Pells Consulting

ABN 20 634 346 517
Phone: +61 409 155 946
The Old Post Office
49 Lakeside Drive
MacMasters Beach NSW 2251
www.pellsconsulting.com.au

Our Ref: 0001P.P4.L1
28 March 2022

Rachael Chick | Solicitor
Environmental Defenders Office
a: Suite 8.02, Level 8 | 6 O'Connell Street | Sydney NSW 2000
[redacted]

CONFIDENTIAL AND PRIVILEGED

Dear Rachael

EXPERT OPINION – GLENCORE GLENDELL CONTINUED OPERATIONS COAL PROJECT

This letter has been prepared in response to a brief (the Brief) from Environmental Defenders Office (EDO) dated 9 March 2022. The Brief requests review of various documents in relation to the Glencore Glendell Continued Operations Coal Project (The Project) and to provide a report which addresses the following issues in regard to any groundwater and/or surface water impacts arising as a result of the Project:

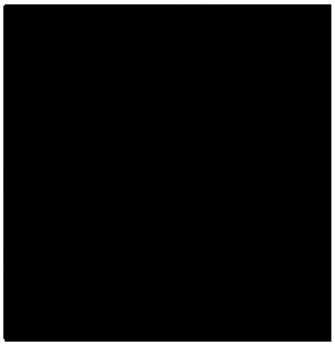
a. summarise any key impacts predicted to arise as a consequence of the Project.
b. In my opinion, was the assessment of environmental impacts, as far as it relates to my areas of expertise, appropriate and sufficient?
c. In my opinion, has the assessment adequately considered any cumulative impacts arising from the Project?
d. What, if any, concerns do I have about the environmental impacts of Project, bearing in mind the mitigation measures proposed?
e. Provide any further observations or opinions which I consider to be relevant.

I confirm that I am qualified to provide expert opinion on these matters of mining effects on groundwater and surface water and that the following letter contains opinions held by myself based upon review of the below-cited reports and data. A copy of my CV is attached to this letter. I also attach a copy of the Brief.

I have read and agree to be bound by Division 2 of Part 31 of the *Uniform Civil Procedure Rules 2005* (UCPR), and the Expert Witness Code of Conduct (Code of Conduct) contained in Schedule 7 of the UCPR.

My opinions addressing items a. to e. above are stated below in the section "Findings". The scientific basis for each these opinions is supported by reference to sections of my "Report" below.

Yours sincerely,



STEVEN PELLS
BE(Civil) MEngSc PhD

FINDINGS

Issue	Statement	Basis
a. summarise any key impacts predicted to arise as a consequence of the Project	The Project will remove both groundwater and its source aquifer in the regions of open-pit mining. Ongoing seepage into the mining pit will cause depressurization of adjacent groundwater resources. Intersection of two tributaries to the Hunter River will require interruption of the natural water course and construction of artificial diversions.	Section 2.1
b. was the assessment of environmental impacts, as far as it relates to my areas of expertise, appropriate and sufficient?	The “highly productive groundwater” resources associated with the alluvium are not given detailed enough assessment or presentation in the EIS.	Section 2.3
c. has the assessment adequately considered any cumulative impacts arising from the Project	Assessment of cumulative impacts is measured relative to existing approved mines rather than baseline conditions. This logic offers no environmental protections.	Section 2.4
d. What, if any, concerns do I have about the environmental impacts of Project, bearing in mind the mitigation measures proposed?	I am concerned that the assessment of environmental impacts has not appropriately quantified effects to the alluvial groundwater resources, which are deemed to be “highly productive groundwater” resources. In my understanding, no suitable mitigation options exist	Section 2.5
e. Provide any further observations or opinions which I consider to be relevant.	Reinterpretation of the extents of alluvium undertaken by the Proponent has not been subject to peer review and without presentation of test pit logs, it is not possible for a third party review the extents of “highly productive groundwater” adopted in the EIS.	Section 2.3
	A detailed plan for monitoring of the alluvium groundwater levels should include considerations to: loss of existing wells to excavation of the open pit; multi-level groundwater level monitoring, and; statutory incentives to ensure long term monitoring is continued.	Section 2.5

1. OVERVIEW OF GLENCORE GLENDELL CONTINUED OPERATIONS COAL PROJECT

1.1 Details of the proposed project

The Project comprises an application to increase the extent of the existing Glendell Mine. Approvals for the current open-cut mine operations cover an area of approximately 3.4 km^2. The Project discussed here is the proposal to increase the footprint of the open-cut mine operations to approximately 9 km^2 by including the additional 5.6 km^2 region shown in Figure 1.

Figure 1 – Overview of the existing and proposed mine extents

1.2 Regional setting

The aerial photograph in Figure 1 shows that the Project is located amidst various other existing mine workings. These mines are targeting the regional coal seams at various depths and with various mining methodologies.

Topographic features are presented in Figure 2, showing the several named tributaries of the Hunter River that are in proximity to and/or will be interrupted by the Project.

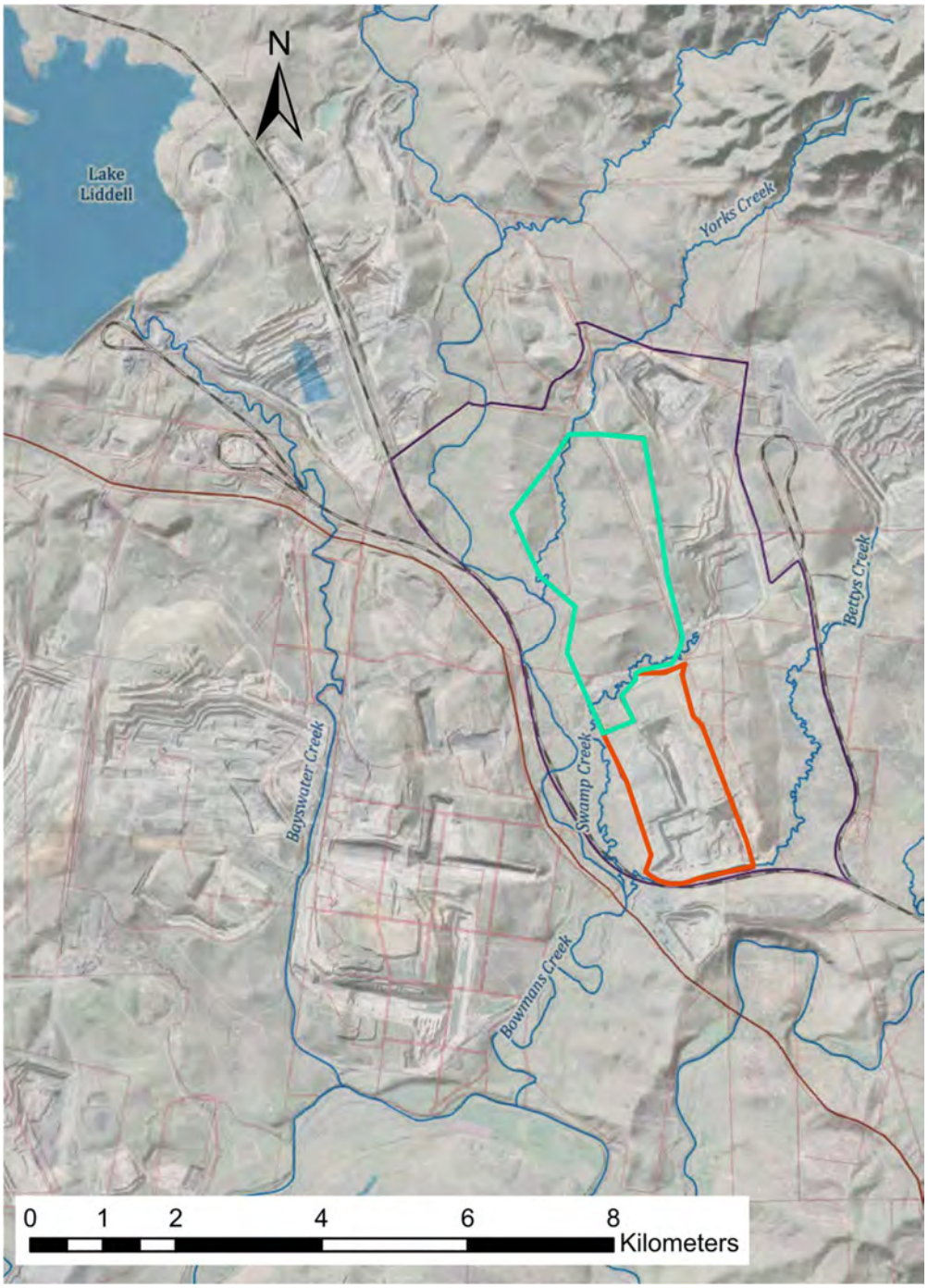


Figure 2 – Overview of the regional topographic features, including rivers (map modified from Figure 1-1 of Appendix 16 of the EIS)

Groundwater resources within coal formations, and adjacent formations, are often of poor quality and not greatly valued as a groundwater resource, at least for human utilisation. However, alluvial deposits adjacent to the tributaries hold groundwater which has been identified in mapping of "groundwater source zones" by DPI Water (2012) as being a "highly productive groundwater" resource (Figure 3). The classification of "highly productive" attracts more careful protection measures from the Aquifer Interference Policy (AIP).[1]

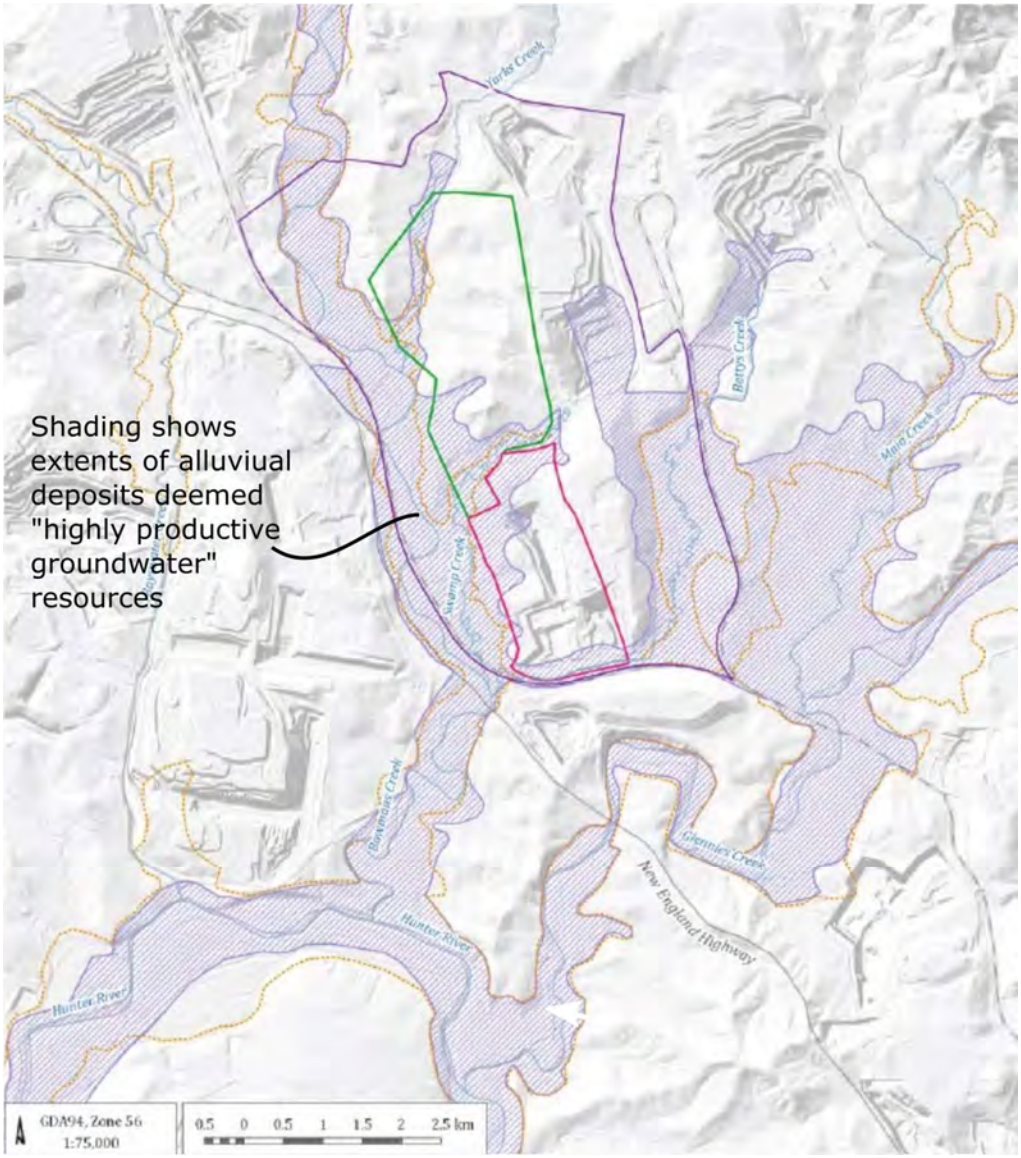


Figure 3 – Overview of the alluvial deposits identified as "highly productive groundwater" based on DPI Water, 2012 (figure modified from Figure 2-2 of Appendix 16 of the EIS)

[1] https://www.industry.nsw.gov.au/__data/assets/pdf_file/0005/151772/NSW-Aquifer-Interference-Policy.pdf

2. EFFECTS OF THE PROJECT UPON SURFACE AND GROUNDWATER RESOURCES

2.1 Expected effects

Open-cut mining involves accessing the desired underground resource through excavation from the surface. Clearly then, a primary effect of the Proposal is removal of existing resources within the open-cut footprint, including existing creeks and aquifers.

Intersection of Yorks Creek and Swamp Creek (Figure 2) by the Project will remove natural sections of these creeks, to be replaced by artificial diversions. There will also be loss of the watershed area to these creeks during the period of mining, although the Project's EIS allows for watershed areas to be restored (to various degrees) following closure.

Portions of the "highly productive" alluvial groundwater resources will be removed.

The open-cut mine pit will intersect groundwater from within coal seams and adjacent geological formations. This groundwater will be removed where they are within the pit, but also longer term removal of groundwater resources occurs as seepage flows to the pit are removed through pumping and/or evaporation. The loss of groundwater could be described as a 'drawdown', which I define in this context as a reduction in water quantity within the geological strata, and this drawdown will propagate further out from the pit over time. It is expected that this drawdown will pass under regions of the alluvial aquifers, and potentially induce downward seepage flow from these alluvial aquifers, causing pressure to drop in the alluvial aquifers and inducting a loss of water from the aquifers.

2.2 Methodology for quantification of effects used in the EIS

The physical removal of material from the pit is set out in mine plans. The planned extent of the pit is not reviewed in this present report. However, the EIS argues for reducing the interpreted extents of the alluvial groundwater resources, thereby reducing the interpreted volume of these "highly productive groundwater" resources that is removed. This argument by the Proponent is based upon the undertaking and interpretation of a number of test pits around the periphery of the mapped alluvium (in the vicinity of the Project) by the Proponent. The resulting re-interpreted extents of "highly productive groundwater" is reproduced in Figure 4.

The EIS utilises a 3D numerical groundwater flow model to examine the extent of propagation of effects to groundwater resources. The boundaries of this model are reproduced in Figure 5.

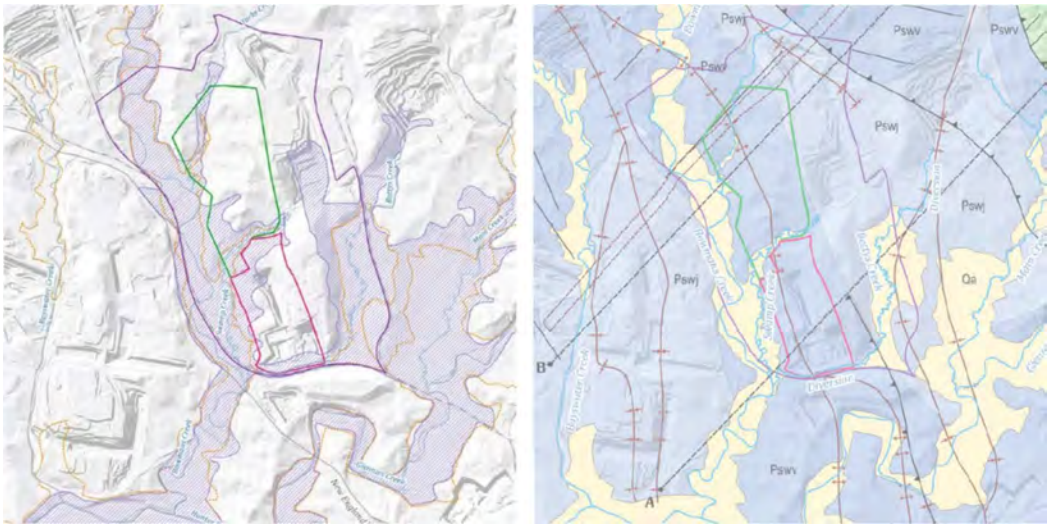


Figure 4 – Extents of "highly productive groundwater", as gazetted (left – shown as blue hatch) and as interpreted by the Proponent (right – shown as yellow) (Figures taken from Appendix 16 of the EIS)

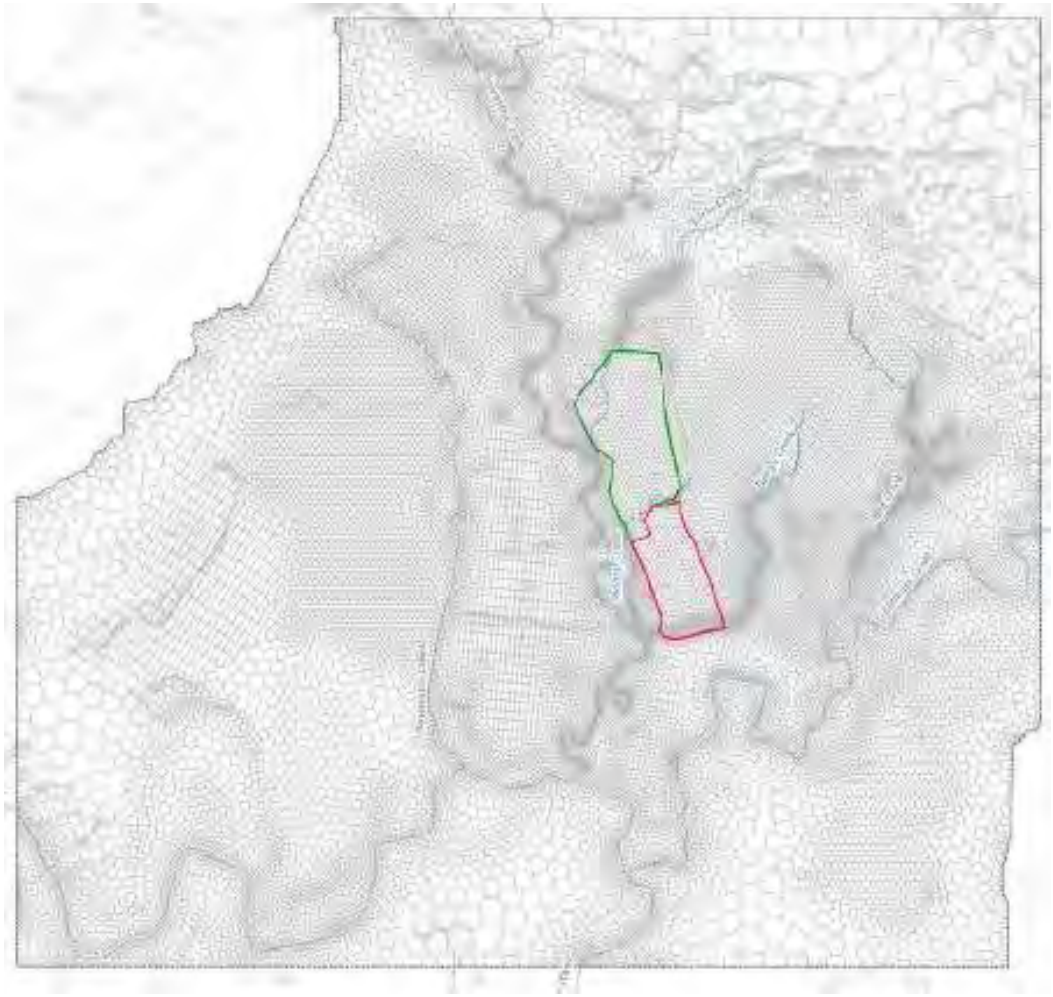


Figure 5 – Extents of numerical groundwater flow model and layout of numerical model grid (taken from Figure B2 of Appendix 16 of the EIS

2.3 Comments on the suitability of methodology used in the EIS

I have reviewed the details of the numerical groundwater report presented in the EIS. It is calibrated reasonably to a number of observational wells, which is a notable achievement in this location given the extensive regional mining works that must be represented in the model. I will note that prediction of groundwater impacts in absolute terms is almost impossible due to the number of mining workings being undertaken in the vicinity.

I note that the impacts on the "highly productive groundwater" resources in the alluvium is predicted in the EIS to be small, and I have a number of concerns in accepting this finding, which I describe in turn below.

Firstly, the Proponent has taken liberty to greatly reduce the mapped extent of these "highly productive groundwater" resources. The basis of this reinterpretation is test pits, but to my understanding the test pit logs (which typically include photographs) are not presented in the EIS for review, and the interpretation of the extents of the alluvium was not subjected to peer review. In my view, test pits logs should be presented in the EIS, and it is unclear to me if the reduced extents of mapped alluvium by the Proponent can be considered authoritative without independent review.

Secondly, the regional groundwater flow model does not have the necessary resolution to examine groundwater processes in the alluvium with accuracy. Based on information presented in the EIS (e.g. Figure 6), a 40-m grid size (or so) is not adequate to simulate detailed exchange of flows with streams, and in my understanding the alluvium is represented with a single model layer, which does not allow detailed examination of changes to pressure and saturation within the alluvium. I do not argue that a regional groundwater model should attempt to represent such detailed processes, but I argue that a more detailed sub-study (e.g. a localised model) could be adopted to examine these processes.

Thirdly, the groundwater modelling the EIS does not clearly represent details of the alluvium regions. For example, I have drafted an approximate cross-section for this Project (Figure 7), showing the extents of alluvium at a particular location relative to the proposed pit extension. I argue that such a cross-section, taken from the numerical model, should be presented. Such a cross-section would illustrate clearly the resolution to which this alluvium has been physically represented within the numerical grid. It could also be used to present simulated groundwater depressurisation in detail, which would allow examination of why such a small amount of depressurisation is realised within the alluvium.

Lastly, the EIS is unclear in differentiating the concepts of "drawdown", "depressurisation", "dewatering" and "saturation" when discussing mining effects (for example, Section 7.5.6.2 of the EIS). The mechanics of groundwater flow is such that removal of groundwater from the pit may induce vertical downward flow from the alluvium. Under such conditions, it is possible that a significant reduction in pressure (and even saturation) of the alluvium can occur without a significant change in the elevation of the water table in the alluvium, particularly if recharge over the alluvium is large enough to maintain the water table level. In my view, the EIS should clearly define and differentiate these concepts and then clearly present what is simulated to occur in the alluvium. My concern is that the maps showing drawdown in the EIS are simply plotting change to the water table, and that this is not giving adequate representation of the actual impacts to the alluvial groundwater.

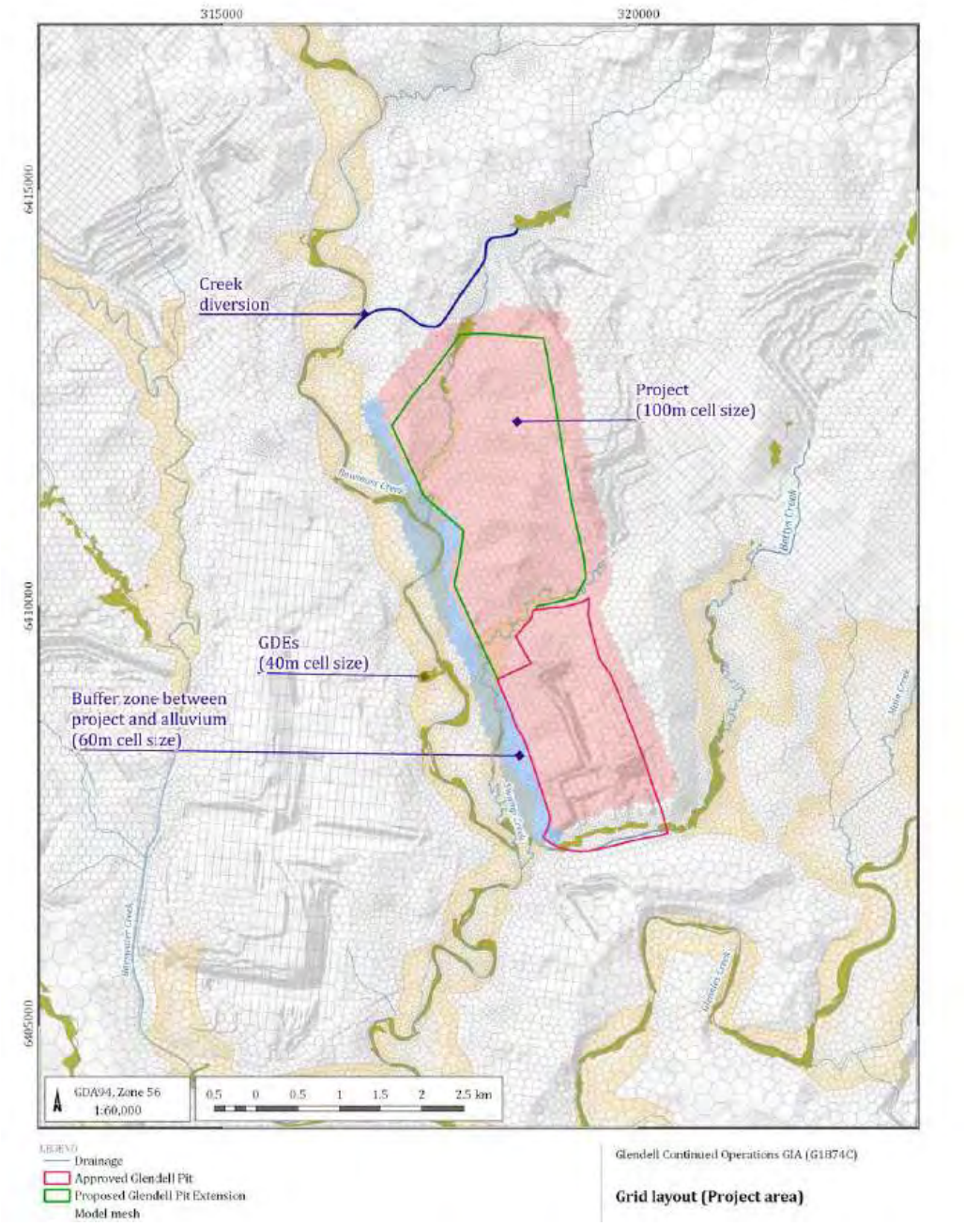


Figure 6 – Details of numerical groundwater flow model in the vicinity of the Project (taken from Figure B3 of Appendix 16 of the EIS)

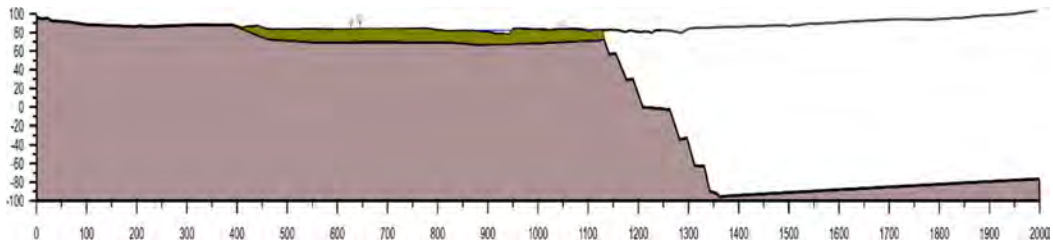


Figure 7 – Example of a cross-section that could be presented in the modelling report (alluvium extents shown in green)

2.4 Discussion of cumulative impacts on surface and groundwater resources

As discussed above, there is extensive mining in the vicinity of the Project, making assessment of cumulative impacts an important matter.

The EIS makes reference to an argument of diminishing the impacts from the Project by comparison to the impacts by the Project against those of “already approved mines” (for example, Section E2.1.4 of the EIS).

In my view, this is a problematic argument, as it offers no protection of environmental values once the first project is approved. In my view, cumulative impacts should consider the net impact on the region, as compared to pre-mining (‘baseline’) conditions, rather that referencing existing mining activities.

2.5 Comments on observation and mitigation of impacts on surface and groundwater resources

Locations of groundwater monitoring are presented in Figure 5-1 of Appendix 16 of the EIS. The proposed mining footprint infers that many locations that are currently monitoring groundwater in the alluvium will be lost once mining commences. Three points are made:

1. Additional monitoring locations within the alluvium may be required to provide adequate observation of mining effects on groundwater conditions.
2. In my view, monitoring should include some nested wells – being adjacent wells screened at different depth intervals, as this will allow observation of depressurisation that is more insightful that just changes to an interpreted water table level.
3. Statutory conditions should incentivise ongoing and continuous monitoring from selected bores.
4. Statutory conditions should carefully consider the possible absence of suitable mitigation measures. For example, the question is posed: “what if the numerical groundwater model is found to be wrong?” - what if impacts are greater than predicted? In such a scenario, I argue that there is very little, if anything, that can be undertaken to mitigate against such effects.