

## Department of Planning and Environment

Our ref: OUT22/5495

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15 June 2022

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**Subject: Dendrobium Mine Extension Project (SSI-33143123) – Environmental Impact Statement (EIS)**

Dear Ms Allan

I refer to your email of 3 May 2022 to the Department of Planning and Environment (DPE) Water about the above matter.

Illawarra Coal Holdings Pty Ltd has submitted a State Significant Infrastructure (SSI) application for the Dendrobium Mine Extension Project (SSI-33143123).

DPE Water acknowledges that the proposal aims to address significant concerns raised previously for the refused State Significant Development project, with the overall footprint of the project being decreased. However, there remain some key concerns, including:

- Groundwater - assessment and impacts to water quality and groundwater dependent ecosystems in relation to the NSW Aquifer Interference Policy (2012).
- Surface water - watercourse identification, significance and impacts.
- Licensing, noting that this issue may be resolved by outcomes from the department's Mining in the Catchment Action Plan.
- Offsets to incidental water take, and the approach taken to ensure that there is a net benefit to the metropolitan drinking water supply.

Detailed recommendations and explanations are contained in the following attachments:

- Attachment A - Licencing and Approvals
- Attachment B - Groundwater
- Attachment C - Surface Water
- Attachment D - Water Offsets

Any further referrals to DPE Water and NRAR can be sent by email to [water.assessments@dpie.nsw.gov.au](mailto:water.assessments@dpie.nsw.gov.au), or to the following coordinating officer within DPE Water:

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Yours sincerely



Mitchell Isaacs  
Chief Knowledge Officer, Water Group

## Attachment A

### Detailed Licencing and Approvals advice to DPE Planning & Assessment regarding the Dendrobium Mine Extension Project (SSI-33143123) – EIS

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#### Recommendations – Prior to Determination

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##### 1.1 Site Water Balance

The proponent should provide an updated consolidated site water balance for all water take during construction and operation.

##### Explanation

The updated consolidated site water balance for all water take during construction and operation should include a clear indication where the take requires a water access licence (WAL).

DPE Water notes that inconsistencies are shown in the site water balance. For example, the groundwater inflows are noted as 5,160ML/year in the current operational balance within Table 14 of Appendix C – Surface Water Assessment. This is different from the inflows shown in Table A8-2 of Attachment 8 - Aquifer Interference & Water Licensing which shows 5,830ML in Sydney Basin Nepean (MZ1), 34ML in Sydney basin Nepean (MZ2) and 53ML in Sydney Basin South, totalling 5,917ML/year in the Water Sharing Plan for the Greater Metropolitan Region Groundwater Source.

Additionally, Appendix E – Aquatic Ecology Assessment notes on page 36 that water from the proposed pump station may be required for the construction of Ventilation Shaft No. 5A, but no estimates have been provided.

##### 1.2 Water Take and Licencing

The proponent should:

- a) Continue to liaise with DPE Water regarding the licencing requirements for the project.
- b) Clarify if the proposed sediment dams are expected to be exempt under Schedule 4 Clause 12 of the *Water Management (General) Regulation 2018*, and confirm if there are any other dams proposed.
- c) If these dams are not exempt, then the proponent will require sufficient entitlement under a water access licence.

##### Explanation

- a) The proponent will require sufficient water entitlement to account for the predicted and existing water take for the project.

Attachment 8 mentions the use of the Mining in the Catchment Action Plan (which is currently being implemented) to account for some of the proposed water take for the project in the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011.

The Minister for Planning and Public Spaces announced in April 2020 that the NSW Government intended to implement a “licensing regime to properly account for any water losses”, in response to the findings of the Independent Expert Panel on Mining in the Catchment. DPE is currently working to implement this decision of government, with further detail expected to be available shortly. It is therefore difficult to specify exactly what entitlements will be required for the project, however based on projected take in the EIS, further entitlements will be required.

The proponent should continue to liaise with DPE Water and acquire all necessary entitlements in the applicable surface water and groundwater sources. This is to ensure the existing and proposed project can operate in compliance with water legislation.

The existing and proposed water take, and the entitlements currently held by the proponent were detailed in Table 8-2 of Attachment 8 to the EIS (shown as Table 1.1 below). The table shows the

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water take for this project where additional entitlement is required, based on the current regulatory regime, as follows:

- 34 ML in the Sydney Basin Nepean Management Zone 1 of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources, with 29ML for the existing project and 5 ML for the expansion. Significant available entitlement in Management Zone 1 indicates there is a viable pathway to acquire this entitlement.
- 1454 ML in the Upper Nepean and Upstream Warragamba Water Source of the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources, with 1,026 ML for the existing project and 428 ML for the expansion. Entitlement and trading limitations currently prevent the ability of the proponent to account for this water take. As described above, the “Mining in the Catchment Action Plan” is proposing a new regulatory regime to account for surface water losses. This is yet to be released and the proponent will need to keep abreast of and follow relevant obligations once it is implemented.
- 17ML in the Illawarra Rivers Water Source of the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources (currently 16-17ML with an increase of less than 1ML). Significant entitlement in this water source indicates there is a viable pathway to acquire this entitlement.

It is unclear if the two sediment dams proposed at Ventilation Shaft No. 5A are exempt from requiring a WAL. The proponent should confirm if these are expected to be exempt under Schedule 4 Clause 12 of the *Water Management (General) Regulation 2018* and if there are any other dams proposed for the project. If they are not exempt, the proponent needs to demonstrate the ability to obtain sufficient entitlement.

Water Sharing Plan	Water Source (Management Zone)	Allocation (Shares) held by IMC <sup>1</sup>	Maximum Dendrobium Mine (inclusive of Project) Licensing Requirement (ML/year) <sup>2</sup>	Maximum Project Increment
<i>Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011</i>	Sydney Basin – Nepean (MZ2)	9,755 <sup>A</sup>	5,830	1,970
	Sydney Basin – Nepean (MZ1)	-	34	5
	Sydney Basin – South	75	53	5
<i>Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011</i>	Upper Nepean and Upstream Warragamba Water Source	-	1,454	428
	Illawarra Rivers Water Source	-	17	<1

After: Watershed HydroGeo (2022).  
ML/year = Megalitres per year

<sup>A</sup> Refer Table A8-1 for a breakdown of this volume.

<sup>1</sup> Typically 1 ML/unit share (subject to available water determinations for the relevant water source).

<sup>2</sup> Licensing requirement for groundwater includes direct pit inflows from the porous rock and induced leakage from surface water systems.

**Table 1.1 – Estimated Water Licencing Requirements for the Project**

### 1.3 Works on waterfront land

The proponent should:

- a) Show due consideration of the NSW Guidelines for Controlled Activities on Waterfront Land (2018) for all works on waterfront land.
- b) Confirm setbacks and show due consideration of the Guidelines for Dendrobium Top of Pit Car Park, the proposed sections of the Fire Trail widening and power pole locations.

#### Explanation

It is unclear from the proposal if the Dendrobium Top of Pit Car Park, proposed sections of the Fire Trail widening or power pole locations are on waterfront land. It is therefore unclear if due consideration has been shown to the Guidelines, particularly setback requirements.

#### **1.4 Other infrastructure works**

The proponent should:

- a) Clarify how the pump water supply pipeline is proposed to cross watercourses, and provide an assessment of the impacts and mitigation measures if required.
- b) Provide an assessment and adequate mitigation measures for possible impacts of the underground road ways (including volumes for water take and how this will be obtained).

##### **Explanation**

- a) The proposed pump water supply pipeline appears to cross multiple watercourses, however, insufficient information has been provided on how it will cross watercourses. The proponent should provide information on how it will cross watercourses, and an assessment of impacts and mitigation measures, if required.
- b) The project description mentions underground road ways to be constructed as a part of this proposal, namely from Area 3 to Area 5. It is unclear if this has been assessed as a part of this proposal.

#### **Recommendations – Post Approval**

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#### **1.5 Water Licencing**

The proponent should:

- a) Ensure Water Access Licences (WALs) with adequate entitlements are held for all water take in the relevant source prior to works commencing.
- b) Ensure WALs are linked to the appropriate works.

It is noted that WAL 37464, WAL 42386 and WAL 42385 are currently not linked to a work.

##### **Explanation**

As per Recommendation 1.2 above.

#### **1.5 Impacts to waterfront land**

Subsidence impacts to watercourses need to be remediated to ensure stability and natural ecological functioning. Works are to be in accordance with the NSW Guidelines for Controlled Activities on Waterfront Land (2018).

##### **Explanation**

Subsidence impacts have the potential to increase erosion and sedimentation of watercourses, loss of water into subsidence cracks and cause die-back in riparian areas. These impacts to watercourses will need to be monitored and remediated to ensure channel stability and to minimise impacts to natural hydrological and ecological functioning. This will need to be supported with appropriate geomorphic and hydrologic monitoring parameters and a trigger action response protocol.

**End Attachment A**

## Attachment B

### Detailed Groundwater advice to DPE Planning & Assessment regarding the Dendrobium Mine Extension Project (SSI-33143123) – EIS

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#### Groundwater Quality, Groundwater Dependent Ecosystems and Modelling

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##### NSW AIP ‘minimal impact considerations’ - Groundwater Quality and Groundwater Dependent Ecosystems

#### 2.1 Recommendations – Prior to Determination

The proponent should:

- a) Provide further studies, evidence, and full disclosure of all groundwater monitoring data (including water quality and bore logs) to determine:
  - i. The water quality impacts in relation to the NSW AIP ‘minimal impact considerations’ for groundwater beneficial use; and
  - ii. Drawdown impacts on high priority Groundwater Dependent Ecosystems (GDEs) as listed in the proposed remake of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023, which will be publicly exhibited shortly, in relation to NSW AIP ‘minimal impact considerations’ for high priority GDEs.

- b) Demonstrate that adequate arrangements will be in place to ensure that the level 1 minimum impact considerations can be met.

If the level 1 minimal impact considerations cannot be met, the proponent should propose specific remedial actions as required by the NSW AIP. These should include remedial actions for water quality affecting stream and aquifers, during and post mining, and for GDEs.

- c) Assess the transmissive capacity of the interpreted fault passing centrally through Area 5, and discuss the associated potential impact to water quality and water level changes.

DPE Water also recommends that DPE Planning and Assessment should robustly assess the longwall mining methods proposed, as other alternative mining methods would have significantly lower impacts to water quality and ecological assets.

#### Explanation

##### General – Impact Risk

The potential groundwater quality risks are two-fold:

- (i) short- and medium-term effects from initial subsidence and the release of soluble metals into the aquifer; and
- (ii) longer term impacts associated with the modelled upward flux of groundwater driving movement and mixing of poor-quality groundwater from the Permian age geology into the shallower Triassic age Hawkesbury Sandstone.

The full detrimental extent of the groundwater quality changes once the groundwater systems re-equilibrate is uncertain. As such, the significance of the combination of both short, medium and long term groundwater quality impacts on both the ecological receptors and WaterNSW, with their ability to fulfil their duty of care as custodians of Metropolitan Special Area, is uncertain.

The potential water quality impacts of the Project are summarised by the proponent in Appendix B Section 3.4.3. The proponent acknowledges there will be groundwater and surface water quality impacts in the vicinity of the mining and in the upper tributaries. However, they argue that these water quality changes are acceptable as the water quality impacts do not affect WaterNSW’s storage reservoirs.

##### Water Quality Data - EIS

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Surface water quality data is provided in Appendix B, Groundwater Assessment (pg.201). The graph for iron concentration shows numerous exceedances above 5 mg/L following the baseline period for the Wongawilli Creek observation points. The EIS presents in Appendix B Table 6-2 a summarised statistical overview (count, median and 95 percentile concentrations) of groundwater quality without provision of raw data for review.

The groundwater quality information reported in the EIS is insufficient for DPE Water to complete a technical review. Raw data is required to understand and assess temporal and spatial differences in the concentrations reported. Iron concentrations in groundwater for the Hawkesbury Sandstone are reported to be P50 of 0.8 mg/L and a P95 concentration of 23.1 mg/L value. A search online for end of panel reporting shows groundwater quality data is not being reported.

The water quality information presented in the EIS does not satisfactorily inform if the Project would affect the beneficial use category of the groundwater resource. Groundwater quality monitoring data is reported using very basic statistics only (count, median and 95th percentile), and no predictions are provided on groundwater quality change due to the project. It is incorrect to assert that because there is expected to be no water quality impacts on the reservoirs, therefore there will be no change to the groundwater beneficial use category. In the long term, deteriorating groundwater quality could lead to surface water quality impacts and toxicity to ecological assets.

The impacts of increasing trace metals are acknowledged in 'Attachment 8 - Aquifer Interference and Water Licensing'. The increase in groundwater iron concentrations is visually shown as iron staining within the overlying stream where baseflow discharges occur. WaterNSW (pers comm: 30.06.22) has informed DPE Water that these impacts then propagate downstream. This means that with larger rainfall events, slugs of iron which have accumulated in pools are flushed down into the reservoir, and due to temperature differences within the reservoir water, could potentially transfer iron slugs right up to the reservoir wall. Photos 15 and 16 (9 August 2021 report) below show this temporal outcome resulting from the increase in iron due to Dendrobium's mining related subsidence.

**Plates 15 and 16 (ref: Dendrobium Area 3B, Illawarra Metallurgical Coal Impact Report 9 August 2021)**



Each additional longwall approved within the Metropolitan Special Area has the potential to contribute incrementally to deterioration of groundwater quality in the shallow Hawkesbury Sandstone. The proponent identifies these impacts and expects them to continue within Area 5. The EIS however does not provide sufficient evidence to support their conclusion that these impacts are acceptable. The AIP 'minimal impact considerations' for water quality limits the impacts for a beneficial use change at 40m from the activity and not by diluting the potential impacts to a catchment or reservoir scale.

Appendix B Section 7 (Conclusions) states:

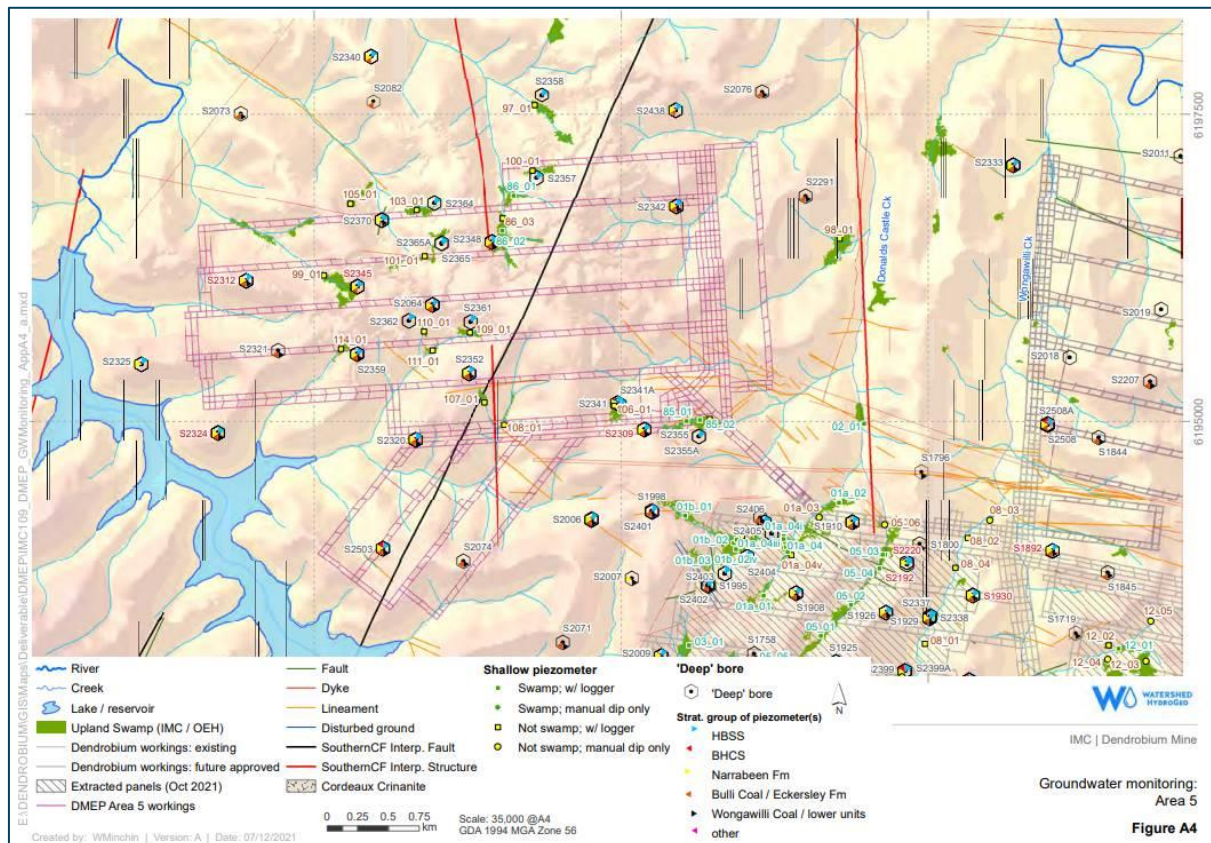
*"After mining, groundwater levels are likely to equilibrate over decades or longer. In Area 5, modelling suggests that groundwater levels in the deeper units, in particular, but also within the*

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*Hawkesbury Sandstone, may recover to greater pressures than in shallower strata, leading to the possibility of an upward gradient. Analysis of whether this might result in poorer quality water from the coal measures upwelling from the goaf and fractured zones to the Hawkesbury Sandstone aquifer, with the potential to reduce the quality of water in that strata, suggests that the potential for this pathway is minimal.”*

It is reported that the deeper Permian geology has saline groundwater, whilst the groundwater in the shallower Triassic Hawkesbury Sandstone is relatively fresh. Post mining groundwater re-equilibration predicts upward movement of groundwater from the Permian to the Triassic. The proponent asserts that mixing of waters would be acceptable however no evidence is provided to support this conclusion.



**Figure 1 – Groundwater Monitoring (ref: Appendix B Groundwater Assessment)**

### Water Quality Data – Other

The end of longwall panel (LW 18) report 'Dendrobium Mine Iron-staining in Wongawilli Creek' (Illawarra Metallurgical Coal, August 2021) identified the extent of iron related impacts within Wongawilli Creek. It is evident from Figure 1 above that significant water quality deterioration is occurring within Wongawilli Creek and tributaries. It should also be noted that no secondary extraction was undertaken beneath Wongawilli Creek, this being the main water course separating areas 3A and 3B. The longwall panels viewed in Figure 1 of 3A and 3B, like Area 5, are beneath 1st and 2nd order streams as is proposed under the current Project. That is, current water quality impacts aren't constrained to 1st and 2nd order streams where longwall mining occurs, but is propagating to the main water courses regardless of the main water course not being undermined.

These water quality impacts are possibly driving a change in the beneficial use category of the groundwater resource. A statistical overview of P50 and P95 trace metal concentrations is not sufficient evidence to demonstrate that the groundwater quality will not deteriorate to a lower beneficial use class.

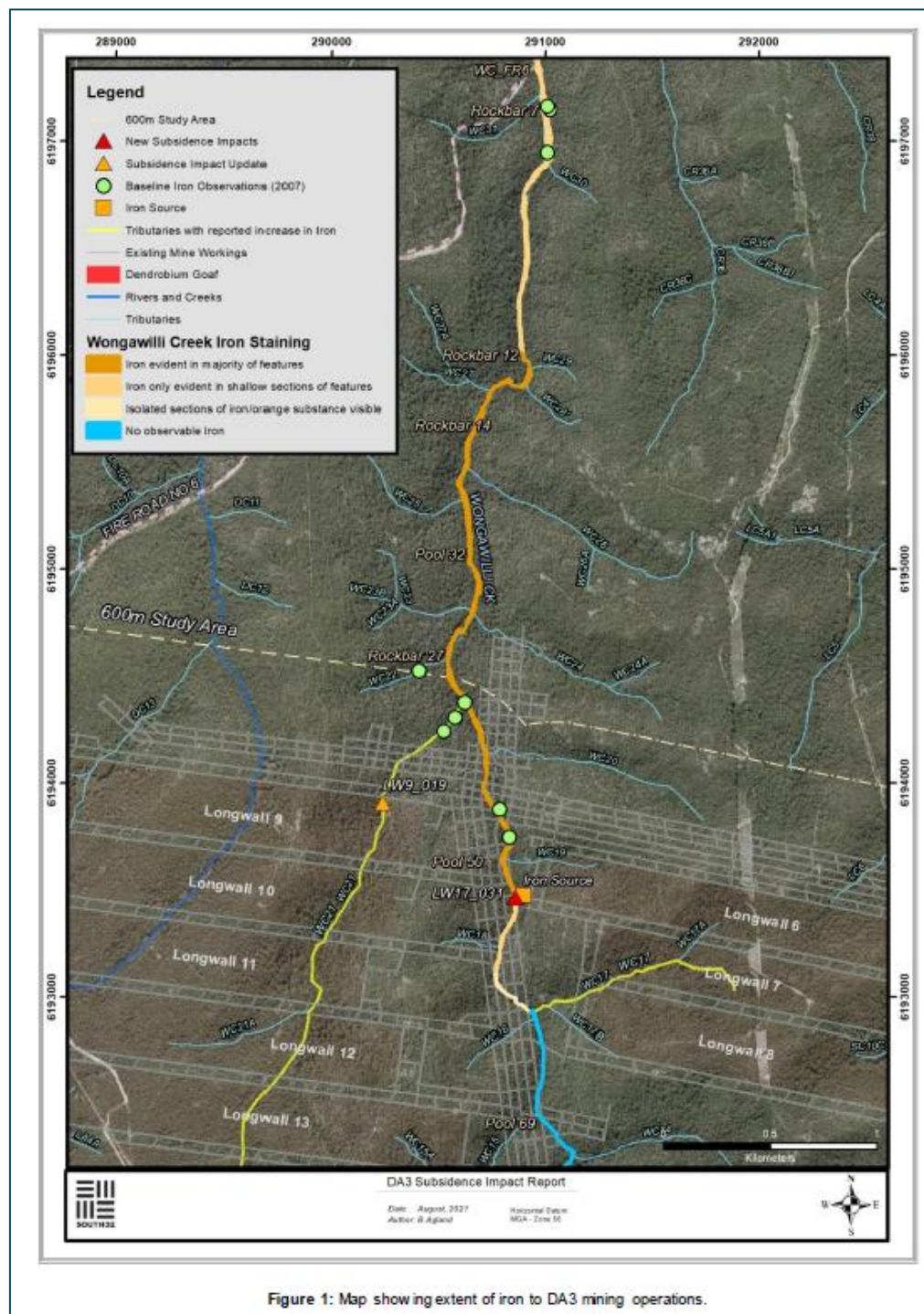


Figure 1: Map showing extent of iron to DA3 mining operations.

**Figure 2 - Extent of iron in DA3 mining operations (ref: Dendrobium Area 3B, Illawarra Metallurgical Coal Impact Report 9 August 2021)**

### The NSW Aquifer Interference Policy

The NSW Aquifer Interference Policy (AIP) established a water quality ‘minimal impact consideration’ that “any change in the groundwater should not lower the beneficial use category of the groundwater source beyond 40 m of the activity”. The EIS does not report detailed baseline groundwater quality data or provide an estimate for groundwater quality changes. Hence, DPE Water is unable to determine if the project will exceed the water quality impact threshold.

Under the NSW AIP, a change in beneficial use category more than 40m from the activity is a level 2 impact. The objective for the establishment of 40m limit is to ensure the rights of adjacent water users or



the ecosystems is not being diminished as a consequence of the activity. In this instance, the activity is at depth and water impacts are notably occurring within the overlying shallow groundwater system of the Hawkesbury Sandstone and the surface water drainages and ecological receptors

#### Ecological Significance and Groundwater Dependent Ecosystems

The ecological environment overlying the Project is abundant with high conservation ecological value assets. Toxicity of plants to iron is typically reported to be 5 – 10 mg/L and very low concentrations are set for fish, aesthetics and irrigation.

The current Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 does not identify any High Priority Groundwater Dependent Ecosystems (GDEs). However, the Plan is now due for remake with a draft to go on Public Exhibition in late June 2022, which is prior to Project Determination. The draft Plan identifies the upland and hanging swamps overlying and in proximity to the Project as High Priority GDEs. Level 2 drawdown impacts, as defined by the AIP 'minimal impact considerations', are predicted to occur at these ecological assets.

While these assets are not currently listed formally as High Priority GDEs, it is likely that this will occur in 2023 and DPE Water recommends that they are considered in a similar manner to how they would be once listed.

These ecological assets play a key feature in natural buffering of drought with storage and release of water, and filtering catchment run-off providing an additional natural augmenting feature to WaterNSW management of the Metropolitan Special Area. The potential detrimental impact on the GDEs and the value that these swamps has not been sufficiently assessed by the proponent.

#### WaterNSW's Water Quality Criteria Limits

WaterNSW has variable water quality criteria limits for water passing into its water treatment facilities. These are based on historical raw water quality data and the water treatment facility's ability to treat the water. Iron concentrations of 5 mg/L is the "bulk water supply" concentration limit for the Nepean Water Filtration Plant (WFP). This is the highest concentration limit for all WFPs in the Sydney region. Illawarra WFP has a limit of 1.1 mg/l of iron. There is cost involved if these limits are exceeded.

#### Significance of Large Fault

There is an interpreted fault (called 'SouthernCF Interpreted Fault' – see Figure 1 above which is Figure A4 in Appendix B) feature that passes directly through the centre of Area 5 and under the Avon Dam reservoir. This relatively large fault feature has not been investigated to assess its transmissive capacity and how subsidence may alter the capacity of the fault to be a water conduit. If it does behave as a water conduit, it may be able to transfer poor quality water from the deeper Permian geology to both the Avon Reservoir and Hawkesbury Sandstone. The proponent seeks to defer any assessment of this fault feature until the post-Approval Extraction Plan stage. Such a fault feature poses considerable uncertainty in estimating the range of take given its connection with the Avon Reservoir, and the re-distribution of poor quality water due to mining.

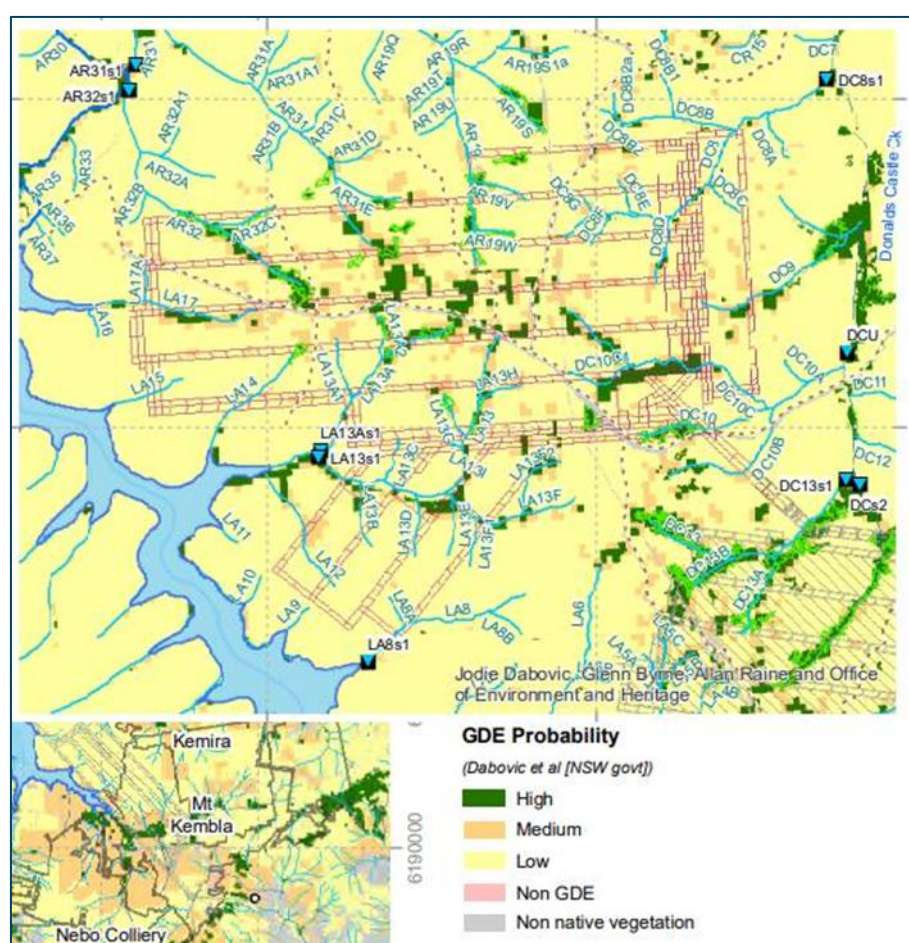
#### Alternative Mining Methods

As the impacts to water quality and GDEs are largely due to the subsidence associated with longwall mining, DPE Water recommends that DPE Planning and Assessment robustly assess the methods proposed. It is noted that alternative mining methods (such as bord and pillar) will have significantly lower impacts, and that neighbouring mine(s) with similar geological and environmental characteristics use these methods.

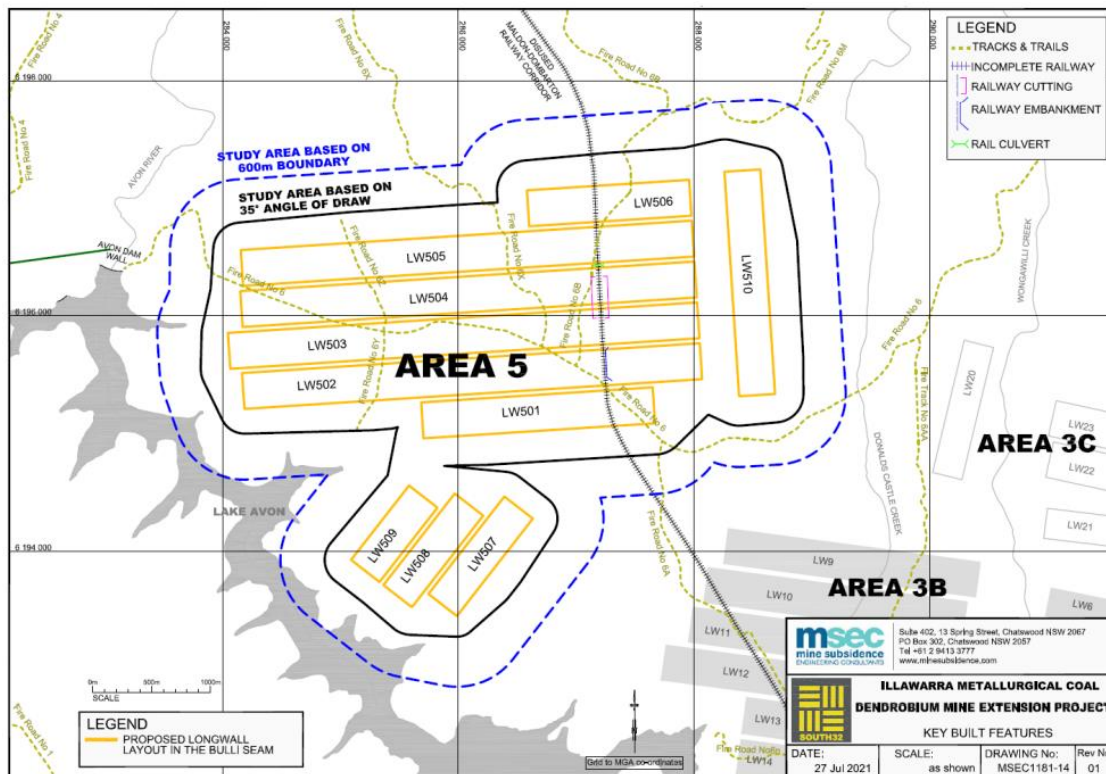
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**Table 2 - Details of Proposed Longwall Panels (ref: Appendix B Groundwater Assessment)**

Mine Domain	Long-wall	Status	Date		Days	Panel length (m)	Width [m]		Cutting height [m]		Depth of cover [m]		
			Start	End			Panel	Void	Mean	Max	Min	Mean	Max
Area 5 (‘the Project’)													
Area 5	501	Proposed	1/04/2026	28/02/2027	330	1967	295	305	2.6	2.78	300	357	386
Area 5	502	Proposed	1/04/2027	31/05/2028	430	3890	295	305	2.7	2.89	286	342	373
Area 5	503	Proposed	1/07/2028	31/05/2029	330	3988	295	305	2.8	3.03	314	355	377
Area 5	504	Proposed	1/07/2029	31/05/2030	330	3860	295	305	2.9	3.20	313	363	386
Area 5	505	Proposed	1/07/2030	31/08/2031	425	3834	295	305	2.9	3.20	325	365	392
Area 5	506	Proposed	1/10/2031	29/02/2032	150	1378	295	305	2.8	3.06	365	389	398
Area 5	507	Proposed	1/04/2032	30/06/2032	90	1048	295	305	2.4 <sup>#</sup>	2.46	255	320	358
Area 5	508	Proposed	1/08/2032	30/11/2032	120	984	295	305	2.4 <sup>#</sup>	2.49	282	318	345
Area 5	509	Proposed	1/01/2033	31/03/2033	90	799	295	305	2.4 <sup>#</sup>	2.54	272	288	318
Area 5	510	Proposed	1/05/2033	31/12/2033	240	1910	295	305	2.5	2.60	319	361	388



**Figure 3 - Hydrology and groundwater dependent features (ref Appendix B Groundwater Assessment).**



#### Current Risk Assessment

The Project poses level 2 impact risks as defined by the “minimal impact considerations” of the NSW Aquifer Interference Policy for:

- (i) water quality; and
- (ii) drawdown at High Priority Groundwater Dependent Ecosystems, noting that proposed High Priority GDEs will be formally exhibited from late June 2022 as part of the draft remake of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources. These proposed High Priority GDEs encompass the upland swamps overlying and in proximity to the Project.

A position of progressive mining expansion, with anticipated cumulative water quality deterioration and only a limited understanding of the full extent of change once equilibration occurs and an upward flux is generated, poses a risk. The accumulation of water quality impacts being realised within the Metropolitan Special Areas that aren’t subject to secondary extraction is now evident in Wongawilli Creek. The EIS states (Appendix B Section 6.10.1):

*“In recent years, new or recurrent iron-staining has been noted on Wongawilli Creek, WC21, LA5 and SC10C. In most cases the iron-staining can be traced back to individual springs from fractures within or adjacent to the watercourse. Groundwater monitoring indicates that reactivation of iron-rich springs correlates with recovery in shallow groundwater levels, including above mined longwalls”.*

Existing mining within the Metropolitan Special Area is causing groundwater and surface water quality impacts that were not as well recognised in the previous development application. The proponent acknowledges that such water quality impacts will be further exacerbated should the Project proceed. These impacts are incrementally increasing risk to the quality of water to the Sydney drinking water supply and the environment.

## **Groundwater Modelling**

### **2.2 Recommendations – Prior to Determination**

- a) The proponent should revise the groundwater model and report to:
  - i. include adequate sensitivity analysis as part of the model calibration to identify the most influential parameters; and
  - ii. include adequate uncertainty analysis to explicitly explore the potential impacts of possible fault zones in Area 5.
- b) The proponent should revise the groundwater level datasets assignments to model layers to provide higher level of confidence in the model performance.

#### **Explanation**

##### **a) Sensitivity analysis**

Adequate sensitivity analysis is required to identify which parameters have the most influence on the model performance. Without this, the model calibration may be focusing on the wrong parameters. This analysis can enhance the uniqueness of the model, reducing uncertainty. Notwithstanding, it is acknowledged that a unique model is not attainable.

##### **Potential fault zone impacts**

The potential impacts of faults within Area 5 can be explored using uncertainty analysis, making assumptions with regards to their hydraulic properties based on available knowledge of the area's geology (refer to Recommendation 2.1(c) above).

- b) For the model to be considered calibrated and representative of the field and the Project conditions, groundwater level datasets must be assigned correctly to the model layers. Failure to do so may affect the model performance and certainly reduces the confidence in the modelled predictions.

**End Attachment B**

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## Attachment C

### Detailed Surface Water advice to DPE Planning & Assessment regarding the Dendrobium Mine Extension Project (SSI-33143123) – EIS

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#### Recommendations – Prior to Determination

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##### 3.1 Significance of lower order water courses

The proponent must provide more detailed explanation of indicators of stream significance for all 1st and 2nd order streams overlying and adjacent to longwall panels in Area 5.

This requires an assessment that includes a clear methodology and should consider criteria such as connectivity to adjacent upland swamps and swamp size, water quality, ecological importance, visual amenity (e.g., cascades and pools) and connectivity to high order streams and water supplies (NSW Planning Assessment Commission 2009).

##### Explanation

The existing assessment does not consider or differentiate the significance of lower order water courses.

The EIS acknowledges that lower order streams near proposed longwalls will likely be impacted by surface cracking and subsidence. The current assessment of stream significance (Section 7-43 of the EIS) does not explain how criteria have been used to assign significance to water courses, particularly for low order streams. The criteria that were used limit the ability to identify significance in smaller watercourses and/or differentiate the significance of smaller order watercourses. There is a risk that not identifying the relative significance of these streams, nor setting out an adequate proposal for remediation or monitoring, could result in significant impacts to significant water courses.

One example demonstrating this is 'AR32', a lower order stream adjacent to a large swamp with near-perennial flow. This proximity is likely to make this a more significant stream than other similar low order streams. Lower order water courses should be prioritised for protection, monitoring and/or remediation.

Assessing the significance of lower order streams will help determine the nature and level of protection for lower order streams and help attribute value to individual water courses. This will assist in informing appropriate monitoring and remediation plans.

##### 3.2 Stream / watercourse features

The proponent must provide:

- a) A justification for adopting the thresholds for defining key stream features.
  - b) More detailed mapping of water course features (pools, rock-bars and outlet controls) directly above longwall panels. The mapping should identify all of the following features overlying longwall blocks:
    - i. Permanent and semi-permanent pools deeper than 0.5 m
    - ii. Rock-bars that form outlet controls to pools deeper than 0.5 m
    - iii. Rock-bars that form outlet controls for upland swamps that maintain persistent flows into downstream watercourses.
  - c) An explanation of the additional stream features depicted in Map 7-9 (Section 7-45) of the EIS.
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### Explanation

- a) The proponent has defined Significant Stream Features as pools with holding capacities greater than 100m<sup>3</sup>, or as waterfalls greater than 5m height. The proponent has restated these thresholds without a geomorphic or hydrologic justification. The proponent has not adequately explained the reason to choose the above figures to establish significance. Without a geomorphic or hydrologic justification, these thresholds may be arbitrary and likely reduce the number of Significant Features in Area 5 (Map 7-9 of the EIS). This reduces the proponent's obligation to reduce longwall lengths to avoid direct subsidence of other pools and overlying swamps and connected watercourses.
- b) The existing mapping of water course features (Map 7-9 of the EIS) is limited to 'key stream features' and 'additional features'. These features are unlikely to reflect the range of important water course features overlying longwall panels due to the thresholds chosen by the proponent (see Recommendation 3.2(a)). Mapping the features listed (i) to (iii) in this recommendation will give better understanding of important features that will be impacted. Mapping these water course features will give a better understanding of baseline geomorphic conditions above longwall panels. These features can be used as sites for the purpose of monitoring and remediation post-approval (refer to Recommendation 3.4(a) below).
- c) The submission does not define the additional stream features depicted as green circles in Map 7-9 (Section 7-45) of the EIS. It is uncertain if these features represent pools and waterfalls with lower threshold values than the key features deemed to be significant. This is important because many of these features overlie longwalls and would be impacted. For example, four additional stream features overlie the eastern longwall panel 'LW510' and will likely be impacted by subsidence, cracking and draining. It is unclear what these features are.

### **3.3 Swamp stability assessment**

The swamp stability assessment (Section 5.7 of Appendix C) needs to account for the decrease in soil moisture after mining. The risk of potential erosion and scouring during rare flow events should be re-assessed once the decrease in soil moisture is included.

### Explanation

The swamp stability assessment does not account for decreased soil moisture following undermining (Mason et al., 2021). It currently considers changes in swamp gradient and vegetation coverage after mining. This has the potential to underestimate the risk of erosion and scouring of swamps during a rare flow event, as soil moisture has a key role in erosion resistance (Moragoda et al., 2022).

## **Recommendations – Post Approval**

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### **3.4 Monitoring and management**

The proponent should:

- a) Provide greater details for monitoring at sites overlying and adjacent to longwall panels to monitor for subsidence, cracking and draining.

This should include specifying the exact location of these sites on lower order streams and adjacent swamps, and also specify the specific thresholds and triggers for which remediation actions will be implemented as part of a Trigger Action Response Plan (TARP).

The water course features mapped as part of Recommendation 3.2(b) above can be used for this purpose.

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- b) Additionally, the proponent should commit to using full extent aerial surveys (such as Interferometric Synthetic Aperture Radar (InSAR) Light Detection and Ranging (LiDAR)), extending to the whole tenure and at a regular frequency to detect land deformation impacts at surface and risks to swamps (and GDEs, see Appendix B for details) and surface water features. This would enable the documentation and reporting of the impacts and their management over time. Incorporate the identification of macroinvertebrates (to genus level) into the aquatic ecology monitoring program.

#### Explanation

- a) The proposal indicates that monitoring for visual signs of cracking, subsidence and iron staining would occur at key stream features (Section 7-50 of EIS). Given that key stream features are defined as ponds greater than 100 m<sup>3</sup> and waterfalls greater than 5 m, it is unclear in the submission whether there will be any monitoring for the stream features overlying longwall panels. The location of key stream features, using the proponent's definition of a key stream feature, which is not adequately explained, suggests that there may be limited monitoring directly above longwall panels.
- b) The proposed monitoring program uses the AUSRIVAS OE50 model, which is considered outdated and regularly outperformed by EPT indices and SIGNAL (Chessman 2021). In particular, sensitive taxa from Ephemeroptera, Plecoptera and Trichoptera (EPT) and any *Euastacus* should be identified to species. The freshwater crayfish *Euastacus hirsutus* is listed as Critically Endangered by the IUCN and may occur in ephemeral streams within the catchment.

### **3.5 Risk to Swamp Integrity**

The proponent should:

- a) Provide a risk assessment of fracture or disruption to outlet controls on upland swamps, with relevant mitigation and/or remediation actions for upland swamp outlet controls; and
- b) Provide specific detail on any proposed monitoring of and protection mechanisms for any bedrock-controlled swamp outlets.

#### Explanation

The significance of upland swamp outlet controls, including the presence of, and risk to, bedrock outlet controls for upland swamps, is not satisfactorily explained in the EIS.

Several upland swamps in the Woronora Plateau have exposed bedrock outlet controls that provide critical water level control in many upland swamps. Loss of exposed bedrock outlet controls is very likely to have significant impacts to water holding capacity of upland swamps.

#### References

- Chessman, B.C. (2021) What's wrong with the Australian River Assessment System (AUSRIVAS)? *Marine and Freshwater Research*, 72, 1110-1117.
- Mason, T. J., Krogh, M., Popovic, G. C., Glamore, W., & Keith, D. A. (2021). Persistent effects of underground longwall coal mining on freshwater wetland hydrology. *Sci Total Environ*, 772, 144772-144772.
- Moragoda, N., Kumar, M., & Cohen, S. (2022) Representing the role of soil moisture on erosion resistance in sediment models: Challenges and opportunities. *Earth-Science Reviews*, 229, 104032.
- NSW Planning Assessment Commission (2009). The Metropolitan Coal Project Review Report, pages 54-56.

**End Attachment C**

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## Attachment D

### Detailed advice on water offsets to DPE Planning & Assessment regarding the Dendrobium Mine Extension Project (SSI-33143123) – EIS

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#### Recommendations – Post Approval

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##### 4.1 Establish an agreement to offset water losses

DPE Planning and Assessment should ensure that an appropriate agreement is in place with the proponent to offset water losses from the metropolitan water drinking supply. This agreement should ensure that there is an overall net benefit to the metropolitan water supply, to deliver the NSW Government's position on water offsets.

##### Explanation

The proponent acknowledges that the project will result in water losses from the metropolitan drinking water supply. The proponent also proposes to reach an agreement with the NSW Government, similar to that proposed in the previous project application, in which water losses and water quality effects for the metropolitan drinking water supply are offset by payments directed to the Minister for Lands and Water for use increasing the net supply of water.

The interagency taskforce established under the Mining in the Catchment Action Plan has developed an approach to ensure that any 'additional' water losses of any new mining proposal in the Special Areas are fully offset under the *Environmental Planning & Assessment Act 1979* (EP&A Act). This includes ensuring that the value of any water offsets would significantly exceed the value of any water losses.

This is significant because the draft Greater Sydney Water Strategy identifies that Greater Sydney's demand for water is fast exceeding the city's sustainable level of supply (yield) and therefore any added pressure on the city's water security should be offset in the short-term. While the new project proposal has a significantly lower effect on water resources than the previous proposal, the resulting water losses are still significant.

The established approach for the offset mechanism involves:

- imposing conditions on development consents under the EP&A Act requiring mining companies to minimise the surface water losses of new mining proposals and to pay the full cost associated with offsetting these water losses;
- collecting and administering all offset payments from mining companies in a dedicated offset fund under the EP&A Act; and
- giving the Minister for Lands and Water the authority to spend the funds collected on priority water projects to increase the drinking water supply of the Sydney metropolitan area.

While developing this approach, the interagency taskforce obtained technical advice from Marsden Jacob Associates on methodologies that could be used to determine the quantum of any water offsets.

Marsden Jacob Associates considered several options and identified several key principles that should be adopted in any approach, including:

- Impactor pays – costs should be allocated to the party who generates the costs, or the need to incur costs. The impactor pays principle is commonly applied by regulators for water pricing purposes. The expectation is that the offset arrangement will provide a net gain to metropolitan water supplies
  - Economic efficiency – the value of surface water offsets should reflect the long-term costs of supplying water (long-term given the impact of the Project on surface water supplies is permanent).
  - Intergenerational equity – The principle of inter-generational equity involves the right of the
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present generation to use and enjoy the resources of the earth but without compromising the ability of future generations to do likewise.

- Precautionary principle – the value of surface water offsets should account for not only known risks, but also scientific uncertainty particularly given the Project is in a drinking water catchment. Scientific uncertainty arises from several sources, including for example, an incomplete understanding of natural processes and phenomena that affect surface water losses and water quality.
- Transparency – where possible the value of surface water offsets should be based on information that is publicly available or can be verified.
- Independence – where possible, the parameters for determining surface water offsets should be independently determined.
- Robustness – the value of surface water offsets should be based on an approach that is robust and repeatable, particularly given the Project will operate over a long period.

DPE Planning and Assessment should ensure that these principles are reflected in the agreement with the proponent, and ensure that the agreement implements the NSW Government's position on water offsets.

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