

Our ref: MF23/1647

Professor Neal Menzies
Chair, Mining and Petroleum Gateway Panel

By email: [REDACTED]
10 August 2023

Subject: Cadia Valley Operations Modification 15 Gateway Certificate Application

Dear Professor Menzies

Thank you for your letter of 26 May 2023 to the Minister for Water, the Hon Rose Jackson MP, requesting advice on the gateway certificate application for the Cadia Valley Operations Project in respect of Biophysical Strategic Agricultural Land proposed to be disturbed by modification 15. The Minister has asked me to provide a technical assessment from the Department of Planning and Environment – Water (DPE Water).

As set out under *the State Environmental Planning Policy (Resources and Energy) 2021*, our technical assessment (attached) has considered the minimal impact considerations of the NSW Aquifer Interference Policy (AIP), as well as other aspects of that policy.

The proponent has generally undertaken an appropriate assessment against the AIP for this preliminary application, and according to the AIP the project is unlikely to create more than minimal impacts to groundwater as defined by the AIP.

Our recommendations include that the proponent should quantify impacts to Groundwater Dependent Ecosystems and to update the proposed monitoring and management of water quality impacts when completing its modification report.

We have also considered the Independent Expert Scientific Committee's (IESC) advice in relation to the proposal's impacts on water resources and support the IESC's findings that improved documentation is required when the modification is lodged to quantify impact assessment predictions and to enable adequate consideration of proposed monitoring and management measures.

DPE Water's Assessment team is available to assist with further queries by email at water.assessments@dpie.nsw.gov.au.

Yours sincerely,

[REDACTED]
Mitchell Isaacs

Chief Knowledge Officer
Water Group

Attachment

Technical Assessment by the Department of Planning & Environment – Water

Advice on the gateway certificate application for the Cadia Valley Operations Project (Modification 15)

Purpose

The purpose is to provide water assessment advice in response to the gateway certificate application as per the requirements of the *State Environmental Planning Policy (Resources and Energy) 2021*. The advice takes into account:

- the minimal impact considerations of the NSW Aquifer Interference Policy (AIP), and
- other elements of the AIP.

This advice also considers the submission by the Independent Expert Scientific Committee (IESC).

Background to the Project

Cadia Holdings Pty Limited (the Proponent) is intending to apply to modify its existing approval PA06_0295 for the Cadia Valley Operations located 25 km southwest of Orange in the Central Tablelands of New South Wales (see **Figure 1**).

The proposed modification would extend the tailings dam embankments into Biophysical Strategic Agricultural Land and the proponent is seeking a gateway certificate in relation to that land.

The gateway certificate application document has been examined in detail for this review.

Review and Comment

DPE Water Gateway Assessment

DPE Water confirms that the information provided is satisfactory for the purpose of the gateway certificate application.

Minimal Impact Considerations of the Aquifer Interference Policy (AIP)

Considerations of minimal impacts as required by the AIP have generally been appropriately assessed with the project unlikely to create more than minimal impacts. The primary risk is to groundwater quality due to potential seepage from the tailings dams. Whilst the proponent's assessment did not directly assess the AIP minimal impact consideration of not lowering the beneficial use category of the groundwater source beyond 40 m from the activity, water quality impacts are to be mitigated by constructing the tailings dam embankment with a low permeability core and monitoring with an expanded monitoring bore network.

Other Elements of the AIP

Additional considerations have been addressed by the proponent and outcomes are supported by DPE Water.

The proposed activity does not require an increase in water take so no additional entitlement is required.

Please note more detailed advice regarding the AIP in Table 1 below.

IESC Review

DPE Water has considered the advice provided by the Commonwealth's Independent Expert Scientific Committee on Large Coal Mines and Coal Seam Gas (IESC) dated 1 August 2023. The IESC advice is thorough and detailed. DPE Water supports the IESC advice and its view that impacts on water resources require enhanced modification documentation to quantify impact predictions and the development of appropriate monitoring and management measures.

DPE Water notes the potential for impacts in areas of mapped high potential groundwater dependent ecosystems (GDEs) along Cadiangullong Creek within 200m of the embankment works from compaction and loading with the result of raising groundwater levels. Whilst the application is only an incremental change in the tailings dam, a risk to GDEs is evident and it is the cumulative impact that requires a quantitative assessment against the NSW Aquifer Interference Policy category 1 'minimal impact consideration' for High Priority GDEs. DPE Water supports the IESC recommendation on this issue.

DPE Water also supports the IESC recommendations that leakage pathways from the tailings dam require more detailed evaluation and the need for an improvement in the monitoring plan and infrastructure to detect leachate movement passed the containment system.

DPE Water Recommendations

Recommendation 1:

The modification report demonstrates that the embankment design and associated monitoring and mitigation measures will be sufficient to ensure that any change in the groundwater quality will not lower the beneficial use category of the (highly-productive) groundwater source beyond 40 m from the activity. This is to include a review of the monitoring bore network, water quality parameters, and monitoring frequency. This is to meet the level 1 minimal impact considerations of the AIP.

Recommendation 2:

The modification report comprehensively investigates the source of water level increases with consideration of tailings deposition (e.g. timing, volumes) to understand how the tailings dams are affecting groundwater levels and risks to High Priority GDEs during and after construction and post-closure and report the impact prediction against the NSW AIP category 1 'minimal impact consideration' for High Priority GDEs.

Table 1: Assessment of the Cadia Valley Operations Modification 15 Gateway Certificate application against the AIP

Conditions	Proponent comment	DPE Water comment
<p>3.2.1 Aquifer Impact Assessment</p> <p>Assessment criteria for the minimal impact considerations of the NSW Aquifer Interference Policy (AIP) for highly productive aquifers</p>	<p>The groundwater review shows that the modification meets the 'Level 1' minimal impact considerations of the Aquifer Interference Policy for key regional 'highly productive' groundwater resources (AGE, 2023) (Appendix C).</p> <p>Notwithstanding, groundwater level and quality monitoring would be undertaken for the modification.</p> <p>Potential impacts on Highly Productive Groundwater</p> <p>The proposed reinforcement of the STSF embankment would not have an influence on groundwater take, and therefore would not affect water access licensing. AGE (2023) has identified seepage from the TSF into the underlying bedrock and creeks as a potential impact mechanism (Appendix C). Accordingly, the TSF embankment would be designed with a very low permeability core to minimise seepage through the wall. No impacts have been identified on highly productive groundwater in the context of the Aquifer Interference Policy (AGE, 2023) (Appendix C).</p> <p>App. 3, S2.4.1 Conclusion</p> <p>In conclusion, the predicted impacts from the proposed modification of the TSF embankment are considered to be less than Level 1 in Table 1 – Minimal Impact Considerations for Aquifer Interference Activities within the Aquifer Interference Policy. This follows considering the effect that the reinforcement and extension of the southern TSF embankment will have on potential</p>	<p><i>Assessed as acceptable</i></p> <p>The proponent has demonstrated that the proposed modification would meet the level 1 minimal impact considerations for highly-productive fractured-rock water sources of the NSW Aquifer Interference Policy (AIP).</p> <ul style="list-style-type: none"> • The proposed modification would not include additional groundwater take, therefore drawdown at water supply bores or GDEs is unlikely. • Potential reduction in water quality (via seepage from the TSF) is proposed to be managed with a suitable low-permeability embankment design. • Any water level rises (from additional loading) is likely to be localised relative to the GDEs and other water users <p>The Orange Basalt Groundwater Source is defined as a highly-productive groundwater source, based on the general characteristics of the water source.</p> <p>5.2 Groundwater source categories</p> <p>Section 3.2.1 in the Policy defines the two types of groundwater source categories for which minimal impact considerations have been developed. All NSW groundwater sources have been categorised as being either highly productive, or less productive, based on the general character of the water source meeting, or not meeting, the criteria of 1500mg/L total dissolved solids and a bore yield rate of greater than 5L/s. This categorisation applies to a whole groundwater source as it is defined in a water sharing plan, not to the specific groundwater conditions at a particular location. Applications to change category because of local conditions will not be accepted.</p> <p>A list of highly productive groundwater sources is given in Appendix 1 and a list of less productive groundwater sources is given in Appendix 2. A map of groundwater productivity is available at:</p> <p>http://www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/Strategic-Regional-Land-Use</p> <p>Note – the map only shows the shallowest groundwater source; in most cases there will be other water sources under these.</p> <p>From time to time these lists, and the map, may be updated to reflect any new information or other changes, including the commencement of new water sharing plans.]</p> <p>Source: <i>Guideline to the Aquifer Interference Policy</i>, NOW 2014</p>

	<p>changes to productivity of aquifer sources, and potential impacts on sensitive receptors, groundwater levels/quality and nearby surface water bodies.</p>	
<p><u>Water Table</u></p> <p>1. Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic “post-water sharing plan” variations, 40 m from any:</p> <p>(a) high priority groundwater dependent ecosystem; or</p> <p>(b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan.</p> <p>A maximum of a 2 m decline cumulatively at any water supply work.</p> <p>2. If more than 10% cumulative variation in the water table, allowing for typical climatic “post-water sharing plan” variations, 40 m from any:</p> <p>(a) high priority groundwater dependent ecosystem; or</p> <p>(b) high priority culturally significant site;</p> <p>listed in the schedule of the relevant water sharing plan then appropriate studies will need to demonstrate to the Minister’s satisfaction that the variation will not prevent the long-term</p>	<p>The modification of the TSF footprint outside the mining lease will not result in additional water being taken from the groundwater regime during operations or post closure.</p>	<p><i>Assessed as acceptable</i></p> <p>The proposed modifications do not induce any additional water take and are therefore unlikely to affect the nearby water levels. Potential localised water level rise (from increased loading) is addressed below.</p>

<p>viability of the dependent ecosystem or significant site.</p> <p>If more than 2 m decline cumulatively at any water supply work then make good provisions should apply.</p>		
<p><u>Water Pressure</u></p> <p>1. A cumulative pressure head decline of not more than a 2m decline, at any water supply work.</p> <p>2. If the predicted pressure head decline is greater than requirement 1.(a) above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.</p>	<p>The modification of the TSF footprint outside the mining lease will not result in additional water being taken from the groundwater regime during operations or post closure.</p> <p>No changes in water levels from the proposed TSF embankment modification on GDEs in the area are anticipated as there is no groundwater take associated with the proposed activities.</p> <p>The closest mapped high potential aquatic GDEs are over 2 km to the east along Flyers Creek and are located cross gradient of the Gateway Project Application Area groundwater flow direction. Due to distance and the receptors not located hydraulically downgradient there is considered to be no potential impacts on groundwater quality and levels in the vicinity of Flyers Creek from the proposed activities.</p> <p>The influence of the Project's activities on groundwater dependant ecosystems will be assessed further within Mod 15 following provision of detailed embankment design information, which is expected to confirm minor impacts.</p>	<p><i>Assessed as acceptable</i></p> <p>The proposed modifications do not induce any additional water take and are therefore unlikely to affect the nearby water levels. Potential localised water level rise (from increased loading) is addressed below.</p> <p>Commitment to further assessment of impacts to GDEs following detailed embankment design noted.</p>
<p><u>Water Quality</u></p> <p>1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.</p>	<p>See above, also:</p> <p>Direct seepage from the existing TSFs is currently conceptualised and modelled to be a relatively small flux, with predictions from the recent AGE (2021) numerical model providing an average of 0.4 ML/day and 0.2 ML/day from the NTSF and STSF, respectively. These</p>	<p><i>Assessed as acceptable</i></p> <p>Seepage of water from the TSF should be managed by an appropriately designed embankment. Water quality monitoring should be reviewed during the pre-approval and post-approval stages.</p>

<p>2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.</p>	<p>predictions are also consistent with the findings of other seepage investigations (KCB, 2019; GHD, 2018). As the Modification would not change amount or height of tailings stored or the general embankment construction methodology, these estimates would not be expected to materially change.</p>	<p>The proponent should demonstrate that embankment design will be sufficient to ensure that <i>any change in the groundwater quality should not lower the beneficial use category of the (highly-productive) groundwater source beyond 40 m from the activity.</i></p>
<p>3.2.2 Additional considerations</p>		
<p>Acidity issues to arise, for example exposure of acid sulphate soils;</p>	<p>Material for the construction of the NTSF encapsulation and STSF embankment construction to be sourced from non-acid forming material from the site waste rock dumps.</p>	<p><i>Assessed as acceptable</i></p> <p>If acid sulfate soils are identified prior to or during construction, an acid sulfate soil management plan must be developed and implemented.</p>
<p>Waterlogging or water table rise to occur, which could potentially affect land use, groundwater dependent ecosystems and other aquifer interference activities.</p>	<p>The mass loading of the TSF embankment would lead to some degree of compaction (varies between consolidated / unconsolidated rock types) and reduced porosity in the immediate vicinity. This in turn would cause a slight groundwater level rise due to reduced storage, and this effect is more notable in unconsolidated sediments. Based on existing groundwater rise on the periphery of the TSF attributed to loading effects, the spatial extent away from the TSF for this loading effect to occur is within 200 m. Any localised groundwater level increase due to the overburden loading compaction effect, however, diminishes the distance from the TSF increases.</p>	<p><i>Assessed as acceptable</i></p> <p>Water level rises resulting from the expanded TSP footprint, are likely to be localised – as is currently the case. The relative distances to GDEs and local water users are such that the sites are unlikely to be impacted.</p>
<p>3.2.3 What is required from proponents</p>	<p>A network of baseline monitoring bores has been installed within the alluvium, Tertiary basalts, Ordovician and Silurian basement rocks for the existing Cadia operations. The monitoring bore network extends to the south of the</p>	<p><i>Assessed as acceptable</i></p>

<p>Establishment of baseline groundwater conditions;</p>	<p>mining lease as shown on Figure 2.5. The CVO monitoring bore network has been operating for over 25 years and has been continuously expanded over time in response to additional mining infrastructure and local site investigations. Currently there are approximately 150 groundwater bores active within and surrounding CVO. There are a number of bores that have been decommissioned or abandoned due to mine site operations or bore blockages as shown on Figure 2.5. The most recent review of the data from the monitoring network was completed for the 2020-2021 financial year by AGE (2021b).</p> <p>With the proposed modification of the embankment there will be some monitoring bores decommissioned in the footprint of the expansion footprint and new bores installed outside the proposed embankment extension.</p> <p>These new monitoring bores are currently in a planning stage. They will be integrated into the water management plan with monitoring at similar frequencies as existing monitoring bores in the area.</p>	<p>Baseline conditions are well-established.</p> <p>Intention to install replacement bores for any destroyed during construction embankment extension noted. Placement and coverage to be considered during review of modification 15 application and/or post-determination</p>
<p>A strategy for complying with any water access rules applying to relevant categories of water access licences, as specified in relevant water sharing plans;</p>	<p>The modification of the TSF footprint outside the mining lease would not result in water being taken from the groundwater regime during operations or post closure.</p> <p>CVO mining activities take water directly from the NSW Murray-Darling Fractured Rock Groundwater Sources water sharing plan. Under this water sharing plan CVO will directly take water from the Lachlan Fold Belt (MDB) Groundwater Source, and indirectly through induced flow from the Orange Basalt Groundwater Source.</p>	<p><i>Assessed as acceptable</i></p> <p>The proposed modifications do not include any additional groundwater take, therefore changes to existing licencing arrangements are unlikely to be necessary.</p>
<p>Details of potential water level, quality or pressure drawdown impacts on nearby water users who are</p>	<p>The nearest landholder bores to the Gateway Project Application Area are at a distance of 1.5 km to the south (GW704196 and GW052182) as shown in Figure 2.3 and are screened within the Orange Basalt. There will be no water level changes on landholder bores from the</p>	<p><i>Assessed as acceptable</i></p>

<p>exercising their right to take water under a basic landholder right;</p>	<p>proposed STSF embankment modification as there is no groundwater take and the landholder bores are outside the approximate 200 m influence of the zone where loading/compaction may induce water level rises.</p> <p>Although landholder bores are in several cases located hydraulically downgradient from the TSF, it is anticipated that there would be no changes in water quality for these bores from the Project's activities due to:</p> <ul style="list-style-type: none"> - design of embankment with anticipated very low rate of seepage; - dilution of water quality over the distance of 1.5 km or more to nearest landholder bores when considering the make up of decant water is low in salinity and metals are not noticeably elevated; and - most historic seepage occurs at shallow depths at the interface of soil/weathered materials and low permeability fresh bedrock and emanates in low areas, such as drainage lines, where it is recaptured and recycled back into the CVO operations. (refer to Section 2.3 for more information). 	<p>Water level changes to other water users are unlikely as a result of the proposed activities.</p>
<p>Details of potential water level, quality or pressure drawdown impacts on nearby licensed water users in connected groundwater and surface water sources;</p>	<p>There are no licensed water users in 5 km of the proposed Gateway Project Application Area who have connected groundwater and surface water sources.</p>	<p><i>Assessed as acceptable</i></p>
<p>Details of potential water level, quality or pressure drawdown impacts on groundwater dependent ecosystems;</p>	<p>There is anticipated to be no changes in water levels from the proposed TSF embankment modification on GDEs in the area as there is no groundwater take associated with the proposed activities. Along Cadiangullong Creek, the mapped high potential terrestrial GDE's are within 200 m of the proposed embankment footprint on the western side of the STSF. However, these terrestrial GDE's are not expected to be adversely affected by any localised groundwater level rise due to the influence of overburden compaction which occurs adjacent to the TSF. The</p>	<p><i>Assessed as acceptable</i></p> <p>The nature of the proposed modifications is unlikely to increase groundwater take. Seepage and water quality impacts should be managed by appropriate design of the TSF.</p> <p>The proponent should demonstrate that embankment design will be sufficient to ensure that any change in the groundwater quality should not</p>

	<p>potential of changes in water quality from seepage influencing GDE health is considered to be negligible based on:</p> <ul style="list-style-type: none"> - design of embankment raise with anticipated very low rate of seepage; - dilution of water quality over the distance travelled from the embankment to the creek; and - the make up of decant water is low in salinity and metals are low in concentrations. <p>The closest mapped high potential aquatic GDE's are over 2km to the east along Flyers Creek and are located cross gradient of the Gateway Project Application Area groundwater flow direction. Due to distance and the receptors not located hydraulically downgradient there is considered to be no potential impacts on groundwater quality and levels in the vicinity of Flyers Creek from the proposed activities.</p> <p>The influence of the Project's activities on groundwater dependant ecosystems will be assessed further within Mod 15 following provision of detailed embankment design information, which is expected to confirm minor impacts.</p>	<p>lower the beneficial use category of the (highly-productive) groundwater source beyond 40 m from the activity.</p>
<p>Details of potential for increased saline or contaminated water inflows to aquifers and highly connected river systems;</p>	<p>The water quality of existing TSF decant water has similarities with native groundwater, that is, of low salinity, and has low concentrations of dissolved metals, although elevated in sulphate (AGE, 2021b). The Gateway Project Application Area is largely located on Ordovician bedrock of low groundwater productivity (refer to Figure 2.1). The Orange basalt groundwater source is intercepted by the Gateway Project Application Area in two small areas to the south and west of the TSF (note that the basalt already occurs under the existing STSF).</p> <p>The TSF embankment modification is unlikely to result in increased saline and contaminated water inflow into underlying aquifer systems due to the underlying rocks</p>	<p><i>Assessed as acceptable</i></p> <p>Water quality and seepage should be managed by a suitably designed low-permeability embankment.</p>

	<p>mainly being of poor permeability below the weathered zone (Ordovician volcanoclastics), and the presence of the pump back systems.</p> <p>There are no highly connected groundwater – river/stream systems within 3.5 km of the Gateway Project Application Area. The closest waterway of significant alluvium thickness is the Belubula River located 3.5 km south of the Gateway Project Application Area.</p>	
<p>Details of the potential to cause or enhance hydraulic connection between aquifers;</p>	<p>The emplacement of TSF embankment material would not enhance hydraulic connection between aquifer systems. Alternately, the TSF embankment may reduce hydraulic connection due to a decrease in porosity from mass loading in close vicinity to the embankment. There would be expected greater reduction of porosity in places where there is unconsolidated sediments/soils/weathered bedrock compared to where there is competent bedrock.</p> <p>An assessment of the distance of mass loading influence of the proposed embankment modification on groundwater level rise will be undertaken in Mod 15. This will be in the form of a review of the existing mass loading influence on groundwater levels in the existing monitoring network adjacent to the TSF and applying to area adjacent to the proposed embankment modification.</p>	<p><i>Assessed as acceptable</i></p> <p>Enhanced hydraulic connection is unlikely to result as a result of the proposed changes</p>