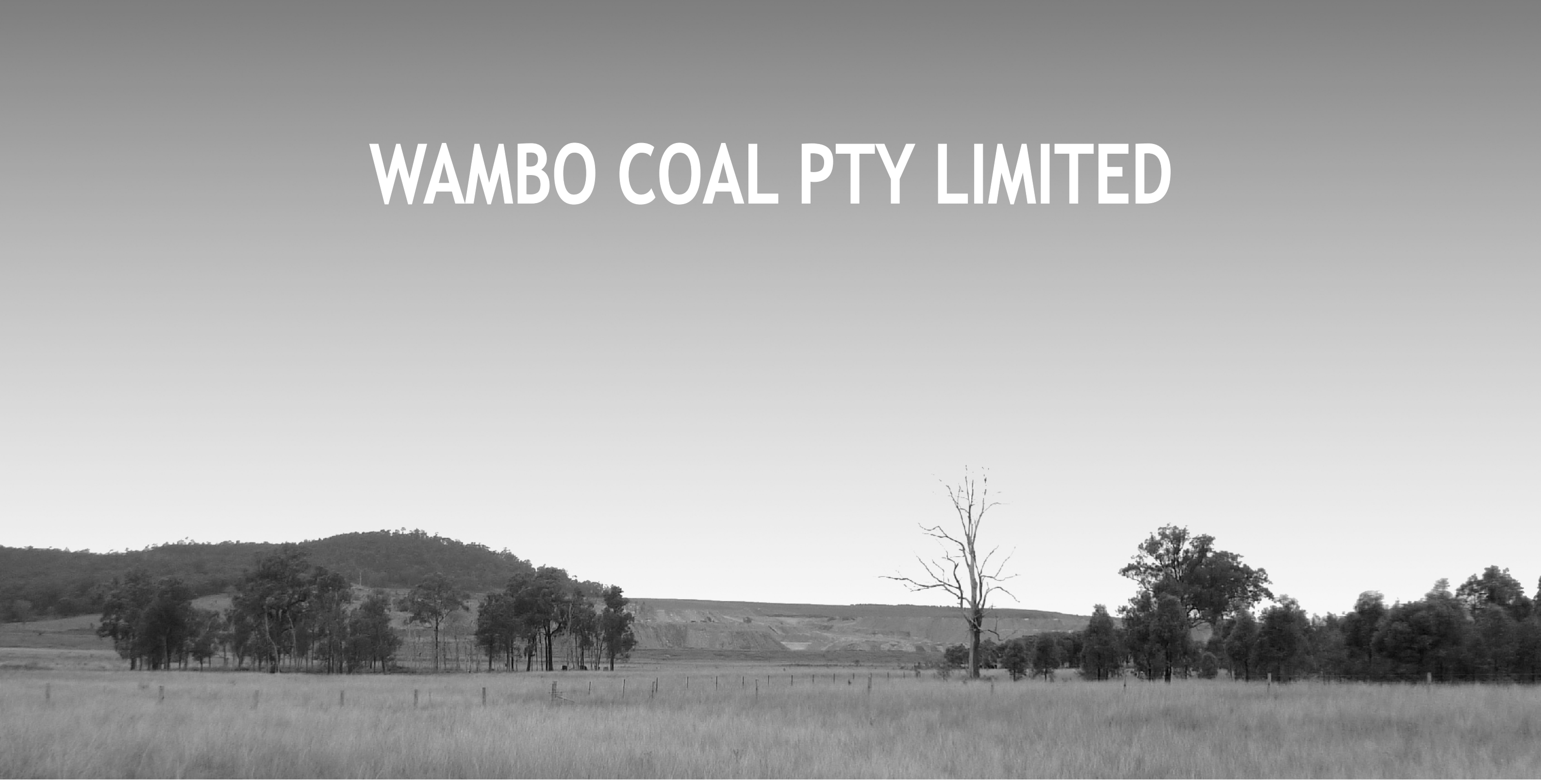
WAMBO COAL PTY LIMITED



SOUTH BATES EXTENSION UNDERGROUND MINE

EXTRACTION PLAN
LONGWALLS 24 TO 26

REPORT 2
GROUNDWATER ASSESSMENT REVIEW

Peabody

Wambo Coal Mine

Longwall 24 – 26 Updated Extraction Plan Groundwater Assessment Review

Wambo Coal Pty Ltd

PMB1 Singleton
NSW, 2330

Prepared by:

SLR Consulting Australia

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1	20 September 2024	Raymond Minnaar	David Western	David Western
2	29 October 2024	Raymond Minnaar	David Western	David Western
3	31 October 2024	Raymond Minnaar	David Western	David Western

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Wambo Coal Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

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Executive Summary

This report presents the updated groundwater assessment for Longwalls (LW) 24 to 26 at Wambo Coal Mine, conducted by SLR Consulting Australia. The assessment evaluates the potential groundwater impacts resulting from revised mine layout, which include a reduction in the mining footprint. The revised mine layout divides LW 24 into two sections (LW 24a and LW 24b), involves minor extensions towards North Wambo Creek and Waterfall Creek, results in an overall reduction of LW25-26 mining area, and reduction in mining period.

Key findings indicate that while the overall mining footprint is reduced, minor extensions of LW 25 and LW 26 may slightly increase groundwater drawdown in the vicinity of North Wambo Creek. However, the impact on groundwater dependent ecosystems (GDEs) is expected to be minor and localised. Previous studies have shown that subsidence from mining activities is unlikely to cause long-term detrimental effects on the GDEs associated with North Wambo Creek and it is not anticipated to change significantly due to the revised mine layout.

Groundwater drawdown in the Permian coal measures will remain confined to areas near the mining activities, and no significant incremental impacts are anticipated on the alluvial groundwater systems. Additionally, the assessment concludes that the revised mine layout will not significantly alter the predicted impacts on private bores, and the risk to baseflow in nearby creeks is expected to decrease due to the smaller mining area and period.

Mitigation measures remain unchanged from the previously approved groundwater management plans, with ongoing monitoring to ensure that groundwater quality and levels meet regulatory standards. Overall, the revised layout is anticipated to reduce cumulative groundwater impacts, while localised impacts on groundwater-dependent ecosystems and baseflow are expected to be minimal.

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Acronyms and Abbreviations

AIP	Aquifer Interference Policy
BoM	Bureau of Meterology
GDE	Groundwater Dependent Ecosystem
GWMP	Groundwater Management Plan
LW	Longwall
ML/day	Megalitres per day
ML/year	Megalitres per year
NSW	New South Wales
SBEUG	South Bates Extension Underground Mine
SLR	SLR Consulting Pty Ltd
United	United Collieries Pty Limited
VWP	Vibrating Wire Piezometer
Wambo	Wambo Coal Mine
WCPL	Wambo Coal Pty Ltd
WSPs	Water Sharing Plans

1.0 Introduction and Background

1.1 Introduction

Wambo Coal Mine (Wambo) is located approximately 15 kilometres (km) west of Singleton, near the village of Warkworth, New South Wales (NSW). Wambo is owned and operated by Wambo Coal Pty Ltd (WCPL), a subsidiary of Peabody Energy Australia Pty Ltd (Peabody).

Wambo is operated under Development Consent (DA 305-7-2003, as modified). Development Consent (DA 305-7-2003) allows for the extraction of coal resources from Longwalls (LW) 17 to 26 in the Whybrow Seam at the South Bates Extension Underground Mine (SBEUG) mining area.

The SBEUG was originally approved as part of the South Bates Extension Modification in 2017. A subsequent Modification application was submitted in 2022 to allow for the re-orientation of LW 24 and LW 25, and the addition of LW 26 on the northwestern side of the SBEUG mining area (i.e. the approved LW 24-26 layout).

WCPL submitted an Extraction Plan for the approved LW 24-26 layout, which was subsequently approved on 6 December 2023.

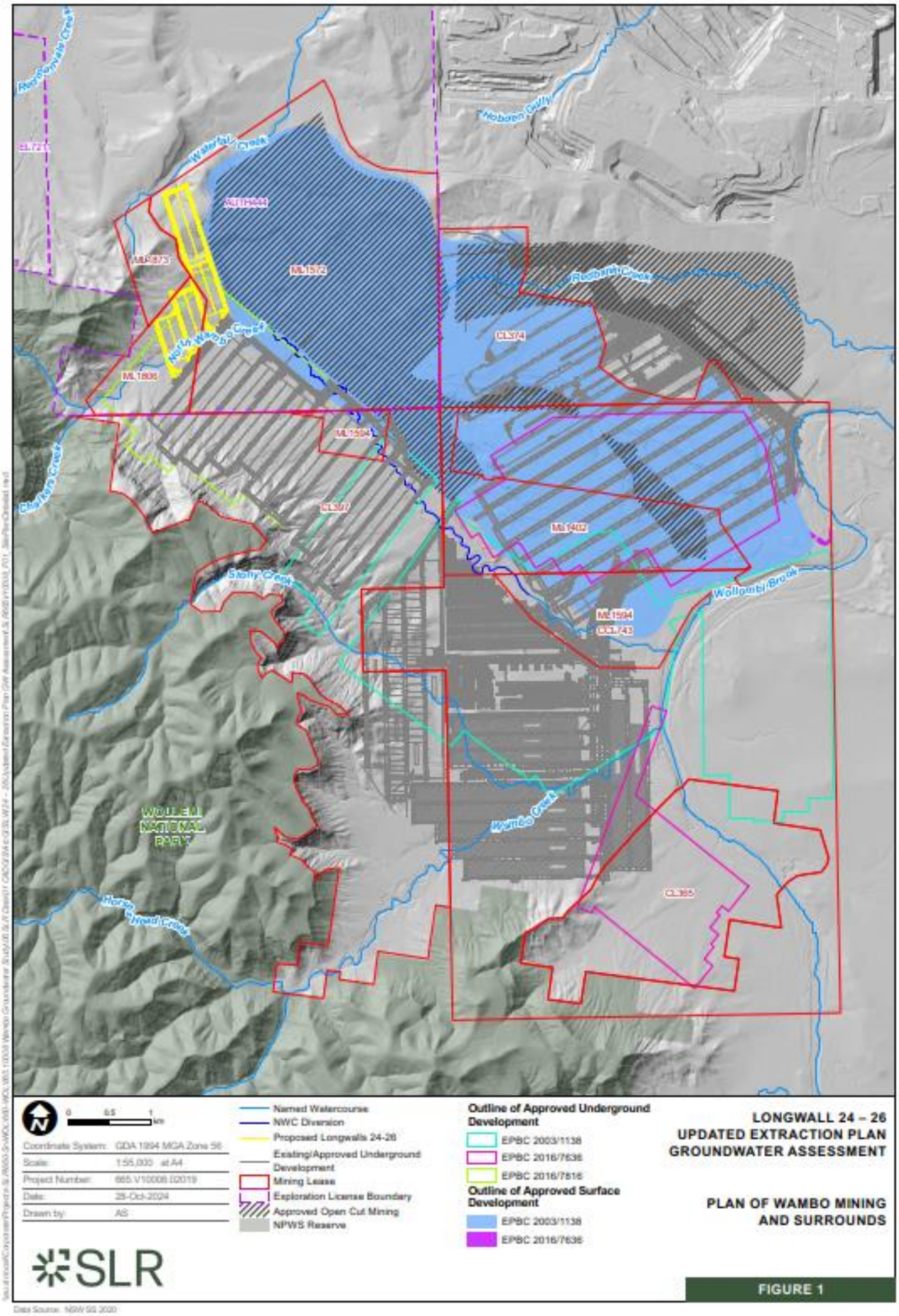
Since the approval of the Extraction Plan for the approved LW 24-26 layout, WCPL has identified adverse geological conditions in the mining area, which will hinder the full development and extraction of the approved LW 24-26 layout. WCPL proposes an alteration of the LW 24-26 underground mine layout (the revised mine layout) to avoid these adverse geological conditions (refer **Figure 1**).

SLR Consulting Australia Pty Ltd (SLR) has been engaged by WCPL to review the anticipated groundwater impacts predicted for the revised mine layout based on understanding and results from the *Wambo Coal Mine – Longwalls 24-26 Modification Groundwater Assessment* (SLR, 2022). SLR (2022) will help inform anticipated changes to potential groundwater impacts for the revised Extraction Plan.

1.2 Approved Wambo Coal Mine

Wambo is operated in accordance with Development Consent (DA 305-7-2003). The approved development described in the Wambo Environmental Impact Statement (EIS) and eighteen subsequent modifications extend the underground mine life until 31 August 2042. Under the most recent modification (Modification 19, determined 25 January 2023) current operations at Wambo include underground mining and coal processing and handling activities. Open cut mining activities are managed by the United Wambo Open Cut Project (UWOCP).

Figure 1 Approved Wambo Coal Mine Layout



Development Consent (DA 305-7-2003) covers the following mining operations at Wambo (**Figure 1**):

- Underground mining operations in the approved North Wambo Underground Mine (Wambo seam) (*completed*).
- Underground mining operations in the approved South Bates Underground Mine (Wambo and Whybrow seams) (*completed*).
- Underground mining operations in the approved SBEUG (Whybrow seam) (*in progress*).
- Underground mining operations in the approved South Wambo Underground Mine (Woodlands Hill and Arrowfield Seams) (*future operation*).
- Ongoing operation of the Coal Handling and Processing Plant (CHPP) and processing of coal from the underground mining operation and the UWOCP.

1.2.1 Revised Mine Layout

The revised mine layout is shown on **Figure 1**.

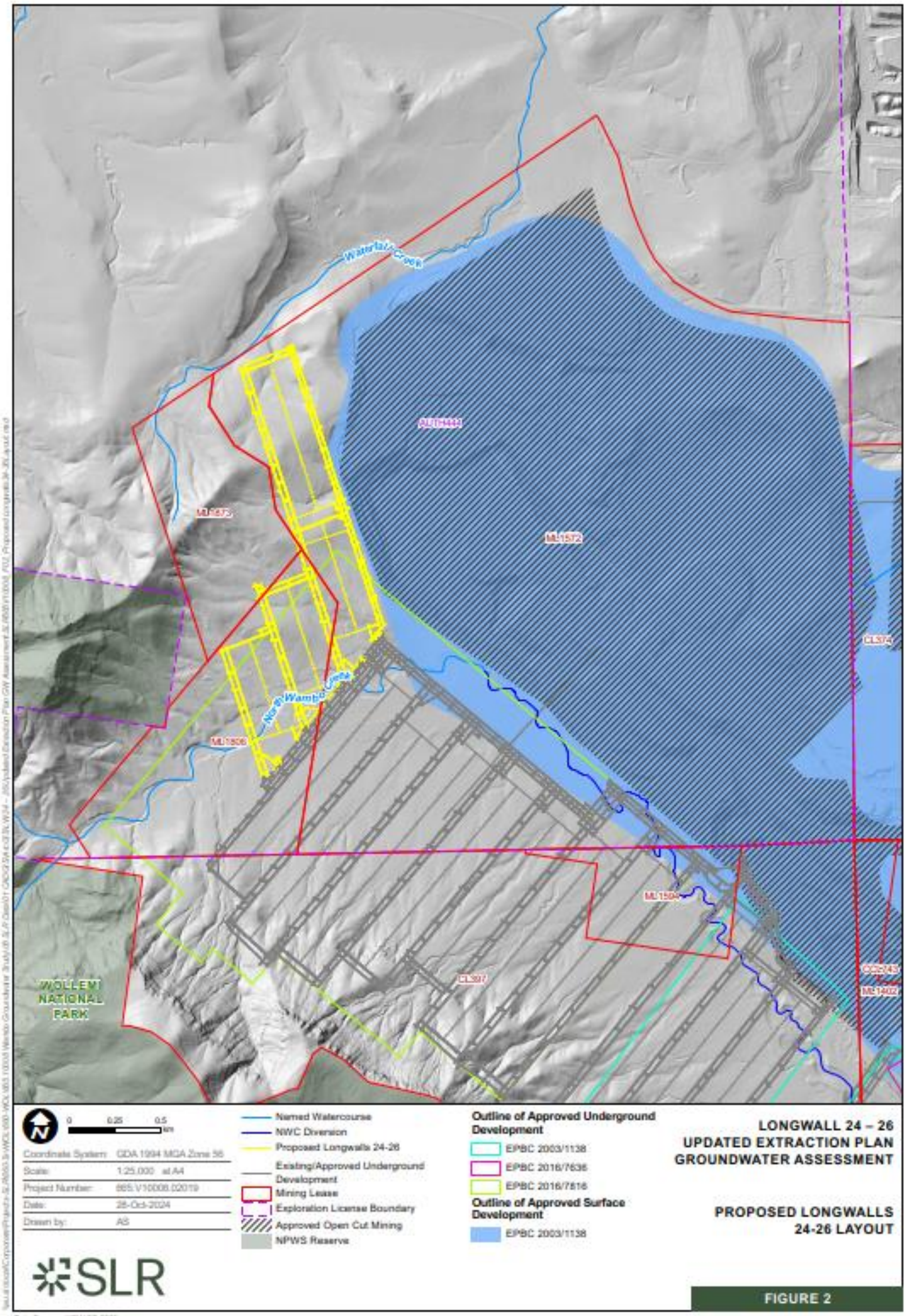
Overall, the revised mine layout is reduced by up to 40% with the current approved LW 24-26 area, with minor southern extensions of LW 25 (approximately 0.25 hectares [ha]) and LW 26 (approximately 2 ha) towards North Wambo Creek. The revised mine layout changes are illustrated in **Figure 2**.

Table 1 provides the proposed mine schedule for the revised mine layout.

Table 1 Proposed Mine Schedule for LW 24-26

Longwall	Estimated Start Date	Estimated Duration	Estimated Completion Date	Existing LW 24-26 Layout Duration
Longwall 24a	January 2024	181 days	June 2024	275 days
Longwall 24b	August 2024	121 days	November 2024	
Longwall 25	December 2024	120 days	March 2025	304 days
Longwall 26	April 2025	121 days	July 2025	273 days

Figure 2 Proposed Longwall 24 – 26 Extraction Plan Update



Data Source: NSW SS 2020

1.3 Extraction Plan Objectives

An Extraction Plan outlines the proposed management, mitigation, monitoring and reporting of potential subsidence impacts and environmental consequences from the secondary extraction of approved longwalls.

Condition B7, Schedule 2 of Development Consent (DA 305-7-2003) requires the Extraction Plan to *"…provide updated predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed mining covered by the Extraction Plan, incorporating any relevant information obtained since this consent…"*

The most recent groundwater predictions were provided in the groundwater assessment conducted by (SLR, 2022) for Modification 19 and (SLR, 2023) for the existing LW 24-26 Extraction Plan. The model utilised in this groundwater assessment was rebuilt from previous Wambo groundwater models (e.g. HydroSimulations, 2019), the United Wambo Open Cut numerical model (Australasian Groundwater and Environmental Consultants Pty Ltd (AGE, 2016)) and site and regional geological models using current best practice modelling techniques.

This groundwater technical review presents and discusses the following:

- Recent relevant environmental monitoring data.
- Groundwater impacts predicted in (SLR, 2022) – the Longwalls 24-26 Groundwater Assessment.
- Relevant information obtained since the completion of the (SLR, 2022) groundwater assessment (e.g. Groundwater Dependant Ecosystem [GDE] studies, or information from recently installed environmental monitoring sites).
- Predicted groundwater impacts due to the extraction of SBEUG LW24-26.

2.0 Existing Environment

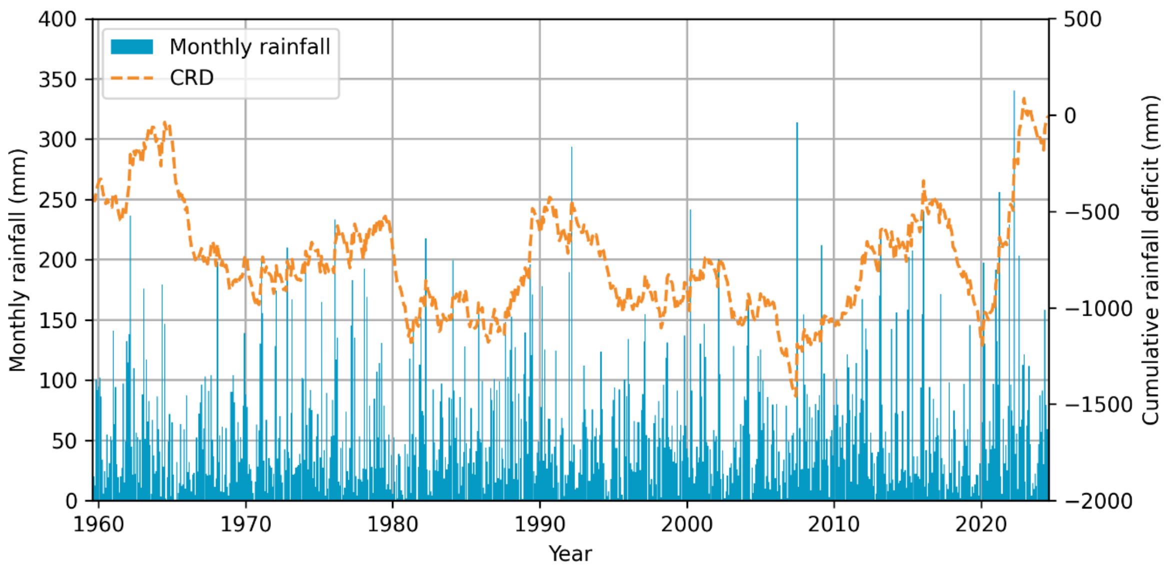
2.1 Climate

The temperate climate of the Wambo area is characterised by hot summers and mild dry winters. Locally, daily rainfall is monitored and recorded at Bulga (South Wambo) (Bureau of Meteorology [BoM] Station 061191), with data available from 01 January 1959 to 31 August 2024 (Queensland Government, 2024).

Rainfall data was used to generate a cumulative rainfall deficit (CRD) plot (**Figure 3**). A CRD plot is provided as a comparative tool to illustrate long term climate trends and their influence on groundwater in the Wambo area. The CRD graphically shows trends in recorded rainfall compared to long-term averages and provides a historical record of relatively wet and dry periods. A rising trend in slope in the CRD graph indicates periods of above average rainfall, whilst a declining slope indicates periods when rainfall is below average. A level slope indicates average rainfall conditions.

Wambo area experienced below average rainfall from 2017 to early 2020, followed by above average rainfall from January 2020 through late 2022. CRD shows that since late 2022 and throughout 2023, rainfall has generally been below average. Above average rainfall has been experienced during the first half of 2024.

Figure 3 Bulga (South Wambo) Long-Term Monthly Rainfall and CRD (Queensland Government, 2024)



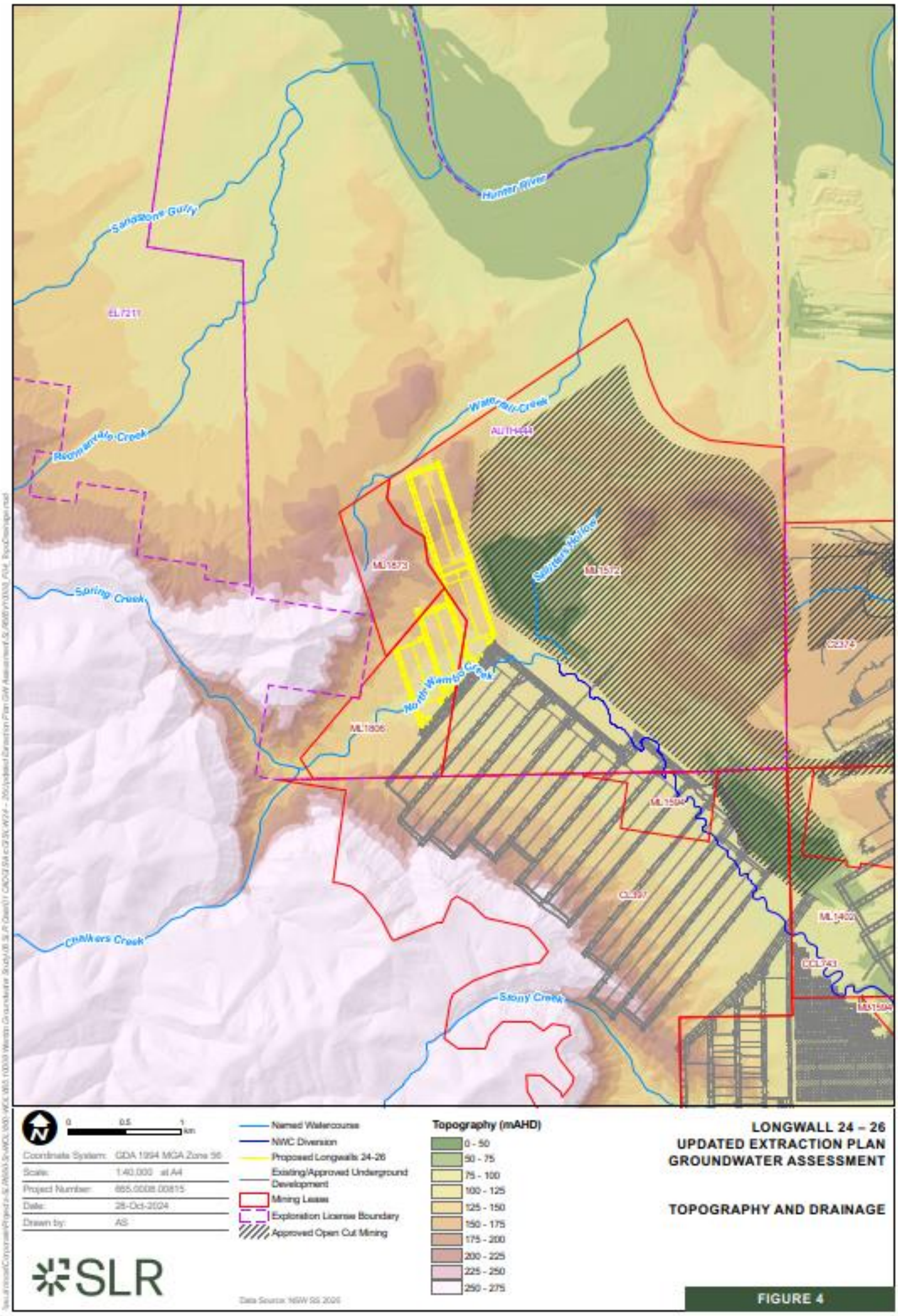
2.2 Topography, Land Use and Drainage

Wambo is located in the Upper Hunter Valley region where landforms are characterised by gently sloping floodplains associated with the Hunter River and the undulating foothills, to the ridges and escarpments of the Mount Royal Range and Great Dividing Range. Elevations in the vicinity of Wambo range from approximately 60 metres Australian Height Datum (mAHD) at Wollombi Brook to approximately 650 mAHD within the Wollemi National Park to the west of Wambo (WCPL, 2003). Topographic data available for the site includes site LiDAR with <1 metres (m) refinement (used for key water courses and site features); publicly available data with 1 to 2 m refinement (used where available); and Shuttle Radar Topography Mission (satellite) Digital Elevation Model (DEM) with 1 to approximately 30 m refinement (used for the remaining model domain).

Due to historical farming and mining, the majority of the Wambo area is cleared of vegetation. Wollemi National Park, to the west (**Figure 1**), is densely vegetated with various plant communities, including open forests dominated by eucalypt species (Australasian Groundwater and Environmental Consultants (AGE, 2016)).

Figure 4 shows local topography and drainage features in the SBEUG area. The primary drainage features of this area are the perennial Hunter River to the north and ephemeral North Wambo Creek and Waterfall Creek to the south and north of SBEUG LW 24-26 respectively. North Wambo Creek drains into Wollombi Brook while Waterfall Creek drains into the Hunter River.

Figure 4 Topography and Drainage



2.2.1 Ephemeral Creeks

Within the vicinity of Wambo Coal Mine, the following creeks are ephemeral in nature (**Figure 4**):

- North Wambo and Wambo Creeks, which drain into Wollombi Brook.
- Stony Creek, which drains into Wambo Creek prior to its confluence with Wollombi Brook.
- Waterfall Creek, which drains into the Hunter River.

Of the ephemeral creeks, North Wambo Creek and Waterfall Creek are the most relevant to this Groundwater Technical Report. North Wambo Creek and Waterfall Creek overlie or are near SBEUG LW 24-26. The Wollombi Brook and Hunter River located close to the WCPL mine area and are discussed separately in more detail in **Section 2.2.2** and **Section 2.2.3**, respectively. Description on ephemeral creeks not discussed in the following section is provided in (SLR, 2023), which focused on the broader Wambo underground mine complex.

2.2.1.1 North Wambo Creek

North Wambo Creek traverses from west to south-east, through the centre of the Wambo area and flows into Wollombi Brook. At its upstream end it drains to the north-east across the southern ends of SBEUG LW 24-26 and the northern edge of SBEUG LW23. Recent installation of monitoring bores has shown the alluvium along North Wambo Creek to be 4 to 10 m deep comprising mainly sands, silts, and gravels, overlying weathered sandstones (regolith). Most of the south-west draining channel section of North Wambo Creek is an artificial realignment as open cut operations to the west mined out the natural channel.

North Wambo Creek is usually dry and only flows in response to heavy rainfall events. During peak flow events, conditions are likely to be losing (surface water leaking to the underlying aquifer). However, if rainfall and surface water flow sufficiently recharge the North Wambo Creek alluvium, gaining conditions may occur (groundwater discharging to surface water).

2.2.1.2 Waterfall Creek

Waterfall Creek is located in a catchment to the north of North Wambo Creek, and generally flows in a north easterly direction to the Hunter River. The UWOCP Surface Water Management Plan (United, 2022) describes Waterfall Creek as “ephemeral and frequently dry. Its channel is generally shallow and poorly defined along its length as its catchment is predominantly drained by overland sheet flow. As such, Waterfall Creek’s riparian zone is also poorly defined.”

The northern end of LW 24a extends to within 100 m of Waterfall Creek (**Figure 4**). A review of aerial imagery and the DEM shows that just north of the revised mine layout, the channel is either poorly defined or not discernible along the floor of a reasonably steep sided valley in this location, with a floor elevation approximately 50 m lower than the valley sides. A farm dam has been constructed on the upper reach of the creek, which holds water, and a small pond is present within the valley just north of LW 24a.

There is currently no data on the frequency and duration of flows, creek bed material, surface water – groundwater interactions, and or the presence of alluvium along Waterfall Creek. It is noted, however, that the presence of surface water flow within Waterfall Creek is infrequently encountered in routine and rain event surface water monitoring. Five events from 52 attempts (9.6%) at midstream Waterfall Creek (SW39) and 13 events from 52 attempts (25%) at downstream Waterfall Creek (SW41) encountered flow from October 2019 to December 2022, noting that three (at SW36) and seven (at SW41) sampling events were successful in 2022 with above average rainfall conditions. Infrequent flows monitored at Waterfall Creek, despite recent above average rainfall conditions is consistent with the ephemeral and frequently dry description above (United, 2022).

2.2.2 Wollombi Brook

Wollombi Brook flows north to north-easterly before meeting the Hunter River and is located approximately 6.5 km south-east of the SBEUG LW 24-26. Alluvium along Wollombi Brook comprises up to 10 to 20 m of unconsolidated sediment including gravel, sand, silt, and clay (MER, 2009). Stream flow analysis was undertaken by (AGE, 2016) to assess the contribution of baseflow in Wollombi Brook with results showing flow is largely a function of rainfall. (AGE, 2016) estimated that groundwater contributes up to 70 megalitres per day (ML/day) to the flow in the Wollombi Brook. Although Wollombi Brook is predominantly a gaining environment (receiving groundwater) there are also areas where the Wollombi Brook recharges the underlying alluvium (losing environment), particularly in high flow events.

2.2.3 Hunter River

Within the Wambo area, the Hunter River is around 20 to 50 m wide and flows in a south to south-easterly direction. The Hunter River is approximately 2.5 km north north-east of SBEUG LW24. The surface water is used for industrial and agricultural purposes, as well as town water supplies. Flowing perennially, daily flows generally range between 100 ML/day and 1,000 ML/day (from WaterNSW gauging station data). Flood events, recorded in May 2001, June 2007, September 2008, June 2011, and March 2013, experience daily flows of over 2,000 ML/day.

Baseflow separation completed by AGE (2016) indicates that surface water flow within Hunter River is largely a function of rainfall. However, it is estimated that groundwater contributes up to 231 ML/day to the Hunter River. The baseflow in the Hunter River is likely to be less than estimated due to releases from the Glenbawn Dam that maintains a permanent flow for downstream users. Although the Hunter River is predominantly a gaining environment (receiving groundwater) there are also areas where the river recharges the underlying alluvium (losing environment), particularly in high flow events.

2.3 Mining

Historically coal mining in the region has been undertaken via both open cut and underground mining techniques. Currently, mining is still occurring via both mechanisms undertaken by several operators. **Table 2** summarises the mine activities in the area, with those operational shown in bold.

Table 2 Summary of Mine Activities (Operational Mines in Bold)

Operator	Mine Name	Seam(s) Mined	Date Operational	Mine Type
WCPL	Homestead Underground	Whybrow	1969 – 1977	Underground
	Wollemi Underground	Whybrow	1997 – 2002	Underground
	Ridge Underground	Whybrow	1973 – 1983	Underground
	Wombat Pit	Whybrow to Whynot	1969 – 2009	Open Cut
	Hunter Pit	Whybrow to Whynot	1969 – 2011	Open Cut
	Bates / Bates South Pit	Whybrow to Whynot	1986 – 2016	Open cut
	Glen Munro Pit	Glen Munro	2016 – 2017	Open Cut
	South Bates Underground	Whybrow Wambo	2016 – 2019	Underground
	SBEUG	Whybrow	2018 – Ongoing	Underground
	Montrose Pit	Whybrow to Whynot	2013 – 2020	Open Cut
	Homestead Pit	Whybrow to Whynot	1969 – 2009	Open Cut
	North Wambo Underground	Wambo	2007 – 2016	Underground
	South Wambo Underground (Approved)	Arrowfield Bowfield	To 2042	Underground
	SBEUG – Longwalls 24-26	Whybrow	2023 – 2025	Underground
United Colliery	United Open Cut	Wambo to Whynot	1989 – 1992	Open Cut
	United Underground	Arrowfield	1992 – 2010	Underground
United Wambo Joint Venture	**UWOCP**	Whynot to Vaux	2020 – 2039	Open Cut
Hunter Valley Operations	**Hunter Valley Operations (HVO) North**	Mt Arthur Bayswater	1979 – 2025	Open Cut
	HVO South	Arrowfield to Bayswater	1997 – 2030	Open Cut
	Lemington Underground	Mt Arthur Seam	1971 – 1992	Underground
	North Lemington	Mt Arthur to Vaux	1971 – 1999	Open Cut
Mount Thorley Operations Pty Ltd and Warkworth Mining Ltd	**Mount Thorley Warkworth (MTW)**	Woodlands Hill to Bayswater	1981 – 2035	Open Cut

3.0 Existing Groundwater Environment and Values

3.1 Geological Setting

The following content has been summarised from the *Longwalls 24-26 Modification Groundwater Assessment* (SLR, 2022), which assessed the potential impacts associated with the cumulative and incremental impacts of Wambo (including the approved LW 24-26 layout) on groundwater levels, groundwater quality, and groundwater dependent assets at various stages during mine operations and post closure.

Wambo is situated within the Hunter Coalfield subdivision of the Sydney Basin, which makes up the southern part of the Sydney-Gunnedah-Bowen Basin. The basin was formed during the Late Carboniferous to Early Permian as a result of continental rifting processes and deposition of Permian and Triassic sediments. Regionally, the geological stratigraphic profile is characterised by surficial alluvium, overlying shallow bedrock (regolith), Jurassic volcanics (intrusions), Triassic sandstone and Permian coal measures (including the target seams for regional mining activities).

Locally the main lithostratigraphic units at Wambo include:

- Alluvium
- Sediment and weathered bedrock (regolith)
- Jurassic volcanics
- Triassic sandstone
- Permian coal

Economic coal seams within the Wambo area include the Bayswater, Broonie, Vaux, Piercefield, Mt Arthur, Warkworth, Arrowfield, Woodlands Hill, Glen Munro, Blakefield, Whynot, Wambo, Redbank Creek and Whybrow seams.

A summary of the stratigraphic profile is provided in **Table 3**. The outcrop geology and geological structure relevant to the updated SBEUG LW 24-26 is presented in **Figure 5**.

3.1.1 Structural Geology

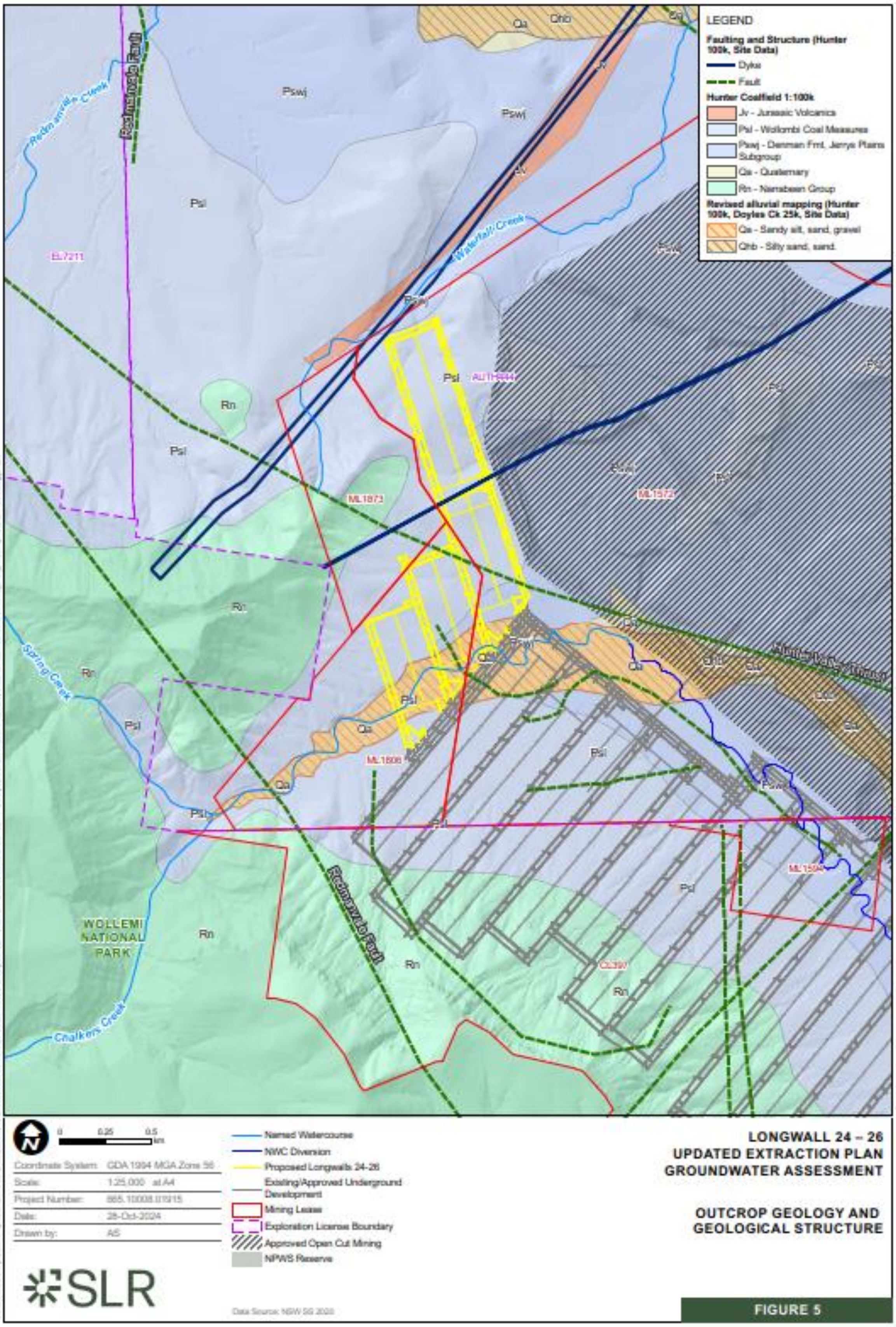
Figure 5 shows the structural geology of the Wambo area overlain on the regional geological mapping. The Permian coal measures generally dip at approximately three degrees to the south-west with structure complicated by some local variations in seam dip and direction. Coal seams generally have consistent thicknesses and interburden intervals (SLR, 2020). There are several northeast to southwest trending faults in the area. The major fault structures in the area include the Redmanvale fault and Hunter Valley Thrust Faults, which occur to west of and within the approved LW 24-26 layout respectively. Drill logs indicate that the Hunter Valley Cross fault has a maximum displacement of approximately 10 m (AGE, 2016). There are several other north-east to south-west minor fault structures in the area; these have been mapped indicating up to 5 m displacement within the Permian coal measures (AGE, 2016).

Several dykes and intrusions occur within the Permian strata across the Wambo area, including the approved LW 24-26 layout. The revised mine layout attempts to avoid mining through a NE-SW trending dyke located between LW 24a and LW 24b, and by not mining north of the dyke for revised LW 25 and LW 26 layouts. Another dyke is mapped directly north of the approved LW 24-26 layout and may be having some control on the alignment of Waterfall Creek (**Figure 5**).

Table 3 Regional Stratigraphic Profile

<table>
<tr><th colspan="2">Era</th><th colspan="3">Stratigraphic unit</th><th>Description</th></tr>
<tr><td colspan="2">Quaternary</td><td colspan="3">Quaternary alluvium (Qha/Qhb)</td><td>Shallow sequences of clay, silty sand, and sand (Qhb) and Basal sands and gravels along major watercourses (i.e. Hunter River) (Qha)</td></tr>
<tr><td colspan="2" rowspan="4">Tertiary</td><td colspan="3">Tertiary alluvium (Cza)</td><td>Alluvial terraces – Silt, sand, and gravel</td></tr>
<tr><td colspan="3">Aeolian Dunes (Czb)</td><td>Sand</td></tr>
<tr><td colspan="3">Silicified Weathering Profile (Czas)</td><td>Silcrete</td></tr>
<tr><td colspan="3">Alluvial Terraces (Cza)</td><td>Silt sand and gravel</td></tr>
<tr><td colspan="2">Jurassic</td><td colspan="3">Volcanics (Jv)</td><td>Flows, sills, and dykes</td></tr>
<tr><td colspan="2">Triassic</td><td colspan="3">Narrabeen Group (Rn)</td><td>Sandstone, interbedded sandstone, siltstone, and claystone. Localised at Wollemi National Park.</td></tr>
<tr><td rowspan="7">Permian</td><td rowspan="6">Late</td><td rowspan="6">Singleton Supergroup</td><td>Newcastle Coal Measures (Psl)</td><td>Glen Gallic Sub-group, Doyles Creek Sub-group, Horseshoe Creek Sub-group, Apple Tree Flat Sub-group</td><td>Coal seams, claystone (tuffaceous), siltstone, sandstone, and conglomerate.</td></tr>
<tr><td colspan="2">Watts Sandstone</td><td>Medium to coarse grained sandstone</td></tr>
<tr><td rowspan="4">Wittingham Coal Measures</td><td>Jerrys Plains Subgroup (Pswj)</td><td>Interbedded coal measures with siltstone, sandstone, and shale. Coal seams include Whybrow, Redbank Creek, Wambo, Whynot, Blakefield, Glen Munro, Woodlands Hill, Arrowfield, Bowfield, Warkworth, Mt Arthur, Piercefield, Vaux, Broonie and Bayswater.</td></tr>
<tr><td>Archerfield Sandstone (Psws)</td><td>Massive coarse-grained lithic sandstone.</td></tr>
<tr><td>Vane Subgroup (Pswv)</td><td>Interbedded coal measures with siltstone, sandstone, and shale. Coal seams include Lemington, Pikes Gully, Arties, Lidell, Barrett, and Hebden.</td></tr>
<tr><td>Saltwater Creek Formation (Pswc)</td><td>Sandstone and siltstone, minor coaly bands, marine siltstones intercalated towards base.</td></tr>
<tr><td>Middle</td><td>Maitland Group</td><td colspan="2">Mulbring Siltstone (Pmm)</td><td>Dark grey shale and siltstone, bioturbated and fossiliferous.</td></tr>
</table>

Figure 5 Outcrop Geology and Geological Structures



3.2 Hydrogeological Setting

This section presents a summary of the groundwater monitoring network near SBEUG and the revised mine layout, and discussion on groundwater level and quality trends in this area. Information is based on the findings of SLR (2022, 2023, 2024), and updated with the latest available groundwater monitoring site data.

The main aquifer units of importance relating to the revised mine layout are:

- The Quaternary alluvium
- Sediment and weathered bedrock (regolith)
- Permian coal seam measures

A summary of the main aquifer units is given below:

- Alluvial sediments of the ephemeral watercourses, North Wambo Creek – the alluvium associated with these ephemeral creeks is typically unsaturated and will receive recharge via losses from the watercourse during periods of flow. However, following flow events and periods of saturation, groundwater drains laterally or to the underlying strata.
- Due to the small catchment size of Waterfall Creek compared with other ephemeral watercourses in the Wambo area (e.g., North Wambo Creek, Wambo Creek), and the relatively confined valley it is in, it is likely that any alluvial material will be limited in extent. Alluvial groundwater at Waterfall Creek will likely be sourced from upward or lateral flow from Permian coal measures, or downward infiltration following rainfall and flow in Waterfall Creek, as is observed at other ephemeral creeks at Wambo.
- Shallow bedrock (regolith) – typically saturated, with groundwater occurring between 4 to 12 m below surface.
- Permian Coal Measures – comprised of a stratified sequences of sandstone, siltstone, and claystone (interburden) and coal, with the coal seams acting as the primary water bearing units whilst the low permeability interburden generally confines the individual seams. Mining activities locally influence the recharge and discharge mechanisms of the Permian Coal Measures. Recharge typically occurs via downward seepage from overlying aquifer units, and site water storage losses. Groundwater discharge is via mining, private abstraction, and in localised areas outside of the extent of mine influence, potential upward seepage where gradients enable this.

3.2.1 Groundwater Monitoring

Groundwater monitoring is conducted at WCPL in accordance with the Groundwater Management Plan (GWMP) (Peabody, 2023). The purpose of the GWMP is to monitor and manage groundwater quality and levels to detect potential impacts on surrounding groundwater users, assess the performance of the mine against the performance indicators, and to ensure that relevant legislative and policy requirements are met. The overall objective of the GWMP is to establish a program of data collection that can be utilised to assess potential impacts of mining activities on local groundwater resources. Groundwater levels are compared to background data, EIS predictions, and historical trends as a means of assessing any WCPL related drawdown impacts to local aquifers. Ongoing groundwater monitoring requirements at WCPL are as follows:

- Groundwater monitoring above and in close proximity to mine workings.
- Monitoring of potential groundwater leakage from alluvial aquifers.

- Monitoring of groundwater inflows to underground and open cut mining operations.

The monitoring programme at WCPL also assesses the quality of groundwater against background data and historical trends. Bi-monthly monitoring of groundwater levels, pH, and Electrical Conductivity (EC) is undertaken at all standpipe bores included in the groundwater monitoring program. Comprehensive analysis of major ions is conducted at each standpipe bore annually. Details of the monitoring standpipe and vibrating wire piezometers within the current WCPL monitoring network are provided in the *WCPL 2023 Annual Review* (SLR, 2024) and shown on **Figure 6**.

3.2.2 Monitoring Data

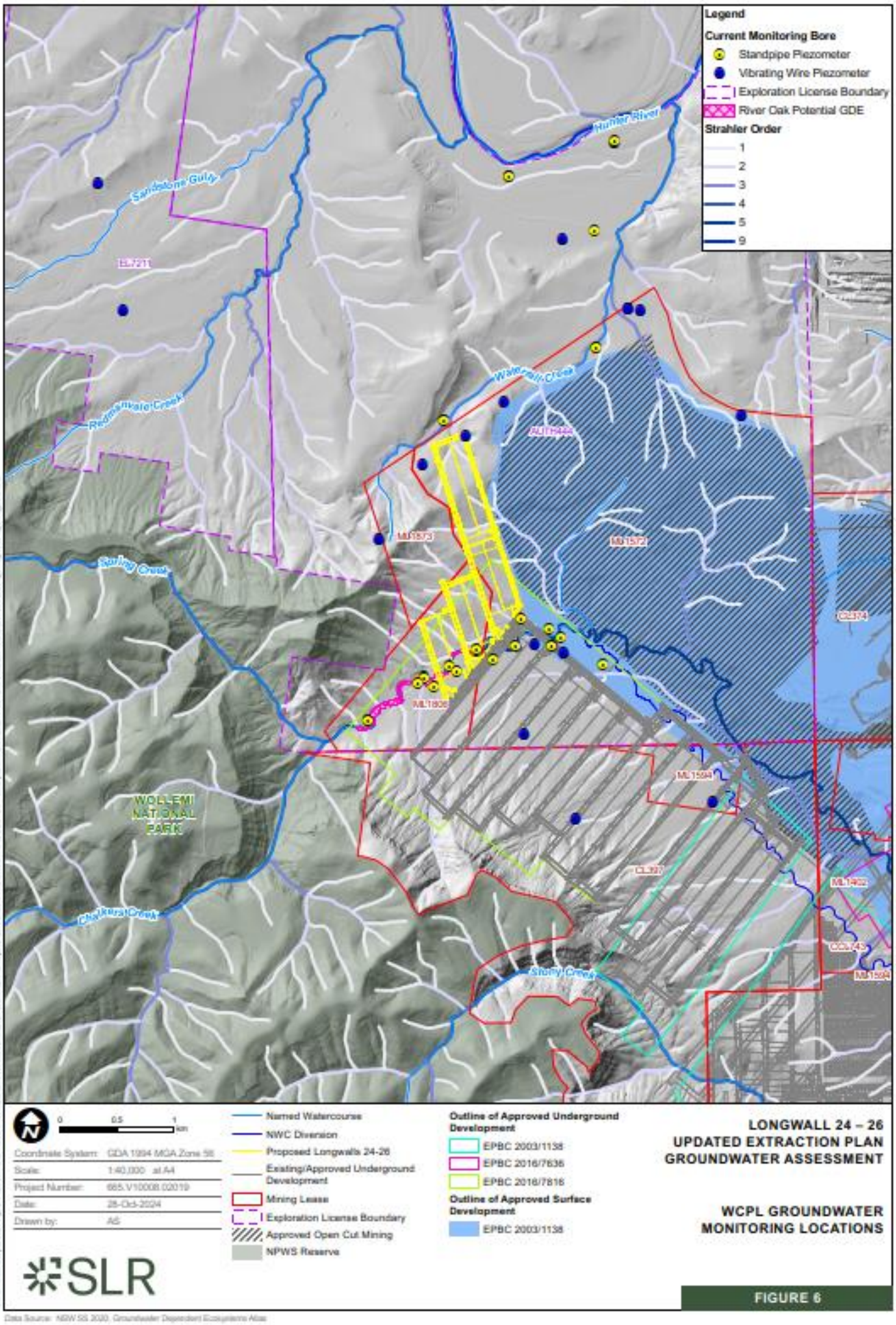
A summary of the groundwater level data for each of the main water bearing units within the approved LW 24-26 layout is provided below together with a review of electrical conductivity (EC) and pH for 2023 (SLR, 2024) and observations made in SLR (2022, 2023).

3.2.2.1 Alluvium

The following groundwater level and quality trend observations were made for Wambo alluvial monitoring locations relevant to the approved LW 24-26 layout:

- Outside of high rainfall and flow events, alluvial bores in this area can be unsaturated with shallow saturation and flow occurring primarily within the underlying regolith.
- The alluvium does not sustain peak levels of saturation for long periods of time following rainfall/ flow events, with water percolating laterally or through to the underlying regolith.
- Upstream bores in the North Wambo Creek alluvium generally show increasing groundwater levels when higher-than-average rainfall conditions are experienced.
- Rapid groundwater level response to high rainfall events is observed and appears closely linked to flow and flow recession in North Wambo Creek.
- Declining and dry groundwater levels within the North Wambo Creek Alluvium bores were observed in 2023 and were attributed to below average rainfall and lack of North Wambo Creek flow events.
- EC was stable at some sites while increased late in 2023 at others, while pH was generally stable.
- SBEUG LW 23 extraction was completed in 2023 near North Wambo Creek alluvial monitoring locations. SLR (2024) noted no clear trends at these locations that indicated mining was causing groundwater level declines additional to what would be expected from low-flow and dry conditions.

Figure 6 WCPL Groundwater Monitoring Locations



3.2.2.2 Regolith

The following groundwater level and quality trend observations were made for Wambo regolith monitoring locations relevant to the approved LW 24-26 layout:

- In some locations a short-term perched groundwater system may form within the regolith in periods of significant rainfall when recharge rates exceed the ability of the underlying rock to receive the overlying recharge.
- Relatively large fluctuations in groundwater levels in response to rainfall events were observed in groundwater level monitoring data. The rapid groundwater level response to high rainfall events appears similar to the North Wambo Creek alluvium and is closely linked to flow and flow recession in North Wambo Creek.
- Similar to alluvial sites, below average rainfall in 2023 has resulted in declining groundwater levels within North Wambo Creek regolith bores.
- Increasing EC has been widely observed as a response to below average rainfall/recharge. pH has remained stable with generally neutral conditions.
- Similar to the alluvium bore observations, SLR (2024) noted that there were no clear trends at the North Wambo Creek regolith monitoring locations that indicated mining was causing groundwater level declines additional to what would be expected from low-flow and dry conditions.

3.2.2.3 Permian Coal Measures

The following groundwater level and quality trend observations were made for Wambo Permian Coal Measures monitoring locations relevant to the approved LW 24-26 layout:

- Where mining is occurring, the actively mined coal seams are depressurised, and groundwater levels are significantly lower than groundwater levels in the overlying strata.
- Groundwater level trends from the VWPs north and west of the approved LW 24-26 layout indicated that Waterfall Creek was not likely directly interacting with the regional water table north of the approved LW 24-26 layout and that temporary perched groundwater levels were possible in response to rainfall.
- Declining groundwater levels in Permian Coal Measure bores were attributed as possible SBEUG LW 23 mining impact as well as below average rainfall (SLR, 2024).

3.2.2.4 Summary

Despite mining within the SBEUG mining area, and more recently the completion of LW 23 in 2023 located adjacent and south of North Wambo Creek, alluvium and regolith monitoring bores did not indicate clear signs of mining induced groundwater level decline. Climatic influences on groundwater levels as well as groundwater quality (EC) appear to be more significant than mining influences on alluvial and regolith monitoring bores, over the period of data availability.

3.2.3 Groundwater Flow and Distribution

Hydrogeological characteristics of aquifer units near SBEUG, including the nature of aquifer material, recharge and discharge mechanisms are presented in the following sections. Groundwater level trends, and responses to climatic and anthropogenic influences are also discussed for aquifer units near the revised mine layout. Hydrogeological characteristics across the broader Wambo mine complex are discussed in SLR (2022).

3.2.3.1 North Wambo Creek Alluvium

The alluvium along the upper reaches of North Wambo Creek is approximately 4 to 10 m thick (SLR, 2022) and generally comprises sand, silt, and gravel, overlying weathered sandstones (regolith). Approximately 0.6 square kilometres (km^2) of North Wambo Creek alluvium is mapped to underlie the approved LW 24-26 layout. Outside of high rainfall and flow events, alluvial bores in this area can be unsaturated with shallow saturation and flow occurring primarily within the underlying regolith (SLR, 2022). Recharge to the alluvium is observed in response to rainfall events of sufficient magnitude to induce flow on the alluvial flats and upstream confined valley of North Wambo Creek, with alluvial saturation observed near ground surface, indicating the potential for baseflow to North Wambo Creek.

Recharge to the North Wambo Creek alluvium occurs via diffuse infiltration from rainfall events of sufficient intensity or flow within the ephemeral North Wambo Creek. The creek is characterised as dominantly having losing conditions, with limited baseflow, consequently acting as a recharge mechanism for the North Wambo Creek alluvium in periods of flow (SLR, 2022). The alluvium does not sustain peak levels of saturation for long periods of time following rainfall/ flow events, with water percolating laterally or through to the underlying regolith.

Upstream bores in the North Wambo Creek alluvium (GW23, GW25, GW27 - refer **Figure 7**) generally show increasing groundwater levels with recent higher-than-average rainfall (2020 to early 2023) fluctuate between 1 to 3 m in response to rainfall events.

Alluvial bores closer to the North Wambo Creek Diversion and Montrose Open Cut (GW28, GW30, GW31, GW32, GW33, GW34, GW35 and GW36b) show large fluctuations in groundwater level (4 to 7 m) in response to the high rainfall events during 2020 - 2023 (**Figure 7**). The rapid groundwater level response to high rainfall events appears closely linked to flow and flow recession in North Wambo Creek.

3.2.3.2 Shallow Weathered Bedrock/ Residual Sediment (Regolith)

The regolith is generally saturated, with groundwater occurring between 4 to 12 m below ground surface. The regolith thickness map developed by Commonwealth Scientific and Industrial Research Organisation (CSIRO) (2015) indicates the regolith in the vicinity of SBEUG and the revised mine layout is variable in thickness ranging from less than 1 m up to 11 m outside the mapped alluvium extents. At higher elevations, the regolith is typically thin and is generally thicker in areas of lower elevation.

The regolith may also host the regional water table and is the conduit for the main source of recharge to the underlying rock. In some locations a short-term perched groundwater system may form within the regolith in periods of significant rainfall when recharge rates exceed the ability of the underlying rock to receive the overlying recharge. The regolith likely contains localised areas of increased recharge associated with its weathered nature. Coal seams that weather to finer material will have limited ability to transmit groundwater, while the sandier units offer increased potential for groundwater recharge.

Groundwater levels in shallow/ weathered Permian strata (regolith) near North Wambo Creek are monitored upstream of the North Wambo Creek diversion at bores GW24, GW26, GW36a, GW16, GW17 and SBX-GW02 (**Figure 8**). Data loggers are installed in two of these regolith bores (SBX-GW02 and GW36a).

Despite relatively shallow construction depths (less than 20 m), and nearby mining and the drought conditions from 2017 to 2020, the bores upstream of the North Wambo Creek Diversion maintained saturation.

Groundwater levels illustrated in **Figure 8** indicate large fluctuations in groundwater levels up to 8 m in response to rainfall events. The rapid groundwater level response to high rainfall events appears similar to the North Wambo Creek alluvium and is closely linked to flow and flow recession in North Wambo Creek.

Figure 7 North Wambo Creek Alluvium Hydrographs

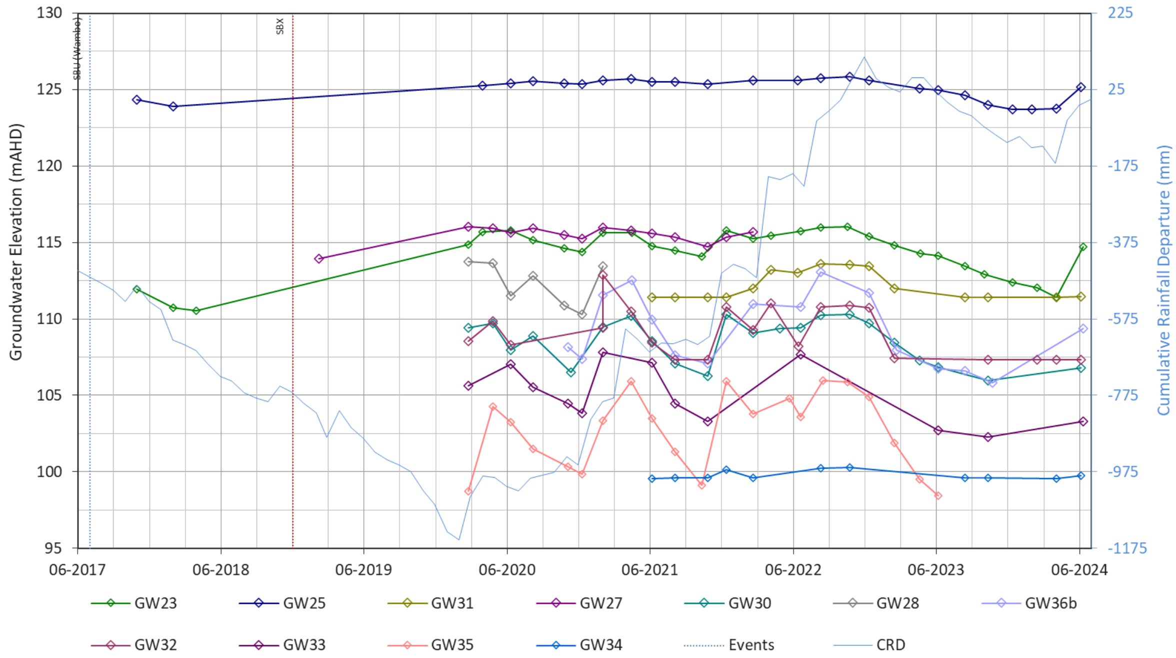
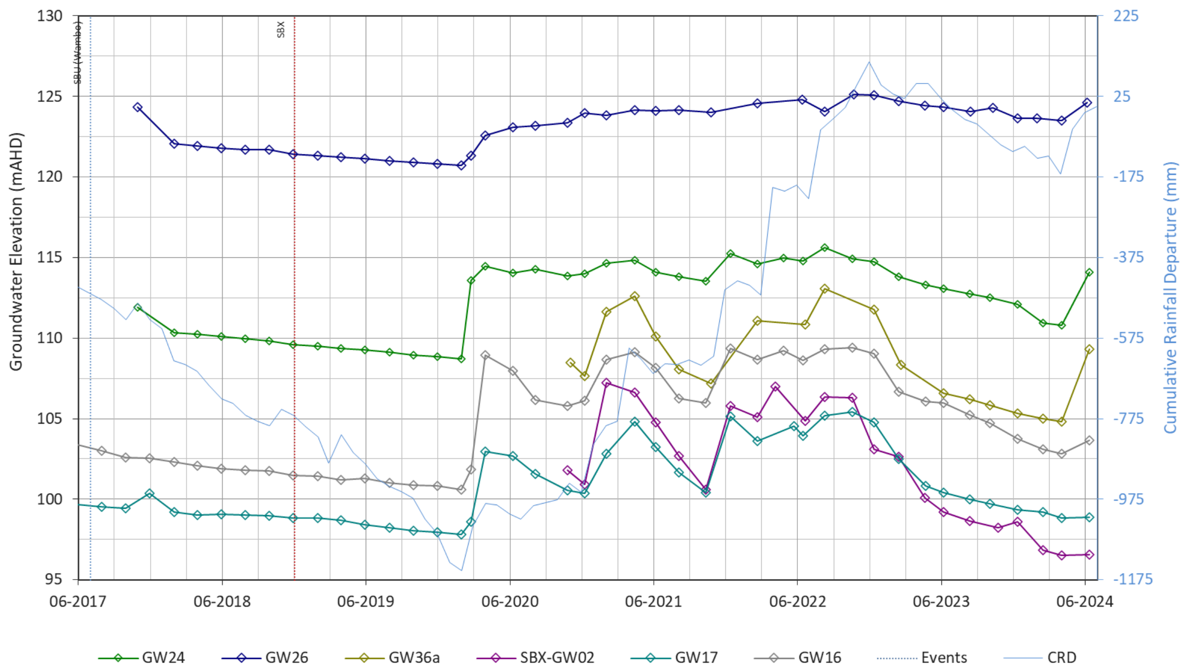


Figure 8 Shallow Weathered Bedrock/ Regolith Hydrographs



3.2.3.3 Permian Coal Measures

The Permian coal measures comprise stratified sequences of sandstone, siltstone, and claystone (interburden) and coal. The coal seams are generally identified as the groundwater bearing units, with the low permeability interburden generally confining the individual seams (SLR, 2022).

Hydraulic conductivity of the coal decreases slightly with depth due to increasing overburden pressure reducing the aperture of fractures. Vertical movement of groundwater (including recharge) is limited by the confining interburden layers, meaning that groundwater flow is primarily horizontal through the seams with recharge primarily occurring at sub-crop (SLR, 2022).

Groundwater flow largely follows the regional topography, flowing in a north-easterly direction and is likely host to the water table in elevated areas away from incised drainage lines and watercourses. Localised drawdown nearby active mining is apparent.

The Permian coal measures are recharged from rainfall primarily occurring at sub-crops, from downward seepage, and site water storage. Where mining is occurring, the actively mined coal seams are depressurised, and groundwater levels are significantly lower than groundwater levels in the overlying strata resulting in no upward leakage.

Groundwater discharges to active mining areas and abstraction bores, and in localised areas outside the extent of mining influence. Potential upward seepage to the Quaternary alluvium can occur where hydraulic gradients enable this (AGE, 2016).

Extensive historical open cut and underground mining in the district has generated a regional zone of depressurisation within the Permian coal sequences. Groundwater levels in the in Permian strata near the approved LW 24-26 layout (**Figure 6**) are monitored at Wambo multi-sensor VWPs P328, N5, SBX_GW02, DDH1234_LW24, DDH1235_LW25, and DH1240_SBXX_20_ST07 and summarised below. Detailed discussion and hydrographs are presented in the *WCPL 2023 Annual Review* (SLR, 2024).

VWP sensors in the overburden above the Whybrow seam generally show water levels near the top of the unit, with a downward gradient from overlying weathered strata and alluvium and are frequently observed to decline with the approach of mining.

(SLR, 2023) noted from groundwater level trends from the VWPs north and west of the approved LW 24-26 layout that Waterfall Creek is not likely to be directly interacting with the regional water table north of LW 24 and that temporary perched groundwater levels were observed in some shallow sensors in response to rainfall trend.

3.2.4 Groundwater-Surface Water Interaction

(SLR, 2022) confirmed from surface water and groundwater monitoring data and past studies at the site that high rainfall events typically result in flow in the ephemeral streams within the project area. Rapid increase in groundwater levels have been historically observed and correlated with periods of high rainfall and flow at one of the North Wambo Creek surface water monitoring sites. Groundwater levels in some of the ephemeral stream alluvium monitoring bores typically decline during the dry winter months.

Similar trends have been observed in underlying Permian strata, with peak groundwater levels occurring approximately 2 to 3 weeks after peak water levels are observed in the overlying ephemeral alluvium. This is consistent with delayed infiltration into the lower conductivity weathered coal measures from the North Wambo Creek alluvium.

Therefore, high rainfall events resulting in flow in North Wambo Creek, and other ephemeral streams, are likely to be an important recharge mechanism for its alluvium and underlying weathered strata when stream flow is observed.

3.2.5 Water Quality

This section briefly discusses the chemical characteristics and possible beneficial uses of groundwater within the various geological units. Water quality results for surface water (North Wambo Creek) are also briefly discussed.

General groundwater quality at Wambo is described in terms of electrical conductivity (EC), a measure of water's capability to pass electrical flow and is correlated to the salinity and dissolved constituents within the water.

EC observations for surface water at Waterfall Creek (approximately 2 km downstream from the approved LW 24-26 layout) indicate the water is typically fresh (<200 micro Siemens per centimetre [µS/cm]), but due to the highly ephemeral nature of Waterfall Creek, collection of water quality data is limited to periods shortly after rain events. There were no groundwater monitoring sites near Waterfall Creek at the time of the *Longwalls 24-26 Modification Groundwater Assessment* (SLR, 2022).

Groundwater quality within the North Wambo Creek alluvium is characterised by low EC, generally ranging between 350 µS/cm to 1000 µS/cm. Higher surface water EC observed at surface water monitoring sites within a more confined bedrock and boulder-lined channel upstream of the North Wambo Creek alluvial plain, may be indicative of groundwater discharge from Narrabeen Group or Newcastle Coal Measures aquifers.

The upper limits of EC observations at shallow Permian monitoring bores are generally more saline than overlying alluvial sites, with EC values prior to 2020 ranging between 1000 µS/cm to 5000 µS/cm. However, following above average rainfall conditions through 2020 and 2021, EC declined at most shallow Permian sites to values consistent with those observed in the alluvium. This indicates downward leakage from the alluvium is a recharge source for shallow Permian strata during periods of above average rainfall and saturation within the alluvium when flow is observed in the ephemeral streams. Outside of wet climatic periods, up-flow or lateral flow through Permian strata is the likely recharge mechanism for the shallow Permian aquifer unit.

3.3 Groundwater Values

Groundwater Dependent Ecosystems (GDEs) and private bores are the two most relevant environmental values considered in evaluating potential changes in mining related impacts due to their direct reliance on the quantity and quality of shallow groundwater.

3.3.1 Groundwater Dependent Ecosystems

Ecosystems that rely on groundwater to maintain their structure and function are classified as GDEs. The GDE Atlas developed by the Bureau of Meteorology (BoM) provides high level mapping for surface and sub-surface GDEs, based on national-scale analysis and regional studies (BoM, 2024). The Atlas contains information about three types of ecosystems:

- Terrestrial ecosystems are ecosystems that rely on the subsurface presence of groundwater – this includes all vegetation ecosystems.
- Aquatic ecosystems are ecosystems that rely on the surface expression of groundwater. This includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands, and springs. Marine and estuarine

ecosystems can also be groundwater dependent, but these are not mapped in the Atlas.

- Subterranean ecosystems, includes cave and aquifer ecosystems (stygofauna).

The first two categories may overlap in riparian zones where vegetation may access groundwater in the subsurface but also via its surface expression during overbank flooding of streamflow sourced from baseflow.

Hunter Eco (2019) and Eco Logical Australia Pty Ltd (ELA) (2022) assessed potential GDEs above the approved LW 24 -26 layout and identified two high potential GDEs associated with the North Wambo Creek and Waterfall Creek.

All GDEs are shown spatially in relation to the Wambo Coal Mine and surrounding area in **Figure 9**.

3.3.1.1 Terrestrial GDEs

The GDE Atlas (BoM, 2024) indicate that large parts of the approved LW 24-26 layout are mapped as low potential terrestrial GDEs.

Available data from monitoring bores indicate that the North Wambo Creek alluvium is only saturated to near ground level following high magnitude rainfall events when flow in the ephemeral North Wambo Creek occur. However, groundwater levels decline relatively quickly following these rainfall events. Past studies that identified high potential GDEs in the SBEUG Mine area, as further described in SLR (2023), concluded that these GDEs will only have periodic access to groundwater.

Hunter Eco (2019) assessed potential impacts of subsidence associated with the SBEUG on GDEs associated with North Wambo Creek. Hunter Eco (2019) concluded it is unlikely that subsidence from the SBEUG will have a long-term detrimental effect on the River Oak GDE found along North Wambo Creek. The approved LW 24-26 layout would result in a 4.9 ha reduction in the area of high potential GDE within mining areas, and no new areas of high potential GDE would be directly undermined (ELA, 2022). It should be noted that the revised layout of LW 26 would see an extension of the LW to the south that would be located underneath North Wambo Creek.

In addition, high potential GDEs were identified to occur north of the approved LW 24-26 layout along Waterfall Creek. This GDE occurs outside of the revised mine layout and the potential GDE would not be directly undermined.

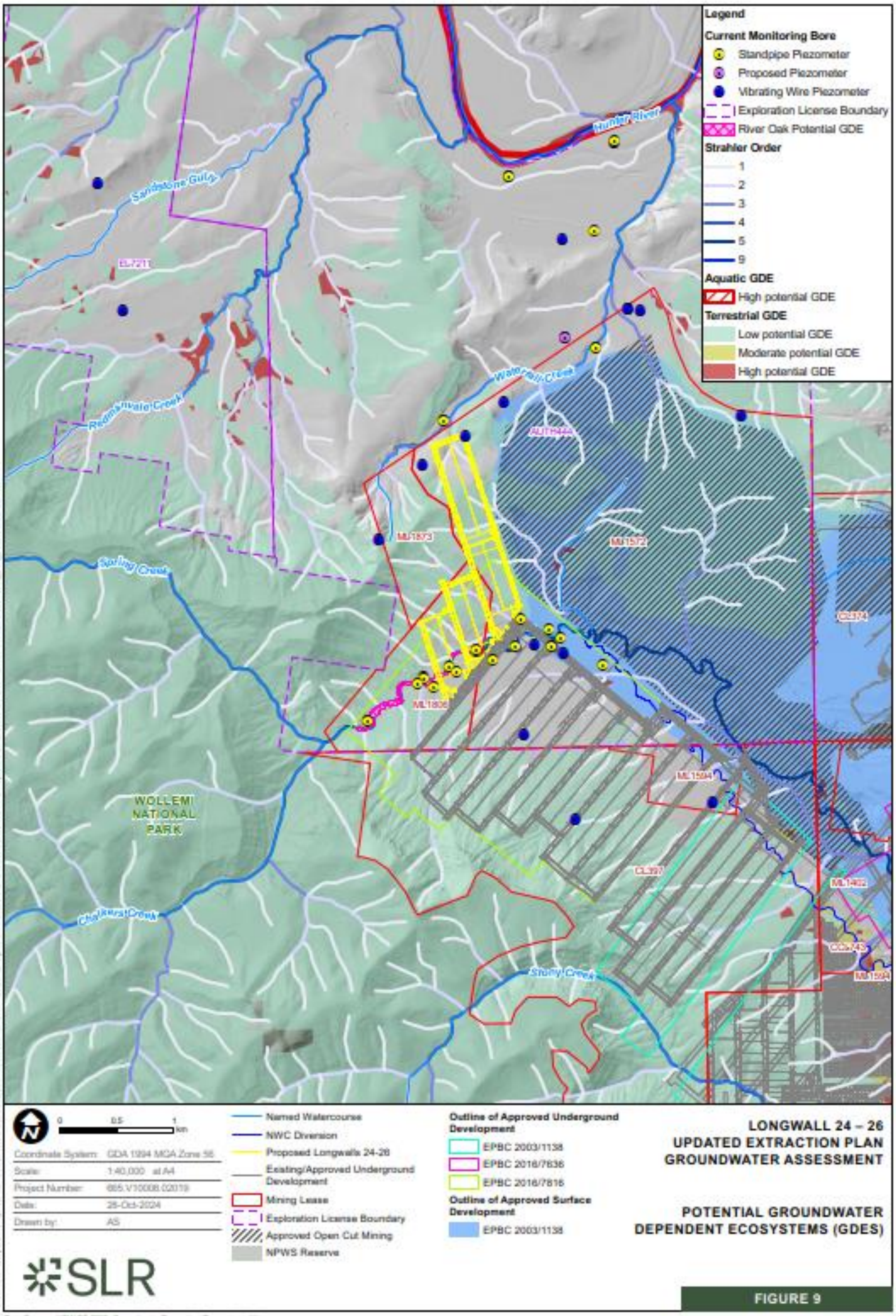
3.3.1.2 Aquatic Groundwater Dependent Ecosystems

The GDE Atlas (BoM, 2024) identifies the Hunter River (located approximately 3 km north of the approved LW 24-26 layout) as a high potential Aquatic GDE.

3.3.1.3 Subterranean Groundwater Dependent Ecosystems

The GDE Atlas (BoM, 2024) indicates no available data to support the occurrence of potential subterranean GDEs in or around the Wambo mine.

Figure 9 Potential Groundwater Dependent Ecosystems



Data Source: NSW SS 2020, Groundwater Dependent Ecosystems Atlas

3.3.2 Landholder Bores

Search results from several studies conducted between 2014 – 2020 of the NSW Bore Database are detailed in SLR (2022). Results from these studies indicate that there were 122 bores within a 4 km radius of Wambo.

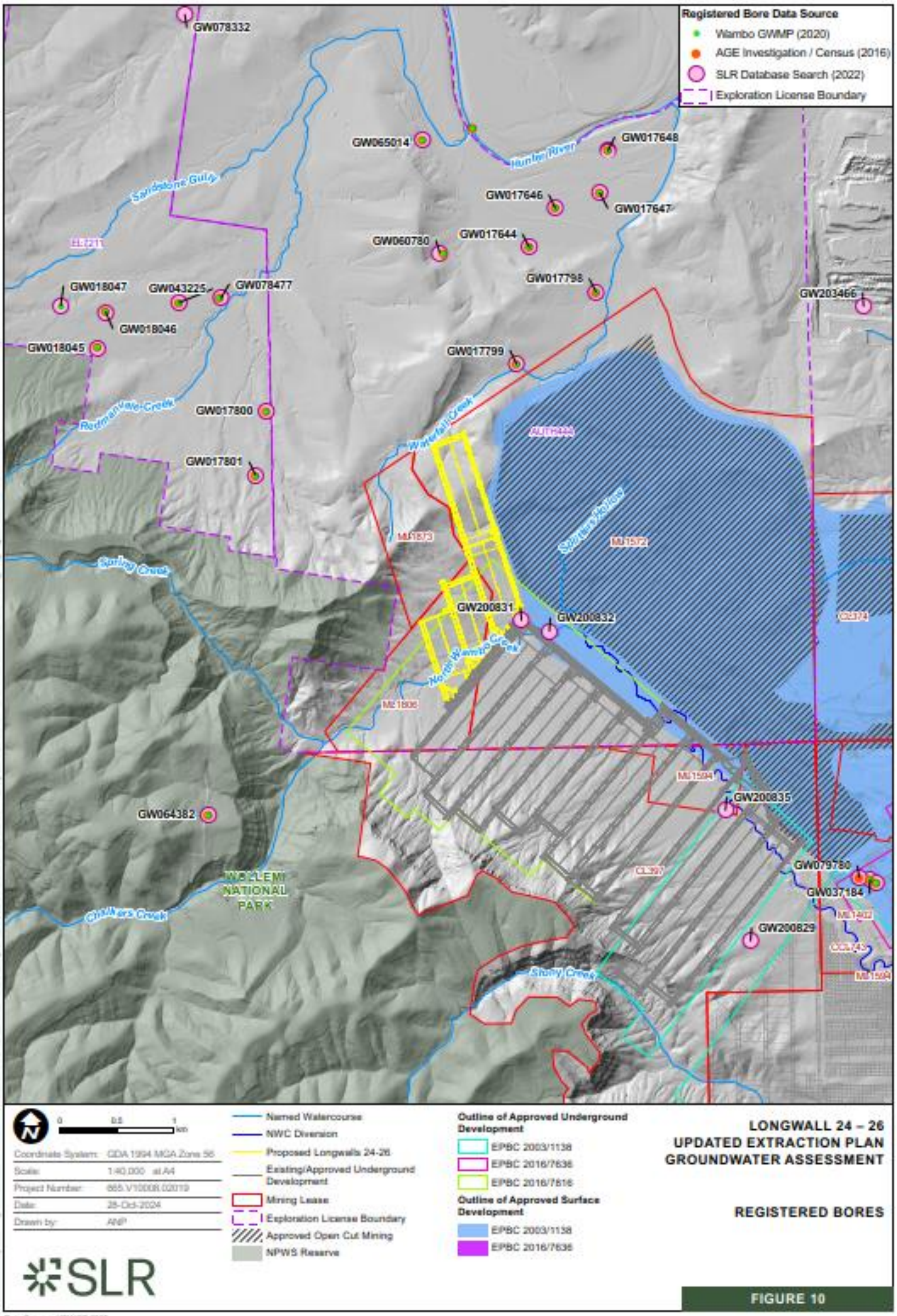
A total of 41 bores were registered as monitoring/ test bores and located within Wambo Mine tenement boundaries (namely Mining Lease 1402, Coal Lease 743, and Mining Lease 1594). A total of 15 bores were identified as mining/ dewatering/ exploration bores, and 16 bores were of unknown use. There were 27 bores registered for irrigation, domestic and/or stock use. The remainder of identified bores were noted as abandoned or destroyed.

SLR (2022) details an additional assessment into 9 NSW Bore Database registered bores nearest to the approved LW 24-26 layout. The aim of that assessment was to confirm the location, construction, and whether the bores were in use. There were no metered records available for abstraction from these bores, although significant groundwater use was considered unlikely. SLR (2022) outlines outcomes from consultation with landowners which indicated generally infrequent use of private bores. A total of seven bores were identified to be located on private, non-mine owned land, and are listed together with their local aquifer units (where available):

- GW043225 (Triassic Sandstone aquifer)
- GW064382 (Triassic Sandstone aquifer)
- GW078477 (Triassic Sandstone aquifer)
- GW078574 (Unknown)
- GW078575 (Unknown)
- GW078576 (Regolith and Permian coal measures)
- GW078577 (Unknown)

The approximate locations of bores registered for irrigation, domestic and/or stock use, or have an unknown use near LW 24-26 are shown in **Figure 10**.

Figure 10 Registered Bores Surrounding the Wambo Mine Area



Data Source: NSW SS 2020

4.0 Potential Impacts on Groundwater Resources

Numerical modelling was undertaken in the *Longwalls 24-26 Modification Groundwater Assessment* (SLR, 2022) to evaluate the potential incremental impacts of the approved LW 24-26 layout on the local groundwater regime.

Routine groundwater monitoring is conducted across WCPL, and the data reviewed and analysed on an annual basis. Groundwater level and quality data assessed and relevant to the approved LW 24-26 layout was reviewed in (SLR, 2023) and subsequently in the *WCPL 2023 Annual Review* (SLR, 2024) (as summarised in **Section 3.2.2**).

Potential impacts of the revised mine layout have been qualitatively assessed based on a comparison with the assessment results (including numerical groundwater modelling) provided in (SLR, 2023) and the most recent review of site groundwater monitoring data (SLR, 2024).

4.1 2022 Numerical Groundwater Modelling

The (SLR, 2022) numerical groundwater model was developed based on the conceptual groundwater model, and more detail on the conceptual model, numerical model design, calibration, model performance, and limitations are presented in detail in (SLR, 2022). The objectives of the predictive modelling were to:

- Assess the groundwater inflow to the mine workings as a function of mine position and timing.
- Simulate and predict the extent and area of influence of dewatering, and the level and rate of drawdown at specific locations and in specific strata.
- Identify areas of potential risk, where groundwater impact mitigation/control measures may be necessary.
- Estimate direct and indirect water take.
- Estimate post-mining recovery conditions.

4.1.1 Predicted Groundwater Drawdown

The key predictions made by (SLR, 2022) relevant to drawdown associated with the approved LW 24-26 layout includes:

- A maximum annual inflow of 480.45 ML (megalitres) (1.32 ML/day) was predicted for the SBEUG Mine.
- Incremental drawdown to the water table of approximately 20 m was previously predicted above the approved LW 24-26 layout, with the 1 m drawdown contour extending up to 1.6 km north of the approved LW 24-26 layout (**Figure 11**).
- No incremental drawdown impacts were predicted for the alluvium.
- The drawdown extent within the Whybrow Seam was influenced by unit structure and was confined to unit extents, meaning that drawdown did not extend east of where the Whybrow Seam has outcropped. The 1 m drawdown influence was predicted to extend up to 3.4 km north-west of the approved LW 24-26 layout (**Figure 12**). No incremental drawdown was predicted for the Vaux Seam.

Figure 11 Maximum Incremental Drawdown in the Water Table

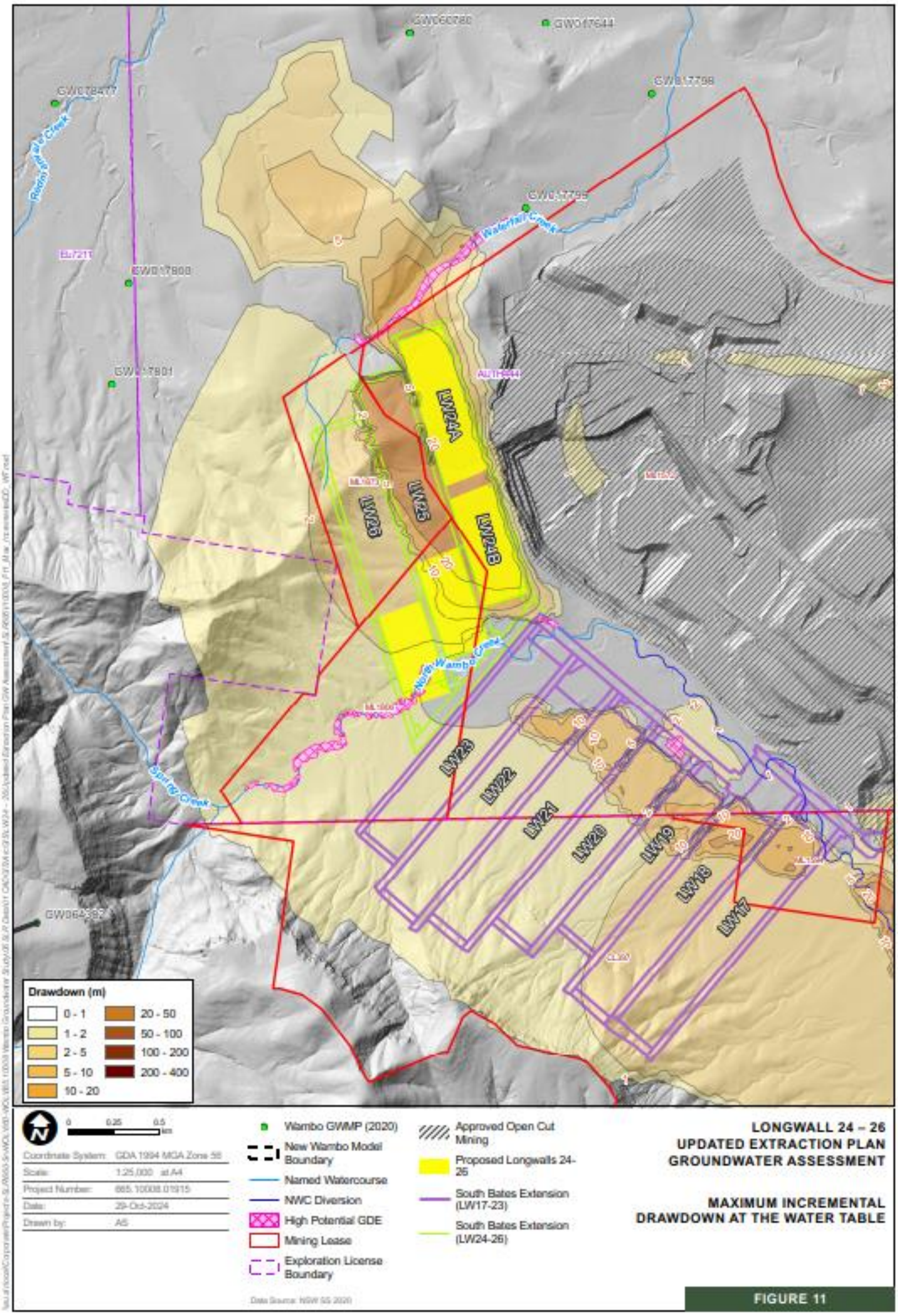
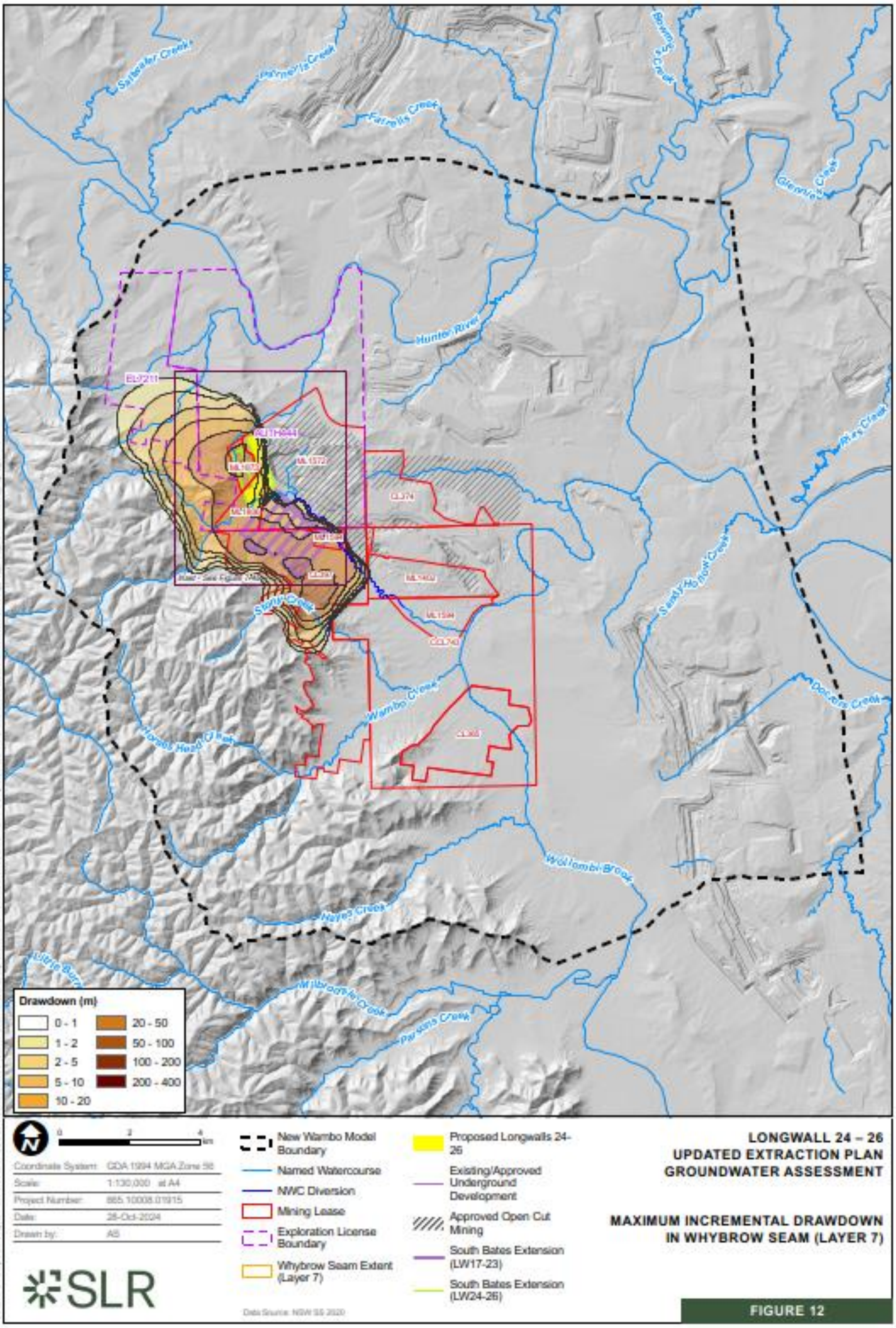


Figure 12 Maximum Incremental Drawdown in Whybrow Seam (Layer 7)



As the revised mine layout reduces the extent and duration of underground mining operations at the SBEUG compared to the approved LW 24-26 layout, the potential drawdown impacts associated with the revised layout are anticipated to be similar or reduced due to the following factors:

- *Reduced Maximum Annual Inflow*: With a smaller mining area, the revised layout is expected to maintain or possibly reduce maximum annual inflow rates to the SBEUG mine, previously estimated at 1.32 ML/day. This reduction in area directly contributes to a decrease in groundwater inflow, which could lead to a lower incremental groundwater drawdown.
- *Shortened Mining Period*: The reduced operational timeframe will shorten the period of active groundwater inflow into the mine, further decreasing the cumulative volume of groundwater extracted. This shorter duration will likely reduce both the extent and intensity of groundwater drawdown effects on surrounding aquifer units.
- *Limited Drawdown Extent*: With a smaller mining footprint, the spatial extent of drawdown is anticipated to be confined closer to the revised mine layout. Consequently, the impacts on sensitive receptors, such as groundwater-dependent ecosystems and private bores, should be reduced.
- *Reduction in Alluvium Impact*: The reduced mine area and duration lessen the likelihood of significant impacts on the alluvium, especially for North Wambo Creek. The revised layout is expected to have minimal additional leakage from the alluvium into underlying Permian coal measures, particularly in areas where the layout extends toward North Wambo Creek. This leakage, if any, would likely be minor, localized, and temporary.
- *Groundwater Dependent Ecosystems (GDEs)*: Given the revised layout's reduction in footprint, particularly the adjustment of LW 26's southern end, it is anticipated that potential impacts on nearby high-potential GDEs along North Wambo Creek will be localized and temporary, aligning with previous subsidence and GDE assessments indicating minimal long-term effects. The revised layout is thus unlikely to introduce new significant risks to GDEs.
- *Private Bore Impacts*: Prior modelling indicated that drawdown in private bores would remain well below critical thresholds. With the revised layout further limiting drawdown extent, no significant additional impacts are expected for private water users, thus ensuring continued groundwater availability.

In summary, the revised mine layout's smaller area and shortened mining period are projected to contain groundwater drawdown impacts to a lesser degree than previously modeled, providing an overall reduction in potential cumulative impacts on regional aquifers and associated water resources.

4.1.2 Impact on Alluvium

There was no direct interception predicted of the alluvium, including that associated with North Wambo Creek, the approved LW 24-26 layout. Any predicted interference of alluvial groundwater relates to the depressurisation of the underlying Permian coal measures resulting in the potential for increased leakage from the alluvium to the Permian coal measures, or decreased flow from the Permian coal measures to the alluvium (SLR, 2022).

It was conceptualised for there to be a slight increase in mining induced flux change in North Wambo Creek alluvium upstream of the creek diversion due to the approved LW 24-26 layout. North Wambo Creek downstream of the diversion, Wambo Creek and

Wollombi Brook alluvium were conceptualised to show minor, temporary incremental differences due to the approved LW 24-26 layout (SLR, 2022).

Over the extent of alluvium near Wambo, (SLR, 2022)predicted a low magnitude, short-term decrease in leakage of water (i.e. less impact) from the North Wambo Creek, Wambo Creek, and Wollombi Brook alluvium due to the approved LW 24-26 layout. There was negligible effect predicted for the Hunter River alluvium due to the approved LW 24-26 layout.

There is no significant alluvium mapped at Waterfall Creek, and the model predicted the alluvium (where present) and regolith to be unsaturated at Waterfall Creek near the approved LW 24-26 layout (SLR, 2022).

As such, on the basis of the conclusions presented by SLR (2022, 2023), and in consideration of the potential groundwater impacts anticipated as a result of the revised mine layout, it is considered unlikely that there would be any significant impact on alluvium of North Wambo Creek, Wambo Creek, Wollombi Brook, Hunter River and Waterfall Creek as a result of the revised mine layout.

LW 23 extraction was completed in 2023 near North Wambo Creek. Monitoring data from the site's North Wambo Creek alluvial monitoring locations indicated that no clear trends indicate a mining effect is causing groundwater level declines additional to what would be expected from low-flow and dry conditions (**Section 3.4**).

There may be a slight increase in leakage from the alluvium into the underlying Permian coal measures, particularly in areas where the revised LW 26 layout extends toward and underneath North Wambo Creek (this includes potential impacts to an approximately 120 m section of North Wambo Creek high potential GDE). This leakage is expected to be minor and temporary, diminishing over time and having no substantial additional impacts compared to the approved LW 24-26 layout.

The reduction in mining area and duration due to the revised mine layout is expected to further minimise the potential for long-term effects on the alluvial groundwater system.

4.1.3 Impact on Baseflow

(SLR, 2023) predicted that the approved LW 24-26 layout would not decrease baseflow to or increase leakage from watercourses near Wambo compared to the previously approved mine plan scenario. Based on the reduced area and duration of mining for the revised mine layout, it is anticipated that there would be potentially less impact on baseflow near LW 24-26.

4.1.4 Water Licensing and WSP Rules

The NSW Aquifer Interference Policy (AIP) requires that all groundwater taken as a result of an aquifer interference activity, either directly or indirectly, is accounted for via water licences. Groundwater intercepted from the mining area is considered a direct take from the Permian aquifer unit, while the changes in flow occurring within the alluvium and rivers resulting from depressurisation of the underlying aquifer is considered an indirect take.

For the duration of Wambo mining operations, including the approved LW 24-26 layout, (SLR, 2022) predicted a net average loss of alluvial groundwater to the underlying rock of 71 megalitres per year (ML/year) during mining and a maximum of 128 ML/year for the Lower Wollombi Brook Alluvial Water Source, predicted to occur post mining (in 2049). No loss of alluvial groundwater to underlying Permian rock was predicted for the *Jerrys Water Source of the Upstream Glennies Creek Management Zone*; net flow change for this water source was predicted to be a reduction in Permian flow to the alluvium. The maximum take from the porous/fractured rock groundwater sources from the hard rock water source due to

Wambo mining was estimated to be 657 ML/year (SLR, 2022). The revised mine layout and duration is not expected to change the maximum take.

Wambo currently has licence entitlements of 420 ML/year for the Lower Wollombi Brook Water Source and 1,647 ML/year for groundwater derived from the North Coast Fractured and Porous Rock Groundwater Sources.

The current groundwater licences held by WCPL are therefore sufficient to cover the predicted annual groundwater volumes required over the life of Wambo (including the revised mine layout).

4.1.5 Cumulative Impacts

No change to maximum inflows were predicted as a result of the approved LW 24-26 layout (SLR, 2022). The approved LW 24-26 layout was not predicted to have a significant impact on water levels in the Permian coal measures from a regional perspective due to the regional zone of depressurisation within the Permian coal measures created by historical and ongoing open cut and underground mining (SLR, 2022). This is expected to remain the case due to the revised mine layout.

No cumulative drawdown was predicted in alluvium/ regolith (layer 1) at the high potential GDE at Waterfall Creek due to Wambo area underground and open cut operations (**Figure 13**). Up to 26 m cumulative drawdown at the water table was predicted at the high potential GDE at Waterfall Creek north of LW 24a due to the Wambo area underground and open cut operations (**Figure 14**) (SLR, 2022). The revised mine layout is anticipated to result in a potentially minor reduction in cumulative impacts due to the reduced mining area and duration.

An approximately 1 m drawdown within the North Wambo Creek alluvium was predicted for the eastern-most extent (a 120 m reach) of the high potential GDE along North Wambo Creek due to Wambo area underground and open cut operations cumulative impact (**Figure 13**). Approximately 5 – 7.5 m drawdown was predicted for the water table underlying the entire vegetation community identified by Hunter Eco (2019) as likely to be groundwater dependent and the broader SBEUG area (**Figure 14**).

1 m drawdown within the alluvium/ regolith (model layer 1) was predicted for the north-eastern 20% (approximately 0.15 ha) of the SBEUG LW 20 high potential GDE due to Wambo since 2003 (**Figure 13**). Approximately 10 – 30 m drawdown was predicted for the water table underlying the entire additional high potential GDE due to Wambo area underground and open cut operations. This is likely due to nearby open cut and underground mining (**Figure 14**).

It is not anticipated that the revised mine layout would result in any significant additional cumulative impacts to the North Wambo Creek high potential GDE, despite a relatively small increase in area of LW 26 underneath North Wambo Creek.

SLR predicted that, of the private bores near Wambo, none exceeded a drawdown of 2 m or more due to the approved LW 24-26 layout (SLR, 2022) (**Figure 14**). It is not expected that the revised mine layout would result in a significant change in the predicted impacts on private bores.

Figure 13 Maximum Cumulative Drawdown in Alluvium and Regolith (Layer 1)

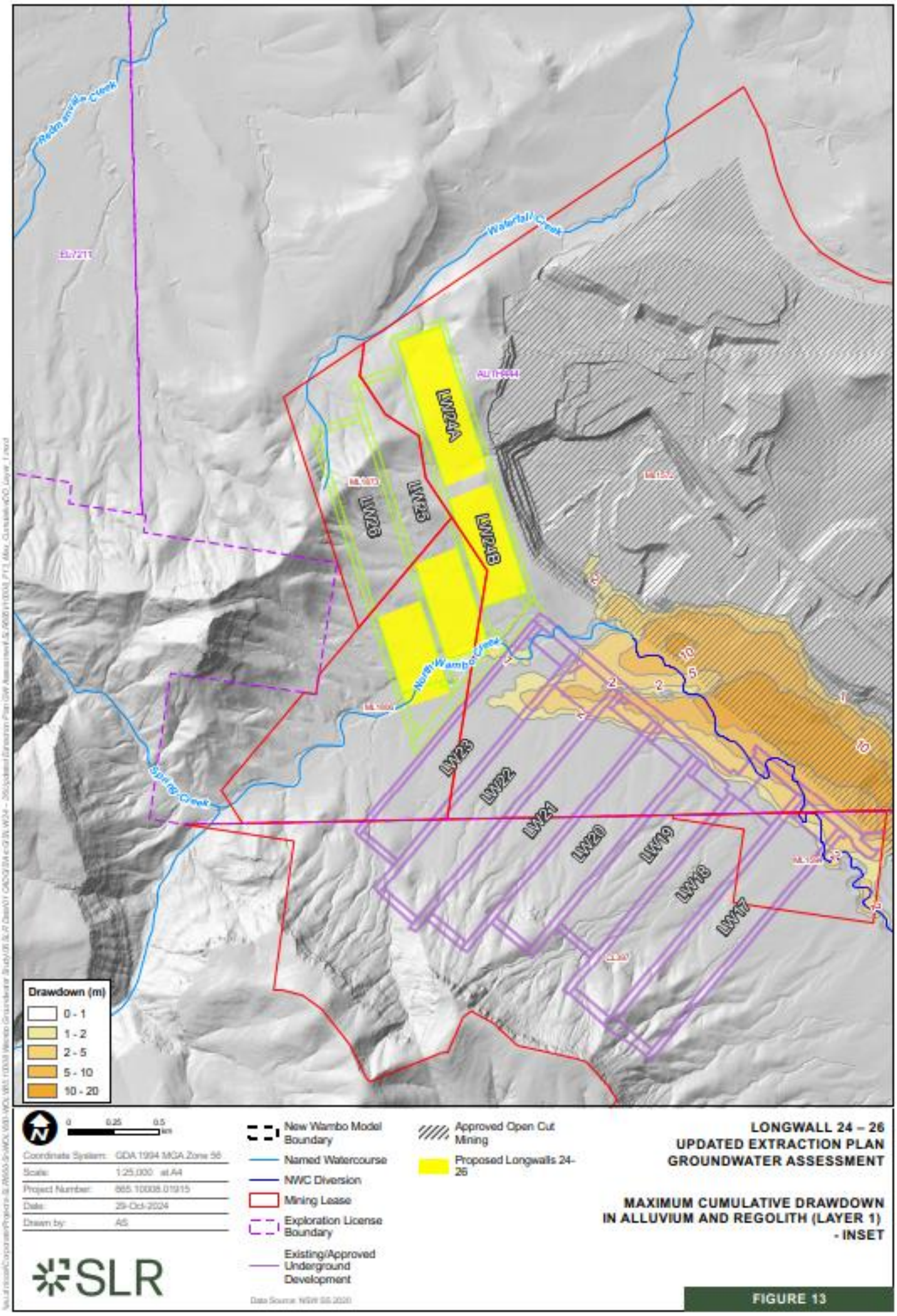
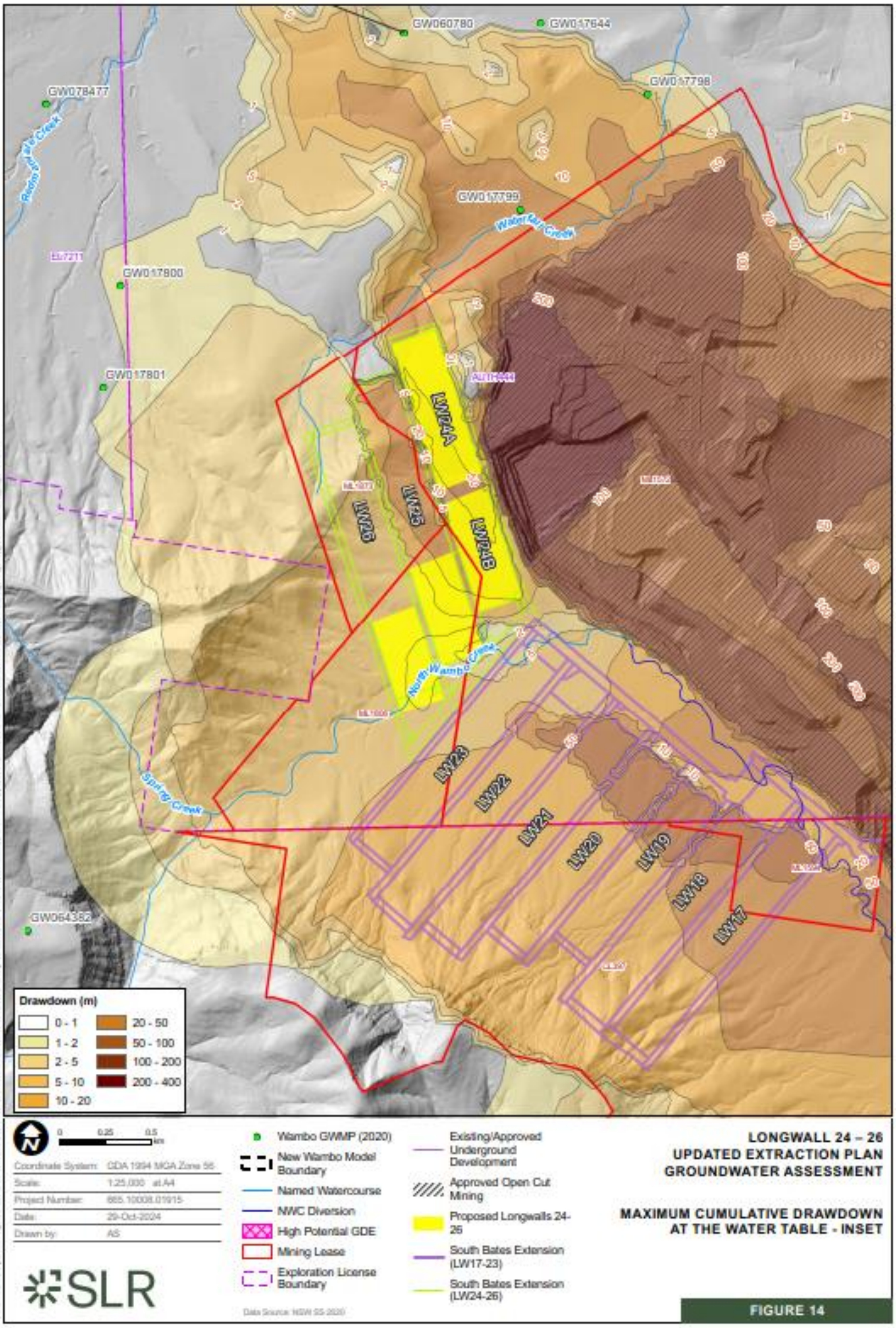


Figure 14 Maximum Cumulative Drawdown at the Water Table



4.2 Subsidence

The Subsidence Assessment for the approved LW 24-26 layout, prepared by Mine Subsidence Engineering Consultants (MSEC), was completed in 2022 and summarised in detail by SLR (2022). The main findings by (MSEC, 2022) relating to subsidence due to the approved LW 24-26 layout included:

- The maximum predicted subsidence effects of the approved LW 24-26 layout was expected to be the same or slightly less than those based on the previously approved SBEUG layout that had a different LW orientation.
- Fracturing and compression heaving are expected to develop along the sections of watercourses located directly above the LW panels. The impacts are expected to be similar to those observed along the streams above the previously extracted Wambo Seam LW at the North Wambo Underground Mine, South Bates Underground Mine and the SBEUG Mine.
- Compression and dilation were also expected to impact the upper 10 m to 20 m of bedrock (regolith), which has the potential to affect groundwater conditions within the regolith. Compression can also result in buckling of the upper bedrock resulting in heaving in the overlying surface soils.

Subsidence from underground mining has the potential to alter groundwater flow patterns, primarily by creating fractures and voids in the surrounding rock and soil. These fractures can act as new pathways for groundwater movement, potentially redirecting water away from shallow aquifers and causing a decline in the local water table. As a result, GDEs may experience reduced water availability. Additionally, the increased vertical permeability caused by subsidence can enhance groundwater leakage into deeper aquifers, further increasing potential water loss from shallow aquifer systems.

The revised mine layout was assessed by (MSEC, 2024). (MSEC, 2024) predicted the following subsidence impacts associated with the revised mine layout:

- The maximum predicted subsidence effects for North Wambo Creek based on the revised mine layout are the same as the maximum predicted values based on the approved LW 24-26 layout. The length of creek located above the revised mine layout slightly increases due to the lengthened finishing (i.e., southern) end of LW 26; however, the overall levels of potential impact do not change.
- The maximum predicted subsidence effects for Waterfall Creek based on the revised mine layout are less than the maximum predicted values based on the approved LW 24-26 layout. This is because the creek is now located outside the mining area, whereas the upper reaches of the creek were previously partially located above LW26.
- The maximum predicted subsidence effects for the drainage lines based on the revised mine layout are the same as the maximum predicted values based on the approved LW 24-26 layout. However, the extents of the drainage lines located above the mining area reduce. The overall levels of potential impacts on the drainage lines therefore also reduce.

5.0 Environmental Risk Review

An Environmental Risk Assessment (ERA) was undertaken in March 2023 (SLR, 2023). The scope of the risk assessment included:

- establishing the context including review of supporting information and objectives;
- identifying potential issues by review of the project description and similar issues from previous Wambo risk assessments;
- analysis of identified risks and nomination of key environmental issues; and
- ranking of the key issues and associated risks, including consideration of mitigation measures.

The ERA identifies environmental issues and ranks these issues in consideration of control measures. As part of the ERA, a risk review team identified the key environmental issues associated with the project, including those related to:

- impacts on North Wambo Creek and Waterfall Creek flow regime associated with subsidence resulting from the underground mine;
- impacts on shallow groundwater sources (i.e. regolith and alluvium) with subsidence resulting from the underground mine;
- impacts on groundwater users in the study area with groundwater loss, including private landholders and vegetation;
- incremental increases in subsidence induced ponding effects on areas of agricultural land;
- potential subsidence impacts on the groundwater monitoring network;
- potential subsidence impacts on cliffs and steep slopes; and
- potential subsidence impacts on items of Aboriginal heritage.

The review team risk ranked the key environmental issues and concluded that with the application of the identified controls, the subsidence related impacts over the approved LW 24-26 layout could be managed at a tolerable level of risk.

Given the revised mine layout represents an overall reduction in the underground mining area for LW24–26, the key environmental issues and associated risks identified above are considered to also be relevant to the revised mine.

6.0 Mitigation and Monitoring Measures

Groundwater levels and quality should continue to be monitored at Wambo in accordance with the GWMP approved under Development Consent (DA 305-7-2003). No additional groundwater impact mitigation measures are proposed.

Data collected at the VWPs north and west of LW 24-26 should continue to be monitored to validate conceptual model assumptions and numerical model predictions.

Consistent with the currently approved GWMP, in the event that a groundwater quality or water level trigger level specified in the GWMP is exceeded, an investigation should be conducted in accordance with the GWMP.

7.0 Conclusions

The revised mine plan for LW 24-26 at Wambo includes a reduction in the overall mining area by up to 40%. This change includes the division of LW 24 into two sections (LW 24a and 24b), a minor extension of LW 25 and LW 26 toward North Wambo Creek and Waterfall Creek, and a reduction in the mining footprint of LW 25 and LW 26.

A review of the expected potential impacts has been made by comparing the (SLR, 2022) study outcomes against the revised mine layout in-addition to recent site groundwater monitoring data observations. Expected impacts are summarised as follows:

- *Current impacts*: Despite mining within the SBEUG mining area, and more recently the completion of LW 23 in 2023 located adjacent and south of North Wambo Creek, alluvium and regolith monitoring bores did not indicate clear signs of mining induced groundwater level decline. Climatic influences on groundwater levels as well as groundwater quality (EC) appear to be more significant than mining influences on alluvial and regolith monitoring bores, over the period of data availability.
- *Reduced Groundwater Drawdown*: The reduced area and shortened mining duration are expected to limit groundwater drawdown in the vicinity of the mining operations, particularly within the Permian coal measures. This suggests that impacts on surrounding groundwater levels will be less pronounced than initially predicted for the approved layout.
- *Inflow Rates*: The maximum inflow rate to the mine is anticipated to remain within previously estimated levels (1.32 ML/day). Given the reduced mining footprint and duration, this rate could potentially be lower, thereby minimizing cumulative groundwater extraction over time.
- *Limited Impacts on Alluvium*: The alluvial aquifer systems, particularly along North Wambo Creek, are not expected to experience significant additional drawdown or leakage. Minor leakage from the alluvium into underlying Permian measures may occur, particularly where LW 25 extends beneath North Wambo Creek; however, this is expected to be minimal and short-term. The revised layout’s smaller scale further mitigates potential long-term impacts on these sensitive aquifers.
- *Groundwater-Dependent Ecosystems (GDEs)*: Although minor extensions of LW 25 and LW 26 may marginally increase proximity to high-potential GDEs along North Wambo Creek, previous assessments indicate these ecosystems are unlikely to face significant long-term detriment due to the reduced scale of mining. Impacts on GDEs are expected to be localized and temporary.
- *Baseflow*: The potential impact on baseflow to North Wambo Creek, Wollombi Brook, and Wambo Creek should decrease due to the shorter duration of groundwater inflow into the mine. This will likely reduce any indirect impacts on baseflow to nearby surface water systems.
- *Minimal Impact on Private Bores*: The drawdown in nearby private bores is expected to remain below critical thresholds, ensuring continued water availability. The revised layout’s reduced footprint suggests a potentially smaller zone of influence, further safeguarding private water sources.
- *Compliance with Licensing and Management*: The revised groundwater take, both direct and indirect, aligns with WCPL's current water licensing entitlements. No additional mitigation measures are required beyond those established in the existing Groundwater Management Plan.

Overall, the revised layout is anticipated to reduce the potential cumulative impacts on key environmental and hydrological receptors, such as alluvium, baseflow, GDEs, and private bores, noting the potential for additional localised impacts on GDEs where LW26 extends underneath North Wambo Creek.

8.0 Closure

Should you have questions or clarifications concerning this report, please contact the undersigned.

Sincerely,

SLR Consulting Australia

Raymond Minnaar
Associate Hydrogeologist

David Western
Technical Director

9.0 References

AGE, 2016. *Australiasian Groundwater and Environmental Consultants Pty Ltd. United Wambo Open-Cut Coal Mine Project - Groundwater Impact Assessment, Prepared for Umwelt Australia,* s.l.: s.n.

BoM, 2023. *Bureau of Meteorology (BoM). Groundwater Dependent Ecosystems Atlas, Available at http://www.bom.gov.au/water/groundwater/gde,* s.l.: s.n.

ELA, 2022. *Wambo Coal Mine Longwalls 24-26 Modification Biodiversity Review,* s.l.: s.n.

Hunter Eco, 2019. *Wambo Coal Mine South Bates Extension Underground - Groundwater Dependent Ecosystems Vegetative Assessment,* s.l.: s.n.

MER, 2009. *Mackie Environmental Research. Hydrogeological Characterisation of coal measures and overview of impacts of coal mining on groundwater systems in the Upper Hunter Valley of NSW, PhD thesis, Faculty of Science, University of Technology, Sydney,* s.l.: s.n.

MSEC, 2022. *Mine Subsidence Enginerring Consulting. South Bates Extension Underground Mine Longwalls 24 to 26 Modification Subsidence Assessment,* s.l.: s.n.

MSEC, 2024. *Mine Subsidence Enginerring Consulting. South Bates Extension Underground Mine Longwalls 24 to 26 Extraction Plan Modification Subsidence Assessment,* s.l.: s.n.

Peabody, 2023. *Wambo Groundwater Management Plan. Document No. WA-ENV-MNP-509.1 November 2023,* s.l.: s.n.

Queensland Government, 2024. *SILO Long Paddock.* [Online]
Available at: https://www.longpaddock.qld.gov.au/
[Accessed 4 September 2024].

SLR, 2020. *South Bates Extension LW21-24 Groundwater Technical Review. Report 665.10008-R02 For Wambo Coal Pty Ltd February 2020,* s.l.: s.n.

SLR, 2022. *Wambo Coal Mine – Longwalls 24-26 Modification Groundwater Assessment. Report 665.10008.00815-v4.0-20220728 prepared for Wambo Coal Pty Ltd. July 2022.,* s.l.: s.n.

SLR, 2023. *Technical Report 2 - Groundwater Assessment Review. Longwalls 24-26 Extraction Plan Groundwater Technical Report,* s.l.: s.n.

SLR, 2024. *Wambo Coal Pty Ltd. Groundwater Annual Review 2023,* s.l.: s.n.

United, 2022. *United Wambo Open Cut Project. Surface Water Management plan,* s.l.: s.n.

WCPL, 2003. *Wambo Coal Pty Ltd. Wambo Development Project Environmental Impact Statement,* s.l.: s.n.

10.0 Feedback

At SLR, we are committed to delivering professional quality service to our clients. We are constantly looking for ways to improve the quality of our deliverables and our service to our clients. Client feedback is a valuable tool in helping us prioritise services and resources according to our client needs.

To achieve this, your feedback on the team's performance, deliverables and service are valuable and SLR welcome all feedback via https://www.slrconsulting.com/en/feedback. We recognise the value of your time and we will make a $10 donation to our Charity Partner - Lifeline, for every completed form.

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