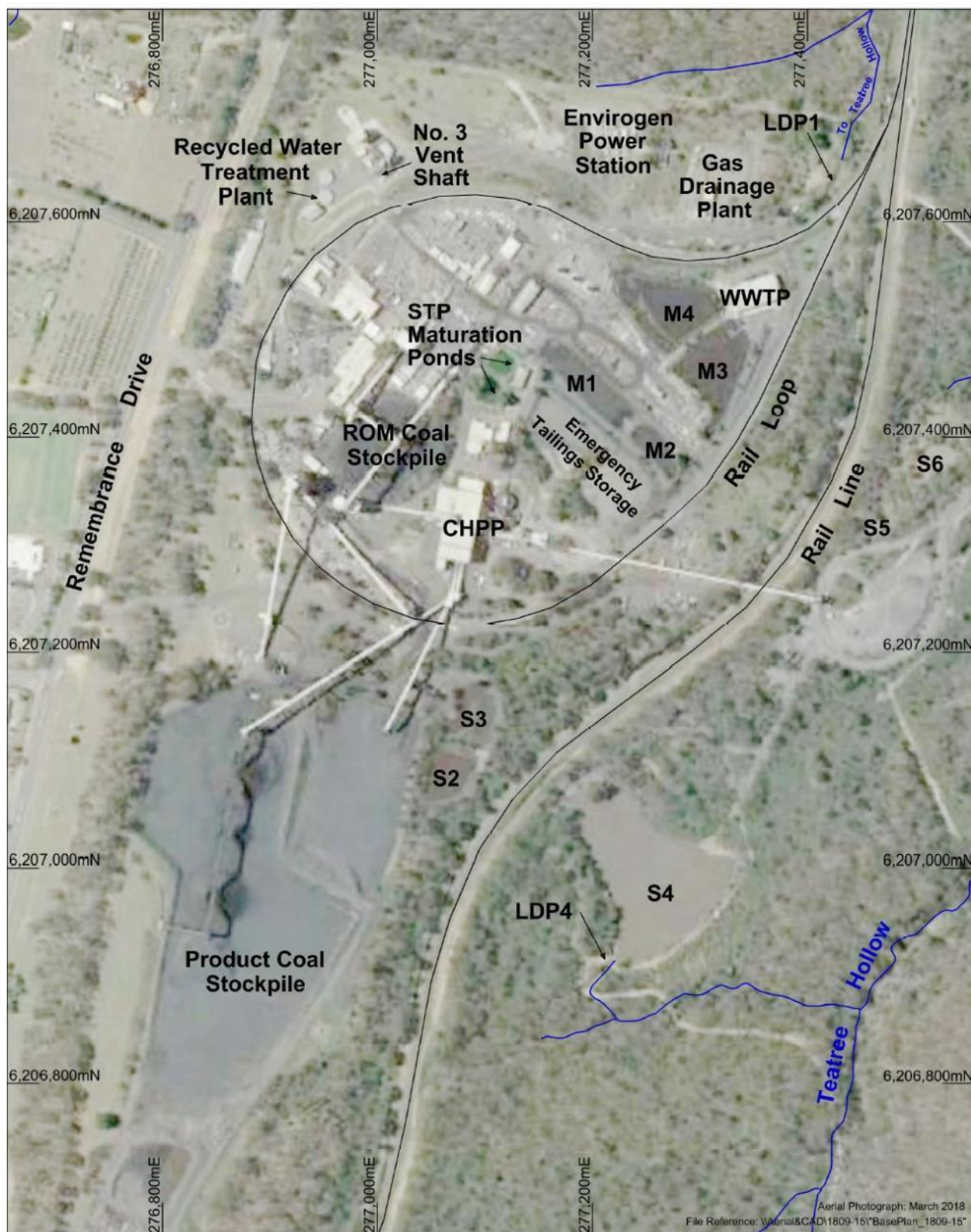
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**Figure 3 General Arrangement of Surface Facilities Area**





**Figure 4**      **Reject Emplacement Area**

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### 1.3 Scope

This SWMP includes management measures and monitoring requirements relating to:

- channel stability, streamflow and water quality in the sections or parts of watercourses and/or water bodies potentially impacted by the Project; and
- the Tahmoor Mine surface water management system.

### 1.4 Preparation

The SWMP forms part of the Environmental Management System (EMS) for the Tahmoor Mine. The SWMP has been prepared by Dr Camilla West and Mr Anthony Marszalek who have been endorsed by the Department of Planning, Industry and Environment (DPIE) as suitability qualified to prepare this SWMP (refer Appendix C of the Water Management Plan [in preparation]).



## 2 Statutory Requirements and Legislation

### 2.1 Relevant Legislation

#### 2.1.1 *Water Management Act 2000*

The NSW Department of Planning, Industry and Environment (DPIE) – Water develops, assesses and recommends changes to water sharing/water resources plans and water management rules for regional water in NSW in accordance with the *Water Management Act 2000*. A primary objective of DPIE – Water is the sustainable management and use of water resources, balancing environmental, social and economic considerations. DPIE – Water has developed Water Sharing Plans (WSPs) for much of the State and these establish rules for sharing and trading water between the environment, town water supplies, basic landholder rights and commercial uses. The Natural Resources Access Regulator (NRAR) is an independent regulatory body established by DPIE – Water and is responsible for compliance with and enforcement of the regulatory framework. The Tahmoor Mine is located within the Upper Nepean River Water Source which is regulated by the *Water Sharing Plan for Greater Metropolitan Region Unregulated River Water Sources*.

Water used in existing and on-going mining and coal processing operations will continue to be sourced from the underground operations (groundwater ingress and recycling of supply for mining operations) and from water captured within the existing pit top water management system. Some water is also supplied under agreement with Sydney Water.

#### 2.1.2 *Protection of the Environment Operations Act 1997*

The *Protection of the Environment Operations Act 1997* and the *Protection of the Environment Operations (General) Regulation 2009* set out the general obligations for environmental protection in NSW. The Tahmoor Mine operates in accordance with Environment Protection Licence (EPL) 1389.

### 2.2 Development Consent Conditions

In accordance with the Consent, Tahmoor Coal is required to prepare a Water Management Plan for the Tahmoor Mine. The requirements of the Water Management Plan are established by Condition B34 under Schedule 2 of the Consent.

The plan must:

- a) be prepared by a suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;
- b) be prepared in consultation with DPIE - Water and the Environment Protection Authority (EPA);
- c) describe the measures to be implemented to ensure that Tahmoor Coal complies with the water management performance measures; and
- d) utilise existing data from nearby mines and build on existing monitoring programs, where practicable.

#### 2.2.1 *Water Management Performance Measures*

The water management performance measures specified in Condition B33 of the Consent are listed in Table 1 below. The performance measures have been/will be adhered to in the development and operation of the water management system for the Project, as described in this SWMP.

**Table 1 Water Management Performance Measures**

Feature	Performance Measure
Water management - general	<ul style="list-style-type: none"> <li>• Maintain separation between clean and dirty (including both sediment-laden water and mine water) water management systems</li> <li>• Minimise the use of clean and potable water on site</li> <li>• Maximise water recycling, reuse and sharing opportunities to the extent that is reasonable and feasible</li> <li>• Maximise the capture and reuse of mine water and dirty water to meet operational demands for water to the extent that is reasonable and feasible</li> <li>• Minimise the use of make-up water from external sources</li> <li>• Design, install, operate and maintain water management systems in a proper and efficient manner</li> <li>• Minimise risks to the receiving environment and downstream water users</li> </ul>
Aquatic and riparian ecosystems	<ul style="list-style-type: none"> <li>• Maintain or improve baseline channel stability</li> <li>• Develop site-specific in-stream water quality objectives in accordance with the <i>Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC &amp; ARMCANZ, 2000)</i> and <i>Using the ANZECC Guidelines and Water Quality Objectives in NSW (DEC, 2006)</i></li> </ul>
Erosion and sediment control works	<ul style="list-style-type: none"> <li>• Design, install and maintain erosion and sediment controls in accordance with the guidance series <i>Managing Urban Stormwater: Soils and Construction</i> including <i>Volume 1: Blue Book</i> (Landcom, 2004), <i>Volume 2A: Installation of Services</i> (DECC, 2008), <i>Volume 2C: Unsealed Roads</i> (DECC, 2008), <i>Volume 2D: Main Road Construction</i> (DECC, 2008) and <i>Volume 2E: Mines and Quarries</i> (DECC, 2008)</li> <li>• Design, install and maintain any new creek crossings generally in accordance with the <i>Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI, 2013) and <i>Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings</i> (NSW Fisheries 2003).</li> <li>• Ensure all works on waterfront land are consistent with the guidance series for <i>Controlled Activities on Waterfront Land</i> (DPI Water, 2012)</li> </ul>
Clean water diversions and storage infrastructure	<ul style="list-style-type: none"> <li>• Design, install and maintain any new components of the clean water system to capture and convey the 100 year ARI flood</li> <li>• Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on the site, except where clean water is captured for use on the site</li> </ul>
Sediment dams	<ul style="list-style-type: none"> <li>• Design, install and/or maintain sediment dams to prevent off-site discharges to surface waters, except as may be permitted under condition B31</li> <li>• Design, install and maintain sediment dams in accordance with the guidance series <i>Managing Urban Stormwater: Soils and Construction – Volume 1</i> (Landcom, 2004) and <i>2E Mines and Quarries</i> (DECC, 2008) and the requirements under the POEO Act</li> <li>• Design, install and maintain mine water storage infrastructure to avoid unlicensed or uncontrolled discharge of mine water</li> </ul>



**Table 1 (Cont.) Water Management Performance Measures**

Feature	Performance Measure
Above ground mine water storages	<ul style="list-style-type: none"> <li>• Ensure adequate freeboards within all mine water storage dams at all times to minimise the risk of discharge to surface waters</li> <li>• New on-site storages (including mine infrastructure dams, groundwater storage and treatment dams) are suitably designed, installed and maintained, including being lined to comply with a permeability standard of <math>&lt; 1 \times 10^{-9}</math> m/s</li> </ul>
Reject management	<ul style="list-style-type: none"> <li>• Restrict emplacement of any reject material to the REA in a manner that is consistent with the EIS</li> <li>• Design and maintain tailings storage areas to prevent the movement of tailings seepage/leachate outside the REA</li> </ul>
Chemical and hydrocarbon storage	<ul style="list-style-type: none"> <li>• Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standard</li> </ul>

### 2.2.2 Surface Water Management Plan Conditions

This SWMP forms a component of the overarching Water Management Plan. The requirements of Condition B34 under Schedule 2 of the Consent specific to the SWMP are listed in Table 2. The section of this report in which the requirements have been addressed is also listed.

**Table 2 Surface Water Management Plan Consent Conditions**

Requirement	Where Addressed or Why not Addressed
<b>Site water balance</b> that includes details of: <ul style="list-style-type: none"> <li>• predicted annual inflows to and outflows from the site;</li> <li>• sources and security of water supply for the life of the development (including authorised entitlements and licences);</li> <li>• water storage capacity;</li> <li>• water use and management on the site, including any water stored underground in goaf areas of Tahmoor North Mine;</li> <li>• licensed discharge points and limits; and</li> <li>• reporting procedures, including the annual preparation of a site water balance.</li> </ul>	<p>Tahmoor Coal are planning to stage the next update of the site water and salt balance model to coincide with the update of the numerical groundwater model for the Project which is currently planned to be completed by April 2022.</p> <p>Section 8 provides further detail of the site water and salt balance model development which will provide predictions of the annual inflows to and outflows from the site.</p> <p>Section 5 provides detail of the sources of water supply for the Tahmoor Mine.</p> <p>Section 3.4 details the Water Access Licences held by Tahmoor Coal.</p> <p>Table 13 of Section 5 lists the Tahmoor Mine water management storages and capacities.</p> <p>Section 5 provides detail of water use and management on the site.</p> <p>Section 4.1.4 details the licenced discharge points and discharge limits.</p> <p>Section 9.4 describes the proposed reporting procedures.</p>

**Table 2 (Cont.) Surface Water Management Plan Consent Conditions**

Requirement	Where Addressed or Why not Addressed
<p><b>Salt balance</b> that includes details of:</p> <ul style="list-style-type: none"> <li>• sources of saline material on the site;</li> <li>• saline material and saline water management on the site;</li> <li>• measures to minimise discharge of saline water from the site; and</li> <li>• reporting procedures, including the annual preparation of an updated salt balance.</li> </ul>	<p>Tahmoor Coal are planning to stage the next update of the site water and salt balance model to coincide with the update of the numerical groundwater model for the Project which is currently planned to be completed by April 2022. Section 6 provides further detail of the site water and salt balance model development. Approval for staging was granted on 03/12/2021.</p> <p>Section 9.4 describes the proposed reporting procedures.</p>
<p><b>Surface Water Management Plan</b> that includes:</p> <ul style="list-style-type: none"> <li>• detailed baseline data on channel stability, water flows and water quality in the sections or parts of watercourses and/or water bodies potentially impacted by the development (including Teatree Hollow, Dog Trap Creek, Bargo River and all associated tributaries);</li> <li>• a detailed description of the surface water management system;</li> <li>• detailed plans, design objectives and performance criteria for water management infrastructure including: <ul style="list-style-type: none"> <li>- any approved creek restoration works associated with the development;</li> <li>- water run-off diversions and catch drains;</li> <li>- erosion and sediment controls, including sediment dams;</li> <li>- any water storages, including mine water management systems;</li> <li>- water treatment plant required under the EPL;</li> <li>- compliance with the objectives for aquatic and riparian river systems set out in Table 4;</li> <li>- the sewage treatment plant; and</li> <li>- reinstated drainage networks on rehabilitated areas of the site;</li> </ul> </li> </ul>	<p>Section 3 describes the surface water resources within and adjacent to the Tahmoor Mine surface facilities.</p> <p>Section 4.2 presents baseline data on water flows and water quality.</p> <p>Section 5 provides a detailed description of the surface water management system.</p> <p>Section 5 provides detail of the existing and proposed water management infrastructure including design objectives and performance criteria.</p> <p>N/A</p> <p>Diversion channels and collection drains are described in Section 5.</p> <p>Erosion and sediment control measures are described in the <i>Erosion and Sediment Control Plan</i> (in preparation).</p> <p>Section 5 describes the Tahmoor Mine water management storages and water management system.</p> <p>Section 5.1.3 describes the Reverse Osmosis Wastewater Treatment Plant required under EPL 1389.</p> <p>Section 9.1 describes the proposed derivation of site specific trigger values for surface water quality.</p> <p>The sewage treatment plant is described in Section 5.1.1.</p> <p>Section 7.1 describes the proposed progressive rehabilitation of the REA including construction of diversion channels.</p>



**Table 2 (Cont.) Surface Water Management Plan Consent Conditions**

Requirement	Where Addressed or Why not Addressed
<ul style="list-style-type: none"> <li>• surface water performance criteria, including trigger levels for identifying and investigating any potentially adverse impacts (or trends) associated with the development for; <ul style="list-style-type: none"> <li>- water supply for other water users;</li> <li>- downstream surface water flows and quality;</li> <li>- stream and riparian vegetation health; and</li> <li>- post-mining water pollution from rehabilitated areas of the site;</li> </ul> </li> <li>• a program to monitor and evaluate: <ul style="list-style-type: none"> <li>- compliance with the relevant performance measures listed in Table 4 (Table 1 of this SWMP) and the performance criteria in this plan;</li> <li>- controlled and uncontrolled discharges and seepage/leachate from the site;</li> <li>- impacts on water supply for other water users;</li> <li>- surface water inflows, outflows and storage volumes, to inform the Site Water Balance;</li> <li>- the effectiveness of the surface water management system, and the measures in the Erosion and Sediment Control Plan;</li> <li>- reporting procedures for the results of the monitoring program, including notifying other water users of any elevated results;</li> <li>- a trigger action response plan to respond to any exceedances of the performance measures in Table 5, and to repair, mitigate and/or offset any adverse surface water impacts of the development, including measures to provide compensatory water supply to affected water users under condition B26;</li> </ul> </li> <li>• a program to periodically update and validate the stream flow water balance model;</li> </ul>	<p>Section 9 describes the proposed surface water performance criteria and Trigger Action Response Plans.</p> <p>Section 8 describes the proposed surface water monitoring program.</p> <p>Section 8.3 describes the water management system monitoring program.</p> <p>Monitoring of erosion and sediment control measures is described in the <i>Erosion and Sediment Control Plan</i> (in preparation).</p> <p>Section 9.4 describes the Tahmoor Coal reporting procedures.</p> <p>Section 9 describes the proposed surface water performance criteria and Trigger Action Response Plans.</p> <p>Section 9.3 describes measures to provide compensatory water supply to affected water users.</p> <p>The Project does not involve the development of a stream flow water balance model.</p>
<p><b>Long-term water management strategy</b> for the whole Tahmoor mining complex that:</p> <ul style="list-style-type: none"> <li>• includes detailed modelling of the potential water impacts of the mining complex as water levels recover following the cessation of mining operations within the complex and rehabilitation of these operations;</li> <li>• identifies the measures that would be implemented at each of these mining operations to minimise any adverse water impacts;</li> <li>• includes a water licencing strategy for the ongoing take of any water over time; and</li> <li>• includes a program to monitor and review the water impacts of the mining complex over time.</li> </ul>	<p>Section 7 describes the proposed development of the long-term water management strategy.</p> <p>Section 7.2 describes the updated numerical groundwater modelling.</p> <p>Section 9 describes the proposed surface water performance criteria and Trigger Action Response Plans.</p> <p>Section 7.3 describes the water licencing strategy for the Project.</p> <p>Section 8 presents a program to monitor relevant water resources prior to, during and post completion of mining activities.</p>

### 2.2.3 Management Plan Requirements

Consent Condition E5 outlines the general requirements for all management plans. Table 3 outlines the requirements under this condition and identifies where these requirements have been addressed.

**Table 3 Management Plan Requirements**

Condition Reference	Condition	Where Addressed
E5	Management plans required under this consent must be prepared in accordance with relevant guidelines, and include:	
(a)	a summary of relevant background or baseline data;	Section 3 and Section 4
(b)	details of:	
(b) (i)	the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 2
(b) (ii)	any relevant limits or performance measures and criteria; and	Section 2.2.1
(b) (iii)	the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	Section 9 describes the proposed surface water performance criteria and Trigger Action Response Plans.
(c)	any relevant commitments or recommendations identified in the document/s listed in condition A2(c);	Section 2.3
(d)	a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;	Section 5
(e)	a program to monitor and report on the:	
(e) (i)	impacts and environmental performance of the development; and	Section 8
(e) (ii)	effectiveness of the management measures set out pursuant to condition E5(d);	Section 9.5
(f)	a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 9.2
(g)	a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 9.3
(h)	a protocol for managing and reporting any:	
(h) (i)	incident, non-compliance or exceedance of any impact assessment criterion or performance criterion;	Section 9.4.1
(h) (ii)	complaint; or	Section 9.4.4
(h) (iii)	failure to comply with other statutory requirements;	NA
(i)	public sources of information and data to assist stakeholders in understanding environmental impacts of the development; and	Section <b>Error! Reference source not found.</b>
(j)	a protocol for periodic review of the plan.	Section 10.2

## 2.3 EIS Commitments

Condition A2(g) of the Consent requires that the Project is carried out generally in accordance with the EIS. The specific commitments made in the EIS which are relevant to this SWMP, and have not been specifically defined in the Consent, are listed in Table 4. The section of this report in which the requirements have been addressed is also listed.



**Table 4 EIS Commitments Relevant to this SWMP**

Requirement	Where Addressed or Why not Addressed
Surface Water	
A stream flow gauging station would be implemented at Teatree Hollow, downstream of the edge of the longwall and upstream of Licensed Discharge Point (LDP) 1.	Section 8 describes the proposed water monitoring program.
Additional water level monitoring would be implemented to establish baseline water level data to enable the assessment of potential impacts to pool water levels.	
Enhanced low flow control weirs would be established at the existing gauging station at Dog Trap Creek and the proposed gauging station at Teatree Hollow to support the generation of reliable continuous flow data (including reliable low flow data) at these stations.	
A water quality monitoring site would be established on the Bargo River downstream of the confluence with Teatree Hollow and upstream of SW14 to increase the spatial representation of water quality sites downstream of LDP1.	
Geomorphology	
A geomorphology survey (baseline and post mining) of waterways overlying each longwall	A baseline geomorphology survey was conducted by Fluvial Systems in 2013 with key findings documented in Section 3.  A post mining geomorphology survey will be undertaken as described in Section 8.
Pre, during and post-mining photographic surveys and visual inspections of geomorphological features for each longwall	Section 8.1.5 describes the proposed monitoring of geomorphological features, headwater locations and knickpoint formation.
Annual catchment survey at 10 headwater photographic locations to monitor mining-induced subsidence impacts of the Project over time	
Monitoring of knickpoint formation during mining of each longwall and appropriate controls to prevent knickpoint formation	

## 2.4 Consultation

### 2.4.1 Internal Stakeholder Communication

Internal stakeholders include employees, contractors and visitors of Tahmoor Coal. *TAH-HSEC-00119-Communication and Engagement Procedure* has been developed to include the following:

- Methods of communication between internal stakeholders;
- Types of information that is communicated between internal stakeholders;
- Responsibilities for communication of information to internal stakeholders; and
- Review of communication methods, including the consideration of feedback to / from internal stakeholders.

### 2.4.2 External Stakeholder Communication

External stakeholders include neighbours and the local/regional community, local council, state and federal government agencies and regulators, and press/media. Any external communications relating to water management will be conducted in accordance with Tahmoor Coal's standard communications procedures. External stakeholders are identified in accordance with the following:

- *TAH-HSEC-00031 – Community Development Plan; and*
- *TAH-HSEC-00039 – Stakeholder Engagement Plan.*

External stakeholder communication is undertaken in accordance with:

- *TAH-HSEC-00039 – Stakeholder Engagement Plan; and*
- *TAH-HSEC-00119 – Communication and Engagement Procedure.*

These documents include information on the following topics:

- Methods of communication to external stakeholders.
- Types of information that is communicated between external stakeholders.
- Responsibilities for communication of information to external stakeholders.
- Review of communication methods, including the consideration of feedback to/from external stakeholders.

A key objective of *TAH-HSEC-00119 - Communication and Engagement Procedure* is to maintain positive relationships established with the local community and other external stakeholders.

### 2.4.3 Consultation to Date

A draft version of this SWMP was distributed to the following stakeholders for review and feedback:

1. *Department of Planning, Industry and Environment (DPIE) - Water*
2. *Environment Protection Agency (EPA)*

A summary of the consultation outcomes is presented in Table 4 below.

**Table 5 Stakeholder Consultation**

Consulted Parties	Consultation Conducted	Outcomes of Consultation
DPIE - Water	Draft SWMP provided to DPIE – Water and EPA 14 December 2021	Comments received 19 January 2022 and actioned as documented in Appendix A
EPA		Comments received 22 December 2021 and actioned as documented in Appendix A
DPIE - Water	Final Rev 0 SWMP provided to DPIE 31/1/2021	Comments received 14 February 2022 and actioned as documented in Appendix A

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## 3 Surface Water Resources

### 3.1 Regional Settings

Tahmoor Mine is located within the Bargo River catchment. From its headwaters near the townships of Hill Top and Yerrinbool, the Bargo River flows in a generally north-easterly direction through incised valleys and gorges to its confluence with the Nepean River (refer Figure 5).

The headwaters of the Nepean River rise in the coastal ranges to the south of Tahmoor Mine. Flows in the Nepean River near Tahmoor are highly regulated by the Upper Nepean Water Supply Scheme, operated by WaterNSW, which incorporates four major water supply dams on the Cataract, Cordeaux, Avon and Nepean Rivers. Releases from the Cordeaux, Avon and Nepean Dams are made to enable withdrawal for water supply purposes from the Pheasants Nest Weir located further downstream on the Nepean River. The Nepean Dam is situated some 18 km upstream of the Bargo River confluence, while the Pheasants Nest Weir is located approximately 7 km upstream of the confluence. Flows in the Nepean River near and downstream of the Project area (downstream of the Peasants Nest Weir) are not part of a WaterNSW Drinking Water Catchment Area.

The Nepean River flows into the Warragamba River near Wallacia at which point it is referred to as the Hawkesbury-Nepean River. The Hawkesbury-Nepean catchment is one of the largest coastal catchments in NSW with an area of some 21,400 km<sup>2</sup> from its mouth in Broken Bay on the northern side of the Sydney Metropolitan area.

### 3.2 Local Surface Water Resources

The Project is located predominantly within the Teatree Hollow and Dog Trap Creek sub-catchments of the Bargo River catchment (refer Figure 5). Teatree Hollow and a third order<sup>1</sup> stream known as Teatree Hollow tributary overlie the approved LWS1A-S6A while Dog Trap Creek and its tributaries overlie the approved LWS1B-S6B (refer Figure 6 and Figure 7). Teatree Hollow and Dog Trap Creek flow generally north-northeast toward the Bargo River, with Teatree Hollow traversing bushland between the Tahmoor Mine surface facilities and the Reject Emplacement Area (REA) and Dog Trap Creek traversing predominantly bushland to the east of the REA (refer Figure 6 and Figure 7). The lower reaches of Tea Tree Hollow, Dog Trap Creek and the Bargo River have, to varying degrees, experienced subsidence-related effects due to historical mining operations at the Tahmoor Mine.

#### 3.2.1 Bargo River

The Bargo River catchment area is approximately 130 square kilometres (km<sup>2</sup>) at its confluence with the Nepean River. The Bargo River has intermittent flow in its upstream reaches which, to some degree, are regulated by the Picton Weir<sup>2</sup> which is located approximately 14 km upstream of the Nepean River confluence. Downstream of the Tahmoor Mine pit top (i.e. downstream of the Teatree Hollow confluence) flow is perennial due to persistent licensed discharges from Tahmoor Mine.

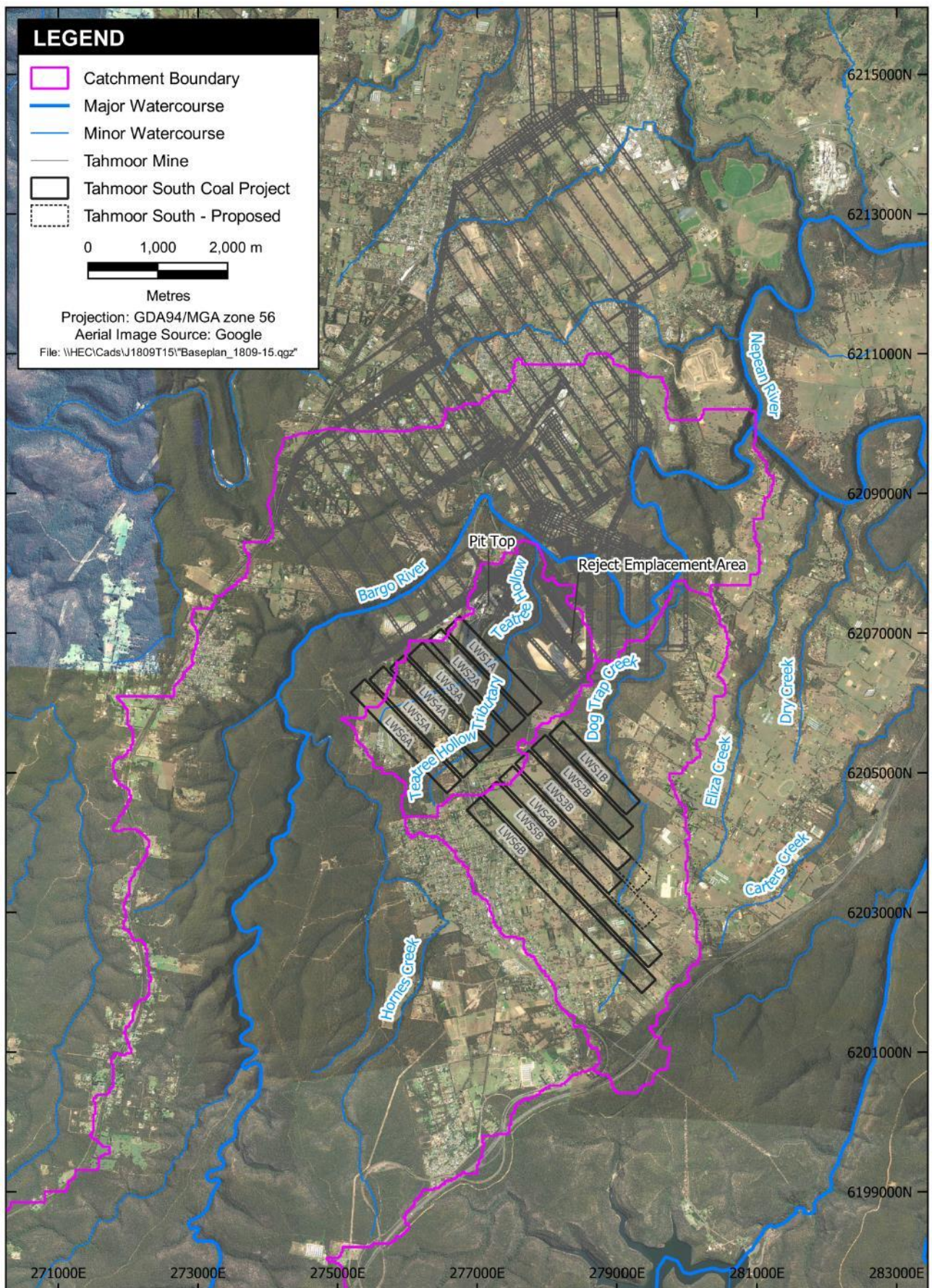
The lower 4 kilometres (km) of the river pass through the Bargo River Gorge, which is characterized by steep rock faces up to 110 m high. The river consists of a sequence of pools, glides and rock bars across sandstone bedrock, with occasional boulder fields and cobblestone riffles. The Bargo River flows into the Nepean River approximately 9 km downstream of the Teatree Hollow confluence.

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<sup>1</sup> Strahler stream order classification scheme (Strahler, 1952).

<sup>2</sup> The weir was constructed in the late 19<sup>th</sup> century to supply the township of Bargo, is now heavily silted and no longer in use.





**Figure 5 Surface Water Systems**

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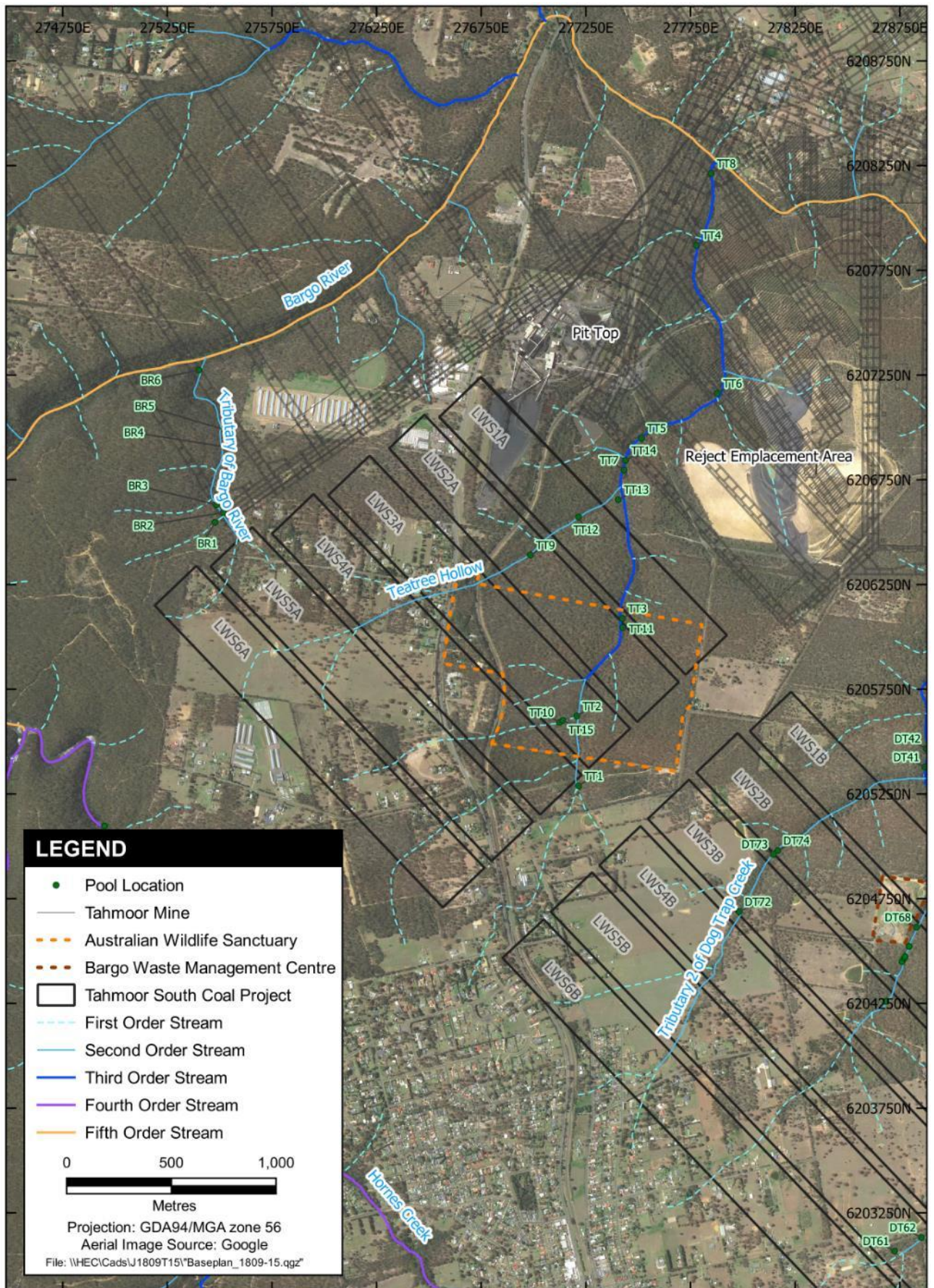
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**Figure 6 Teatree Hollow, Teatree Hollow Tributary and Bargo River Tributary Pool Locations**

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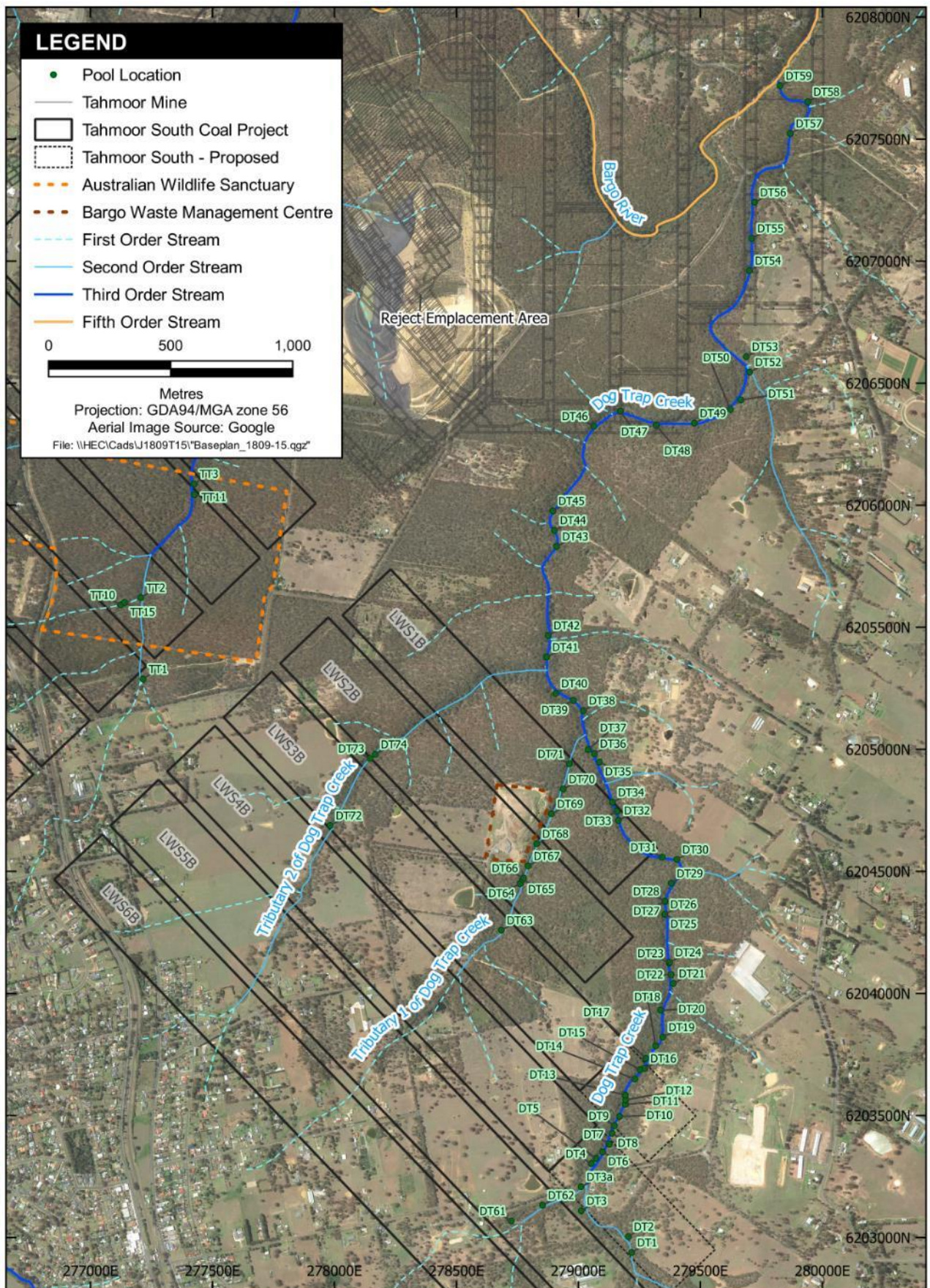
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**Figure 7 Dog Trap Creek and Dog Trap Creek Tributaries Pool Locations**

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The headwaters of a second order tributary of the Bargo River overlie the western edge of the approved LWS5A (refer Figure 6). Rock slabs and bedrock outcrop were mapped in the mid to lower reach of the tributary and a total of 6 pools were identified with the dominant pool control comprising boulders (Fluvial Systems, 2013). Predominantly hard (likely to be fixed) knickpoints<sup>3</sup> of varying dimensions were observed in the Bargo River tributary (Fluvial Systems, 2013). The baseline geomorphology survey identified that the Bargo River tributary was generally in good geomorphic condition (i.e. essentially natural with intact form and process) (Fluvial Systems, 2013). Sites where the redirection of surface flow to the subsurface was observed, presumed to be associated with historical mining-induced bed fracturing, were classified as having moderate geomorphic condition (Fluvial Systems, 2013).

### 3.2.2 *Teatree Hollow*

Teatree Hollow has its headwaters in the northern part of the Bargo Township, above the approved LWS1A-S6A and between the existing Tahmoor Mine surface facilities and REA to the Bargo River. Teatree Hollow is a third order stream from the northern boundary of the approved LWS1A to the confluence with the Bargo River and has a total catchment area of approximately 6.8 km<sup>2</sup>. A third order tributary joins with Teatree Hollow at the eastern edge of the approved LWS1A (refer Figure 6).

The baseline geomorphology survey (Fluvial Systems, 2013) identified that the upper to mid reach of Teatree Hollow and the mid to lower reach of Teatree Hollow Tributary were predominantly in good geomorphic condition while the mid to lower reach of Teatree Hollow and the upper reach of Teatree Hollow Tributary were predominantly in moderate geomorphic condition. The sites of moderate geomorphic condition related to minor culvert or track crossings, low riparian vegetation cover or discharge from the LDPs (Fluvial Systems, 2013). The upper reaches of Teatree Hollow and Teatree Hollow Tributary were characterised by a low relief landscape, with a dominant bed material of mud (cohesive clay/silt/sand) and notable grass coverage (Fluvial Systems, 2013). In the mid to lower reaches, the landscape was characterised as high relief with dominant bed material of mud, sand, boulders and/or exposed bedrock and little low flow channel grass coverage.

Exposed bedrock comprising rock slabs, rock bars and bedrock outcrop, were mapped in the upper reaches of Teatree Hollow Tributary and in the mid to lower reaches of Teatree Hollow. A total of 15 pools were mapped in Teatree Hollow and Teatree Hollow Tributary with the dominant pool control comprising boulders or cohesive clay/silt/sand high point (Fluvial Systems, 2013).

Hard (likely to be fixed) and soft (likely to be mobile) knickpoints of varying dimensions were mapped in Teatree Hollow and Teatree Hollow Tributary (Fluvial Systems, 2013). Soft knickpoints, with the potential to impact channel stability, were identified in the mid to lower reaches of Teatree Hollow and the upper to mid reach of Teatree Hollow Tributary. Two notable soft knickpoints were identified in Teatree Hollow, one located just downstream of pool TT13 and one located just downstream of pool TT5 (refer Figure 6). The deeply incised section downstream of pool TT5 extended for 130 m and comprised a bed sand deposit which was identified as rare for the area surveyed (Fluvial Systems, 2013).

### 3.2.3 *Dog Trap Creek*

Dog Trap Creek has its headwaters in the southern part of the Bargo Township, above the approved LWS1B-S6B and east of the REA to the Bargo River. Dog Trap Creek is a third order stream from approved LWS4B to the confluence with the Bargo River and has a total catchment area of approximately 13.6 km<sup>2</sup>. Two second order tributaries join with Dog Trap Creek at the northern edge of approved LWS1B (refer Figure 7).

The outcomes of the geomorphology survey concluded that the majority of Dog Trap Creek and its tributaries were in good geomorphic condition with some sites in the upper reaches of Dog Trap Creek

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<sup>3</sup> A knickpoint is a part of a watercourse where there is a steep fall in channel bed elevation and, as such, may be susceptible to erosion and channel instability.

and its tributaries characterised as moderate geomorphic condition. The sites of moderate geomorphic condition related to minor culverts, track crossings or low riparian vegetation cover. The upper reaches of Dog Trap Creek and its tributaries were characterised by a low relief landscape, with dominant bed material of mud or exposed bedrock and moderate grass coverage (Fluvial Systems, 2013). In the mid to lower reaches, the landscape was characterised as high relief with bed material predominantly comprising boulders and/or exposed bedrock and little low flow channel grass coverage. The frequency of bedrock features was found to be high in Dog Trap Creek comprising rock slabs, rock bars and exposed bedrock (Fluvial Systems, 2013). A total of 74 pools were mapped in Dog Trap Creek and the two main tributaries with the dominant pool controls comprising rockbars, boulders or gravel, cobble or sand bars (Fluvial Systems, 2013).

Predominantly hard knickpoints were mapped in the Dog Trap Creek catchment with some soft knickpoints mapped in the upper reaches of Dog Trap Creek and its tributaries. An isolated section of incised gully was observed in the upper reach of Dog Trap Creek approximately 100 m upstream of pool DT1 (refer Figure 7). The drainage line was incised to 1.2 m deep and two soft knickpoints were present in the main channel of Dog Trap Creek. A bank gully network had developed into the surrounding hillslope for a distance of approximately 50 m to the west of Dog Trap Creek (Fluvial Systems, 2013).

### 3.3 Licensed Discharge Points

In accordance with EPL 1389, Tahmoor Coal is licensed to discharge from one licenced discharge point (LDP) and three licenced overflow points (LOPs). The locations of the LDP and LOPs are shown in Figure 8 and summarised in Table 6.

**Table 6 EPL 1389 Licenced Discharge Points**

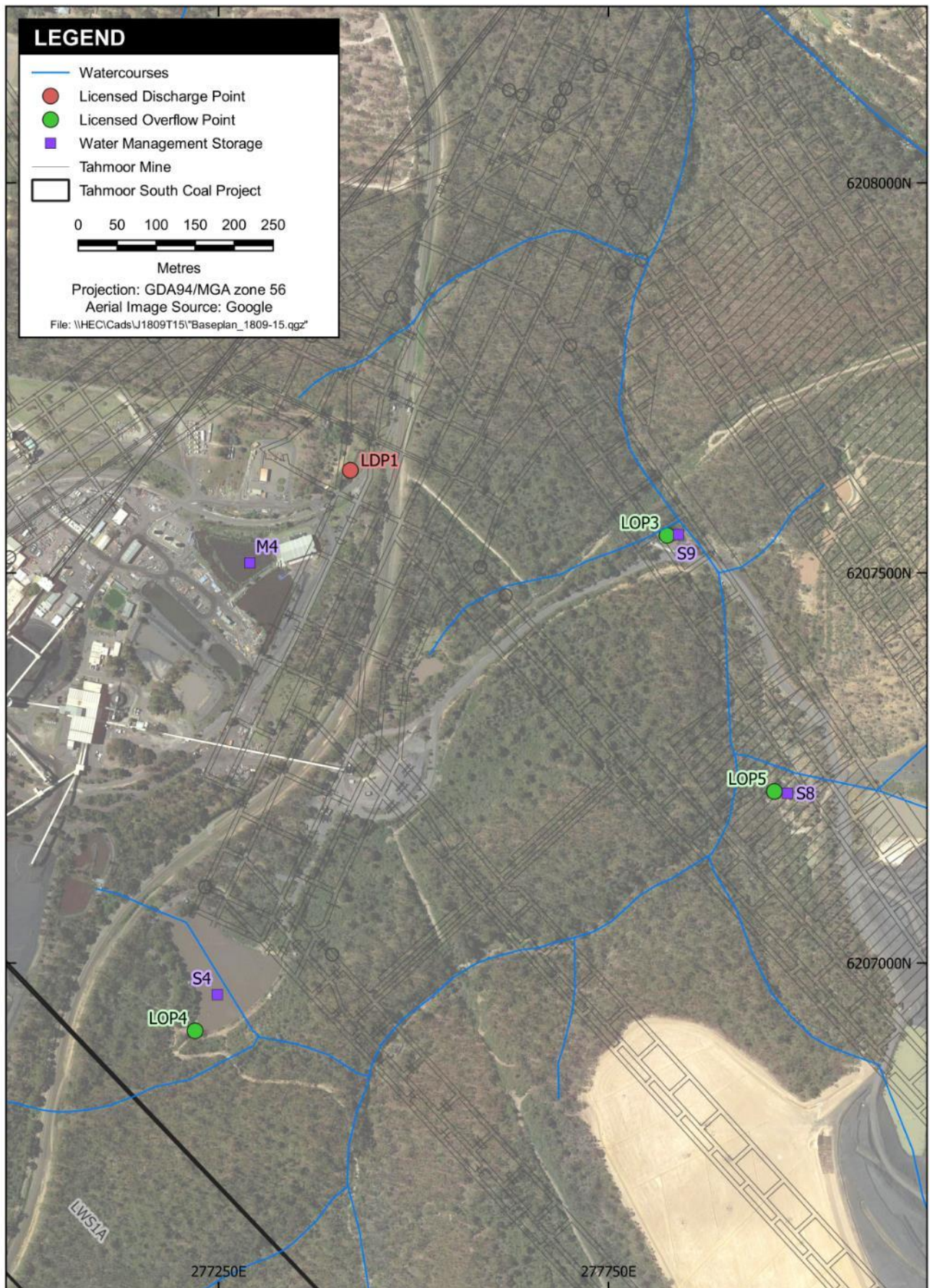
Discharge/Overflow Point	Type of Discharge Point	Location Description	Discharge Limit
LDP1	Discharge to waters Discharge quality monitoring Volume monitoring	Main water discharge - discharge drain located downstream of the final mine water treatment dam (dam M4)	15,500 kilolitres per day during low rainfall conditions Unlimited during wet weather conditions* <sup>†</sup>
LOP3	Discharge to waters	Overflow from sediment dam S9	Unlimited during wet weather conditions* <sup>†</sup>
LOP4		Overflow from sediment dam S4	
LOP5		Overflow from sediment dam S8	

\* Defined as more than 10 millimetres (mm) rainfall within a 24 hour period.

<sup>†</sup> Provided that all practical measures are taken to reduce potential water quality impacts.

Water quality discharge limits for LDP1, as specified in EPL 1389, are listed in Table 7.





**Figure 8 Tahmoor Mine Licenced Discharge Points**

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**Table 7 EPL 1389 Licenced Discharge Point 1 Water Quality Limits**

Constituent	Discharge Limit
Aluminium (µg/L)	110
Arsenic (µg/L)	200
Barium (µg/L)	6,440
Copper (µg/L)	5
Electrical Conductivity (µS/cm)	2,600
Enterococci (colony forming units per 100 ml)	1,700
Nickel (µg/L)	200
Total Nitrogen (mg/L)	8
pH	6.5-9
Total suspended solids (mg/L)	30
Turbidity (NTU)	150
Zinc (µg/L)	300

### 3.4 Water Access Licences

The Tahmoor Coal surface facilities are located within the Maldon Weir Management Zone of the Upper Nepean and Upstream Warragamba Water Source which is regulated in accordance with the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011*. The NSW Water Register<sup>4</sup> indicates that there are 24 Water Access Licences (WALs) for the Maldon Weir Management Zone with a total share component of 669 ML for the period July 2020 to June 2021 (inclusive).

Tahmoor Coal currently holds a WAL for the Sydney Basin Nepean Groundwater Source which is regulated in accordance with the *Greater Metropolitan Region Groundwater Sources Water Sharing Plan*. Additionally, Tahmoor Coal holds WALs for a number of Upper Nepean and Upstream Warragamba Water Source management zones as listed in Table 8.

Tahmoor Coal is actively pursuing outstanding WAL requirements in accordance with the Water Licencing Strategy discussed with and presented to NRAR in August and October 2021.

<sup>4</sup> <https://waterregister.watarnsw.com.au> accessed October 2021.

**Table 8 Tahmoor Coal Water Access Licences**

WAL Number	Water Sharing Plan	Water Source	Management Zone	Entitlement	Category
36442	Greater Metropolitan Region Groundwater Sources WSP	Sydney Basin Nepean Groundwater Source	Nepean (2)	1,642 units	Aquifer
25777	Greater Metropolitan Region Unregulated River Water Sources WSP	Upper Nepean and Upstream Warragamba Water Source	Maldon Weir	5 ML	Unregulated river
43572			Stonequarry Creek	16 ML	
43631			Little River	0 units	
43655			Maguires Crossing	0 units	
43656			Maldon Weir	0 units	
43657			Pheasants Nest Weir to Nepean Dam	0 units	
43658			Stonequarry Creek	0 units	
43659			Upper Nepean Tributaries Headwaters	0 units	

## 4 Baseline Surface Water Monitoring

### 4.1 Surface Water Monitoring Program

Tahmoor Coal has implemented an extensive surface water monitoring program within and adjacent to the Project area. The Tahmoor Mine surface water monitoring program includes water level, water quality and streamflow monitoring and was developed generally in accordance with a Before-After-Control-Impact (BACI) framework. The monitoring program aims to develop a baseline (before) dataset for a range of surface water features and to assess operational and post-mining (after) impacts through the monitoring of reference (control) and potential impact sites (impact).

The monitoring sites are characterised as follows:

- Reference site: a site which is to provide reference data against which potential future impacts associated with the Project activities could be compared; or
- Baseline/potential impact site: a site which is to be used to compare conditions before, during and after the Project activities.

The locations of the monitoring sites relevant to the Project and the Tahmoor Mine surface facilities are shown in Figure 9 and the site details summarised in Table 9.

#### 4.1.1 Water Level Monitoring

Surface water level data has been monitored continuously and downloaded monthly during the monitoring periods specified in Table 9. Monthly manual water level measurements have also been recorded at each site at the time of data download. Additionally, visual inspection records of the presence of water at each monitoring site and flow at the monitoring site have been recorded monthly.

#### 4.1.2 Water Quality Monitoring

Water quality monitoring has been undertaken monthly at the sites listed in Table 9 and included the following:

- Field monitoring: pH, electrical conductivity (EC), temperature, dissolved oxygen (DO) and oxidation-reduction potential (ORP).
- Laboratory monitoring: pH, EC, total dissolved solids (TDS), major cations<sup>5</sup>, sulphate, alkalinity, chloride, selected dissolved metals<sup>6</sup>, selected total metals<sup>7</sup>, total kjeldahl nitrogen, total nitrogen, total phosphorus, total cations and total anions.

#### 4.1.3 Streamflow Monitoring

Streamflow ratings have been derived for specific sites on the Bargo River, Dog Trap Creek, Teatree Hollow, Hornes Creek, Eliza Creek and Carters Creek. A streamflow rating is a relationship specific to each gauging station site which enables flow rate to be derived from recorded water level at that particular site location. A period of time is normally required following station establishment to develop a rating relationship. Manual flow measurements (gaugings) were undertaken using an OSS-PC1 'Pygmy' current meter which was calibrated annually and serviced weekly. All gaugings conformed to the relevant Australian Standard (AS 3778.3.1-2001). For specific sites, the ratings were extended to high flows by theoretical means using surveyed stream cross-sections and hydraulic modelling.

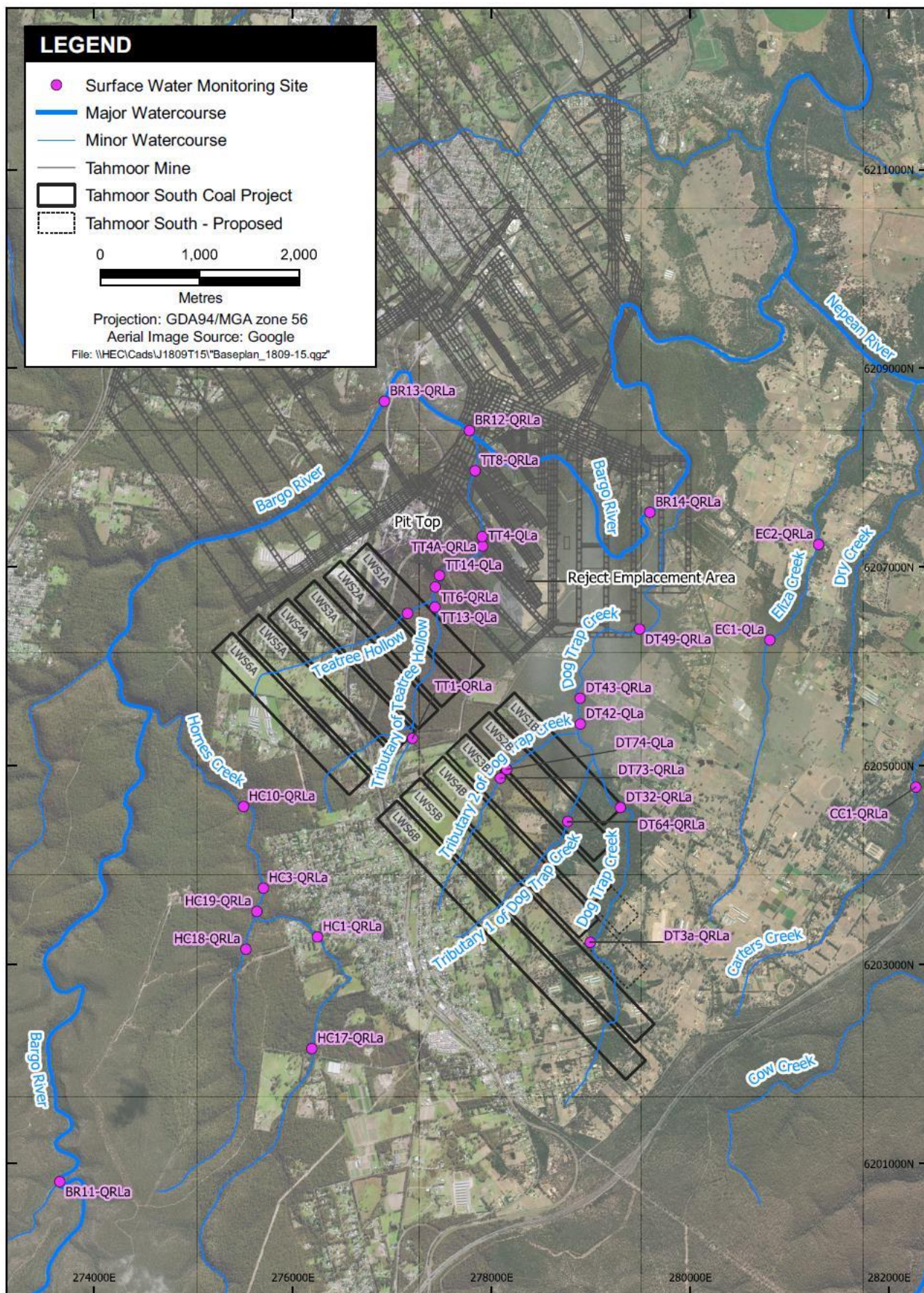
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<sup>5</sup> Calcium, magnesium, sodium and potassium.

<sup>6</sup> Aluminium, arsenic, barium, copper, iron, lead, lithium, manganese, nickel, selenium, strontium and zinc.

<sup>7</sup> Aluminium, arsenic, barium, cadmium, copper, iron, lead, lithium, manganese, nickel, selenium, strontium and zinc.





**Figure 9 Existing Surface Water Monitoring Sites**

**Table 9 Surface Water Monitoring Sites**

Site Name	Previous Site Name	Location Description	Category	Monitoring Type	Period of Monitoring
<b><i>Bargo River Catchment</i></b>					
BR11-QRLa	Bargo River Upstream Site 1 (300061)	Upstream of mining influences	Reference site	Water level, streamflow and water quality	May 2012 – Jun 2015 (Q) Mar 2013 – Nov 2015 (La) Feb 2019 – current (Q, La & R)
BR13-QRLa	Bargo River Site 13 (300010A)	Downstream of historical mining areas, upstream of confluence with Teatree Hollow	Baseline/potential impact site	Water level, streamflow and water quality	Apr 2012 – Jun 2015 (Q) Feb 2019 – current (Q) Mar 2013 – current (La & R)
BR12-QRLa	Bargo River at Teatree Hollow (300012)	Above historical mining areas, upstream of confluence with Teatree Hollow	Baseline/potential impact site	Water level, streamflow and water quality	Jan 2019 – current (Q, La & R)
BR14-QRLa	Bargo River at Rockford Road Bridge Site 14 (300011A)	Above historical mining areas, downstream of confluence with Teatree Hollow, upstream of confluence with Dog Trap Creek	Baseline/potential impact site	Water level, streamflow and water quality	Apr 2012 – Jun 2015 (Q) Feb 2019 – current (Q) Mar 2013 – current (La & R)
<b><i>Teatree Hollow Catchment</i></b>					
TT1-QRLa	Teatree Site 1 (300132)	Above approved LWS4B workings, upstream of mine site facilities	Baseline/potential impact site	Water level, streamflow and water quality	Aug 2019 – current (Q) Feb 2020 – current (La & R)
TT6-QRLa	Teatree Hollow at REA (300089)	Adjacent to pit top, downstream of LOP4, upstream of REA	Baseline/potential impact site	Water level, streamflow and water quality	Mar 2019 – current (Q) Mar 2021 – current (La & R)
TT4-QLa	Teatree Site 4 (300135)	Above historical mining areas, adjacent to REA, upstream of LOP5	Baseline site	Water quality	Aug 2019 – May 2020 (Q)
TT4A-QRLa	Teatree Site 4A (300135A)	Above historical mining areas, adjacent to REA, downstream of LOP5	Baseline/potential impact site	Water level, streamflow and water quality	May 2020 – current (Q, La & R)

Q = water quality; La = automated and manual water level; R = rating relationship derived streamflow

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**Table 9 (Cont.) Surface Water Monitoring Sites**

Site Name	Previous Site Name	Location Description	Category	Monitoring Type	Period of Monitoring
<b><i>Teatree Hollow Catchment</i></b>					
TT8-QRLa	Teatree Site 22 (300056)	Above historical mining areas, downstream of pit top, REA, LDP1 and LOP3	Baseline/potential impact site	Water level, streamflow and water quality	Sep 2012 – Jun 2015 (Q) Apr 2019 – current (Q) Mar 2013 – current (La & R)
TT12-QLa	Teatree Site 12 (300144)	Above approved LWS1A, adjacent to mine site facilities	Baseline/potential impact site	Water level and water quality	Sep 2021 – current (Q & La)
TT13-QLa	Teatree Site 13 (300146)	Above approved LWS1A workings, adjacent to mine site facilities	Baseline/potential impact site	Water level and water quality	Oct 2021 – current (Q & La)
TT14-QLa	Teatree Site 14 (300145)	Downstream of LWS1A workings, adjacent to mine site facilities	Baseline/potential impact site	Water level and water quality	Sep 2021 – current (Q & La)
<b><i>Dog Trap Creek Catchment</i></b>					
DT3a-QRLa	Dog Trap Site 1 (300128)	Above approved LWS4B, upstream of mine site facilities	Baseline/potential impact site	Water level, streamflow and water quality	Aug 2019 – current (Q) Jan 2019 – current (La & R)
DT32-QRLa	Dog Trap Site 2 (300129)	Above approved LWS1B, upstream of mine site facilities	Baseline/potential impact site	Water level, streamflow and water quality	Feb 2020 – current (Q) Jan 2020 – current (La & R)
DT64-QRLa	Dog Trap Site 3 (300130)	Above approved LWS2B, upstream of mine site facilities	Baseline/potential impact site	Water level, streamflow and water quality	Aug 2019 – current (Q) Feb 2020 – current (La & R)
DT74-QLa	Dog Trap Site 4 (300131)	Above approved LWS2B workings, upstream of mine site facilities	Baseline/potential impact site	Water level and water quality	Aug 2019 – Nov 2020 (Q) Feb 2020 – Nov 2020 (La)
DT73-QRLa	Dog Trap Site 4A (300131A)	Above approved LWS3B, upstream of mine site facilities	Baseline/potential impact site	Water level, streamflow and water quality	Nov 2020 – current (Q, La & R)

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**Table 9 (Cont.) Surface Water Monitoring Sites**

Site Name	Previous Site Name	Location Description	Category	Monitoring Type	Period of Monitoring
<b><i>Dog Trap Creek Catchment</i></b>					
DT49-QRLa	Dog Trap Site 15 (300063)	Downstream of approved longwalls	Baseline/potential impact site	Water level, streamflow and water quality	Apr 2012 – Jun 2015 (Q) Mar 2013 – Nov 2015 (La & R) Feb 2019 - current (Q, La & R)
DT42-QLa	Dog Trap Site 16 (300064)	Downstream of approved longwalls	Baseline/potential impact site	Water level and water quality	Dec 2010 – Jun 2015 (Q & La) Feb 2019 – Mar 2021 (Q & La)
DT43-QRLa	Dog Trap Site 16A (300064A)	Downstream of approved longwalls	Baseline/potential impact site	Water level, streamflow and water quality	Mar 2021 – current (Q, La & R)
<b><i>Hornes Creek Catchment</i></b>					
HC17-QRLa	Hornes Creek Upstream (300113)	Outside of mining influences	Reference site	Water level, streamflow and water quality	Mar 2019 – current (Q, La & R)
HC1-QRLa	Hornes Site 1 (300124)	Outside of mining influences	Reference site	Water level, streamflow and water quality	Sep 2019 – current (Q, La & R)
H18-QRLa	Hornes Site 2 (300125)	Outside of mining influences	Reference site	Water level, streamflow and water quality	Mar 2020 – current (Q, La & R)
HC19-QRLa	Hornes Site 3 (300126)	Outside of mining influences	Reference site	Water level, streamflow and water quality	Sep 2019 – current (Q, La & R)
HC10-QRLa	Hornes Site 4 (3000127)	Outside of mining influences	Reference site	Water level, streamflow and water quality	Sep 2019 – current (Q, La & R)

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**Table 9 (Cont.)      Surface Water Monitoring Sites**

Site Name	Previous Site Name	Location Description	Category	Monitoring Type	Period of Monitoring
<b><i>Hornes Creek Catchment</i></b>					
HC3-QRLa	Hornes Site 9 (300062)	Outside of mining influences	Reference site	Water level, streamflow and water quality	May 2012 – Jun 2015 (Q) Oct 2020 – current (Q) Mar 2013 – Nov 2015 (La & R) Feb 2019 – current (La & R)
<b><i>Eliza Creek and Carters Creek Catchment</i></b>					
CC1-QRLa	Carters Site 24 (300076)	Outside of mining influences	Reference site	Water level, streamflow and water quality	Sep 2012 – Jun 2015 (Q) Feb 2019 – current (Q) Mar 2013 – Nov 2015 (La & R) Feb 2019 – current (La & R)
EC2-QRLa	Eliza Site 18 (300073A)	Outside of mining influences	Reference site	Water level, streamflow and water quality	Sep 2019 – current (Q) Feb 2019 – current (La & R)
EC1-QLa	Eliza Site 1 (3000136)	Outside of mining influences	Reference site	Water level and water quality	Feb 2019 – current (Q & La)

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#### 4.1.4 *Licensed Discharge Point Monitoring*

Water quality and continuous flow monitoring are undertaken at LDP1, dam S9 (LOP3), dam S4 (LOP4) and dam S8 (LOP5). An extensive range of constituents are monitored including:

- selected dissolved and total metals;
- physicochemical parameters;
- nutrients;
- oil and grease; and
- *Escherichia coli* and flagellates.

A wider suite of constituents is monitored annually, with key constituents monitored monthly.

A continuous turbidity meter has been installed in dam M3 to enable real time monitoring of dam turbidity levels prior to potential discharge to dam M4 and subsequently to LDP1. The continuous turbidity monitoring enables controls to be implemented in a timely manner in the event that turbidity levels may potentially exceed the LDP1 discharge limits.

## 4.2 **Baseline Surface Water Data**

The following sections present a summary of the baseline monitoring data for sites in the Bargo River, Teatree Hollow and Dog Trap Creek. Reference sites in Hornes Creek, Eliza Creek and Carters Creek are outside the influence of the Project and the Tahmoor Mine surface facilities and have therefore not been discussed in the following sections.

### 4.2.1 *Water Level and Streamflow Monitoring Data*

Appendix B presents plots of the water level monitored over the period of record at each monitoring site. For comparative purposes, rainfall data from SILO Point Data<sup>8</sup> for a point in close proximity to the watercourses is also presented in the plots.

Field records of the presence of water in the pool and water flow at the pool are collected during the monthly monitoring campaigns at each monitoring site. Due to data gaps<sup>9</sup> in the water level records for some sites, the field records have been used to calculate the frequency of days in which water was present at each monitoring site at the time of sampling. Table 10 presents a summary of the field records. The summary is presented for the period August 2019 to September 2021 only as this was a common period of record for all sites and thereby enables direct comparison between sites.

The data presented in Table 10 indicates that the monitoring sites on the Bargo River contained water at the time of each sampling event between August 2019 to September 2021. BR11-QLa, BR13-QLa and BR14-QLa were flowing at the time of each sampling event while BR12-QLa was flowing on 96% of sampling occasions.

The presence of water at the monitoring sites on Teatree Hollow varied from upstream to downstream with TT1-QLa (upstream) recorded as dry on 15% of sampling occasions and TT4-QLa (downstream) recorded as dry on 82% of sampling occasions. It should be noted that the water level records for monitoring site TT4A-QLa, instated in May 2020 downstream of TT4-QLa, indicated that the pool contained water for the period of record (refer Figure A7, Appendix B). As discharge from LDP1 reports to TT8-QLa, this site was recorded as containing water and flowing at the time of all sampling events.

The presence of water at the monitoring sites on Dog Trap Creek generally declined from upstream (DT3a-QLa) to downstream (DT49-QLa), varying between 100% of sampling occasions and 60% of sampling occasions respectively. At the monitoring sites on the Dog Trap Creek tributaries (DT64-QLa and

<sup>8</sup> The SILO Point Data is a system which provides synthetic daily climate data sets for a specified point by interpolation between surrounding point records held by the Bureau of Meteorology – refer <https://www.longpaddock.qld.gov.au/silo/point-data/>.

<sup>9</sup> Data gaps occur due to site access restrictions, decommissioning of monitoring sites, sensor errors and dry periods.

DT74-QLa/ DT73-QLa), the presence of water was recorded on 81% of sampling occasions with DT64-QLa recorded as flowing on 64% of sampling occasions and DT74-QLa/DT73-QLa recorded as flowing on 44% of sampling occasions.

**Table 10 Frequency of Samples with Water Present**

Site	Number of Sampling Days	Number of Days Pool was Dry	Frequency of Sampling Days with Water Present	Frequency of Sampling Days with Flowing Water
<b><i>Bargo River Catchment</i></b>				
BR11-QLa	22	0	100%	100%
BR13-QLa	27	0	100%	100%
BR12-QLa	26	0	100%	96%
BR14-QLa	27	0	100%	100%
<b><i>Teatree Hollow Catchment</i></b>				
TT1-QLa	27	4	85%	79%
TT6-QLa	30	8	73%	70%
TT8-QLa	23	0	100%	100%
TT4-QLa	28	23	18%	8%
<b><i>Dog Trap Creek Catchment</i></b>				
DT3a-QLa	27	0	100%	84%
DT32-QLa	27	5	81%	68%
DT64-QLa	27	5	81%	64%
DT74-QLa / DT73-QLa	27	5	81%	44%
DT49-QLa	30	12	60%	48%
DT43-QLa	28	6	79%	65%

Table 11 presents summary statistics of long-term flow data recorded at select streamflow monitoring sites listed in Table 9. The summary statistics have been derived for the full period of record at each site and from daily water level records. Only sites with long-term monitoring data are presented. It should be noted that high flow rates have been theoretically derived (refer Section 4.1.3) and that monitoring site DT42-QLa has since been relocated to DT43-QLa.

**Table 11 Daily Streamflow Summary Statistics**

Statistic (ML/d)	BR13-QLa	BR14-QLa	BR11-QLa	TT8-QLa	DT49-QLa	DT42-QLa
Min	0	0	0	0	0	0
Median	3.1	0.6	2.2	6.0	0.1	0.0
Mean	18	8	10	7	5	3
Max	2,360	2,134	707	1,091	722	562



#### 4.2.2 Water Quality Monitoring Data

Site specific trigger values (SSTVs) will be derived within the relevant Extraction Plan ahead of commencement of secondary extraction from the Project. Details of the proposed derivation of the SSTVs are provided in Section 9.1.

For comparative purposes and to provide an indication of baseline water quality conditions in the vicinity of the Project and the Tahmoor Mine surface facilities, water quality data for the period of record has been compared with the ANZECC (2000) and ANZG (2018) default guideline trigger values for the protection of aquatic ecosystems and recreational use in accordance with the perceived principal beneficial uses of the surface water resources in the area. The default guideline trigger values are summarised in Table 12.

**Table 12 Surface Water Default Guideline Trigger Values**

Parameter	ANZECC (2000) & ANZG (2018) Default Guideline Trigger Values		
	Aquatic Ecosystems (95%ile level of species protection) <sup>†</sup>	Upland Rivers (NSW) <sup>‡</sup>	Recreational Use <sup>‡</sup>
pH (pH units)	-	6.5 - 8	6.5 - 8.5
EC (µS/cm) and TDS (mg/L)	-	EC 350	TDS 1,000
Total Alkalinity as CaCO <sub>3</sub> (mg/L)	-	-	500
Sulphate (mg/L)	-	-	400
Sodium (mg/L)	-	-	300
Aluminium (mg/L) pH > 6.5	0.055	-	-
Arsenic (mg/L) (As III)	0.024	-	-
Barium (mg/L)	-	-	1
Cadmium (mg/L)	0.0002	-	-
Copper (mg/L)	0.0014	-	1
Iron (mg/L)	-	-	0.3
Lead (mg/L)	0.0034	-	0.05
Manganese (mg/L)	1.9	-	0.1
Nickel (mg/L)	0.011	-	-
Selenium (mg/L)	0.011	-	0.01
Zinc (mg/L)	0.008	-	5
NO <sub>x</sub> (mg/L)	-	0.015	-
Total Phosphorous (mg/L)	-	0.02	-
Total Nitrogen (mg/L)	-	0.25	-

Note: EC = Electrical Conductivity; TDS = Total Dissolved Solids; - no relevant trigger value; <sup>†</sup> ANZG (2018); <sup>‡</sup> ANZECC (2000)

Water quality summary tables are presented in Appendix C for each monitoring site. Where multiple default guideline values are specified for a parameter, the most conservative value has been adopted for comparison. Where laboratory results have been recorded at below the limit of detection the result has been analysed assuming the concentration was equal to the limit of detection.

#### Bargo River

The field and laboratory pH records for monitoring sites on the Bargo River indicate slightly acidic to alkaline conditions, with some exceedances of the ANZECC (2000) default guideline trigger value for pH recorded at all monitoring sites. The field EC records for BR11-QLa, BR13-QLa and BR12-QLa indicate that

median EC values have ranged between 185  $\mu\text{S}/\text{cm}$  and 215  $\mu\text{S}/\text{cm}$ . A median of 1,071  $\mu\text{S}/\text{cm}$  EC was recorded at BR14-QLa due to the influence of higher EC water discharged at LDP1.

Exceedances of the ANZG (2018) default guideline trigger value for aluminium and zinc (dissolved and total) have been recorded historically at all monitoring sites on the Bargo River, including BR11-QLa and BR13-QLa which are located outside of mining influences, indicating that concentrations of aluminium and zinc are naturally elevated in the Bargo River. Exceedances of the ANZG (2018) default guideline trigger value for selenium (total) at BR11-QLa, BR13-QLa and BR14-QLa have also been recorded. Additionally, exceedances of the ANZECC (2000) default guideline trigger values for total nitrogen and total phosphorus have been recorded historically at all monitoring sites.

Exceedances of the ANZG (2018) default guideline trigger value for arsenic, barium and nickel have been recorded historically at BR14-QLa due to the influence of higher concentrations of these constituents discharged at LDP1. In accordance with EPL 1389, Tahmoor Coal propose to commission an upgraded wastewater treatment plant (WWTP) to reduce the concentration of constituents released to LDP1 (refer Section 5.1.3 for further details).

### **Teatree Hollow**

The field and laboratory pH records for monitoring sites on Teatree Hollow and Teatree Hollow tributary indicate slightly acidic to alkaline conditions, with some exceedances of the ANZECC (2000) default guideline trigger value for pH recorded at all monitoring sites.

The field EC records for monitoring sites on Teatree Hollow and Teatree Hollow tributary indicate that maximum EC values have ranged from 663  $\mu\text{S}/\text{cm}$  recorded at TT1-QLa to 2,275  $\mu\text{S}/\text{cm}$  recorded at TT8-QLa. It should be noted that TT8-QLa on Teatree Hollow is influenced by higher EC water discharged at LDP1.

Exceedances of the ANZG (2018) default guideline trigger value for aluminium, copper, manganese and zinc (dissolved and total) have been recorded historically at TT1-QLa on Teatree Hollow tributary, located upstream of existing mining influences, indicating that these constituents are naturally elevated in the Teatree Hollow catchment. Additionally, exceedances of the ANZECC (2000) default guideline trigger values for total nitrogen and total phosphorus have been recorded historically at all monitoring sites.

Exceedances of the ANZG (2018) default guideline trigger value for arsenic, barium and nickel have been recorded historically at TT8-QLa due to the influence of higher concentrations of these constituents discharged at LDP1. The ANZG (2018) default guideline trigger value for total lead was exceeded in one sample recorded at TT4-QLa and 20% of samples recorded at TT8-QLa, although the dissolved lead concentrations recorded at these sites did not exceed the ANZG (2018) default guideline trigger value.

### **Dog Trap Creek**

The field and laboratory pH records for monitoring sites on Dog Trap Creek and its tributaries indicate slightly acidic to slightly alkaline conditions, with some exceedances of the ANZECC (2000) default guideline trigger value for pH recorded at all monitoring sites except DT74-QLa.

Median EC values (field) recorded at monitoring sites on Dog Trap Creek and its tributaries have remained below the ANZECC (2000) default guideline trigger value (less than 350  $\mu\text{S}/\text{cm}$ ). During a period of drought in 2019, a maximum of 6,060  $\mu\text{S}/\text{cm}$  EC (field) was recorded at DT3a-QLa and a maximum of 2,380  $\mu\text{S}/\text{cm}$  EC (laboratory) at DT49-QLa. The field records indicate that there was no flowing water at the monitoring sites at the time of sampling.

Exceedances of the ANZG (2018) default guideline trigger values for aluminium, copper and zinc (dissolved and total) have been recorded historically at all monitoring sites on Dog Trap Creek and its tributaries, indicating that these constituents are naturally elevated in the Dog Trap Creek catchment. Additionally, exceedances of the ANZECC (2000) default guideline trigger values for total nitrogen and total phosphorus have been recorded historically at all monitoring sites.

One slight exceedance of the ANZG (2018) default guideline trigger value for total lead and total manganese was recorded at DT49-QLa. At all other monitoring sites, the concentrations of total lead and total manganese have been recorded below the ANZG (2018) default guideline trigger value. No exceedances of the ANZG (2018) default guideline trigger values for arsenic, barium or nickel have been recorded at monitoring sites on Dog Trap Creek or its tributaries.

## 5 Surface Facilities Water Management

### 5.1 Water Management System

The existing Tahmoor Mine water management system would be maintained and upgraded as required for the Project. The Tahmoor Mine water management system has been designed to:

- appropriately manage disturbed area runoff;
- increase to a practical maximum the capture and reuse of mine water and disturbed area runoff to meet operational demands;
- increase to a practical maximum on-site water recycling and reuse;
- reduce the capture and use of undisturbed area runoff;
- reduce the use of make-up water from external sources; and
- manage risks to the receiving environment and downstream water users.

The water management system at the Tahmoor Mine comprises infrastructure and management measures which are employed to manage water on the site and the movement of water onto and off the site. The locations of the Tahmoor Mine water management storages are shown in Figure 10. Table 13 provides a summary of the Tahmoor Mine water storages, with further details and locations provided in the sections which follow.

**Table 13 Tahmoor Mine Water Management Storages**

Dam	Catchment Area (ha)	Capacity (ML)	Details
S2	14.8	8.3	Captures and conveys mine affected water from product coal stockpiles.
S3			
S4	7.9	36.9	Captures and conveys mine affected water transferred from dam S2 and S3.
S5	6.6	0.5	Captures and conveys mine affected water from reject bin hardstand loading area.
S6		1.5	Captures and conveys mine affected water from the reject bin and loading area, haul road runoff and water transferred from dam S5.
S6a		0.7	Captures and conveys runoff from the haul road and water transferred from S6.
S7	14.8	41.5	Captures and conveys mine affected water from reject emplacement area.
S7a	29.9	12	Captures and conveys mine affected water from the reject emplacement area.
S7b	2.7	1.0	Captures and conveys mine affected water from the reject emplacement area.
S8	0.6	4.5	Captures and conveys reject emplacement area seepage and runoff.
S9	4.3	0.4	Captures and conveys mine affected water from the reject emplacement area.
S10	0.4	0.2	Captures and conveys runoff from the haul road.
S11	2.6	0.3	Captures and conveys runoff from the storage area and access road.



**Table 13 (Cont.) Tahmoor Mine Water Storages**

Dam	Catchment Area (ha)	Capacity (ML)	Details
M1	14.2	1.8	Captures and conveys mine site surface runoff, water transferred from dam T1 and pumped groundwater from mine workings.
M2		0.5	Captures and conveys water transferred from dams M1, T1 and T2 and runoff from the surrounding reject conveyor area.
M3	0.8	9.0	Captures and conveys mine affected water transferred from dams M1 and M2 and runoff from the surrounding store yard and road areas.
M4	3.5	8.0	Captures and conveys mine affected water transferred from dams M1, M2 and M3 and runoff from the surrounding hardstand and storage areas.
M5	2.8	3.0	Captures and conveys runoff from no. 2 upcast shaft site and the access road.
M6		4.5	Captures and conveys water transferred from dam M5.

A schematic representation of the current Tahmoor Mine water management system is shown in Figure 11, including locations of flow monitoring undertaken across the system. Figure 12 presents a schematic representation of the proposed Tahmoor Mine water management and monitoring system, with details of the proposed changes to the water management system provided in the following sections. Proposed changes are subject to approval.

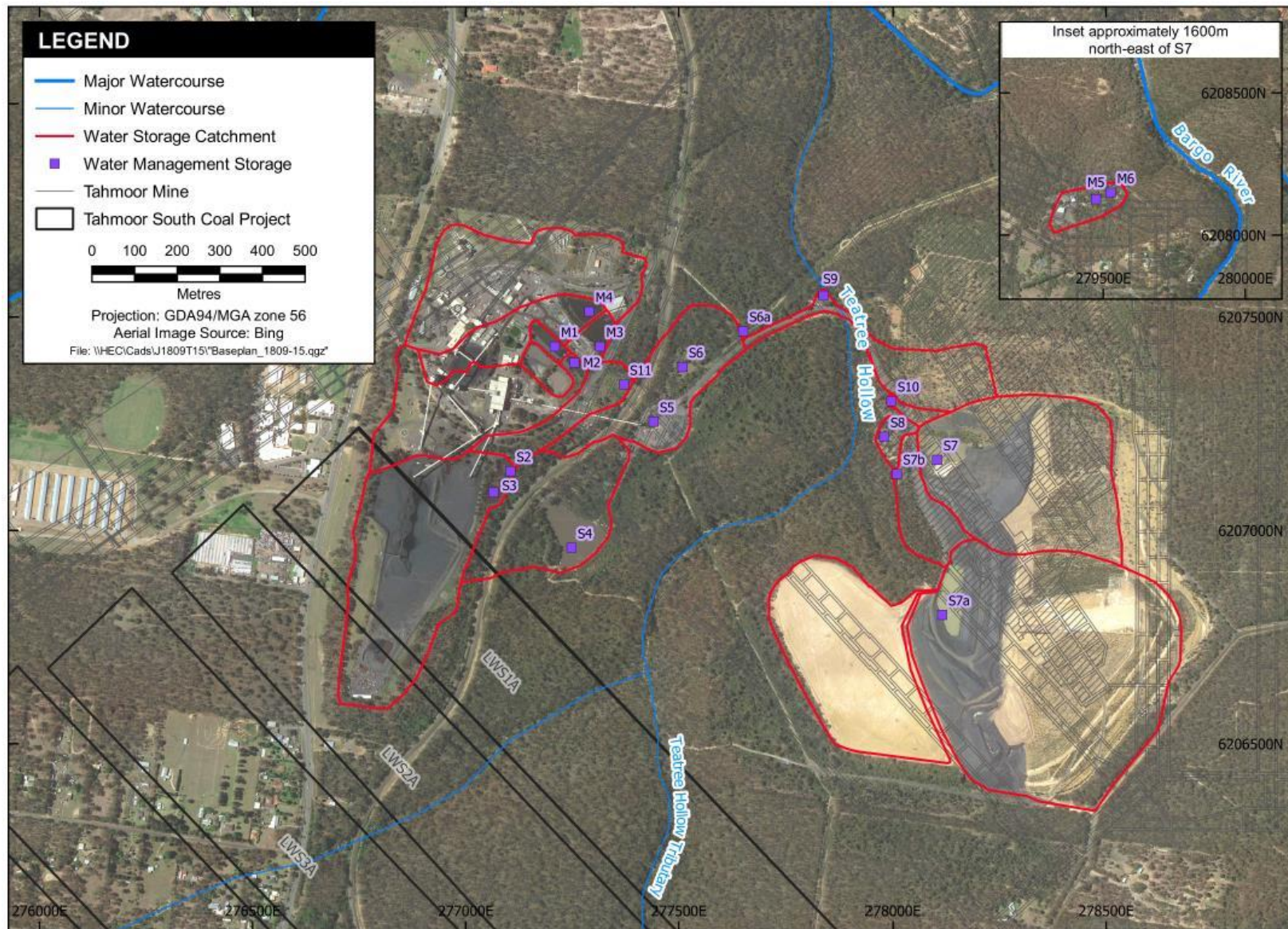
#### 5.1.1 Pit Top Area

The pit top area is predominantly located within the rail loop and encompasses the main surface operations including the CHPP, workshop, warehouse, storage yard areas and mine water dams M1, M2, M3 and M4 (refer Figure 3). The dams are interconnected such that dam M1 flows to M2, M2 flows to M3 and M3 flows to M4. The pit top area dams are dosed with coagulant to enhance sediment settling and improve discharge water quality.

The CHPP incorporates screening and cyclone circuits to remove overburden and inter-burden rock fragments. The CHPP also separates the coal into coking and thermal products. Coal wash reject material is produced as a waste stream from the CHPP with the fine rejects dewatered in the CHPP using a belt filter press prior to being combined with coarse rejects. This material is conveyed to a transit area on the eastern side of the rail loop prior to being trucked and placed in the REA.

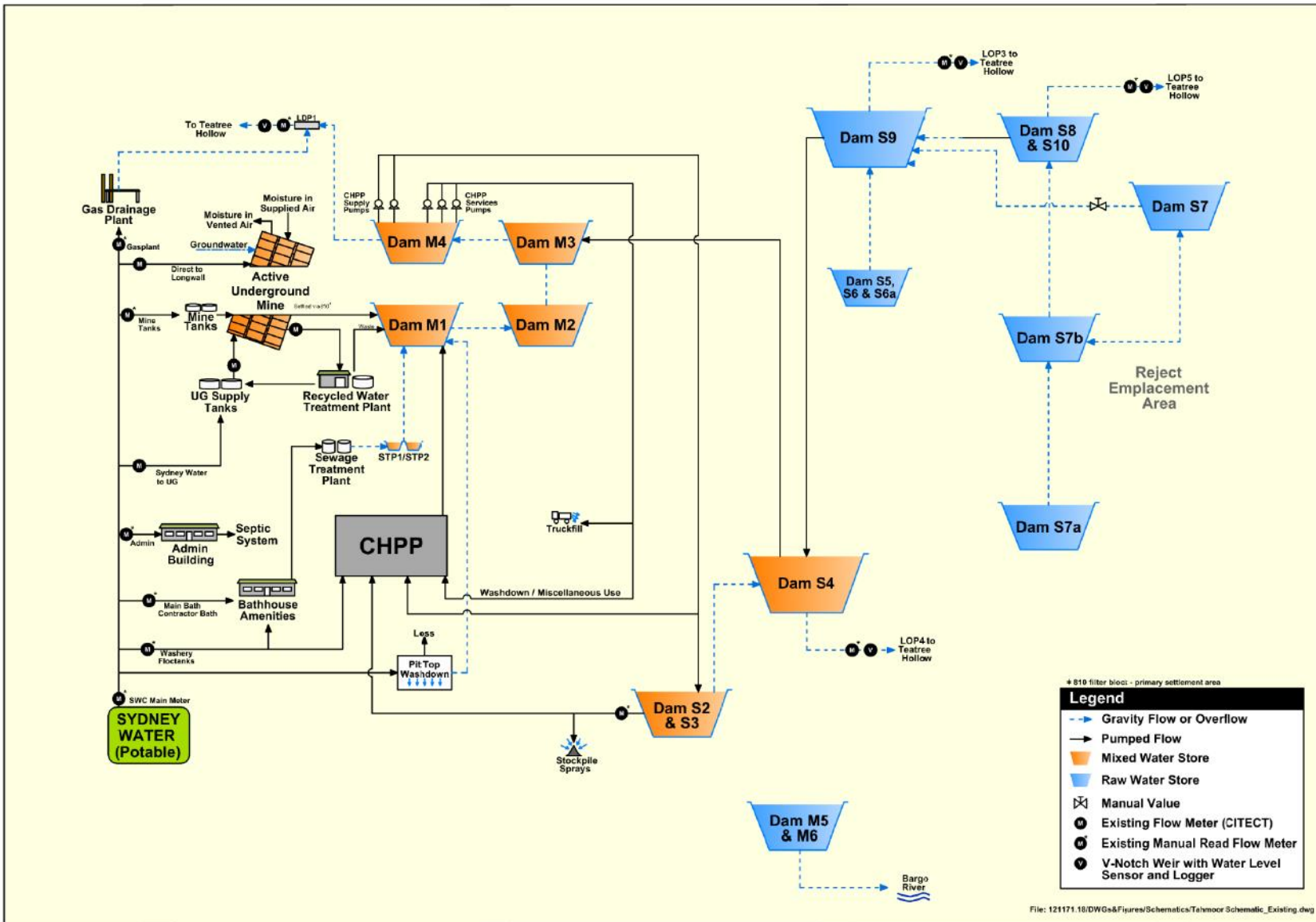
Runoff from the workshop area and waste oil tank/storage area reports to an oil water separator. Treated water from the separator reports to dam M1, while the recovered waste oil is transferred to an above ground waste oil tank prior to disposal off site. Runoff from the remaining pit top area, including the ROM coal stockpile area and the CHPP, drains to dams M2, M3 and M4. Excess water in M4 is discharged to Teatree Hollow via LDP1. A non-toxic binding agent is used to control dust emissions and suspended sediment in runoff from the pit top area.

A Gas Drainage Plant and Envirogen Power Station are located adjacent to the mine pit top area (refer Figure 3). Drainage from this area reports to a surface drain on the outside of the rail loop which discharges to Teatree Hollow via LDP1. The product coal stockpile area drains to dams S2 and S3. Water overflows from these storages into the larger dam S4 where water is automatically dosed with a coagulant. Water from dam S4 is transferred to dam M3 while overflow reports to Teatree Hollow via LOP4 in accordance with EPL 1389.



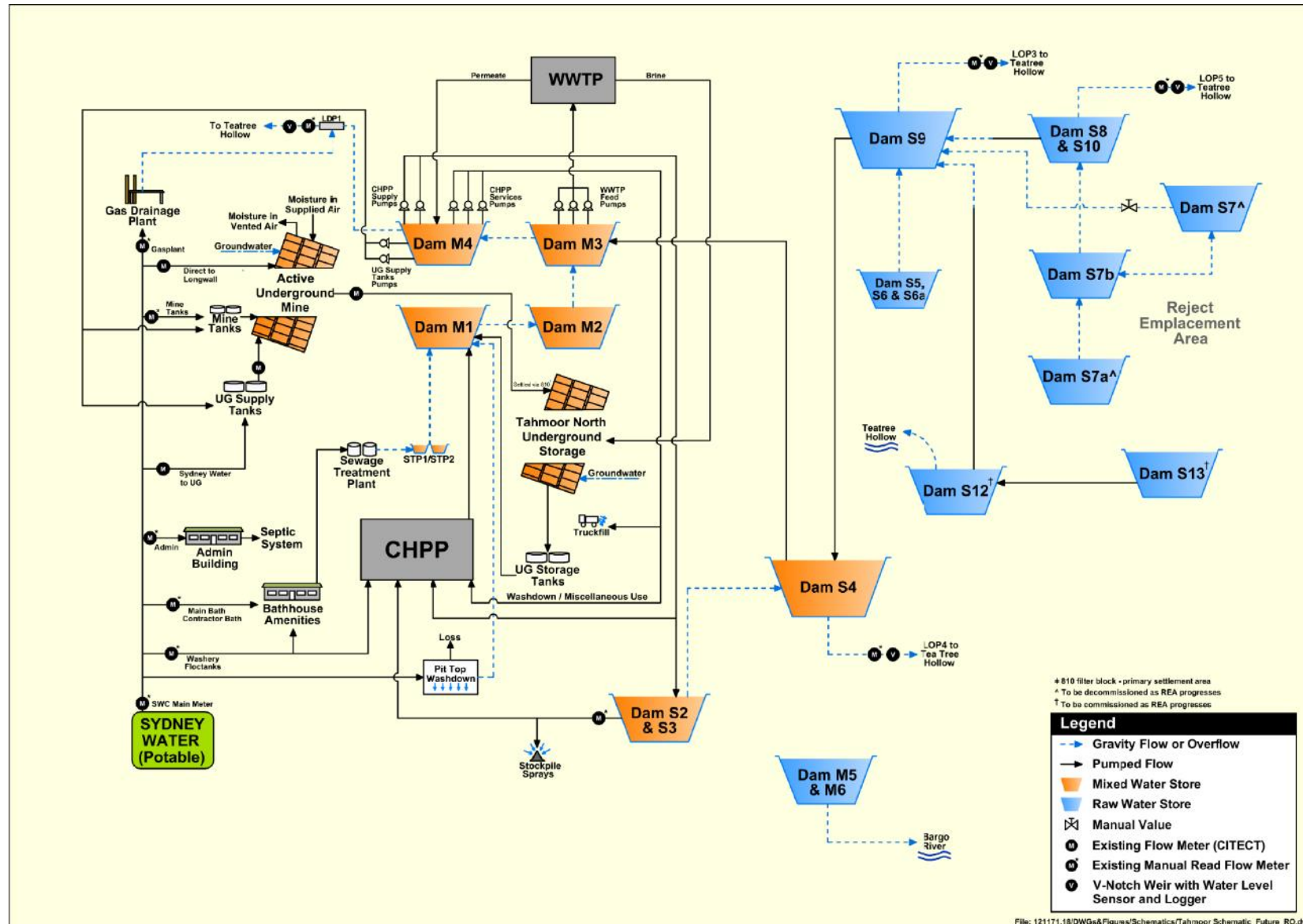
**Figure 10 Tahmoor Mine Water Management Storages**





**Figure 11 Schematic Representation of Existing Water Management System**





**Figure 12** Schematic Representation of Proposed Water Management System (subject to approval)

An upgraded sewage treatment plant (STP) is to be installed prior to secondary workings in accordance with Consent Condition B50. The STP would be located near dam M1 and used to treat sewage from the mine production offices, mine bathhouses and the CHPP. The upgraded STP is to comprise secondary treatment, alkalinity dosing, filtration and ultra-violet disinfection. The upgraded STP has been designed with a peak capacity of 61 kL/day. Treated effluent from the existing STP currently discharges into two maturation ponds which overflow to dam M1. A separate septic treatment system is used to treat sewage from the demountable offices located on site.

Water required in the CHPP is supplied (recycled) from dam M4. A small volume of potable water is supplied by Sydney Water for pump glands, flocculation and reagent dosing. Water in dam M4 is also pumped to a truckfill point near the REA for use in dust suppression on the haul road to the REA and on the REA itself. Water for dust suppression on the product coal stockpile area is drawn from dams S2 and S3.

A Recycled Water Treatment Plant (RWTP), located in an area adjacent to the rail loop, is used to treat a proportion of the water recovered from the underground mine which is recycled back underground for non-potable uses. Recovered water in excess of the non-potable underground demand is directed to dam M1. Following commissioning of the Reverse Osmosis Wastewater Treatment Plant (RO WWTP), the RWTP is proposed to be decommissioned (refer Section 5.1.3).

#### **5.1.2 Hazardous Chemical and Hydrocarbon Storage**

Management of hazardous substances and dangerous goods is undertaken in accordance with the *Work Health and Safety Regulation 2011*, the *NSW Dangerous Goods (Road and Rail Transport) Act 2008*, the *NSW Dangerous Goods (Road and Rail Transport) Regulation 2014* and the *Protection of the Environment operation Act 1997* as described in *TAH-HSEC-00059 - Hazardous Substances and Dangerous Goods*. Hazardous chemicals and hydrocarbon products are stored in bunded areas in accordance with relevant Australian Standards.

#### **5.1.3 Wastewater Treatment Plant**

##### **Existing Wastewater Treatment Plant**

A WWTP was constructed in June 2015 to treat up to 6 ML/d of mine water drawn from sediment dam M3. However, the WWTP has had continued performance issues and, as such, is no longer in operation. At present, excess water from the Tahmoor Mine is transferred from dam M3, dosed with flocculant and discharged to dam M4 which subsequently discharges to LDP1.

In order to improve the quality of water discharged to LDP1, Tahmoor Coal has been exploring a range of water treatment options. A Reverse Osmosis (RO) WWTP is to be commissioned as per Condition B30.

##### **Reverse Osmosis Wastewater Treatment Plant**

The RO WWTP will be constructed within the footprint of the existing WWTP once decommissioned and demolished. Under normal operations, the RO WWTP will treat up to 6 ML/d of water from dam M3, with a maximum of 7.2 ML/d able to be treated. Following commissioning, revised limits for specific constituents will be instated for water discharged at LDP1.

In accordance with EPL 1389:

- New limits for the concentration of substances discharged from LDP1 will replace the interim concentration limits listed in Table 7.
- The limits will be based on the actual measured performance of the RO WWTP when operated in an effective and efficient manner. The EPA will consider recommendations made by Tahmoor Coal in relation to statistical parameters for discharge limits.

- the RO WWTP must be operated and maintained to achieve 90% availability during the reporting period when input water is available.

The design parameters for the RO WWTP, as defined in EPL 1389, are presented in Table 14 in addition to the projected water quality of the RO WWTP treated water stream.

**Table 14 RO WWTP Projected Water Quality and EPL 1389 Design Parameters**

Parameter	Units	EPL 1389 Design Parameters	Projected Water Quality
pH	-	6.5-8.0	6.5-8.0
Electrical Conductivity	µS/cm	350	<250
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L	185	<50
Dissolved Aluminium	mg/L	0.055	<0.01
Dissolved Arsenic	mg/L	0.024	<0.002
Dissolved Barium	mg/L	0.7	<0.05
Dissolved Copper	mg/L	0.0014	<0.0005
Dissolved Nickel	mg/L	0.011	<0.005
Dissolved Zinc	mg/L	0.008	<0.005
Total Nitrogen	mg/L	0.25	<0.25

#### **Brine management**

The RO WWTP will produce a brine by-product which will be managed through transportation and disposal off-site or stored in the completed underground workings of Tahmoor North (subject to approval). The potential management methods are currently under investigation and may require a modification to the Consent and/or EPL 1389. This SWMP will be updated in future to detail the proposed brine management approach following confirmation and approval.

#### **5.1.4 Ventilation Shafts**

Three ventilation shafts service the existing underground mining operations. No. 1 shaft is located on Stratford Road, Tahmoor and is considered to be a clean water catchment devoid of potential surface water contaminants (refer Figure 2). Stormwater runoff from the no. 1 ventilation shaft area discharges to the Bargo River. No. 2 shaft is located on Rockford Road, Tahmoor. The no. 2 shaft is the main up-cast ventilation fan. Runoff from the surface area around the no. 2 shaft is directed via a surface drain to sediment dams M5 and M6 for settling (refer inset in Figure 10). These storages overflow to the Bargo River. The no. 3 ventilation shaft site is located adjacent to the mine pit top (refer Figure 2). Drainage from the area around the no. 3 shaft site reports to a series of sediment dams. Overflow from these structures is discharged to Teatree Hollow via LDP1.

#### **5.1.5 Reject Emplacement Area**

##### **Existing REA**

Rejects from the CHPP comprise dewatered fines and coarse reject. These reject streams are mixed and transported via conveyor to a bin and loading area prior to placement in the REA which is located some 1.5 km east of the pit top area – refer Figure 10. The REA stormwater management system comprises a network of collection drains and sediment dams (S7, S7a, S7b, S8, S9 and S10). Runoff which collects in these storages is pumped to dam S4 for automatic coagulant (flocculant) dosing. Water from dam S4 is pumped to mine water dam M3 or, during



wet weather, discharges to Teatree Hollow via LOP4 in accordance with EPL 1389. The REA is also currently served by LOP3 for overflow from dam S9 and LOP5 for overflow from dam S8.

### **REA Expansion**

The REA is proposed to be developed in stages over the Project life. The staging of the REA, which is currently being developed as part of design, will be generally consistent with that presented in the EIS. As with the current REA, drainage (runoff and seepage) from the REA would be directed to a series of sediment dams (refer Figure 11 and Figure 12). Changes to the REA water management system are likely to comprise infilling of dams S7 and S7a and commissioning of two additional sediment dams (S12 and S13) designed to collect runoff from the REA expansion (refer Figure 12). As per the existing REA water management system, runoff which collects in sediment dams S12 and S13 would be pumped to dam S4, via dam S9, for automatic coagulant (flocculant) dosing. Overflow from sediment dam S13 would be directed to sediment dam S12. Overflow from sediment dam S12 would be directed to LOP3 and discharged to Teatree Hollow in accordance with EPL 1389.

In accordance with the measures specified in Table 1, erosion and sediment control for the REA development, including the additional sediment dams, will be designed, installed and maintained in accordance with the *Managing Urban Stormwater: Soils and Construction* series including *Volume 1: Blue Book* (Landcom, 2004) and *Volume 2E: Mines and Quarries* (DECC, 2008).

This SWMP will be updated in future to detail the proposed REA staging and water management system.

#### **5.1.6 Underground Water Storage**

Under normal operations the RO WWTP will treat up to 6 ML/d. Forecast groundwater modelling for the Tahmoor Mine (HydroSimulations, 2018) has indicated that groundwater inflow rates may at times exceed 6 ML/day. In addition to underground dewatering, water recovered from the pit top area and REA which is pumped to mine water dam M3 (i.e. rainfall runoff from these areas) will also report to the RO WWTP (refer Figure 12). Therefore, there may be times when the capacity of the RO WWTP is exceeded.

Tahmoor Coal propose to utilise storage within the completed Tahmoor North underground to store excess mine water (subject to approval). Water would be pumped directly from the Project to Tahmoor North underground when mine dewatering rates exceeded the RO WWTP capacity. At times of lower inflow, water could be recovered from the underground storage, treated within the RO WWTP and released via LDP1. The development of storage within Tahmoor North underground is currently in the investigation and design phase and requires modification to the Consent. This SWMP will be updated in future to detail the proposed Tahmoor North underground storage following assessment of the proposal.

## **5.2 EPL1389 Special Conditions**

EPL 1389 outlines a program of works for water quality treatment and investigation. These works, listed as follows, will be undertaken by Tahmoor Coal in accordance with EPL 1389.

- Condition E1.1 - installation of a water treatment plant at Tahmoor Mine (as described in Section 5.1.3).
- Condition E2.1 - toxicity monitoring of water discharge from LDP1 to commence in the quarter prior to commencement of operation of the final RO WWTP and continue for a period of 2 years following commencement of operation.
- Condition E3.1 - an aquatic health monitoring program to identify changes in the aquatic health of the Bargo River following commissioning of the final RO WWTP.

- Condition E4.1 - an investigation into sediment contamination in Teatree Hollow associated with precipitation of dissolved metals in discharge water from LDP1 has been completed.

## 6 Site Water and Salt Balance

A water balance model of the Tahmoor Mine water management system has been developed to simulate the management of water over the remaining Tahmoor North and the approved Project mine life. The model simulates:

- the water balance of all water management storages;
- the generation of runoff from rainfall over mine surface facility catchments;
- the recovery of water from underground mining operations and the rate of excess mine water required to be stored;
- on-site and off-site supply of water to meet the demands of the CHPP, the underground mine and for dust suppression;
- water recycling and reuse rates; and
- the volume of water released to LDPs.

The model includes a salt balance to predict the mass of salt:

- generated from surface runoff;
- transferred between water management storages;
- treated and recycled on-site;
- proposed to be stored underground; and
- released to LDPs.

The Consent requires the site water and salt balance to be completed prior to construction activities associated with the Project commencing. However, it is not anticipated that construction activities will impact water management on site or result in changes to the site water and salt balance. Consequently, Tahmoor Coal are planning to stage an update of the site water and salt balance to coincide with the update of the numerical groundwater model for the Project which is currently predicted to be completed by April 2022. The staging of these works was approved by the DPIE on 3 December 2021.

The updated site water and salt balance and the numerical groundwater model would be completed prior to the commencement of secondary extraction from the Project. Specific Construction Environmental Management Plans will be developed prior to the commencement of construction activities pertaining to the management of all necessary environmental aspects including water. Any associated management plans (including this SWMP) would be updated accordingly.



## 7 Long-Term Water Management Strategy

The long-term water management and monitoring strategy for Tahmoor Mine would be developed progressively as the Project development progresses. Progressive development of the long-term water management strategy is described below while Section 8 describes the progressive development of the long-term water monitoring strategy.

### 7.1 Progressive Rehabilitation

As defined in the EIS, progressive rehabilitation would be undertaken where feasible following completion of each stage of the REA. Following completion of each stage of the REA, rehabilitation measures would be implemented including the construction of diversion channels to manage surface water runoff from rehabilitated areas independently of disturbed area runoff. Surface water runoff from rehabilitated areas would be directed to natural watercourses and discharged off-site. The proposed progressive rehabilitation, water management and water monitoring strategy would be developed following confirmation of the proposed staging of the REA.

During detailed closure planning for the REA a specific long-term management strategy would be developed in consultation with regulatory agencies and in accordance with relevant regulatory guidelines. Key objectives of the long-term management strategy would comprise:

- maintaining a stable landform;
- ensuring the landform surface is resistant to erosion;
- maintaining a surface cover that reduces the risk of infiltration, promotes shedding of surface water runoff and promotes growth of vegetation; and
- reducing the risk of environmental impact from seepage.

### 7.2 Detailed Modelling of Potential Impacts to Water Resources

The numerical groundwater model previously developed for the Tahmoor Mine, which includes simulation of the Project, historical operations at Tahmoor North and current operations in the Western Domain, is currently being reviewed and updated. Following completion, the model simulations will be undertaken for the operational period of the Western Domain and the Project and for the post-mining recovery period. The model predictions will be used to assist with decision-making and planning on the following aspects:

- potential water related impacts associated with operations and the post-mining recovery period;
- management of underground mine dewatering;
- groundwater and surface water licensing; and
- the level of risk associated with adaptive management options.

The mine inflow predictions will be input to the site water and salt balance model described in Section 6 with those model predictions used to inform the long-term water management strategy for the Tahmoor Mine.

### 7.3 Water Licensing Strategy

Tahmoor Coal has developed a water licensing strategy for long-term operations at the Tahmoor Mine and for post-mining. The proposed water licensing strategy was presented to NRAR for discussion in August 2021. In addition to the existing WALs held by Tahmoor Coal, as listed in Section 3.4, Tahmoor Coal is currently seeking to obtain additional WALs as necessary based on model predictions of groundwater and surface water take associated within mining operations.

## 8 Water Monitoring Plan

The water monitoring program for the Project would be progressively developed as the Project development progresses. In addition to the existing monitoring sites detailed in Section 4.1, additional monitoring sites are proposed as described in the following sections. The number and location of monitoring sites will be dependent on gaining the necessary land access agreements and following an assessment of site suitability.

### 8.1 Surface Water Monitoring Program Design

#### 8.1.1 Water Quality Monitoring

Water quality monitoring is proposed to be undertaken monthly at the existing and proposed monitoring sites. The water quality monitoring is to comprise:

- Field monitoring: pH, EC, temperature, DO and ORP.
- Laboratory monitoring: pH, EC, TDS, major cations (calcium, magnesium, sodium and potassium), sulphate, alkalinity, chloride, selected dissolved metals (aluminium, arsenic, barium, copper, iron, lead, lithium, manganese, nickel, selenium, strontium and zinc), selected total metals (aluminium, arsenic, barium, cadmium, copper, iron, lead, lithium, manganese, nickel, selenium, strontium and zinc), total kjeldahl nitrogen, total nitrogen, total phosphorus, total cations and total anions.

Monitoring at the additional sites is proposed to commence a minimum of 12 months prior to the potential occurrence of mining related effects.

#### 8.1.2 Water Level Monitoring

In accordance with the current monitoring program, automated and manual water level monitoring is proposed to be undertaken at select proposed monitoring sites. The automated water level monitoring will comprise installation of a water pressure sensor that continuously records pressure measurements. Water level measurements will also be recorded manually on a monthly basis at sites with and without automated water level monitoring.

Monitoring at the proposed sites is proposed to commence a minimum of 12 months prior to the potential occurrence of mining related effects.

#### 8.1.3 Streamflow Gauging Stations

Two streamflow gauging stations are proposed to be constructed – one on Teatree Hollow (TT-F1 in Figure 13) and one on Dog Trap Creek (DT-F1 in Figure 14). The streamflow gauging stations would be constructed with a concrete and steel v-notch weir to enable accurate and continuous low flow monitoring from commissioning. The specific design of the streamflow gauging stations is currently in development.

It is proposed that the streamflow gauging station at TT-F1 would be commissioned prior to the commencement of mining of LWS1A. Water level monitoring data recorded at monitoring site TT6-QLa will be used in conjunction with monitoring data recorded at the proposed streamflow gauging station to enable derivation of baseline flow data for Teatree Hollow downstream of the approved Project longwalls and, as far as practicable, upstream of the Tahmoor Mine surface facilities.

A similar structure will be constructed on Dog Trap Creek at DT-F1 (at or adjacent to DT43-QLa dependent on site suitability). It is proposed that the streamflow gauging station on Dog Trap Creek would be installed approximately four years prior to commencement of mining LWS1B to enable collection of a significant period of baseline flow data for Dog Trap Creek downstream of the approved LWS1B-S6B.

#### **8.1.4 Monitoring of Pool Physical Features and Natural Behaviour**

Visual inspections of the physical features and natural behaviour of pools will be undertaken prior to, during and following completion of the Project. A baseline inspection of mapped pools in Teatree Hollow, Teatree Hollow tributary, Bargo River tributary, Dog Trap Creek and Dog Trap Creek tributaries will be undertaken in stages prior to the commencement of secondary extraction from the Project (refer Figure 6 and Figure 7 for pool locations). Following commencement of secondary extraction, visual inspection of pools in the active subsidence zone will be undertaken monthly during the active subsidence period. Following completion of mining, visual inspections will be undertaken on a quarterly basis for a minimum of 12 months.

#### **8.1.5 Geomorphology and Channel Stability Monitoring**

Photographic surveys and visual inspections of geomorphological features will be undertaken prior to, during and post-mining activities. The photographic surveys and visual inspections will comprise:

- annual catchment survey at headwater sites;
- monitoring of knickpoint formation prior to and during mining of each longwall; and
- geomorphology survey (post mining) of waterways overlying each longwall.

The location of survey points will be defined with consideration to features mapped during the baseline geomorphology survey and to the predicted subsidence effects associated with the Project.

Visual inspection of headwater sites and knickpoints will be undertaken prior to the commencement of secondary extraction from the Project to confirm/revise the findings of the baseline geomorphology survey. Following commencement of secondary extraction, visual inspection of knickpoint formation in the active subsidence zone will be undertaken monthly during the active subsidence period (refer Figure 13 and Figure 14 for knickpoint locations). Following completion of mining, visual inspections will be undertaken on a quarterly basis for a minimum of 12 months.

Further details of the geomorphology and channel stability monitoring will be defined during the Extraction Plan process and documented in the associated Water Management Plan.

### **8.2 Monitoring Site Locations**

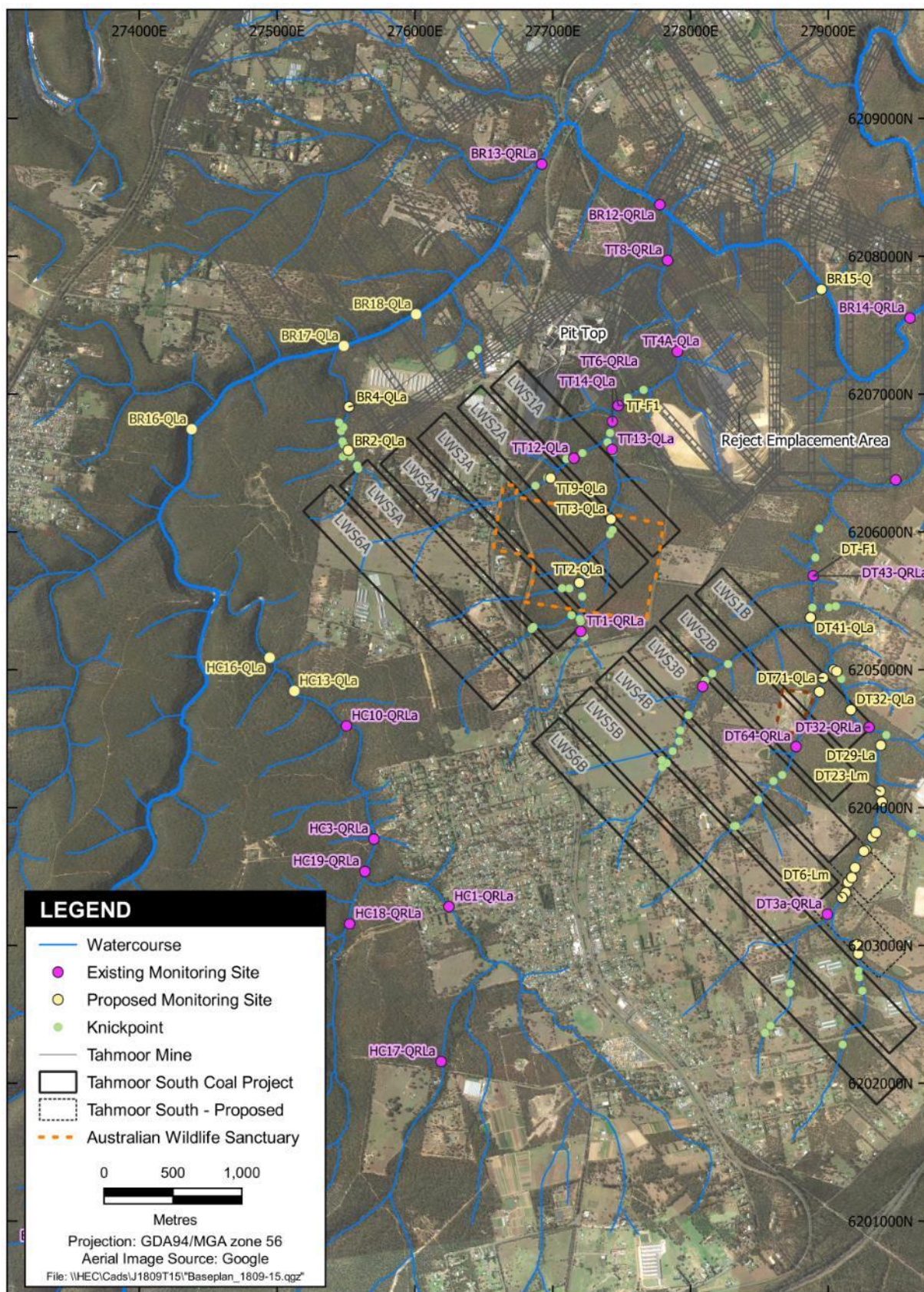
The proposed monitoring sites to be instated in Teatree Hollow, Teatree Hollow tributary, Dog Trap Creek and its tributaries, the Bargo River, the Bargo River tributary and Hornes Creek are shown in Figure 13 and Figure 14, in addition to the location of knickpoints. The monitoring site nomenclature is associated with the watercourse and pool number (i.e. DT15 is pool 15 on Dog Trap Creek) and the type of monitoring to be implemented: water quality (Q), automated (continuous) water level monitoring (La), monthly manual water level measurements (Lm) and streamflow gauging (F).

Monitoring of pool physical features and natural drainage behaviour will be undertaken at pools within the active subsidence zone. The locations of mapped pools within the Project area are shown Figure 6 and Figure 7. The specific pools to be monitored for physical features and natural drainage behaviour will be defined in the Extraction Plan following confirmation of the subsidence zone.

The locations of photographic surveys and visual inspections of headwater sites and other relevant geomorphological features will be specified in the Extraction Plan following confirmation of the subsidence zone.

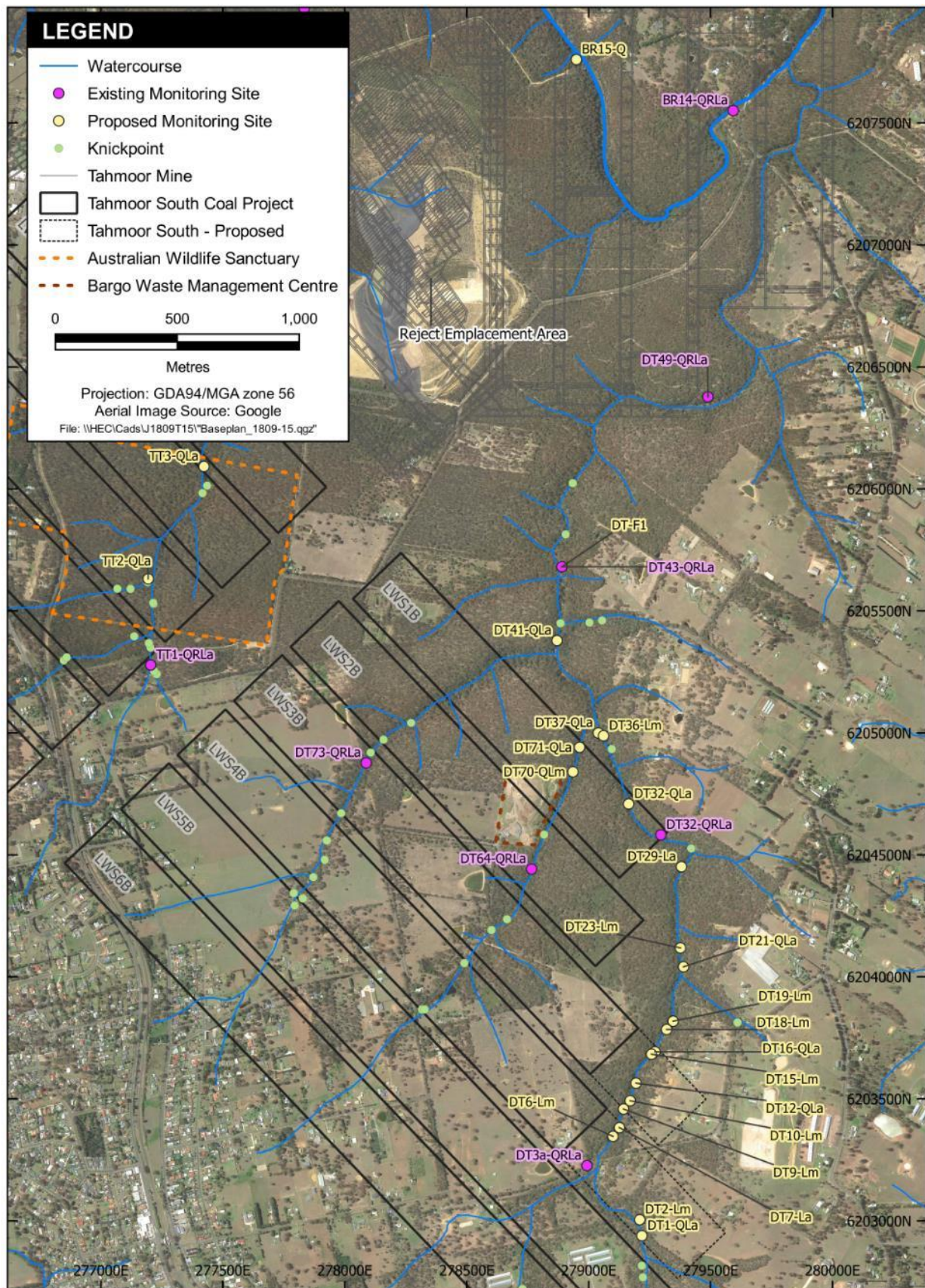
Details of the proposed surface water monitoring sites are provided in Table 15.





**Figure 13 Proposed Monitoring Sites on Teatree Hollow, Bargo River, Hornes Creek and Associated Tributaries**





**Figure 14** Proposed Monitoring Sites on Dog Trap Creek and Dog Trap Creek Tributaries

**Table 15 Proposed Surface Water Monitoring Sites**

Site	Purpose / Reason for Monitoring	Monitoring Type	Associated Reference Site(s)
Bargo River			
BR15-Q	Increase the spatial representation of water quality monitoring downstream of the Tahmoor Mine surface facilities and the Project	Water quality	BR11-QLa BR12-QLa
BR16-QLa	Baseline characterisation; monitoring of potential impacts to Bargo River outside of the predicted subsidence zone	Water level and water quality	BR11-QLa
BR17-QLa	Baseline characterisation; monitoring of potential impacts to Bargo River outside of the predicted subsidence zone	Water level and water quality	BR11-QLa BR16-QLa
BR18-QLa	Baseline characterisation; monitoring of potential impacts to Bargo River outside of the predicted subsidence zone	Water level and water quality	BR11-QLa BR16-QLa
Bargo River Tributary			
BR2-QLa	Baseline characterisation; monitoring of potential Project impacts to Bargo River tributary; surface water-groundwater connectivity monitoring <sup>†</sup>	Water level and water quality	DT64-QLa DT73-QLa
BR4-QLa	Baseline characterisation; monitoring of potential impacts to Bargo River tributary downstream of the predicted subsidence zone		
Teatree Hollow Catchment			
TT-F1	Monitoring of potential impacts to streamflow associated with mining of LWS1A-S6A	Streamflow gauging	DT49-QLa DT43-QLa CC1-QLa
TT2-QLa	Baseline characterisation; monitoring of potential Project impacts to Teatree Hollow tributary; Australian Wildlife Sanctuary pool; surface water-groundwater connectivity monitoring <sup>†</sup>	Water level and water quality	TT1-QLa
TT3-QLa	Baseline characterisation; monitoring of potential Project impacts to Teatree Hollow tributary; Australian Wildlife Sanctuary pool; surface water-groundwater connectivity monitoring <sup>†</sup>		TT1-QLa
TT9-QLa	Monitoring of potential Project impacts to Teatree Hollow		TT1-QLa

<sup>†</sup> adjacent to proposed groundwater monitoring bore

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**Table 15 (Cont.) Proposed Surface Water Monitoring Sites**

Site	Purpose / Reason for Monitoring	Monitoring Type	Associated Reference Site(s)
<b><i>Dog Trap Creek Catchment</i></b>			
DT-F1	Monitoring of potential impacts to streamflow associated with mining of LWS1B-S6B	Streamflow gauging	CC1-QLa
DT1-QLa	Baseline characterisation; monitoring of potential Project impacts to Dog Trap Creek	Water level and water quality	CC1-QLa EC2-QLa EC1-QLa
DT2-Lm	Baseline characterisation; monitoring of potential Project impacts to Dog Trap Creek; surface water-groundwater connectivity monitoring†	Manual water level	
DT6-Lm	Baseline characterisation; monitoring of potential Project impacts to Dog Trap Creek	Manual water level	
DT7-La	Baseline characterisation; monitoring of potential Project impacts to Dog Trap Creek; surface water-groundwater connectivity monitoring†	Water level	CC1-QLa EC2-QLa EC1-QLa
DT9-Lm	Baseline characterisation; monitoring of potential Project impacts to Dog Trap Creek	Manual water level	Upstream monitoring sites on Dog Trap Creek
DT10-Lm		Manual water level	
DT12-QLa		Water level and water quality	
DT15-Lm		Manual water level	
DT16-QLa	Baseline characterisation; monitoring of potential Project impacts to Dog Trap Creek; surface water-groundwater connectivity monitoring†	Water level and water quality	
DT18-Lm	Baseline characterisation; monitoring of potential Project impacts to Dog Trap Creek	Manual water level	
DT19-Lm		Manual water level	
DT21-QLa	Baseline characterisation; monitoring of potential Project impacts to Dog Trap Creek; surface water-groundwater connectivity monitoring†	Water level and water quality	
DT23-Lm	Baseline characterisation; monitoring of potential Project impacts to Dog Trap Creek	Manual water level	
DT29-La		Water level	
DT32-QLa		Water level and water quality	
DT36-Lm		Manual water level	
DT37-QLa	Baseline characterisation; monitoring of potential Project impacts to Dog Trap Creek; surface water-groundwater connectivity monitoring†	Water level and water quality	
DT41-QLa	Baseline characterisation; monitoring of potential Project impacts to Dog Trap Creek	Water level and water quality	

† adjacent to proposed groundwater monitoring bore

**Table 15 (Cont.)      Proposed Surface Water Monitoring Sites**

Site	Purpose / Reason for Monitoring	Monitoring Type	Associated Reference Site(s)
<b><i>Dog Trap Creek Catchment</i></b>			
DT70-QLm	Baseline characterisation; monitoring of potential impacts to Dog Trap Creek tributary associated with the Project and Bargo Waste Management Centre	Manual water level and water quality	DT64-QLa
DT71-QLa		Water level and water quality	
<b><i>Hornes Creek Catchment</i></b>			
HC13-QLa	Baseline characterisation; monitoring of potential impacts to Hornes Creek outside of the predicted subsidence zone	Water level and water quality	HC17-QRLa
HC16-QLa	Baseline characterisation; monitoring of potential impacts to Hornes Creek outside of the predicted subsidence zone	Water level and water quality	HC17-QRLa

† adjacent to proposed groundwater monitoring bore

### 8.2.1 *Surface Water Monitoring Program*

A summary of the proposed surface water monitoring program is presented in Table 16. The program, as it relates to surface water has been/will be undertaken in phases: prior to mining (secondary extraction), during secondary extraction and subsidence and following the end of mining and cessation of subsidence.



**Table 16 Surface Water Monitoring Program**

Feature	Locations	Monitoring		
		Prior to Mining	During Mining	Post Mining
Streamflow	Streamflow gauging stations (refer Figure 13 and Figure 14): <ul style="list-style-type: none"> <li>• TT-F1</li> <li>• DT-F1</li> </ul>	Continuous record. Data downloaded prior to the commencement of secondary extraction in relevant catchment.	Continuous record. Data downloaded and reviewed monthly.	Continuous record, data downloaded and reviewed quarterly for 12 months following the completion of relevant mining activities. This period may be extended as per decision by the Environmental Response Group*.
Stream Water Quality	Water quality monitoring sites shown in Figure 9, Figure 13 and Figure 14.	Monthly sampling for a minimum of 12 months prior to secondary extraction.	Monthly sampling and analysis.	Monthly sampling and analysis for 12 months following the completion of relevant mining activities. This period may be extended as per decision by the Environmental Response Group.
		<i>Parameters:</i> Field analysis: pH, EC and DO, temperature and ORP. Laboratory analysis for: pH, EC, total dissolved solids, total suspended solids, turbidity, major cations <sup>†</sup> , sulphate, alkalinity, chloride, dissolved metals <sup>‡</sup> , total metals <sup>‡</sup> , total kjeldahl nitrogen, total nitrogen, total phosphorus, total cations and total anions.		
Automated pool water level	Automated water level monitoring sites shown in Figure 9, Figure 13 and Figure 14.	Continuous record. Data downloaded prior to the commencement of secondary extraction in relevant catchment.	Continuous record. Data downloaded and reviewed monthly.	Continuous record, data downloaded and reviewed quarterly for 12 months following the completion of relevant mining activities. This period may be extended as per decision by the Environmental Response Group.
Manual water level	Manual water level monitoring sites shown in Figure 9, Figure 13 and Figure 14.	Monthly manual level record.	Monthly manual level record.	Monthly manual level record for 12 months following the completion of relevant mining activities. This period may be extended as per decision by the Environmental Response Group.

\* External technical specialists in subsidence, water resources, hydrogeology and aquatic ecology tasked with assessing the Project performance against the TARPs.

<sup>†</sup> Calcium, magnesium, sodium and potassium.

<sup>‡</sup> Aluminium, arsenic, barium, copper, iron, lead, lithium, manganese, nickel, selenium, strontium and zinc.

**Table 16 (Cont.) Surface Water Monitoring Program**

Feature	Locations	Monitoring		
		Prior to Mining	During Mining	Post Mining
Physical features and natural behaviour of pools	Stream reaches of Teatree Hollow, Teatree Hollow tributary, Dog Trap Creek, Dog Trap Creek tributary, Bargo River and Bargo River tributary.	Observations prior to mining using fixed location photo points.	Observations every month during the active subsidence period for sites within the active subsidence zone^ using fixed location photo points.	Quarterly observations over 12 months for pools that are no longer within the active subsidence zone. This period may be extended as per decision by the Environmental Response Group.
Geomorphology and channel stability	Stream reaches of Teatree Hollow, Teatree Hollow tributary, Dog Trap Creek, Dog Trap Creek tributary and Bargo River tributary.	Observations prior to mining using fixed location photo points.	Observations of knickpoint formation every month during the active subsidence period for sites within the active subsidence zone using fixed location photo points. Annual catchment survey of headwater sites.	Post-mining geomorphology survey. Annual catchment survey of headwater sites.
Stream and riparian vegetation	As per the Biodiversity Management Plan to be developed as a component of the Extraction Plan.	Aquatic habitat assessment, macroinvertebrate survey, water quality sampling and fish sampling.	Bi-annually (Spring and Autumn).	Bi-annually (Spring and Autumn) for 12 months following the completion of relevant mining activities. This period may be extended as per decision by the Environmental Response Group.

^Survey area to include upstream, downstream and adjacent pools (to the extent of the potential impact) where a trigger exceedance has occurred at a potential impact site(s) in accordance with the TARP (refer Table 18).

### 8.3 Water Management System Monitoring

Visual inspection, monitoring and maintenance of the Tahmoor Mine water management system is undertaken on a regular basis by Tahmoor Coal. Daily inspections (Monday to Friday) of the water quality of dams M1, M2, M3 and M4 are conducted by the Tahmoor Coal Environment and Community Department. The inspections include visual observations of water quality characteristics (i.e. sediment load, high turbidity). Daily turbidity testing is also conducted at LDP1.

Routine inspections of each water management storage are conducted on a monthly basis and during or immediately following a high rainfall event. Each water management storage is inspected for:

- physical defects (piping, cracking, slumping, bulging or heaving);
- functionality of critical controls (outlet pipes and spillways);
- changes to the storage structure that may affect performance;
- water storage level;
- sediment level;
- presence and rate of seepage; and
- required maintenance works.

Other components of the water management system are inspected on a daily, monthly or as required basis as summarised in Table 17.

**Table 17 Water Management System Monitoring and Maintenance**

Component	Frequency
<u>Visual Inspection</u>	
Sediment load and turbidity of dam M1, M2, M3, M4 and water discharged at LDP1	Daily #
Dam M3, M4, REA dams and drainage lines	Monthly
Sediment level in dam M1, M2 and emergency tailings dams	Monthly
<u>Monitoring Data Review</u>	
Turbidity levels of water discharged from CHPP	Daily
Turbidity levels of water discharged from underground dewatering lines 1, 2 and 3	Daily
Turbidity levels of water pumped from S4 to M3	Daily
LDP1 water quality (EPL 1389 defined constituents)	Monthly
Dam S9 (LOP3), dam S4 (LOP4) and dam S8 (LOP5) water quality*	Monthly
<u>Maintenance</u>	
Removal of accumulated sediment from dam M1 and M2	As required <sup>†</sup>
Calibration of turbidity meter	Daily
De-silting of drainage lines	As required <sup>†</sup>
Flocculant dosing of dam M1	Daily
De-silting of dams	As required <sup>†</sup>
Service/replacement of pumps and equipment	As required <sup>†</sup>

\* pH, EC, turbidity, oil and grease, total suspended solids, total arsenic, total barium, total iron, total nickel, total zinc

<sup>†</sup> defined by the Environment and Community Department following visual inspection

# normal work days. Excludes public holidays.

Continuous flow monitoring will continue to be undertaken as indicated in Figure 11 and Figure 12. This data, in addition to records of the volume of potable water supplied by Sydney Water, would be used to inform the annual preparation of an updated site water balance.



Monitoring of discharge to LDP1 and overflow from dam S9 (LOP3), dam S4 (LOP4) and dam S8 (LOP5) would continue to be undertaken in accordance with EPL 1389, as described in Section 4.1.4.

## 9 Performance Criteria, Trigger Action Response Plan and Reporting

### 9.1 Performance Criteria

The performance criteria for surface water resources associated with the Project comprise:

- no significant adverse mining-related effects to:
- downstream surface water quality;
- downstream surface water flows;
- water supply for other water users; or
- stream and riparian vegetation health; and
- maintenance or improvement of channel stability.

The environmental monitoring program to be implemented over the life of the Project has been designed to enable assessment of the Project performance in relation to the above criteria. Baseline monitoring data will be used to develop site specific trigger values which will inform the Trigger Action Response Plan (TARP) for surface water resources.

#### 9.1.1 Water Management System Performance Criteria

Performance criteria and TARPs pertaining to the Tahmoor Mine water management system are documented in the Tahmoor Coal *Environmental Management Framework* and the *Tahmoor South Water Management Plan* (in preparation).

As presented in Table 18, TARPs relating to the quality and quantity of water discharged at LDP1 and the clarity of dam M2 and dam M3 have been developed. The TARPs are currently implemented at the Tahmoor Mine and will continue to be implemented throughout the duration of the Tahmoor Mine operations.

#### 9.1.2 Surface Water Quality Site Specific Trigger Values

As indicated in Section 4.2.2, the concentrations of some constituents are naturally elevated in Teatree Hollow, Dog Trap Creek, Bargo River and associated tributaries. Accordingly, site specific trigger values (SSTVs) will be derived for constituents which are naturally elevated at the relevant monitoring site. The SSTVs will be developed for specific monitoring sites which are upstream or outside of the influence of discharge to LDP1. The SSTVs will be derived from a minimum of 24 months of baseline monitoring data recorded prior to commencement of secondary extraction from the Project. The SSTVs will be derived in accordance with ANZECC (2000) and ANZG (2018) and will be based on the 80<sup>th</sup> and 20<sup>th</sup> percentile (where relevant) values of the baseline monitoring data.

As described in Table 18, the SSTVs for potential impact sites will be used to provide an indication of potential changes in surface water quality within the zone of influence of mining activities. In the assessment of a trigger exceedance, water quality monitoring data recorded at potential impact sites will be assessed in relation to monitoring data recorded at reference sites.

Further detail of the derivation of SSTVs, and preliminary SSTVs, will be presented in the WMP prepared as a component of the Extraction Plan.

#### 9.1.3 Pool Water Level and Streamflow Performance Criteria

A TARP for potential streamflow reduction will be developed based on analysis of baseline (i.e. pre-subsidence) streamflow data, streamflow data recorded during the period of mining and contemporaneous data from reference sites. It is envisaged that catchment flow modelling would be used in the analysis. The TARP will be developed with consideration to the predicted streamflow reduction associated with the Project, to be detailed in the WMP prepared as a component of the Extraction Plan.

A TARP relating to the potential reduction in pool water level has been developed and is presented in Table 18. The pool water level TARP has been developed to consider baseline (i.e. pre-subsidence) pool water level data, pool water level data recorded during mining and contemporaneous data from reference pool sites.

#### **9.1.4 *Natural Drainage Behaviour and Channel Stability***

A TARP relating to the physical features and natural behaviour of pools has been developed and is presented in Table 18. The TARP pertains to visual observations of pool level, flow behaviour and mining related impacts including rockbar and/or stream base cracking, gas release and/or increased iron precipitation. The TARP has been developed to consider assessment of baseline (i.e. pre-subsidence) inspection records, inspection records during the period of mining and contemporaneous data from reference sites.

A TARP relating to channel stability and geomorphological conditions will be presented in the WMP prepared as a component of the Extraction Plan.

#### **9.1.5 *Water Supply for Other Water Users***

It is intended that potential impacts to water supply for other water users will be identified through a trigger exceedance of the surface water related TARPs (i.e. water quality, pool water level and streamflow) and the groundwater related TARPs (i.e. groundwater level, groundwater quality and surface water-groundwater interaction). Exceedance of a relevant trigger will initiate further investigation including assessment of the potential reduction in the quantity or quality of water supply for other water users. Where it is identified that a reduction in the quantity or quality of water supply for other water users has occurred as a result of mining related effects, Tahmoor Coal will enter into negotiations with the relevant landholder and regulatory agencies to formulate a remediation agreement (refer Section 9.3 of this SWMP and the Groundwater Management Plan for further detail).

#### **9.1.6 *Stream and Riparian Vegetation Health***

A stream and riparian vegetation health TARP will be presented in the Biodiversity Management Plan to be prepared as a component of the Extraction Plan.

### **9.2 *Trigger Action Response Plan***

TARPs are used as a contingency plan to set out response measures for unpredicted subsidence impacts and have been developed preliminarily for pool water level, physical features and natural behaviour of pools and stream water quality. As described above, TARPs relating to streamflow, channel stability and geomorphological conditions and stream and riparian vegetation health will be developed as a component of the Extraction Plan process. The monitoring results will be used to assess potential impacts of the Project against the performance indicators and performance measures using the TARPs.

The frequency of assessment, impact assessment triggers and proposed action and response plans are detailed in Table 18, trigger level 1 nominally equates to “normal” conditions, trigger level 2 nominally equates to “within prediction” conditions, trigger level 3 nominally equates to “approaching exceedance” conditions and trigger level 4 nominally equates to “exceeds prediction” conditions.



**Table 18**      **Surface Water Trigger Action Response Plan**

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Controlled and uncontrolled discharge – exceedance of EPL 1389 water quality discharge limits	<u>LDP1 DISCHARGE WATER QUALITY</u> LOCATION (refer Figure 8): LDP1  MONITORING: <ul style="list-style-type: none"> <li>Daily: Sediment load and turbidity monitoring of water discharged at LDP1</li> <li>Monthly: EPL 1389 defined constituents (refer Table 7) in water discharged at LDP1</li> </ul> EPL 1389 WATER QUALITY DISCHARGE LIMITS: listed in Table 7	<b>Level 1</b>		
		Constituent levels below EPL 1389 water quality discharge limits	Continue monitoring and review of data as per monitoring program	No response required
		<b>Level 2</b>		
		Constituent levels equal to EPL 1389 water quality discharge limits	<ul style="list-style-type: none"> <li>Notify Environment and Community Department</li> <li>Conduct site inspection and investigation to identify source of elevated constituent levels and define corrective actions</li> </ul>	<ul style="list-style-type: none"> <li>Implement corrective actions as required</li> <li>If pH level is equal to the lower EPL 1389 water quality discharge limit, avoid human contact and begin neutralisation treatment</li> <li>Continue monitoring and review of data as per monitoring program</li> </ul>
		<b>Level 3</b>		
		Constituent levels above EPL 1389 water quality discharge limits (or below the lower discharge limit for pH)	<ul style="list-style-type: none"> <li>Notify Environment Coordinator</li> <li>Conduct site inspection and investigation to identify source of elevated constituent levels and define corrective actions</li> </ul>	<ul style="list-style-type: none"> <li>Implement corrective actions (i.e. eliminate source of exceedance, close valves between dam M3 and dam M4 etc.)</li> <li>If pH level is below the lower EPL 1389 water quality discharge limit, avoid human contact and begin neutralisation treatment</li> <li>Immediately conduct water quality monitoring at LDP1 and assess effectiveness of corrective action</li> <li>Submit exceedance notification to the EPA following investigation</li> </ul>
		<b>Level 4</b>		
		Constituent levels significantly above EPL 1389 water quality discharge limits (or significantly below the lower discharge limit for pH)	<ul style="list-style-type: none"> <li>Notify Environment Coordinator</li> <li>Conduct site inspection and investigation to identify source of elevated constituent levels and define corrective actions</li> </ul>	<ul style="list-style-type: none"> <li>Implement corrective actions (i.e. eliminate source of exceedance, close valves between dam M3 and dam M4 etc.)</li> <li>If pH level is below the lower EPL 1389 water quality discharge limit, avoid human contact and begin neutralisation treatment</li> <li>Immediately conduct water quality monitoring at LDP1 and assess effectiveness of corrective action</li> <li>Immediately conduct field water quality monitoring at TT8-QRLa to assess effect on downstream watercourse</li> <li>Engage external specialist support as necessary</li> <li>Implement Pollution Incident Response Management Plan as required</li> <li>Submit exceedance notification to the EPA following investigation</li> </ul>

**Table 18 (Cont.)**      **Surface Water Trigger Action Response Plan**

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Controlled and uncontrolled discharge – exceedance of EPL 1389 water quantity discharge limit	<u>LDP1 DISCHARGE WATER QUANTITY</u> LOCATION (refer Figure 8): LDP1  MONITORING: continuous flow monitoring at LDP1  EPL 1389 WATER QUANTITY DISCHARGE LIMIT: <ul style="list-style-type: none"> <li>15,500 kilolitres per day during low rainfall conditions</li> <li>Unlimited during wet weather conditions*†</li> </ul>	<b>Level 1</b>		
		Discharge rate below EPL 1389 water quantity discharge limit	Continue monitoring and review of data as per monitoring program	No response required
		<b>Level 2</b>		
		Discharge rate equal to EPL 1389 water quantity discharge limit	<ul style="list-style-type: none"> <li>Notify Environment and Community Department</li> <li>Conduct site inspection and investigation to identify source of elevated flow rate</li> <li>Identify high priority pumping requirements, reduce flow rate from high flow source and investigate potential for alternative storage</li> </ul>	<ul style="list-style-type: none"> <li>Implement corrective actions as required</li> <li>Continue monitoring and review of data as per monitoring program</li> </ul>
		<b>Level 3</b>		
		Discharge rate greater than EPL 1389 water quantity discharge limit	<ul style="list-style-type: none"> <li>Notify Environment Coordinator</li> <li>Conduct site inspection and investigation to identify source of elevated flow rate</li> <li>Identify high priority pumping requirements, reduce flow rate from high flow source and investigate potential for alternative storage</li> </ul>	<ul style="list-style-type: none"> <li>Implement corrective actions</li> <li>Continue monitoring and assess effectiveness of corrective actions</li> <li>Review mine water management protocols and identify opportunities for improvement</li> <li>Submit exceedance notification to the EPA following investigation</li> </ul>
		<b>Level 4</b>		
		Discharge rate significantly greater than EPL 1389 water quantity discharge limit	<ul style="list-style-type: none"> <li>Notify Environment Coordinator</li> <li>Conduct site inspection and investigation to identify source of elevated flow rate</li> <li>Identify high priority pumping requirements, reduce flow rate from high flow source and investigate potential for alternative storage</li> <li>Conduct inspection of downstream watercourse to identify potential impacts and provide recommendations to remedial action</li> </ul>	<ul style="list-style-type: none"> <li>Implement corrective actions</li> <li>Continue monitoring and assess effectiveness of corrective actions</li> <li>Review mine water management protocols and identify opportunities for improvement</li> <li>Engage external specialist support as necessary</li> <li>Conduct inspection of downstream watercourse to assess effectiveness of remedial action</li> <li>Submit exceedance notification to the EPA following investigation</li> </ul>

\* Defined as more than 10 millimetres (mm) rainfall within a 24 hour period.

† Provided that all practical measures are taken to reduce potential water quality impacts.

**Table 18 (Cont.)**      **Surface Water Trigger Action Response Plan**

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Dam M2 and Dam M3 turbidity levels	<u>DAM M2/M3 CLARITY</u> LOCATION (refer Figure 10): Dam M2/M3  MONITORING: daily monitoring of turbidity levels and visual inspection of water clarity of dam M2 and dam M3	<b>Level 1</b>		
		Dam M2/M3 overflow discharge is clear and turbidity is less than 55 NTU	Continue monitoring as per monitoring program	No response required
		<b>Level 2</b>		
		Dam M2/M3 overflow discharge clarity is murky and turbidity is greater than 55 NTU and less than 75 NTU for more than 2 hours	<ul style="list-style-type: none"> <li>Visually inspect clarity of feed water from washery, underground, dam M1 and dam M2</li> <li>Contact Washery Control to verify that tailings overflow clarity is within specification</li> <li>Contact Outbye Coordinator to ascertain any changes in underground dewatering water quality</li> <li>Notify Environment and Community Department or Environmental Coordinator</li> <li>Add flocculant to M3 entry and coagulant at Dam M2</li> </ul>	<ul style="list-style-type: none"> <li>Continue monitoring turbidity at dam M3 to identify change in clarity</li> <li>Continue monitoring turbidity at LDP1</li> </ul>
		<b>Level 3</b>		
		Dam M2/M3 overflow discharge is discoloured and turbidity is greater than 75 NTU and less than 100 NTU	<ul style="list-style-type: none"> <li>Add flocculant to dam M1</li> <li>Increase flocculant at M3 entry and ensure coagulation at dam M2</li> <li>Contact Washery Control to verify that tailings overflow clarity is within specification</li> <li>Contact Outbye Coordinator to ascertain any changes in underground dewatering water quality</li> </ul>	<ul style="list-style-type: none"> <li>Continue monitoring turbidity at dam M3 to identify change in clarity</li> <li>Continue monitoring turbidity at LDP1</li> <li>Monitor turbidity levels in watercourse approximately 100 m downstream of LDP1 to assess effect</li> </ul>
		<b>Level 4</b>		
		Dam M2/M3 overflow discharge is notably discoloured and turbidity is greater than 100 NTU for more than 1 hour	<ul style="list-style-type: none"> <li>Review strategy with Production Coordinator and Environmental Coordinator</li> <li>Inspect all washery dams for water quality issues</li> <li>Close valves between dam M3 and dam M4</li> <li>Over-ride stockpile dam high level alarm to enable continued pumping and overflow to dam S4</li> </ul>	<ul style="list-style-type: none"> <li>Liaise with Environment and Community Manager and CHPP Manager to define course of action</li> <li>Prepare recovery plan</li> <li>Continue monitoring turbidity at dam M3 to identify change in clarity</li> <li>Continue monitoring turbidity at LDP1</li> <li>Submit exceedance notification to the EPA if EPL 1389 discharge limits are exceeded</li> <li>Monitor turbidity levels in watercourse approximately 100 m downstream of LDP1 to assess effect</li> </ul>

**Table 18 (Cont.) Surface Water Trigger Action Response Plan**

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Impact to pool water level	<p><u>AUTOMATED POOL WATER LEVEL</u></p> <p>LOCATIONS (refer Figure 9, Figure 13 and Figure 14):</p> <p>Baseline/potential impact sites:</p> <ul style="list-style-type: none"> <li>Teatree Hollow</li> <li>Teatree Hollow tributary</li> <li>Dog Trap Creek</li> <li>Dog Trap Creek tributary</li> <li>Bargo River tributary</li> </ul> <p>Reference/control sites:</p> <ul style="list-style-type: none"> <li>Upstream pools beyond mining effects (refer Table 15)</li> <li>Eliza Creek</li> <li>Carters Creek</li> <li>Hornes Creek</li> </ul> <p>PRE-MINING – Continuous record, data downloaded monthly.</p> <p>DURING - Continuous record, data downloaded monthly.</p> <p>POST-MINING - Continuous record, data downloaded monthly and reviewed quarterly for 12 months following the completion of relevant mining activities. This period may be extended as per a decision by the Environmental Response Group.</p>	<b>Level 1</b>		
		<ul style="list-style-type: none"> <li>The recorded water level has not declined below the recorded baseline minimum level (in one 24 hour period for automated pool water level)</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>The recorded water level has declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) but the decline is due to a monitoring or sensor error or the magnitude of the decline (below the recorded baseline minimum level) is within the range of sensor accuracy</li> </ul>	<ul style="list-style-type: none"> <li>Continue monitoring as per monitoring program</li> <li>Continue monthly review of data</li> </ul>	<ul style="list-style-type: none"> <li>No response required</li> </ul>
		<b>Level 2</b>		
		<ul style="list-style-type: none"> <li>The recorded water level has declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level)</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>The above has occurred at one of the upstream pools (beyond mining effects) or reference sites</li> </ul>	<ul style="list-style-type: none"> <li>Continue monitoring as per monitoring program</li> <li>Continue monthly review of data</li> <li>Convene Tahmoor Coal Environmental Response Group to review response</li> </ul>	<ul style="list-style-type: none"> <li>As defined by Environmental Response Group</li> </ul>
		<b>Level 3</b>		
		<ul style="list-style-type: none"> <li>The recorded water level has declined, although not atypically<sup>^</sup>, below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level)</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>The above has not occurred at one of the upstream pools (beyond mining effects) or reference sites</li> </ul>	<ul style="list-style-type: none"> <li>Continue monitoring as per monitoring program</li> <li>Continue monthly review of data</li> <li>Review relevant surface water level, groundwater level and streamflow data to assess comparative trends</li> <li>Convene Tahmoor Coal Environmental Response Group to review response</li> </ul>	<ul style="list-style-type: none"> <li>As defined by Environmental Response Group</li> <li>Consider increasing download and review of data frequency to fortnightly for sites where Level 3 has been reached</li> <li>Review manual and automated water level measurements for additional monitoring sites to identify potential spatial trends in water level decline</li> </ul>
		<b>Level 4</b>		
		<ul style="list-style-type: none"> <li>The recorded water level has declined atypically<sup>^</sup> below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level)</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Similar behaviour has not occurred at one of the upstream pools (beyond mining effects) or reference sites</li> </ul>	<ul style="list-style-type: none"> <li>Increase download and review of data frequency to fortnightly for sites where Level 4 has been reached</li> <li>Continue monthly download and review of data for all other sites</li> <li>Review relevant surface water level, groundwater level and streamflow data to assess comparative trends</li> <li>Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess if the change in behaviour is related to the Project, other catchment changes or the prevailing climate</li> </ul>	<ul style="list-style-type: none"> <li>Conduct detailed investigation of surface water level decline including review and assessment of streamflow records for downstream monitoring sites in comparison with suitable reference sites</li> <li>Report to DPIE and relevant government agencies within 7 days of investigation completion</li> <li>Review manual and automated water level measurements for additional monitoring sites to identify potential spatial trends in water level decline</li> <li>If it is concluded that there has been a mining-related impact then implement a corrective action management plan in accordance with a timeframe as recommended by the Environmental Response Group in consultation with the Resources Regulator</li> </ul>

<sup>^</sup> 'Atypical' surface water characteristics relate to a notable and/or rapid water level decline or change in the slope of the falling limb of the hydrograph or the water level recessionary behaviour below the cease to flow level which is inconsistent with baseline conditions and cannot be attributed to climatic conditions



**Table 18 (Cont.) Surface Water Trigger Action Response Plan**

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Impact to physical features and natural behaviour of pools	<p><u>VISUAL INSPECTIONS</u></p> <p>LOCATIONS: Stream reaches of Teatree Hollow, Teatree Hollow tributary, Dog Trap Creek, Dog Trap Creek tributary, Bargo River and Bargo River tributary.</p> <p>PRE-MINING - Observations prior to mining using fixed location photo points.</p> <p>DURING MINING - Observations every month during active the subsidence period (after 200 m of secondary extraction of relevant longwall) for sites within the active subsidence zone* using fixed location photo points.</p> <p>POST-MINING - Quarterly observations over 12 months for pools that are no longer within the active subsidence zone. This period may be extended as per a decision by the Environmental Response Group.</p>	<b>Level 1</b>		
		<ul style="list-style-type: none"> <li>No observed impacts to pool level, drainage or overland connected flow</li> </ul>	<ul style="list-style-type: none"> <li>Continue monthly monitoring</li> <li>Continue monthly review of data</li> </ul>	<ul style="list-style-type: none"> <li>No response required</li> </ul>
		<b>Level 2</b>		
		<ul style="list-style-type: none"> <li>Visually observed reduction in pool level, drainage or overland connected flow</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>The above has occurred at one of the upstream pools (beyond mining effects) or reference sites</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>Visual monitoring of pools has not noted any mining related impacts<sup>‡</sup></li> </ul>	<ul style="list-style-type: none"> <li>Continue monitoring as per monitoring program</li> <li>Continue monthly review of data</li> <li>Convene Tahmoor Coal Environmental Response Group to review response</li> </ul>	<ul style="list-style-type: none"> <li>As defined by Environmental Response Group</li> </ul>
		<b>Level 3</b>		
		<ul style="list-style-type: none"> <li>Rockbar and/or stream base cracking, gas release or iron precipitation noted during visual inspection (in excess of baseline conditions)</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>No reduction in pool water level, drainage or overland connected flow taking into account climatic conditions and observations during baseline monitoring period</li> </ul>	<ul style="list-style-type: none"> <li>Continue monitoring as per monitoring program</li> <li>Continue monthly review of data</li> <li>Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess if the change in behaviour is related to the Project, other catchment changes or the prevailing climate</li> </ul>	<ul style="list-style-type: none"> <li>As defined by Environmental Response Group</li> <li>Consider increasing inspection and review of data frequency to fortnightly for sites where Level 3 has been reached</li> </ul>
		<b>Level 4</b>		
		<ul style="list-style-type: none"> <li>Visually observed reduction in pool water level, drainage or overland connected flow taking into account climatic conditions and observations during baseline monitoring period</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>The above change has not occurred at one of the upstream pools (beyond mining effects) or reference sites</li> </ul>	<ul style="list-style-type: none"> <li>Increase inspection and review of data frequency to fortnightly for sites where Level 4 has been reached</li> <li>Continue monthly download and review of data for all other sites</li> <li>Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess if the change in behaviour is related to the Project, other catchment changes or the prevailing climate</li> <li>Conduct visual inspection of downstream reaches beyond mining effects to identify if flow re-emergence is occurring</li> <li>If flow re-emergence sites are located, implement water quality monitoring at these location(s)</li> </ul>	<ul style="list-style-type: none"> <li>Conduct detailed investigation of surface water level decline including review and assessment of streamflow records for downstream monitoring sites in comparison with suitable reference sites</li> <li>Report to DPIE and relevant agencies within 7 days of investigation completion</li> <li>If it is concluded that there has been a mining-related impact then implement a corrective action management plan in accordance with a timeframe as recommended by the Environmental Response Group in consultation with the Resources Regulator</li> </ul>

\* Survey area to include upstream, downstream and adjacent pools (to the extent of the potential impact) where a trigger exceedance has occurred at a potential impact site(s)

<sup>‡</sup> Rockbar and/or stream base cracking, gas release or iron precipitation in excess of baseline conditions

**Table 18 (Cont.) Surface Water Trigger Action Response Plan**

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Stream water quality impact	<p><u>STREAM WATER QUALITY</u></p> <p>LOCATIONS (refer Figure 9, Figure 13 and Figure 14):</p> <p>Baseline/potential impact sites:</p> <ul style="list-style-type: none"> <li>Teatree Hollow</li> <li>Teatree Hollow tributary</li> <li>Dog Trap Creek</li> <li>Dog Trap Creek tributary</li> <li>Bargo River tributary</li> </ul> <p>Reference/control sites:</p> <ul style="list-style-type: none"> <li>Upstream pools beyond mining effects (refer Table 15)</li> <li>Eliza Creek</li> <li>Carters Creek</li> <li>Hornes Creek</li> </ul> <p>PRE-MINING - Monthly sampling for minimum of 12 months prior to secondary extraction or other relevant mining activity.</p> <p>DURING MINING - Monthly sampling and analysis.</p> <p>POST-MINING - Monthly sampling and analysis for 12 months following the completion of relevant mining activities. This period may be extended as per a decision by the Environmental Response Group.</p>	<b>Level 1</b>		
		<ul style="list-style-type: none"> <li>Exceedance of an SSTV does not occur</li> </ul>	<ul style="list-style-type: none"> <li>Continue monitoring as per monitoring program</li> <li>Continue monthly review of data</li> </ul>	<ul style="list-style-type: none"> <li>No response required</li> </ul>
		<b>Level 2</b>		
		<ul style="list-style-type: none"> <li>Exceedance of an SSTV occurs in one month</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Exceedance of an SSTV occurs in the corresponding month at an upstream monitoring site (beyond mining effects) or reference site OR the value recorded at an upstream monitoring site (beyond mining effects) or reference site is greater than that recorded at the potential impact site in the corresponding month (or less than in the event of an exceedance of a pH lower trigger value)</li> </ul>	<ul style="list-style-type: none"> <li>Continue monitoring as per monitoring program</li> <li>Continue monthly review of data including analysis of water quality trends along creek (upstream to downstream) to identify spatial changes</li> <li>Convene Tahmoor Coal Environmental Response Group to review response</li> </ul>	As defined by Environmental Response Group
		<b>Level 3</b>		
		<ul style="list-style-type: none"> <li>Exceedance of an SSTV occurs in one month</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Exceedance of an SSTV does not occur in the corresponding month at an upstream monitoring site (beyond mining effects) or reference site AND the value recorded at an upstream monitoring site (beyond mining effects) or reference site is not greater than that recorded at the potential impact site in the corresponding month (or less than in the event of an exceedance of a pH lower trigger value)</li> </ul>	<ul style="list-style-type: none"> <li>Continue monitoring as per monitoring program</li> <li>Continue monthly review of data, assess if the trigger was exceeded during the baseline period prior to commencement of mining activities and undertake analysis of water quality trends along creek (upstream to downstream) to identify spatial changes</li> <li>Convene Tahmoor Coal Environmental Response Group to review response</li> </ul>	<ul style="list-style-type: none"> <li>As defined by Environmental Response Group</li> <li>Consider increasing monitoring and review of data frequency to fortnightly at sites where Level 3 has been reached</li> </ul>
		<b>Level 4</b>		
		<ul style="list-style-type: none"> <li>Exceedance of an SSTV occurs in two consecutive months</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>Exceedance of an SSTV does not occur in the corresponding two consecutive months at an upstream monitoring site (beyond mining effects) or reference site AND the values recorded at an upstream monitoring site (beyond mining effects) or reference site are not greater than that recorded at the potential impact site in the corresponding two consecutive months (or less than in the event of an exceedance of a pH lower trigger value)</li> </ul>	<ul style="list-style-type: none"> <li>Increase monitoring and review of data frequency to fortnightly for sites where Level 4 has been reached</li> <li>Continue monthly monitoring and review of data for all other sites</li> <li>Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess if the change in behaviour is related to mining effects, other catchment changes or the prevailing climate</li> <li>Immediately undertake additional water quality sampling and analysis of the site where the trigger has occurred and relevant reference sites to confirm results and that the trigger exceedance is continuing</li> <li>Undertake an investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced cracking upstream), other catchment changes, unrelated pollution or the prevailing climate</li> </ul>	<ul style="list-style-type: none"> <li>Conduct detailed investigation of water quality changes</li> <li>Report to DPIE and relevant government agencies within 7 days of investigation completion</li> <li>If it is concluded that there has been a mining-related impact then implement a corrective action management plan in accordance with a timeframe as recommended by the Environmental Response Group in consultation with the Resources Regulator</li> </ul>

### 9.3 Potential Contingency Measures

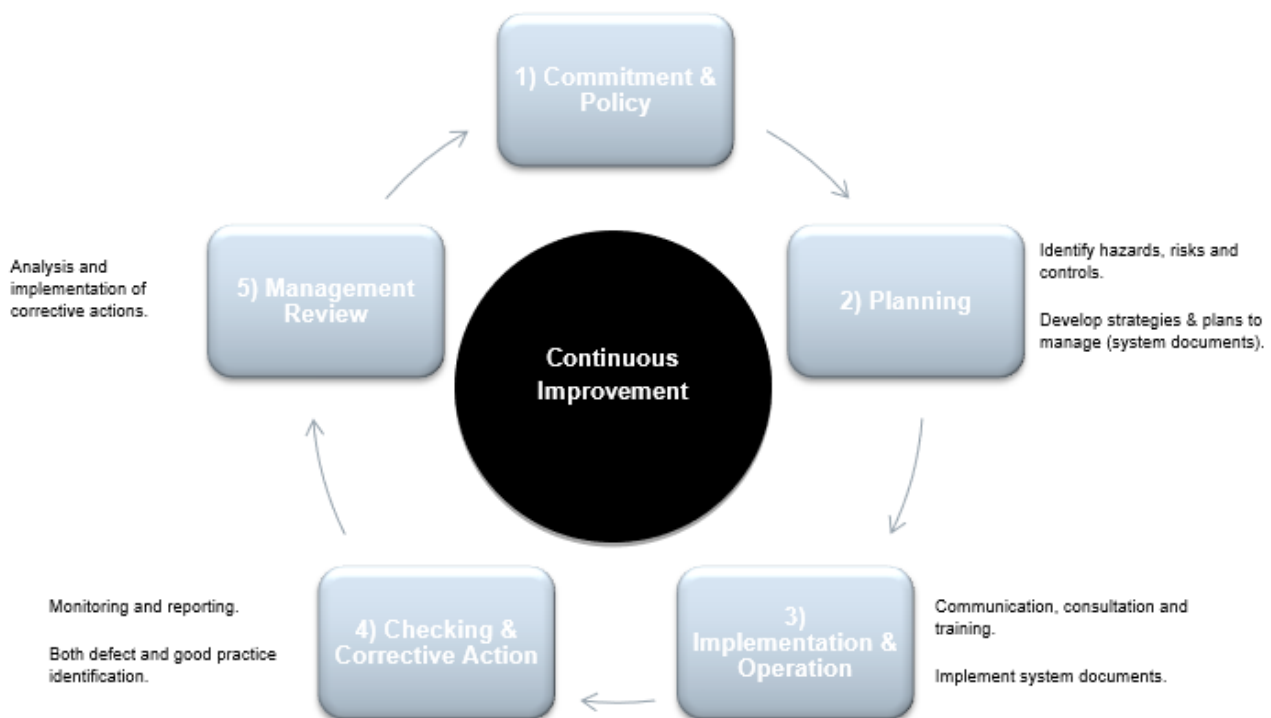
In accordance with Condition E5 (f) of the Consent, in the event that performance measures are considered to have been exceeded or are likely to be exceeded, a response will be undertaken in accordance with the Trigger Action Response Plans (TARP). The TARP responses are a contingency plan that describes the management/corrective actions which can be implemented where required to remedy the exceedance.

The success of remediation measures that have been implemented for any TARP exceedance would be reviewed as part of any Corrective Action Management Plan and the Annual Review.

In accordance with Condition E4 of the Consent, where any exceedance of the criteria or performance measures outlined within this document has occurred, Tahmoor Colliery will:

- a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur;
- b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action;
- c) within 14 days of the exceedance occurring (or other timeframe agreed by the Planning Secretary), submit a report to the Planning Secretary describing these remediation options and any preferred remediation measures or other course of action; and
- d) implement reasonable remediation measures as directed by the Planning Secretary

Tahmoor Coal have adopted the “Plan-Do-Check-Act” model as shown below. This model will be applied to all aspects of Tahmoor Coal’s environmental management and is utilised to embed the continuous improvement process in all system documents.



Potential contingency measures in the event of unforeseen impacts or impacts in excess of those predicted would include:

- conducting additional monitoring (e.g. increase in monitoring frequency or additional sampling) to inform the proposed contingency measures;
- implementing stream remediation measures to reduce the extent and effect of subsidence fracturing;

- providing a suitable offset(s) to compensate for the reduction in the quantity of water resources/flow;
- make good provisions, to be negotiated with an affected landholder, in the event that water supply from a surface water system (as designated by a Water Supply Works and Water Use Approval) is impacted; and/or
- implementing adaptive management measures – e.g. reducing the thickness of the coal seam extracted, narrowing of the longwall panels and/or increasing the setback of the longwalls from the affected area.

## 9.4 Reporting

### 9.4.1 Incidents and Non-Compliances

The Consent defines an incident 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'.

Material Harm is defined within the Consent as 'harm to the environment that:

- involves actual or potential harm to the health or safety of human beings or to the environment that is not trivial, or results in actual or potential loss or property damage of an amount, or
- amounts in aggregate, exceeding \$10,000, (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment)

Tahmoor Coal manages and responds to incidents in accordance with the following plans:

- TAH-HSEC-232 - Emergency and Incident Manual;*
- TAH-HSEC-00155 - Pollution Incident Response Management Plan; and*
- TAH-HSEC-00224 - Notification of Environmental Pollution Incidents.*

These plans have been developed to manage preparation, incident response and reporting requirements under the Protection of the Environment Operations Act 1997 (NSW).

The management plans provide roles and responsibilities, management strategies, action and response plans and record management protocols for incidents and emergencies.

In accordance with Condition E9, the Planning Secretary will be notified in writing via the Major Projects website immediately after Tahmoor South becomes aware of an incident. The notification must identify the development (including the development application number and the name of the development if it has one) and set out the location and nature of the incident. Subsequent notification requirements must be given, and reports submitted in accordance with the requirements set out in Appendix 8 of the Development Consent.

A Written Incident Notification will be submitted to the Planning Secretary via the Major Projects website within seven days after Tahmoor Coal becomes aware of an incident.

Written Incident Notifications will include:

- the development and application number;
- details of the incident (date, time, location, a brief description of what occurred and why it is classified as an incident);
- how the incident was detected;
- when Tahmoor Coal became aware of the incident;
- any actual or potential non-compliance with conditions of consent;
- describe what immediate steps were taken in relation to the incident;
- identify further action(s) that will be taken in relation to the incident; and
- identify a project contact for further communication regarding the incident.



Within 30 days of the date on which the incident occurred or as otherwise agreed to by the Planning Secretary, Tahmoor Coal will provide the Planning Secretary and any relevant public authorities (as determined by the Planning Secretary) with a Detailed Incident Report.

Detailed Incident Reports will include:

- a) a summary of the incident;
- b) outcomes of an incident investigation, including identification of the cause of the incident;
- c) details of the corrective and preventative actions that have been, or will be, implemented to address the incident and prevent recurrence; and
- d) details of any communication with other stakeholders regarding the incident.

The Consent defines a non-compliance as 'an occurrence, set of circumstances or development that is in breach of the consent'. Non-compliances or system defects detected during monitoring, inspections and audits will be managed in accordance with the *TAH-HSEC-00173 Tahmoor Coal Environmental Management Framework Document*, with corrective action plans developed and implemented to rectify any issues.

The Planning Secretary will be notified in writing via the Major Projects website within seven days after Tahmoor Colliery becomes aware of any non-compliance.

If a non-compliance is detected, the following steps will be followed:

- a) Identify and confirm the non-compliance (i.e. review against approval criteria or condition and confirm that a non-compliance has occurred);
- b) Complete internal environmental incident reporting documentation including an investigation to capture all relevant information;
- c) In accordance with the relevant approval, determine what action (i.e. external reporting) is required. Specifically, determine if immediate reporting is required and to which stakeholders, or ensure that the event is captured for future reporting;
- d) Following the incident investigation, develop a corrective action plan aimed at preventing future re-occurrence; and
- e) Complete all required reporting and consult with relevant agencies on the corrective action plan to be implemented.

A non-compliance notification will identify the following:

- a) the development and the application number,
- b) the condition of consent that the development is non-compliant with
- c) the way in which it does not comply and the reasons for the non-compliance (if known); and
- d) any actions which have been, or will be, undertaken to address the non-compliance.

A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.

#### **9.4.2 General Reporting**

Water management performance at the Tahmoor Mine is documented each year in the Annual Environmental Management Review or Annual Review and is distributed among relevant government agencies and uploaded to the Tahmoor Coal website. Information reported in the document relates to any water related incidents, water related community complaints, water make volume for the year, water quality and discharge volumes from site. In accordance with EPL 1389, LDP1 water quality results and discharge volumes are uploaded to the Tahmoor Coal website on a monthly basis.

As a component of the Annual Environmental Management Review or Annual Review, the site water and salt balance would be updated and the performance of the water management system would be assessed through comparison of the monitored and predicted water and salt balance. Revision to the WMP would be undertaken if the performance review indicates that the water management system has, or is likely to

be, unable to meet its regulatory performance requirements. The WMP revision would document the measures to be implemented and their effectiveness in meeting regulatory requirements.

#### 9.4.3 Exceedances

For the purposes of this plan, an exceedance is defined 'any instance where monitoring results show an exceedance of criterion outlined within the Consent or other regulatory instrument'. Exceedances will be managed by Tahmoor Coal through the Contingency Plan process as outlined in Section 9.2 and 9.3.

#### 9.4.4 Complaints and Disputes

Community Complaints at Tahmoor Coal are managed in accordance with *TAH-HSEC-00119- Communication and Engagement* and *TAH-HSEC-00120- Community Complaints & Enquiry Procedure*. Tahmoor Coal operates a 24-hour complaints line (1800 154 415) for receiving community complaints and other stakeholder communications. The general process detailed in *TAH-HSEC-00120- Community Complaints & Enquiry Procedure* for responding to complaints is:

- a) Acknowledging all complaints and responding to the complainant within 24 hours where practicable;
- b) Registering all complaint details in Cority;
- c) Investigating complaints impartially considering the facts and the circumstances prevailing at the time;
- d) Implementing corrective actions if required; and
- e) Reporting to relevant stakeholders of investigation outcomes and corrective actions taken.

A record of all community complaints in relation to activities undertaken by the licensee must be kept in a legible form and be in accordance to Tahmoor Coal's Environmental Protection Licence 1389.

The following information will also be kept in the event of a community complaint; as required by Section M4 in Tahmoor Coal's EPL 1389:

- a) The date and time of the complaint;
- b) The method by which the complaint was made;
- c) Any personal details of the complainant which were provided by the complainant or a note to that effect;
- d) The nature of the complaint;
- e) The action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
- f) If no action was taken by the licensee, the reasons why no action was taken.

These records must be kept for at least 4 years after the complaint was made and be able to be produced to any authorised officer who asks to see them.

In the event of a dispute or conflict between Tahmoor Coal personnel and a member of the community, the Tahmoor Coal E&C Manager will facilitate communication between both parties to reach a resolution, which may include a meeting with the complainant to discuss the issue.

Where relevant, negotiations will be initiated in accordance with any relevant Consent conditions. This general process is documented in *TAH-HSEC-00119- Communication and Engagement*. If a dispute cannot be resolved, the matter will be escalated to involve the site Operations Manager or General Manager as required and may involve consultation with the relevant government agency to assist in reaching a determination on the matter.

### 9.5 Effectiveness

The effectiveness of surface water management measures will continue to be evaluated throughout the life of the mine through. Additional management controls will be investigated and implemented where practicable.

Potential contingency and adaptive management measures will be implemented accordingly as outlined in Section 9.3.

## 10 Review and Improvement

### 10.1 Audit

Audits of the SWMP shall be conducted in consultation with the Plan owner and nominated individuals and shall focus on the content and implementation.

Audits on the content shall consist of a determination of understanding of the SWMP by the individual's allocated responsibility under this plan.

Audits on the implementation shall consist of reviews of the safe working procedures and risk assessments developed to ensure safe operation of the SWMP, they may also involve discussions with personnel involved in the management plan to determine understanding and compliance.

Should an audit of the SWMP determine that a deficiency is evident in the content or implementation; a corrective action must be developed and implemented. Actions will be assigned to a nominated individual and tracked in CMO.

Tahmoor Coal is responsible to verify that the nominated corrective action has been implemented by way of a follow up audit.

Any changes to the SWMP are to be managed and communicated to all personnel in line with the Change Management Process.

### 10.2 Review

This SWMP will be reviewed:

- Event based:** In accordance with Condition E7 (a) of the Consent, a review will be required within 3 months of any incident, event or finding that identifies an inadequacy in the SWMP, risk assessment or associated documents to continue to effectively manage the identified hazard; a change to the workplace itself or any aspect of the work environment, a change to a system of work, a process or a procedure; or
- In accordance with Condition E8 if necessary, to either improve the environmental performance of the development, cater for a modification or comply with a direction, the strategies, plans and programs must be revised, to the satisfaction of the Planning Secretary. Where revisions are required, the revised document must be submitted to the Planning Secretary for approval within six weeks of the review; or
- Time based:** in the absence of regular event-based reviews and in accordance with Condition E7 (b-e) of the Consent, this plan will be reviewed within three months of:
- b) the submission of an Annual Review under Condition E13;
  - c) the submission of an Independent Environmental Audit under Condition E15;
  - d) the approval of any modification of the conditions of this consent (unless the conditions require otherwise); or
  - e) notification of a change in development phase under Condition A19.

If deemed appropriate, external service providers may be included in the review process. All reviews are to be documented.

### 10.3 Change Information

Details of the document history are provided in Table 19.

**Table 19 Document History**

Version	Date Reviewed	Review Team	Change Summary
Draft Rev 0	7/12/2021	Michelle Grierson, April Hudson, Natalie Brumby, Thomas O'Brien, Zina Ainsworth	Minor text changes
Draft Rev 1	13/12/2021	Michelle Grierson, April Hudson, Natalie Brumby, Thomas O'Brien, Zina Ainsworth	Minor text changes
Final Rev 0	22/12/2021	DPIE-Water and EPA	Revision in response to DPIE-Water and EPA comments
Final Rev 1	18/3/2022	DPIE-Water	Revision in response to DPIE-Water comments

#### 10.4 Access to Information

Information pertaining to Tahmoor Coal's general environmental performance against internal targets and external approvals criteria is reported to the community via the mine website and Tahmoor Coal's Community Consultative Committee (TCCCC). Examples of reports to government agencies include:

- a) Environmental Protection Licence Annual Return (submitted to Environment Protection Authority);
- b) Annual Review (submitted to Department of Planning & Infrastructure, Council, TCCCC etc.); and
- c) Independent Environmental Audit (submitted to Department of Planning & Infrastructure).

These reports are prepared in accordance with relevant guidelines and *TAH-HSEC-00119- Communication and Engagement* and are published on Tahmoor Coal's website in accordance with *TAH-HSEC-00221- Website Management Procedure*.

In accordance with Condition E23, Tahmoor Coal have made the following information and documents publicly available on its website:

- i. the EIS;
- ii. all current statutory approvals for the development;
- iii. all approved strategies, plans and programs required under the conditions of this consent;
- iv. the proposed staging plans for the development if the construction, operation or decommissioning of the development is to be staged;
- v. minutes of CCC meetings;
- vi. regular reporting on the environmental performance of the development in accordance with the reporting requirements in any plans or programs approved under the conditions of this consent;
- vii. a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs;
- viii. a summary of the current phase and progress of the development;
- ix. contact details to enquire about the development or to make a complaint;
- x. a complaints register, updated monthly;
- xi. a register of incident and non-compliance notifications made to the Planning Secretary, updated monthly;
- xii. the Annual Reviews of the development;
- xiii. audit reports prepared as part of any Independent Environmental Audit of the development and the Applicant's response to the recommendations in any audit report;
- xiv. annual returns made under the National Greenhouse and Energy Reporting legislation
- xv. any other matter required by the Planning Secretary; and
- xvi. Tahmoor Coal will keep such information up to date, to the satisfaction of the Planning Secretary.



# 11 References

- AECOM (2018). "Tahmoor South Project Environmental Impact Statement". Prepared for Tahmoor Coal, December.
- ANZECC (2000). "Australian and New Zealand Guidelines for Fresh and Marine Water Quality". National Water Quality Management Strategy, Paper No. 4. Volume 1. The Guidelines, Chapter 1-7. Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resources Management Council of Australia and New Zealand (ARMCANZ).
- ANZG (2018). "Australian and New Zealand Guidelines for Fresh and Marine Water Quality". Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at [www.waterquality.gov.au/anz-guidelines](http://www.waterquality.gov.au/anz-guidelines).
- DECC (2008). "Managing Urban Stormwater Soils and Construction – Volume 2E – Mines and Quarries". NSW Department of Environment and Climate Change, Sydney, June.
- Fluvial Systems (2013). "Tahmoor South Project Environmental Impact Statement Technical Specialists Report Geomorphology". Prepared for Tahmoor Coal, December.
- HydroSimulations (2018). "Tahmoor South Project EIS: Groundwater Assessment". Prepared for Tahmoor Coal, December.
- Landcom (2004). "Managing Urban Stormwater: Soils & Construction Volume 1", 4th edition, March.
- Strahler, AN (1952). "Dynamic Basis of Geomorphology", *Bulletin of the Geological Society of America*, no. 63, pp. 923–938.

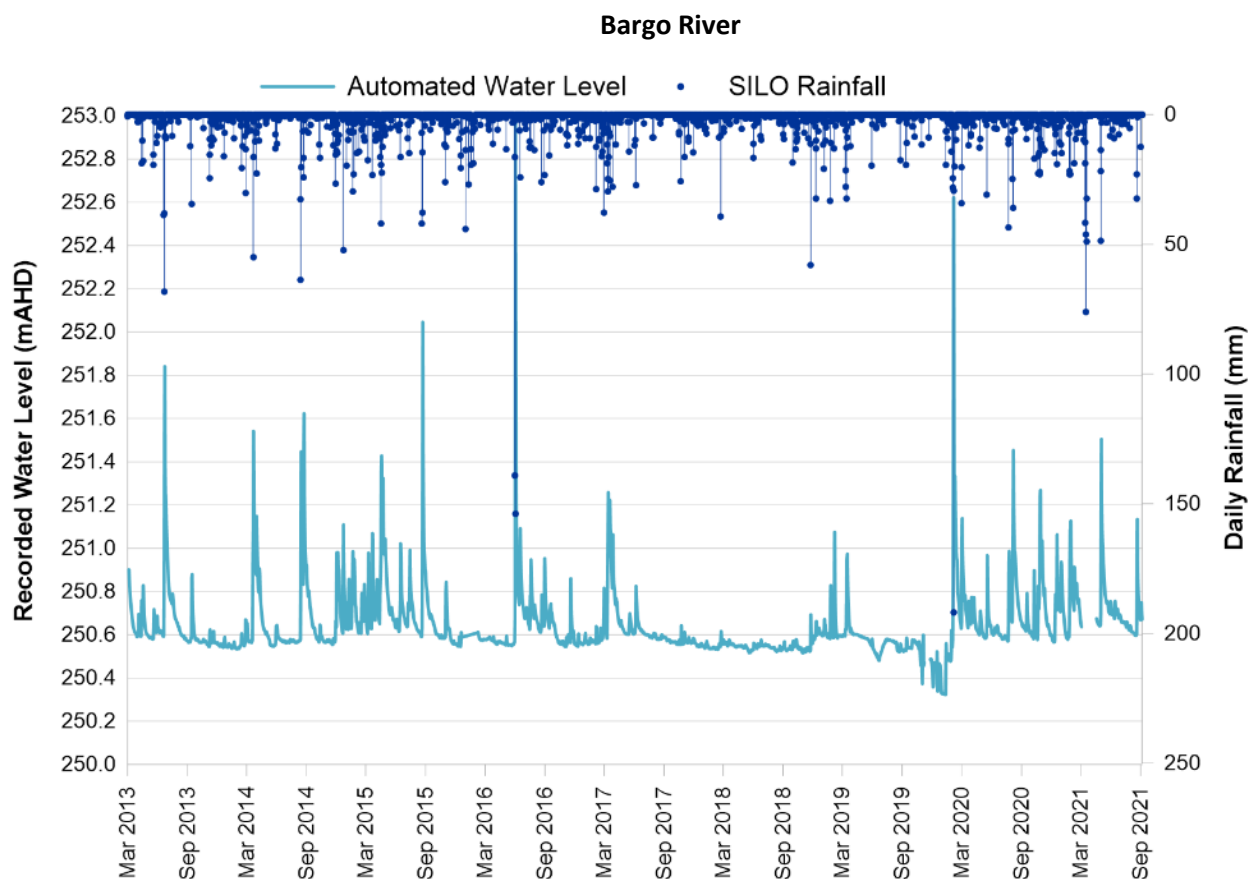
# Appendix A Stakeholder Comments and Responses

Stakeholder	Stakeholder Comment	Response
Department of Planning, Industry and Environment (DPIE) - Water (19 January 2022)	A copy of the Fluvial Systems geomorphological survey and report on stream condition should be made available to DPE Water and a copy held on site for reference.	A copy of the <i>Tahmoor South Project Environmental Impact Statement Technical Specialists Report Geomorphology</i> (Fluvial Systems, 2013) has been provided to DPIE and a copy held on site for reference.
	A record of pre- and post- subsidence state of key rock bars and pools should be maintained for review of impact predictions reporting.	The Extraction Plan will present the monitoring and reporting requirements in relation to potential subsidence impacts on pool physical features and surface water resources. The reporting requirements will include record of the pre- and post-subsidence conditions of key rock bars and pools.
Environment Protection Agency (EPA)	<p>Section 8.1.1 Water Monitoring Plan</p> <p>Chloride be added to the list of parameters to be analysed in the monthly monitoring program.</p> <p>Chloride analysis will provide the ability to distinguish electrical conductivity caused by alkaline mine water from conductivity caused by background salinity from the local Ashfield shale (Wianamatta) rock unit and its product soils. This is the case for Tea Tree Hollow where higher conductivity readings in the upper sections are likely due to shale seeps but alkalinity dominates the creek below the LDP1 discharge further downstream (related observation are made in section 4.2.2 of the plan).</p>	Chloride is currently monitored at all monitoring sites on a monthly basis by Tahmoor Coal. Chloride was inadvertently excluded from Section 4.1.2, Section 8.1.1 and Appendix B of the draft SWMP. Section 4.1.2, Section 8.1.1 and Appendix C (previously Appendix B) have been updated to include chloride.
	<p>Appendix B Water Quality Monitoring Tables</p> <p>There appear to be a few typographical or transcription errors in the tables which could be reviewed for accuracy. A couple of examples are given here.</p> <p>The data presented in the table on page 72 (BR1-QLa etc) appears to have been inadvertently copied to the table on page 74 (BR14-QLa).</p> <p>There appears to be an error in data presented in the table on page 76. The median field electrical conductivity at TT4-QLa is not given but values range from 157 to 1238 uS/cm. The corresponding total alkalinity values for TT4-QLa are only 3 to 19 mg/L which are much lower than would be expected from a site downstream of the reject emplacement sedimentation basins. A similar comment applies for TT8-QLa located downstream of the minewater discharge (median EC 2097 uS/cm but the median total alkalinity is only 14 mg/L, on page 78).</p>	<p>The water quality data summary tables in Appendix C (previously Appendix B) of the revised SWMP have been corrected and reviewed for accuracy.</p> <p>The total alkalinity values have now been entered into the correct row and indicate that a range of 52 to 712 mg/L has been recorded at TT4-QLa and a range of 681 to 1,320 mg/L total alkalinity recorded at TT8-QLa.</p>

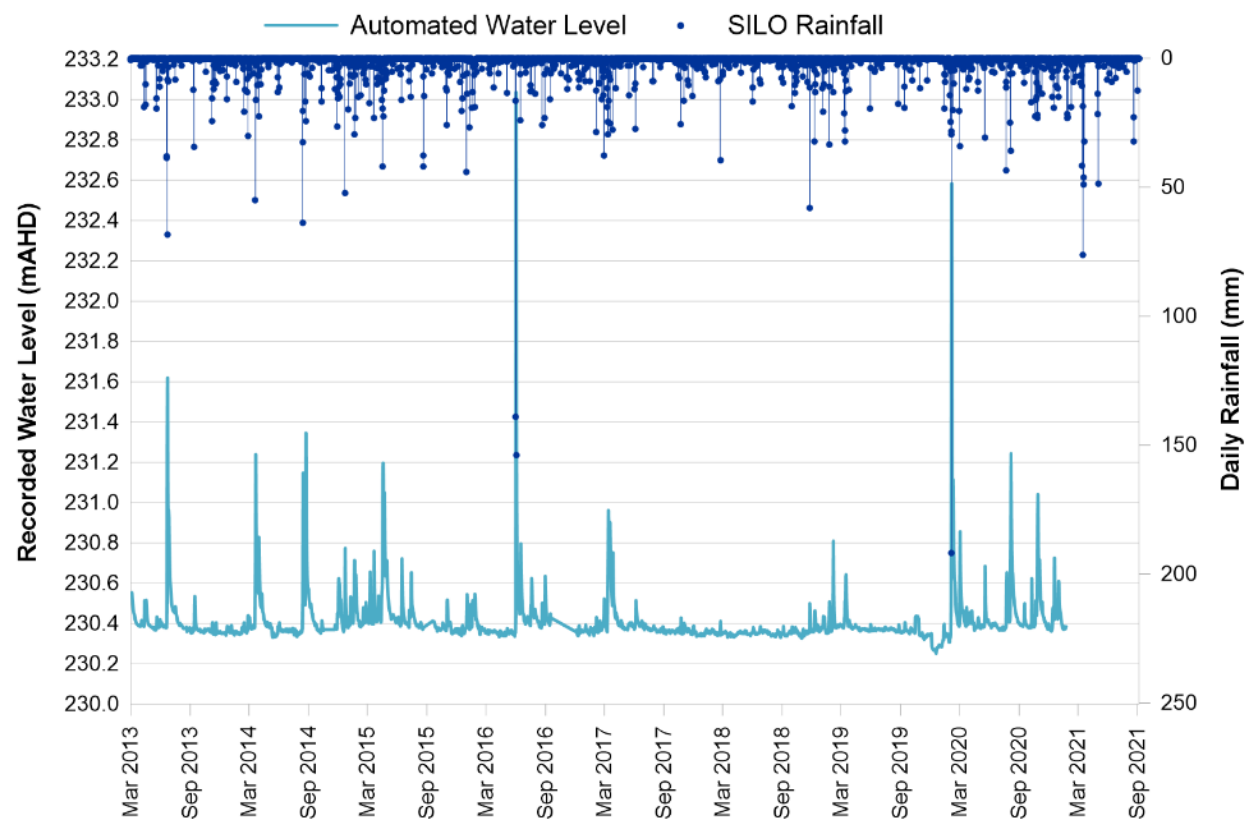
Stakeholder	Stakeholder Comment	Response
Department of Planning, Industry and Environment (DPIE) - Water (14 February 2022)	Describe the water management system for the REA expansion and new ventilation shaft site. Describe the new approved STP.	Additional detail on the proposed management of water stored in sediment dams S12 and S13 has been included in Section 5.1.4 of the revised SWMP. Figure 12 of the SWMP has been revised to reflect the updated text. Section 5.1.1 of the SWMP has been revised to provide details of the upgraded sewage treatment plant.
	Provide details of on-site chemical and hydrocarbon storage.	Section 5.1.2 of the revised SWMP describes the management of hazardous chemicals and hydrocarbon storage. Hazardous chemicals and hydrocarbon products are stored in bunded areas in accordance with relevant Australian Standards.



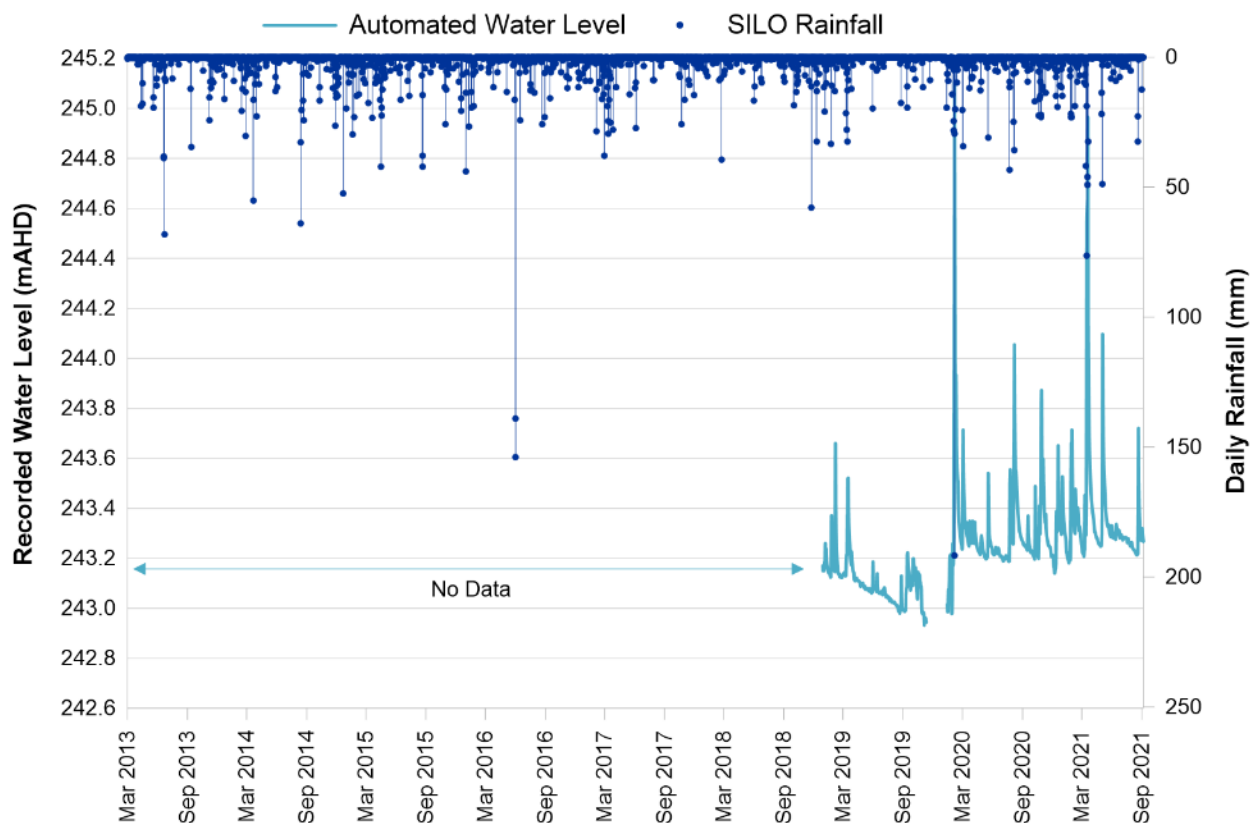
# Appendix B   Surface Water Level Plots



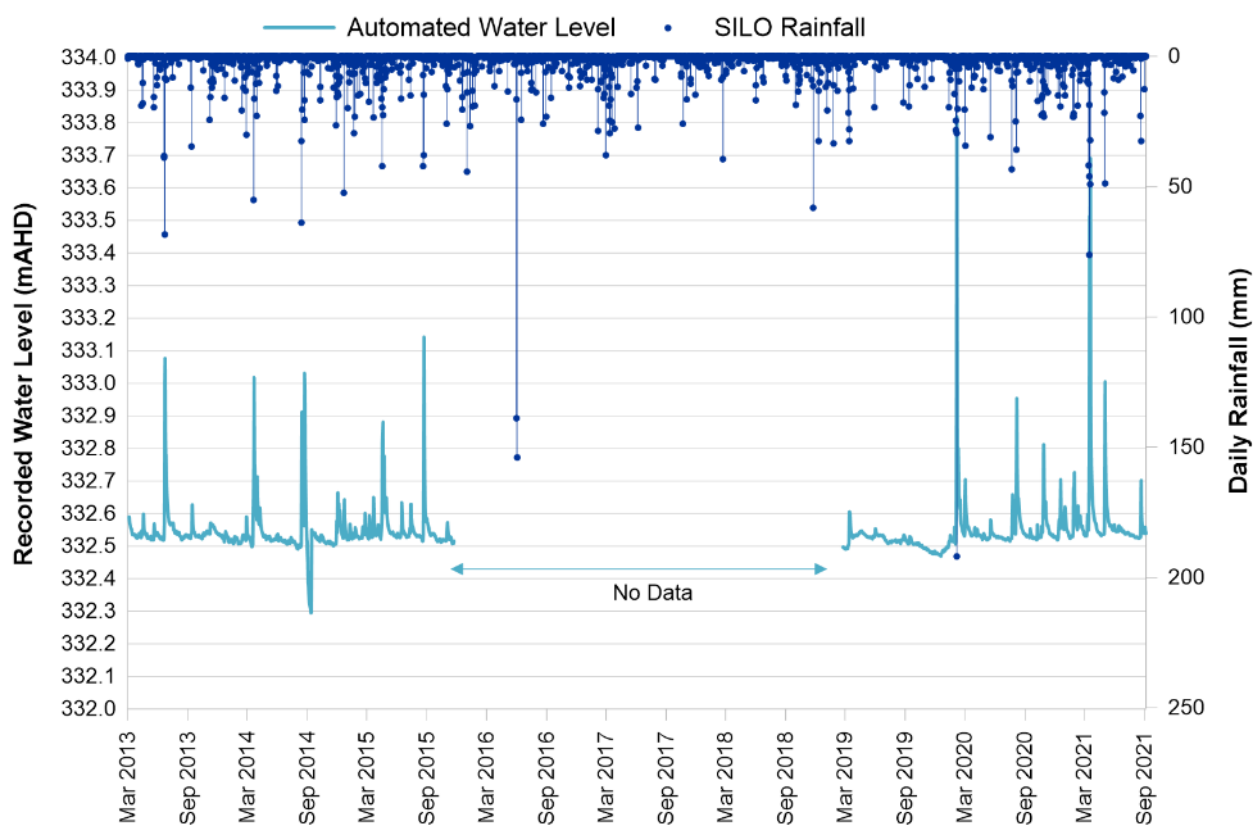
**Figure A1**      **BR13-QLa Water Level Records**



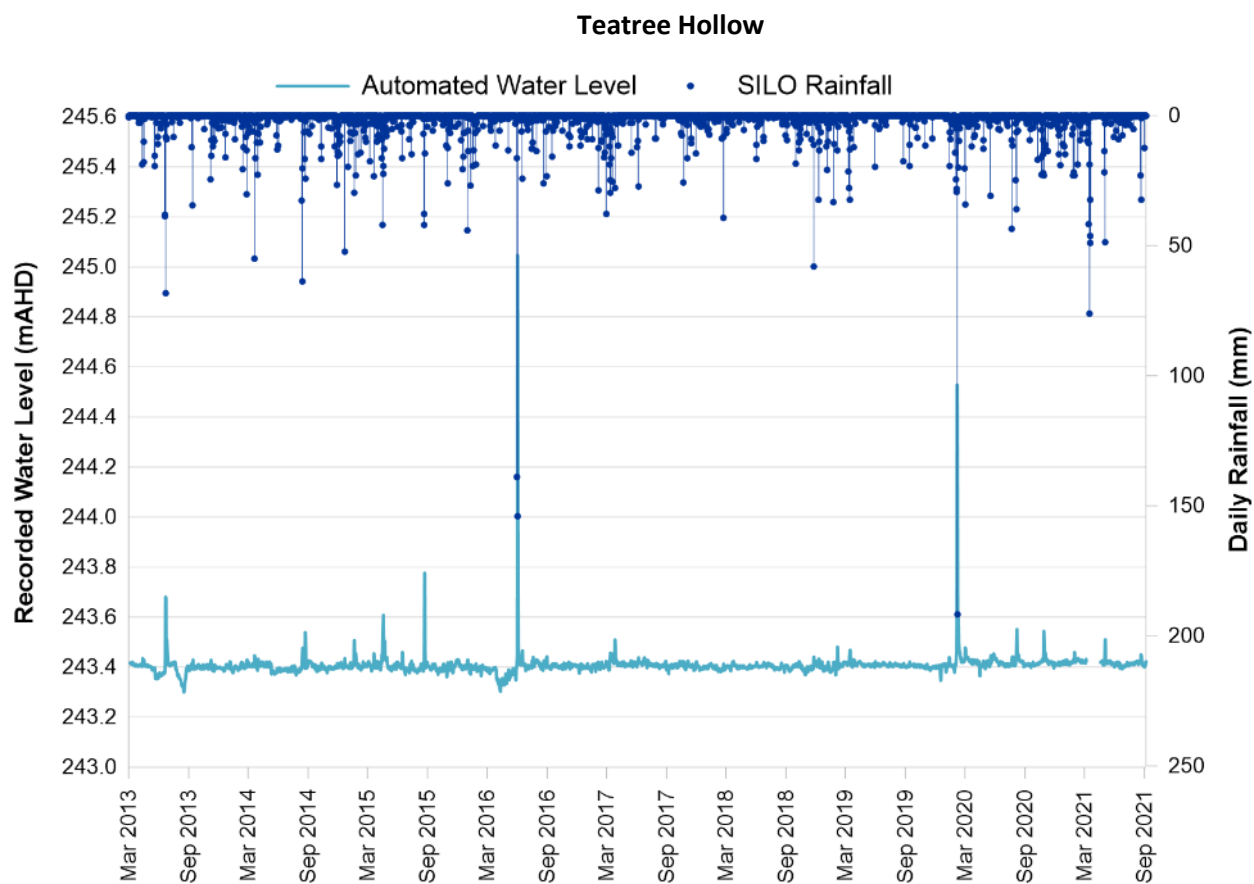
**Figure A2**      **BR14-QLa Water Level Records**



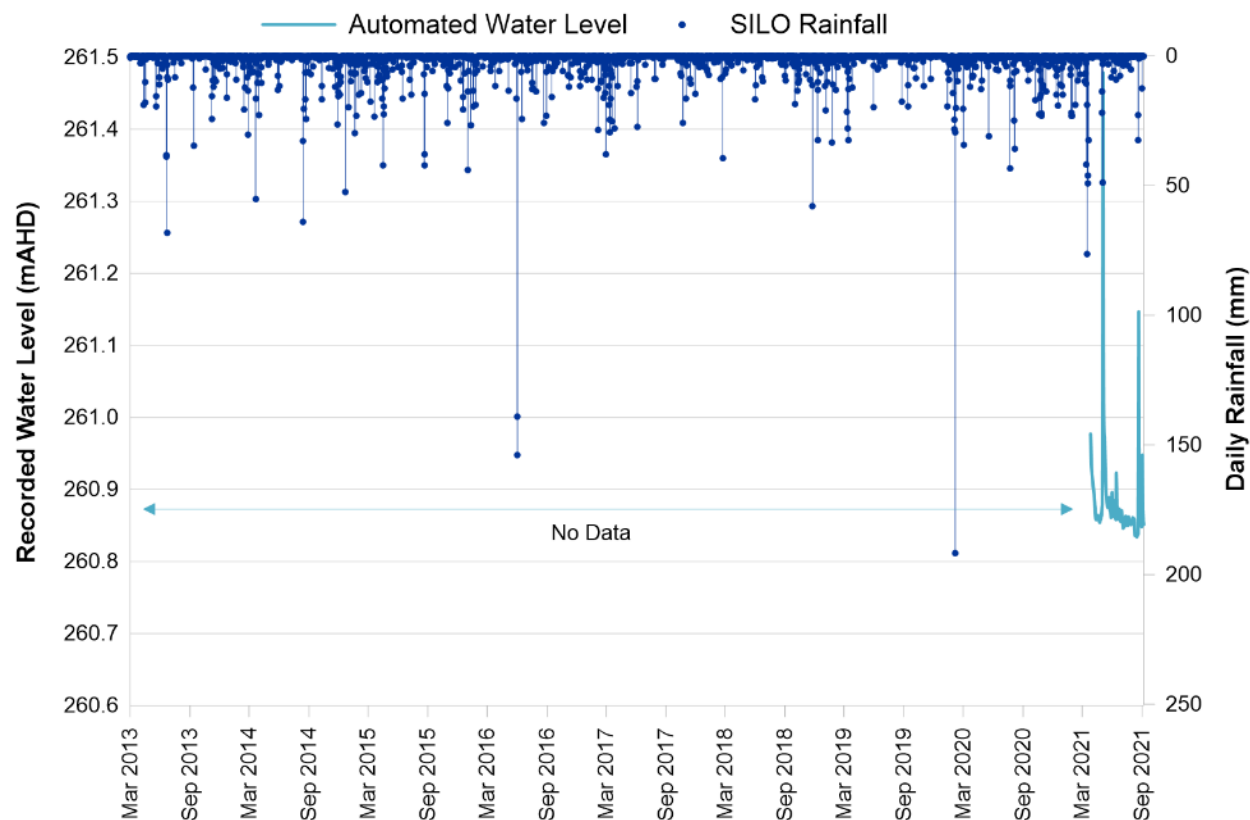
**Figure A3** BR2-QLa Water Level Records



**Figure A4** BR1-QLa Water Level Records

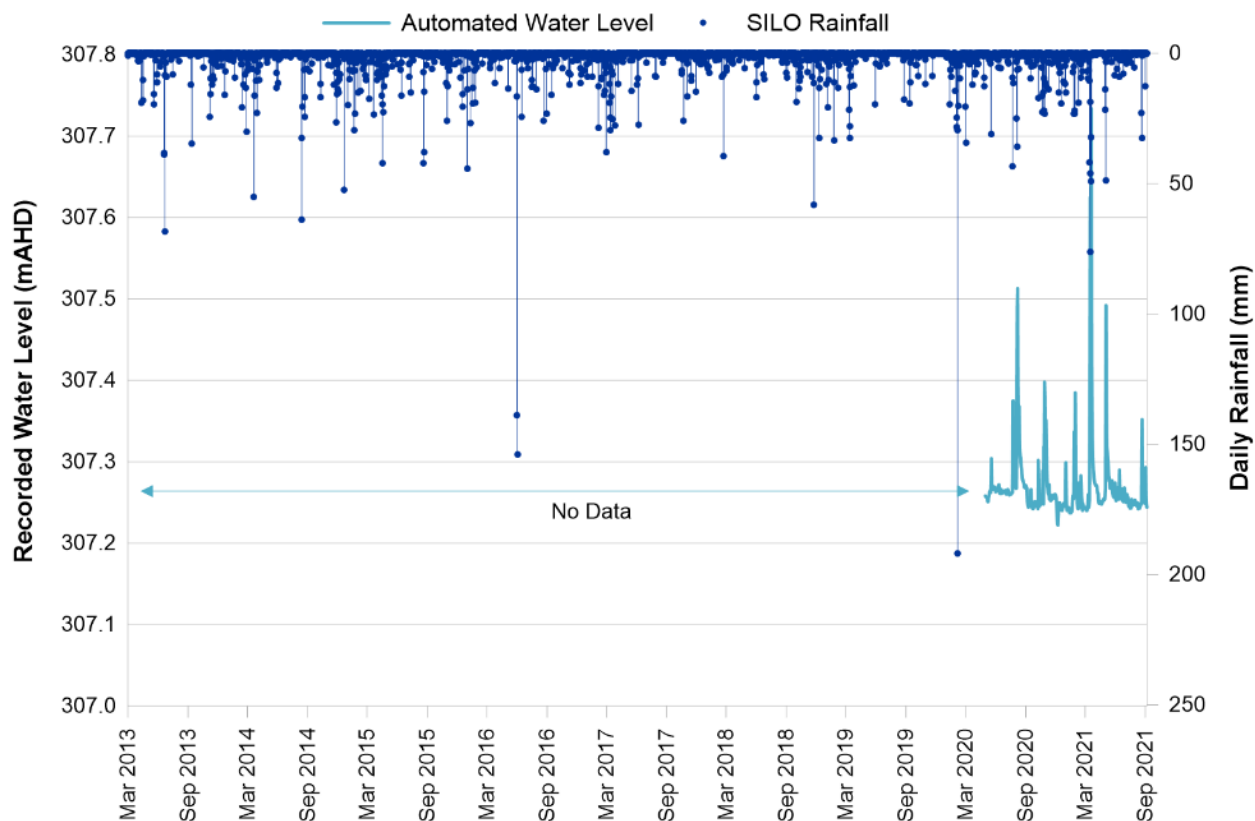


**Figure A5** TT8-QLa Water Level Records

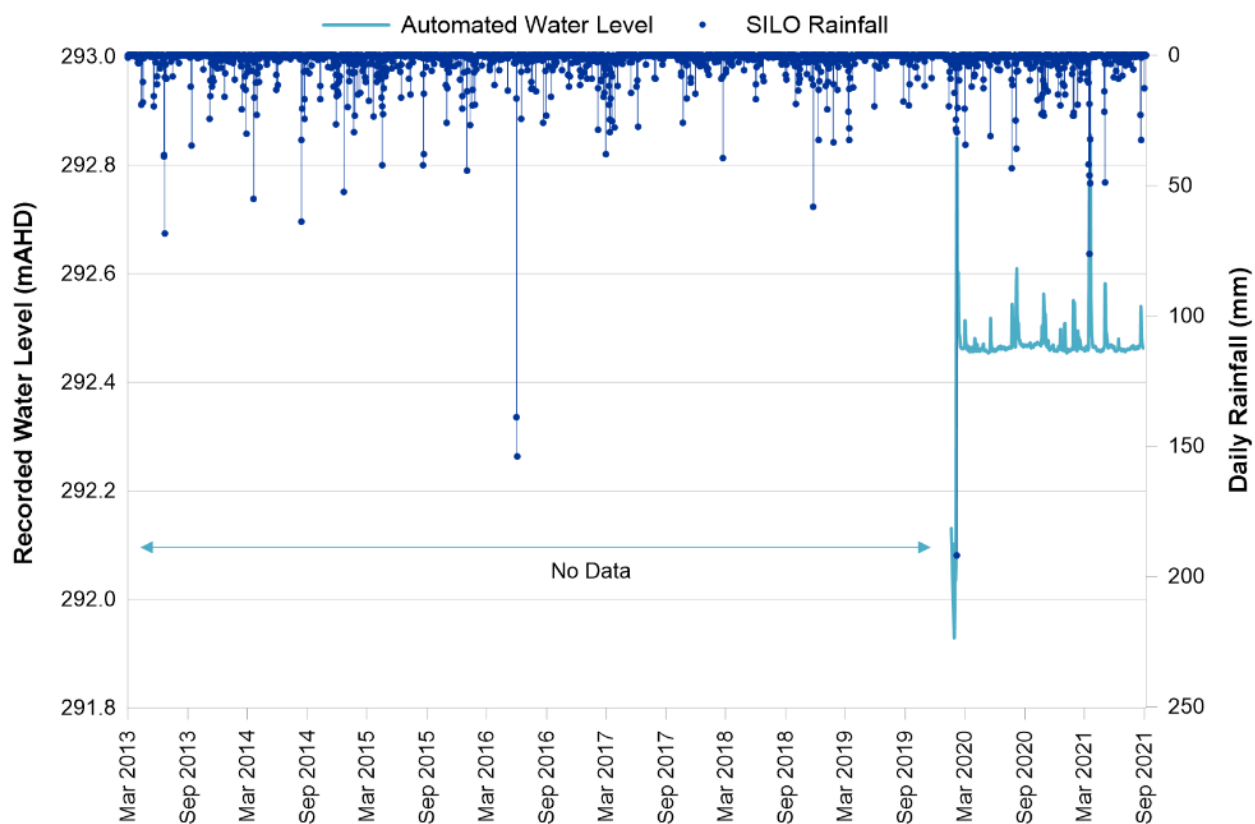


**Figure A6** TT6-QLa Water Level Records

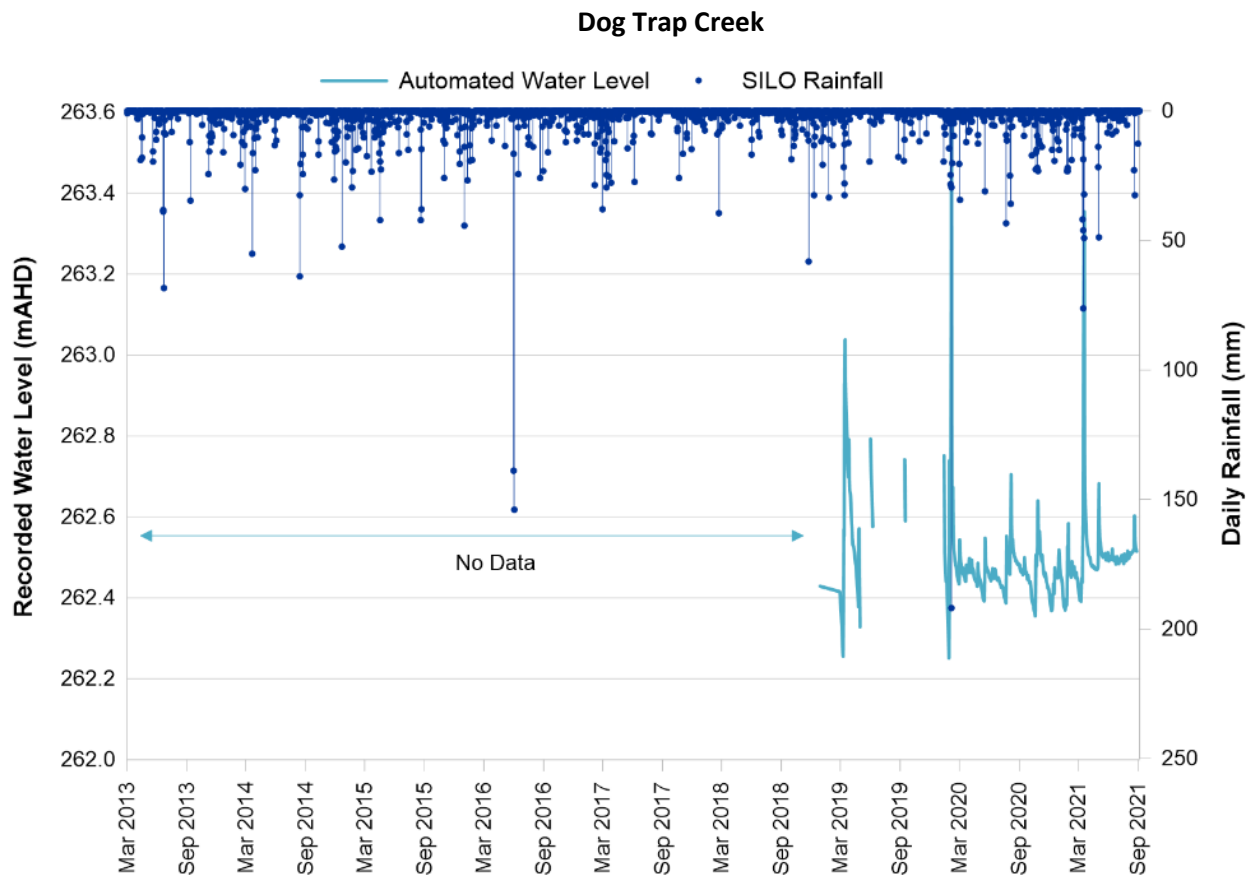




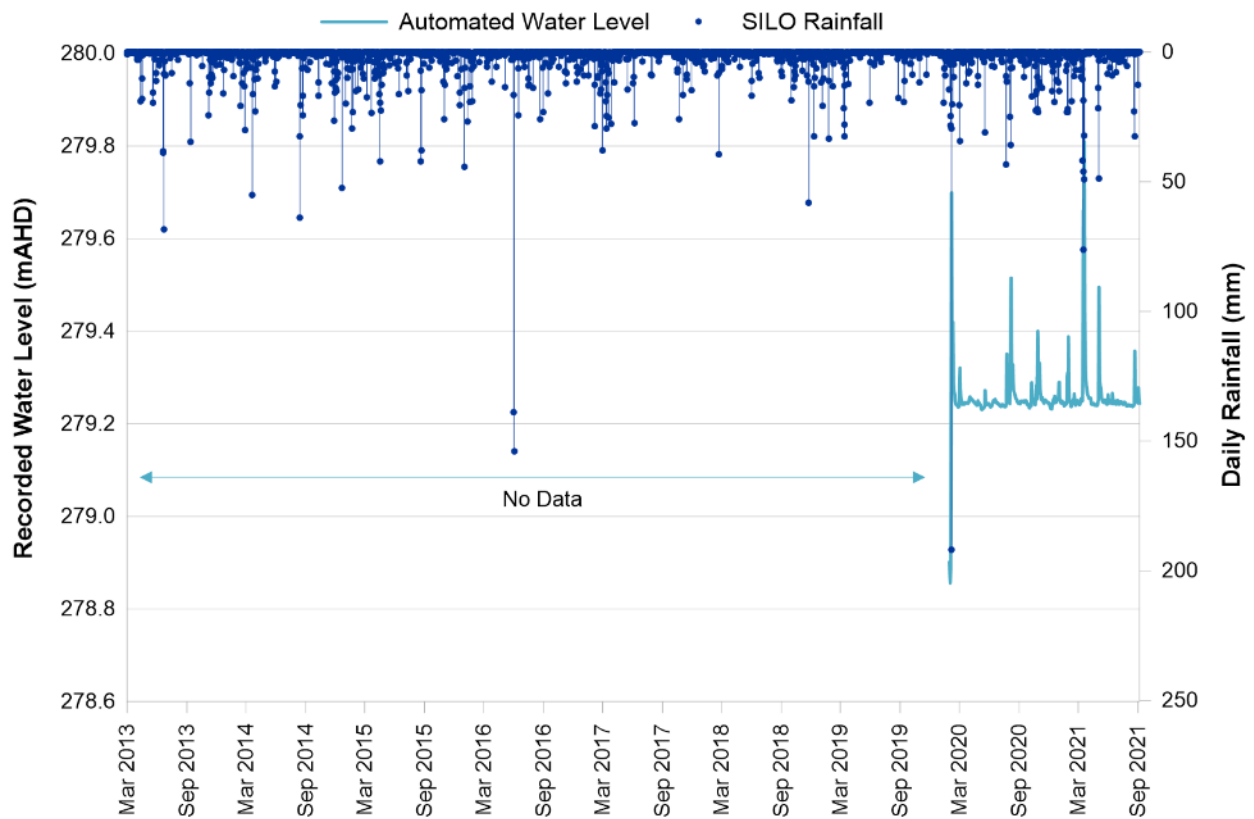
**Figure A7** TT4A-QLa Water Level Records



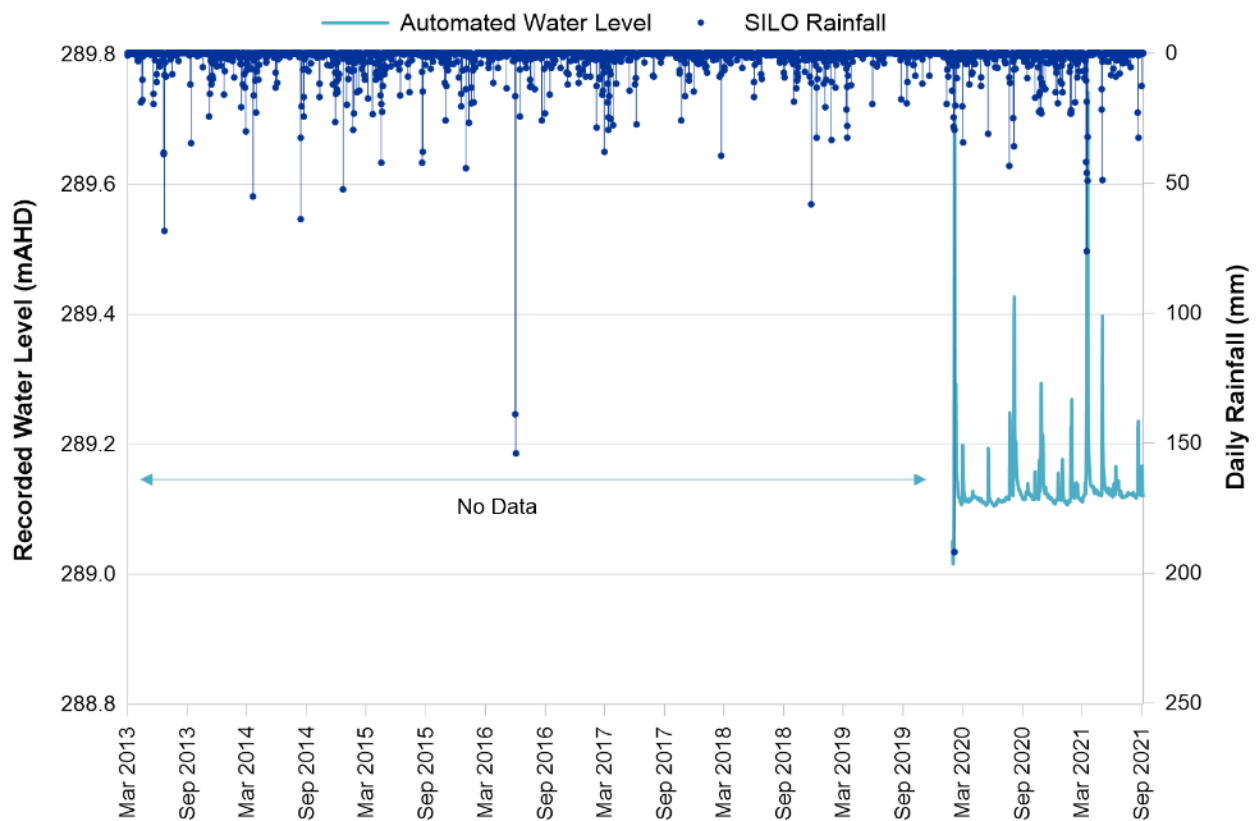
**Figure A8** TT1-QLa Water Level Records



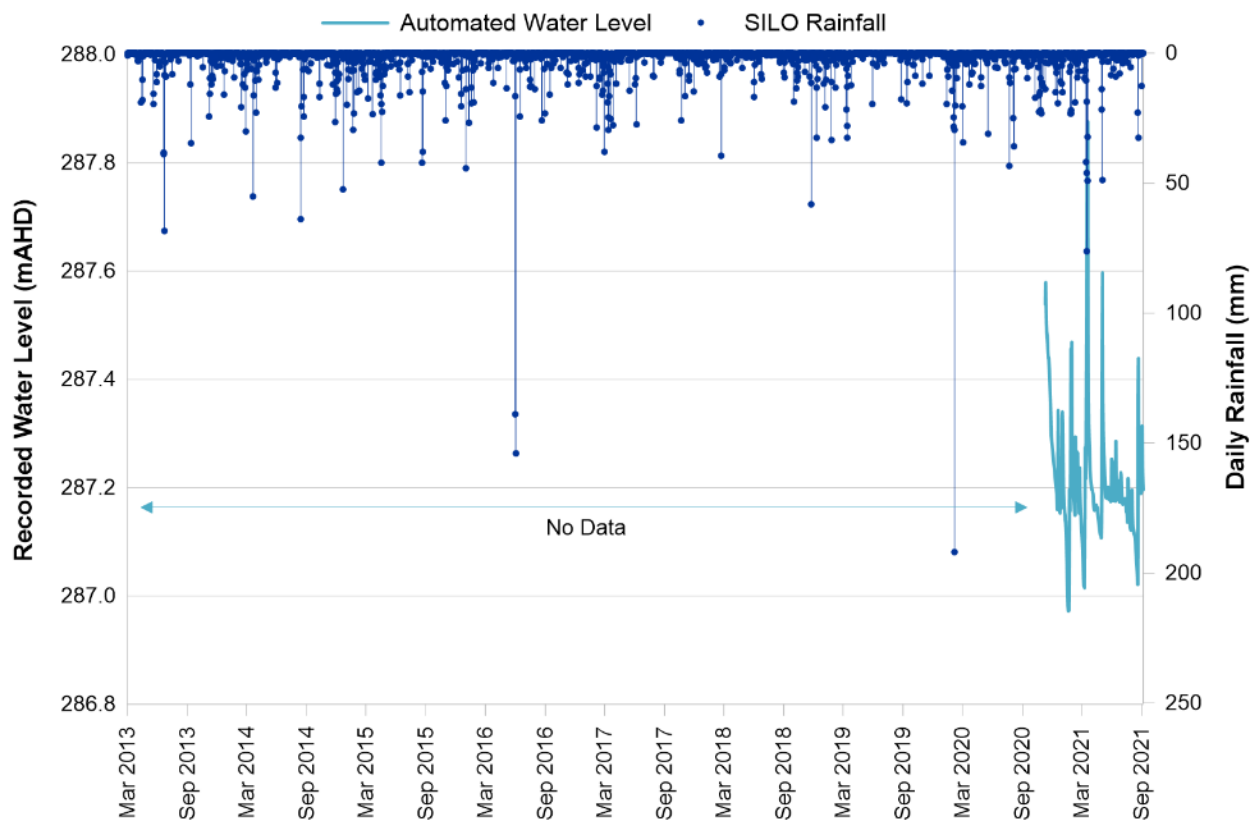
**Figure A9 DT3a-QLa Water Level Records**



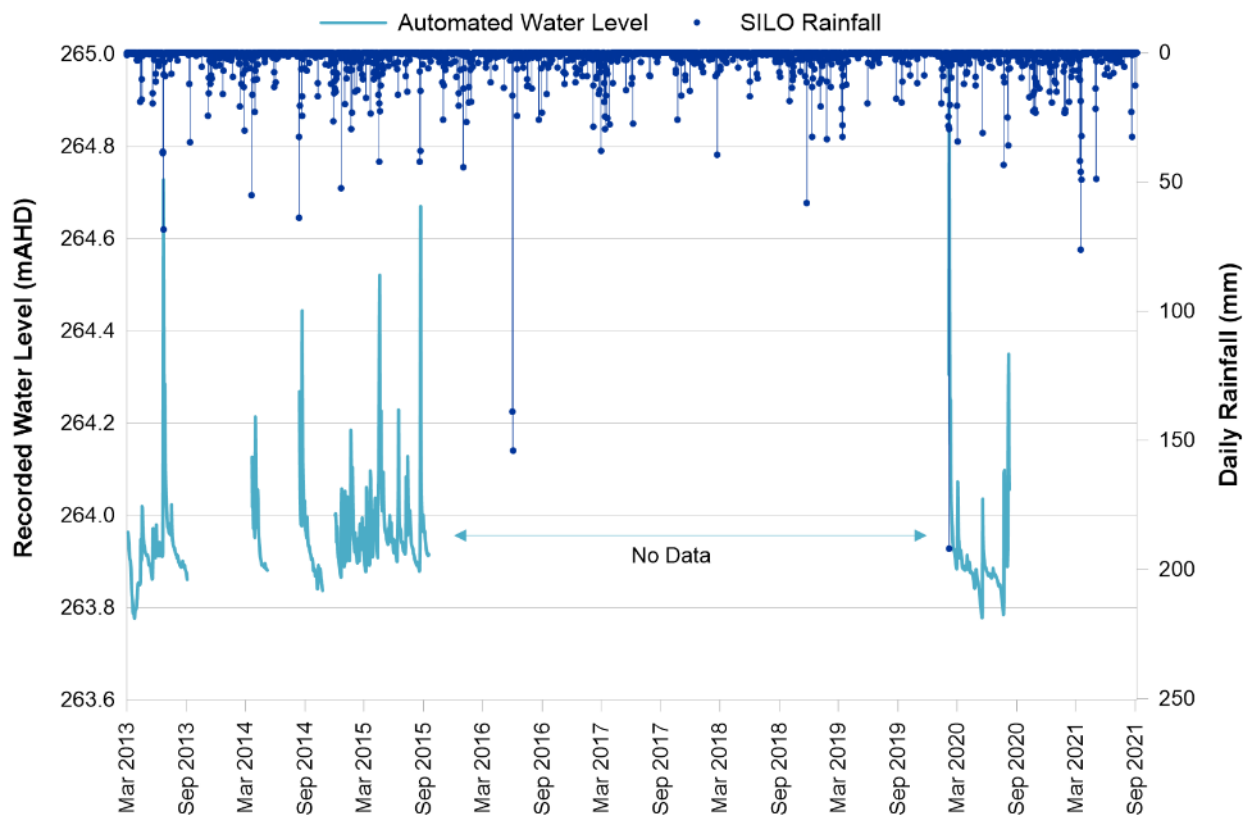
**Figure A10 DT32-QLa Water Level Records**



**Figure A11 DT64-QLa Water Level Records**



**Figure A12 DT73-QLa Water Level Records**



**Figure A13 DT43-QLa Water Level Records**



# Appendix C Water Quality Monitoring Summary Tables

## Bargo River (BR1-QRLa and BR13-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	BR1-QRLa					BR13-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Field pH	6.5 - 8.5 <sup>†</sup>	25	5.4	7.09	8.21	8%	29	5.73	7.11	9.11	7%
Lab pH	6.5 - 8.5 <sup>†</sup>	48	5.35	6.90	8.84	38%	50	3.73	6.83	8.93	38%
Field EC (µS/cm)	350 <sup>†</sup>	25	103	185	282	0%	29	136	213	406	7%
Lab EC (µS/cm)	350 <sup>†</sup>	48	92	165	342	0%	51	19	196	490	6%
Field DO	-	25	4.66	10.02	11.87		29	4.76	10.08	6.75	
Sulphate as Turbidimetric SO <sub>4</sub>	400*	48	<1	<3.5	19	0%	56	<2	<5	18	0%
Total Alkalinity as CaCO <sub>3</sub>	500*	48	<1	8	50	0%	56	<1	7	57	0%
Chloride	400*	47	22	45	60	0%	56	21	49	119	0%
Dissolved Calcium	-	48	1	3	11		56	1	3	17	
Dissolved Magnesium	-	48	2	5	12		56	1	5	14	
Dissolved Potassium	-	55	1	2	6		56	2	2	13	
Dissolved Sodium	-	48	13	21	30		20	17	24.5	50	
Dissolved Aluminium	0.055 <sup>†</sup>	18	<0.01	0.02	0.08	17%	20	<0.01	<0.01	0.08	10%
Dissolved Arsenic	0.024 <sup>†</sup>	18	<0.001	<0.001	<0.001	0%	20	<0.001	<0.001	<0.001	0%
Dissolved Barium	1*	18	0.01	0.01	0.03	0%	20	0.01	0.02	0.055	0%
Dissolved Copper	0.0014 <sup>†</sup>	18	<0.001	<0.001	<0.001	0%	20	<0.001	<0.001	<0.001	0%
Dissolved Iron	0.3*	18	<0.05	0.28	0.87	44%	20	<0.05	0.22	1.52	40%
Dissolved Lead	0.0034 <sup>†</sup>	18	<0.001	<0.001	<0.001	0%	20	<0.001	<0.001	<0.001	0%
Dissolved Lithium	-	18	<0.001	<0.001	0.003		20	<0.001	<0.001	0.003	
Dissolved Manganese	1.9 <sup>†</sup>	18	0.03	0.08	0.41	0%	20	0.06	0.16	0.638	0%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; <sup>‡</sup> ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.

## Bargo River (BR1-QRLa and BR13-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	BR1-QRLa					BR13-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Dissolved Nickel	0.011 <sup>†</sup>	18	<0.001	<0.001	<0.001	0%	20	<0.001	<0.001	0.006	0%
Dissolved Selenium	0.011 <sup>†</sup>	18	<0.01	<0.01	<0.01	0%	20	<0.01	<0.01	<0.01	0%
Dissolved Strontium	-	18	0.01	0.02	0.12		20	0.02	0.03	0.13	
Dissolved Zinc	0.008 <sup>†</sup>	18	<0.005	<0.005	0.014	17%	20	<0.005	<0.005	0.023	25%
Total Aluminium	0.055 <sup>†</sup>	48	<0.01	0.05	2.57	44%	56	<0.01	0.055	1.03	50%
Total Arsenic	0.024 <sup>†</sup>	48	<0.001	<0.001	<0.001	0%	56	<0.001	<0.001	<0.001	0%
Total Barium	1 <sup>*</sup>	48	0.01	0.01	0.04	0%	56	0.009	0.02	0.09	0%
Total Cadmium	0.0002 <sup>†</sup>	22	0.0001	0.0001	0.0001	0%	29	0.0001	0.0001	0.0001	0%
Total Copper	0.0014 <sup>†</sup>	45	<0.001	<0.001	0.002	2%	53	<0.001	<0.001	0.004	13%
Total Iron	0.3 <sup>*</sup>	48	0.15	0.73	6.15	90%	48	<0.01	0.965	3.28	77%
Total Lead	0.0034 <sup>†</sup>	48	<0.001	<0.001	0.003	0%	56	<0.001	<0.001	0.002	0%
Total Lithium	-	48	<0.001	<0.001	0.01		56	<0.001	<0.001	0.004	
Total Manganese	1.9 <sup>†</sup>	48	0.02	0.08	1.07	0%	56	0.04	0.16	2.23	2%
Total Nickel	0.011 <sup>†</sup>	48	<0.001	<0.001	0.004	0%	56	<0.001	0.002	0.01	0%
Total Selenium	0.011 <sup>†</sup>	48	<0.01	<0.01	0.02	2%	56	<0.01	<0.01	0.032	16%
Total Strontium	-	48	0.01	0.02	0.13		56	0.01	0.02	0.14	
Total Zinc	0.008 <sup>†</sup>	48	<0.005	<0.005	0.143	21%	56	<0.005	0.008	0.05	46%
Nitrogen Oxides	0.015 <sup>‡</sup>	48	<0.01	0.07	2.22	94%	56	<0.01	0.16	25.8	96%
Total Nitrogen	0.25 <sup>‡</sup>	48	<0.1	0.25	2.90	50%	56	<0.10	0.40	26.80	77%
Total Phosphorus	0.02 <sup>‡</sup>	48	<0.01	<0.01	0.14	15%	56	<0.006	<0.01	0.22	23%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; <sup>‡</sup> ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.

## Bargo River (BR14-QRLa and BR2-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	BR14-QRLa					BR2-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Field pH	6.5 - 8.5 <sup>†</sup>	30	8.0	8.9	10.7	97%	29	6.1	7.3	9.1	10%
Lab pH	6.5 - 8.5 <sup>†</sup>	50	3.7	8.6	9.4	92%	27	5.6	6.7	7.7	33%
Field EC (µS/cm)	350 <sup>†</sup>	30	201	1071	2070	93%	29	110	215	2210	3%
Lab EC (µS/cm)	350 <sup>†</sup>	50	1.47	1030	2260	86%	27	98	204	404	4%
Field DO	-	30	5.6	9.6	7.4		29	2.9	9.0	10.3	
Sulphate as Turbidimetric SO <sub>4</sub>	400*	55	<1	11	33	0%	27	<1	6	24	0%
Total Alkalinity as CaCO <sub>3</sub>	500*	55	10	490	1100	47%	27	4	10	72	0%
Chloride	400*	55	21	64	118	0%	27	21	48	85	0%
Dissolved Calcium	-	55	1	11	20		27	2	4	19	
Dissolved Magnesium	-	55	1	10	15		27	2	5	13	
Dissolved Potassium	-	55	2	12	27		27	2	3	8	
Dissolved Sodium	-	55	14	248	504		27	14	25	38	
Dissolved Aluminium	0.055 <sup>†</sup>	20	0.02	0.06	0.16	55%	26	<0.01	0.02	0.1	19%
Dissolved Arsenic	0.024 <sup>†</sup>	20	<0.001	0.0165	0.051	40%	27	<0.001	<0.001	0.002	0%
Dissolved Barium	1*	20	0.01	0.98	2.39	45%	27	0.01	0.01	0.09	0%
Dissolved Copper	0.0014 <sup>†</sup>	20	<0.001	<0.001	<0.001	0%	27	<0.001	<0.001	0.002	4%
Dissolved Iron	0.3*	20	<0.05	0.09	0.45	20%	27	<0.05	0.24	1.56	41%
Dissolved Lead	0.0034 <sup>†</sup>	20	<0.001	<0.001	<0.001	0%	27	<0.001	<0.001	<0.001	0%
Dissolved Lithium	-	20	<0.001	0.5395	1.25		27	<0.001	<0.001	0.008	
Dissolved Manganese	1.9 <sup>†</sup>	20	0.00	0.02	0.10	0%	27	0.03	0.08	1.10	0%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; ‡ ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.



## Bargo River (BR14-QRLa and BR2-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	BR14-QRLa					BR2-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Dissolved Nickel	0.011 <sup>†</sup>	20	<0.001	0.026	0.064	85%	27	<0.001	<0.001	0.006	0%
Dissolved Selenium	0.011 <sup>†</sup>	20	<0.01	<0.01	<0.01	0%	27	<0.01	<0.01	<0.01	0%
Dissolved Strontium	-	20	0.01	0.26	0.52		27	0.01	0.03	0.14	
Dissolved Zinc	0.008 <sup>†</sup>	20	<0.005	0.0145	0.03	80%	27	<0.005	<0.005	0.021	7%
Total Aluminium	0.055 <sup>†</sup>	55	0.03	0.12	1.30	84%	27	<0.01	0.04	3.06	37%
Total Arsenic	0.024 <sup>†</sup>	55	<0.001	0.021	0.082	40%	27	<0.001	<0.001	0.004	0%
Total Barium	1 <sup>*</sup>	55	0.01	1.21	4.56	67%	27	0.01	0.02	0.10	0%
Total Cadmium	0.0002 <sup>†</sup>	28	0.0001	0.0001	0.0001	0%	0	-	-	-	-
Total Copper	0.0014 <sup>†</sup>	52	<0.001	<0.001	0.006	23%	27	<0.001	<0.001	0.003	26%
Total Iron	0.3 <sup>*</sup>	47	<0.01	0.39	1.61	53%	27	0.07	0.78	3.62	74%
Total Lead	0.0034 <sup>†</sup>	55	<0.001	<0.001	0.007	7%	27	<0.001	<0.001	0.003	0%
Total Lithium	-	55	<0.001	0.586	1.22		27	<0.001	<0.001	0.008	
Total Manganese	1.9 <sup>†</sup>	55	0.00	0.03	0.78	0%	27	0.04	0.09	1.02	0%
Total Nickel	0.011 <sup>†</sup>	55	<0.001	0.023	32	71%	27	<0.001	<0.001	0.006	0%
Total Selenium	0.011 <sup>†</sup>	55	<0.001	<0.01	0.563	16%	27	<0.01	<0.01	<0.01	0%
Total Strontium	-	55	0.01	0.25	0.75		27	0.01	0.03	0.15	
Total Zinc	0.008 <sup>†</sup>	55	0.007	0.026	0.11	95%	27	<0.005	0.006	0.02	26%
Nitrogen Oxides	0.015 <sup>‡</sup>	55	0.03	0.94	6.37	100%	27	<0.01	0.22	0.78	96%
Total Nitrogen	0.25 <sup>‡</sup>	55	0.60	1.50	7.2	100%	27	<0.1	0.40	1.4	74%
Total Phosphorus	0.02 <sup>‡</sup>	55	<0.01	0.02	0.31	25%	27	<0.01	<0.01	0.2	11%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; <sup>‡</sup> ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.

## Teatree Hollow (TT1-QRLa and TT4-QLa/TT4A-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	TT1-QRLa					TT4-QLa/TT4A-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Field pH	6.5 - 8.5 <sup>†</sup>	20	6.3	6.8	8.3	10%	3	7.8	-	8.3	67%
Lab pH	6.5 - 8.5 <sup>†</sup>	17	6.1	6.8	7.2	12%	4	6.6	-	8.2	25%
Field EC (µS/cm)	350 <sup>†</sup>	20	279	508	663	85%	3	157	-	1238	33%
Lab EC (µS/cm)	350 <sup>†</sup>	17	258	514	780	82%	4	197	-	1250	50%
Field DO	-	20	0.2	8.0	11.9		3	0.2	-	10.3	
Sulphate as Turbidimetric SO <sub>4</sub>	400*	17	8	25	126	0%	4	6	-	26	0%
Total Alkalinity as CaCO <sub>3</sub>	500*	17	23	50	187	0%	4	52	-	712	25%
Chloride	400*	17	49	108	156	0%	4	12	-	109	0%
Dissolved Calcium	-	16	5	10.5	55		4	7	-	34	
Dissolved Magnesium	-	17	5	14	37		4	3	-	19	
Dissolved Potassium	-	17	4	9	31		4	5	-	14	
Dissolved Sodium	-	17	28	58	73		4	24	-	234	
Dissolved Aluminium	0.055 <sup>†</sup>	17	<0.01	<0.01	0.3	18%	4	0.02	-	0.66	50%
Dissolved Arsenic	0.024 <sup>†</sup>	17	<0.001	<0.001	0.003	0%	4	<0.001	-	<0.001	0%
Dissolved Barium	1*	17	0.02	0.05	0.15	0%	4	0.04	-	0.49	0%
Dissolved Copper	0.0014 <sup>†</sup>	17	<0.001	<0.001	0.004	18%	4	<0.001	-	0.004	50%
Dissolved Iron	0.3*	17	<0.05	0.39	0.78	71%	4	<0.05	-	0.4	25%
Dissolved Lead	0.0034 <sup>†</sup>	17	<0.001	<0.001	<0.001	0%	4	<0.001	-	<0.001	0%
Dissolved Lithium	-	17	<0.001	<0.001	0.003		4	<0.001	-	0.642	
Dissolved Manganese	1.9 <sup>†</sup>	17	0.01	0.11	3.00	6%	4	0.00	-	0.07	0%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; ‡ ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.

## Teatree Hollow (TT1-QRLa and TT4-QLa/TT4A-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	TT1-QRLa					TT4-QLa/TT4A-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Dissolved Nickel	0.011 <sup>†</sup>	17	<0.001	<0.001	0.008	0%	4	<0.001	-	0.007	0%
Dissolved Selenium	0.011 <sup>†</sup>	17	<0.01	<0.01	<0.01	0%	4	<0.01	-	<0.01	0%
Dissolved Strontium	-	17	0.03	0.09	0.70		4	0.05	-	0.52	
Dissolved Zinc	0.008 <sup>†</sup>	17	0.01	0.022	0.215	100%	4	<0.005	-	0.034	75%
Total Aluminium	0.055 <sup>†</sup>	17	0.06	0.13	1.31	100%	4	0.09	-	2.44	100%
Total Arsenic	0.024 <sup>†</sup>	17	<0.001	<0.001	0.003	0%	4	<0.001	-	0.002	0%
Total Barium	1 <sup>*</sup>	17	0.02	0.06	0.16	0%	4	0.05	-	0.50	0%
Total Cadmium	0.0002 <sup>†</sup>	0	-	-	-	-	0	-	-	-	-
Total Copper	0.0014 <sup>†</sup>	17	<0.001	<0.001	0.008	24%	4	<0.001	-	0.004	75%
Total Iron	0.3 <sup>*</sup>	17	0.38	1.22	1.71	100%	4	0.16	-	1.3	75%
Total Lead	0.0034 <sup>†</sup>	17	<0.001	<0.001	0.003	0%	4	<0.001	-	0.006	25%
Total Lithium	-	17	<0.001	<0.001	0.003		4	<0.001	-	0.71	
Total Manganese	1.9 <sup>†</sup>	17	0.02	0.12	2.97	6%	4	0.00	-	0.13	0%
Total Nickel	0.011 <sup>†</sup>	17	<0.001	<0.001	0.009	0%	4	<0.001	-	0.008	0%
Total Selenium	0.011 <sup>†</sup>	17	<0.01	<0.01	<0.01	0%	4	<0.01	-	<0.01	0%
Total Strontium	-	17	0.03	0.10	0.74		4	0.06	-	0.51	
Total Zinc	0.008 <sup>†</sup>	17	0.012	0.031	0.34	100%	4	0.014	-	0.04	100%
Nitrogen Oxides	0.015 <sup>‡</sup>	17	<0.01	0.05	0.57	71%	4	0.10	-	3.25	100%
Total Nitrogen	0.25 <sup>‡</sup>	17	0.20	0.40	7.3	88%	4	0.30	-	4.0	100%
Total Phosphorus	0.02 <sup>‡</sup>	17	<0.01	0.02	2.58	41%	4	<0.01	-	0.44	50%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; <sup>‡</sup> ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.

## Teatree Hollow (TT6-QRLa and TT8-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	TT6-QRLa					TT8-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Field pH	6.5 - 8.5 <sup>†</sup>	20	6.4	7.0	8.0	5%	26	5.8	9.0	9.6	96%
Lab pH	6.5 - 8.5 <sup>†</sup>	20	6.0	6.7	7.4	25%	39	8.2	8.7	9.2	100%
Field EC (µS/cm)	350 <sup>‡</sup>	20	186	274	687	40%	24	1644	2097.5	2275	100%
Lab EC (µS/cm)	350 <sup>‡</sup>	20	190	317	703	45%	38	1650	2031	2490	100%
Field DO	-	20	0.7	9.4	12.6		26	6.9	9.3	11.5	
Sulphate as Turbidimetric SO <sub>4</sub>	400*	20	7	10.5	36	0%	41	9	19	40	0%
Total Alkalinity as CaCO <sub>3</sub>	500*	20	11	36	126	0%	41	681	1000	1320	100%
Chloride	400*	19	28	60	195	0%	41	53	83	122	0%
Dissolved Calcium	-	20	3	8	42		41	5	19	28	
Dissolved Magnesium	-	20	4	7	15		22	10	14	18	
Dissolved Potassium	-	20	3	4	12		22	17	22	26	
Dissolved Sodium	-	20	24	36	81		22	337	485.5	551	
Dissolved Aluminium	0.055 <sup>†</sup>	20	<0.01	0.02	0.18	25%	22	<0.01	0.04	0.11	36%
Dissolved Arsenic	0.024 <sup>†</sup>	20	<0.001	<0.001	0.002	0%	22	0.022	0.061	0.094	91%
Dissolved Barium	1*	20	0.01	0.04	0.15	0%	22	1.58	2.64	5.36	100%
Dissolved Copper	0.0014 <sup>†</sup>	20	<0.001	<0.001	0.004	15%	22	<0.001	0.0015	0.007	50%
Dissolved Iron	0.3*	20	0.07	0.54	1.54	80%	22	<0.05	<0.05	0.48	5%
Dissolved Lead	0.0034 <sup>†</sup>	20	<0.001	<0.001	<0.001	0%	22	<0.001	<0.001	0.003	0%
Dissolved Lithium	-	20	<0.001	<0.001	0.006		22	0.66	1.19	1.64	
Dissolved Manganese	1.9 <sup>†</sup>	20	0.01	0.11	0.59	0%	22	0.00	0.02	0.06	0%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; <sup>‡</sup> ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.



## Teatree Hollow (TT6-QRLa and TT8-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	TT6-QRLa					TT8-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Dissolved Nickel	0.011 <sup>†</sup>	20	<0.001	0.003	0.011	0%	22	0.033	0.0595	0.081	100%
Dissolved Selenium	0.011 <sup>†</sup>	20	<0.01	<0.01	<0.01	0%	22	<0.01	<0.01	<0.01	0%
Dissolved Strontium	-	20	0.02	0.04	0.18		22	0.38	0.59	0.90	
Dissolved Zinc	0.008 <sup>†</sup>	20	<0.005	0.029	0.091	80%	22	0.021	0.0475	0.111	100%
Total Aluminium	0.055 <sup>†</sup>	20	0.06	0.145	0.75	100%	41	0.02	0.11	0.68	80%
Total Arsenic	0.024 <sup>†</sup>	20	<0.001	<0.001	0.002	0%	41	0.023	0.071	0.116	95%
Total Barium	1 <sup>*</sup>	20	0.01	0.04	0.13	0%	41	1.76	3.32	6.47	100%
Total Cadmium	0.0002 <sup>†</sup>	0	-	-	-	-	19	0.0001	0.0001	0.0002	0%
Total Copper	0.0014 <sup>†</sup>	20	<0.001	<0.001	0.004	20%	41	<0.001	0.002	0.006	66%
Total Iron	0.3 <sup>*</sup>	20	0.39	0.85	2.84	100%	41	<0.05	0.08	0.42	2%
Total Lead	0.0034 <sup>†</sup>	20	<0.001	<0.001	0.002	0%	41	<0.001	0.002	0.015	20%
Total Lithium	-	20	<0.001	<0.001	0.005		41	0.731	1.26	2.04	
Total Manganese	1.9 <sup>†</sup>	20	0.01	0.12	0.67	0%	41	0.01	0.02	0.10	0%
Total Nickel	0.011 <sup>†</sup>	20	<0.001	0.0035	0.01	0%	41	0.038	0.065	0.102	100%
Total Selenium	0.011 <sup>†</sup>	20	<0.01	<0.01	<0.01	0%	41	<0.01	<0.01	<0.01	0%
Total Strontium	-	20	0.02	0.04	0.18		40	0.40	0.74	1.12	
Total Zinc	0.008 <sup>†</sup>	20	0.006	0.031	0.09	95%	41	0.023	0.06	0.32	100%
Nitrogen Oxides	0.015 <sup>‡</sup>	20	<0.01	0.07	2.47	75%	41	0.20	1.93	8.68	100%
Total Nitrogen	0.25 <sup>‡</sup>	20	<0.1	0.30	4.5	55%	41	1.60	3.00	10.2	100%
Total Phosphorus	0.02 <sup>‡</sup>	20	<0.01	<0.01	0.13	30%	41	<0.005	0.02	0.14	49%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; <sup>‡</sup> ANZECC (2000) default guideline value for Upland Rivers in NSW; <sup>\*</sup> ANZECC (2000) water quality guideline value for recreational purposes.

## Dog Trap Creek (DT3a-QRLa and DT32-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	DT3a-QRLa					DT32-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Field pH	6.5 - 8.5 <sup>†</sup>	26	6.0	7.1	8.4	8%	21	6.3	7.1	8.0	5%
Lab pH	6.5 - 8.5 <sup>‡</sup>	19	6.0	6.7	7.5	37%	18	5.7	6.6	7.0	33%
Field EC (µS/cm)	350 <sup>‡</sup>	26	139	261	6060	27%	21	85	216	252	0%
Lab EC (µS/cm)	350 <sup>‡</sup>	19	160	240	6260	26%	18	92	204	266	0%
Field DO	-	26	0.2	7.3	11.7		21	4.2	8.5	11.7	
Sulphate as Turbidimetric SO <sub>4</sub>	400*	19	<1	<4	59	0%	18	<1	<4	8	0%
Total Alkalinity as CaCO <sub>3</sub>	500*	19	<1	24	55	0%	18	10	20.5	38	0%
Chloride	400*	18	26	55	2290	17%	17	20	48	58	0%
Dissolved Calcium	-	19	3	4	81		17	2	4	5	
Dissolved Magnesium	-	19	3	7	198		16	2	5	7	
Dissolved Potassium	-	19	16	31	900		17	10	25	32	
Dissolved Sodium	-	19	3	5	32		17	4	5	7	
Dissolved Aluminium	0.055 <sup>†</sup>	19	<0.01	0.04	0.36	32%	18	0.02	0.085	0.38	78%
Dissolved Arsenic	0.024 <sup>†</sup>	19	<0.001	<0.001	<0.001	0%	18	<0.001	<0.001	<0.001	0%
Dissolved Barium	1*	19	0.02	0.02	0.75	0%	18	0.01	0.02	0.02	0%
Dissolved Copper	0.0014 <sup>†</sup>	19	<0.001	<0.001	0.002	11%	18	<0.001	<0.001	0.018	11%
Dissolved Iron	0.3*	19	0.17	0.39	0.87	74%	18	0.1	0.27	0.44	44%
Dissolved Lead	0.0034 <sup>†</sup>	19	<0.001	<0.001	<0.001	0%	18	<0.001	<0.001	<0.001	0%
Dissolved Lithium	-	19	<0.001	<0.001	<0.001		18	<0.001	<0.001	<0.001	
Dissolved Manganese	1.9 <sup>†</sup>	19	0.01	0.04	0.79	0%	18	0.00	0.01	0.08	0%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; <sup>‡</sup> ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.

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## Dog Trap Creek (DT3a-QRLa and DT32-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	DT3a-QRLa					DT32-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Dissolved Nickel	0.011 <sup>†</sup>	19	<0.001	<0.001	0.002	0%	18	<0.001	<0.001	<0.001	0%
Dissolved Selenium	0.011 <sup>†</sup>	19	<0.01	<0.01	<0.01	0%	18	<0.01	<0.01	<0.01	0%
Dissolved Strontium	-	19	0.03	0.05	1.03		18	0.02	0.04	0.05	
Dissolved Zinc	0.008 <sup>†</sup>	19	<0.005	<0.005	0.022	32%	18	<0.005	<0.005	0.024	33%
Total Aluminium	0.055 <sup>†</sup>	19	<0.01	0.1	0.60	74%	18	0.09	0.23	0.98	100%
Total Arsenic	0.024 <sup>†</sup>	19	<0.001	<0.001	<0.001	0%	18	<0.001	<0.001	<0.001	0%
Total Barium	1 <sup>*</sup>	19	0.02	0.03	0.79	0%	18	0.01	0.02	0.02	0%
Total Cadmium	0.0002 <sup>†</sup>	0	-	-	-	-	0	-	-	-	-
Total Copper	0.0014 <sup>†</sup>	19	<0.001	<0.001	0.004	21%	18	<0.001	<0.001	0.036	33%
Total Iron	0.3 <sup>*</sup>	19	0.24	0.95	2.14	95%	18	0.24	0.46	1.08	83%
Total Lead	0.0034 <sup>†</sup>	19	<0.001	<0.001	<0.001	0%	18	<0.001	<0.001	0.002	0%
Total Lithium	-	19	<0.001	<0.001	<0.001		18	<0.001	<0.001	<0.001	
Total Manganese	1.9 <sup>†</sup>	19	0.01	0.05	0.79	0%	18	0.00	0.01	0.10	0%
Total Nickel	0.011 <sup>†</sup>	19	<0.001	<0.001	<0.001	0%	18	<0.001	<0.001	<0.001	0%
Total Selenium	0.011 <sup>†</sup>	19	<0.01	<0.01	<0.01	0%	18	<0.01	<0.01	<0.01	0%
Total Strontium	-	19	0.03	0.05	1.12		18	0.02	0.04	0.05	
Total Zinc	0.008 <sup>†</sup>	19	<0.005	0.007	0.03	32%	18	<0.005	0.0115	0.03	56%
Nitrogen Oxides	0.015 <sup>‡</sup>	19	<0.01	0.03	1.14	79%	18	<0.01	0.06	1.03	83%
Total Nitrogen	0.25 <sup>‡</sup>	19	0.20	0.60	2.6	95%	18	0.20	0.45	2.3	89%
Total Phosphorus	0.02 <sup>‡</sup>	19	<0.01	0.02	0.13	47%	18	<0.01	0.02	0.11	39%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; <sup>‡</sup> ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.

## Dog Trap Creek (DT64-QRLa and DT74-QLa/DT73-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	DT64-QLa					DT74-QLa/DT73-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Field pH	6.5 - 8.5 <sup>†</sup>	21	6.4	7.1	8.1	5%	21	6.7	7.1	7.9	0%
Lab pH	6.5 - 8.5 <sup>†</sup>	18	5.8	6.6	7.1	33%	19	5.6	6.8	7.3	16%
Field EC (µS/cm)	350 <sup>†</sup>	21	76	182	233	0%	21	155	259	328	0%
Lab EC (µS/cm)	350 <sup>†</sup>	18	82	179.5	238	0%	19	154	253	325	0%
Field DO	-	21	5.1	7.9	10.7		21	2.7	8.6	11.3	
Sulphate as Turbidimetric SO <sub>4</sub>	400*	18	<1	<5	12	0%	19	<3	12	26	0%
Total Alkalinity as CaCO <sub>3</sub>	500*	18	10	30	55	0%	19	24	47	92	0%
Chloride	400*	17	14	36	40	0%	19	24	41	80	0%
Dissolved Calcium	-	18	2	6	8		19	6	10	14	
Dissolved Magnesium	-	18	2	4.5	6		19	4	6	8	
Dissolved Potassium	-	18	8	20	27		19	18	28	42	
Dissolved Sodium	-	18	4	5	8		19	3	5	7	
Dissolved Aluminium	0.055 <sup>†</sup>	18	<0.01	0.03	0.27	22%	19	<0.01	0.04	0.6	37%
Dissolved Arsenic	0.024 <sup>†</sup>	18	<0.001	<0.001	<0.001	0%	19	<0.001	<0.001	<0.001	0%
Dissolved Barium	1*	18	0.01	0.02	0.03	0%	19	0.01	0.03	0.04	0%
Dissolved Copper	0.0014 <sup>†</sup>	18	<0.001	<0.001	0.003	6%	19	<0.001	<0.001	0.003	21%
Dissolved Iron	0.3*	18	<0.05	0.25	0.55	28%	19	0.07	0.30	1	47%
Dissolved Lead	0.0034 <sup>†</sup>	18	<0.001	<0.001	<0.001	0%	19	<0.001	<0.001	0.002	0%
Dissolved Lithium	-	18	<0.001	<0.001	<0.001		19	<0.001	<0.001	<0.001	
Dissolved Manganese	1.9 <sup>†</sup>	18	0.00	0.01	0.07	0%	19	0.00	0.03	0.12	0%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; ‡ ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.



## Dog Trap Creek (DT64-QLa and DT74-QLa/DT73-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	DT64-QLa					DT74-QLa/DT73-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Dissolved Nickel	0.011 <sup>†</sup>	18	<0.001	<0.001	<0.001	0%	19	<0.001	<0.001	<0.001	0%
Dissolved Selenium	0.011 <sup>†</sup>	18	<0.01	<0.01	<0.01	0%	19	<0.001	<0.01	<0.01	0%
Dissolved Strontium	-	18	0.02	0.05	0.07		19	0.04	0.07	0.09	
Dissolved Zinc	0.008 <sup>†</sup>	18	<0.005	<0.005	0.061	33%	19	<0.005	0.007	0.06	42%
Total Aluminium	0.055 <sup>†</sup>	18	0.04	0.115	0.43	94%	19	0.03	0.21	0.68	95%
Total Arsenic	0.024 <sup>†</sup>	18	<0.001	<0.001	<0.001	0%	19	<0.001	<0.001	<0.001	0%
Total Barium	1 <sup>*</sup>	18	0.01	0.02	0.03	0%	19	0.02	0.03	0.04	0%
Total Cadmium	0.0002 <sup>†</sup>	0	-	-	-	-	0	-	-	-	-
Total Copper	0.0014 <sup>†</sup>	18	<0.001	<0.001	0.004	28%	19	<0.001	<0.001	0.004	26%
Total Iron	0.3 <sup>*</sup>	18	0.12	0.32	1.2	61%	19	0.3	0.77	1.22	95%
Total Lead	0.0034 <sup>†</sup>	18	<0.001	<0.001	0.002	0%	19	<0.001	<0.001	<0.001	0%
Total Lithium	-	18	<0.001	<0.001	<0.001		19	<0.001	<0.001	<0.001	
Total Manganese	1.9 <sup>†</sup>	18	0.00	0.01	0.08	0%	19	0.01	0.04	0.14	0%
Total Nickel	0.011 <sup>†</sup>	18	<0.001	<0.001	<0.001	0%	19	<0.001	<0.001	<0.001	0%
Total Selenium	0.011 <sup>†</sup>	18	<0.01	<0.01	<0.01	0%	19	<0.001	<0.01	<0.01	0%
Total Strontium	-	18	0.02	0.05	0.07		19	0.04	0.08	0.10	
Total Zinc	0.008 <sup>†</sup>	18	<0.005	0.0055	0.06	44%	19	<0.005	0.009	0.06	53%
Nitrogen Oxides	0.015 <sup>‡</sup>	18	<0.01	0.02	0.56	50%	19	<0.01	0.02	1.26	58%
Total Nitrogen	0.25 <sup>‡</sup>	18	<0.10	0.30	1.7	56%	19	<0.10	0.50	2.0	95%
Total Phosphorus	0.02 <sup>‡</sup>	18	<0.01	<0.01	0.09	22%	19	<0.01	0.02	0.08	47%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; <sup>‡</sup> ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.

## Dog Trap Creek (DT49-QRLa and DT42-QLa/DT43-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	DT49-QRLa					DT42-QLa/DT43-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Field pH	6.5 - 8.5 <sup>†</sup>	17	6.1	7.3	8.3	6%	21	6.5	7.2	8.4	5%
Lab pH	6.5 - 8.5 <sup>†</sup>	40	5.1	7.1	8.5	20%	45	5.9	7.0	9.4	13%
Field EC (µS/cm)	350 <sup>†</sup>	17	194	256	323	0%	21	204	299	700	24%
Lab EC (µS/cm)	350 <sup>†</sup>	40	132	237.5	2380	8%	45	31	273	702	18%
Field DO	-	17	3.8	8.4	12.8		21	3.4	7.9	11.3	
Sulphate as Turbidimetric SO <sub>4</sub>	400*	43	<1	15	108	0%	48	<1	16	124	0%
Total Alkalinity as CaCO <sub>3</sub>	500*	43	6	30	65	0%	48	11	33	88	0%
Chloride	400*	43	25	46	767	5%	48	26	50	128	0%
Dissolved Calcium	-	43	4	7	36		48	4	8	28	
Dissolved Magnesium	-	21	4	8	70		18	4	7.5	22	
Dissolved Potassium	-	21	21	29	275		18	21	31	64	
Dissolved Sodium	-	21	5	7	24		18	6	8	15	
Dissolved Aluminium	0.055 <sup>†</sup>	21	<0.01	0.04	0.26	33%	18	<0.01	0.045	0.19	39%
Dissolved Arsenic	0.024 <sup>†</sup>	21	<0.001	<0.001	0.002	0%	18	<0.001	<0.001	<0.001	0%
Dissolved Barium	1*	21	0.02	0.02	0.29	0%	18	0.02	0.02	0.07	0%
Dissolved Copper	0.0014 <sup>†</sup>	20	<0.001	<0.001	0.004	15%	18	<0.001	<0.001	0.005	11%
Dissolved Iron	0.3*	21	<0.05	0.26	2.36	48%	18	<0.05	0.17	0.46	17%
Dissolved Lead	0.0034 <sup>†</sup>	21	<0.001	<0.001	<0.001	0%	18	<0.001	<0.001	<0.001	0%
Dissolved Lithium	-	21	<0.001	<0.001	0.002		18	<0.001	<0.001	<0.001	
Dissolved Manganese	1.9 <sup>†</sup>	21	0.00	0.01	2.33	5%	18	0.00	0.01	0.05	0%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; ‡ ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.

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## Dog Trap Creek (DT49-QRLa and DT42-QLa/DT43-QRLa) Water Quality Summary

Parameter (mg/L unless otherwise stated)	Guideline Value	DT49-QRLa					DT42-QLa/DT43-QRLa				
		No. Samples	Min	Median	Max	% Exceedance	No. Samples	Min	Median	Max	% Exceedance
Dissolved Nickel	0.011 <sup>†</sup>	21	<0.001	<0.001	0.003	0%	18	<0.001	<0.001	0.002	0%
Dissolved Selenium	0.011 <sup>†</sup>	21	<0.01	<0.01	<0.01	0%	18	<0.01	<0.01	<0.01	0%
Dissolved Strontium	-	21	0.04	0.07	0.42		18	0.06	0.07	0.29	
Dissolved Zinc	0.008 <sup>†</sup>	21	<0.005	0.007	0.044	33%	18	<0.005	<0.005	0.015	11%
Total Aluminium	0.055 <sup>†</sup>	43	0.04	0.33	2.10	95%	48	0.02	0.335	2.10	98%
Total Arsenic	0.024 <sup>†</sup>	43	<0.001	<0.001	0.01	0%	48	<0.001	<0.001	0.002	0%
Total Barium	1 <sup>*</sup>	43	0.02	0.02	0.29	0%	48	0.02	0.02	0.07	0%
Total Cadmium	0.0002 <sup>†</sup>	22	0.0001	0.0001	0.0001	0%	29	0.0001	0.0001	0.0001	0%
Total Copper	0.0014 <sup>†</sup>	39	<0.001	<0.001	0.009	26%	45	<0.001	<0.001	0.005	33%
Total Iron	0.3 <sup>*</sup>	40	<0.01	0.47	3.91	65%	45	<0.01	0.44	24.8	67%
Total Lead	0.0034 <sup>†</sup>	43	<0.001	<0.001	0.004	2%	48	<0.001	<0.001	0.003	0%
Total Lithium	-	43	<0.001	<0.001	0.003		48	<0.001	<0.001	0.002	
Total Manganese	1.9 <sup>†</sup>	43	0.00	0.01	2.28	2%	48	0.01	0.01	0.19	0%
Total Nickel	0.011 <sup>†</sup>	43	<0.001	<0.001	0.01	0%	48	<0.001	<0.001	0.01	0%
Total Selenium	0.011 <sup>†</sup>	43	<0.01	<0.01	0.082	9%	48	<0.01	<0.01	0.082	8%
Total Strontium	-	43	0.01	0.07	0.43		48	0.01	0.08	0.29	
Total Zinc	0.008 <sup>†</sup>	43	<0.005	0.009	0.06	58%	48	<0.005	0.006	0.05	35%
Nitrogen Oxides	0.015 <sup>‡</sup>	43	<0.01	0.44	13.30	93%	48	<0.01	0.52	2.34	96%
Total Nitrogen	0.25 <sup>‡</sup>	43	0.20	1.00	16.9	98%	48	0.20	1.20	3.4	98%
Total Phosphorus	0.02 <sup>‡</sup>	43	<0.01	0.02	0.56	42%	48	<0.007	0.02	0.37	46%

<sup>†</sup> ANZG (2018) default guideline value for aquatic ecosystems (95% level of species protection for slightly to moderately disturbed ecosystems) – the default guideline value relates to the total concentration of a constituent although should also be compared with the dissolved concentration which represents the bioavailable fraction; <sup>‡</sup> ANZECC (2000) default guideline value for Upland Rivers in NSW; \* ANZECC (2000) water quality guideline value for recreational purposes.