Table of comments from DPIE-Water 2020, Attachment B – Recommendations 2.2. and 2.4 – Groundwater Model – Specific Comments and Recommendation, RtS for the Tahmoor South Coal Project (SSD 8445) – with reference to where these have been addressed by SLR/HydroSimulations.

DPIE – Water Groundwater Model recommendations (DPIE-Water, 2020):

- Recommendation 2.2 (prior to determination) – Provide a clear plan for a groundwater model rebuild and calibration.
- Recommendation 2.4 (post determination) – The proponent should rebuild the model within two years of project determination.

Item	DPIE – Water EIS Recommendations (Ref)	Proponent RtS Response (HydroSimulations, 2019)	DPIE – Water RtS Comments and Recommendations (DPIE, 2020)	Where Addressed
a	A detailed list of the limitations and assumptions in the techniques used to inform the modelling should be provided.	Model assumptions are included in discussion in relevant subsections in Section 4, and limitations discussed in Section 4.11 of the revised Groundwater Assessment (Appendix C of Project Amendment Report). Refer to the opinion of the Independent Reviewer (HydroGeoLogic, 2019) about the standard of reporting and documentation of modelling.	Section 4.11 describes some of the model limitations in terms of data (geological layer elevations and groundwater levels)… The section is incomplete and relevant information is provided in other sections, e.g. the high level of uncertainty in the groundwater abstraction dataset discussed in Section 3.8.1 and other sections. Further improvements are required as follows: 1) Completion of list of limitation (some items are missing). 2) Discussion of implications on the model's ability to make reliable predictions, particularly with regards to the Thirlmere Lakes and groundwater users (bores). Require: USG-MODFLOW see justification in Sec 4.11 and add lakes 3) Better representation of heterogeneity (e.g. pilot point calibration)	1) and 2) Addressed in Section 4.12 of the revised APR GW Assessment (HydroSimulations, 2020). Added discussion of lake representation in Table 7-1 of the Groundwater Modelling Plan (SLR, 2020). 3) Addressed in Section 7.1 and 7.2 of the Groundwater Modelling Plan (SLR, 2020). 4) Addressed in Section 7.2 of the Second APR (HydroSimulations, 2020), and Section 7 of the Groundwater Modelling Plan (SLR, 2020).

Item	DPIE – Water EIS Recommendations (Ref)	Proponent RtS Response (HydroSimulations, 2019)	DPIE – Water RtS Comments and Recommendations (DPIE, 2020)	Where Addressed
			4) List additional actions to address each limitation in future versions of the model.	
b	Once the model is redeveloped, the sensitivity and uncertainty of the model should be characterised in line with the Explanatory Note, Uncertainty Analysis in Groundwater Modelling, Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining, 2018.	A set of deterministic scenarios has been carried out, focussing on major conceptual processes and impact pathways. Refer to the opinion of the Independent Reviewer (HydroGeoLogic, 2019) about the deterministic scenarios carried out. The Groundwater Assessment recommends that the model undergo revision only once the findings of the OEH Research Program are available for incorporation. At that time, additional uncertainty analysis can be carried out.	The numerical model presented in the original EIS (HS, 2018) was updated to incorporate a number of items raised by IESC, local councils, DPIE/DPE, DPIE (DoI) Water and DPIE's Independent Reviewer following the public exhibition of the EIS and following a further meeting with these groups in early 2019. There are enhancements to the model that are required to be made regardless of other data becoming available, e.g. better representation of heterogeneity (use available data and pilot point model parametrisation and calibration technique) and refinement of the model grid (e.g. by using unstructured grid). Further enhancement of the model are required when additional data become available, e.g. data from the OEH Research Program.	Addressed in Section 7.1 of the Groundwater Modelling Plan (SLR, 2020).
c	Impact predictions should be given using the P90 of the outcome of the sensitivity and uncertainty analysis.	Characterisation of 90%ile is useful at greenfield sites where the hydrology of the system in response to stresses are not well understood. Tahmoor Mine has been operating for almost 40 years, and the groundwater model is calibrated against groundwater levels and inflow. Refer to the opinion of the Independent Reviewer	Noted. It is also noted that the worse-case deterministic scenario for mine in-flows is characterised by the proponent as unreasonably high.	No response required.

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		(HydroGeoLogic, 2019) about the deterministic scenarios carried out.		
d	Justification should be provided as to why bore abstraction was not included in the model, including detailed sensitivity and uncertainty analysis of the inclusion or exclusion of the effects of pumping.	There is significant uncertainty in the groundwater abstraction dataset, and this remains. Refer to Section .8.1 of the revised Groundwater Assessment (Appendix C of Project Amendment Report) for discussion of the available data, and Section 5.2.1 for discussion of how this process is incorporated into a single predictive scenario.	This has been adequately addressed. This is a reasonable argument. Groundwater use data is very uncertain and its inclusion in the model would be very problematic.	No response required.
e	Steady-state results and calibration data should be provided to identify the transient model sensitivity to initial conditions and compare how the model behaves without storage terms.	This issue was discussed with DoI – W, NRAR and DoI Water staff in the April 2019 meeting. An appropriate steady state calibration, using the same model parameters as the transient model, was presented and discussed with attendees at the meeting.	This being the case, the proponent is required to include this information in the report to address the Department’s requirement, help understand the system’s behaviour, give confidence in the steady-state and transient model, and enhance the quality of model documentation.	Addressed in Section 4.8.2 and Table 4-4 of the revised APR GW Assessment (HydroSimulations, 2020).
f	Explanation of why the surface water stage (elevation) was not used in calibration.	The representation of surface water stage was deficient in the EIS groundwater model. Surface water stages for watercourses have been modified in the revised Groundwater Model (Section 4.4.4 of Appendix C of the Project Amendment Report). Lake stages for Thirlmere lakes have been modified in the revised Groundwater Model (Section 4.4.5).	This issue has been adequately addressed.	No response required.
g	Clarification of the effects of weights that were assigned	Discussion of target weightings is provided in Section 4.8.2 of the revised	This issue has been adequately addressed. The weighting applied for calculating	No response required.

Item	DPIE – Water EIS Recommendations (Ref)	Proponent RtS Response (HydroSimulations, 2019)	DPIE – Water RtS Comments and Recommendations (DPIE, 2020)	Where Addressed
	to observations on transient model performance.	Groundwater Assessment (Appendix C of Project Amendment Report).	assessing model performance has been provided and is based on perceived data reliability. See item (r) below for further discussion on performance statistics.	
h	Justification of the overestimated evapotranspiration (ET) from the water table (e.g. 40%, Table 5-2) despite this effect being included in the recharge (RCH) component (which represents a form of double counting). Sensitivity and uncertainty analyses for this parameter should be provided.	Evapotranspiration (ET) occurs above the land surface, at the land surface, within the soil zone, and also from shallow water tables. The first three of those components are considered when making estimates of recharge, as per Doble and Crosbie (2016). If the water table is within ~20cm of bare soil or within the root zone of plants, it can be subject to evapotranspiration, as such modelling is considered to be appropriate in relation to this parameter.	1. Clarification is required to whether evapotranspiration took place in lakes and surface water areas. In such cases, water will evaporate from the surface water feature rather than evapotranspire from the underlying water table. 2. Model sensitivity to this parameter is required 3. Maps showing the distribution of this parameter in the steady-state model and the average values in the transient model are required. 4. The same is required for recharge. 5. Confirmation is required to that there is no double counting of evapotranspiration between the groundwater and the GoldSim models.	1. Text added to Section 4.4.3 of the revised APR (HydroSimulations, 2020) to clarify that evapotranspiration has not been simulated within the mapped boundaries of lakes and reservoirs. 2. Addressed in Section 7.1 of the Groundwater Modelling Plan (SLR, 2020). 3. Figure 4-15 added, along with new text in Section 4.9.2. of the revised APR (HydroSimulations, 2020). 4. Figure 4-15 added, along with new text in Section 4.9.2. of the revised APR (HydroSimulations, 2020). 5. As per response 1, above, evapotranspiration has not been simulated within the mapped boundaries of lakes and reservoirs. In addition, the surface water model only simulates evapotranspiration from within the surface area of the lakes, taking water from the open water surface or from shallow groundwater limited to a depth of 1m below ground level. This means that the evapotranspiration is not double-counted between groundwater and surface water models.

Item	DPIE – Water EIS Recommendations (Ref)	Proponent RtS Response (HydroSimulations, 2019)	DPIE – Water RtS Comments and Recommendations (DPIE, 2020)	Where Addressed
i	Justification of the potentially underestimated recharge. Sensitivity and uncertainty analyses for this parameter should be provided.	Refer to detailed review and analysis of recharge in Section 3.8.4 of the revised Groundwater Assessment (Appendix C of Project Amendment Report). The Nepean Sandstone GW Source extends from areas of rain ~1800 mm/yr and PE 1500 mm/yr in the south/east to rain 800- 850 and PE 1400 mm/yr in the north and west. LTA rainfall at Tahmoor is 1000 mm/yr. Crosbie (2015) includes estimate of average recharge around Tahmoor of 5-21 mm/a, higher (20-100 mm/a near escarpment/Dendrobium). Therefore, it is reasonable to expect lower recharge at Tahmoor than the average 6% estimated by NOW (2011). The model uses recharge zones (Figure 4-3 within Section 4.8.2 of the revised Groundwater Assessment in Appendix C of the Project Amendment Report) applied consistent with broad rainfall zones and consistent with Crosbie estimates (i.e. higher at the escarpment, lower in the north and west).	This issue has been adequately addressed.	No response required
j	Clarification of the calibration targets for steady-state modelling.	Steady state simulation was used for initialising the transient simulation. Mining has occurred since ~1980 at this site, while the first available groundwater level from a monitoring bore is from 2005 (and from 2008 in VWPs), so calibration to 'steady state' groundwater levels is not	1. model calibration to steady-state is only critical in this case because transient models are sensitive to initial conditions. 2. Assessment of model sensitivity to initial conditions is recommended. 3. As indicated in the Department's comment on evapotranspiration above	1) Addressed in Section 4.8.2 of the revised APR GW Assessment (HydroSimulations, 2020). 2) Initial conditions assessed as part of model calibration and variation or parameters /boundary conditions using steady state calibration. This was part of

Item	DPIE – Water EIS Recommendations (Ref)	Proponent RtS Response (HydroSimulations, 2019)	DPIE – Water RtS Comments and Recommendations (DPIE, 2020)	Where Addressed
		viewed as critical. However, model calibration to 'steady state' water levels was presented at the meeting in April 2019 and considered satisfactory.	(point h), maps showing the distribution of this parameter in the steady-state model and the average values in the transient model are required.	the modelling presented already, and will also be done in future modelling. 3) Figure 4-15 (HydroSimulations, 2020) shows steady state distribution of evapotranspiration, with accompanying text in Section 4.9.2. Average transient evapotranspiration was not extracted due to time constraints.
k	Provision of the steady-state simulation water balance is required.	steady state mass balance was presented at the meeting in March 2019, noting 0.04% mass balance error. Tah_045 (SS Sp1) Units: m^3 Component IN OUT RECHARGE 182,768 0 RLEAKAGE 39,086 54,884 DRAINS 0 0 ET 0 163,006 HDBOUNDS 757 4,640 STORAGE 0 0 TOTAL 222,611 222,531	Please include this response and discuss in the report. Also please refer to the Department's comment on point e above.	Addressed in Section 4.8.2 and Table 4-5 of the revised APR GW Assessment (HydroSimulations, 2020).
l	Provision of the relative parameter sensitivity assessments is needed for both the steady-state and transient models.	Refer Figure 5-1 (Transient Sensitivities) below. This was discussed at the meeting in April 2019. Kh parameters generally more sensitive, as well as some like Sy6 (Bulgo Sandstone) in response to fracturing and drawdown (and observations) in that unit.	Please include figure and adequate discussion in the report, including used methodology. This section may need to be changed following better representation of heterogeneity using pilot point or similar parameterisation and calibration techniques.	Parameter sensitivity is now described in Section 4.10 and Figure 4-16 of the revised APR GW Assessment (HydroSimulations, 2020). Scope to address changes to the representation of hydraulic properties in future modelling is discussed in Section 7.1.1 of the Groundwater Modelling Plan (SLR, 2020).

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m	Documentation of the hydraulic conductivity anisotropy (KH/KV) data based on project domain field data and discussion of the significance of this characteristic is required.	The field data is presented alongside modelled results in the assessment. The model has been parameterised via independent inputs of Kh and Kv, rather than relying on anisotropy ratios. Packer and core testing results are summarised for each stratigraphic unit on Figure 4-6 of the Project Amendment Report revised Groundwater Assessment (Appendix C of the Project Amendment Report). The modelled parameters are well constrained by field data.	This is noted. The Department required this information to help the readers/reviews of the report to readily understand the difference between the various layers as well as between field and model calculated data, i.e. to make the report more user-friendly. Inclusion of this data is still strongly recommended.	A description of ratios from field observations is included in Section 3.8.6.1 and updated version of Figure 3-29C of the revised APR GW Assessment (HydroSimulations, 2020). Ratios for the modelled data have been added to Table 4-3 with supporting text in Section 4.5.
n	Verification of the geological layering uncertainty noted in Section 4.11 is required based on borehole logs and other project intrusive investigation data.	In accordance with the recommendations in the revised Groundwater Assessment (Appendix C of the Project Amendment Report), the geological model and groundwater model would be revised to into account any developments from the OEH Thirlmere Lakes research program once detailed findings are available. This would include more detailed assessment of geological structure around Tahmoor South – something best achieved once development begins underground on site.	This issue has been adequately addressed.	No response required.
o	Discussion of the consequences of changes in aquifer storage presented in the water balance accounts for surface water and groundwater systems	The storage components reported in Table 4-6 of the revised Groundwater Assessment are representative of lowering or increasing groundwater levels through time across the model domain. These changes in groundwater levels are a	Please include response in a relevant section in the report including a discussion of the “consequences” to the model and hydrological system.	A discussion has been included in Section 4.8.3.7 of the revised APR GW Assessment (HydroSimulations, 2020).

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	around the project domain is required.	response to recharge, evapotranspiration, baseflow, mine inflow. There is an imbalance between the IN and OUT between 1980-2019 (an overall decline in groundwater level), related to generally dry conditions in the second half of that period, as well as an increasing amount of mining across the model domain.		
p	Quantification of the error in the estimation of project area rainfall and subsequently recharge component of the groundwater model, as well as justification of the approach of combining the rainfall records from two separate weather stations. The data combination method is not described and the resultant synthetic rainfall estimates may not be realistic, particularly in representing the Millennium Drought.	As discussed at the meeting in April 2019, this was agreed to be a secondary issue. It was demonstrated that the rainfall records used in the EIS Groundwater Assessment were appropriate. The comparison of monthly total rainfall at the two sites is presented below, showing good correlation (R2 = 0.84). Rainfall totals vary by 7% at the two sites across months where records are available for both.	This issue has been adequately addressed. It is recommended that the proponent add this discussion into the groundwater report for completeness. The report reader should not be expected to refer to the RtS for information.	An updated description of rainfall records (BoM and SILO) is included in Section 3.2 of the revised APR GW Assessment (HydroSimulations, 2020).
q	Inclusion of improved sensitivity and uncertainty analysis to clarify the representation of faults as	Broadly, the Nepean Fault zone is known to be more permeable, enhancing groundwater inflow to mine workings that intersect it. This is represented as such in the groundwater model. Other mapped	This issue has been adequately addressed. However, we recommend the Groundwater report is improved to: 1. address a cross-reference error in the map legends Appendix G to Table 4-	1. All cross-reference errors have been addressed. 2. Text added to Section 4.5 has been added to the revised APR GW Assessment (HydroSimulations, 2020).

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	either flow barriers or conduits within the model.	faults are considered possible conduits, and this is investigated in deterministic scenarios. Parameterisation of faults is presented in Sections 4.5 and 5.2.1 of the revised Groundwater Model (Appendix C of the Project Amendment Report).	2, which should be Table 4-3 2. explain why Ss and Sy were kept undifferentiated from the host strata. 3. include fault parameters in Figure 5-1 (parameter sensitivity) which is provided only in the RtS but is required to be added to the revised model report.	3. Section 4.10 has been added to the revised APR GW Assessment (HydroSimulations, 2020) to summarise parameter sensitivity. Scope to address specific changes to the representation of fault properties of differing fault zones (e.g. Nepean Fault versus others) has been recommended for future modelling and is discussed in Section 7.3 of the Groundwater Modelling Plan (SLR, 2020).
r	Enhance the model to reduce SRMS (Scaled Root Mean Squared) error for all layers within the model to rectify the high values presented for the current version (Table 4-3 shows that SRMS>5% for all units except layer 1).	Model improvement is desirable; however, this point is not critical for current predictions. The "high values" include all layers above SBSS having SRMS <10%, with detailed discussion of model errors in Section 4.8 of the revised Groundwater Model (Appendix C of the Project Amendment Report). It is also unusual to report layer-by-layer sRMS – this was done on the request of the Independent Reviewer, who considered the reported statistics to be acceptable. The Australian Groundwater Monitoring Guidelines states: "a target SRMS of 5% or 10% is only meaningful when those setting the target know that it is achievable for a particular kind of problem and a particular environment with a known density of informative data."	The calibration statistics for the calibrated transient model are 2.8% Scaled Root Mean Square (SRMS) and an absolute residual mean of 10.7 m. This is a significant improvement to the residual mean of 21 m presented in the EIS version of the model. The proponent has broken down the sources of error by stratigraphic unit showing the larger errors are found in the deeper units. The three shallow most layers above the confining Bald Hill Claystone have SRMS < 6%. Considerably higher SMRS and average residuals occur in the deeper layers below the Bald Hill Claystone. The better performance for the shallower layers provides better confidence in predicted impacts to third party bores in the vicinity of the mine as	No further action is required for this item. DPIE-Water's comment about "SBSS" is incorrect. SBSS is the Scarborough Sandstone (see Table 4-1 in the GW Assessment), and the previous response was correct in referring to "layers above the SBSS".

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			almost all water extraction is from the shallower Hawkesbury Sandstone units. Note: the layers described as "SBSS" in the proponent's response is a typo and should be HBSS – Hawkesbury Sandstone.	
s	Reconstruct the model to address the model calibration error (21m absolute residual mean) and reduce the uncertainty in predicted outcomes.	See discussion of sources of error (Section 4.8.2 of revised Groundwater Assessment), which are dominantly in the coal seam and up to the lower Narrabeen Fm (Table 4-4). The model has overall sRMS <3% and is well calibrated to mine inflow. The mine inflow metric overrides the stated residual for an individual layer.	This issue has been adequately addressed. Whole of model average residual reduced from 21 m to 10.7 m. See (r) above for further discussion on performance statistics. By implementing the recommendations provided herein and by the independent reviewer, it is anticipated further improvements will be achieved.	No response required.
t	Improve model zonation or undertake pilot point calibration to correct the single zone per layer representation of hydraulic properties and improve model calibration.	There is no basis for a more "advanced" calibration method when the %RMS metric conforms to Australian modelling guidelines. Uniform properties per lithology is standard practice for difficult mining models. Further, the AGMG states (p.74): "The number of parameters can be increased in such a way that calibration appears to be robust and the SRMS becomes negligibly small, but there may be no rational hydrogeological basis to support the degree of detail (the number of parameters) added to the model. This phenomenon is known as 'overfitting'. Overfitting should not be preferred relative to a larger SRMS with rational	The Department still recommends more realistic representation of hydraulic layer heterogeneity in future versions (e.g. by using pilot point parameterisation), mainly to enhance inflow predictions. It is noted that the recommendation in Section 7.2 in the revised report recommends pilot point calibration following the re-implementation of the numerical model in unstructured grid environment (e.g. MODFLOW-USG). Both the EIS and RtS modelling reports highlighted pilot point calibration as a method to enhance the model. In addition, peer reviews of both models endorsed this recommendation. The latest peer review states: "This review endorses the HS recommendation for	Addressed in Section 7.1 and 7.2 of the Groundwater Modelling Plan (SLR, 2020).

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		relationships between model parameters".	future work (monitoring and modelling, plus research into Thirlmere Lakes) to further reduce the effects of uncertainty on simulations through pilot points and/or regularisation methods, which would require revisions to the model and refinement of the grid, reducing the number of cells."	
u	Undertake and report on a detailed sensitivity and uncertainty analysis of the exclusion of the eastern area of the model domain resulting from the placement of a no flow boundary.	The area where the no flow boundary was extended occurs around MINE, which is located beyond Appin/West Cliff Mines, and approximately 15 km from Tahmoor South. Cumulative impact assessment of this area should be accounted for in Bulli Seam Operations modelling or Russell Vale modelling.	We require advice to explain the reasons for: 1. setting a 'no-flow' boundary as opposed to other types of boundaries? 2. "Cumulative impact assessment of this area should be accounted for in Bulli Seam Operations modelling or Russell Vale modelling" but not this model?	1) Additional text has been added to Section 4.4.8 of the revised APR GW Assessment (HydroSimulations 2020) to address this point. 2) That is correct; cumulative impact assessment for areas beyond neighbouring mines (e.g. between BSO and Russell Vale) should be more reliably described in BSO/Russell Vale modelling studies.
v	Explanation of the counter intuitive results obtained from running different lake level scenarios, how this affects model confidence level and possible reasons (e.g: numerical instability) which can impact on model performance and predictions	.An explanation was provided in the meeting in April 2019. The error occurred because of model numerical error (imprecision) when dealing with very small fluxes (typically 5-30 m3 at each lake), when the model solver tolerance is 4 cm and the area of a lake (e.g. Couridjah) is 15,000-45,000 m2.	This is a valid explanation. However, could you please advise whether this has been resolved in the revised model and if yes, how? Are there any implications to this on the model predictions? This issue and the response should be addressed/described in the new model report.	This has not been resolved. We have included this as a recommendation for future modelling in the Groundwater Modelling Plan (refer to Section 7.1 of SLR, 2020). The implications of such error are that drawdowns of a similar or lesser magnitude are only accurate to the head close criterion (as already noted in Section 5.6 and 5.8 of HydroSimulations, 2020). This does not have significant bearing on the predictions of lake leakage or

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				drawdown from Tahmoor South, as the predicted effects are low and less than natural variability.
w	Reconstruction of the model to utilise the unstructured grid capability of the Modflow USG platform to address the excessive run time and disk space requirements of the current version.	The model layering and extent were developed in response to the cumulative impact requirements of the Aquifer Interference Policy. That is, to represent mines and watercourses with relative detail, incorporate geomechanical changes, transient recharge and ET, carry out cumulative assessment in an area where there are not clear hydrological boundaries (to the north/south/east) and then have a model that runs quickly. Given the more contemporary focus on uncertainty, it is recommended that the model be revised (re-built) once the findings of the OEH Research Program are available and use this revised model to carry out more complete assessment of uncertainty.	The Department is satisfied with the proponent's understanding for the need to rebuild the model to enhance its performance and confidence in its predictions. However, this can be done independently of the new data becoming available from the OEH Research Program. A phased approach is recommended whereby the first phase will include a model rebuilt and the second phase will be updating the model with OEH research Program data.	See response for item B.
x	Clarification of how the groundwater model has simulated changes in the lakes wetted area as a result of changes in water levels.	This was done via steady state models and passed to the Surface Water model. The open water area of each lake was estimated for a 4 or 5 specified water levels (as recommend by the Surface Water technical specialist - HEC). The wetted area was estimated from LiDAR data, and then translated into model cells.	This is proof that the steady-state model is important and must be included in the model report. The information provided in the RtS must be added into the model's report.	Information has been added to Section 4.4.5 of the revised APR GW Assessment (HydroSimulations, 2020).

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y	Explanation of the discrepancy between the surface water bodies mainly being conceptualised as losing whereas they are implemented as gaining features in the numerical model as suggested in the presented water budgets.	The main surface water features mentioned and conceptualised as being 'losing' are the Thirlmere Lakes and reservoirs. Thirlmere Lakes are small features on a regional scale or in water balance sense, although important ecologically. Baseflow to watercourses is analysed in the EIS Groundwater Assessment, and watercourses as described as losing or switching between gaining and losing. It was agreed that that the model could be modified to include an estimate of watercourse stage (transient or otherwise) applied to modelled watercourses to simulate variable or losing watercourses. This has occurred and is discussed in Section 4.4.4 and 4.4.5	This issue has been adequately addressed. However, DPIE Water requires that future versions of the model: 1. revise the adopted approach and consider alternatives 2. include bed conductance in the parametric sensitivity analysis (parameter identifiability).	1. Addressed in Section 7.1 of the Groundwater Modelling Plan (SLR, 2020). 2. Addressed in Section 7.2 of the Groundwater Modelling Plan (SLR, 2020).
z	Undertake of particle tracking or another suitable method to define zones affected by mining activities (capture zone extent) for licencing purposes.	Particle tracking is not necessary nor is it appropriate for licensing. Zone budget has been used to partition the 'take' from different sources.	Zone budget approach is suitable to calculate inputs and outputs to [3D] zones. However, the report does not clarify how these zones were delineated. The Department requires clarification of the methodology used to define zones as errors in zone definition could render licensing requirements estimations invalid.	Text has been added to the relevant sections of the revised APR GW Assessment (HydroSimulations, 2020) to clarify how zones were delineated (Section 6.3 is most relevant): - Sections 4.8.3. Mine Inflows - Section 4.8.3.6 – Baseflow - Section 6.3 – Licensable Takes of Water.
aa	Clarification of the drain cell inactivation to represent change from open space to goaf.	Section 4.4.9 of the EIS Groundwater Assessment describes the activation and inactivation of MODFLOW Drains representing dewatering in the workings.	This issue has been adequately addressed.	No response required

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		It also states: "Hydraulic parameters were also changed with time in the goaf and surrounding enhanced permeability zone (EPZ) directly after mining of each longwall panel (see Section 4.6 for details)". Section 4.6 of the EIS Groundwater Assessment describes how K and Sy were changed in mine seam.		
bb	Discussion of the possibility that mine inflows (2.1% of water budget) may be an underestimation as a result of the overestimation of ET and discharge to surface water.	See earlier discussion re: ET (point #h). See also discussion of recharge (point #i). 2.1% may be an underestimate or an overestimate. The actual value, be that 1-3%, is not the critical point. The water balance highlights that mine inflow has been a small part of the overall regional groundwater balance.	The water balance is important: to provide an understanding of the important processes in and controls over the system, and for licensing purposes. An underestimation of a component in the water balance will necessarily mean overestimation in other component/s, and visa versa. Importantly, overestimation of ET could mean underestimation of mine inflows and/or depletion of the lakes. The report does not provide an analytical water balance for the modelled domain as part of the system conceptualisation. This is required to enable comparison with the numerical model results. It is noticed here that recharge has been varied through the model calibration process (Section 4.9.2), but evapotranspiration was kept constant. The proponent is required to justify these decisions. It is noted the model sensitivity is not assessed for recharge and	Section 3.10.3 has been added to the revised APR GW Assessment (HydroSimulations, 2020) to address this item. Recommendations to include transient potential evapotranspiration have been included in Section 7.1 of the Groundwater Modelling Plan (SLR, 2020).

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			evapotranspiration (Figure 5-1 in the RtS report).	
cc	Justification of the adopted bed conductance (C) values (e.g. 100 m²/d for drain cells representing longwalls).	Conductance = k.x.y/t. Conductance of longwall Drains is difficult, and there is no clear calculation of what the thickness term should be, i.e. vertical thickness or horizontal distance. In fact, it should be a combination of both. We applied k = 0.01 m/d for 100 x 100 m cells, and a thickness of 1 unit. This conductance has achieved desaturation of the mine workings, and the mine inflow is well calibrated.	This information is not presented in the report. It must be included so that the reader should not be left to speculate or be asked to refer to the RtS. In addition, the model sensitivity to this parameter is required to be assessed.	Text has been added to Section 4.4.9 of the revised APR GW Assessment (HydroSimulations, 2020). Recommendations to address the sensitivity of the model to drain conductance has been included in Section 7.2 of the Groundwater Modelling Plan (SLR, 2020).
dd	As the effects on baseflow may be underestimated, especially in low flow conditions, transient analysis should be undertaken to identify the magnitude of depletion and possible length of dry periods.	Regional groundwater models are not the tool for estimating change to length of dry periods – that is the role of the SWIA.	Noted and supported by surface water model assessment documented above.	No response required.
ee	Justification for the use if the Modflow River Package rather than the MODFLOW lake package to represent the Thirlmere Lakes and use the most appropriate package based on the analysis.	The RIV package is appropriate for use in the groundwater model. It would be ideal to use the Lake package in a local-scale model. The Surface Water model by HEC accounts for those processes, allowing the regional groundwater model to concentrate on simulating the ~40 years of historical mining and the proposed/future mining at appropriate	This issue has been adequately addressed.	No response required.

Item	DPIE – Water EIS Recommendations (Ref)	Proponent RtS Response (HydroSimulations, 2019)	DPIE – Water RtS Comments and Recommendations (DPIE, 2020)	Where Addressed
		scales while providing estimates of GW-SW flux to/from the lakes.		
ff	Provide more detailed information on the natural variability or a base case of ponded water levels in Thirlmere Lakes to justify the statements made within the EIS. A stochastic sensitivity analysis would allow the department to identify the uncertainty in the model used for Thirlmere Lakes.	Detailed modelling of surface water stages (lake levels) is described in the Surface Water Assessment by HEC (Appendix D of Project Amendment Report). However, we note that Tahmoor South is >3.6 km from Thirlmere Lakes.	Refer to Surface Water Assessment comments in Attachment C.	No response required here.

References:

DPIE-Water, 2020. Tahmoor South Coal Project (SSD 8445) – Response to Submissions. Letter and Attachments from DPIE-Water, 4 June 2020. Ref: OUT20/2603.

HydroGeoLogic, 2020. Tahmoor South Coal Project Groundwater Assessment Independent Review. Prepared for NSW Department of Planning, Industry and Environment, 24 April 2020.

HydroSimulations, 2018. Tahmoor South Project: Groundwater Assessment. Report prepared for Tahmoor Coal. Doc ref. HS2018/52c; December 2018.

HydroSimulations, 2019. Tahmoor South Amended Project Report: Groundwater Assessment. Prepared for Tahmoor Coal Pty Ltd, November 2019. Doc ref. HS2019/42 (665.10010 v3.0 – this original document is now superseded by following document)

HydroSimulations, 2020. Tahmoor South Amended Project Report: Groundwater Assessment. Revised for Tahmoor Coal Pty Ltd, July 2020. Doc ref. HS2019/42 (665.10010 v4.0).

SLR, 2020. Tahmoor Coal Mine: Groundwater Modelling Plan. Prepared for Tahmoor Coal Pty Ltd, August, 2020. Doc Ref: 665.10010.R03