



Mining and Energy Division

Review of Environmental Assessment
Wallarrah 2 Coal Project
SSD-4974

Submission

Construction Forestry Mining and Energy
Union (Mining and Energy Division)
Northern District Branch

June 2013

Wallarrah Area Coal Joint Venture (WACJV) has applied to the Minister, Department of Planning seeking approval to construct and operate an underground coal mine and associated facilities for 28 years. This Project is classified as a State significant development as defined under the State Environmental Planning Policy, 2011 and requires development consent under Division 4.1 of Part 4 of the EP&A Act, 1979.

The Director General made the Environmental Assessment publicly available on the 26 April 2013 at the DP & I Information Centre Sydney, Wyong Shire Council, Lake Macquarie City Council and Nature Conservation Council.

The Union is pleased to take the opportunity to comment on the Wallarrah 2 Coal Project and related activities Environmental Assessment.

The Mining and Energy Division is a Division of the CFMEU under the Federal Workplace Relations Act 1996, with over 120,000 members, one of the largest in Australia. The Division covers several industries including the coal industry, coal ports, metalliferous mining industries, electrical power generation, oil and gas and the Nation's small coking industry.

The Northern District Branch of the CFMEU Mining and Energy Division, being the branch that on behalf of the organisation which is making the submission is the principal Union representing coal miners in the Northern District coalfields of New South Wales. The Project facility is located approximately 4.7 kilometres east of Wyong and is wholly within the State's Northern District coalfields.

The Union is familiar with the Project site and has engaged the services of an Environmental Consultant with extensive experience in local government and environmental assessments on coal mining related projects.

After reviewing all the material and taking advice, the Union supports this application to for the development of the Wallarrah 2 Coal Project as proposed.

Project Overview

Wyong Areas Coal Joint Venture WACJV seeks a Development for a period of 28 years to facilitate the construction and operation of the Project. Construction will occur over an approximate three year period. Coal mining will commence after this period and

continue for the duration of the Development Consent within the designated Extraction Areas. Further mineable coal will remain in the Extraction Area at the completion of the Project mine life. A further planning approval will be required to enable the continuation of mining beyond Year 28.

The Project will involve the extraction of export quality thermal coal; via underground longwall mining methods. The Project is generally comprised of an underground longwall mine, coal handling and storage facilities, rail loop and loading infrastructure, an underground drift entry, ventilation shafts, gas and water management facilities and administration buildings.

The Project surface facilities would be located on land zoned largely for industrial development and include:

- The Tooheys Road Site surface facilities between the Motorway Lind Road and the F3 Freeway which will include a rail loop and spur, stockpiles, water and gas management facilities, workshop and offices;
- The Buttonderry Site surface facilities between Sparks Road and the Buttonderry Waste Management Facility. This facility will include the main personnel access to the mine, main ventilation facilities, offices and employee amenities; and
- The Western Ventilation Shaft located in the Wyong State Forest which is required for ventilation purposes by Year 13.

An inclined tunnel will be constructed from the surface at the Tooheys Road Site to the coal seam around 360m beneath the Buttonderry Site. The drift will be primarily used for transportation of coal to the surface.

The land which is subject of the Development Application comprises the area within the Project Boundary and excludes the Jilliby State Conservation Area (SCA). Areas below 50m from the surface will be used for coal extraction and related underground mining activities. Existing roads and surface land access in the Jilliby SCA may be utilised during the Project for a variety of purposes.

Outside the nominated Disturbance Area, additional minor disturbance associated with ancillary works may be required including firebreaks, water diversion structures, minor contour banks, pipelines and associated tracks and other services, power supply, power lines, fences and sediment and erosion control structures.

The Project seeks to recover approximately 150 Mt of coal from within the Extraction Area. The identified coal resource will support mining at a rate of up to 5 Mtpa for at least the period sought by this Development Application.

During the three year construction period, the Project will employ up to 450 personnel on site. The Project will employ up to approximately 300 full time equivalent employees during mining operations.

The majority of the mining employees will work from the Buttonderry Site and approximately 30 workers will be based at the Tooheys Road Site.

Some construction activities and maintenance activities, deliveries, coal processing, coal transport and mining operations will occur 24 hours per day, 7 days per week.

Coal mining will be undertaken at depths of between 350m and 690m below the surface within the underground Extraction Area.

All coal will be transported by rail to either the Newcastle port for export or to local domestic power stations.

Stakeholder Engagement

According to the proponent they have participated in formal engagement activities utilising regular Wallarah Coal 2 Project Community Representative Group (CRG) meetings.

A range of stakeholders were identified for the Project based on approaches to WAGCV, regulatory requirements for the Project and the EIS.

Community and regulatory stakeholder engagement for the Project was undertaken in accordance with the following key objectives:

- To identify potential stakeholders;
- To engage with relevant stakeholders to understand and discuss stakeholder/community issues and concerns;

- To assess the compatibility of the Project with existing land uses in the local area and the values of the local community;
- To identify the primary and higher order social impacts (direct and indirect) associated with the Project, particularly on those communities within WSC, LMCC and GCC LGA's;
- To maintain a process for consistent, ongoing consultation and communication with key stakeholders and the local community;
- To enable stakeholders to have input into the EIS and Project planning (especially in relation to any VPA funds); and
- To proactively respond to and work to address the issues of relevant stakeholders to develop appropriate solutions and mitigation strategies to minimise potential impacts of the Project.

Various methods were employed to engage with the local community including personal briefings, the distribution of newsletters, Project information days and presentations.

Overview of issues raised by regulatory and community stakeholders

Regulatory Issues

| Ref | Details | Issue Raised |
|-----|--|-----------------------|
| 1. | Letter sent to DP&I on 29 March 2012 Reply sent to WACJV on 7 June 2012 | Groundwater |
| | | Surface water |
| 2. | Presentation to Gosford Council 27 March 2012 | Economic and social |
| | | Surface water |
| | | Groundwater |
| 3. | Presentation to LMCC 16 April 2012 | Subsidence |
| | | Groundwater |
| | | Surface water |
| | | Rail |
| 4. | Letter to NOW 22 March 2012 and meeting with NOW 31 August 2012 | Groundwater |
| 5. | Meeting with WSC 9 July 2012 | Social |
| | | Traffic and transport |
| 6. | Meeting with WSC 20 December 2012 | Water Management |
| 7. | Meeting with OEH 19 and 27 November 2012 | Ecology |
| | | Flooding |
| 8. | Meeting with NOW 10 and 25 January 2013 | Surface Water |
| | | Groundwater |
| | | Geology |

Community Issues

| | |
|-----------|---|
| 1 | <i>Air Quality</i> |
| | Dust impacts from Tooheys Road facility on Blue Haven suburb |
| | Dust impacts from Tooheys Road facility on local neighbours |
| | Dust monitoring including monitoring locations and availability of data |
| 2 | <i>Noise</i> |
| | Operational noise and minimisation techniques |
| | Noise impact created by rail traffic on Wyee township |
| | Traffic generated noise |
| 3 | <i>Social and Economic</i> |
| | Employment opportunities in Wyong, Central Coast and Lake Macquarie |
| | Benefits to region during construction period |
| | Economic benefits to local community |
| | Specific company contributions to local community |
| | Land zoning for surface facilities |
| 4 | <i>Water and water management</i> |
| | Protection of local and regionally significant surface water regimes |
| | Protection of sub-surface water regimes |
| | Protection of regional water supply infrastructure |
| | Protection of individual property water systems/private bores |
| | Impact on flooding |
| | Water management at surface facilities |
| 5 | <i>Subsidence</i> |
| | Impact on built environment |
| | Impact on natural environment |
| | Impact on water regimes |
| | Impact on regional infrastructure |
| 6 | <i>Visual</i> |
| | Impact from F3 Freeway |
| | Impact from Motorway Link Road |
| | Impact from neighbouring residential areas |
| 7 | <i>Heritage</i> |
| | Impact on Aboriginal heritage |
| | Impact on European heritage |
| 8 | <i>Ecology</i> |
| | Impact on State Forest |
| 9 | <i>Traffic</i> |
| | Impact on road network |
| 10 | <i>Other</i> |
| | Consultation with community throughout EIS process |
| | Understanding of refusal of earlier related W2CP EA |

According to the Project EA the proponent is committed to continuing its stakeholder engagement program throughout the life of the Project.

Ongoing stakeholder engagement will include regular contact with neighbouring land owners, representative of key Local and State regulatory authorities and industry bodies, and the release of information on the status of the Project, key Project issues and environmental performance.

Subsidence

A Subsidence Impact Assessment was completed for the Project by WACJV and other technical experts, SCT Operations Pty Ltd (SCT) and Mine Subsidence Engineering Consultants Pty Ltd (MSEC). The purpose of this Impact Assessment was to predict the likely subsidence related ground movements resulting from the Project and then to assess the impacts of this predicted subsidence on the natural and built environments.

Subsidence related issues, particularly with their potential effect on residential structures; water catchments and groundwater regimes within the Project Boundary were recognised from the outset as being a key factor for consideration in the mine design process. Similarly, any disruption to the water regime that will result in water ingress into the proposed mine workings was identified as a major safety risk that must also be addressed through appropriate mine design.

As part of the development of the Project mine plan, the chain pillars have been designed so that they will yield when isolated in the goaf. The benefit of this is to minimise the risk of delayed pillar failure, which has the potential to result in unplanned subsidence events at some point in the future. This design also serves to reduce the differential subsidence that will otherwise occur between the troughs above the extracted longwall panels and the peaks that would exist above the chain pillars that were not designed to fail.

Modelling demonstrated that caving related fracturing will only extend approximately 200m above the seam, while the minimum depth of cover is approximately 400m. Fracturing in the upper portion of the rock mass is generally limited to bedding plane shear, which exhibits very low vertical conductivity, the modelling further indicates that the design has effectively limited the potential for hydraulic connection between the surface waters to the underground mining areas.

Subsidence Effects

Conventional Subsidence Effects

The conventional subsidence parameters vary across the Extraction Area according to the depth of cover, panel width, chain pillar width, and surface topography and extraction heights.

The values detailed are typical subsidence figures:

- Hue Hue MSD Area: 600 – 1000 mm;
- Valley Area: 1200 – 1400 mm; and
- Forest Area: 1500 – 2000 mm.

There are two major streams passing through or in the vicinity of the Extraction Area; Jilliby Jilliby Creek and Wyong River. There are also numerous minor, intermittent streams including Little Jilliby Jilliby Creek, Armstrong Creek, Myrtle Creek, Hue Hue Creek, Camans Gully, Hughes Gully, Splash Gully, Youngs Gully and a number of unnamed tributaries.

The prediction of ground strain is more difficult than the prediction of subsidence, tilt and curvature. These horizontal strain predictions are not as accurate as the vertical predictions of subsidence and a statistical approach has also been used for the Project to predict the magnitudes of strains for the assessment of impacts. The locations that are predicted to experience hogging or convex curvature are expected to be net tensile strain zones. Conversely, the locations that are predicted to experience sagging or concave curvature are generally expected to be net compressive strain zones.

Non-conventional Subsidence Effects

The Project also has the potential to generate far-field horizontal movements which can potentially impact on certain surface features, such as, bridges and other large built features. These are small bodily movements towards the extracted area. The far-field horizontal movements resulting from the Project are not expected to result in any adverse impacts.

Environmental Consequences

Water Courses

The Extraction Area is mainly located within one of the catchments feeding the water supply scheme for the Gosford City Council and Wyong Shire Council. The report of the Independent Expert Panel (2008) for the 'Strategic Inquiry into potential coal mining in the Wyong LGA', concluded that proposed longwall mining within the area was not anticipated to have a significant impact on the region's catchment area and water supply infrastructure. The subsidence impact assessment for the Project has further assessed the impacts upon these water resources.

The streams within the Extraction Area are expected to experience ground tilt as a result of longwall mining. Increased levels of flooding and scouring of the stream banks can potentially occur where longwall mining induces a considerable increase in the natural stream gradients, while a decrease in the natural stream gradient can potentially lead to increased ponding.

Mining is not proposed under the Wyong River and only small levels of subsidence have been predicted along the river alignment. Since the predicted maximum subsidence at the Wyong River is only 175 mm it will experience a change in gradient in the order of 1 mm/m. (1:1000).

Small levels of upsidence of up to 150mm have also been predicted to occur and this will result in a net subsidence along the Wyong River of 25 mm. Consequently, the change in stream gradient along the river will be negligible. Since these levels of movement are so small, no significant changes in the levels of ponding, flooding or scouring are predicted for Wyong River.

The other streams within the Subsidence Impact Limit are predicted to experience greater tilts, generally in the order of 1% (1:100). These tilts are not expected to significantly increase scouring of the stream banks, although there may be localised scouring in sections where the tilt is the greatest (Up to 1.5%). The potential for increased ponding is expected to occur in sections of Jilliby Jilliby Creek that overlie longwall panels LW1S and LW6N.

Cross-bed tilts induced by longwall mining can potentially cause changes in stream alignment. However, the predicted cross-bed tilt for the Wyong River is minimal (0.1%) and will not result in any noticeable changes to stream alignment. The cross-bed tilts for Jilliby Jilliby Creek (1%), Little Jilliby Jilliby Creek (1.2%) and the minor streams (up

to 1.5%) are an order of magnitude lower than the natural gradient across the stream width. As a result, the changes to stream alignment from longwall mining are expected to be minor and within the range of existing natural variability.

Subsidence induced fracturing of the bedrock can affect overlying or adjacent streams where the mining occurs at shallow depths of cover resulting in connective fracturing of rock between the seam and the surface.

Numerical modelling undertaken by SCT demonstrates that due to the high depths of cover of underground mining operations within the Extraction Area and the characteristics of the rock strata that are present at the Project, there will be no connectivity between the mining induced fracture system and the surface. The proposed mine layout has been specifically designed to avoid such connectivity to minimise the impact on surface water resources and avoid the potential for flooding of the mine.

Upsidence and closure can generate fracturing of bedrock beneath streams, dilating the immediate strata down to a depth of several metres, and potentially result in subterranean flows which can reduce the normal environmental flow of the stream. While this may affect localised sections of the headwaters of some of the minor ephemeral streams, it is not predicted to occur in the major streams within the Extraction Area as these streams exist within saturated alluvium up to 30m thick.

Topographic Features

There are no cliffs located within the Subsidence Impact Limit, although there are some isolated rock outcrops and benches in the Forest Area.

The incidence and scale of subsidence-induced surface cracking in the Extraction Area is likely to be minor and notably less than in the Southern Coalfields due to lower subsidence effects, greater cover depth, and a thicker alluvial cover in both the valleys and on the hill sides. These factors provide an elastic medium that tends to absorb cracks that may occur within the bedrock.

Transport Infrastructure

There are a number of roads, both seal and unsealed passing over the Extraction Area. Changes in grade due to ground tilt can potentially affect the drainage and serviceability

of roads, while curvature and strain can potentially result in cracking, spalling and heaving of the pavement.

The maximum predicted tilt for the sealed local roads is 9 mm/m. The maximum change in grade will be 1.5%. The predicted changes in grade for both sealed and unsealed roads are minor, and are unlikely to significantly affect the drainage and serviceability of the roads.

The maximum curvatures for the main roads are 0.12 km⁻¹ hogging and 0.17 km⁻¹ sagging. These are similar to the curvatures induced by mining at the Tahmoor Colliery in the Southern Coalfield. The impacts of longwalls at the Tahmoor Colliery included cracking and heaving of road surfaces and impacts to concrete kerbs and guttering. Impacts on sealed roads will be of a nature that can be remediated using normal road maintenance techniques. With appropriate monitoring and management, the impacts on roads will be minor and will not pose a significant risk to public safety.

The maximum predicted curvatures for the unsealed roads are 0.28 km⁻¹ and 0.37 km⁻¹. As a result, unsealed roads may experience cracking and heaving, however it is expected that these unsealed roads can be maintained in serviceable conditions using normal road maintenance techniques.

There are a number of local road bridges crossing the streams and lower lying areas within the Extraction Area. The predicted maximum tilts for the local road bridges vary from 0.2 mm/m and 2 mm/m. These changes in grade are negligible and are unlikely to affect the drainage and serviceability of these bridges. The maximum predicted curvatures are 0.05 km⁻¹ hogging and 0.04 km⁻¹ sagging. These curvatures are unlikely to result in any adverse impacts on local road bridges.

The F3 Freeway is located approximately 1.1 km from the nearest longwall. As a result the F3 Freeway pavement is unlikely to be impacted by far-field horizontal movements. However, the freeway bridges could be sensitive to far-field horizontal movements. These bridges may only be adversely impacted if the differential horizontal movements exceed the distances that the movement joints in the bridges can accommodate.

There is numerous drainage culverts associated with the local road network that are located within the Subsidence Impact Limit. The maximum predicted tilt in the

Extraction Area is 15 mm/m. This change in grade is unlikely to significantly affect the serviceability of these culverts.

Water Infrastructure

The Treelands Drive Reservoir is located 300m from the nearest longwall panel proposed. Due to its distance from the mining area, the reservoir is predicted to experience less than 50 mm of conventional subsidence and the corresponding tilts and curvatures are unlikely to significantly impact upon the reservoir.

The Mardi to Mangrove Creek Dam pipeline is predicted to experience less than 20 mm conventional subsidence. Since this pipeline is located within the valley of the Wyong River, the pipeline could experience minor upsidence, which is predicted to peak at 80 mm, or experience horizontal movement which is predicted to peak at 145 mm. The subsidence and upsidence predictions from the Project were provided to the designers of the water pipeline so that the pipeline could be designed to withstand these subsidence effects.

There are other pipelines located to the east and well outside the Extraction Area. Due to the considerable distances of these pipelines from the proposed longwalls, the maximum conventional subsidence is predicted to be less than 20 mm.

The conventional tilts and curvatures are small in magnitude, resulting in a low likelihood of significant impacts on these pipelines.

Electricity Infrastructure

There are two 330 KV transmission lines passing through the Extraction Area.

WACJV has consulted with TransGrid about potential impacts caused by subsidence. Three key impacts were identified:

- Increase in conductor tensions, which can possibly overload the support towers;
- Deformation of the tower bases due to ground curvature and strain; and
- Reduction in cable heights below the statutory minimum clearances.

There is an additional 330 kV transmission line located outside of the Extraction Area, but still in the vicinity of the Project. There is also a 132 kV transmission line near the Project. Neither transmission line is predicted to experience conventional subsidence

greater than 20 mm. The subsidence effects are too minor to have any material impact on these transmission lines.

Discussions between WACJV and TransGrid will continue so that preventative measures can be developed to allow the undermining of all TransGrid towers. These discussions will concentrate on investigating each of the possible options that could provide for the continued safe operation of the transmission lines and avoid the sterilisation of such large quantities of coal resources.

Telecommunication Infrastructure

There are two types of copper telecommunications cables occurring in the Extraction Area; direct buried cables and aerial cables suspended on poles. Experience from other NSW operations indicates that the incidence of impacts on direct buried cables is low when the depth of cover exceeds 350m, as will be the case for the Project.

Impacts to aerial cables at other mines in NSW where the depths of cover are similar to the Project, are uncommon and generally of a minor nature. As such, impacts to aerial cables are not predicted to be a concern for the Project and can readily be rectified through adjustments to the poles or cables if necessary.

A Telstra optical fibre cable passes directly over Longwalls 11N to 15N and Longwalls 1S to 5S. Since this cable is direct buried, potential impacts are more likely to be caused by ground strain. The predicted strains are similar to observed strains at other NSW operations, where the optical fibre cables have been maintained in serviceable conditions.

There is a Cellular Mobile Telephone Service site located directly above Longwall 1N. The tilts and curvatures are unlikely to affect the structural integrity of the building, while any impacts on the antennae can be remediated by adjustment.

Public Amenity

Jilliby Public School and a scout camp are located on land overlying the main development headings which separate the northern and south-eastern series of longwalls. Neither of these facilities is expected to experience more than 20 mm of subsidence. Therefore subsidence is unlikely to cause any significant impacts on these structures.

Commercial Sites

There is a disused quarry site above Longwalls 14N and 15N. Subsidence related ground movements are unlikely to cause significant instabilities and the potential to dislodge loose or marginally stable rocks will be assessed prior to mining.

The Linton Park and Parkview horse studs are located within the Extraction Area. Given that the depth of cover is approximately 400 m in these locations, any surface cracking that may occur is expected to be minor and can easily be remedied by infilling or ploughing if necessary.

Rural Infrastructure

There are a large number of rural buildings within the Subsidence Impact Limit.

635 of the 755 rural structures, the maximum curvatures will be less than 0.15 km^{-1} . The remaining 120 structures will experience curvatures of up to 0.15 km^{-1} hogging and 0.30 km^{-1} sagging. Extensive data from the Southern, Newcastle and Hunter Coal fields indicate that the incidence of impacts on rural structures is very low, particularly when the depth of cover exceeds 200m. This is because these structures are generally able to cope well with ground movements due to their small size and light weight construction.

At 341 of the 420 farm dams, the maximum predicted curvature will be less than 0.15 km^{-1} . The remaining 79 dams are predicted to experience curvatures of up to 0.25 km^{-1} hogging and 0.35 km^{-1} sagging. Observations from other operations indicate that the incidence of impacts on farm dams is low when the cover exceeds 200m, while any cracking that may occur in these dam walls can be readily repaired.

Residences

There are 245 residences within the Extraction Area. Vertical subsidence alone does not generally impact on the stability or serviceability of buildings. However, vertical subsidence could affect the heights of houses above the flood level.

Of the 245 residences, 88 are situated within the Hue Hue Mine Subsidence District. The maximum predicted tilt for these residences is 4 mm/m which meets the Hue Hue Mine Subsidence District criteria of 4 mm/m. As a result impacts on these residences

are expected to be limited to minor serviceability impacts. The remaining 157 residences are situated within the Wyong Mine Subsidence District. The maximum tilt is not expected to exceed 7 mm/m at 144 of these residences.

The maximum tilt will be between 7 mm/m and 10 mm/m at 8 residences, and greater than 10 mm/m at 5 residences. These 13 residences may require more substantial remediation works.

For 226 of the 245 residences, the maximum hogging and sagging curvatures will be less than 0.2 km^{-1} and 0.25 km^{-1} respectively. Experience from the Southern and Newcastle Coalfields suggests that, at these curvatures, approximately 16% of residences may experience material impacts with significant repairs potentially required at approximately 5% of residences. The risk to public health is low because sudden and immediate impacts are very rare.

Downslope movements can affect residences which are situated on steep slopes. Residences are generally located on slopes of less than 1 in 5 with the maximum slope for a residence within the Project Boundary being 1 in 3, which is considered stable. Therefore no predicted impacts are anticipated due to down slope movements.

Some of the residences are equipped with waste water systems. As a result, curvatures and strains are not expected to cause any impacts to the structural integrity of these systems. The change in grade due to tilt is expected to be 1-2 %. This is not likely to significantly affect the serviceability of the waste water system.

There is the potential for damage to buried pipelines and impacts associated with these systems though these impacts can usually be mitigated through the installation of flexible couplings. Any leaks caused by ground strain are expected to be minor and easily remediable.

Recreational Facilities

There are 107 pools situated within the Extraction Area. For 82 of the 107 pools, the maximum predicted tilt is less than 3 mm/m. The other 25 pools will experience tilt exceeding AS 2783-1992 and will therefore require remediation measures.

Maximum curvatures of less than 0.1 km^{-1} hogging and 0.15 km^{-1} sagging are predicted to be experienced at 82 pools in the vicinity of the Project. Experience has indicated that around 15% of such pools may be impacted, required repair or even replacement in some cases.

There are 11 tennis courts located within the Extraction Area. The maximum predicted tilt for the tennis courts is 9mm/m. This is a minor change in gradient and is unlikely to significantly impact the serviceability of tennis courts. The maximum predicted curvatures of 0.15 km^{-1} and 0.20 km^{-1} sagging. The curvatures can result in minor cracking of grass or clay courts, however cracking of this nature can be easily repaired.

The mine plan for the Project has been designed so that environmental consequences are minimised wherever practicable. The chain pillars have been designed to yield once isolated in the goaf so as to reduce the effect of differential subsidence as well as mitigate the risk of future unplanned subsidence events.

Field monitoring data will be used as it becomes available to further validate predictions and underpin the final subsidence management process.

The subsidence predictions in the study are conservative and as such the degree of subsidence that will actually result from future mining is likely to be less than those upon which management strategies have been formulated.

Groundwater

A Groundwater Impact Assessment for the Project was completed by Mackie Environmental Research.

Impact Assessment

Depressurisation of Aquifers - Coal Seam Aquifer

The extraction of coal from the WGN seam will result in the depressurisation of the coal seam and the strata above and below the seam. Depressurisation of the overlying strata will be accelerated through caving and subsidence.

Model W3 predicted significant depressurisation of the WGN seam, with the greatest hydraulic head loss occurring near the access drift. The region where head loss exceeds 2 m extends approximately 2 km beyond the mine foot print in the east. In

contrast, this region only extends 400 m beyond the mine footprint in the western extent of the longwall panels.

The head loss propagates slowly outwards from the extracted longwalls due to the low permeability of the coal seam. As a result, the head loss is lowest in the western most longwalls, since these are extracted later in the Project life. The drawdowns within the coal seam aquifer predicted using the W4 model are almost identical to the values predicted using the W3 model.

Other Hard Rock Strata and Water Table Drawdown

The depressurisation zone expands over time, extending upwards from the extracted coal seam as mining progresses. However major depressurisation effects featuring relatively free drainage only extend upwards through the strata to the limit of connective cracking in the zone known as the fractured zone. The overlying strata in the constrained zone do not feature connected vertical fracturing, and depressurisation effects are relatively insignificant.

The generally low permeability's of the strata in this zone further limit the potential for water movement and depressurisation. The total leakage from the shallow hardrock aquifer is estimated to be 0.04 ML/day. Given the significant depths at which coal extraction occurs, the constrained zone will be very thick and acts as a safeguard protecting and separating the surface water system from the effects of the caving and fracturing zones associated with subsidence.

The only water table drawdown within the shallow zone is predicted to occur near the Tooheys Road Site due to the main access drift development through the Tuggerah Formation. This drawdown effect is not predicted to exceed a few metres. The predicted water table drawdown after 28 years indicates that only a very small area of affectation is predicted in the area immediately surrounding the access drift.

Alluvial Aquifer

The modelling predicts only minimal depressurisation of the alluvial aquifers. The groundwater in the alluvial lands in the Yarramalong Valley and Dooralong Valley is predicted to be only minimally impacted by the Project. The negligible impact on alluvial lands is due to the very low permeability of the underlying Patonga Claystone and

Tuggerah Formation, and the high storage capacity and sustained rainfall recharge in the alluvial aquifers.

The level of groundwater table within the alluvial areas is not predicted to change measurably as a result of the Project. Downward leakage is predicted to be minimal, and rainfall recharge will be sufficient to sustain water levels. It is predicted that the loss of base-flow from alluvial aquifers to creek catchments will be negligible. The leakage loss has been calculated to be 2 millilitres/day for each square metre of alluvial land surface. The leakage from the alluvial aquifer is estimated to be 0.02 ML/day.

Inflows to Mining Areas

The predicted depressurisation of the hard rock strata will induce seepage into the mine workings and goaf areas. The depressurisation will migrate upwards from the WGN seam due to cracking, bedding parting and pores in the rock induced by subsidence. This depressurisation has been predicted to extend up to 220 m above the WGN seam and includes the lower portion of the Tuggerah Formation.

The loss of pressure within the strata will induce seepage into the mine workings and goaf. The 220m above the WGN seam is more than three times the previously reported conditions in the region. It is also greater than the height suggested by geo-mechanical modelling of the subsidence zone and is considered to be conservative.

Model W3 predicts a total influx to mining areas of 26 500 ML over the 38 year simulation period. The daily influx is predicted to increase from 0 ML/day in Year 1 reaching the maximum rate in Year 19 of 2.5 ML/day under model W3.

Post Mining Recovery

Regional aquifer pressures within the hard rock strata will begin to recover upon the completion of mining. The rate of recovery is dependent upon the remaining water stored within the hard rock strata, the hydraulic properties of the goaf, and the sustained gravity drainage of strata above extracted panels. The rate of recovery is expected to be slow due to the increase in storage caused by the creation of underground workings and goaf, as well as the low permeability of the hard rock strata.

Changes in Groundwater Storage Due to Subsidence

Mining induced subsidence can alter the volume of groundwater storages.

The increase in alluvial groundwater storage is temporary, as the water level is expected to re-equilibrate after the extraction of each longwall. As a result, the increases in storage caused by the various longwalls are not expected to accumulate. Therefore, the maximum increase in storage that will be experienced at any one time is 181 ML, which will be experienced during the extraction of longwall LW 9N. This effect is expected to be fully replenished over an 8 to 10 months period before the adjacent panel (LW 10N) is subsided.

Due to the effect of increasing alluvial groundwater storage, a slightly greater proportion of rainfall is needed to recharge groundwater storages. As a consequence, the quantity of run off to streams is slightly reduced, resulting in marginally lower flows in local streams.

Compared to the pre-subsidence water table, the shallower post-subsidence water table has the potential to saturate the soil profile for longer periods during rainfall events. Saturation may occur until stream bed elevations re-equilibrate through stream bed erosion. Final re-equilibrium is expected to occur after the final longwall is completed.

In areas where the water table is less than 1 m below the surface, and where predicted subsidence is in the order of 1 m, the water table is expected to be close to the subsided surface. As a result the soil profile may reach field capacity more frequently during prolonged rainfall periods. The water table is expected to re-equilibrate at about the same depth as pre-mining conditions.

Increased Seepage Due to Cracking

Seepage from the alluvial aquifers to deeper hardrock aquifers ordinarily occurs. The rate of seepage can become magnified by subsidence induced cracking, which creates additional flow paths. The subsidence modelling indicates that cracking above the goaf will not exhibit continuity to the surface. The subsidence model predicts that there will be a 100 m – 400 m thick zone of rock that will be free of connected cracking. As a result there is unlikely to be significant increase in the rate of downward seepage from the alluvial aquifers to the deeper hard rock aquifers.

Existing Bores

Due to the lack of connected cracking, there will not be a significant loss of water through downward leakage. Consequently the yields of existing bores and wells are not predicted to be significantly affected in this regard.

The alluvial water table will initially drop as a result of subsidence, but will undergo a 55% - 75% recovery within 200 days. As a result these bores will temporarily experience a minor reduction in yield, but longer term yields are likely to be unaffected.

Subsidence effects also have the potential to cause structural damage to these existing bores, which may require the bores to be extended or re-drilled.

Changes to Groundwater Quality

The depressurisation of hard rock strata is not expected to have any significant impacts on the quality of groundwater in the hard rock aquifers. There may be localised changes in salinity where groundwater mixes with fragmented materials in the goaf. Water that is dewatered from the underground workings will be managed within the mine water management system.

There is unlikely to be any measurable change in the quality of groundwater within the alluvial aquifer systems. These changes to the water table caused by subsidence are not expected to impact groundwater quality. Active flushing of salts by recharge processes will not be interrupted.

Storage of Salt and Brine

The semi-solid salt mixture produced by the water treatment process will be stored in the underground sump during the first 14 years of operation. Although the coal seam and surrounding strata will become re-saturated following the completion of mining, the stored salt is expected to remain immobile.

After year 14, waste brine will be stored within the goafs of completed longwalls. The post-mining recovery of water levels and pore pressures is predicted to be extremely slow. As a result, the underground mine is predicted to behave as a groundwater sink for at least 500 years after mining.

Due to the high density of the salt mixture and the very slow rate of groundwater recover, the storage of brine and salt is not predicted to have any measurable impacts on water quality.

Groundwater Dependent Eco Systems

GDE's have been identified along surface drainage channels within the Project Boundary.

The GDE's that have been identified include Paperbark, Coachwood, Blackbutt and other species that rely on the shallow water table. The changes in the depth of the water table will be minimal. The system is expected to be rapidly recharged by rainfall, resulting in only minimal impacts on GDE's.

In elevated and forested areas, the water table is generally predicted to be deep. GDE's in these areas rely on soil moisture within the unsaturated zone. This moisture is provided by rainfall and runoff. Subsidence will not affect these processes, and will therefore have no impact on GDE's in these areas.

A peer review for Groundwater Impact Assessment was conducted by Kalf and Associates.

"The predictions provided are considered reasonable based on the available data. The main groundwater impacts are likely to occur at depth with some transient storage effects on the alluvial sediments but limited drawdown effects. There is unlikely to be significant losses of groundwater from the alluvial sediments and any such losses would be more than compensated by recharge through rainfall and significant storage buffering within these sediments based on the report findings.

Maximum groundwater inflows to the mine are predicted to be between 2.0 and 2.5 ML/day after 20 to 25 years after mining commences. These results are reasonable in consideration of other similar mining project inflows based on the reviewer's experience."

Surface Water

A Surface Water Impact Assessment for the Project has been completed by WRM

Site Description

The Project is located within the Tuggerah Lakes Basin, which has a total catchment area of approximately 700 km². The major rivers and tributaries in this catchment are the Wyong River, Jilliby Jilliby Creek and Ourimbah Creek.

The Tooheys Road Site is located within the Wallarah Creek catchment on the eastern (and downstream) side of the F3 Freeway. Wallarah Creek flows to the east and enters Budgewoi Lake approximately 6.6 km downstream from the Tooheys Road Site. Wallarah Creek has a catchment area of approximately 45 km² to Budgewoi Lake. Wallarah Creek is ephemeral, with a median flow rate of approximately 0.25 ML/day and 10% of flows being recorded at greater than 4 ML/day.

The Buttonderry Site is located within the Buttonderry Creek catchment. Buttonderry Creek has a catchment area of approximately 5.4 km² upstream of the Project, and joins the Woongarra and Hue Hue Creeks at the Porters Creek wetland to the east of the Buttonderry Site. This wetland has a surface area of 6 km² and a total catchment of 55 km². Porters Creek drains into the Wyong River, with the confluence located approximately 7.6 km downstream of the Buttonderry Site.

Buttonderry Creek and Wallarah Creek are ephemeral creeks with small, well defined low-flow channels. Both creeks have well vegetated banks, and small floodplains that are vegetated with grass cover and scattered trees.

Water Supply System

An analysis of base flow in the Wyong River and Jilliby Jilliby Creek was undertaken as part of the Wyong Water Study (SKM, 2010). The results of the base flow analysis indicate that base flow comprises 14% to 28% of measured stream flow across the region. During dry periods, the proportion of base flow may increase to 100% of recorded stream flow (SKM, 2010).

The combination of subsidence and changes in water table levels across the floodplain of Jilliby Jilliby Creek will potentially reduce the drainage efficiency of the floodplain, leading to possible increased wet areas and surface ponding during wet weather. As a consequence, slightly increased infiltration and evaporation may occur across the

subsidised floodplain. Through appropriate land management and remedial drainage management practices, the change in surface drainage efficiency is unlikely to result in a measurable reduction in total surface water volumes draining to the Gosford-Wyong Water Supply Scheme.

The total potential Subsidence Impact Limit of approximately 37 km², located within the catchment area of the Gosford- Wyong Water Supply Scheme, represents approximately 5% of the total catchment contributing to the Scheme. Approximately 29 km² of the Subsidence Impact Limit is located within the Jilliby Jilliby Creek catchment, a further 4.2 km² is located in the catchment of Hue Hue Creek and the remaining 3.8 km² is located in the direct catchment of the Wyong River.

Flow in upland drainage paths is highly ephemeral, with these drainage lines commonly featuring sandstone boulders, minor areas of alluvium and significant vegetative litter. Due to these features, no significant loss of surface flow through surface cracking along drainage paths in upland areas is anticipated (IEC, 2009).

An analysis of the impacts of subsidence on base flow to surface drainage paths has been completed as part of the groundwater impact assessment. The results of these analyses show that subsidence will have no measureable impact on base flows.

Subsidence of alluvial lands is likely to create a temporary increase in groundwater storage which may affect surface runoff volumes in the short term. The change in alluvial groundwater storages will vary from year to year depending on the progression of mining, with an estimated maximum increase in storage of approximately 181 ML for a period of eight to 10 months. Although this water is retained within the catchment, groundwater storage is not part of either the Jilliby Jilliby Creek Water Source or the Central Coast Unregulated Water Source. Water relocated in this way within the catchment is referred to in the WM Act as “taking” water.

Considering uncertainty in permeability and effective porosity, it is conservatively estimated that a maximum annual volume of 270 ML could potentially be taken from the Jilliby Jilliby Creek Water Source and 30 ML from the Central Coast Unregulated Water Source.

Impact Assessment

Demand from External Water Supplies

The water balance shows that the maximum demand from external water supplies is 52 ML in Year 1. The external water demand then decreases to approximately 20 ML/year over the first four years. From Year 4 onwards, the external water demand peaks at 49 ML/year in Year 14 before decreasing to approximately 20 ML/year for the remainder of the Project life.

Surface Water from the Catchment

Mining induced subsidence has the potential to cause surface water flows to be diverted to groundwater. The subsidence modelling study indicates that cracking above the goaf will not extend to the surface. The subsidence model predicts that there will be a 100 m – 400 m thick zone of rock that will be free of connected cracking. As a result, there is unlikely to be a significant increase in the rate of downward seepage from the alluvial aquifers to the deeper hard rock aquifers and hence minimal effect on the surface water flows.

A change in shallow groundwater storage may occur as a result of transient tensile cracking of ground strata caused by subsidence. The change in groundwater storage is likely to be transient in nature and would occur through either temporary filling of tensile cracking storage or by re-adjustments to the groundwater levels to changed surface geomorphology brought about by subsidence. Impacts on surface water flows resulting from this change in alluvial storage are expected to be minor.

Changes in water table elevations are likely to occur as a result of subsidence effects of the Project, which may affect surface water resources. In alluvial areas with slopes less than a few degrees, surface drainages and groundwater levels will initially fall as part of a panel being subsided relative to an adjacent unsubsidised area.

The relative change in groundwater levels from unsubsidised to subsidised areas will establish localised gradients with groundwater migrating towards the subsidised area. This will lower the water table in the unsubsidised area and raise the water table within the subsidised area. Additional alluvial storage volumes created by the transient subsidence effects will be filled with rainfall recharge and surface water runoff, potentially resulting in a marginal reduction in surface water flows.

If it is assumed that the increase in alluvial groundwater storage translates to an equivalent reduction in surface water, the Project will result in an estimated maximum

additional groundwater retention equivalent to a surface water loss of approximately 300 ML/year or less than 1% of the long term average annual extraction limit of the water licences held by the Gosford / Wyong Water Authority (36,750 ML/year) under the Central Coast Unregulated WSP and the Jilliby Jilliby Creek WSP.

The 300 ML/year reduction in surface water occurs in the Jilliby Jilliby Creek water source (270 ML/year) and the Wyong River water source (30 ML/year). Flow volumes in these streams will decrease due to a reduction in base flow and a loss of surface runoff. The Groundwater Impact Assessment determined that the impact on base flow is negligible. To ensure a conservative approach, it was assumed that the reduction in surface water runoff accounted for the entire volume diverted to groundwater.

The pre-mining and post-mining flow-duration curves for Jilliby Jilliby Creek indicate that the loss of 270 ML/year in surface runoff will have a negligible impact on the flow regime of the creek. The impact on the Wyong River is also likely to be negligible, due to the lower impact on surface runoff and the greater flow volumes in the river.

Catchment Area

The Project's water management system will intercept surface water runoff within the Buttonderry Creek and Wallarah Creek catchments generally at constant rates throughout the life of the Project, including:

- At the Tooheys Road Site, the Wallarah Creek catchment (flows to Lake Budgewoi), will be reduced by approximately 36 ha (9.3% of the catchment to the downstream Project Boundary). However, it is intended to replace this loss with discharges of treated water from the Water Treatment Plant; and
- At the Buttonderry Site, the Buttonderry Creek catchment (flows to Porters Creek wetland) will be reduced by approximately 7.4 ha (1.1% of the Buttonderry Creek catchment to the downstream Project Boundary).

After the completion of mining, drains and sediment dams will be retained at both sites and the captured catchment areas will remain the same.

The reductions in each catchment area will result in a decrease in flow volumes in Wallarah Creek and Buttonderry Creek. On average, flow volumes in Wallarah Creek and Buttonderry Creek will be reduced by 150 ML/year and 30 ML/year respectively. The flows in Wallarah Creek will be replaced using controlled discharges of treated

water.

Uncontrolled Offsite Discharges

The mine water management system at the Tooheys Road Site is not expected to experience any uncontrolled discharges even under very wet rainfall conditions (99th percentile model results).

The Entrance Dam at the Buttonderry Site is predicted to experience a number of overflows during the Project life. Discharges are predicted to range between 15 ML/year under median rainfall conditions and 67 ML/year under very wet conditions. Since there is no coal handling at the Buttonderry Site, the primary potential pollutant will be suspended sediment. Since this dam has been sized in accordance with 'Managing Urban Stormwater: Soils and Construction' (DECC, 2008), the runoff captured within this dam will be suitable for release after sedimentation occurs within the dam.

Controlled Discharges to Wallarah Creek

It is proposed that excess treated water will be released into a tributary of Wallarah Creek. These controlled discharges will restore the flows that are lost due to the reduction in the catchment area of Wallarah Creek. Maximum annual discharges are predicted to occur in Year 7 and range from 50 ML/year in a median rainfall year to more than 500 ML/year under very wet conditions.

With these proposed discharges of treated water to Wallarah Creek, the net impact on Wallarah Creek will be an increase in flow volumes. Under wet conditions, the flow volumes in Wallarah Creek are predicted to increase by approximately 2%. Under average to dry conditions, flows volumes are expected to increase by approximately 3%.

Controlled releases are predicted to have the following impacts on the flow regime of Wallarah Creek, including:

- • Negligible impact on the frequency of flows greater than 10 ML/day; and
- • An increase in the frequency of low flows (less than 10 ML/day) from 17% of the time to 30% of the time.

Releases to Wallarah Creek are not expected to have a flow rate of greater than 3

ML/day (35 L/s). Due to the proposed rate of release and the good condition of bank vegetation, it is unlikely that releases of treated water will cause increased erosion in Wallarah Creek. Since Wallarah Creek is an ephemeral stream in the vicinity of the Tooheys Road surface facilities, releases are likely to occur when there is no natural flow in the creek. Despite these releases, Wallarah Creek will remain ephemeral in nature.

Appropriate erosion control measures, such as the installation of an energy dissipation device at the discharge point and channel bed protection immediately downstream of the outlet will minimise scour erosion at the point of release.

The maximum discharge rate of 35 L/s will result in a very low water level compared to the full capacity of the channel. As a result, bank stability is not predicted to be impacted. Due to the low risk of erosion, the geomorphology in the creek is also unlikely to be altered by the discharges.

The Water Treatment Plant will treat mine water to a quality that is similar to the existing Wallarah Creek water quality. The expected quality of treated water is consistent with the existing water quality of Wallarah Creek for all key parameters. The detailed design of the Water Treatment Plant will consider the implementation of additional processes and technologies to eliminate excess quantities of water pollutants, as required. As a result, releases of treated water are not expected to adversely impact the water quality of Wallarah Creek.

Flooding

A Flood Impact Assessment has been undertaken by G Herman and Associates (GHA).

Impact Assessment

Subsidence has the potential to alter the topography within a floodplain, which can alter flood behaviours. The maximum conventional subsidence for the main channel and floodplain of the Wyong River is predicted to be 150 mm, which is not considered significant. As a result, the changes to flood extents and depths in the Yarramalong Valley are expected to be negligible.

Subsidence is expected to occur along approximately 5.2 km of Jilliby Jilliby Creek and Little Jilliby Jilliby Creek, with conventional subsidence being generally less than 1.3 m. The floodplain of Jilliby Jilliby Creek will generally experience similar levels of

conventional subsidence, although the Little Jilliby Jilliby Creek floodplain will experience less subsidence. Subsidence will occur along a 1.3 km section of the Hue Hue Creek floodplain, with conventional subsidence peaking at 0.95 m.

Post-subsidence Flood Behaviour

Subsidence will generally result in a lowering of flood levels. This is because the water level drops with the land surface. However, the flood depth will generally increase within subsided areas. Flood behaviour in the Yarramalong Valley is not predicted to change significantly as a result of subsidence. This is due to the constraints incorporated into the mine plan to minimise subsidence effects on the Wyong River floodplain. The flood levels in the Yarramalong Valley are predicted to decrease by 0.01 m to 0.03 m. These small changes are due to subsidence effects on the Dooralong Valley creating a flood detention effect that reduces peak flows entering the Wyong River from Jilliby Jilliby Creek.

As there will be no significant areas of subsidence in the Yarramalong floodplain, flood depths in the Yarramalong Valley will also decrease by approximately 0.01 m to 0.03 m in almost all locations. The lateral flood extent will decrease by up to 5 m, which translates to a reduction in flood prone land of 0.55 ha. The only increases in flood depths within the Yarramalong Valley occur at three small backwaters on the left bank of the Wyong River that will experience minor subsidence. The flood fringe for these backwaters during a 100 year ARI event will increase by 5.2 ha. The increase in flood fringe arises since the topography has subsided without any material reduction in the flood level of the Wyong River.

The following changes to flood behaviours are predicted to occur in the Dooralong Valley during a 100 year ARI event:

- Flood levels will decrease by up to 1.3 m, but there are areas in the valley where the flood levels will remain unchanged;
- Flood depths will increase by up to 1.3 m, but generally by less than 0.5 m;
- Inundation extent on a lateral basis will increase by up to 240 m in areas affected by subsidence; and
- • An additional 33.2 ha of land will become inundated; however 4.9 ha of land will no longer be inundated, resulting in a net increase in inundation of approximately 28.3 ha.

Changes in flood behaviours will be experienced along the 8.7 km length of Jilliby Jilliby Creek, upstream of its confluence with the Wyong River. The post-subsidence flow velocities are predicted to be similar to existing flow velocities. Subsidence will also alter the proportions of the three floodplain components. In the Dooralong Valley, approximately 28 ha of flood fringe will become flood storage and approximately 12 ha of flood storage will become floodway.

Conversely, there are also 7 ha of flood storage that will become flood fringe and 4 ha of floodway that will become flood storage.

Flood levels in the Hue Hue Creek floodplain will generally decrease by less than 0.1 m. However, the area immediately upstream from Sandra Street will experience a decrease of up to 0.5 m. The flood depth will increase by up to 0.64 m; however the increase in flood depth over most of the floodplain will be much less. The flood extent across the floodplain will increase by up to 30 m in the 1.6 km reach of the floodplain that is directly impacted by subsidence. An additional 1.9 ha of land will become inundated during flooding, but there will also be 0.8 ha of land that will no longer become inundated. The post-subsidence flow velocities will remain similar to existing flow velocities. Due to the predicted increases in flood depths, the floodplain will remain in the high flood hazard category.

Impacts on Dwellings

Yarramalong Valley and Dooralong Valley

There are 283 known properties that are wholly or partially located within the predicted floodplains of the Wyong River and Jilliby Jilliby Creek considered in the Flood Impact Assessment study area. There are 88 structures (83 dwellings and five sheds) within or close to these floodplains. The five large sheds are not primarily used as dwellings. The majority of the dwellings are located in low hazard flood storage areas or flood fringe areas and are currently flood prone in the 100 year ARI flood.

There are 13 other dwellings located downstream of the flood impact assessment study area near the F3 Freeway or Deep Creek that will experience small beneficial impacts due to the (backwater) detention effects mentioned previously. These have not been considered in the flood impact assessment as they are too distant from the Subsidence Impact Limit to be significantly affected by the Project.

For a 100 year ARI flood event, 14 of the 83 dwellings will not experience any material changes to flood impacts. An additional 36 dwellings and three sheds will be beneficially impacted by the Project. That is, the predicted subsidence will lead to reduced flood impacts to these dwellings. A total of 33 dwellings and two sheds are predicted to be adversely impacted by the Project.

Of the 33 dwellings that are predicted to experience adverse impacts, four dwellings were not previously subject to inundation by flooding. That is, these dwellings are predicted to become subject to flooding as a result of the subsidence for the Project. There are an additional 10 dwellings and two sheds that will experience increased flood inundation. These dwellings are already prone to inundation, but will experience inundation more frequently (as the flood levels will exceed the floor levels during lesser floods). The remaining 19 dwellings will remain fully or partially within the flood limits, but will have reduced freeboard).

Of the 36 dwellings and three sheds that are predicted to be beneficially impacted, 33 will experience minor decreases in the frequency of inundation. The other six structures will have increased freeboard and will not be prone to inundation.

For a 5 year ARI event, the flood impacts will remain unchanged for 10 structures. For another 36 structures, flood impacts will improve as a result of subsidence. Nine of these dwellings will experience less frequent inundation. It is predicted that 33 structures will be adversely affected by the Project, including 10 structures which will be subject to increased inundation during a 5 year ARI event.

Hue Hue Creek

In the Hue Hue Creek catchment, there are a number of dwellings near the flood extent for a 100 year ARI event. There is only one dwelling that is prone to inundation under existing conditions. This dwelling will become subject to more frequent inundation as a result of subsidence. There is one other dwelling, currently not subject to inundation, that will become subject to inundation as a result of subsidence. There is another dwelling that is currently affected as flooding blocks access to the property from Cottesloe Road. This impact will remain unchanged after subsidence. Four dwellings will experience a reduction in freeboard as a result of the Project. Ten dwellings will be positively impacted through an increase in freeboard as a result of the Project. The Project will not adversely impact any infrastructure through changes to the flood behaviours of Wallarah Creek.

Impacts on Access to Property

In addition to inundation, flooding can also affect dwellings by interrupting access to the property. In the Hue Hue Creek catchment, both Sandra Street and Hue Hue Road are expected to be inundated during a 100 year ARI event. However, access to properties in the Hue Hue precinct will still be available via other routes.

Inundation durations after subsidence will be similar to or slightly lower than existing durations for low points in the Yarramalong Valley. Subsidence will not result in any major access interruptions for any dwellings that are not already subject to access interruptions. Three dwellings (D0016, D0028 and D0042) will experience access interruptions for a slightly longer period due to increased flooding of tertiary access roads.

In the Dooralong Valley, subsidence will not result in access interruptions for any dwellings that are not already impacted under existing conditions.

The access interruptions described above are the impacts to primary access routes. Access to some dwellings may still be available via secondary routes. However, if points D50 and D70 become inundated concurrently, 198 dwellings in the Dooralong Valley will become temporarily inaccessible for longer periods. These dwellings will be inaccessible for up to 28 hours, which is an increase of 13 hours on pre-subsidence conditions. Even when primary and secondary access routes become inundated, there are emergency evacuation routes available.

Air Quality

An Air Quality and Greenhouse Gas Assessment were undertaken by PAEHolmes.

Impact Assessment

Construction

During the construction of the surface infrastructure fugitive dust emissions can be expected from the following:

- Vegetation clearing / stripping;
- Bulk earthworks and material handling;
- Hauling along unsealed surfaces; and
- Wind erosion on exposed areas.

The total estimated emissions are less than 35% of the emissions estimated to occur during the operation of the Project and therefore further assessment for construction is not considered appropriate. Compliance with air quality goals during the operation of the mine is assumed to represent compliance during mine construction.

Dust Predictions

During operations, the Project will result in emissions of particulate matter, primarily from coal handling activities at the pit top and the operation of upcast ventilation shafts. The results of the modelling indicate that the incremental PM₁₀, PM_{2.5}, TSP and dust deposition at the closest residential receivers are all well below the impact assessment criteria.

The highest ground level concentrations occur at the closest residence to the north of Tooheys Road Site. A cumulative assessment, incorporating existing background levels, indicates the Project is unlikely to result in additional exceedances of relevant impact assessment criteria at the neighbouring receivers. Based on the modelling results, it is not anticipated that the Project will result in any significant impact for future residential dwellings as part of the Jilliby Subdivision.

Coal Haulage

Dust emissions associated with train loading have been included as part of the modelling assessment on mining operations. PAEHolmes reviewed an assessment that has been completed by Queensland Rail (QR) that provided an environmental evaluation of coal dust emissions from rail lines in the Central Queensland Coal Industry (Connell Hatch, 2008). Based upon the results of this study there appears to be a minimal risk of adverse impacts due to fugitive coal emissions from trains. The results of monitoring and modelling indicate that the levels at the edge of the rail corridor are below levels that are known to cause adverse impacts on amenity.

Flare Emissions

Initially methane will be flared in an enclosed structure; however consideration will be given for a beneficial use of methane in electricity generation as actual gas flows are assessed. Parameters used in modelling were typical for enclosed flares installed at

Hunter Valley coal mines.

The maximum predicted 1-hour NO₂ ground level concentrations from flaring is approximately 14% of the goal while the maximum predicted annual average NO₂ ground level concentrations from flaring is less than 1% of the goal.

Odour Emissions

The potential for odour from the ventilation shaft was assessed and found to be minor. The modelling indicates that only one privately owned receiver in the vicinity of the Buttonderry Site is predicted to experience odour above the most stringent odour impact assessment criterion of 2 OU.

The most stringent criterion of 2 OU is considered to be acceptable for the whole population. On this basis, a predicted odour level of 3 OU at one privately owned receiver will be acceptable to the average person.

Notwithstanding this, it is recommended that post commissioning verification of the ventilation shaft emissions is conducted once operational, to validate the assumptions presented in this report.

Greenhouse Gas

PAEHolmes conducted an Air Quality and Greenhouse Gas (GHG) Assessment for the Project.

Impact Assessment

The main sources of greenhouse gas emissions from the Project have been identified as resulting from electricity consumption, fugitive emissions of CO₂ and CH₄, diesel usage, emissions associated with flaring and the transport and final use of the product coal. The proposed planned capture and flaring of remaining CH₄ during operations was found to have significant benefits in the reduction of GHG emissions. When compared with 100% fugitive emissions of CH₄, the flaring scenario results in a GHG saving of approximately 8 Mt CO_{2-e} or 54% of Scope 1 emissions, over the Project life.

Additional GHG savings may be realised through the use of onsite power generation to be implemented if economically suitable to do so. Initially, methane will be flared, however consideration will be given for beneficial use of methane in electricity

generation as actual gas flows are assessed. An installed capacity of 10 MW will provide enough power demand for the site (based on the anticipated electricity demand), thereby eliminating GHG emissions from purchased electricity (~1.5 Mt CO_{2-e} over the Project life). Any additional electricity generated onsite will be distributed back into the grid, thereby offsetting further Scope 1 GHG emissions.

Emission rates for gas engines have been derived based on an assumed total power output of 10 MW (2 MW across five gas engines) and using emission factors (kg/kWh) for uncontrolled gas turbines on natural gas.

The Project's contribution to projected climate change, and the associated impacts, will be in proportion with its contribution to global GHG emissions.

Average annual Scope 1 emissions from the Project (0.2 Mt CO_{2-e}) will represent approximately 0.04% of Australia's annual average commitment under the Kyoto Protocol (591.5 Mt CO_{2-e}) and a very small portion of global greenhouse emissions, given that Australia contributed approximately 1.5% of global GHG emissions in 2005 (Commonwealth of Australia, 2011).

Noise

A Noise and Vibration Impact Assessment for the Project was undertaken by Atkins Acoustics.

Impact Assessment

Construction Noise

During construction, noise levels have the potential to exceed the PSNC at Amberwood Close by 4-9 dBA under worst case weather conditions. This property is owned by WACJV. PSNC are not predicted to be exceeded at any other residential receivers.

Construction Vibration

The greatest levels of ground vibration are produced by the dynamic impact rollers used during construction. Dynamic impact rollers typically produce vibration levels of 2-4 mm/s at a distance of 20 m and less than 1.5 mm/s at a distance of 40 m.

Vibration levels are predicted to be below the structural damage assessment criteria at distances greater than 20 m. Vibration levels at private receivers are predicted to be

within acceptable limits for human comfort.

Ground vibration levels predicted from the use of rock hammers will satisfy the structural damage assessment criteria at all private receivers and will be acceptable from a human disturbance point of view.

Ground vibration levels predicted from the use of rock hammers at the distances to all receivers will satisfy the structural damage assessment criteria and will be acceptable from a human disturbance point of view.

Blasting

Qualitative modelling results show that the air blast overpressure criteria and the ground vibration criteria can be satisfied at the closest private receiver with the employment of controlled Maximum Instantaneous Charge (MICs) and detailed planning of any blasts needed to assist in construction of either surface facilities or underground activities.

Project Operational Noise

Tooheys Road Site

The noise modelling assumed that fixed and mobile plant were operating simultaneously with train loading at the Tooheys Road Site. It has been assumed that train loading occurs with locomotives and wagons stationary on the rail loop and two locomotives stationary on the rail spur. Noise modelling for the Project shows that the PNSC will be met under all weather conditions at all private receivers surrounding the Tooheys Road Site. As such, operational noise levels predicted at Blue Haven and the Warnervale Town Centre are also predicted at less than 35 dBA under adverse wind and temperature inversion conditions at the nearest private receivers.

Receiver 57 and Receiver 58 are privately owned properties where the predicted noise levels under a worst case modelling scenario may exceed the PNSC for more than 25% of a contiguous block of land in single landownership.

The Tooheys Road Site has been designed to minimise operational noise impacts. In order to minimise intermittent noise sources, the design includes an inclined track for training loading, avoidance of at-grade rail crossings, laminated transfer chutes, a concrete coal storage bin and insulated wall cladding on the crusher building.

All curves in the rail loop and spur have been designed with a radius of at least 200 m.

Observations at West Wallsend Colliery, Tahmoor Colliery, Baal Bone Colliery, Charbon Colliery and Koorangang Island Coal Loader have established that wheel / rail interface noise does not occur where the radii of curvature is 200 m or greater and as such, locomotive noise is not anticipated to contribute to operational noise levels.

Buttonderry Site

Modelling shows that the PSNC are not predicted to be exceeded at any private residence or more than 25% of a contiguous block of land in single landownership due to activities from the Buttonderry Site. Consideration was also given to the proposed Jilliby 2 Subdivision. Noise impacts are not predicted to exceed accepted amenity criteria at any future dwelling in this subdivision.

Sleep Disturbance

The noise impact assessment addressed sleep disturbance by considering plant and activities identified as likely to generate short term noise impacts. Key sources assessed included train horns, coal wagon bunching, and train loading bin and coal transfer chutes. Without secondary noise mitigation, modelling identified that sources could give rise to noise levels that exceed the recommended sleep disturbance criteria at up to five representative receiver locations under worst-case meteorological conditions.

However with the application of effective noise controls noise levels from the Project are predicted to remain below the recommended sleep disturbance criteria.

Road Traffic

Due to the limited number and duration of traffic at the Western Ventilation Shaft site around Project Year 13, the assessment has confirmed noise road impacts are unlikely to occur. The predicted $LA_{eq, 1 \text{ hour}}$ road traffic noise levels for Hue Hue Road at 30 m satisfy the day time 60 dBA and night time 55 dBA criteria for collector roads.

Existing dwellings constructed along Hue Hue Road between Bushells Ridge Road and Sparks Road are set back approximately 200 m – 250 m. On Bushells Ridge Road, the predicted traffic noise levels satisfy the PSNC at 10 m from the road.

Existing dwellings constructed along Bushells Ridge Road are set back approximately 20 m – 60 m. During construction periods, traffic noise levels at 10 m are predicted to satisfy the day time 60 dBA target noise assessment goals for collector roads.

Noise modelling for peak annual production output of 5 Mtpa shows that the additional rail traffic noise will marginally increase (1-2 dBA) the existing LA_{eq} , 24 hour rail traffic noise levels on the Main Northern Rail Line. With respect to the LA_{max} noise levels, the Project is not expected to increase the existing levels.

Vibration

The key sources of vibration from mining related activities are anticipated to be dozers and trucks. Vibration levels at private receivers are predicted to be within acceptable limits for human comfort.

Ecology

An Ecological Impact Assessment for the Project has been undertaken by Cumberland Ecology.

Impact Assessment

The assessment lands within the Project Boundary / Subsidence Impact Limit for the Ecological Impact Assessment show evidence of substantial alteration by long-term vegetation clearing for agriculture, farms and forestry activities. This has resulted in a highly disturbed and fragmented landscape. Despite this, the local area has been shown to support a high diversity of threatened flora and fauna and ecological communities, including EECs as listed under the TSC Act.

Detailed assessments of vegetation communities and native flora and fauna have determined that the Project will not have any significant impacts on areas currently identified as potential conservation lands under WSC's Development Control Plan (DCP) 13 – Interim Conservation Areas. Similarly, assessments have confirmed that the Project will not have any significant impact within the areas zoned as 7(g) wetlands under the Wyong LEP. There is a small area of zone 7(g) land within the Project Boundary, as represented by the small yellow area near the Tooheys Road Site.

The Project has been deemed a Controlled Action under the EPBC Act for the Charmhaven Apple and Black-eyed Susan (listed as vulnerable under the Act), and Spotted-tailed Quoll and Giant Barred Frog (listed as endangered under the Act).

Vegetation Communities

Over the life of the Project, approximately 89 ha of vegetation will be directly impacted,

consisting of remnant and regenerating forest and woodland communities and large areas of open grassland and scattered trees located within the Disturbance Boundary. The remaining 13.9 ha within the Infrastructure Boundary is land that is currently in a cleared state.

The areas to be cleared consist of moderate to good condition vegetation, except for areas of Exotic/Agricultural/ Low Diversity Grassland which are considered low condition vegetation. The direct removal of vegetation communities for the Project is likely to result in the following impacts to remaining habitat by:

- Removing or reducing the availability of important habitat features that may offer forage, shelter or breeding opportunities for fauna, thus putting more pressure on remaining habitat to provide these features;
- Exacerbating fragmentation and isolation of already patchy areas of woodland vegetation; and
- Increasing edge effects, particularly along linear patches of vegetation.

In addition to direct impacts caused as a result of infrastructure development, a range of indirect ecological impacts also have the potential to occur. Potential indirect impacts to vegetated areas of the Project located outside of the Disturbance Boundary may include:

- Subsidence impacts due to surface cracking, surface subsidence or groundwater impacts associated with the longwall mining operations proposed for the Project.
- Noise generated by construction and operation of the Project;
- Lighting spillage effects as a result of the infrastructure area;
- Increased likelihood of vehicle strike;
- Erosion and sediment controls;
- Change in flow regimes of streams due to discharges of treated water into Wallarah Creek; and
- Weeds and feral animal controls.

Whilst the Project has the potential to affect the flow regime and water quality of Wallarah Creek through the discharge of surplus treated water into a tributary of Wallarah Creek, due to the low rate of discharge and the quality of water to be discharged, the controlled discharges are not likely to adversely impact the ecology of

Flora

Suitable habitat is present within the Project Boundary and Subsidence Impact Limit for a number of threatened flora species listed under the EPBC Act and TSC Act. Despite the completion of targeted surveys for the Project, only six threatened flora species were found to occur.

Impacts to these species as a result of the Project include the removal of approximately:

- One known specimen of Bynoe's Wattle and 42.9 ha of potential habitat;
- 80 specimens of Charmhaven Apple and approximately 47.7 ha of potential habitat;
- 48.7 ha of potential habitat for the Leafless Tongue Orchid;
- 44.6 ha of potential habitat for the Small-flower Grevillea;
- 9.5 ha of potential habitat for the Biconvex Paperbark; and
- Known specimens of Black-eyed Susan from approximately 28 locations and approximately 50.5 ha of potential habitat. Habitat suitable for 11 additional threatened flora species listed under the EPBC Act and TSC Act recorded in the locality that are considered to have potential to occur were also considered in the Ecological Impact Assessment.

All the native vegetation in the Project Disturbance Boundary was considered to be potential habitat for all of these potential species and as such, 60.5 ha have been assumed to be removed by the Project.

Fauna

The Project will result in the removal of forest, woodland and grassland vegetation communities which provide foraging, shelter and breeding habitat for fauna species in the area.

A number of threatened (TSC Act and EPBC Act) and migratory (EPBC Act) listed fauna species were recorded during field surveys for the Ecological Impact Assessment. Although not identified within the Project Boundary or Subsidence Impact Limit, a number of other threatened species were also considered to have the potential to occur.

The potential impacts of the Project on these species are mostly related to the removal of habitat and potential indirect effects. Approximately 89 ha of vegetation will be removed for construction of the surface infrastructure, and 4,011 ha of vegetation have the potential to be impacted through subsidence effects.

The fauna species most at risk of subsidence impacts are those that depend on waterways and riparian vegetation that have potential to be affected by changes in hydrology caused by subsidence and by minor surface cracking.

Of the 89 ha of vegetation to be directly impacted, potential impacts to species from the Project include removal of approximately:

- 10.4 ha of habitat for threatened frog species (including the Wallum Froglet, Giant Barred Frog, Green and Golden Bell Frog and Green-thighed Frog which are known to occur);
- 44.5 ha of habitat for species of forest owl species, including the Powerful Owl, Masked Owl, Barking Owl and Sooty Owl;
- 46.6 ha of habitat for a range of arboreal mammals, including the Eastern Pygmy Possum, the Squirrel Glider and the Yellow-bellied Glider;
- 50.4 ha of habitat for nine threatened bat species;
- 2.9 ha of habitat suitable for threatened wetland birds, including the Black Bittern, Black-necked Stork, Black-tailed Godwit and White Fronted Chat;
- 51.6 ha of habitat for the two migratory parrot species, the Little Lorikeet and the Swift Parrot;
- 38.3 ha of habitat for the two threatened cockatoo species, the Glossy Black Cockatoo and the Gang-gang Cockatoo;
- 44.2 ha of habitat for the Regent Honeyeater;
- 48.4 ha of habitat for the Grey-headed Flying Fox, mostly due to the removal of areas of Spotted Gum – Grey Ironbark forest or Mountain Blue Gum Turpentine;
- 43.4 ha of habitat for the Little Eagle;
- 37.6 ha of habitat for the Varied Sittella;
- 37.6 ha of habitat for the Bush Stone-curlew;
- 51.5 ha of habitat for the Koala; and
- 48.4 ha of habitat for the Spotted-tailed Quoll.

Cumulative Impacts

A high proportion of the surrounding locality has been and will continue to be subject to underground mining, which involves limited surface disturbance. The Project will contribute to ecological impacts on a regional scale by removing approximately 89 ha of vegetation, including 60.5 ha of remnant forest, open woodland and derived native grassland. Substantial clearing has occurred in proximity to the Project in the past for agriculture, residential and industrial land uses. The offsets provided by the Project will protect existing remnant forest and woodland communities and restore vegetation in areas previously cleared for agricultural and other purposes.

Biodiversity Offset

As a component of the Ecological Impact Assessment, WACJV formulated a Biodiversity Offset Strategy for the Project in conjunction with Cumberland Ecology.

Strategy

The Biodiversity Offset Strategy for the Project has been developed to conserve specific areas within the existing land holdings of WACJV as offsets.

The three main areas proposed for conservation as biodiversity offsets for the Project include a total of 261 ha comprised of the:

- • Hue Hue Road Offset area (160 ha);
- • Tooheys Road Site Northern Offset area (48.4 ha); and
- • Tooheys Road Site Southern Offset area (52.5 ha).

Detailed field assessment of the proposed biodiversity offset areas was undertaken during the surveys for the Ecological Impact Assessment for the Project to determine their biodiversity values, including the vegetation communities, habitat and flora and fauna species present within each. The Project will impact on Charmhaven Apple (*Angophora inopina*) and Black-eyed Susan (*Tetralochea juncea*); however *Angophora inopina* occurs in higher densities within the offset areas. These surveys confirmed that the vegetation communities within the biodiversity offset areas were almost identical to those recorded in the Project Boundary.

Management

The management of the biodiversity offset areas will include the conservation and ongoing management of existing vegetation, as well as revegetation and rehabilitation

of degraded areas.

The conservation and ongoing management of existing vegetation in the biodiversity offset areas will be undertaken in order to maintain and improve their ecological value and facilitate regeneration of native vegetation and associated fauna habitat.

This will include weed and feral animal management, active replanting and reseeding of vegetation and ongoing monitoring.

Revegetation remediation work is proposed for the biodiversity offset areas in order to establish habitat for the suite of threatened species impacted by the Project, particularly the threatened plants *Angophora inopina* and *Tetratheca juncea*. This will occur in areas of Derived Native Grassland and Exotic/ Low Diversity Grassland within the Tooheys Road Southern Offset and Hue Hue Road Offset. Trees and shrubs will be planted in these degraded areas to form the core of woody habitats to be progressively regenerated back into woodland or open forest communities in the medium to long term. Since the areas of Derived Native Grassland within the Tooheys Road Site are showing signs of natural regeneration, the prospects of successful revegetation are good.

Areas in the offset properties will be protected from edge effects by planting of a buffer zone and by undertaking weed and feral animal management.

Control action plans will be developed to account for unexpected impacts from discharges into creeks within the area. Details of these processes will be contained in the BMP.

An estimate of the cost of revegetation and ongoing management of offsets has been prepared by WAJCV and is approximately \$5.9 Million over the 28 years of the Project.

Biodiversity Management Plan

The BMP will guide the implementation and management of impact mitigation and compensatory measures over the life of the Project, including the proposed biodiversity offset areas. The BMP will also specify the management measures that will be undertaken for the biodiversity offset areas, how they will be undertaken, who they will be undertaken by and an associated timeline for each action. The BMP will include details on pre-clearance surveys, capturing and release of fauna (where appropriate), translocation, measures to reduce edge effects and the monitoring and management measures required for the offset areas. Subsidence effects will be monitored to

determine their impact on flora and fauna. The BMP will include an assessment of the likelihood of success of the revegetation proposed for the Project including relevant criteria. If mine subsidence causes any harm to threatened biodiversity, including due to subsequent changes in surface water and groundwater flows, the Biodiversity Offset Package will offset the impact. All procedures will be conducted in accordance with relevant OEH policy guidelines, with appropriate licenses acquired where necessary. The final mechanism to fund management of the offsets in perpetuity will be determined by WACJV, in consultation with OEH and other relevant agencies for inclusion in the BMP.

Aquatic Ecology

An Aquatic Ecology Impact Assessment for the Project has been undertaken by Marine Pollution Research.

Impact Assessment

Project Component Impacts

Potential impacts on Aquatic Ecology arising from the Project can be broadly classified into three categories:

- Surface infrastructure development such as clearing and bulk earthworks for required infrastructure and associated ancillary works;
- Longwall mining, including indirect impacts from subsidence; and
- Surface operations, such as mine water discharges during mine operations.

Impacts due to Infrastructure Development

The vegetation clearing and bulk earthworks required for the development of surface infrastructure have the potential to impact upon aquatic ecology. The various components of the surface facilities have been sited to avoid and minimise any direct impact on creek lines and associated riparian corridors.

The Tooheys Road Site facilities are located between the branches of Wallarah Creek to prevent direct damage to the creek aquatic habitats. There will be a need to clear 1.1 ha of paperbark swamp and 6 ha of Blackbutt-Turpentine open forest, with portions of this habitat located along the riparian bank of Wallarah Creek. There will also be a need to clear 1.8 ha of Swamp Mahogany forest, which also includes some riparian

vegetation along a tributary of Spring Creek.

Road, rail and services links at the Tooheys Road site will need to pass over several branches of Wallarah Creek. These branches are not designated Key Fish Habitat (KFH) but are designated Class 3 to 4 fish habitat and include important wetlands and Wallum froglet habitat.

The Tooheys Road Site rail loop connects to the Main Northern Rail Line Spring Creek crossing, and will also require a crossing over Spring Creek. Spring Creek at this location is designated (KFH) and is a Class 2 stream. These crossings will need to be designed to minimise disturbance to riparian and aquatic ecosystems and to ensure minimum disturbance to stream hydrodynamics, water quality and aquatic habitat condition.

The Buttonderry Site facilities are located on mainly cleared lands approximately 200 m south-west of Buttonderry Creek. The clearing of vegetation for the Buttonderry Site facilities would not directly impact creek or creek riparian habitats. Whilst the Buttonderry site does not require any creek crossings, the site slopes to Buttonderry Creek, which is designated as a Class 3 to 4 aquatic habitats at the runoff locations.

The Western Ventilation Shaft site is located more than 100 m north of the Armstrong Creek (north arm) on a ridge that is accessible via an existing forest track access (Brothers Road). Clearing of vegetation for the site would not directly impact creek or creek riparian habitats. In addition, the Western Ventilation Shaft site does not require any creek crossings. However, the site is located on a hillside that slopes down to the north arm of Armstrong Creek and Brothers Road drains through agricultural land to Little Jilliby Creek at its northern end and drains through forest to Armstrong Creek at its southern end.

Impacts due to Longwall Mining

Due to differential or variable slumping (higher subsidence under longwalls and lower subsidence over pillars between longwalls) there can be potential for sequential ponding as longwalls progress across a valley, with ponding occurring above subsided longwalls and drainage to the subsided longwall ponds from adjacent longwall areas not yet mined. Further, ponding can also be exacerbated by localised differential variations in groundwater levels. This has the potential for altering flooding regimes, causing localised ponding of catchment runoff waters and causing temporary changes in water depth for dams and natural lagoons leading to inundation or waterlogging of emergent

or marginal/riparian vegetation.

These potential impacts are applicable to the alluvial plain in the Dooralong Valley and to the section of Hue Hue Creek within the Extraction Area. Given the comparatively flat nature of these valley floors there is the potential to create additional ponded water bodies. There is also the potential to alter the depths of existing shallow water bodies with subsequent alterations to emergent and fringing vegetation communities and increased isolation of ponds from one another.

It should be noted that these potential impacts need to be considered against the dynamic nature of the streams within the Project Boundary. These streams are subjected to natural events that result in stream, habitat and water quality/quantity changes over time including floods, changes during prolonged droughts, changes due to altered land-uses or changes in catchment soil stabilisation due to bushfires.

Subsidence modelling indicates that post-mining, the overall variation in valley floor topography will be similar to the pre-mining condition. Accordingly, it is anticipated that there will be sufficient adaptive opportunities available to ensure that there would not be significant changes to the overall makeup and function of aquatic habitats within the creeks on the alluvial plain or within the ponded water bodies over the valley floor as mining progresses.

Due to the plasticity of the gullies in the western forested area, the subsidence consequences associated with rock-constrained valleys are unlikely to occur.

The predicted tilts are not expected to result in any slope instability. However, some of the steeper gullies may experience slope instability due to the predicted ground curvatures and strains. The potential for impacts on the stability of the western streams will be assessed prior to mining in the western area. Adaptive management measures will be adopted if it is determined that there is a risk of slope instability.

Impacts due to Surface Operations

The water balance model concludes that there will be excess water after the reuse of water for operational activities. All surplus treated water will be discharged to Wallarah Creek.

The water balance indicates that annual discharge volumes will range from 50 ML/year to 500 ML/year. Although the treated water discharges will alter the flow regime of Wallarah Creek, the creek will remain ephemeral. The frequency of no flow and low flow

conditions is predicted to be similar to existing conditions.

Traffic and Transport

A Traffic and Transport Impact Assessment was undertaken by Parsons Brinkerhoff.

Cumulative Impacts

Approved and proposed projects in the surrounding area were also taken into consideration in the assessment of possible future traffic volumes.

Known additional traffic volumes generated from these developments were included in the background volumes of traffic in the future assessment years.

Impact Assessment

Forecast Traffic Demand

The peak construction period (Year 2) at the Tooheys Road Site is expected to generate 600 two-way trips per day associated with contractors and employees shift changes. At the Buttonderry Site, construction of surface facilities including the shafts will generate 300 two-way trips per day. Deliveries of construction materials, equipment and concrete will be via rigid vehicles. The Tooheys Road Site expects 20 such deliveries per day. The Buttonderry Site only expects 10 deliveries per day using rigid vehicles. During peak production of the Project (assumed Year 12), the Buttonderry Site is expected to generate 500 two-way trips per day associated with the departure and arrival of employees, while the Tooheys Road Site only expects 42 two-way trips per day. It was also assumed that each site will experience 20 delivery and service vehicle movements per day (limited to the business hours of 7:00 am to 5:00 pm).

The construction of the Western Ventilation Shaft in Year 13 is expected to generate up to 25 two-way trips per day associated with the departure and arrival of employees. Up to four two-way constructions vehicle trips per hour may access the site throughout the day, for delivering construction material, equipment, and concrete. The continuous operation of the Tooheys Road Site and Buttonderry Site in 2026 was assumed to generate the same number of traffic trips as it will in 2025.

Peak Hour Selection

The Future peak hours were assessed based on the sum of the following: the 2011 surveyed traffic, growth in the background traffic, traffic associated with the surrounding

new developments; and traffic generated by the Project at key intersections.

Two separate peak hours have been assessed for each future assessment year:

- Total traffic peak hours: representing the highest traffic volumes in the morning and afternoon periods associated with the sum of the background traffic growth, the operation of the surrounding developments, and the inclusion of the Project; and
- Project traffic generation peak hours: the identified hour associated with the maximum traffic generation volumes in the morning and afternoon peaks associated with the Project's employee trips and delivery trips.

Road Intersection Performance

The 'Year 2 with Project' provides Project impact predictions during the construction phase, with background traffic growth and other nearby developments. The 'Year 12 with Project' provides impact predictions during peak production of the Project with background traffic growth and other nearby developments

The F3 Freeway / Sparks Road interchange (western side) is currently operating near its practical capacity during the AM peak hour, despite operating at an acceptable LoS D during the PM peak hour.

A comparison between the 'no-Project' results and those during the construction of the Tooheys Road and Buttonderry Site (Year 2) shows that there is only a marginal deterioration in the performance of the key intersection.

Conditions

Year 13 will include the construction of the Western Ventilation Shaft and mine operations at both Tooheys Road and Buttonderry sites. The results of modelling of Year 13 demonstrate that when comparing the 'no-Project' results with those when both sites are in operation and the Western Ventilation Shaft is in construction (Year 13) there is a slight decrease in performance at all intersections during both the AM and PM peak hours as a result of the increased traffic on the network.

The intersections that are expected to perform poorly with the inclusion of Project related traffic flows in both the Year 2; Year 12 and Year 13 scenarios also show capacity constraints in the 'no-Project' scenarios. At these intersections the traffic

queues will exceed the available turning bay lengths and interrupt the operation of their adjacent intersections. The analysis indicates that the construction and operational activities of the Project will not materially impact on the performance of any of the intersections of the road network. That is, the capacity constraints arising at various intersections are not caused by the Project.

The intersection of Hue Hue Road and Wyee Road is located within the Lake Macquarie LGA. This intersection is generally expected to perform satisfactorily. The exception is during the peak operational period (2025), where the intersection is predicted to perform poorly (LoS F) during the PM peak. However, the contribution of the Project to traffic at this intersection is negligible. The unsatisfactory LoS is due to growth in background traffic and the traffic volumes generated by other developments, as opposed to traffic generated by the Project.

Service and delivery trips associated with the Project will not use the Hue Hue Road / Wyee Road intersection. Therefore, the Project does not increase the heavy vehicle traffic at this intersection. The Project is predicted to account for approximately 4% of light vehicles accessing this intersection during the peak construction period (2015). During the peak operational period (2025), the Project contributes less than 1% of light vehicle traffic at this intersection.

Road Network Performance

Tooheys Road in its current condition is unlikely to efficiently and safely accommodate the additional traffic, which includes a significant proportion of heavy vehicles (20%) associated with the surrounding new developments.

With the additional traffic associated with the operational activities of the Tooheys Road Site, the road is expected to carry only 20 additional vehicles per peak hour – which equates to approximately 3% of the total traffic volume during the peak hour. Consequently, the additional forecast traffic associated with the Project will not impose any adverse impact on Tooheys Road.

Hue Hue Road is expected to carry approximately 1,000 vehicles (two-way) during the total traffic peak hour by Year 13 on the section between Hue Hue Road and Alison Road. This is as a result of the background traffic growth supplemented with the commencement of the surrounding new developments and will occur irrespective of the Project. The additional traffic associated with the Project is estimated as being approximately 4% of the total traffic volume during the peak hours, and thus will not

impact materially on Hue Hue Road.

Road Safety

Potential road safety impacts were identified as a direct result of creating new intersections to access the Buttonderry Site (off Hue Hue Rd), the Tooheys Road Site and the Western Ventilation Shaft Site (off Jilliby Road).

Hue Hue Road/Sparks Road intersection and the F3/Sparks Road interchange currently have a poor crash record and the additional Project related traffic changing the future traffic patterns at these intersections could impact on the frequency of incidents.

Rail

A Rail Study was completed for the Project by Rail Management Consultants Australia Pty Ltd (RMCA) with substantial input provided by RailCorp.

Impact Assessment

Scenarios Assessed

Three scenarios were investigated for the model and are described below.

Scenario One

Existing infrastructure, trains with 46 x 100 t wagons as currently used on the Northern Line travelling at 80 kph

Modelling indicates that only 50% of modelled Project cycles could be considered as reliable. This scenario will not provide an acceptable, long term, sustainable and reliable transport plan. This scenario was reassessed with some of the existing coal paths being “flexed” in order to improve the problematic paths. Some problems were resolved with this option and some new path opportunities were identified, however these changes eliminated one NSFC interstate path each.

Scenario Two

Existing infrastructure, trains with 38 x 120 t wagons which are in line with industry standards for Hunter Valley coal wagons but travelling is constrained to 60 kph (due to track constraints).

The lower speed restrictions of this scenario resulted in substantial cumulative running time losses and path viability. Only one of the six cycles was found to be reliable over a 24 hour cycle. Similarly a “flexed” sub-option of Scenario 2 was developed in order to improve problematic cycles and the sub-option which resulted in some new path opportunities being presented. However, each of these improvements to the coal paths required the loss of one NSFC interstate path which occurred during the “core demand period” for such train paths.

None of these scenario modelling results provided an acceptable transport alternative and therefore suggested an argument for network capacity enhancement by way of additional infrastructure to make the train paths viable.

Scenario Three

Existing infrastructure with new loops and signals constructed at Awaba; trains with 38 x 120 t wagons travelling at 60 kph.

This scenario examined the introduction of a northbound and southbound passing loop in order to improve path reliability. Awaba North was selected as the site of the new passing loop due to the undulating terrain between Broadmeadow and the Central Coast, the spacing of the various coal load points within this corridor, and the proximity to urban development. The introduction of an additional signal south of the Awaba Station was found to allow refuged trains to depart sooner from the passing loop and enhance viability.

The results show that the construction of southbound and northbound loops north of Awaba provide an overall more robust network operation for the Project trains with eight pairs of completely reliable cycles being achieved. The proposed loops also improved the performance of the other train movements on the network. This scenario provided the best outcome for all of the modelled scenarios.

Summary

The forecast growth in freight train movements on the Main Northern Railway Line is an aggregate of increased numbers of NSFC interstate trains, coal trains from Cobbora supplying domestic power stations and export coal trains to the port of Newcastle. These increased freight movements are placing growing pressure on the ARTC and RailCorp Networks specifically between Vales Pt Junction and Kooragang Island.

The provision of new 1,700 m southbound and northbound passing loops at Awaba, emerges as the most suitable option that should be considered by the rail network providers to maintain train programming robustness ahead of significant expansions in coal and interstate freight as associated with the NSFC programme and the forecast Newcastle related port expansion. Such infrastructure will also provide 'future proofing' to cover technical developments particularly in coal enabling the shorter train configurations currently used by the mines to be increased in length.

Level Crossings

Train movements associated with the Project will increase delays for road traffic at level crossing. The Project will impact the level crossings on St James Road, Adamstown and Clyde Street, Islington. Under existing conditions, the Adamstown level crossing is closed for 432 minutes per day (30% of the time) and the Islington level crossing is closed for 463 minutes per day (32% of the time).

The Project will generate an average of 4.33 train movements per day. However, there is capacity for a maximum of 6 trains per day, 6 days per week. Each train will result in an additional closure time of 7 – 8 minutes in the loaded direction and 5 – 6 minutes in the unloaded direction. The average of 4.33 train movements per day will increase level crossing closure times by approximately 56 minutes. Therefore, closure time at the Adamstown Crossing will increase to 488 minutes per day (34% of each day) and closure time at the Islington level crossing will increase to 519 minutes per day (36% of each day). The additional closures due to the Project will generally occur during the night and other non-peak vehicular traffic periods.

Aboriginal Archaeology and Cultural Heritage

OzArk Environmental & Heritage Management Pty Ltd (OzArk) has undertaken an Aboriginal Cultural Heritage Assessment of the areas within the Project Boundary.

Impact Assessment

Archaeological Resource

The archaeological potential of the landform units investigated is constrained by the extent of previous land uses (e.g. cultivation, forestry and development) which have greatly altered the archaeological landscape.

As a consequence of the high levels of disturbance to the ground surface throughout the Infrastructure Boundary, findings confirmed that sites will be in a disturbed context. Landscapes around Wallarah Creek and Spring Creek were considered incapable of supporting large permanent populations, so the remaining sites found tend to display evidence of transient camps. Transient camps have lower levels of lithic discard which can be removed from the landscape if disturbed by ground surface alteration.

A total of eight sites were identified during the field survey within the Project Boundary

and on other WACJV owned land. Of these, an open site (WC-OS2) was located in the Infrastructure Boundary at the Tooheys Road Site. Another four sites (all axe grinding grooves) were located within or near the Subsidence Impact Limit in the west. The remaining three sites are located on other WACJV owned lands west of the Tooheys Road Site. No sites were located within either the Buttonderry Site or Western Ventilation Shaft Site.

The excavation program conducted along Wallarah Creek during March 2010 involved 46 separate excavation pits and confirmed that site WC-OS2 is of low archaeological potential. While items of Aboriginal heritage are present on site, the distribution and nature of these items suggest a random “background” scatter rather than a site. The locations were recorded as an Aboriginal site as they were located within 50 m of each other (consistent with OEH requirements).

The assessment within the Subsidence Impact Limit recorded five axe grinding grooves in the Wyong State Forest/Jilliby SCA within the Terrigal Formation (WSF-AG3, WSF-AG4, 45-3-3040, 45-3-3041 and 45-3-3042). The results of previous studies and the use of the predictive model show that there may be at least some potential for further axe grinding groove sites on other drainage systems in the Wyong State Forest/Jilliby SCA although no other sites were found during field surveys. Other site types, such as open sites, will be rare given the nature of watercourses and the steeply sloping lands comprising the Subsidence Impact Limit. Other areas of the Subsidence Impact Limit include the floodplains which are represented by the survey area within Honeysuckle Park. The floodplains display high degrees of disturbance from farming and clearing activities and from periodic flooding. It has been concluded that this landform will hold low potential for the existence of undisturbed, subsurface deposits.

Definitive impacts as a result of the expected subsidence cannot be accurately predicted due to their indirect nature. Therefore the predicted impacts are a risk based consideration. The low strain impacts may serve to preserve the sandstone where the grooves are located from cracking. If there are minor increases in siltation along the bed of Myrtle Creek as a result of changes in runoff patterns then this may cover the grooves from view. This process can also occur naturally, for example following the sediment mobilisation after a bush fire event. These effects are considered to be of negligible to very low risk of damage to the sites’ integrity.

Cumulative Impacts

Surveys conducted as part of this assessment show that the potential of undetected artefacts is low; therefore the predicted existing resource within the Project Boundary is minimal. Mining operations will have an insignificant cumulative effect as a result of surrounding land uses and the heavily modified state of the environment.

Historic Heritage

A Historical Heritage Assessment was undertaken by OzArk to determine the potential impacts of the Project on historical heritage items identified within and adjacent to the Project Boundary.

Impact Assessment

Summary of Items

There were few previously unrecorded items of historical heritage documented during the most recent fieldwork. There was a low incidence of historical items which was not considered surprising given the nature of the surveyed lands.

Disturbance Area

No historical heritage items were identified within the Disturbance Area. No further discussion of the Disturbance Area is required in relation to historic heritage items.

Subsidence Impact Limit

Items of Heritage Significance

Three items of heritage significance have the potential to be affected by Project related subsidence or the possibility of increased flooding levels. This encompasses items of regional significance, including a brick and iron silo (Heritage Site 1), the dwelling 'Bangalow' (Heritage Site 3) and the Wyong State Forest Historic Site 1 (WSF- HS1). Also located within the Project Boundary is the locally significant Jilliby Public School (Heritage Site 11). This item is however located outside the Subsidence Impact Limit and there is therefore no predicted potential impact to this site.

The Wyong State Forest Historic Site 1 (WSF-HS1) was recorded on the eastern bank along the lower reaches of Little Jilliby Creek. WSF-HS1 consists of a disused forestry road. Historical features of this site include road cuttings, axe marks in trees and evidence of repairs and upgrades being made to the road in the form of different styles of culverts. Currently the road is used by recreational walkers and is in a fragile

state in places, with trees growing through the earthen road and wash outs destroying evidence of engineering efforts.

WSF-HS1 is assessed as holding low historic significance. This is a result of the poor state of repair and the widespread nature of logging in NSW, noting that sites similar to WSF-HS1 are common.

Items of Potential Historic Heritage Significance

The items of potential historic heritage significance recorded by ERM in 2001 were not recorded in the heritage studies that led to the generation of the Wyong LEP heritage list. The majority of these items are privately owned dwellings or parts thereof (sheds / silos) while only two (bridges) are public utilities.

Nine of the 18 potential heritage items identified by ERM are situated within the Subsidence Impact Limit, comprised of five dwellings (G, J, K, R and S), Little Jilliby Road Bridge (M), Bunya Pine (N), Keegan's Silo (O) and Silos (Q).

The nine items within the Subsidence Impact Limit were surveyed on 27 November 2012 to determine their heritage significance. The assessment determined that seven of the items (G, J, N, O, Q, R & S) held no heritage significance. Item M was the only item that was assessed as holding heritage significance. Item M is a bridge on Little Jilliby Road (c. 1894) and was determined to be of local heritage significance. Item K is a dwelling located on private property and could not be accessed during the November 2012 survey. The heritage significance of the dwelling could not be assessed and consequently, the dwelling remains an item of potential heritage significance. Adopting a precautionary approach, mitigation measures have been recommended for Item K.

Items N, O and Q hold some heritage value, despite falling short of satisfying the criteria for local heritage significance. Accordingly, mitigation measures have been recommended for these items. The items identified by ERM that are outside of the Subsidence Impact Limit were not re-assessed. These items (A, B, C, D, E, F, H, I and L) remain as items of potential heritage significance. Since these items are not predicted to be impacted by the Project, no mitigation measures have been recommended.

Subsidence Consequences

The potential consequences of subsidence on historic heritage items were assessed by MSEC. Three items of heritage significance (Items 1, 3 & M) are located within the

Subsidence Impact Limit. There is also one item of potential heritage significance (Item K) within the Subsidence Impact Limit.

The Brick and Iron Silo (Item 1) is predicted to experience a maximum tilt of 7.5 mm/m, which represents a change in grade of 1 in 135. The maximum hogging and sagging curvatures for this structure are predicted to be 0.09 km^{-1} and 0.04 km^{-1} respectively. The structure consists of full masonry walls. The maximum tilt of 7.5 mm/m is unlikely to affect the stability of the structure. However, the predicted curvatures could result in cracking of the masonry walls. The cracking is expected to be of a nature that can be remedied using ordinary maintenance techniques.

The dwelling known as “Bangalow” (Item 3) is predicted to experience a maximum tilt of 7.5 mm/m, which translates to a change in grade of 1 in 135. A tilt of this magnitude can adversely affect the serviceability of the house, such as impacts to gutter and wet area drainage.

Remediation measures may be necessary, such as re-levelling of wet areas. The maximum hogging and sagging curvatures are predicted to be 0.08 km^{-1} and 0.01 km^{-1} respectively. These curvatures are unlikely to significantly impact the structure. There is a low probability that significant repair work will be required.

The Little Jilliby Bridge (Item M) is predicted to encounter a maximum tilt of 0.8 mm/m. This represents a change in grade of 1 in 1,250. This change in grade is unlikely to affect the drainage or serviceability of the bridge. The maximum hogging and sagging curvatures are both predicted to be less than 0.01 km^{-1} . Curvatures of this magnitude are unlikely to cause adverse impacts on the structure.

Little Jilliby Bridge (Item M) is also expected to be subject to non-conventional subsidence movements. The bridge may encounter upsidence and closure movements of up to 50 mm. The bridge is expected to be able to accommodate these movements due to the flexibility of the timber and steel structure. Nevertheless, a structural inspection of the bridge will be undertaken prior to and following mining.

Item K is predicted to experience a maximum tilt of 1.5 mm/m, maximum hogging curvature of 0.02 km^{-1} and maximum sagging curvature of 0.01 km^{-1} . The predicted subsidence effects are not expected to have any significant impact on this dwelling. There is only a 1% probability that substantial repairs will be required.

All other items with potential heritage significance are outside of the Subsidence Impact Limit and will not be impacted.

Visual

The Design Partnership was commissioned to complete a Visual Impact Assessment on the potential impacts of the Project.

Impact Assessment

Tooheys Road Site

Visibility

Key visual impacts towards this site are generally restricted to motorists, with the exception of some private residences in the east. The Tooheys Road Site has a Low visibility category to the public in general. House numbers 209 and 235 Bushells Ridge Road will have some minor impacts upon view. However, these impacts are significantly reduced due to their views being limited to the uppermost section of the product coal stockpile.

The Tooheys Road Site is not expected to have any visual impact on the Warnervale Town Centre and areas of the public domain associated with the town centre. This is due to screening provided by vegetation and a ridgeline between the Tooheys Road Site and the Warnervale Town Centre.

Visual Absorption Capacity

The scenic quality of the Tooheys Road Site is defined in part by its relationship to the wider locality, sharing a similar characteristic to the surrounding area. However, it is important to note that this is a transitional area, with large areas of surrounding land being zoned industrial, with subsequent developments anticipated to occur. Land to the north and west is largely rural in nature but zoned either rural or 10(a) Investigation.

The tallest elements on this site will be the Product Stockpile and the Raw Coal Stockpile which are approximately 29 m and 30 m respectively. The Product Stockpile base will be cut and filled on the southern section of the site. Extensive existing vegetation and the existing mound will effectively shield these features of the site from passing views.

As a result of the topography and the existing vegetation in the area, VAC has been

assessed as moderate, as the Tooheys Road Site infrastructure can be absorbed by the surrounding environment. Other developments surrounding the site such as the Clay Quarry and Tile Factory, electricity pylons and the F3 Freeway also have the capacity to integrate the proposed infrastructure.

On the basis of the above assessment, it is clear that the Tooheys Road Site infrastructure as a whole can be easily absorbed visually by the hills and denser bushland trees as well as by the other developments surrounding the site, such as a quarry, electricity pylons and the F3 Freeway.

Overall, the VAC of the Tooheys Road Site is assessed as Moderate. With appropriate landscape management, (i.e. with very little physical intervention) the overall VAC can be increased to Moderate – High. In order to further minimise the effects, it is recommended that landscaping around key building structures and painting of these buildings in a neutral colour be undertaken to minimise potential impacts. The visual impact of the Tooheys Road Site can be expected to decrease with distance from the site. On this basis the overall VAC of the Tooheys Road Site is Moderate but tends towards High.

Visual Impact Rating

The VIR for the Tooheys Road Site is determined by utilising the visibility and VAC ratings. Using the matrix to align the Low level of visibility and the Moderate-High VAC given to the Tooheys Road Site, these two values result in a Low VIR.

Lighting

Lighting impacts may be created by night operations of the Project. Direct light effects are generally restricted to vehicle and train lights and lighting of coal handling and office areas. Lighting will largely be screened by topography and vegetation.

Buttonderry Site

Visibility

Given the approval of the Warner Industrial Park on the opposite side of Hue Hue Road, and the appearance of this site as being of a commercial nature, the Buttonderry Site is in keeping with the desired future land use of the area.

The Project cannot be viewed by adjoining rural and rural residential properties due to

both vegetation and topography. As such, the visibility of this site is not a major consideration, and the Project will have little to no adverse visual effects and will largely not be visible from any public or private areas.

The Buttonderry Site may be visible from areas within the proposed Wyong Employment Zone (WEZ). The visual character of the Buttonderry Site is light industrial, which is similar to the character of the WEZ. Therefore, the visual impact on the WEZ is predicted to be minimal.

Visual Absorption Capacity

The development proposed in this part of the Buttonderry Site is located within a portion of the site that is largely sheltered from view by both topography and vegetation. The VAC of the eastern portion of the Buttonderry Site is currently Moderate – High. The minor mitigation work proposed will result in this classification being maintained. Overall, the VAC applicable to the Buttonderry Site is Moderate – High, tending towards High.

The rezoning of rural and residential lands to the east for the WEZ industrial development negates the need to consider viewing zone and view sheds in that direction. In addition, the land immediately to the north is owned by WACJV and no residences exist in this vicinity. The Buttonderry Waste Management Facility is located beyond the northern boundary of the WACJV owned land. Consequently, there is no need to consider viewing zones or view sheds in that direction.

The steep rise from the east to the west along the site's southern boundary obscures all views into the site from the south, other than the south-eastern corner. In this location, existing dense vegetation shields the eastern third of the site.

Visual Impact Rating

Using the matrix to align the low level of visibility and the Moderate-High VAC given to the Buttonderry Site, these two values result in a Low VIR for the Site.

Lighting

Lighting impacts may be created by night operations of the Project. Direct light effects are generally restricted to vehicles and office areas. It is predicted that lighting will be screened by topography and vegetation.

Western Ventilation Shaft

The Western Ventilation Shaft is located within the Wyong State Forest and is not visible from any surrounding residences. As it is located adjacent to an existing forestry track it will be visible to any bushwalkers, horse riders or 4WD enthusiasts that may use the track. The number of passers-by is anticipated to be very low to negligible.

Due to the location of the site, the nature of the development and the surrounding environment, there is anticipated to be no adverse visual impact from this site.

Socio Economics

Impact of Construction Phase

The average annual Project construction workforce onsite is estimated to reach a peak of approximately 450 in Year 2. For Year 1 and Year 3, the average annual construction workforce is estimated at 250 and 400, respectively.

In order to support 450 construction workers (Year 2), approximately \$114 M of capital expenditure will be required in the “other construction” sector and “construction trade services” sector.

Expenditure on machinery and equipment is estimated to reach a peak of \$65M in Year3.

The input-output impact analysis found that the construction workforce will provide the following contributions to the regional economy during the peak construction year (Year 2):

- • \$237 M in annual direct and indirect output;
- • \$100 M in annual direct and indirect regional value added;
- • \$76 M in annual direct and indirect household income; and
- • 1,041 direct and indirect jobs.

When the impact of \$114 M of expenditure in the other construction sector and construction trade services sector is assessed for the NSW economy, the impacts are greater due to the larger inter-sectoral linkages and hence multipliers of a larger economy.

The construction phase of the Project will contribute up to the following to the NSW

economy during the peak construction year of the Project (Year 2):

- • \$351 M in annual direct and indirect output;
- • \$159 M in annual direct and indirect regional value added;
- • \$115 M in annual direct and indirect household income; and
- • 1,403 direct and indirect jobs.

The Project will also contribute to the regional and NSW economy through purchases of construction equipment. Expenditure on machinery and equipment is estimated to peak at \$65 M in Year 3. The expenditures for Years 1, 2 and 4 are estimated at \$15 M, \$50 M and \$40 M respectively.

In total, the construction equipment purchases of the Project during the peak year of expenditure (Year 3) will generate the following contributions to the regional economy:

- \$23 M in annual direct and indirect output;
- \$8 M in annual direct and indirect regional value added;
- \$6 M in annual direct and indirect household income; and
- 74 direct and indirect jobs.

The impact of the peak year of equipment purchases (Year 3) on the NSW economy will be up to:

- \$114 M in annual direct and indirect output;
- \$48 M in annual direct and indirect regional value added;
- \$33 M in annual direct and indirect household income; and
- 382 direct and indirect jobs.

Impact of Operations Phase

The input-output impact analysis found that the operations phase of the Project will contribute in the order of up to the following to the regional economy:

- \$625 M in annual direct and indirect regional output or business turnover;
- \$381 M in annual direct and indirect regional value-added;
- \$79 M in annual direct and indirect household income; and
- 805 direct and indirect jobs.

For the NSW economy, the operations phase of the Project is estimated to make up to the following contributions:

- \$900 M in annual direct and indirect output;
- \$507 M in annual direct and indirect regional value added;
- \$154 M in annual direct and indirect household income; and
- 1,711 direct and indirect jobs.

The estimated contributions of the Project to the NSW economy are substantially greater than for the regional economy as the NSW economy is able to capture more Project and household expenditure, and there is a greater level of inter-sectoral linkages in the larger NSW economy. The Project is also estimated to make a substantial contribution to regional, State and Federal Government revenue bases paying corporate taxation and royalty benefits amounting to a net present value of \$346 M (\$1.58 Billion undiscounted value) over the 28 year Project life.

Justification

The EIS has assessed the potential impacts of the Project in accordance with the DGRs issued on 12 January 2012 and the supplementary DGRs issued on 11 July 2012. All relevant regulatory requirements and the findings from the consultation program undertaken for the Project have also been considered in its preparation.

The Project as designed, after considering all options, will maximise the social and economic benefits from the extraction of the NSW Government owned coal resource within EL 4911 and A 405. At the same time it will minimise any impacts to the natural and man-made environment.

In particular, it has been determined that the Project will not unduly impact on either the surface or groundwater regime within or beyond the Project Boundary and will not affect in any measurable way the water supply to the Wyong-Gosford catchment. The Subsidence Impact Limit for the Project encompasses an area of approximately 37 km² representing about 5% of the total catchment area contributing to the Gosford-Wyong Water Supply Scheme.

Further, the Project is consistent with the objects of the EP&A Act when its resultant social and economic benefits are weighed carefully against its predicted social and

environmental costs.

When the management and mitigation measures committed to in this EIS are adopted, the residual environmental impacts of the Project are well within acceptable limits. These impacts are justifiable when considered against the need for the Project and its social and economic benefits.

The Project is not predicted to place significant increased pressure on community infrastructure, such as health or education facilities within the Central Coast region. Additionally, population increase associated with the Project workforce is not predicted to place significant pressures on the currently depressed local housing market.

The Project will provide much needed employment opportunities to the Wyong LGA which has fared poorly in relation to NSW in many measurements of socio-economic indicators. For example, in September 2012, the unemployment rate of the Wyong LGA was 8.1%, compared to the NSW rate of 5.1%.

The Project will contribute positively to the key economic and transport challenges identified in the *Central Coast Regional Strategy 2008*, particularly “increasing and diversifying job opportunities and increasing the level of employment self containment”.

An additional 243 jobs are also predicted to be filled by people currently living outside the Secondary Study Area, but who are likely to relocate to that Area due to the Project.

Should the Project be approved, WACJV will implement the following strategies which will result in tangible social benefits to the Wyong LGA:

- •A workforce recruitment strategy which addresses the needs of the semi-skilled and unskilled workforce which is available locally but will require on the job and more specific operator training;
- The use of best endeavours to achieve the WACJV goal of 70% of its permanent workforce residing within the Secondary Study Area;
- The preparation of a communications program within the Secondary Study Area targeting the current commuting workforce in order to publicise the type of professional and managerial positions that will be available locally;
- Assistance in the development of training and apprenticeship programs for skills relevant to the Project at the College of TAFE in Wyong and/or Newcastle; and
- A VPA with WSC to provide contributions to address demands on local community infrastructure associated with the Project.

Since the granting of the WACJV mining authorities in 1995, extensive exploration programs and detailed feasibility studies have been carried out in order to identify the most efficient and environmentally responsible mining operation to extract the coal reserves. This process has included the consideration and refinement of numerous mine plans and operational alternatives.

The objective of these studies was to develop a mine plan that considered financial viability, the principles of ESD and the minimisation of potential negative environmental and social impacts, whilst maximising coal recovery and retaining operational flexibilities.

The mine plan selected (when compared to other mine plan options considered) will provide the following benefits to the environment:

- Modification to mine layout within the Hue Hue MSD to ensure consistency with local subsidence criteria;
- Restrictions to longwall panel design and layouts to ensure protection of surface and groundwater systems in key areas surrounding Jilliby Jilliby Creek and other surface water channels;
- Removal of specific longwall panels from the mine plan to avoid the Wyong River and its associated alluvium to address perceived community risks in relation to these features;
- Minimised ecological disturbance footprint and a reduction in potential surface water and visual impacts due to the location of the Tooheys Road and Buttonderry sites; and
- Major reduction in infrastructure development footprint (ecological, surface water, air quality, noise and visual impacts) through the removal of a CHPP and associated infrastructure from the Project design, whilst locating the remaining required infrastructure in existing cleared or disturbed areas.

The Project has been assessed with certainty based on a worst case scenario and assuming that operations will be undertaken at a maximum coal production rate of 5 Mtpa over an exaggerated Extraction Area, with all feasible and reasonable management and mitigation measures applied.

The Project mine plan has been prepared to facilitate resource extraction and economic productivity within the constraints of the site and all relevant environmental impact

criteria.

The environmental assessment of the Project has adopted the following general methodology:

- Considering the objects of the EP&A Act, including the principles of ESD and leading practice environmental and social standards (Section 4);
- Performing a Project risk assessment;
- Consultation with stakeholders to identify any additional issues to be addressed in this EIS;
- Undertake a detailed technical assessment to quantify potential environmental impacts with certainty; and
- Develop environmental management and mitigation measures.

In Summation

The Project has been rigorously environmentally assessed in accordance with the EP&A Act, its 'objects', including the principles of ESD, and by processes and in the manner required by the DGRs. This assessment has concluded that the Project should be approved under the EP&A Act.

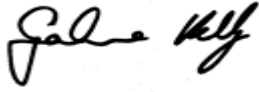
There are environmental costs which have been identified and which are capable of being acceptably managed by operational controls, land acquisition and management plans that would be established and adopted as approved by the Director-General of Planning & Infrastructure and appropriate other Government agencies and authorities. Ecological and long term costs have been minimised and will be offset by management strategies to maintain and improve vegetation and ecological values in the long term.

The Project mine plan appropriately represents a material reduction in scale and impact from the maximum resource extraction mine plan and justifiably sacrifices a material proportion of the remaining in-situ coal reserve. The Project as proposed meets environmental and social requirements and still results in a mine plan and development for which there is a demonstrated need and from which there are material economic, environmental and social benefits.

The Project will maximise the economic and social value from the remaining coal resource by a mine plan that will appropriately address the environmental and socio-economic constraints and the objects of the EP&A Act, including the principles of ESD.

There is no basis for the rejection of the granting of the consent being sought by the Proponent. The Construction, Forestry, Mining & Energy Union (CFMEU) and its Members strongly support the approval being granted in the form sought.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Grahame Kelly', with a stylized, cursive script.

Grahame Kelly

DISTRICT SECRETARY