Mandalong Southern Extension Project
Modification 4 - Extension of Longwalls 22 and 23
(SSD 5144 MOD 4)

Environmental Assessment Report
Section 96(2) of the *Environmental Planning and Assessment Act 1979*

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1. BACKGROUND

Centennial Mandalong Pty Limited (Centennial) owns and operates the Mandalong Coal Mine, located near Morisset, approximately 35 kilometres (km) southwest of Newcastle, in the Central Coast and Lake Macquarie local government areas (see **Figure 1**).

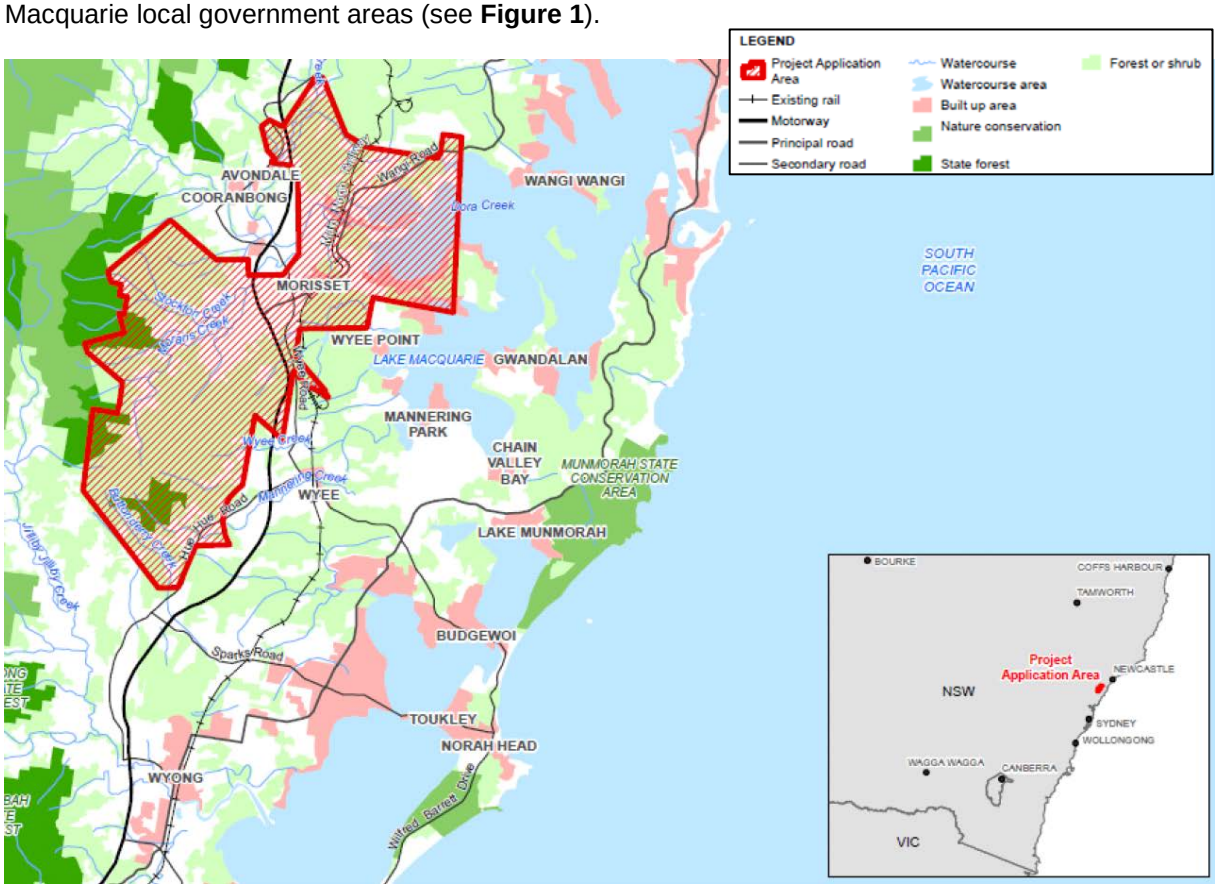

Figure 1: *Location of the Mandalong Coal Mine*

The Mandalong Coal Mine was originally approved under development consent DA 97/800 granted in 1998. In October 2015, consent was granted for the Mandalong Southern Extension Project (MSEP) under SSD 5144. The MSEP involves the continuation and extension of existing mining operations, as well as the development of an additional 40 longwall panels in the Southern Extension Area. SSD 5144 has been modified three times to:

- relocate an existing transmission line;
- extend first workings associated with Longwalls 22 and 23; and
- increase the annual production limit from 6.0 to 6.5 million tonnes per annum (Mtpa) of run of mine (ROM) coal.

Under SSD 5144, mining operations can be undertaken until 31 December 2040.

2. PROPOSED MODIFICATION

On 18 November 2016, Centennial lodged a modification application for the MSEP under section 96(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The modification seeks to:

- extend Longwall Panels 22 and 23 by 582 and 761 metres (m), respectively; and
- extract approximately 1.4 million tonnes of additional run of mine (ROM) coal from the extended panels.

An igneous sill lies to the west of existing longwall panels 22 to 24. Due to previous uncertainty over the extent of this sill, these panels were first designed to be shorter to avoid the sill impacting on the mine's production. However, due to ongoing geological exploration and successful extraction of adjacent panels below the sill, its extent has become better understood.

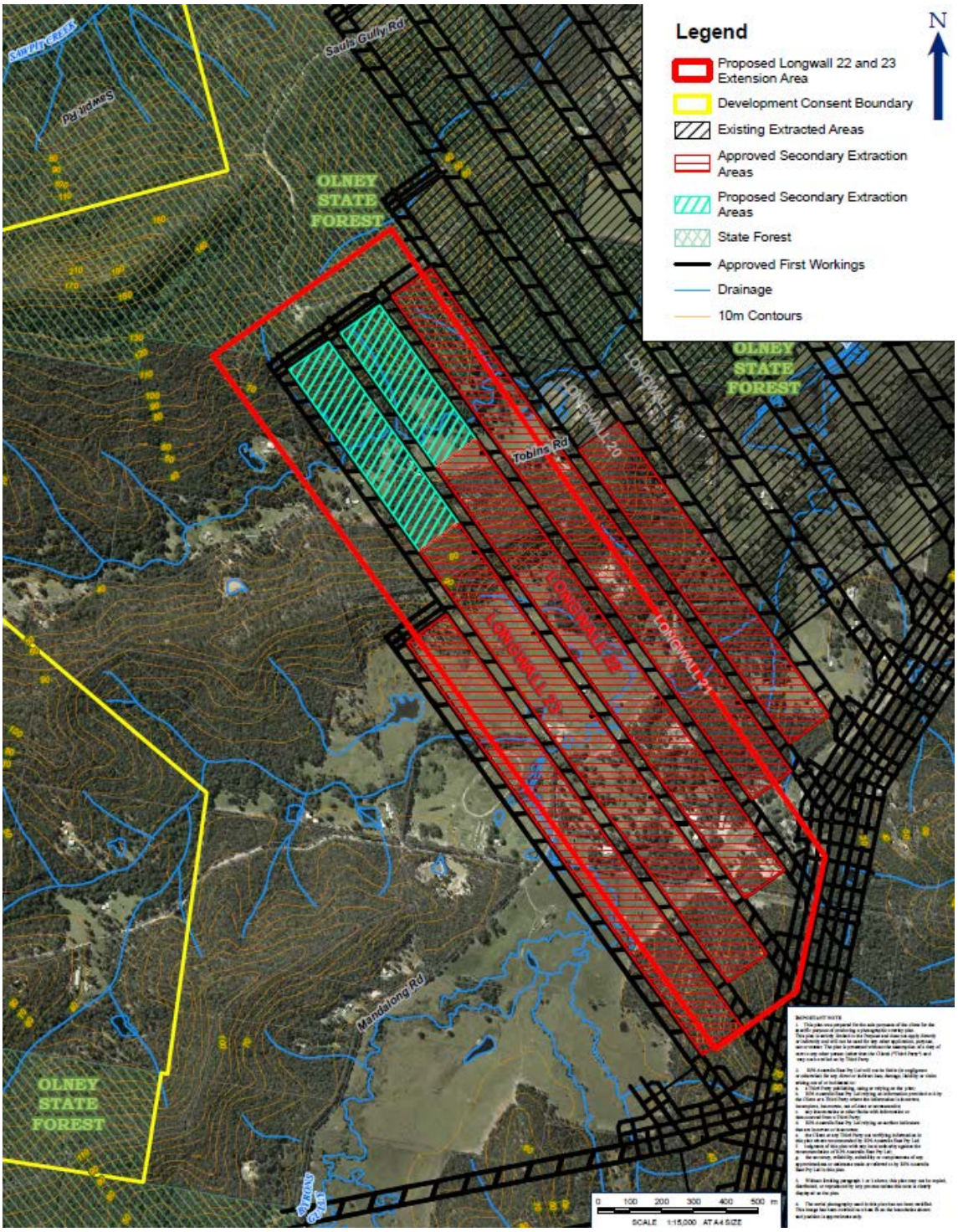

Figure 2: *Approved and proposed longwall layout*

In effect, the modification would allow an extension of mining in the West Wallarah Seam and would utilise the existing underground workforce and mining equipment. No changes are proposed to the approved mine life, extraction rate, delivery limits, hours of operation or site infrastructure (including ventilation systems). In addition, the proposed mining extension would be within the existing Project Application Area (see **Figure 2**).

Table 1 provides details of the geometry of existing Longwalls 22 and 23 and the proposed amendments.

Table 1: *Proposed Longwall Amendments*

Longwall No.	Existing Length (m)	Proposed Length (m)	Additional Yield (tonnes)
22	1,630	2,212	617,381
23	1,631	2,392	799,933

A detailed description of the modification is provided in Centennial's Statement of Environmental Effects (SEE, see **Appendix A**).

3. STATUTORY CONTEXT

3.1 Section 96(2)

The modification application proposes to modify the consent granted under SSD 5144 in accordance with section 96(2) of the EP&A Act.

By operation of section 96(2)(a), a consent cannot be modified unless the consent authority is satisfied that the modified proposal is substantially the same development as the development for which consent was originally granted. The modification application does not seek to change the nature or scale of development approved under the development consent. Rather, the modification involves a relatively minor expansion of the development as originally proposed. The Department is satisfied that the proposed modification is within the scope of section 96(2), and may be determined accordingly.

3.2 Approval Authority

The Minister for Planning is the approval authority for the proposed modification. However, the Executive Director, Resource Assessments and Compliance may determine the modification application under the Minister's delegation of 16 February 2015. This is because less than 25 objecting public submissions were received, neither Central Coast nor Lake Macquarie City Councils objected to the proposal, and no political donations have been reported by Centennial,

3.3 Landowner's Consent

The proposed longwalls would be located underneath both privately-owned land and State forest. However, as SSD 5144 was 'public notification development' under clause 49(4) of the *Environmental Planning & Assessment Regulation 2000* (EP&A Regulation), landowner's consent was not required for the lodgement of the development application. By operation of clause 115(2) of the EP&A Regulation, the same principle applies to a modification application. Therefore, the written consent of the third-party property owners is not required for the lodgement of this application.

3.4 Environmental Planning Instruments

A number of environmental planning instruments apply to the modification, including:

- *State Environmental Planning Policy (SEPP) (Mining, Petroleum and Extractive Industries) 2007*;
- *SEPP (Infrastructure) 2007*;
- *SEPP (State and Regional Development) 2011*;
- *SEPP No 33 – Hazardous and Offensive Development*;
- *Lake Macquarie Local Environmental Plan 2004*;
- *Lake Macquarie Local Environmental Plan 2014*; and
- *Wyong Local Environmental Plan 2013*.

4. CONSULTATION

After accepting the SEE (see **Appendix A**) for the proposed modification, the Department:

- publicly exhibited the SEE from 1 to 15 December 2016 on the Department's website and at the:
  - Department's Information Centre;
  - Central Coast Council's and Lake Macquarie City Council's offices; and

  - Nature Conservation Council's office;
- advertised the exhibition of the SEE in the *Central Coast Express Advocate* and the *Lakes Mail*;
- notified relevant State government agencies, utility providers, and the two local Councils; and
- notified each person that made a submission in relation to the original development application.

The Department is satisfied that the notification process met the requirements of the EP&A Act and the EP&A Regulation.

4.1 Agency Submissions

The Department received eight submissions from government agencies. No issues were raised by **Heritage NSW**, **Roads and Maritime Service,** the **Environment Protection Authority** and **NSW Health**.

The **Office of Environment and Heritage** (OEH) raised concerns that Centennial's survey effort above the proposed longwall extensions had not appropriately quantified the biodiversity values of the site, and that it did not meet OEH's survey requirements. OEH noted that without adequate surveying prior to mining, it would be difficult to monitor post-mining impacts. OEH recommended that full surveys be undertaken or Centennial provide an assessment of biodiversity impacts under the Framework for Biodiversity Assessment. This matter is discussed further in **Section 5.3**.

Lake Macquarie City Council (LMCC) raised concerns with the potential increase in greenhouse gas emissions associated with coal mining. Further information was requested on the Ventilation Air Methane Regenerative After Burner (VAM RAB) being trialled at Mandalong Mine to determine whether this technology could reduce further emissions.

Department of Primary Industries Office of Water (DPI Water) recommended that the mine's existing water management plan is updated to address potential impacts of the proposed modification. DPI Water requested that Centennial provide a consolidated list of all water licences held for Mandalong to demonstrate that it can account for the incremental increase of groundwater extraction from the proposed modification. Additionally, DPI Water sought further information on the impacts of the proposed modification on the catchment of Dora Creek.

The **Division of Resources and Energy** (DRE) within the Department of Industry considered the information in the SEE to be adequate to identify and address risks to the environment associated with the proposed modification. DRE noted that no changes were proposed to the mine's surface footprint or final land use.

The Department did not receive a submission from **Central Coast Council.**

4.2 Public Submissions

The Department received 13 public and special interest group submissions for the proposed modification. These submissions comprised 11 objections and two supportive submissions.

The majority of objections raised concerns about the potential impact on water resources, particularly the Dora Creek catchment. Concerns were raised that the Water Resources Impact Assessment (WRIA) did not adequately consider catchment flows due to their ephemeral nature and that the WRIA lacked an independent perspective.

Additionally, objectors raised concerns with the potential increase in salts extracted from groundwater inflows, and noted that following transfers to the Borehole Dam, subsequent discharges were not clearly defined. It was also emphasised that long-term salinity impacts can affect water and land resources and that a sound approach to handling saline discharges should be defined by Centennial.

A copy of all submissions can be found in **Appendix B**.

4.3 Response to Submissions

Centennial provided a Response to Submission (RTS) on 31 January 2017, addressing all submissions received during the exhibition period. The RTS was made publicly available on the Department's website. A copy of the RTS can be found in **Appendix C**.

5. ASSESSMENT

The Department has assessed the merits of the proposed modification in accordance with the relevant objects and requirements of the EP&A Act. In its assessment, the Department has considered the:

- EIS for the original development application;
- conditions of consent for the development as originally approved;
- the modification application, SEE, and RTS; and
- relevant environmental planning instruments, policies and guidelines.

The Department considers the key impacts of the modification relate to subsidence, water resources and biodiversity. Consideration of these impacts is provided below, with consideration of other impacts provided in **Table 4**.

5.1 Subsidence

5.1.1 Introduction

Underground longwall mining operations commenced at Mandalong Mine in January 2005. Under SSD 5144, granted in 2015, Centennial is permitted to continue and develop mining operations in the West Wallarah and Wallarah-Great Northern Seams.

The modification would cause surface and sub-surface subsidence impacts, including cumulative subsidence impacts, which could affect a range of natural and built features. An assessment of these impacts was provided in the SEE's Subsidence Assessment (SA). The subsidence impact zone assessed in the SA was set as the greater of the 20 mm subsidence contour and a 26.5 degree angle of draw from the proposed longwalls.

In accordance with the Department's standard practice for managing mine subsidence, SSD 5144 already contains consent conditions which stipulate key subsidence performance measures and require the development of a detailed Extraction Plan to govern the extraction of the approved longwall panels. Extraction Plans are required to be approved by the Secretary before carrying out any second workings. Key potential subsidence impacts are considered below.

5.1.2 Subsidence Predictions and Effects

Subsidence effects refer to the deformation of the groundmass due to mining, including all mining-induced ground movements. 'Conventional subsidence' includes vertical displacement, tilt, and tensile and compressive strains. 'Non-conventional subsidence' components include those arising in steep or incised topography (valley closure and upsidence) and far-field horizontal movements.

The SA states that similar geotechnical conditions would be encountered by Longwalls 22 and 23, as those for previously mined longwalls on the site. A review of subsidence impacts to date identified that vertical subsidence of less than one metre is generally experienced across the mining area.

The width of Longwalls 4 - 23 is 160 m. However, Longwalls 22 and 23 would incorporate narrower chain pillars (a width of 37 m compared to 46 m used previously) which is consistent with the Approved Mine Plan contained in SSD 5144. Centennial predicts that the narrower chain pillars could result in approximately 10-15% of additional subsidence impacts. However, despite this potential increase, predicted impacts would remain within the approved limits of extraction under the existing consent.

Table 2 summarises the proposed predicted conventional subsidence effects for the extended Longwalls 22 and 23 in comparison to the maximum predicted subsidence approved under SSD 5144.

Table 2: *Predicted conventional subsidence effects – approved vs proposed*

Subsidence Parameter	Range of Subsidence Effect (Approved, all longwalls)	Predicted Subsidence Effect (LW 22-23)
Maximum Vertical Subsidence (mm)	270-1340	960
Maximum Tilt (mm/m)	3-40	7.1
Maximum Tensile Strain (mm/m)	1-7	1.6
Maximum Compressive Strain (mm/m)	2-8	3

The maximum predicted vertical subsidence resulting from the proposed modification is 960 mm, which represents approximately 18% of the West Wallarah seam thickness. The predicted values for maximum tilt and tensile and comprehensive strains are low and within the approved range of subsidence impacts.

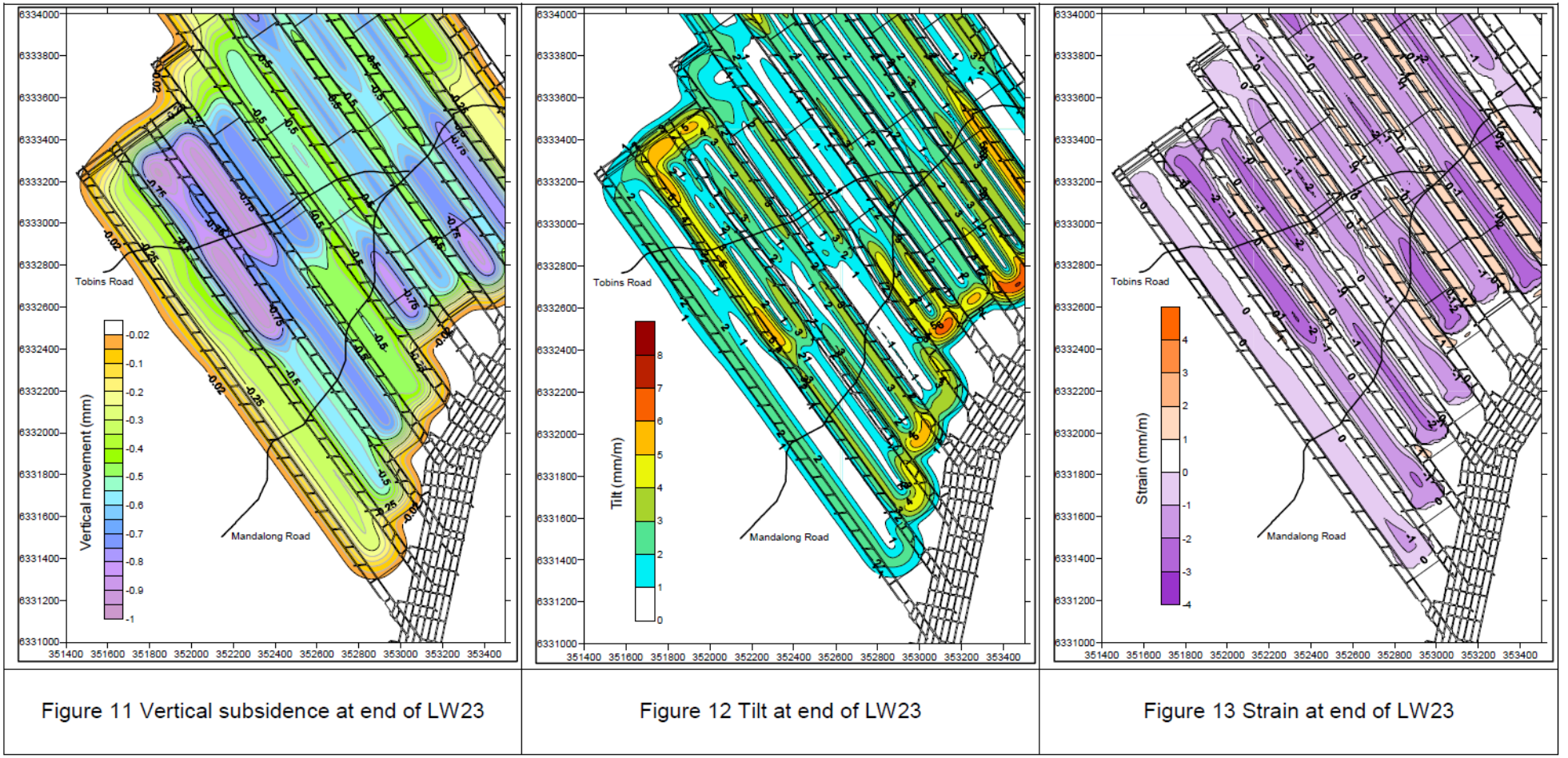

Figure 11 Vertical subsidence at end of LW23

Figure 12 Tilt at end of LW23

Figure 13 Strain at end of LW23

Figure 3 *– Predicted vertical subsidence, tilt and strain at the end of Longwall 23*
Note: Longwall 23 is the most southerly longwall in this figure.

The maximum predicted values for all parameters occur above the north-western end of Longwall 22 (see **Figure 3**).

The SA notes that it is unlikely that any tensile cracking or compressive buckling will develop in soil or rock. Additionally, due to the low values of tilt and strain, no significant far-field subsidence or 'upsidence' impacts are predicted to occur.

Discontinuous fracturing above the proposed longwalls is predicted to extend up to 100 m above the coal seam. However, as the minimum depth of cover is approximately 280 m, the fracture zone is not predicted to reach the surface.

The Department is satisfied that an appropriate subsidence prediction model has been used by Centennial and notes that the model is calibrated using local geological information and monitoring results from completed longwalls at the mine. The Department considers that Centennial's subsidence predictions are likely to be conservative.

5.1.3 Surface Features and Potential Impacts

The proposed modification area is comprised of rural pastoral areas and properties, creeks, roads and forest vegetation. The topography is generally characterised by the floodplains of Morans Creek and Tobins Creek and their valley slopes and ridgelines.

Houses and Rural Structures

The SA considered four specific built structures within the proposed longwall extension area. These structures and their predicted subsidence impacts are detailed in **Table 3**.

***Table 3**: Predicted impacts at four structures above longwall extension areas*

Building Reference	Building Type	Vertical Subsidence (m)	Tilt (mm/m)	Strain (mm/m)	Horizontal Subsidence (m)
A (R73)	Horse Shelter	0.84	1.2	-2.3	0.04
B (R73)	Dwelling	0.37	1.4	0.7	0.04
C (R80)	Timber Cabin	0.77	4.9	-1.1	0.14
D (R207)	Dwelling	0.03	1.0	0.4	0.03

Under DA 97/800 (Longwalls 1-24), these structures were located beyond the anticipated 20 mm limit and no previous subsidence assessment was undertaken. Predictions in the SA for these structures are less than the maximum subsidence predictions encountered at the Mandalong Mine to date and Centennial predicts that the houses and cabin would remain in a safe, serviceable and repairable condition throughout mining, in accordance with Subsidence Advisory NSW (SA NSW) criteria.

Previous longwall mining indicates that tilt of less than 7 mm/m generally does not result in significant impacts to houses. Houses may experience some minor and repairable serviceability impacts such as cracking of internal plasterboard or cornices.

Under the existing consent, Centennial is required to manage subsidence impacts on private property through a Property Subsidence Management Plans (PSMPs) which are developed in consultation with each landholder. All four potentially impacted structures have been included in the PSMP process for Longwalls 22-23 and would be subject to pre and post-mining subsidence monitoring.

The Department is satisfied that the structures within the proposed modification area would not be significantly impacted and that any minor impacts would be readily identified and repaired.

Electrical and Telecommunications Infrastructure

Three TransGrid towers (T45 – T47) on Transmission Line 24 (TL24) are likely to be impacted by subsidence from the proposed modification. Of these towers, Tower 47 is expected to experience the greatest vertical subsidence (460 mm), tilt (3 mm/m) and strain (0.79 mm/m). The SA predicts that these towers would remain in a safe, serviceable and repairable condition, in accordance with the SA NSW criteria.

However, to mitigate subsidence impacts on TL24, Centennial has entered into an agreement with TransGrid to construct concrete cruciform footings on Towers 45, 46 and 47. This method is supported by DRE as an appropriate method for managing impacts of mine subsidence on transmission towers set in a straight line.

The existing consent requires Centennial to provide a Built Features Management Plan to manage potential subsidence impacts and/or environmental consequences to key items of public infrastructure. Centennial has proposed to update this plan to include a TransGrid Management Plan. This plan would require the Secretary's approval prior to the towers encountering any subsidence impacts from Longwalls 22-23.

The Department is satisfied that potential impacts to the three Transgrid towers would be limited and can be managed in accordance with the existing conditions of consent and Centennials proposals.

Local Roads
Tobins Road and Mandalong Road run across Longwalls 22 and 23, with sections of Tobins Road passing directly above the proposed extension area. The predicted strains may be sufficient to cause minor compression bumps in the bitumen seal of these roads. However, these impacts are likely to be similar to, or lower than, previous predictions (See Figures 15 and 16 of SA). The Department is satisfied that the existing Built Features Management Plan requirement is appropriate to manage impacts on local roads and significant long-term impacts are unlikely.

5.1.4 Conclusion

Existing consent conditions require Centennial to ensure compliance with subsidence performance measures for the natural and built environment. This includes providing compensatory and offset measures in the event of any exceedance. Centennial is required to monitor subsidence levels as part of the Extraction Plan for all second workings on site. Monitoring to date has shown that the actual recorded subsidence levels are less than predicted.

The Department is satisfied that subsidence levels and resultant impacts during and following the mining of the extended longwall panels are likely to be similar to those which have been recorded for the 19 longwall panels mined to date. Given the existing requirements already in place, the Department is satisfied that no additional conditions of consent with regard to subsidence management are required, other than updating the Extraction Plan to include the proposed extension of Longwall Panels 22 and 23.

5.2 Water Resources

The modification would cause surface and sub-surface subsidence impacts, which could affect a range of surface water and ground water features. The SEE included a Water Resources Impact Assessment (WRIA) as well as a Flood Impact Assessment.

5.2.1 Groundwater Resources

The main sources of water that make up the groundwater regime within the Mandalong Mine and surrounding area are low yielding alluvial and non-alluvial aquifer systems.

The alluvial system comprises a shallow aquifer with a depth of up to approximately 20 m and a water table ranging in depth from less than one to approximately three metres below ground level. Previous monitoring of groundwater quality has indicated consistent pH levels of between 5 and 8 and variable electrical conductivity (EC) levels ranging from 1,000 to over 10,000 µS/cm.

The non-alluvial hard rock aquifer system comprises porous and fractured rock aquifers including coal seams and overburden rock. Deeper groundwater monitoring indicates that depressurisation of these water sources occurs up to 230 m above the longwalls with the greatest depressurisation occurring at 120 m above the longwalls. Monitoring of groundwater quality for both pH and EC has indicated considerable variability in results. However, the WRIA notes that both parameters have generally remained within the pre-mining range during and after undermining. This variability in monitored EC has also reduced following an update of the groundwater monitoring methodology.

The potential impacts of subsidence on groundwater resources are discussed below.

Groundwater Levels / Pressure
Alluvial groundwater levels in the vicinity of the proposed longwall extensions are predicted to reduce by no more than 0.1 m. This reduction is expected to be localised and temporary in nature and is likely to be the result of shallow tensile and compressive cracking. The WRIA notes that these cracks are

expected to fill over time following the completion of Longwalls 22 and 23. Consequently, the hydraulic conductivity and porosity would likely return to its pre-mining state.

Alluvial groundwater levels can vary by approximately 1 m due to climatic variations. Accordingly, the proposed reduction of 0.1 m is considered to be minor. Additionally, groundwater monitoring at Mandalong Mine indicates that the majority of reductions in alluvial groundwater have occurred at locations with a depth of cover within 170 m – 200 m. As the depth of cover above the proposed extended longwalls is 250 m, there is unlikely to be any adverse effect on groundwater levels in the near surface aquifer system.

The WRIA calculated drawdown as the groundwater pressure differential, pre and post mining. For fractured and porous rock sources, it was predicted that drawdown would extend laterally up to 226 m within the 50 m layer of overburden above the coal seam. This is less than the maximum predicted drawdown extent at the end of the Mandalong Southern workings (273 m). The predicted 2 m drawdown contour at the completion of mining in 2037 is generally within 2 km of Mandalong Mine and within approximately 1.8 km of Longwalls 22 and 23. The Department notes that there are no Groundwater Dependent Ecosystems (GDEs) or privately-owned bores that rely on water within this layer of overburden.

Depressurisation greater than 2 m may occur in fractured and porous rock water sources up to 230 m above the longwalls. This is consistent with existing levels of depressurisation at the mine.

The Department considers that the proposed impacts are within the Level 1 minimal impact considerations under the *NSW Aquifer Interference Policy* and are acceptable.

Mine Inflows

Increasing mine inflows at Mandalong Mine over time are likely to relate primarily to the extension of the mining footprint. The proposed modification would result in additional groundwater inflow of 0.1 megalitres (ML) per day during 2017 and 2018. This additional inflow would result in a small incremental increase in total water inflow into the mine. Following their completion in 2023, modelling indicates no ongoing observable increase in groundwater inflows into the mine workings attributable to the extraction of Longwalls 22 and 23.

Groundwater Quality

There has been no change in groundwater pH or EC resulting in a lowering of the beneficial use category (primary industry) since longwall mining began at Mandalong Mine in 2005. It is not expected that the proposed modification would reduce the beneficial use category for either alluvial or fractured and porous rock groundwater sources.

Considering the history of water quality at the site and the minor nature of the proposed longwall extensions, the Department is satisfied that there would be no adverse impacts on water quality as a result of the proposed modification.

Water Users

There is unlikely to be an adverse impact on alluvial groundwater the vicinity of the extended longwalls. Additionally, no registered alluvial bores are located within this area.

However, there are four registered bores within the affected area of fractured and porous rock aquifer. Two of these bores are not expected to experience drawdown due to their depth of cover greater than 230 m and one has been abandoned and has not been assessed.

Drawdown of approximately of 0.9 m is expected at groundwater bore GW078601. This bore is located approximately 180 m above the coal seam. Drawdown would likely be due to discontinuous fracturing.

DPI Water raised no objections to the proposed impacts on water users. However, it recommended that the Water Management Plan be updated to make provisions for all impacted surface and groundwater users (i.e. not limited to 2 m drawdown).

The Department considers that the proposed impacts are within the Level 1 minimal impact considerations under the *NSW Aquifer Interference Policy* and are acceptable.

Groundwater Dependent Ecosystems

GDEs within the proposed modification area include *Coastal Wet Gully*, *Alluvial Tall Moist Forest* and *Alluvial Floodplain Cabbage Gum Forest*. These GDEs are located along ephemeral drainage lines and are likely to be reliant on the shallow alluvial aquifer.

Due to the depth of cover above the proposed longwalls, impacts on the shallow aquifer system would be negligible. The Department is satisfied that the proposed modification would not significantly impact GDEs.

Management and Monitoring

Centennial proposes to manage and monitor groundwater resources in accordance with its existing regional and site-specific management plans. Centennial's Extraction Plan is required to include a Water Management Plan which requires the Secretary's approval prior to commencing extraction of Longwalls 22 and 23. These plans require Centennial to undertake comprehensive groundwater monitoring to ensure that water management measures are effective and that any adverse impacts can be readily identified, mitigated and rectified.

The Department is satisfied that the existing conditions of consent regarding groundwater would appropriately manage the impacts of the proposed modification.

5.2.2 Surface Water Resources

There are two small watercourses and several unnamed tributaries in the vicinity of the proposed modification area. These catchments are considered to be ephemeral and contribute to the wider Dora Creek catchment via Stockton Creek. Tobins Creek is located directly above the proposed extended longwalls and drains in a north-easterly direction. Morans Creek is located further south and runs in a northerly direction above the approved areas of Longwalls 22 and 23.

The maximum predicted impacts to these creeks would occur above Longwalls 21 and 19, with a maximum grade changes between 1- 4%. Subsidence and associated grade changes are predicted to be less than these maximum impacts and would be unlikely to alter the flow capacity of the primary channels in the vicinity of Longwalls 22 and 23. The potential grade changes are likely to occur downstream of chain pillars and would be similar to existing channel gradients.

Loss of water from these two watercourses is not expected as the height of continuous and discontinuous fracturing is not predicted to extend to the surface and surface cracking is not predicted.

A 0.2 m headcut was identified in Tobins Creek above the proposed extension area of Longwall 23. Centennial considers that this headcut is unlikely to be exacerbated due to its location. However, it is proposed to undertake regular monitoring of flow paths at this location.

Remnant ponding is predicted to occur inside and outside of channel areas within the predicted zones of subsidence. Centennial has proposed to monitor at seven locations to identify if any ponding occurs and, if required, undertake remediation drainage works.

DPI Water recommended that Centennial implement a monitoring and rehabilitation strategy for Tobins Creek and its two tributaries, particularly in areas directly above the proposed longwall extension. This recommendation is accommodated in the existing Water Management Plan condition.

Water Licensing, Discharge and Salts

The sources of water at Mandalong Mine's surface site includes potable water supplies, rainfall, runoff and groundwater inflow into the underground mine workings which is subsequently pumped to the surface.

Water balance modelling for the proposed modification indicates that rainfall, runoff, evaporation, transfers from the Cooranbong Entry Site (CES) and potable water supply to the underground workings would be similar to existing conditions. However, the modelling predicted an increase in groundwater inflows that would need to be transferred to the Borehole Dam at the CES and discharged through the site's Licensed Discharge Point (LDP001). The maximum groundwater extraction volume under the site's existing water licence is 1,825 ML per year. Under the modelled scenario the maximum groundwater extraction would be 1,264 ML/year in 2036.

In response to DPI Water's request, Centennial confirmed that only one water access licence is held for the Mandalong Mine and that extraction limits to date have been well below the licensed maximum.

An increase in groundwater inflows would also see additional salt transfers and discharges. This was a key issue raised in submissions. The proposed modification would result in a maximum salt discharge at LDP001 of 3,009 tonnes in 2036 with an average salinity in water discharged of 3,550 µS/cm. This is significantly less than the peak discharge predicted under SSD 1544 (8,583 tonnes per year with an average salinity of 4,970 µS/cm). This variation can be attributed to the improved data collection which was used to recalibrate the hydrogeological model at the time of Modification 3 (2016).

Changes to Flooding Regimes
A Flood Assessment Report was included in the SEE. This report analysed the cumulative impacts of underground mining for Longwalls 1-23, including the proposed extension areas for Longwalls 22 and 23.

This cumulative assessment predicted that the flooding hazard would increase by one level at six properties and two access routes during a 1 in 100 year ARI event. These locations would experience hazard levels 1 and 2 under OEH's *Floodplain Development Manual (2005)*. All these locations are located outside the proposed extension area.

Modelling indicates that very small changes in flooding regimes related to mining of Longwalls 22 and 23 would be limited to areas of predicted subsidence. Two properties are subject to predicted subsidence (identified as properties 73 and 207). Flood hazard level and predicted freeboard are not predicted to change at these properties and Department considers that adverse flooding impacts to these properties would be negligible.

Modelling also indicates an increase in potential remnant ponding as a result of the proposed modification. These impacts would also be limited to areas of predicted subsidence. Centennial has proposed to undertake monitoring at seven potential ponding locations during and after longwall mining, and if required, implement remedial drainage works. The Department considers these monitoring locations to be appropriate and recommend that they are included in the Extraction Plan for Longwalls 22 and 23.

OEH raised no objection to the proposed flooding impacts and the Department is satisfied that the predicted flood impacts are quite minor and can be adequately managed through the existing Extraction Plan process.

Management and Monitoring
Centennial currently implements a range of surface water management and monitoring measures across the mine site in accordance with its Site Water Management Plan. The Department is satisfied that the predicted impacts on surface water resources can be managed through existing management plan and Extraction Plan processes.

5.2.3 Conclusion
Overall, the Department is satisfied that:
- hydrological connection (i.e. cracking) between the coal seam and the surface is highly unlikely to occur;
- the proposed modification would have a negligible impact on regional groundwater levels and there would be no discernible drawdown in any alluvial aquifer;
- drawdown at GW078601 would be within the Level 1 minimal impact consideration under the *NSW Aquifer Interference Policy*;
- there would be no discernible impact on flow capacity in Tobins and Morans Creek;
- there would be no significant impact on the quality of groundwater or surface water; and
- flooding impacts would be minor and could be managed through existing conditions of consent.

The Department is satisfied that the modification would not result in significant adverse surface water or groundwater impacts and that any potential impacts can be managed through amendments to existing management and response plans and the implementation of a contemporary Extraction Plan process.

5.3 Biodiversity

An Ecological Impact Assessment (EIA) was included in the SEE. This assessment included database searches to identify flora and fauna species potentially occurring above Longwalls 22 and 23, as well as targeted surveys. However, due to accessibility, not all sites within the study area were surveyed.

In its submission, OEH identified that the EIA did not meet biodiversity survey requirements, and that the extent of biodiversity values in the project area was not fully known. It recommended that the biodiversity value of the project area be further quantified or an assessment be provided in accordance with the *Framework for Biodiversity Assessment* (FBA) (OEH 2014).

The RTS provided a revised Biodiversity Assessment Report (BAR) undertaken in accordance with the FBA. The proposed modification does not involve any additional surface development and there would be no direct impact on biodiversity as a result of clearing. However, potential impacts on biodiversity may occur through ponding, as a result of subsidence.

The BAR predicted that as a result of the proposed modification, ponding would increase by approximately 1.9 hectares (ha) of which 1.5 ha is classified as native vegetation. Approximately 1.37 ha of the potential ponding area contains four endangered ecological communities.

To minimise impacts to biodiversity, Centennial has proposed to monitor areas of predicted subsidence to identify any ponding requiring remediation. Centennial has also recommended that the detection and management of impacts to biodiversity are managed under the existing regional and site specific Biodiversity Management Plan. OEH accepted that the revised BAR provided a sufficient baseline against which future impacts to biodiversity can be measured.

As the proposed modification would not result in the direct clearing of vegetation, and the potential impacts on biodiversity are subsidence related, no offset strategy has been proposed. OEH raised no issue with this approach and identified that neither the FBA nor the *NSW Biodiversity Offsets Policy for Major Projects* effectively deals with impacts from mine subsidence, particularly when there is no direct clearing. However, OEH recommended a condition whereby if any threatened species, populations, or communities are harmed by unexpected subsidence, the impacts are offset in accordance with OEH's biodiversity offsetting policies.

The Department notes that the existing consent requires Centennial to provide suitable offsets where the subsidence impact performance measures are not met. This includes impacts on threatened species, populations and communities. The Department is satisfied that the impacts on biodiversity would be minor and that Centennial's proposed mitigation measures and the existing conditions of consent would allow for the effective identification of areas requiring remediation and/or offset.

5.4 Other Impacts

The Department is satisfied that the other impacts of the proposed modification are likely to be minor or negligible. The assessment of other impacts is summarised in **Table 4** below.

***Table 4**: Other impacts*

Issue	Impact and Consideration	Recommendation
Aboriginal Cultural & Historic Heritage	• A Heritage Impact Statement (HIS) focused on a study area within a 26.5 degree angle of draw around Longwalls 22 and 23. • A search of OEH's Aboriginal Heritage Information Management System identified three previously recorded Aboriginal sites within the study area, including a grinding groove, artefact scatter and isolated find. • Field surveys identified one scarred tree (#45-3-3678) located in the south-east corner of the study area. • All four identified sites were assessed as having low regional and local archaeological significance, except for the grinding groove which was assessed as having moderate local significance. • Two of these sites are located within predicted subsidence zones and two are located within the angle of draw. However, predicted tilts, strain and vertical subsidence at these sites are minimal and the	Existing conditions requiring management plans are appropriate to manage the predicted impacts on Aboriginal cultural and European heritage. Any heritage sites potentially affected by the mining of Longwalls 22 and 23 would be included and considered in a revised Extraction Plan prior to the commencement of second workings.

Issue	Impact and Consideration	Recommendation
	Department is satisfied that the risk of impact to these sites is low. • Centennial notes that registered Aboriginal parties were involved in the identification and surveying of these sites and would continue to be engaged in accordance with the site's Aboriginal Cultural Heritage Management Plan (ACHMP). • OEH raised no concern with respect to Aboriginal cultural heritage and recommended that the existing ACHMP is updated to include the location and significance of the sites found in the study area. • The Department is satisfied that the modification's potential impacts to Aboriginal sites could be appropriately managed under the ACHMP. • The proposed modification would not impact any registered historic heritage sites. • If during the course of development works any significant historic heritage material is discovered, Centennial has proposed to immediately cease works and notify OEH's Heritage Branch. • The Heritage Branch has agreed with this proposed approach and requested it as a condition of consent. • The Department considers that the existing condition requiring Centennial to update its Management Plans within three months of any modification would lead to satisfaction of this request.	
Soil and Land Resources	• The study area consists of land with Land and Soil Capability rating of Class 5, 6 and 7. The agricultural capability of the land ranges from moderate to very low. • No soil stripping activities will occur as a result of the proposed modification. However, the extended longwalls may result in an additional 1.9 ha of ponding from subsidence impacts. • Centennial has proposed to remediate soils that are subject to ponding by developing engineered drainage channels and applying gypsum to minimise erosion. • The Department is satisfied that potential impacts to land and soil resources could be appropriately managed via existing Extraction Plan conditions and rehabilitation requirements.	No additional conditions necessary.
Air Quality and Noise	• The modification is not expected to materially change the mine's approved air quality and noise impacts, which would continue to be managed in line with existing monitoring and management plans. • The contribution of the longwall 22 and 23 extensions to the total life-of-mine greenhouse gas emissions is less than 1%. • Centennial proposes to continue to support research into suitable abatement technologies regarding ventilation air methane.	No additional conditions necessary.
Socio-economic	• The modification would utilise the existing operational workforce and mining equipment to increase coal recovery, with minimal additional impacts on nearby receivers. The Mandalong workforce currently consists of 420 FTE employees. • The modification would allow recovery of an additional 1.4 million tonnes of ROM coal, provide continued employment for the mine's employees and contractors, provide continued State and Commonwealth taxes and royalties, and efficiently recover State-owned mineral resources that would otherwise be sterilised. • Properties 73 and 207 may experience minimal impacts as a result of the modification. Impacts to	No additional conditions necessary.

Issue	Impact and Consideration	Recommendation
	these properties would be mitigated and managed under Property Subsidence Management Plans.	

6. CONCLUSION

The Department has assessed the modification application, SEE, submissions and RTS in accordance with the relevant requirements of the EP&A Act. The modification would permit the extension of longwalls 22 and 23 and the extraction of an additional 1.4 million tonnes of ROM coal.

This assessment has shown that, subject to implementation of contemporary Extraction Plans, other management plans and the proposed mitigation measures, the modification can be carried out with minimal environmental impacts. Under existing conditions, all management plans, strategies and programs must be updated within 3 months of the approval of any modification.

The Department considers that the project would optimise the recovery of coal resources within approved extraction limits, using existing infrastructure and equipment. The Department has carefully considered the proposal's potential impacts on the natural and cultural environment and on nearby residents. Potential mine subsidence, water resources impacts and biodiversity impacts have been carefully considered. The Department is satisfied that all potential impacts can be appropriately managed under existing and/or updated conditions of consent.

The Department is satisfied that the proposed modification is in the public interest and should be approved, subject to conditions.

7. NOTICE OF MODIFICATION

A Notice of Modification (see **Appendix D**) and version of the Mandalong Southern Extension consent as proposed to be amended (see **Appendix E**) have been prepared. Centennial has accepted the proposed modified conditions of consent.

8. RECOMMENDATION

It is RECOMMENDED that the Executive Director, Resource Assessments & Compliance, as delegate of the Minister for Planning:

- **considers** the findings and recommendations of this report;
- **determines** that the modification request falls within the scope of section 96(2) of the EP&A Act;
- **approves** the modification application SSD 5144 MOD 4, subject to conditions; and
- **signs** the attached notice of modification (**Appendix D**).

Howard Reed
Director
Resource Assessments

24/3/17
Oliver Holm
Executive Director
Resource Assessments & Compliance

APPENDIX A: STATEMENT OF ENVIRONMENTAL EFFECTS

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8091

APPENDIX B: SUBMISSIONS

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8091

APPENDIX C: RESPONSE TO SUBMISSIONS

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=8091

APPENDIX D: NOTICE OF MODIFICATION

APPENDIX E: CONSOLIDATED CONSENT (SSD 5144)