Agency Advice on Residual Matters Report

July – October 2014

NSW GOVERNMENT | Department of Primary Industries

OUT14/20339

Ms Jessie Evans
Mining Projects
NSW Department of Planning and Environment
GPO Box 39
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24 JUL 2014

Jessie.Giblett@planning.nsw.gov.au

Dear Ms Evans,

Russell Vale Colliery Underground Expansion Project (MP 09_0013)
Residual Matters Report

I refer to your email dated 24 June 2014 to the Department of Primary Industries in respect to the above matter.

Comment by NSW Office of Water
The NSW Office of Water appreciates the opportunity to review and comment on the Russell Vale Colliery Residual Matter Report as follows:

- Geoterra has undertaken a modelling study and the report provided is part of the Residual Matter Report. Dr Noel Merrick of Hydro Simulations has provided a modelling review report. The modelling study and the review satisfy the requirements of the NSW Aquifer Interference Policy.

- The Office of Water notes that management strategies are to be developed to avoid or mitigate potential impacts due to dimensions of the longwall panels.

- The proponent must hold access licences with sufficient shares from relevant water sources prior to commencement of the project. The Geoterra report indicates that an additional 182 ML/year of aquifer access licence shares will be required.

- There is a notable difference in the predicted loss of surface water modelled in the groundwater model and the surface water model, and this discrepancy should be clarified by the proponent.

- The Office of Water requests that it is consulted in developing any conditions for this project, and notes that stringent monitoring and reporting requirements are considered necessary. It is recommended that monitoring

is in place to confirm the model assumptions when geological structures are encountered.

For further information please contact Mitchell Isaacs, Manager Strategic Stakeholder Liaison (Parramatta office) on 8838 7529 or at mitchell.isaacs@water.nsw.gov.au.

Comment by Fisheries NSW
Fisheries NSW offer no further comment.

For further information please contact Scott Carter, Senior Conservation Manager, (Port Stephens Office) on 4916 3931, or at scott.carter@dpi.nsw.gov.au

Yours sincerely

Kristian Holz
Director Policy, Legislation and Innovation

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Your Ref:N/AMP 09_0013

Ms Jessie Evans
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Dear Ms Evans

RE: Heritage comments on Residual Matters Report for Russell Vale Colliery Underground Expansion Project.

I refer to your email of the 25th of June requesting any comment that the Heritage Council may have on the Residual Matters Report for the Russell Vale Colliery Underground Expansion Project. A copy of this report was sourced from the Department of Planning & Environment's website.

Accordingly, after consideration of both the report and Appendix H (Underground Expansion Project: Response To Submissions On the Preferred Project Report- Heritage, by Biosis), the following comments are provided.

It is acknowledged that the Biosis Letter in Appendix H states that they incorporated the 7 changes the Heritage Branch (now Division) recommended into Section 3.1 of the HMP, which was then submitted to the Department of Planning & Environment in October 2012. However the Heritage Division has not had the opportunity to corroborate that these changes have been made and no updated version has been submitted to the Heritage Division for this purpose.

Therefore, as Delegate of the Heritage Council I advise that prior comments regarding the Historic Heritage Management Plan (HMP) for the Russell Vale Colliery remain unchanged.

If you have any questions regarding the above advice, please feel free to contact Katrina Stankowski at Katrina.Stankowski@environment.nsw.gov.au.

Yours sincerely

14/07/2014

Dr Siobhan Lavelle, OAM.
Manager, Conservation
Heritage Division
Office of Environment & Heritage

As Delegate of the NSW Heritage Council

Office of Environment & Heritage

NSW GOVERNMENT

Date:	14 July 2014
Your reference:	MP09_0013
Our reference:	DOC14/128839
Contact:	Calvin Houlison
	(02) 4224 4179

Jessie Evans
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Dear Jessie

Thank you for the opportunity to provide comment on the proposed Residual Matters Report for the Wollongong Coal Limited (formerly Gujarat NRE) Underground Expansion Project. OEH previously provided comments on the project as exhibited in February 2013 and subsequently the Preferred Project Report in November 2013. OEH has also provided comments on the Preliminary Works Approval for Russell Vale Colliery (MP10_0046) and subsequent modifications to this approval seeking consent for the extraction of coal from sections of Longwalls 4, 5 and 6.

Despite significant modifications to the original proposal, the latest Residual Matters Report for the Preferred Project Plan still proposes a potentially high impact mine plan in what is clearly a sensitive area; which forms an important part of the catchment for Sydney's Drinking Water Supply; and is a high value conservation area. Detailed comments on the Residual Matters Report are provided in Attachment 1.

In summary, OEH considers that the PPR does not fully address the issues previously identified and the principal concerns in relation to the Residual Matters Report are:

- Subsidence impacts;
- Risk assessment and impacts to the Coastal Upland Swamps endangered ecological community (EEC), particularly to swamps of 'special significance';
- Potential loss of surface water to deeper storage via mining induced fracture networks; and
- Impacts to threatened species.

If an approval is granted to the project, OEH recommends that:

- Amendments to the mining layout are made to avoid or minimise impact upon swamps of special significance and threatened species habitat, as was undertaken for longwalls 4 and 5;
- If amendments to the mining layout to avoid or minimise impact are not considered feasible, a biodiversity offset strategy for both swamps and threatened species should be prepared; and
- The approval consider the recent report by the Chief Scientist report into the cumulative impact of underground mining with regard to acceptable levels of impact and performance measures. The report recommended "*providing clearly agreed impact definitions at the point of approvals, and ensuring compliance. These impact definitions must be agreed upon by all parties, so that*

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the current situation, where an impact may be considered significant by the part of the government charged with protecting the environment, and minimal, by the part of the government charged with facilitating mining, cannot continue".

OEH also notes that the proponent is currently preparing an updated flood study which will investigate the impact upon the catchment of Bellambi Creek. Accordingly, OEH's previous comments relating to east bound flows have not been addressed at this stage.

Please do not hesitate to contact Calvin Houlison, Conservation Planning Officer on 4224 4179 or email calvin.houlison@environment.nsw.gov.au should you require any further information.

Yours sincerely

CALVIN HOULISON
Conservation Planning Officer

ATTACHMENT 1: OEH DETAILED COMMENTS ON RESIDUAL MATTERS REPORT, RUSSELL VALE COLLIERY UNDERGROUND EXPANSION PROJECT (MP09-0013)

1. Ecosystems & Threatened Species - Illawarra review of Wollongong Coal Residual Matters Report for the Preferred Project Report for the Major Underground Expansion

Subsidence Impacts

Subsidence and stress levels for the mine are very high, largely because there has already been multiple coal seams extracted (ie Bulli and Balgownie seams) in various parts of the mining domain.

The Residual Matters Report (RMR) identifies that the extraction of the Wongawilli Seam in the Wonga East area will result in a maximum of 2.1 m of subsidence, with tilts between 24 and 51 mm/m, tensile strain of between 7 and 15 mm/m and compressive strains between 14 and 31 mm/m. By any comparison the subsidence, tilts and strains predicted for the RMR are high and are likely to result in subsidence impacts to surface features. For example, the Dendrobium Area 3B Longwall 9 was predicted to have maximum predicted conventional subsidence of 2.05m, tilt of 25 mm/m, tensile strains[1] of 7.5 mm/m and compressive strains of 9 mm/m. Numerous impacts have been identified over the Dendrobium longwalls including the loss of perched aquifers in four Upland Swamp EECs above Longwall 9. Significant fracturing has also already been identified over the previously extracted LW4 & LW5 at the Russell Vale/Gujarat NRE Mine.

Risk Assessment and Impacts to Coastal Upland Swamps endangered ecological community

OEH supports the proponent's identification of upland swamps of 'special significance' in the project area in line with the methodology contained in OEH's draft Upland Swamp Environmental Assessment Guidelines. OEH has consistently stated that longwall mining under the Sydney Catchment Authority Special Areas of the Woronora Plateau should meet a performance measure of no negative environmental outcomes, or negligible environmental consequence for swamps of special significance. OEH considers that all swamps recognised to be of special significance should be protected from the impacts of mining.

Results of monitoring by both BHP Billiton Illawarra Coal (BHPBIC) and OEH in upland swamps undermined by longwall mining in Dendrobium mine on the Woronora Plateau has demonstrated that mining resulted in the fracturing of bedrock beneath a swamp causing:

- a loss of the perched aquifer in the swamps (determined by piezometer monitoring of shallow groundwater levels)
- a loss of water flow at the base of the swamp (determined by V-notch weir monitoring); and
- a loss of soil moisture within the swamp (determined by soil moisture probes)

Impacts of these types significantly alter the ecological function of the upland swamp with a high likelihood of eventual loss of the vegetation communities and habitats that characterise this EEC.

Subsidence estimates provided by SCT (2014) indicate that mining of the proposed panels are predicted to have measurable subsidence in the following swamps: CCUS2, CCUS3, CCUS4, CCUS5, CCUS6, CCUS10, CCUS11, CCUS12, CCUS14, CCUS21, CCUS23, CRUS1, BCUS4, & BCUS11.

[1] Tensile and compressive strains have been calculated using a factor of 15 times maximum curvature as described in MSEC (2012; MSEC459 Revision B).

OEH does not concur with the risk assessment provided by Biosis (2014), which does not provide any BACI assessment of swamp water levels or consider swamps recently impacted by mining in other areas of the Southern Coalfields. OEH does not accept that an upland swamp EEC at a moderate or high risk of subsidence induced fracturing should subsequently be assessed to have a low final risk of impact due to modification of such a risk rating using flow accumulation measures.

As a result, OEH has undertaken its own individual risk assessment for each swamp based on predicted subsidence levels, Planning Assessment Commission threshold levels for negative environmental consequence (Bulli Seam PAC Report 2010) and previous experience in the Southern Coalfields (See Appendix 1). For the remaining longwalls to be extracted as part of the current PPP, three swamps (CCUS1, CCUS14 & CRUS1) are assessed to have a LOW or LOW to MODERATE risk of impact (fracturing of bedrock base of the swamp and draining of any perched aquifer). One swamp (CCUS12) is assessed as having a MODERATE to HIGH risk of impact. Seven swamps (CCUS2, CCUS4, CCUS5, CCUS10, CCUS11, BCUS4 and BCUS11) are assessed as having a HIGH risk of impact, likely to lead to the draining of any perched aquifer within the swamp.

The proposed mine plan is likely to lead greater than negligible impacts to 4 upland swamp EECs agreed to as being of "special significance" (CCUS4, CCUS5, CCUS10 and CRUS1).

Despite predicted impacts to upland swamp EECs (some of which are agreed to be of "Special Significance"), no offsetting or remediation[2] of groundwater or biodiversity impacts are proposed. This is not consistent with government principles to avoid, mitigate or offset environmental impacts. Further amendments to the mining layout should be considered to enable negligible impact criteria to be met.

Although the overall risk to upland swamps may be lower as a result of the removal of the Wonga West domain from the RMR, OEH notes that none of the upland swamp EECs in Wonga West are protected from future mining developments.

Flow Accumulation

OEH maintains that Biosis has over emphasised the impact of tilt and flow accumulation modelling when developing risk rankings for upland swamps. The type of impact most frequently observed and of concern for upland swamps in the Southern Coalfields is bedrock fracturing, which is more closely related to physical stresses, strains and subsidence than tilt.

OEH accepts that use of additional information in a multi-criteria analysis may be useful, but is concerned that the outcome of subsequent risk assessment is affected by the weightings applied in such a multi-criteria analysis. As a result the Biosis Risk Assessment has identified upland swamp EECs as having a moderate or high risk of subsidence induced fracturing but subsequently assessed them to have a low final risk of impact due to modification of such a risk using flow accumulation measures.

Potential loss of surface catchment water to deeper storage

Due the multi-seam nature of the proposed extraction, there is a significant potential for surface to seam fracturing in various parts of the proposed mining domain. OEH previously recommended a reassessment of this potential given the changes made to the mining layout. Previously the PPR had modified the layout so that:

[2] OEH notes the recent review by WRL (2012) that there has been no demonstration (or citation) of successful remediation of a swamp affected by longwall mining.

- Longwalls 1-3 have increased panel widths (the largest change being for longwall 3 which is increased from 105m to 150m wide – a 43% increase)
- Longwalls 6 to 10 have the pillar widths reduced from 60m to 45m
- Longwall 11 has the pillar width reduced from 60m to 40m.

OEH found it difficult to get a clear description of pillar widths from the most recent RMR documents. While this reanalysis of potential for surface to seam fracturing has not occurred, some indications of the potential for surface to seam fracturing are available from Geoterra (2014). The groundwater modelling and observations identify a significant threat to groundwater aquifers, including the potential for surface to seam connective fracturing. If this occurs in conjunction with upland swamp aquifers or streams, surface water (and perched swamp aquifers) could end up draining to the mine itself.

For example:

Geoterra (2014) state:

- ***Figure 35*** *indicates that, based on the inherent assumptions in the Tammetta (2012) empirical method and the adaptation of this equation to multi-seam mining, the depressurisation zone may reach the ground surface over the already extracted Wongawilli Seam Longwalls 4 and 5.*
- *The depressurisation "zone" may also potentially reach the ground surface over the eastern and central sections of Longwalls 6 and 7, but not over Longwalls 9 to 11 (due to the absence of triple seam mining at that location). The depressurisation zone may also reach the ground surface over the eastern and central sections of Longwalls 1 to 3, where there are stacked, overlying, Bulli, Balgownie and Wongawilli secondary extraction workings.*
- *Based on available mine water balance records, the average daily groundwater inflow extracted from Russell Vale Colliery was 0.2 ML/day prior to extraction of LW4 and 1.05ML/day after extraction of LW5.*
- *The modelling predicts a reduction in baseflow of 1.20ML/yr in the Cataract River (upstream of Cataract Reservoir) and a reduction of 0.88ML/yr in Bellambi Creek.*
- *The model has not been designed to simulate the effects of near-surface tensile cracking or discrete structural features, such as the presence of faults or dykes or their displacement due to subsidence resulting from underground extractive mining.*

In reviewing the groundwater modelling, Heritage Computing (2014) commented:

- *Monitoring of water level trends in piezometer NRE-A over the multi-seam mined area seems to lend support to fracturing reaching to the upper Hawkesbury Sandstone.*

Cataract Creek and its tributaries

OEH has previously stated that it believes Cataract Creek should have a negligible impact criteria applied. OEH considers Cataract Creek to be of special significance due to its ecological and biodiversity values, including as habitat to a number of threatened species. Given the interconnected nature of a creek and its tributaries, and the potential for impacts to extend up or downstream of the initial impact area, impacts to water quantity and quality along the entire stretch need to be assessed as a whole.

Closure values for Cataract Creek are predicted to range "*up to 300mm adjacent to the end of Longwall 5 and up to 290mm adjacent to the end of Longwalls 6 and 7. Closure across the second order southern branch of Cataract Creek upstream of the Mount Ousley Road crossing is predicted to reach 700mm"* (SCT 2014).

SCT (2014) also cite Barbato et al 2014 stating "*Barbato et al (2014) report experience in Hawkesbury Sandstone river channels indicating that flow diversion and perceptible cracking in major river channels such as Cataract Creek has not been observed where valley closure is predicted to be less than 100mm with the proportion of pools impacted increasing linearly with closure to be 100% by 700mm of predicted closure".*

The probability exceedance curve in Barbato et al (2014 - Figure 2), indicates that closure of 300mm could lead to a 28% (approx.) probability of a Type 3 Pool Impact causing draining and subsurface redirection of flows. There is no documented evidence that any or all of this water returns to the stream system and there is a serious concern that such water could drain to the mine itself (eg see Coffey review). Indeed, other publications by the SCA also suggest significant flow losses where fracturing has occurred previously in Waratah Rivulet (Jankowski and Knights 2010). OEH is aware of significant stream lengths within the Metropolitan Special Areas where there is now no longer flow (except after heavy rainfall) as a result of longwall mining impacting catchment streams (eg upper Wongawilli Ck, Native Dog Creek, Flying Fox Creek, Waratah Rivulet and a number of other tributaries). OEH does not consider such potential impacts to constitute a negligible impact risk to Cataract Creek and recommends a redesign of longwall panels to reduce closure across Cataract Creek.

There is little evidence of effective remediation of these sort of impacts. Attempts to do so are both expensive and likely to involve additional environmental damage.

Alteration of the natural flow regimes of streams is recognised as a major factor contributing to loss of biological diversity and ecological function in aquatic ecosystems (NSW Scientific Committee 2002). While modifications to long wall layout have now excluded Cataract Creek from direct undermining, 10 mapped tributaries of Cataract Creek will be directly undermined.

Fracturing within swamp and tributaries which feed into Cataract Creek is likely to lead to loss of flow supplying water to Cataract Creek and ultimately Cataract Dam. WRM (2014) states that "*based on observations of groundwater inflows and piezometer behaviour in the area, the credible range of subsidence induced streamflow loss from Cataract Creek due to Wonga East operations is in the range of 0.1 – 0.5 ML/day*". Furthermore WRM state that a loss of 0.5ML/d would:

- *"Reduce the frequency of 1.0ML/d flows to 69%*
- *Reduce the frequency of 0.1ML/d flows to 86%*
- *Increase the maxium cease to flow period length from 0 to 101 days and*
- *Increase the median duration of cease to flow periods from 0-9.5 days*".

Based on the flow exceedance curves in WRL (2014; see Figure 3), a loss of 0.5ML/day in Cataract Creek would increase the number of cease to flow days at CC5 from 0% to approximately 20% of the time. A loss of 0.5ML/day in Cataract Creek would increase the number of cease to flow days at CC9 from 0% to approximately 10% of the time. This is not considered to be a trivial impact to Cataract Creek. Much of the discussion of flow impacts discuss losses with regards to averages or medians, however, the greatest impacts of loss of flow will actually occur during dry/drought conditions when water within the catchment is scarce.

Stream Monitoring

No studies have been undertaken that measure the contribution of swamps to flows in streams above the project area. Consistent monitoring of stream flow itself has also been poor.

The WRM (2014) states that:

- *Wollongong Coal periodically undertakes measurements of flow velocity across transects at Cataract Creek monitoring points. However, at the time of preparing the present study, insufficient data was available to develop full reliable rating curves, and flow-frequency relationships at the monitoring points.*
- *While water levels are monitored in pools along Cataract Creek and Cataract River, insufficient data is available to derive long-term streamflow records for the potentially affected streams.*

OEH has previously stated, and reiterates, that it is the responsibility of the mining companies to collect the data that is needed for major decisions on coal mining in these areas. In the absence of this information, informed decision making by Approval Authorities is not possible and unacceptable impacts may occur.

OEH maintains a concern with WRL's (2014) modelling for Cataract Dam, noting major unexplained discrepancies (up to 20,000 ML) in Cataract Dam modelled volumes (Figure 1).

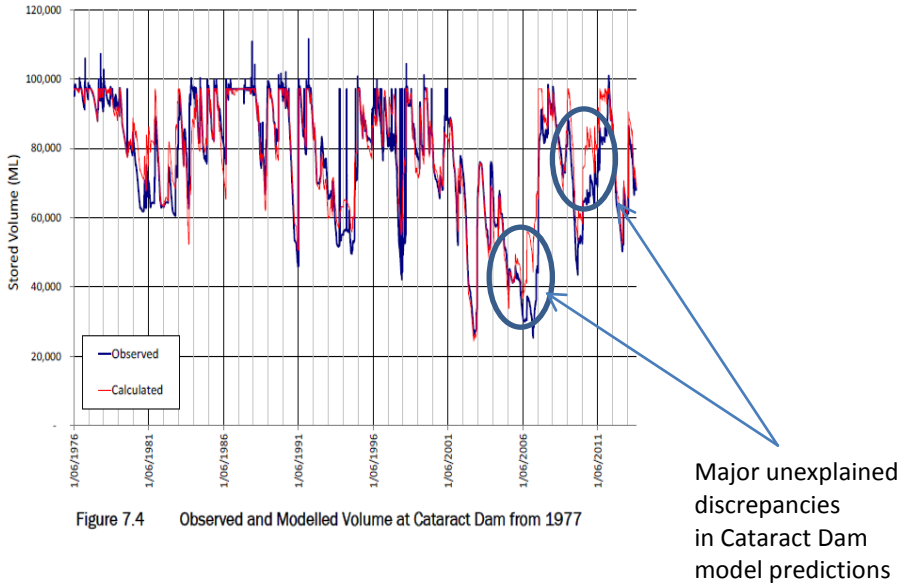

Figure 1. Major unexplained discrepancies (up to 20,000 ML) in Cataract Dam modelled volumes. Source: WRL (2014).

Threatened Species - Giant Dragonfly

The Giant Dragonfly *Petalura gigantea* is listed as Endangered under the TSC Act 1995, with declining population size, and loss or degradation of wetland habitats in which it occurs, identified as threats to its survival (NSW Scientific Committee 1998). The Giant Dragonfly is the third largest dragonfly in Australia and one of the largest dragonflies in the world. They live in permanent swamps and bogs with some free water and open vegetation (Benson and Baird 2013). Females lay eggs into moss, under other soft ground layer vegetation, and into moist litter and humic soils, often associated with groundwater seepage areas within appropriate swamp and bog habitats. The species does not utilise areas of standing water wetland, although it may utilise suitable boggy areas adjacent to open water wetlands. Larvae dig long branching burrows under the swamp. Larvae are slow growing and the larval stage may last 10 years or more.

OEH has twice previously recommended that survey for the threatened Giant Dragonfly (Petalura gigantea) be undertaken. It is noted that a survey has now been undertaken and potential and known habitat

identified (although no information on search effort i.e. spatial extent and survey hours is provided). It is recommended that this information is provided in order to allow assessment of the adequacy of the Giant Dragonfly surveys.

Three swamps (CCUS4, BCUS4 and CRUS1) were identified as known habitat for the Giant Dragonfly in the study area. Two of these swamps, CCUS4 and BCUS4, are also identified at the two most at risk swamps in the final risk assessment (Figure 11 – Appendix G – Biodiversity). Given the potential impacts on groundwater and vegetation in these swamps as a result of mining, and the reliance on these features for breeding habitat OEH considers it likely that this habitat will be rendered unsuitable for the species and that a significant impact on this population of the species is likely as a result of the proposal. Without knowledge of the location within CRUS1 of the Giant Dragonfly records, OEH is unable to determine if this habitat is also likely to be rendered unsuitable.

An annual monitoring program for the Giant Dragonfly should be established to inform our understanding of the impacts of mining on the population over time and an appropriate offset developed for any impact to the species that cannot be avoided or minimised.

Economics

In the PPR the value of the swamps is accepted as $2 million per hectare. By the applicants calculations the value of all swamps would be $38 million, although they have reduced the value to $9.78 million on the basis that the entirety of all swamps will not be undermined. OEH does not support this approach as impacts to groundwater at one part of a swamp is likely to impact groundwater throughout the swamp.

OEH has estimated the value of the swamps it considers at moderate or high risk as $25 million. Given this loss of swamps in addition to impacts to threatened species habitat, impacts to streams, loss of drinking water and damaged and disturbed catchment OEH considers that the project will have an overall negative benefit to cost ratio (royalties to NSW Government calculated at $18 million).

In light of recent cases where both the applicant's calculation and DP&E acceptance of economic benefits approaches have been found to be incorrect and criticised, OEH recommends a detailed and independent review of the economics of this proposal.

References

- Barbato et al (2014) Valley Closure Impact Model for Rock Bar Controlled Streams in the Southern Coalfield. Proceedings of the 9th Triennial Conference on Mine Subsidence, 2014 pp 221-225.
- Benson, D. and Baird, I.R.C. (2012). Vegetation, fauna and groundwater interrelations in low nutrient temperate montane peat swamps in the upper Blue Mountains, New South Wales. Cunninghamia 12(4): 267-307.
- Biosis (2014) Appendix G Russell Vale Colliery – Underground Expansion Project: Preferred Project Report – Biodiversity
- Geoterra (2014) Appendix C Russell Vale Colliery – Underground Expansion Project, Preferred Project Report, Wonga East Groundwater Assessment
- Heritage Computing (2014) Appendix D Peer Review of Groundwater Assessment
- Jankowski, J. and Knights, P. 2010. Surface water-Groundwater interaction in the fractured sandstone aquifer impacted by mining-induced subsidence: 1. Hydrology and Hydrogeology. IAH 2010 Krakow. http://www.sca.nsw.gov.au/__data/assets/pdf_file/0003/36876/2.J.-Jankowski,-P.-Knight-2010.pdf

- MSEC (2012) Dendrobium Area 3B – Longwalls 9 to 18. Subsidence Predictions and Impact Assessments for Natural Features and Surface Infrastructure in Support of the SMP Application. MSEC459 Revision B. September 2012.
- Planning Assessment Commission (2010). The PAC Review of the Bulli Seam Operations Project. NSW Planning Assessment Commission, Sydney ISBN 978-0-9806592-6-9
- SCT (2014) Appendix B Update to Subsidence Assessment of Wollongong Coal Preferred Project Report Russell Vale No 1 Colliery
- WRL (2012). Temperate Highland Peat Swamps on Sandstone. Literature Review. Draft Report for DSEWPAC (to be finalised in 2014).
- WRM (2014). Appendix F Russell Vale Colliery Wonga East Underground Expansion Project Surface Water Modelling

Appendix (Ecosystems & Threatened Species) – Swamp Risk Assessment

Swamp Name	Biosis Final Risk Assessment and Justification	OEH Risk Assessment and Justification
BCUS4	Risk is assessed as MODERATE due to impacts to a small section of this swamp. BCUS4 is located over the edge of Longwall 9. Soils in BCUS4 are up to 160 cm in depth and consist of humic sandy clay. Tilts and strains affect a small section of MU43 Tea-tree Thicket. Lower sections of the upland swamp are unlikely to be subject to strains of sufficient magnitude to fracture bedrock. Swamp Discussion of tilts and strains Undergoes evapotranspiration as well as gradual drainage after rainfall. No evidence of adverse effects due to prior subsidence are evident in this swamp.	Risk is assessed as HIGH. OEH believe that it is likely that the bedrock base of BCUS4 will be fractured leading to the loss of the perched aquifer. A permanent water table is maintained outside of dry/drought conditions based on the piezometer plot for PB4. BCUS4 is stated to contain the MU42 vegetation community (Biosis 2012). Previous subsidence under BCUS4 was estimated by SCT (2014) to be 0.6m (ie not that large). Mining of Longwall10 (and to a lesser extent LW11) is predicted to cause an additional 1.4m of subsidence to give an overall Total Subsidence from all undermining of 2m. Incremental tensile strain from the current plan is 7.1 mm/m (14 times higher than the PAC threshold for tensile strains); incremental compressive strain is 14.2 mm/m (7 times higher than the PAC threshold for compressive strains); incremental tilt is 23 mm/m (over 5 times higher than the PAC threshold for tilt).
BCUS11	Risk is assessed as LOW. No groundwater data is available. BCUS11 does not support vegetation communities reliant on waterlogging.	Risk is assessed as HIGH. OEH believe that it is likely that the bedrock base of BCUS4 will be fractured leading to the loss of the perched aquifer. No groundwater monitoring has been undertaken by the proponent for BCUS11. BCUS11 is stated to contain vegetation communities MU42 and MU44b (Biosis 2012). OEH consider Biosis' statement that these swamp communities are "not reliant on waterlogging" to be incorrect and highly misleading. Previous subsidence under BCUS11 was estimated by SCT (2014) to be 0.5m (ie not that large). Mining of Longwall10 (and to a lesser extent LW9&11) is predicted to cause an additional 1.5m of subsidence to give an overall Total Subsidence from all undermining of 2m. Incremental tensile strain from the current plan is 6.8 mm/m (almost 14 times higher than the PAC threshold for tensile strains); incremental compressive strain is 13.4 mm/m (6 times higher than the PAC threshold for compressive strains); incremental tilt is 23 mm/m (over 5 times higher than the PAC threshold for tilt).
CCUS1	Risk is assessed as LOW. Both Biosis and OEH consider a swamp of special significance. No groundwater data is available. Given changes to the longwall layout, impacts are likely to be restricted to a very small section of this upland swamp at the eastern end. Any changes here are likely to be limited in extent, and are unlikely to result in a significant impact to this upland swamp.	Risk from the current mine plan is considered LOW. No groundwater monitoring has been undertaken by the proponent for CCUS1. Previous subsidence under CCUS1 was estimated by SCT (2014) to be 2m. This may have been sufficient to impact this swamp but no monitoring was undertaken before and after previous mining which confounds any interpretation of potential impacts. No subsidence is predicted for CCUS1 from the current mine plan (SCT 2014).

Swamp Name	Biosis Final Risk Assessment and Justification	OEH Risk Assessment and Justification
CCUS2	Risk of impact is considered LOW. Does not support vegetation communities reliant on waterlogging. Undergoes evapotranspiration as well as gradual drainage after rainfall. No evidence of adverse effects due to prior subsidence are evident in this swamp.	Risk is assessed as HIGH. OEH believe that it is likely that the bedrock base of this swamp will be fractured leading to the loss of the temporary perched aquifer. A temporary water table is maintained after rainfall based on the piezometer plot for PCc2, although no water appeared to be measured between June 2012 and February 2013 . It is possible that CCUS2 has been affected by previous mining but the lack of monitoring before and after such previous mining confounds any interpretation of potential impacts. CCUS2 is stated to contain vegetation communities MU44a and MU44b (Biosis 2012). OEH consider Biosis' statement that a swamp community is "not reliant on waterlogging" to be incorrect and highly misleading. Previous subsidence under CCUS2 was estimated by SCT (2014) to be 1.1m (ie of medium size). Mining of Longwall 2 (and to a lesser extent LW3) is predicted to cause an additional 1.9m of subsidence to give an overall Total Subsidence from all undermining of 3m. Incremental tensile strain from the current plan is 10 mm/m (20 times higher than the PAC threshold for tensile strains); incremental compressive strain is 20 mm/m (10 times higher than the PAC threshold for compressive strains); incremental tilt is 34 mm/m (8.5 times higher than the PAC threshold for tilt).
CCUS3	Risk is assessed as LOW. CCUS3 supports MU42 Banksia Thicket and MU44a Sedgeland, which are not reliant on waterlogging and are thus deemed less susceptible to decreased groundwater availability. Groundwater data indicates rapid recession to basement levels following rainfall.	OEH would have considered the risk of the current proposal to have been HIGH, but since the longwalls have already been extracted this is now a moot point. OEH believe that it is likely that the bedrock base of CCUS3 has been fractured leading to the loss of any perched aquifer. Monitoring was clearly inadequate to identify the exact impacts, but extensive surface fracturing of exposed rock occurred throughout the area. Rapid recession of the water table occurs after rainfall based on the piezometer plot for PCc3, It is possible that CCUS3 has been affected by previous mining but the lack of monitoring before and after such previous mining confounds any interpretation. In addition, there was little to no baseline monitoring of CCUS3 water levels prior to mining of LW4 . CCUS3 is stated to contain vegetation communities MU42 and MU44a (Biosis 2012). OEH consider Biosis' statement that a swamp community is "not reliant on waterlogging" to be incorrect and highly misleading. Previous subsidence under CCUS3 was estimated by SCT (2014) to be 1.1m (ie of moderate magnitude). Mining of Longwall 4 (and to a lesser extent LW5) was predicted (and measured) to cause an additional 1.4m of subsidence to give an overall Total Subsidence from all undermining of 2.5m. Incremental tensile strain from LW4&5 was 7 mm/m (14 times higher than the PAC threshold for tensile strains); incremental compressive strain from LW4&5 was 14 mm/m (7 times higher than the PAC threshold for compressive strains); incremental tilt from LW4&5 was 24 mm/m (6 times higher than the PAC threshold for tilt).
CCUS4	Risk is assessed as HIGH Strains and tilts have increased following the revision of subsidence data. The location of water-dependent communities	Risk is assessed as HIGH. OEH believe that it is likely that the bedrock base of CCUS4 will be fractured leading to the loss of the perched aquifer. This will likely cause the downstream creek to dry up except after heavy rain.

Swamp Name	Biosis Final Risk Assessment and Justification	OEH Risk Assessment and Justification
	at the base of the longwall, in areas of lowest strain and tilt, are likely to mitigate impacts to some degree. An overhanging sandstone formation, approximately 7.1 m high, forms a waterfall and rockbar at the base of CCUS4. There is evidence of impacts from previous mining, including collapse of a section of this sandstone formation and some cracking of the sandstone outcrop. As this sandstone formation forms a rockbar at the downstream extent of CCUS4 any fracturing or rock fall is likely to result in changes in hydrology. No evidence of adverse effects due to prior subsidence are evident in this swamp.	A permanent water table is maintained outside of dry/drought conditions based on the piezometer plot for PCc4. CCUS4 is stated to contain the MU42, MU43 and MU44c vegetation communities (Biosis 2012). Water flow from the base of the swamp is described as semi-permanent (SCT 2014). Both OEH and Biosis agree that CCUS4 is a swamp of "Special Significance". Previous subsidence under CCUS4 was estimated by SCT (2014) to be 0.9m (ie low to moderate magnitude). Mining of Longwall6 (and to a lesser extent LW11) is predicted to cause an additional 1.5m of subsidence to give an overall Total Subsidence from all undermining of 2.4m. Incremental tensile strain from the current plan is 7.7 mm/m (15 times higher than the PAC threshold for tensile strains); incremental compressive strain is 15.5 mm/m (8 times higher than the PAC threshold for compressive strains); incremental tilt is 25 mm/m (over 6 times higher than the PAC threshold for tilt).
CCUS5	Risk is assessed as LOW. Following revision of the longwall layout only a small section of this swamp will be subject to subsidence, and areas of MU43 Tea-tree Thicket are located in areas of lower strain. Undergoes evapotranspiration as well as gradual drainage after rainfall. No evidence of adverse effects due to prior subsidence are evident in this swamp.	Risk is assessed as HIGH. OEH believe that it is likely that the bedrock base of CCUS5 will be fractured leading to the loss of the perched aquifer where the swamp overlies or is adjacent to LW7. A permanent water table is maintained outside of very dry conditions based on the piezometer plot for PCc5a,b. CCUS5 is stated to contain the MU42, MU43 and MU44a vegetation communities (Biosis 2012). Water flow from the base of the swamp is described as semi-permanent (SCT 2014). Both OEH and Biosis agree that CCUS5 is a swamp of "Special Significance". Previous subsidence under CCUS5 was estimated by SCT (2014) to be 0.6m (ie low magnitude). Mining of Longwall6 (and to a lesser extent LW11) is predicted to cause an additional 1.2m of subsidence to give an overall Total Subsidence from all undermining of 2.4m. Incremental tensile strain from the current plan is 6.6 mm/m (13 times higher than the PAC threshold for tensile strains); incremental compressive strain is 13.3 mm/m (6 times higher than the PAC threshold for compressive strains); incremental tilt is 22 mm/m (over 5 times higher than the PAC threshold for tilt).

Swamp Name	Biosis Final Risk Assessment and Justification	OEH Risk Assessment and Justification
CCUS6	Risk is assessed as LOW CCUS6 supports MU42 Banksia Thicket, which is not reliant on waterlogging and is thus deemed less susceptible to decreased groundwater availability. Groundwater data indicates rapid recession to basement levels rapidly following rainfall.	OEH would have considered the risk of the current proposal to have been HIGH, but since the longwalls have already been extracted this is now a moot point. OEH believe that it is likely that the bedrock base of CCUS6 has been fractured by previous mining, but this still requires verification. Tammetta (2013) stated: Using Figure 4 of BR (2012), most of swamp CCUS6 is located over a zone of interpreted protrusion, and is at risk of permanent ecosystem change. Monitoring was clearly inadequate to identify the exact impacts to CCUS6, but extensive surface fracturing of exposed rock occurred throughout the area. No groundwater monitoring has been undertaken by the proponent for the majority of CCUS6. Water levels in Piezometer PCc6 are very similar to PCc3, indicating rapid recession of the water table occurs after rainfall. CCUS6 is stated to contain the vegetation community MU42 (Biosis 2012). OEH consider Biosis' statement that a swamp community is "not reliant on waterlogging" to be incorrect and highly misleading. It is possible that CCUS6 has been affected by previous mining but the lack of monitoring before and after such previous mining confounds any interpretation. In addition, there was little to no baseline monitoring of CCUS6 water levels prior to mining of LW4. Previous subsidence under CCUS6 was estimated by SCT (2014) to be 2m (ie of large magnitude). Mining of Longwall 4 (and to a lesser extent LW5) was predicted to cause an additional 1.8m of subsidence (also measured at 1.8m) to give an overall Total Subsidence from all undermining of 3.8m. Incremental tensile strain from LW4&5 was 9.5 mm/m (19 times higher than the PAC threshold for tensile strains); incremental compressive strain from LW4&5 was 18.9 mm/m (9 times higher than the PAC threshold for compressive strains); incremental tilt from LW4&5 was 32 mm/m (8 times higher than the PAC threshold for tilt).
CCUS10	Risk is assessed as LOW Following revision of the longwall layout only a small section of this swamp will be subject to subsidence, and areas of MU43 Tea-tree Thicket and MU44c Cyperoid Heath are located in areas of lower strain. Soils in the section of CCUS10 overlying Longwall 9 are up to 75 cm in depth and consist of sandy clay. No groundwater data is available.	Risk is assessed as HIGH. OEH believe that it is likely that the bedrock base of CCUS10 will be fractured leading to the loss of any perched aquifer in the swamp. No groundwater monitoring has been undertaken by the proponent for CCUS10. CCUS10 is stated to contain the vegetation communities MU42, MU43 & MU44c (Biosis 2012). It is possible that CCUS10 has been affected by previous mining but the lack of monitoring before and after such previous mining confounds any interpretation of previous impacts. Both OEH and Biosis agree that CCUS10 is a swamp of "Special Significance". Previous subsidence under CCUS10 was estimated by SCT (2014) to be 0.6m (ie of low magnitude). Mining of Longwall 9 is predicted to cause an additional 0.9m of subsidence to give an overall Total Subsidence from all undermining of 1.5m. Incremental tensile strain from the current plan is 4.8 mm/m (9 times higher than the PAC threshold for tensile strains); incremental compressive strain is 9.7 mm/m (almost 5 times higher than the PAC threshold for compressive strains); incremental tilt is 16 mm/m (over 4 times higher than the PAC threshold for tilt).

Swamp Name	Biosis Final Risk Assessment and Justification	OEH Risk Assessment and Justification
CCUS11	Risk is assessed as LOW. CCUS11 supports MU42 Banksia Thicket, which is not reliant on waterlogging and is thus deemed less susceptible to decreased groundwater availability. No groundwater data is available.	Risk is assessed as HIGH. OEH believe that it is likely that the bedrock base of CCUS11 will be fractured leading to the loss of any perched aquifer in the swamp. No groundwater monitoring has been undertaken by the proponent for CCUS11. CCUS11 is stated to contain the vegetation community MU42 (Biosis 2012). It is possible that CCUS11 has been affected by previous mining but the lack of monitoring before and after such previous mining confounds any interpretation of previous impacts. OEH consider Biosis' statement that a swamp community is "not reliant on waterlogging" to be incorrect and highly misleading. Previous subsidence under CCUS11 was estimated by SCT (2014) to be 1.0m (ie of moderate magnitude). Mining of Longwall 9 is predicted to cause an additional 2m of subsidence to give an overall Total Subsidence from all undermining of 3m. Incremental tensile strain from the current plan is 8.8 mm/m (17 times higher than the PAC threshold for tensile strains); incremental compressive strain is 17.7 mm/m (almost 9 times higher than the PAC threshold for compressive strains); incremental tilt is 29 mm/m (over 7 times higher than the PAC threshold for tilt).
CCUS12	Risk is assessed as LOW. CCUS12 supports MU42 Banksia Thicket, which is not reliant on waterlogging and is thus deemed less susceptible to decreased groundwater availability. Soils are between 5 and 85 cm in depth and consist largely of minerals sands with little organic material. No groundwater data is available. However this upland swamp is unlikely to support significant groundwater.	Risk is assessed as MODERATE to HIGH. OEH believe that there is the potential for the bedrock base of CCUS12 to be fractured leading to the loss of any perched aquifer in the swamp. No groundwater monitoring has been undertaken by the proponent for CCUS12. CCUS12 is stated to contain the vegetation community MU42 (Biosis 2012). It is possible that CCUS12 has been affected by previous mining but the lack of monitoring before and after such previous mining confounds any interpretation of previous impacts. OEH consider Biosis' statement that a swamp community is "not reliant on waterlogging" to be incorrect and highly misleading. Previous subsidence under CCUS12 was estimated by SCT (2014) to be 0.5m (ie of low magnitude). Mining of Longwall 9 is predicted to cause an additional 1m of subsidence to give an overall Total Subsidence from all undermining of 1.5m. Incremental tensile strain from the current plan is 4.2 mm/m (8 times higher than the PAC threshold for tensile strains); incremental compressive strain is 8.5 mm/m (over 4 times higher than the PAC threshold for compressive strains); incremental tilt is 14 mm/m (over 3 times higher than the PAC threshold for tilt).

Swamp Name	Biosis Final Risk Assessment and Justification	OEH Risk Assessment and Justification
CCUS14	No risk assessment undertaken	Risk from the current mine plan is assessed as LOW. Biosis (2014) do not discuss CCUS14, probably because it does not lie above any longwall. Previous subsidence under CCUS14 was estimated by SCT (2014) to be 1.2m (ie of moderate magnitude). Mining of Longwall 1 is predicted to cause an additional 0.1m of subsidence to give an overall Total Subsidence from all undermining of 1.3m. Incremental tensile strain from the current plan is 0.6 mm/m (slightly higher than the PAC threshold for tensile strains); incremental compressive strain is 0.5 mm/m (less than the PAC threshold for compressive strains); incremental tilt is 2 mm/m (lower than the PAC threshold for tilt).
CCUS21	No risk assessment undertaken	OEH would have considered the risk of the current proposal to have been HIGH, but since LW4 has already been extracted this is now a moot point. Monitoring was clearly inadequate to identify the exact impacts to CCUS21, but extensive surface fracturing of exposed rock occurred throughout the general area. Biosis (2014) do not discuss CCUS21, probably because it does not lie directly above any longwall. No groundwater monitoring has been undertaken by the proponent for CCUS21. CCUS21 is stated to contain the vegetation community MU42 (Biosis 2012). It is possible that CCUS21 has been affected by previous mining but the lack of monitoring before and after such previous mining confounds any interpretation. In addition, there was little to no baseline monitoring of CCUS21 water levels prior to mining of LW4. Previous subsidence under CCUS21 was estimated by SCT (2014) to be 2m (ie of large magnitude). Mining of Longwall 4 was predicted to cause an additional 1.8m of subsidence to give an overall Total Subsidence from all undermining of 3.8m. Incremental tensile strain from the current plan was predicted to be 9.7 mm/m (19 times higher than the PAC threshold for tensile strains); incremental compressive strain was predicted to be 19.3 mm/m (over 9 times the PAC threshold for compressive strains); incremental tilt was predicted to be 32 mm/m (8 times the PAC threshold for tilt). It appears likely that these estimates were based on the original proposed length of LW4 taking it directly under CCUS21.
CCUS23	Risk is assessed as LOW. CCUS23 supports MU42 Banksia Thicket and MU44a Sedgeland. No groundwater data is available.	Risk was assessed as HIGH but since LW5 has already been extracted this is now a moot point. OEH believe that the bedrock base of CCUS11 could potentially have been fractured but since it was not monitored there is no ability to assess the loss of any perched aquifer in the swamp. Monitoring was clearly inadequate to identify the exact impacts to CCUS23, but extensive surface fracturing of exposed rock occurred throughout the general area. No groundwater monitoring has been undertaken by the proponent for CCUS23. CCUS23 is stated to contain the vegetation communities MU42 & MU44a (Biosis 2012). It is possible that

Swamp Name	Biosis Final Risk Assessment and Justification	OEH Risk Assessment and Justification
		CCUS23 has been affected by previous mining but the lack of monitoring before and after such previous mining confounds any interpretation of previous impacts. Previous subsidence under CCUS23 was estimated by SCT (2014) to be 0.9m (ie of low to moderate magnitude). Mining (primarily of Longwall 5) was predicted to cause an additional 1.2m of subsidence to give an overall Total Subsidence from all undermining of 2.1m. Incremental tensile strain from the current plan was 5.8 mm/m (11 times higher than the PAC threshold for tensile strains); incremental compressive strain was 11.6 mm/m (almost 6 times higher than the PAC threshold for compressive strains); incremental tilt was 19 mm/m (almost 5 times higher than the PAC threshold for tilt).
CRUS1	Risk is assessed as LOW. CRUS1 supports a mix of MU43 Tea-tree Thicket and MU42 Banksia Thicket. Based on shallow soil profile, MU43 Tea-tree Thicket is likely to persist in areas of water accumulation resulting from rock terracing, as evident from analysis of slope and testing of soil depths. Only the upper section of this upland swamp is located within the predicted subsidence zone. Soils in this area are between 25 and 70 cm, and consisting of mineral sands. These areas are unlikely to support significant groundwater. Undergoes evapotranspiration as well as gradual drainage after rainfall. Possible adverse effects due to prior subsidence may be evident in this swamp due to its enhanced drainage recession rates.	Risk was assessed as LOW to MODERATE. OEH believe that the bedrock base of CRUS1 could potentially be fractured where it lies above LW6, but the majority of the swamp is likely to be unaffected. Water levels are monitored in Piezometer PCr1 and appear to be similar to PCc6, indicating rapid recession of the water table occurs after rainfall. CRUS1 is stated to contain the vegetation communities MU42 & MU43 (Biosis 2012). It is noted that the piezometer does not appear to be in the potentially wetter part of the swamp (ie where vegetation type MU43 occurs). It is possible that CRUS1 has been affected by previous mining but the lack of monitoring before and after such previous mining confounds any interpretation of potential impacts. CRUS1 is a very large swamp and both OEH and Biosis agree that CRUS1 is a swamp of “Special Significance”. Previous subsidence under CRUS1 was estimated by SCT (2014) to be 0.5m (ie of low magnitude). Mining of Longwall 6 is predicted to cause an additional 0.3m of subsidence to give an overall Total Subsidence from all undermining of 0.8m. Incremental tensile strain from the current plan was 1.5 mm/m (3 times higher than the PAC threshold for tensile strains); incremental compressive strain was 3 mm/m (1.5 times higher than the PAC threshold for compressive strains); incremental tilt was 5 mm/m (a little higher than the PAC threshold for tilt). Only the upper part of CRUS1 overlies LW6.

2. Floodplain Risk Management

OEH notes that the proponent is currently preparing an updated flood study which will investigate the catchment of Bellambi Creek. Accordingly, OEH's previous comments relating to east bound flow as reproduced below are not addressed by the material supplied.

In reviewing the current proposal it is unclear as to whether adequate consideration has been given to the potential adverse impacts associated with flooding. As identified in the Combined Catchments of Whartons, Collins and Farrahars Creeks, Bellambi Gully and Bellambi Lake Flood Studies (2011) significant downstream flood risk exists with the site potentially increasing risk to life and property as evident in the August 1998 flood event.

The Department of Planning and Environment as approval authority should therefore ensure that it appropriately satisfies itself that the proposal will not cause adverse flood impacts to existing development over the full range of flood events. It should also be noted given the location of the site, opportunity exists for the proponent to consider options which can reduce downstream flood risk. As identified in the Combined Catchments of Whartons, Collins and Farrahars Creeks, Bellambi Gully and Bellambi Lake Flood Risk Management Study and Plan (due for completion June 2014) the conversion of the existing settling pond on site into a dual purpose water quality pond/flood retarding basin and an additional basin has the potential to improve water quality and prevent floodwater from discharging through 22 residential properties in a 100 year ARI event, prevent above-floor inundation from being experienced in 11 residential and 4 commercial properties during a 100 year ARI flood event.

Given the above, OEH suggests that the Department of Planning and Environment consults with Wollongong City Council specifically with regard to consistency with Councils flood study, floodplain risk management study and plan (currently being finalised) and potential options to incorporate measures as part of this proposal to reduce potential adverse flood impacts and downstream flood risk.

SYDNEY CATCHMENT AUTHORITY

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Our Ref: D2014/70021

Mr Howard Reed
Manager Mining Projects
Department of Planning and Infrastructure
GPO Box 39
SYDNEY NSW 2001

Attention: Jessie Giblett

Dear Mr Reed

RESIDUAL MATTERS REPORT
WOLLONGONG COAL RUSSELL VALE COLLIERY
STAGE 2 UNDERGROUND EXPANSION PROJECT APPLICATION NO. MP 09_0013

I refer to your Department's e-mail dated 24 June 2014 inviting comments on the Russell Vale Colliery Stage 2 Underground Expansion Residual Matters Report (RMR) including the additional Response to Submissions (RTS) document. You have also requested advice on whether the issues raised in our submissions on the Preferred Project Report have been adequately addressed and to provide any further comments or any recommended conditions of approval.

The Sydney Catchment Authority (SCA) has adopted a set of principles that underpin its decision making in relation to mining activities in the Special Areas. These have been communicated to Wollongong Coal and to Department of Planning and Environment on previous occasions and are repeated in the attached submission. The SCA has also developed performance measures for natural and built features of interest to the SCA for this project, which are included in our submission. The SCA has assessed the proposed mining proposal contained in the RMR against its mining and coal seam gas principles and performance measures. Please note the comments in this submission are related to additional information provided in the RMR and therefore the SCA's comments in relation to creeks, swamps and cliffs in its previous submission dated 6 November 2013 (D2013/101606) still apply.

The RMR provides a further minor revision to subsidence predictions and more discussion on geological structures. The RMR also includes revised groundwater modelling and assessment and surface water modelling.

The SCA notes there has been no drilling undertaken to confirm the full extent of the Corrimal Fault in the northwest and possibility of reactivation of the fault and/or connection with Cataract Reservoir. The SCA continues to have major concerns with regards to the potential for induced leakage from the Cataract Reservoir and longwall mining within the Cataract Dams Safety Committee (DSC) notification area. These concerns were highlighted in our earlier submission on the project and in subsequent correspondence.

In summary, while the RMR provides some further information it does not fully address the issues raised by the SCA. **Therefore, we continue to object to the proposal as it**

currently stands, particularly with regard to its incursion into the Dams Safety Committee Notification Area surrounding Cataract Reservoir.

The SCA's primary concerns, based on revised information on groundwater modelling, groundwater assessment and surface water modelling and minor revision to subsidence predictions and detailed discussions on geological structures and as outlined in this submission, relate to the potential impacts on Cataract Reservoir, Cataract River, Cataract Creek and associated tributaries, swamps and cliffs. Of particular concern is:

- Incomplete knowledge of key geological structures known to occur in the area proposed to be mined.
- The potential loss of stored waters from Cataract Reservoir to underground mine workings at the upper arm of Cataract Reservoir as a result of mining induced leakage.
- The impact on the environment of Cataract Creek and associated tributaries, swamps and dependent ecosystems as a result of the loss of stream flow, reduction in base flows, increased acidification and iron precipitation, and the reduction in shallow water tables affecting swamp vegetation and significant impacts to the "*Special Significance*" upland swamp CCUS4.

In light of our objection to the proposal, **the SCA recommends**:

1. **The DSC Notification Area around Cataract Reservoir be adopted as an Exclusion Zone where no longwall mining is permitted (the SCA is in particular concerned about the significant extension of Longwall 7 into the DSC notification area).**
2. **The proposed adaptive management approach proposed for mining activities not be used due to the lag time for mining-related impacts to manifest and changes required to be implemented.**
3. **The SCA's impact performance measures developed for the proposed mining area be adopted.**
4. **The Department seek expert advice on the substantive issues raised in this submission prior to making a recommendation on the proposal.**

The SCA requests the opportunity to continue to be involved in any ongoing assessment of the application.

Further queries about our submission can be directed to Malcolm Hughes, Senior Manager Planning and Environment, on 4724 2452 or via e-mail malcolm.hughes@sca.nsw.gov.au.

Yours sincerely

28/7/14

GRAHAM BEGG
General Manager Catchments

Encl. *SCA submission – Russell Vale Colliery Underground Mining Expansion Residual Matters Report.*

SYDNEY CATCHMENT AUTHORITY - SUBMISSION

TRANSITIONAL PART 3A PROJECT

RUSSELL VALE COLLIERY UNDERGROUND EXPANSION PROJECT

ASSESSMENT OF THE RESIDUAL MATTERS REPORT

JULY 2014

1. LOCATION OF MINING AREA & RELATIONSHIPS TO SCA AREAS OF INTEREST

The areas of interest to the SCA and the reasons for its interest are summarised below:

- The entire proposed mining area is located under land managed as Schedule 1 Special Area.
- LWs 1 to 3, 7, 9 to 11 are located under land owned by the SCA.
- LWs 7, 9 to 11 are partially located within the Dams Safety Committee (DSC) notification area of Cataract Dam, and have the potential to induce leakage from the reservoir into mine workings with the possible significant loss of stored water.

2. THE SCA'S PRINCIPLES FOR MANAGING MINING AND COAL SEAM GAS IMPACTS

The SCA has since early 2012 adopted a set of principles that underpin its decision making in relation to mining and coal seam activities in the Special Areas. These principles establish the outcomes the SCA considers as essential to protect the drinking water supplies to the four and half million people of Sydney and the surrounding region.

1. ***Protection of water quantity***
   Mining and coal seam gas activities must not result in a reduction in the quantity of surface and groundwater inflows to storages or loss of water from storages or their catchments.

2. ***Protection of water quality***
   Mining and coal seam gas activities must not result in a reduction in the quality of surface and groundwater inflows to storages.

3. ***Protection of human health***
   Mining and coal seam gas activities must not pose increased risks to human health as a result of using water from the drinking water catchments.

4. ***Protection of water supply infrastructure***
   The integrity of the SCA's water supply infrastructure must not be compromised.

5. ***Protection of ecological integrity***
   The ecological integrity of the Special Areas must be maintained and protected.

6. ***Sound and robust evidence regarding environmental impacts***
   Information provided by proponents, including environmental impact assessments for proposed mining and coal seam gas activities must be detailed, thorough, scientifically robust and holistic. The potential cumulative impacts must be comprehensively addressed.

3. PERFORMANCE MEASURES

The SCA has adopted a risk management approach to assess this mining proposal and developed specific performance measures required for key aspects of interest to the SCA in the proposed mining area. The SCA therefore recommends that the proponent should ensure to the satisfaction of the Director-General that the project does not cause any exceedance of the performance measures identified in Table 1.

Table 1: Subsidence Impact Performance Measures

Water Storages	
Cataract Dam	Zero subsidence and zero impact Always safe and serviceable
Cataract Reservoir	Negligible environmental consequences including: • negligible reduction in the quantity or quality of surface water inflows to the reservoir, • negligible reduction in the quantity or quality of groundwater inflows to the reservoir, • negligible increase in the quantity of water entering the groundwater system from the reservoir, and • negligible leakage from the reservoir to underground mine workings. No connective cracking between the reservoir surface and the mine.
Watercourses	
Cataract Creek Cataract River	Negligible environmental consequences including: • negligible diversion of flows or changes in the natural drainage behaviour of pools, • negligible gas releases and iron staining, • negligible increase in water cloudiness, • negligible increase in bank erosion, and • negligible increase in sediment load.
Swamps	
Swamps identified in the PPR as being of "*Special Significance*"	Negligible environmental consequences including: • negligible change in the size of swamps • negligible erosion of the surface of swamps • negligible change in the functioning of swamps • negligible change to the composition or distribution of species within swamps, and • negligible drainage of water from swamps, or redistribution of water within swamps.
All other swamps mapped in the PPR	No significant environmental consequences beyond predictions in the EA.
Land	
Cliffs	Minor environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 3% of the total face of such cliffs within any longwall mining domain).
Biodiversity	
Threatened species, threatened populations, or endangered ecological communities	Negligible environmental consequences

4. SCA's ASSESSMENT

The SCA has reviewed the Residual Matters Report (RMR) including additional Response to Submissions (RTS) document and considers there is still a lack of information, as well as a number of uncertainties.

The main issues of concern to the SCA are:

- potential induced leakage from the Cataract Reservoir, and
- environmental consequences including water quantity and quality of Cataract Creek and associated tributaries, swamps, cliffs and dependent ecosystems.

These concerns were highlighted in the SCA's earlier submission on the project and in subsequent correspondence. Details of the SCA's continuing concerns are outlined below.

4.1 Review of Geological Structures

The RMR provides more details of the nature of Corrimal Fault intersected during the development of LWs 5 and 6 main gates. However, the RMR does not provide any new information to assess the potential for causing connection between reservoir and the mine workings and the potential for increased mine inflows. There has been no drilling undertaken to confirm the full extent of the fault in the northwest and possibility of reactivation of fault and/or connection with Cataract Reservoir.

Based on field inspections there are indications that movement induced by previous mining of the two overlying seams (Bulli and Balgownie) have impacted the ground surface in the form of cracks and other surface deformations. The roof deterioration encountered during LW6 gate road development in the Wongawilli seam intersected the Corrimal Fault. The SCA is concerned this deterioration may extend all the way to the surface.

The SCA considers that the potential for water in-rush is a major issue and that this matter needs to be comprehensively addressed. Given the complex nature of the goaf areas and the multi seam operation, water in-rush cannot be contained by sealing or plugging of roadways, shafts, drifts or portals.

The SCA is still of the opinion that there is a likelihood that the Corrimal Fault extends northwest and intersects the confluence of Cataract River and Cataract Creek. The SCA:

- disagrees with the conclusion that the Corrimal Fault will decrease in severity and die out within a distance of less than 500m from LW6 main gate. The SCA notes the claim that the fault appears erratic in nature and displays typical characteristics of a fault terminating as it fragments into series of non-correlated faults of inconsistent displacement and sense of dip. This does not prove that the fault will terminate. The SCA considers similar characteristics can be encountered in a zone of intense fracturing and faulting as would be expected for the Corrimal Fault given its combination of lateral and vertical movements with appreciable displacement, and
- is concerned that a risk assessment on the potential for hydrologic connection between mine workings and stored waters, as well as surface/groundwater and mine workings, has not been carried out.

4.2 Subsidence Predictions

SCT Operations Pty Ltd (Appendix B of the RMR) has made minor revisions to the previous subsidence predictions, including for LWs 4 and 5 (due to more subsidence monitoring data, particularly in relation to valley closure, becoming available since the

completion of LW5). Additional field studies have also been undertaken and the previous report has been peer reviewed. The revisions to subsidence predictions include:

- changes to the valley closure estimates
- increases in actual vertical subsidence for LWs 4 and 5 from 1.6 and 1.5m respectively to 1.8m which are still less than the predicted subsidence estimates for these longwalls, and
- identification of a sandstone formation downstream of upland swamp CCUS4.

The SCA notes that the monitoring to date has indicated closure movements of up to 49mm (increased from previous monitoring of 20mm) and are less than the 135mm predicted for LW5. The SCA also notes that the subsidence assessment no longer recommends confirmation that there are no geological structures with the potential to provide elevated hydraulic conductivity between the reservoir and the mining horizon. It states that the recommendation to use exploration drilling to confirm the extent of the Corrimal Fault is not considered practical, is unlikely to be effective or necessary, and that the development of roadways will prove the existence, location, and displacement of this structure prior to any longwall mining.

The subsidence assessment report (SCT 2014) still recommends:

- a review of the integrity of the mine water balance to confirm that all sources of water are accounted for on a regular and ongoing basis with suitably calibrated monitoring equipment, and
- groundwater monitoring in areas where there are multiple goafs stacked above each other and in the area between the reservoir and the mine would increase confidence in and understanding of the impacts of mining on the groundwater system. The design of this monitoring would need to be done in consultation with the DSC.

The SCA considers that there are still uncertainties with regards to the nature and behaviour of Corrimal Fault present within the proposed mining area and therefore uncertainties for the subsidence predictions.

4.3 Water Quantity

The water quantity of Cataract Reservoir can be impacted due to:

- induced leakage from the reservoir
- reduced baseflows to creeks, and
- loss of stream flows and reduced catchment yield to the reservoir.

Induced Leakage

The potential for leakage from Cataract Reservoir, specifically near the western ends of LWs 7 and 9, has been a significant concern to the SCA considering proposed longwalls underlie the existing Bulli seam goafs and are located in an area intersected with dykes and faults. This can result in unpredictable subsidence, increase high hydraulic conductivities of rock strata and/or cause hydraulic connection between the mine and reservoir.

The 0.7 times depth (nominally 203m) stand-off from the Full Supply Level (FSL) for the reservoir including the section that extends up Cataract Creek has been proposed by Wollongong Coal as a primary control for protecting the stored waters of Cataract Reservoir. The PPR states that this barrier is expected to provide a high level of protection to the stored water, including to horizontal flow given the hydraulic conductivities of rock strata, and supported by a lack of evidence of leakage from

reservoirs or water bodies for barriers of this size. The PPR states this barrier is considered more than adequate.

The RMR contains more information supporting the case that there is no potential for developing hydraulic connection between Cataract Reservoir and the proposed mine workings and for inflows to mine workings. The RMR considers that:

- the only credible pathways for leakage from the reservoir to the mine are horizontally from the reservoir to the subsided strata above the longwall goaf and then downward through this strata into the mine or via geological structures
- the only geological structure that extends through to the proposed longwall panels in the area and the reservoir is Dyke D8 and there is no evidence of water ingress about the dyke when it was mined through in LW5, and the experience in the Southern Coalfield indicates that dykes are rarely hydraulically conductive and there also does not appear to have been any significant inflow associated with mining the Bulli Seam on this dyke
- any vertical pathway to the mine roadways directly below the reservoir is not an issue because there is not high enough hydraulic conductivity, and roadways already exist and there is no evidence of any inflow
- LW7 is 125m wide at a depth of approximately 290m and will be mined below the Bulli Seam (there is no mining in the Balgownie Seam at the south western end of LW7). The height of depressurisation is calculated to be 260m, meaning that the height of depressurisation may be approaching the surface and although there may still be some barrier to vertical flow near the surface, the main protection against inflow from the reservoir is the horizontal barrier of 200m. This barrier is maintained all around LW7 and as such there is considered to be no potential for significantly increased inflow from the reservoir to the mine as a result of mining LW7
- the presence of an existing goaf in the Bulli Seam within this barrier may reduce the effectiveness of this barrier against possible leakage into the mine as noted in PPR. However, even if there were to be some further instability in the Bulli seam goafs within the barrier as a result of mining LW7, which is considered most unlikely, the height of depressurisation considered above is for the worst case of full extraction or complete destabilisation of all pillars and the height of depressurisation is therefore not expected to be greater than 260m.

The SCA notes that the RMR further states that although there is no potential for LW7 to significantly increase inflow from the reservoir to the mine, there is still a need to confirm this. In addition the RMR states the need to confirm the heights of depressurisation above multiple goafs and that any depressurisation over LW7 is not causing a change in the groundwater regime between the reservoir and the mine.

The SCA notes that the RMR also states that further groundwater pressure monitoring boreholes are planned to be drilled, including one at a site above LW4 where all three seams have been mined, several others between the end of LW7 and the reservoir, and another near Cataract Creek to monitor depressurisation as LW7 approaches. The first borehole is aimed to confirm the height of depressurisation above three mined seams before LW7 starts. The several boreholes between the reservoir and the start of LW7 aim to confirm the direction of groundwater flow continues to be toward the reservoir above the 200m barrier.

Notwithstanding the proposed monitoring and given that there has been no drilling undertaken to confirm the full extent of the fault in the northwest and the possibility of reactivation of fault and goaf areas and/or connection with Cataract Reservoir, **the uncertainties that the height of depressurisation may approach the surface are of great concern. The current information does not provide confidence that 0.7**

times depth stand-off from the FSL can be used as an effective primary control for protecting the stored waters of Cataract Reservoir in this complex mining environment.

The SCA reiterates its concern that **if a connection between mine workings and stored water occurs, there is the potential for substantial stored water to be lost in the mine. The SCA reiterates its previous advice that the Dams Safety Committee Notification Area around Cataract Reservoir should be adopted as an Exclusion Zone where no mining is permitted.**

Reduced Baseflows

The RMR incorporates a new groundwater assessment report which has been based on new groundwater modelling using different software (MODFLOW SURFAC) and based on revised hydrogeological data.

The SCA notes that the technical aspect of the groundwater modelling has been peer reviewed by Dr Noel Merrick. Dr Merrick concludes that the groundwater model has been developed competently and is "fit for purpose" and the uncertainty in modelling predictions has been assessed thoroughly. Dr Merrick has also highlighted that there is a lack of comparison with the previous model, limited discussion and data on stream flow and areas of enhanced recharge has not been implemented in the uncertainty analysis.

The SCA's overall assessment of groundwater modelling identified the following deficiencies:

- The report does not outline the major differences between the previous (FEFLOW) and current (MODFLOW SURFACT) groundwater model. Using different software and modelling approach does not necessarily mean that model outcomes are more reliable. It is not clear what new data/information with respect to previous mining, geology, groundwater, and strata hydraulic properties have been collected and implemented in the new groundwater model that were not available for the previous FEFLOW model.
- The water balance presented for the calibration period suggests that groundwater recharge (leakage) from streams and storages (22.6 ML/day) is about three times higher than estimated baseflow discharge to streams (6.2 ML/day). This provides evidence that there is permanent loss of surface water (from streams and storages) to deeper aquifers.
- The end of mining in Wonga east does not correspond to the time when maximum changes to the groundwater systems are likely to occur. Therefore, predictions of reduction in baseflow discharge or estimated leakage from Cataract Reservoir presented in the report for end of mining on Wonga east do not capture the full extent of potential impacts.

The SCA is significantly concerned for the potential of permanent loss of surface water from streams and storages to deeper aquifers. **The SCA considers that the proposal must meet the SCA's performance criteria, including that of negligible environmental consequences on features of special significance such as Cataract Reservoir, Cataract River and Cataract Creek, and that this performance criteria should be adopted.**

Impact on Cataract Creek Stream Flows

The RMR includes a revision to the previous surface water modelling and the predictions for the changes to low flow characteristics as a result of loss of low flows in Cataract Creek downstream of the proposed 20mm subsidence zone. The report also includes more pool monitoring data for Cataract Creek and Cataract River. The report

provides modelling predictions for reduction in frequency of flows, reduction in duration of cessation of flow, reduction in total flow rate and baseflows for a range of flow loss scenarios.

As highlighted in the SCA's original submission (D2013/29381), surface water modelling has been prepared for the Loddon River and Bellambi Creek (which do not overlie the mining area and are not impacted by the proposed mining proposal) due to the absence of actual stream flow data for creeks impacted by the mining. Notwithstanding additional pool monitoring data becoming available, the SCA is concerned about the reduction in the frequency of low flows to 86% and maximum duration for the cessation of flow for over 100 days.

The revised modelling has not changed the predictions for Cataract Reservoir yield. The revised surface water modelling assessment reiterates that insufficient data is available to derive long-term stream flow records for the potentially affected streams, and it states that it is not possible to directly predict the magnitude of stream flow losses or the lengths of streams likely to be impacted based on the available subsidence assessments.

The SCA is still of the opinion that there are limitations and uncertainties with the surface water modelling. The SCA notes that the PPR states that by adopting a TARP system based on maintaining closure to less than 200mm, that the potential for loss of surface flow can be managed. The SCA is concerned about the **significantly high predicted closure values of 300mm to 700mm for Cataract Creek and its tributaries from mining of Wonga east longwalls. If approved the consent should only permit mining up to a point where the closure is predicted to be 200mm, consistent with the proposed TARP. The SCA reiterates its previous position that it does not support the adaptive management approach proposed for mining activities given the lag time for mining-related impacts to manifest and changes required to be implemented.**

The SCA considers that the proposal must meet the SCA's performance criteria, including that of negligible environmental consequences on features of special significance such as Cataract Creek, and that this performance criteria should be adopted.

5. CONCLUSION

The SCA's assessment has identified that the proposed mining proposal has the potential to impact on water quantity and water quality of Cataract Reservoir and Cataract Creek. Considering the SCA's mining and coal seam gas principles and performance measures developed for the proposal, the SCA continues to object to the proposal in its current form. In light of this objection, the SCA recommends that:

- The DSC Notification Area around Cataract Reservoir be adopted as an Exclusion Zone where no mining is permitted (the SCA is in particular concerned about the significant extension of Longwall 7 into the DSC notification area).
- The proposed adaptive management approach for mining activities not be used due to the lag time for mining-related impacts to manifest and changes required to be implemented.
- The SCA's performance criteria developed for the proposed mining area be adopted.

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WOLLONGONG CITY COUNCIL

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Ms S Wilson
Planning Officer
Mining Projects
Development Assessment Systems and Approvals
NSW Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Your Ref:	MP 10-0046 Mod 2
Our Ref:	Z14/408508
File:	MP-2010/46/B
Date:	2 October 2014

Dear Ms Wilson

RUSSELL VALE COLLIERY – RESPONSE TO SUBMISSIONS - PRELIMINARY WORKS PROJECT MODIFICATION 2

Thank you for providing Council with the opportunity to provide comment on the revised Bellambi Gully Flood Study dated 27 August 2014 prepared by Cardno (NSW/ACT) Pty Ltd on behalf of Wollongong Coal for the Russell Vale Colliery site.

The revised Bellambi Gully Flood Study has been reviewed against the provisions of Chapter E13: Floodplain Management and Chapter E14: Stormwater Management of Wollongong Development Control Plan 2009. In this regard, the revised Bellambi Gully Flood Study should include final flood mitigation option(s) based upon realistic design assumptions such that no additional flooding impacts occur to areas downstream of the site. This includes no flow diversions down Bellambi Lane for any storm event.

In particular, the design of the culvert being proposed adjacent to the stockpile access road should be based on a 100 year Average Recurrence Interval (ARI) or greater analysis using the Wollongong City Council 'policy based' conduit blockage criteria. In addition, the proposed swale alongside the stockpile access road should be designed to cater for the contributing 100 year ARI design flows or greater and ensure that these flows can be conveyed to the licensed discharge point at Bellambi Creek.

In light of the above, it is recommended that detailed survey work of the site take place bearing in mind the comments raised above and in Council's previous letter dated 5 August 2014.

Should you have any enquiries or wish to discuss this matter further, please contact Mr Ron Zwicker, Special Projects Manager on (02) 4227 7639.

Yours faithfully

David Farmer
General Manager
Wollongong City Council