9 July 2015

Mr Howard Reed  
Manager Mining Projects  
NSW Department of Planning & Environment  
GPO Box 39  
SYDNEY NSW 2001

Dear Mr Reed

Re: Springvale Mine Extension Project – Response to PAC Review Report

On 29 June 2015, the NSW Planning and Assessment Commission released its review report on the Springvale Mine Extension Project. The review report identifies four key issues for further consideration being:

- Quality of water discharged into the Coxs river;  
- Surface water licencing;  
- Monitoring for impacts to swamps; and  
- Swamp offsets

Below is Centennial Springvale’s response to the four key issues.

**Quality of Water Discharged into the Coxs River**

Centennial has reached agreement with the NSW Environment Protection Authority (EPA) that by 30 June 2017 Centennial will meet a 50th percentile of 700, a 90th percentile of 900 and a 100th percentile limit of 1,000 micro-Siemens per centimetre Electrical Conductivity (µS/cm EC) limits for salinity at LDP009.

Modelling undertaken has identified that an electrical conductivity of 700 to 900 µS/cm EC will achieve an improvement in water quality in Lake Lyell and have a neutral or beneficial effect on the salinity level at Lake Burragorang.

Centennial has agreed in principle to a target of 500 EC at the 90th percentile level from its western operations (Springvale and Angus Place), by 30 June 2019. This agreement is subject to the completion of Centennial’s feasibility of such further reductions and the subsequent commercial evaluation required to assess the impact to those operations. Any commitments made to further reductions need to ensure continuity of supply to the local power stations and provide long term security of employment to the Lithgow community.

Centennial is continuing to consult with the EPA and other stakeholders around the development of a detailed plan to achieve the agreed limits within the specified timeframes. Additionally, Centennial is continuing to work with the EPA in relation to other factors associated with the mine water discharge quality which will be incorporated into a new Environmental Protection Licence required for the Project following determination.

To monitor the progress against the performance measures, Centennial has developed, a management program that includes:
a) Water quality, macroinvertebrate and ecotoxicology monitoring across the Coxs River Catchment to measure the performance against the long term water quality objective and the impacts of change on the aquatic ecology and ecosystem health of the Coxs River.

b) The water quality parameters to be monitored at all proposed Licenced Discharge Points, the frequency of monitoring and concentration limits focussed on those that have been identified as having potential to cause harm to the environment.

c) A Trigger Action Response Plan should concentration limits be exceeded that focuses on the extent to which an exceedance of quality limits might affect aquatic ecology of the Coxs River catchment.

The EPA has agreed to capture this programme in a condition on the new EPL required following project determination. Centennial will continue to liaise with the EPA in relation to the detailed design of the monitoring programme.

**Surface Water Licencing**

Centennial is continuing to consult with the NSW Office of Water in relation to surface water licences. Centennial has included the following strategy within the Statement of Commitments to secure water licences required for the Project:

- Trade, within the constraints of the relevant Water Sharing Plan, with other Centennial Coal water licence holders.
- Obtain, when available through controlled allocation orders under the relevant Water Sharing Plan, additional allocations.
- Review the hydrogeological model and predicted water inflows for the Project on a 6 monthly basis to ensure adequate accounting for water take and license requirements.
- Contribute to the 2016 Water Sharing Plan review process, as agreed with the NSW Office of Water.

**Swamp Monitoring**

To assist in understanding how to establish impacts to swamps, the University of Queensland have developed a Monitoring Handbook, titled Flora monitoring methods for Newnes Plateau Shrub Swamps and Hanging Swamps (2014) (UQFM Handbook). This Monitoring Handbook identifies that there are three environmental factors which affect floristics:

1. Geology, through subsidence responses;
2. Hydrology (including water quality, groundwater level, flow and infiltration); and
3. Flora composition and condition.

The Monitoring Handbook identifies performance indicators for vegetation monitoring that take into consideration these factors and their effects on swamp health. Five monitoring parameters are used in detecting impacts in Newnes Plateau Shrub Swamp communities. These parameters include:

1. Reduction in the number of native swamp species present
2. Reduction in the condition of key species (qualitative scores 1-5)
3. Expansion of non-live ground cover (including bare ground and dead plant material)
4. Recruitment of non-swamp species (presently eucalypts)
5. Establishment of non-native weeds.
Based on the Monitoring Handbook Centennial has developed an adaptive monitoring regime that includes a statistically valid sampling design, supported by clear monitoring objectives and trigger values that identify ecosystem trends where management intervention is required. An independent peer review of the Angus Place Temperate Highlands Peat Swamps on Sandstone Monitoring and Management Plan (THPSS MMP) conducted on behalf of the Federal Department of the Environment included a specific review of the UQFM Handbook (Attachment 4).

The monitoring programme established has been implemented by Centennial Springvale for monitoring of previously undermined swamps. This monitoring programme is proposed to be expanded across the Springvale Mine Extension Project Area to monitor impacts to Swamps compared to established reference sites. It includes primary flora monitoring techniques and also references secondary methods of monitoring, which are included in the THPSS MMP. The THPSS MMP is approved under EPBC 2011/5949 for Longwalls 415 - 417 at Springvale. Monitoring under the THPSS MMP comprises:

- Subsidence Monitoring;
- Floristic Monitoring;
- Groundwater monitoring; and
- Surface Water Monitoring.

The assessment of ground and surface water in combination with flora allows a robust assessment of ecological processes and in combination with subsidence will allow a comprehensive analysis of whether any mining related impacts have occurred and the magnitude of any possible impacts. The monitoring of these parameters is detailed below.

**Subsidence Monitoring**

It is proposed longitudinal centre lines will be installed at several key locations to provide early-warning and three dimensional (3-D) swamp subsidence data for trigger level review and corrective action management purposes should corrective action be required. It is also proposed to monitor shrub swamps using Aerial Laser Scanning (LiDAR) techniques to measure subsidence effects. LiDAR data will be gathered as part of a research program into low impact monitoring methodologies and the data will be reviewed and assessed for applicability in ongoing monitoring programs.

**Floristic Monitoring**

Data on each of the five parameters will be collected using techniques described in the UQFM Handbook. The five monitored parameters will be measured seasonally (excluding winter).

**Groundwater**

The existing groundwater monitoring program will be expanded to monitor the shallow groundwater system and to determine whether there are any mining related impacts. Groundwater is monitored using a series of piezometers installed in swamp systems. These piezometers are used for direct measurement of swamp groundwater fluctuations. Groundwater chemistry is monitored only in piezometers located in permanently waterlogged swamp conditions as sampling in periodically waterlogged conditions is often not possible due to the lack of groundwater in the piezometer. Chemical analysis is carried out for analytes that will indicate mining-induced changes in the swamp systems.
**Surface Water**

Surface water monitoring comprises flow rate monitoring, pool water level monitoring and water quality monitoring. Flow rate monitoring using flow meters is proposed to be adopted due to the difficulty in establishing stream flow weirs. Water pool level monitoring will be used in combination with flow rate monitoring in order to monitor stream flow.

Sampling of the surface water is carried out fortnightly. The main parameters that are monitored to detect these impacts, and the justification for their use, are:

- **pH**: Typically, pH in the permanently waterlogged swamps is low (~5 to 6), and any oxidation of minerals in the rock may alter the pH on a local basis. This is the most important parameter as any long-term change in the pH could affect the vegetation in the swamp.

- **EC**: Conductivity of the surface water in the swamps is normally very low (< 50 μs/cm) and chemical processes could result in an increase in the TDS and a consequent increase in conductivity.

- **Fe**: Iron-based minerals are common in the sandstones and tend to oxidise on exposure to surface conditions.

- **Mn**: Like iron, Mn is common in the sandstones and will oxidise when exposed to surface conditions.

- **TSS**: Although erosion is not expected to occur the monitoring of total suspended solids will give an indication of the onset of any erosion upstream in the swamp.

**Hanging Swamps**

A different approach is proposed for the monitoring of the hanging swamps relative to shrub swamps for the following reasons:

- The only mining-related effects that could impact on hanging swamps are surface cracking or excessive tilt that interferes with swamp hydrology. While cracking is theoretically possible no cracking has ever been observed in soft soil or peat covered areas due to the relatively low strains that are normally experienced in this area. In addition, the predicted (and previously measured) tilts are well below the surface tilt required to reverse the hydraulic gradient in these swamps, which follows the dip of the local strata.

- Numerous hanging swamps have been previously undermined by more than 40 longwall panels in both Springvale and Angus Place Mines, and there has not been any report of cracking within a hanging swamp or damage to the vegetation as a result.

- Hanging swamps generally do not have a thick peat base or a consistent free groundwater surface that can be measured. As a result, the conditions are not suited to the installation of swamp piezometers. The current EPBC 2011/5949 approval recognises that it is not practical to install swamp piezometers in hanging swamps and does not require their installation or monitoring. Instead flora monitoring (as described in the UQFM Handbook) is used to enable detection of change at hanging swamps.

- The base of hanging swamps is significantly steeper than in the shrub swamps so any seepage drains away relatively quickly.

- The steep topography associated with many hanging swamps does not permit the use of conventional terrestrial survey techniques. For this reason it proposed to use either LiDAR or photogrammetry to measure subsidence at hanging swamp sites. The current EPBC 2011/5949 approval recognises that it is not practical to use conventional terrestrial survey
techniques and LiDAR surveys are approved for the monitoring of subsidence at hanging swamps.

Centennial considers that the existing THPSS MMP addresses the recommendations of the PAC report in terms of monitoring and adaptive management. A detailed swamp monitoring programme will be developed following project determination based on the previously approved monitoring programme established under the EPBC2011/5949 THPSS MMP at Springvale Mine. A Trigger Action Response Plan will be developed as part of this monitoring programme to identify actions to be taken should identified trigger levels be exceeded. It is proposed that the current approved TARP for swamp monitoring, provided as Attachments 1-3, will be reviewed and modified to incorporate the swamps within the Springvale mine Extension Project Area.

**Draft Swamp Offset Policy**

On 28 May 2015, the Department of Planning and Environment released for public comment the Draft Policy Framework for Biodiversity Offsets for Upland Swamps and Associated Threatened Species Impacted by Longwall Mine Subsidence (the Draft Swamp Offset Policy). This Policy is for the calculation and subsequent provision of offsets for subsidence related impacted of longwall coal mining on upland swamps. The Policy aligns with the framework outlined in the NSW Biodiversity Offsets Policy for Major Projects (the Major Projects Policy). Overarching these policies, there are six principles for offsetting in NSW, These principles are outlined in the Major Projects Policy and are underpinned by an overarching need to avoid and mitigate impacts prior to providing offsets.

A key element of the Swamp Offset Policy is the recognition that longwall mining is not likely to result in a complete, or catastrophic, loss of an entire swamp. Rather, swamps may change in size, function, composition and integrity in only part of a swamp. How these impacts are compensated for is a key requirement of the Draft Swamp Offset Policy that is still under review.

In previous documents furnished to the Department of Planning and Environment on the Springvale Mine Extension Project, Centennial has outlined the processes adopted by the Company to avoid and mitigate impacts to swamps located within its mining footprint. These have included, but are not limited to, an extensive research program targeted at understanding the mechanisms of impact and modifying the mine design to reduce these mechanisms, where practical. The Planning Assessment Commission, in the Review Report, acknowledge that changes to the mine plan have reduced the potential financial benefits to the Applicant, however, it believes that such an approach is necessary to provide an appropriate balance between the protection of environmental assets and the recovery of economic benefits.

As a result of the significant body of research, Centennial has identified the mechanisms resulting from subsidence that are likely to result in a significant and irreversible impact to swamp communities. Importantly, the potential for partial impacts to swamps has also formed a key component of this research. Subsidence predictions alone will not result in the manifestation of irreversible impacts to swamp communities and there are many examples of where this is the case (refer to Chapter 2 of the Springvale Mine Extension Project Environmental Impact Statement). These mechanisms include:

- Erosion of the surface of a swamp;
- Changes in the size of a swamp;
- Changes in the ecosystem functionality of a swamp;
- Changes in the composition or distribution of species within a swamp; and
- Change to the structural integrity of a swamp.

The triggers used to establish these changes are described in the UQFM Handbook.
Using these triggers, there is one swamp that has the potential to be impacted in a way that may result in a significant impact. This swamp is Marrangaroo Creek Swamp. Marrangaroo Creek Swamp is located above Longwall 431 which is proposed to be mined in approximately 7 years. As identified in the PAC Review Report, there are adaptive management measures, informed by the above monitoring regime and associated triggers that could be undertaken by the Company well in advance of mining in the vicinity of this swamp. As such, an upfront worst case scenario liability for impacts to the swamp is not necessary.

Regardless, Centennial has undertaken an assessment, using the Framework for Biodiversity Assessment, of the potential worst case scenario liability for this swamp. This following summarises the approach taken, and resultant outcomes of this assessment.

The assessment undertaken has used a best fit vegetation community because of limitations in the vegetation classifications under the Framework for Biodiversity Assessment. This in turn produced seven (7) vegetation communities within the FBA that could be used to offset impacts.

There is no current mechanism within the FBA to assess either indirect or partial impacts. To compensate for this inadequacy in the framework tool, a condition reduction score of one (1) was applied (this results in a 30% reduction in habitat values, a reduction that is considered to be overly conservative as reductions in swamp functionality due to longwall mining at the Springvale Mine have not been seen to date). As a result, the 12.35 hectares of Marrangaroo Creek Swamp would result in 427 required ecosystem credits, equating to around 46 hectares of offset land required.

Taking the previous mapping of 300,000 hectares of the Greater Blue Mountains Region undertaken by the University of Queensland to identify potential privately owned land with lot sizes greater than 20 hectares, over 990 hectares of swamps occur on privately owned land across 106 lots. These lots have been identified based on the report undertaken by the University of Queensland as commensurate with vegetation characteristics with upland swamps, and specifically Temperate Highland Peat Swamps on Sandstone.

Neither the Biobanking Assessment Methodology nor the FBA contemplate a strict like for like offset expectation and the reality is, the FBA identifies a much broader suite of potential vegetation communities that could be used as offsets meaning more offset land is likely to be available.

On this basis, whilst, Centennial considers that the application of the Draft Swamp Offset Policy to the Springvale Project as inappropriate, Centennial has taken its application into consideration in the assessments undertaken to date and developed a practical and realistic framework for its implementation at the Springvale Mine.

While the Draft Swamp Offset Policy is under review and Centennial has made a submission on it, Centennial considers that the application of the Final Swamp Offset Policy is a more appropriate outcome, particular as the mechanisms outlined above provide a clear, statistically robust and scientifically defensible process for determining and responding to impacts. As a result, Centennial considers that draft conditions for the Springvale Mine Extension Project be revised to take into consideration the UQFM Handbook, the TARPs attached and the framework for offsetting Marrangaroo Creek Swamp outlined above.

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1. This community was HN633
2. It should be noted that these communities can be located within the Wollemi-Hawkesbury/Nepean IBRA subregion and any adjoining subregion.
3. The FBA does not provide a mechanism to determine equivalent land area for offsetting. Following consultation with the OEH Biobanking Team, the FBA Credit Convertor was used as the only measure to provide context around the relationship between credit requirements and land requirements.
Yours sincerely

James Wearne
Group Approvals Manager

Attached

- Attachment 1 - Trigger Action Response Plan Overview
- Attachment 2 - Trigger Action Response Plan – Management Measures
- Attachment 3 - Trigger Action Response Plan - Corrective Actions
- Attachment 4 – Peer Review of Angus Place Revised THPSS Monitoring and Management Plan
THPSS Monitoring and Management Plan

- Subsidence Monitoring
- Flora Monitoring
- Groundwater Monitoring
- Surface Water Monitoring

Trigger Level Exceedance

- Data Error
- Non-mining-related impacts
- Possible mining-related impacts
  - Management Measures – Chart 2
  - Corrective Actions – Chart 3

Trigger Types
Actions

Response Plan

- Minimal Impact
- Severe Impact
THPSS Monitoring and Management Plan – ongoing monitoring

- If a trigger level exceedance is identified the following Management Measures to be carried out within 2 months

  If trigger level exceeded?
  - No
  - Yes

  Check anomalous data for accuracy
  - No
  - Yes

  Is data accurate?
  - No
  - Yes

  Similar trigger at reference sites?
  - No
  - Yes

  Anthropogenic/natural impacts responsible?
  - No
  - Yes

  Abnormal weather conditions?
  - No
  - Yes

  Active mining within 200 m?
  - No
  - Yes

  Evidence of possible mining impacts?
  - No
  - Yes

Management Measures
- Amend anomalous data
- Review process
- Determine likely cause of trigger level exceedance
- Review trigger levels
- Report activities to relevant authorities
- Review trigger levels
- Check at next data review
- Additional monitoring may be warranted
- Implement Corrective Actions – Chart 3

- Misreading
- Human error
- Instrument damage
- Instrument malfunction
- Data handing error
- Calculation error
- Plotting error

- Compare data with data from reference sites

- Forestry activity
- Erosion
- Swamp damage
- Bushfire
- Vandalism

- Above average rainfall period
- Storm event
- Lightning
- Dry or drought conditions

- Statistical exceedence
**Attachment 3 - Trigger Action Response Plan - Corrective Actions**

- **Trigger level exceeded or evidence of mining impacts based on anomalous conditions from ongoing monitoring program**
  - Log trigger level exceedance – note date. Within 5 business days (20 days if trigger level not exceeded but impact detected) –
    - report exceedance to SEWPAC
    - provide monitoring results
    - explain likely or possible cause of exceedance

- **If anomalous subsidence is the trigger**
  - Within 4 weeks –
    - review all data
    - review other data streams for anomalies
    - carry out field inspection with appropriate consultants to examine conditions
    - investigate the need for more frequent or additional targeted monitoring
    - recommendations for future actions or investigations

- **Within 8 weeks –**
  - Report proposed corrective actions to SEWPAC
  - develop and implement additional monitoring, investigation and inspection program

- **Anomalous conditions remain?**
  - Yes
    - Monitor conditions for a six month period.
    - Undertake any necessary investigations
    - Review data from all monitoring programs

- **Anomalous conditions worsen?**
  - Yes
    - Formulate and Implement RESPONSE PLAN when directed to by the Minister
      - Review situation at end of six month period

- **THPSS Monitoring and Management Plan – ongoing**
  - Monitor conditions for an additional six month period.
  - Undertake any necessary additional investigations
  - Obtain opinions from appropriate experts
  - Investigate feasibility and cost of potential engineering solutions
  - Liaise with relevant govt departments on approvals for future engineering solutions
  - Review situation at end of six month period

- **Report worsening conditions to the appropriate Govt department/s under:**
  - Condition 11 of EPBC Act, 1999, approval.

- **Conduct Severe Impact Investigation**
  - Yes
  - Visit site 10 days after conditions worsened
  - Undertake any necessary investigations
  - Review situation at end of six month period
Mr Alex Taylor  
Assistant Director  
EPBC Compliance Monitoring Team  
Compliance and Monitoring Branch  
Environment Assessment and compliance Division.  
24th September 2014

Dear Mr Taylor,

Re: Peer Review of Angus Place Revised THPSS Monitoring and Management Plan

As you would be aware SEWPAC engaged Cenwest Environmental Services in 2010 to provide independent advice to determine whether or not a significant impact had occurred on Temperate Highland Peat Swamps on Sandstone (THPSS) within the Angus Place Colliery Lease on the Newnes Plateau. Cenwest\(^1\) identified significant and adverse impacts to some Temperate Highland Peat Swamps, but not to all THPSSs that had been undermined by Long Wall Mining in both Angus Place and Springvale Collieries. Such adverse impacts were not evident in control sites that had not as yet been undermined or would not be undermined. Cenwest’s report detailed a number of criticisms re the then THPSS monitoring program including the sub-optimal practice of relying on a single 20m square quadrat/swamp to determine any potential impacts from Long Wall Mining. That particular monitoring program was and is incapable of detecting either short or long-term potential impacts on THPSSs. Nevertheless it was accepted by various compliance agencies as an appropriate methodology.

Since mid-2013 I have been engaged from time to time by Centennial Coal to advise them re minimising or avoiding adverse impacts in future longwall mining operations where there is a potential for an adverse impact on THPSSs as well as peer reviewing various reports relevant to the monitoring of swamp health. These included the development of a robust floristic monitoring program within THPSSs,\(^2\) understanding the proposed revised long-wall mining configuration to minimise subsidence, familiarising myself with the monitoring of predicted subsidence dynamics below swamps and the monitoring of within swamp hydrological dynamics using piezometer arrays. I am writing to you regarding my peer

\(^1\) Goldney, David, Mactaggart, Barbara and Merrick, Noel (2010) Determining whether or not a significant impact has occurred on Temperate Highland Peat Swamps on Sandstone within the Angus Place Colliery lease on the Newnes Plateau. Cenwest Environmental Services.

review of the Angus Place EPBC 2011/5952 THPSS Monitoring and Management Plan (MMP).

The following two reports commissioned by Centennial Coal have been particularly valuable in providing important insights into developing robust and repeatable monitoring of THPSSs since our 2010 report:

1. Fletcher and Erskine (2014)³ This pivotal paper outlines a robust and rigorous methodology for monitoring THPSSs using a range of methods including the use of small UAV platforms to capture remotely sensed imagery of a shrub swamp community thereby enabling the detection of change in condition and composition of a THPSS that can be correlated with potential impacts from longwall underground mining. This technology is integrated with an equally robust field monitoring program using distributed - mini-plots, randomised and stratified and designed to minimise trampling impacts by field scientists. The outcome is a robust and achievable monitoring program with the power to determine if an adverse impact has occurred within a particular THPPS as a result of longwall mining.

2. McHugh (2013)⁴ has demonstrated the importance of recognising the Burralow geological formation in the Narrabeen series in regard to swamp formation and integrity. McHugh demonstrated the greater than expected thickness of the Burralow Formation, the presence of aquitards in the formation and hence the more-or-less permanent water sources important for the formation and maintenance of hanging swamps. The aquitards are also an important source of water for maintaining the Newnes Plateau Shrub Swamps. Hence it is not surprising that the majority of the shrub swamps are located within the confines of the Burralow formation, occurring in much broader and gently sloping depressions that are usually waterlogged in the lower reaches. In contrast Banks Wall-type and ‘mixed-type’ shrub swamps are generally smaller in area and located on steep-sided gullies and have less access to seepage at discharge points. Furthermore McHugh rightly argues that ‘The occurrence of the Newnes Plateau Shrub Swamps are multifactorial involving a complex interplay between topography, hydrological regimes and geology’.

It follows from these understandings that programs designed to monitor THPSSs need to integrate contemporary understandings of geology, hydrology and ecology of THPSSs. Some of the research carried out during the course of the development of the monitoring program has already been published in peer reviewed journals and more such peer-reviewed papers are to come or in the pipeline. Furthermore the THPSS MMP monitoring program is also embedded in a wider program seeking to better understand variability within swamps as well as across the landscape.

³ Fletcher, Andrew and Erskine, Peter (2014) Monitoring surface condition of upland swamps subject to mining subsidence with very high-resolution imagery. Centre for Mined Land Rehabilitation, The University of Queensland, St Lucia 4072.

Centennial Coal well understands that any changes to the vegetation of a THPSS is a tertiary response and therefore it follows that it is important to integrate vegetation monitoring with groundwater and subsidence monitoring, as well as with longwall design aimed to minimise or completely avoid adverse impacts on THPSSs. This integration of monitoring methods is achieved in the integrated management plan.

I have much pleasure in commending the proposed UQ Flora Monitoring Handbook to you. Further, in the light of the positive advances in the Handbook, I am able to advise you that I have now completed my Peer Review of the THPSS MMP as required.

I would also like to congratulate Centennial Coal Pty Ltd for readily embracing and facilitating this new and robust monitoring paradigm that will likely lead to safeguarding THPSS integrity and health within their mining domain.

Yours Sincerely

[Signature]

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