Warkworth Continuation 2014

1

Environmental Impact Statement

Prepared for Warkworth Mining Limited | June 2014

VOLUME 1 — Main Report













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ENVIRONMENTAL IMPACT STATEMENT CERTIFICATION

For submission of an environmental impact statement (EIS) under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979.*

EA prepared by

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Applicant

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Proposed development

Warkworth Continuation 2014
Refer to Chapter 2 of the EIS for a detailed description of the proposed development

Land to be developed

Refer to Appendix A of EIS

Certification

We certify that we have prepared this EIS in accordance with the Secretary's requirements and to the best of our knowledge the information contained in this EIS is neither false or misleading

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15 June 2014

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Final

Report J14013RP1 | Prepared for Warkworth Mining Limited | 15 June 2014

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Executive summary

Executive Summary

ES1 Context to the proposal

Development consent for Warkworth Continuation 2014 (the proposal) is required to enable continuation of operations at Warkworth Mine in 2015 and beyond.

Mining in West Pit at Warkworth Mine is forecast to reach consent limits in 2015 which would significantly reduce the length of mining (strike length) in West Pit. This reduced strike length would mean that a dragline could no longer be used to efficiently remove overburden material. The inability to use a dragline to remove overburden material in West Pit would require alternative methods that are more costly and slower. This means the cost of production would increase while revenue decreases from a reduced rate of coal produced, affecting the viability of the mine.

The purpose of the proposal is therefore to extend the spatial limit approved under the current development consent to enable mining in West Pit along the required strike length and, subsequently, enable the two main pits, North and West Pit, to advance down dip to the west.

The resource can be extracted efficiently and effectively by the applicant, Warkworth Mining Limited (WML), because of the hundreds of millions of dollars invested in the mine since it commenced operations in 1981 and, that as an existing mine, it has established access to product transport and distribution infrastructure such as road, rail and port. Extraction of the resource would enable the mine to continue to be a major employer in the Singleton Local Government Area (LGA).

The economic significance of the resource attributable to Warkworth Mine includes:

- the continuation of approximately 1,187 jobs on average in the long-term;
- the payment of $567million in royalties to the state; and
- the making of approximately $75million in additional income in net present value terms (NPV) and additional employment of 57 full-time people in the Singleton LGA.

It is recognised that the proposal has some residual social and environmental impacts some of which would be experienced locally, but as discussed below the impacts meet all current government policies and would be managed in accordance with industry best practice.

ES2 Background to the proposal

Warkworth Mine is an existing open cut coal mine approximately 8 kilometres (km) south-west of Singleton in the Hunter Valley. It has been continuously operating since 1981. It is situated in an area where the dominant land use is mining.

Warkworth Mine and the adjacent Mount Thorley Operations (MTO), although being owned by different entities, have both been managed by Coal & Allied since 2004 to realise cost savings through synergies of sharing equipment, personnel, water, rejects and coal preparation across both operations. The separate ownership is reflected in each mine having its own standalone mining leases and development consent. The integrated operation; namely, Mount Thorley Warkworth (MTW), has a workforce of approximately 1,300 persons on average, which includes full-time contractors.

A separate development application (DA), under Part 4, Division 4.1 of the EP&A Act, referred to as Mount Thorley Operations 2014 has been lodged at the same time as the DA for the proposal. The Mount Thorley Operations 2014 application relates to a continuation of the development consent beyond its current 2017 expiry to enable more time for the completion of existing approved mining, while aligning the consent life with the timeframe contemplated under the proposal to enable the continued integration of the two operations. The current operational integration at MTW is critical to Warkworth Mine's future operation.

The existing Warkworth Mine contains three pits, North Pit, West Pit and South Pit with South Pit nearing completion. Extending the spatial limits of the development consent is required because:

- Between 2015 and the end of the development consent period (2021), mining activity at Warkworth Mine will be severely restricted by approved spatial limits being reached. In addition, MTO's development consent is due to expire in 2017. Securing timely new long-term approvals for the integrated operations is critical to the viability of MTW. The existing mining approvals do not provide adequate longevity to support further capital investment into the MTW business and the extraction of the remaining resource already approved for mining. Without these approvals, MTW would be required to commence closure planning in the very near term.

- MTW is a high strip ratio operation. Given the associated high cost of the operations, the choice of mining method is critical to ensuring the ongoing viability of the operation through changing economic environments. For the MTW operation, draglines are the most efficient mining method used to offset a proportion of the overall higher cost of mining. Draglines move waste material for approximately one third the cost of load and haul mining systems.

- The Warkworth Mine and MTO have high fixed costs and require production to be approximately 18 million tonnes per annum (Mtpa) of Run of Mine (ROM) coal to remain profitable in the current economic environment.

- MTW currently operates three draglines with a total available strike length of 6.65km. The closure of South Pit in approximately 2016 and Loders Pit at MTO in approximately 2020 (subject to approval of the Mount Thorley Operations 2014 application) further reduces dragline strike length, to 3.8km. This represents a 43 per cent reduction from the current strike length and a 61 per cent reduction since 2004. At this point, MTW's only two operating pits would be North Pit and West Pit. To remain a viable operation, Warkworth and MTO require dragline strike length to be maximised. This would enable operating costs to be kept lower given draglines move waste material at a much lower cost compared with load and haul mining systems, as well as maintaining a production profile of approximately 18Mtpa of ROM coal across the two mines. This level of extraction is the critical threshold to ensuring that the coal preparation plants at the respective mines have sufficient coal supply available for processing as well as generating sufficient revenue to offset the high cost of mining the MTW resource.

The proposal seeks to extend West Pit to the south and west into Saddleback Ridge and then both North Pit and West Pit would advance down dip, across Wallaby Scrub Road. North Pit would advance through an area of Warkworth Sands Woodland west of Wallaby Scrub Road.

It is recognised that Saddleback Ridge and Warkworth Sands Woodlands (WSW) are features of interest to a range of stakeholders. Avoidance of these areas is not possible for the continuation of viable mining at Warkworth Mine.

As described above, maximising the dragline strike length is critical to the efficient operation of the mine. Under the current development consent, a dragline would not be able to extract the lower overburden pass in West Pit as the area to the west (Saddleback Ridge) could not be incorporated into the pit. This is because the strike length would decrease to the point where draglines can no longer operate due to insufficient working room for the dragline and the spoil. Further, there would be no room for access ramps so haul trucks would not be able to access extracted coal. The reduced strike length and inadequate physical working area would not allow the required 18Mtpa of ROM coal to be produced across the operation.

Avoidance of WSW in North Pit would have a similar effect that Saddleback Ridge would have on West Pit. This would result in a reduced strike length of up to approximately 60 per cent in some places. The reduced strike length and inadequate physical working area would not allow the required 18Mtpa of ROM coal to be produced across the operation.

ES3 Approval history

Warkworth Mine currently operates under Development Consent No. DA 300-9-2002-i issued in May 2003 by the then Minister for Planning (the development consent) under Part 4 of the EP&A Act. It also operates under Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approvals EPBC 2002/629 and EPBC 2009/5081.

In 2010 an application was made for an extension of Warkworth Mine to the west of the current pit wall (Warkworth Extension 2010). Project approval (PA 09_0202) was issued on 3 February 2012 by the Planning Assessment Commission (PAC), as delegate of the Minister.

The Commonwealth Minister for the Environment also approved the Warkworth Extension 2010 under the EPBC Act on 9 August 2012 (EPBC 2009/5081). This approval is for the activities and the spatial extent the subject of the proposal. No further approval is required under the EPBC Act for the proposal.

Subsequently, the NSW project approval was appealed in the NSW Land and Environment Court (L&E Court). On 15 April 2013, the appeal was upheld by the L&E Court and the application was disapproved. The L&E Court judgment was appealed on administrative law grounds by WML in the Court of Appeal however was dismissed on 7 April. Notwithstanding, Warkworth Mine retains Commonwealth approval for the Warkworth Extension 2010.

The L&E Court judgment resulted in the inability of Warkworth Mine to operate along the required strike length in West Pit to maintain viable production rates. Accordingly, a 350m extension referred to as Modification 6 was sought and approved in early 2014, to enable mining to continue in the very short-term whilst enabling longer term mine planning for Warkworth Mine to continue regarding its future.

ES4 Improvements and differences to the Warkworth Extension 2010

The proposal is submitted with consideration of the outcomes of the L&E Court judgment and Warkworth Mine's long-term mine planning requirements. While the proposal has similarities to the Warkworth Extension 2010 there are a number of important improvements and differences which are summarised below.

- Operational improvements in response to ongoing stakeholder engagement particularly regarding the proactive and reactive management of noise and dust resulting in changes to operations.

- Changed legislative and policy environment. Of importance, this includes the introduction of Clause 12AA of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (the Mining SEPP) which operates to make the 'significance of the resource' the principal consideration of the matters the Minister is to consider under Part 3 of the Mining SEPP. Non-discretionary development standards for mining were also introduced through the operation of Clause 12AB.

- Additional commitments, for example: the inclusion of an additional area within the Wollombi Brook Aboriginal Cultural Heritage Conservation Area (WBACHCA); and establishment of local historic heritage conservation initiatives.

- Design elements, such as a more undulating landform and optional underpass of Putty Road.

- Key matters raised in the L&E Court judgement have been addressed, namely:

  - Noise:

    - Background noise levels in Bulga have been confirmed through further detailed studies enabling a thorough and advanced way of allocating background noise levels to each individual receiver, which was discussed with the NSW Environment Protection Authority (EPA).

    - All residences in Bulga are below the Mining SEPP's cumulative noise limit from all industrial noise sources. Compliance with the Mining SEPP's cumulative noise limit is accepted as providing significant protection against noise impacts. This means that the total impact from all mines in the locality would not result in reduced amenity.

  - Ecology:

    - The proposed offset strategy fully satisfies contemporary policies and provides a significant ecological benefit in the long-term.

    - An assessment of impacts on biodiversity has been undertaken in accordance with new government policies which were not in place for Warkworth Extension 2010. These include the principles and strategies in the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a) and the *Upper Hunter Strategic Assessment* (UHSA) – Interim Policy. These new policies have been developed to encourage a transparent methodology for calculating biodiversity loss and gain and support the strategic management of biodiversity.

    - The calculation of impact credits using the biodiversity certification assessment methodology (BCAM).

    - Warkworth Sands Woodland (WSW) communities impact credits would be retired using a combination of land based offsets and supplementary measures.

    - Non-WSW communities' impact credits would be retired in accordance with the provisions of the UHSA or by providing land based offsets or purchasing credits on the open market.

- Economics:

  - New models have been provided to assist the consent authority in understanding the economics of the proposal. The models used rely on market-based and revealed preference techniques for valuing the external effects associated with the proposal as opposed to choice modelling as it is considered to be a more reliable indicator of people's preferences. It is noted that these are tools only, and do not replace the decision-making task of the consent authority, but are as robust as current economic modelling permits.

  - The resource within the proposed 2014 disturbance area, approximately 230 million tonnes is economically significant as per the matters outlined in clause 12AA(2) of the Mining SEPP.

  - It is clear that the proposal provides significant economic benefits. The benefits of MTW include annual average employment of almost 1,300 full time people, approximately $6.1billion in additional expenditure (including capital investment), and over $617million in royalties (see Section ES5.5). The benefits attributable solely to Warkworth Mine include annual average employment of approximately 1,187 full time people, approximately $5.8billion in additional expenditure (including capital investment), and over $567million in royalties.

- Social:

  - A detailed social impact analysis has been undertaken. The results of which are that, while immediate neighbours have expressed subjective concerns in respect of the proposal, the objective evidence demonstrates that the actual impacts meet the levels prescribed in various government policies. Therefore, while not wanting to minimise the subjective concerns of immediate neighbours, the impacts of the proposal need to be considered in this light.

Further, it should be noted that the decision by the L&E Court in respect of the Warkworth Extension 2010 was a merits based appeal determined on those particular facts the subject of the appeal. Accordingly, it is not a binding legal precedent that limits the discretion of future decision makers in respect of the proposal.

ES5 Impact assessment

A summary of predicted impacts from the proposal after the implementation of proposed avoidance, mitigation and compensatory measures is provided below.

ES5.1 Noise and vibration

Acoustic engineers worked collaboratively with mine planners to ensure noise amelioration measures were incorporated into the mine design where feasible and reasonable. The effectiveness of these measures was continually tested in an iterative process with mine planners until adverse modelling predictions at assessment locations were minimised to the maximum extent that is feasible and reasonable.

A full assessment of noise and vibration was carried out in accordance with the *Industrial Noise Policy* (the INP, EPA 2000). The study was independently peer reviewed with the outcomes reflected in the final study. The findings of the study were:

- all reasonable and feasible measures have been applied to control noise from Warkworth Mine;
- the Mining SEPP's non-discretionary standard for cumulative amenity noise levels at privately-owned residential dwellings is met for Bulga village and, therefore, noise impacts are below the acceptable noise levels and amenity of the village as a rural area would be maintained;
- the determining factor for the project specific noise levels (PSNLs) for all residences is the intrusiveness criteria. Background levels have been determined in full compliance with the required processes in the INP for setting background levels;
- four significant exceedances (>5dB(A)) of the PSNLs are predicted to occur and require the provision of acquisition rights with three at Warkworth village (77, 102 and 264) and one to the north of Bulga village (34). Assessment location 34 is the only residence that would be subject a significant exceedance due to the proposal, the other three already being subject to a significance exceeedance of noise. Assessment location 77 is currently afforded acquisition rights from Wambo Mine. Assessment location 264 is inferred to have acquisition rights from Wambo Mine but is not currently included in its approval. Assessment location 102 is Warkworth Hall, which is a non-residence;
- noise levels would be within 1 or 2dB(A) of the PSNLs for the majority of the residences at Bulga village. Current government practice is not to accord mitigation rights to residences unless noise levels are greater than 3dB(A) above PSNLs;
- low frequency noise levels predicted from the proposal meet current government policy requirements. Noise levels are predicted to meet relevant Broner criteria for low frequency noise and INP criteria for sleep disturbance at representative assessment locations;
- cumulative noise levels would satisfy the INP (and Mining SEPP) night time criterion at all but two residential assessment locations in Warkworth village (77 and 264). However, it should be noted that the exceedance of cumulative noise criteria at these assessment locations is predominantly caused by the nearby Wambo Mine. Furthermore, as noted above, assessment location 77 is currently afforded acquisition rights from Wambo Mine, and assessment locations 264 would be afforded acquisition rights from Wambo Mine had it been previously assessed;
- appropriate management of blasts would ensure blast noise overpressure and ground vibration limits (and Mining SEPP non-discretionary standards) are satisfied;
- the closure of Wallaby Scrub Road and resulting increased traffic on detoured roads would not result in an exceedance of relevant noise criteria; and
- the removal of Saddleback Ridge (initially assessed in indicative Year 9 mine plan) is accounted for in modelled and predicted noise levels for the proposal. At this stage of mining, noise generated from Warkworth Mine would be managed through different combinations of equipment attenuation and onsite operational noise controls such as plant relocation and shutdown to achieve relevant noise criteria.

Overall, only one additional privately-owned residence, that is not within either Warkworth Mine's or a neighbouring mine's existing acquisition zone, would be afforded acquisition rights under the proposal. Furthermore, given that the cumulative noise levels have been met at the majority of assessment locations, and it is unlikely there would be additional noise sources nearby in the future, the residences at Bulga generally have a rural level of amenity as per the INP.

It should be noted that noise limits at some residences are slightly higher than those predicted in the *Warkworth Extension 2010 Environmental Assessment* (EMM 2010a). In 2010, manufacturers indicated that 113dB(A) was a continually achievable sound power level (SWL) for trucks. Measurements taken since that time indicate that, while this level is achievable, it is unlikely to be sustainable in service for the entire operation. Therefore, a more conservative SWL of 115dB(A) was adopted for modelling purposes.

A noise management system is currently implemented at Warkworth Mine which consists of real-time and attended noise monitoring, administration, substitution and elimination controls, engineering measures, and a commitment to continuous improvement. These management practices would continue under the proposal. Compliance assessment monitoring for Warkworth Mine, including independent reviews, has demonstrated a high level of compliance with noise criteria.

ES5.2 Air quality

Consistent with noise, air quality engineers worked collaboratively with mine planners to ensure dust management measures were incorporated into the mine design where feasible and reasonable. The effectiveness of these measures was continually tested in an iterative process with mine planners until adverse modelling predictions at assessment locations were minimised to the maximum extent that is feasible and reasonable.

The air quality and greenhouse gas study was undertaken for the proposal in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC 2005). The findings of the study were:

- all reasonable and feasible measures have been applied to control dust from Warkworth Mine;
- significant air quality impacts would be primarily experienced at Warkworth village due to mining activities moving closer as the mine plan progresses westwards;
- the Mining SEPP's non-discretionary standard for cumulative air quality is met at all but two privately-owned residential dwellings (assessment locations 77 and 264) which are in Warkworth village. These assessment locations, and one non-residence (102 – Warkworth Hall), may experience concentrations above the relevant air quality goals for 24-hour average and annual average PM_{10} (particulate matter with a diameter of 10µm or less). Assessment location 77 is currently afforded acquisition rights from Wambo Mine. Assessment location 264 is inferred to have acquisition rights from Wambo Mine but is not currently included in its approval;
- the Mining SEPP's non-discretionary standard for cumulative air quality at privately-owned residential dwellings is met for Bulga village and, therefore, air quality impacts are below the acceptable air quality concentrations and amenity of the village should not be reduced;
- dust from mining is generally coarse in fraction (> $PM_{2.5}$) whereas the fine fraction dust (< $PM_{2.5}$) of concern to human health typically originates from combustion sources;

- cumulative $PM_{2.5}$ (particulate matter with a diameter of 2.5µm or less) concentrations would be below the National Environment Protection Measure (NEPC 2003) advisory reporting standards at all of the assessment locations where the concentrations of other pollutants are below the relevant air quality goals;

- no air quality impacts are predicted to result from diesel emissions (NO_2 and CO) and blast fume emissions; and

- annual average greenhouse emissions over the 21 year life of the proposal are conservatively estimated at 1.038Mt CO_2-e (Scope 1 and 2), which represents approximately 0.18 per cent and 0.65 per cent of Australia's and NSW emissions, respectively.

Air quality and greenhouse gas impacts are currently managed at Warkworth Mine through an existing integrated management system which involves the implementation of a monitoring network, best practice mitigation measures, and operational control strategies and measures with the objective of continuous improvement. Recent air quality monitoring results for 2012 and 2013 have shown that the Warkworth Mine is complying with the relevant air quality criteria.

The objectives of MTW's climate change programme are integrated into existing business processes and funding is provided for a number of research projects related to the research of low emissions coal technologies. These practices would continue under the proposal.

ES5.3 Ecology

The biodiversity assessment and offsetting approach for the proposal follows the principles and guidelines outlined in the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a) and the accompanying *Draft Framework for Biodiversity Assessment* (OEH 2014b). This is the new Biodiversity Policy introduced by the government since the L&E Court judgment. Relocation of existing options, impacts and offsets have been assessed in accordance with these policies.

In accordance with these policies avoidance and minimisation measures have been implemented through the design of the proposal, including the decision to close rather than relocate Wallaby Scrub Road to reduce further impacts on EECs that would occur if the road was relocated.

The resultant proposal would require the progressive clearing of 611ha of native vegetation, including approximately 72ha of WSW endangered ecological community (EEC), 372ha of Central Hunter Grey Box – Ironbark Woodland EEC and 15ha of Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC (including regenerating vegetation).

In accordance with the principles and guidelines of contemporary government policy, measures to mitigate and compensate for the loss of biodiversity features, including EECs and associated woodland habitat, have also been identified. These measures include:

- establishing offset sites; and/or

- undertaking mine site rehabilitation; and/or

- undertaking supplementary measures (for WSW only given its restricted distribution); and/or

- retiring of credits under the UHSA or purchasing credits on the open market.

Residual impacts on biodiversity would be compensated for by the provision of offsets in the SBA and Northern Biodiversity Area (NBA). The clearing of WSW EEC for the proposal would be offset by the provision of 75.5ha of WSW in the SBA and NBA, as well as the re-establishment of approximately 159ha of this community. In addition, a range of supplementary measures would be implemented for this community including the conservation of previously un-protected Warkworth Sands Grassland to be re-established under the 2003 consent, preparation of an Integrated Management Plan for WSW and the development of completion criteria for rehabilitation.

The proposal's impacts on non-WSW vegetation were assessed using BCAM to calculate the credit requirements under the *Draft NSW Biodiversity for Offsets Policy for Major Projects* (OEH 2014). These credits would be met through WML's participation in the UHSA.

In the future, the SBA and rehabilitated mine area would combine to create a large area (exceeding 2,800ha in size) of treed vegetation in the landscape subject to long-term conservation and would join other conservation initiatives from adjoining mines. The NBA would also be regenerated to form a large patch of woodland and forest of over 300ha. Such vegetation is intended to provide and maintain substantial habitats for native flora and fauna in the long-term.

The proposed mitigation and offset measures presented for the proposal would minimise the impacts on threatened species, populations and ecological communities and compensate for the loss of biodiversity as they would:

- meet the offset requirements of the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a);
- adequately reallocate the offsets for non-WSW vegetation, providing a 'maintain or improve' outcome in accordance with the BCAM;
- provide suitable offsets for the WSW through both land-based and supplementary offsets to maximise the long-term viability of the community;
- adequately compensate for the impacts of the proposal on non-WSW vegetation in accordance with the UHSA;
- provide a net increase in the area of EECs to compensate for the predicted loss as a result of the proposal;
- provide a net increase in habitat available for threatened fauna species such as threatened woodland birds, microchiropteran bats and the Squirrel Glider; and
- provide a connecting corridor of woodland vegetation and fauna habitat across the Site, linking to other rehabilitation areas and remnant vegetation, thus providing large continuous patches of habitat into the future (see Section ES5.11).

ES5.4 Social

A social Impact assessment (SIA) was prepared for the proposal and the Mount Thorley Operations 2014 due to the multifaceted nature of social impacts. The SIA was supported by a comprehensive stakeholder engagement programme.

The proposal would enable operations to continue in 2015 and beyond allowing MTW to maintain 1,300 jobs over the longer term and for it to continue to be a major employer in the Singleton LGA. As a long standing member of the community, with both mines commencing operations in 1981, the greater impacts on the socio-economic environment and community services from the proposal are predicted to occur if the proposal does not proceed. These would include:

- workers and their families moving away from the area;
- workers and their families faced with unemployment and financial difficulties;
- reduced local spending;
- decreased local businesses;
- contribution to population decline;
- reduced viability of services such as local schools; and
- reduced community life and participation.

The stakeholder perceived impacts and opportunities of the proposal, paying particular attention to Bulga village, were determined through consultation and compared to the outcomes of technical studies that form part of the EIS or with external literature. Matters raised related predominately to amenity, the physical environment, health and well-being, the economy, infrastructure and services, and community engagement, relationships and governance.

Since the Warkworth Extension 2010 proposal, based on feedback received from a range of stakeholders, a suite of ongoing and proposal specific strategies have been developed by Coal & Allied to improve communications generally and to manage/ mitigate or enhance proposal-related impacts and opportunities.

In particular, a social impact management plan would be developed for the proposal to further develop these management and mitigation measures and detail a plan of implementation including responsibilities, timing, performance indicators/targets and monitoring measures. The social impact management plan would be prepared in consultation with key stakeholders, following the EIS/SIA, public exhibition and submissions process.

ES5.5 Economic

An economic study, in the form of a cost benefit analysis and regional economic impact assessment, was undertaken to assess the economic benefits of the proposal and address the requirements of the *Guideline for the use of Cost Benefit Analysis in mining and coal seam gas proposals* (NSW Government 2012), the *Guideline for economic effects and evaluation in EIA* (Planning NSW 2002), and the *NSW Government Guidelines for Economic Appraisal* (NSW Treasury 2007).

The economic significance of the resource, as stated in clause 12AA of the Mining SEPP set the context in which the proposal was assessed. Specifically, the matters outlined in clause 12AA(2) are shown in Table E.1.

Table E.1 Matters in clause 12AA(2) of the Mining SEPP regarding the economic significance of the resource

Entity	Employment generation (annual average full time employees)		Incremental expenditure ($M NPV)	Incremental royalties ($M NPV)
	Reference case (no approval)	The proposal		
Warkworth Mine	835	1,187	5,723	567
Integrated MTW	987	1,307	6,020	617

Notes: 1. Figures in the table are the difference between the reference case (ie the proposals are not approved) and the proposal.

The study described direct and flow-on economic benefits of the proposal for Singleton LGA, the Mid and Upper Hunter region, NSW and Australia. These economic effects were described as incremental impacts relative to a reference case, which assumed mining at Warkworth Mine continued until the expiry of the development consent in 2021. This is regarded as a conservative assumption as mining in West Pit is forecast to reach consent limits in 2015 which would result in mining along a reduced strike length. This, in turn, would reduce mining below economically viable production rates well before the 2021 expiry of the current development consent (see Section ES1).

In NPV terms, the proposal combined with the Mount Thorley Operations 2014 would deliver net benefits to NSW of around $1.5billion. Where the economic flow-on effects of the proposal are concerned, the benefits attributable to Warkworth Mine in NPV terms amount to:

- for NSW, the additional disposable income received by employees of $346million, additional annual employment of 191 full time employees, and a contribution to NSW gross operating surplus of $406million;
- for the Mid and Upper Hunter region, the additional disposable income received by employees of $204million, and additional annual employment of 198 full time employees; and
- for the Singleton LGA, the additional disposable income received by employees of $75million, and additional annual employment of 57 full time employees.

ES5.6 Groundwater

A groundwater study was undertaken to assess the potential impacts of the proposal and address the requirements of NSW Office of Water's *Aquifer Interference Policy* and the Mining SEPP. The study applied a groundwater model which was rigorously calibrated with data from the extensive MTW monitoring network. The groundwater model was independently peer reviewed with the outcomes reflected in the final study. The findings of the study were:

- the groundwater model has predicted a water take from the Permian and alluvial sources less than the currently approved water take;
- no privately-owned water supply bores would be impacted above the minimal harm criteria described in the *Aquifer Interference Policy*;

- the proposal is not predicted to significantly change the water table in alluvium that supports groundwater dependent ecosystems. The water table at the base of the Warkworth Sands is perched and not directly connected with the underlying Permian. Therefore, the proposal is not expected to impact on the Warkworth Sands groundwater system or the associated vegetation community. Nevertheless, monitoring bores would be installed in the western extent of the shallow sands west of the approved mining activities;

- the reduction in saline Permian groundwater discharge to the Wollombi Brook alluvium is predicted to reduce the salinity in the alluvium during the life of the proposal; and

- the final void would be a local 'sink' with groundwater, surface runoff and rainfall inflows slowly filling the void before the water surface reaches an equilibrium level and the groundwater levels in the aquifers begin to recover.

Groundwater and surface water at MTW are currently managed through an overarching water management plan (WMP). The MTW WMP includes a groundwater monitoring programme that would continue under the proposal. No additional mitigation measures, to those already implemented, are required for the proposal.

ES5.7 Surface water

The water management systems (WMS) for Warkworth Mine and MTO are currently integrated across MTW. Water engineers have worked closely with mine planners and operational teams over many years to design a WMS that minimises the risk of adverse impacts occurring on surface water resources.

Water requirements would be predominantly sourced from water collected onsite with some water sourced offsite through water sharing agreements with nearby mines and from the Hunter River in accordance with MTW's current licence entitlements. Water would continue to be discharged from MTW's licensed discharge points. All saline discharges would be controlled to meet the requirements of the Hunter River Salinity Trading Scheme so that offsite water quality impacts are managed. The MTW WMS would capture runoff resulting in a minor reduction (maximum of 0.44 per cent) in the Wollombi Brook catchment area and a negligible reduction in the Hunter River catchment area.

The results of the surface water study indicate that the impacts of the proposal on surface water resources are unlikely to be significantly different to the existing approved operations and would not have a significant impact on surface water quality of the adjacent water features. Surface water would continue to be managed under the MTW WMP and the existing MTW surface water monitoring programme. No additional mitigation measures, to those already implemented, are required for the proposal.

ES5.8 Aboriginal cultural heritage

Previous Aboriginal cultural heritage baseline studies have identified a number of heritage items or places within and around the Site. Within the proposed 2014 disturbance area there are 110 extant items or places primarily consisting of stone artefact(s) in disturbed contexts. These items/places are categorised as 'material cultural heritage' that derive from cultural activities of Aboriginal people and are unlikely to have scientific significance.

The WBACHCA is proposed to compensate for the proposal's impacts on Aboriginal cultural heritage. The WBACHCA is west of the proposed 2014 disturbance area adjacent to the Hunter River. A total of 265 items/places have been identified within this area including the Bulga Bora Ground, a place of very high cultural significance to the Upper Hunter Valley Aboriginal community as well as scientific significance. The development of the WBACHCA, as well as the management of other Aboriginal heritage items/places within the Site and surrounds, has been undertaken in consultation with the Aboriginal community. The Aboriginal community would continue to be involved in the development and implementation of a customised management plan for the WBACHCA as well as overall Aboriginal heritage management at MTW.

ES5.9 Historic heritage

The historic heritage study identified 50 historic features within the surrounding area of the proposal including seven registered and 43 non-registered items or places. Within the proposed 2014 disturbance area there are four non-registered historic features, two with local and State significance (the former RAAF Base Bulga Complex and Great North Road Complex) and two with local significance (P1 huts at 297 and 377 Wallaby Scrub Road).

The study found that while small portions of the former RAAF Base Bulga Complex and Great North Road Complex would be impacted by the proposal, heritage impacts are likely to be minor. Impacts on the P1 Huts are likely to be moderate as these style huts are becoming rare. Other historic features within and in close proximity to the proposed 2014 disturbance area may experience indirect impacts associated with activities such as exploration and blasting. Impacts on these features are mostly negligible.

Where impacts on historic heritage sites or places are unavoidable, mitigation measures would be undertaken in accordance with their heritage value. Conservation management plans have been, or would be, prepared for the Great North Road Complex, former RAAF Base Bulga Complex, the Brick Farm House and Springwood homestead.

Coal & Allied also proposes to implement a Local Community Historic Heritage Conservation Initiative, the key element of which is to establish two historic heritage conservation funds – the Mount Thorley Warkworth Historic Heritage Conservation Fund and the Mount Thorley Warkworth Great North Road Conservation Fund.

ES5.10 Traffic and transport

As there are no changes proposed to the existing average MTW workforce, truck traffic or annual train movements, the proposal's potential traffic impacts are limited to the proposed closure of Wallaby Scrub Road as mining progresses westward. The closure would result in current traffic being detoured via Putty Road and the Golden Highway. The detoured traffic would be subject to some increased daily travel distances and journey times; however, travel safety and travelling conditions are expected to improve due to road construction standards on the Golden Highway. The detoured traffic would not significantly impact the capacity of the detoured roads and relevant intersections.

Construction of an appropriate emergency access road between Putty Road and the Golden Highway would occur prior to the closure of Wallaby Scrub Road which would be constructed in accordance with the NSW Rural Fire Service's (RFS) access standards prescribed in *Planning for Bush Fire Protection* (Rural Fire Service 2006) and NSW Bushfire Coordinating Committee Policy No. 2/2007, in consultation with emergency services. Coal & Allied has consulted with the RFS, who has stated their acceptance of the emergency access road provided it is constructed in accordance with the aforementioned standards.

ES5.11 Final landform and rehabilitation

Rehabilitation of the areas mined under the proposal would continue to be undertaken progressively to create a stable, free draining landform able to maintain viable land uses where mining areas are integrated with the surrounding landscape. The final landform would be developed with recognition of the pre-mining landform features and would incorporate the existing rehabilitated landforms to ultimately be consistent with the surrounding landscape features of both the Warkworth Mine and MTO.

Approximately 2,100ha of EEC woodland is proposed to be rehabilitated within Warkworth Mine (around 1,617ha) and MTO (483ha). Woodland and trees over grassland components of the rehabilitation would form a north/south connection corridor of vegetation connecting the planned rehabilitation of the Warkworth Mine, the MTO and Bulga Coal Complex with the Singleton Military Training Area, the Pokolbin State Forest and the Yengo National Park as well as the Southern and Putty Road biodiversity offset areas.

It is noted that the final landform includes a final void. A number of alternatives were considered in relation to the final void; however, all were assessed as unviable and, accordingly, discounted. One of these alternatives was backfilling the final void, this is addressed below.

Backfilling the final void to a similar level as the highwall crest would require over 800 million bank cubic metres of material. As under the proposal Warkworth Mine would have completed mining in 2035, this material would need to be sourced from an alternative location. One option would be to excavate the previously rehabilitated emplacements at Warkworth Mine. This process would take many years and use a large fleet of excavating equipment and trucks. This would initially increase the disturbance footprint of Warkworth Mine, as well as prolong its environmental impacts particularly those related to dust and noise, and would be prohibitively expensive.

Alternatively, material could be transported from elsewhere in the Hunter Valley. Similar to the above, this option is not considered desirable from a social, environmental or economic perspective and, accordingly, was also discounted.

ES5.12 Visual amenity

Existing topography and vegetation would continue to provide screening to Warkworth Mine as mining activities progress westwards. Some residences west of the Site, such as elevated residences around Bulga village, may experience high visual amenity impacts. Progressive rehabilitation of disturbed areas and implementation of visual impact mitigation measures would be undertaken to minimise impacts to visual amenity. In addition, residents of potentially sensitive properties would be able to request site specific visual assessments be undertaken which may identify the need for site specific mitigation measures.

ES5.13 Land and soils capability

The proposed 2014 disturbance area is not mapped as, nor does it meet the requirements for, biophysical strategic agricultural land (BSAL) to which the *Strategic Regional Land Use Policy* (NSW Government 2012) applies. Despite the closest mapped BSAL being approximately 3km from the proposed 2014 disturbance area, a site verification certificate for the proposed 2014 disturbance area confirming the absence of BSAL was provided in June 2014. Due to the proposal, the land and soil capability of the proposed 2014 disturbance area would change from Class 4 and 5 land to Class 7 and 8 land, suitable for wood production, passive tourism, nature conservation or apiary, which is consistent with the proposed final landuse.

ES6 Justification and conclusions

Warkworth Mine and the adjoining MTO are long standing members of the community having commenced operations in 1981. An average workforce of approximately 1,300 people including full-time contractors is employed at MTW.

Overall, while the proposal has some residual social and environmental impacts some of which would be experienced by near neighbours, it should be approved as:

- the resource within the footprint of the proposal is significant (enabling the long-term employment of approximately 1,187 persons, $5.8billion in expenditure and $567million in royalties);
- the majority of the Mining SEPP's non-discretionary standards are met;
- impacts on near neighbours have been minimised to the greatest extent possible using all reasonable and feasible measures while maintaining an economically viable mine plan;
- it meets all government policies;
- Warkworth Mine has a long history of minimal non-compliances with government approvals;
- it ensures maximum return on the substantial capital invested in the mine since it commenced in the 1981 and has access to existing infrastructure such as road, rail and port; and
- it provides a state significant economic benefit to the local, regional, state and national economies.

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Chapter 1

Context

Chapter 1 — Context

1 Context

Development consent for the Warkworth Continuation 2014 (the proposal) is required to enable continuation of operations at Warkworth Mine in 2015 and beyond.

Mining in West Pit at Warkworth Mine is forecast to reach consent limits in 2015 which would result in mining along a decreased strike length (ie working room). This in turn would reduce mining below economically viable production rates.

The purpose of the proposal is to extend the spatial limit approved under the current development consent to enable mining in West Pit along the full strike length and, subsequently, enable the two main pits, North and West Pit, to advance down dip to the west.

The resource within the footprint of the proposal is significant. It can be efficiently extracted by Warkworth Mining Limited (WML), the owners of the mine, because of the hundreds of millions of dollars invested in the operation since it commenced in 1981 and its existing access to product transport and distribution infrastructure such as road, rail and port. Extraction of the resource would enable Warkworth Mine, which is a major employer in the Singleton local government area (LGA), to continue.

The continued operation of the Mount Thorley Warkworth (MTW), which is comprised of Warkworth Mine and the adjacent Mount Thorley Operations (MTO), has significant social and economic benefits in the form of continuing employment for a workforce of approximately 1,300 persons on average, net economic benefits of some $1.5billion and royalties of some $617million. The economic benefits attributable to the proposal at the Warkworth Mine include continuing employment for a workforce of some 1,187 persons, $1.34billion in net economic benefits and some $567million in royalties. The people of Australia would also benefit through the Commonwealth Government in the form of company and income taxes. The need for the proposal is detailed in Chapter 3.

The proposal follows a previous environmental assessment for an extension of mining in a similar area in 2010. The proposal was titled the Warkworth Extension Project and is herein referred to as Warkworth Extension 2010. The Project Approval for Warkworth Extension 2010 was appealed in the NSW Land and Environment Court (L&E Court) and upheld on 15 April 2013. Notwithstanding, Warkworth Mine retains Commonwealth approval for the extension. The approval is for the activities and the spatial extent the subject of the proposal.

The L&E Court decision resulted in the inability of Warkworth Mine to operate along the required strike length in West Pit to maintain viable production rates. Accordingly, a 350m extension referred to as Modification 6 was sought and approved in early 2014, to enable mining to continue in the very short-term whilst enabling longer term mine planning at Warkworth Mine to continue regarding its future.

The decision by the L&E Court in respect of the Warkworth Extension 2010 was a merit appeal determined on those particular facts the subject of the appeal. Accordingly, it is not a binding legal precedent that limits the discretion of future decision makers in respect of the current proposal.

While the proposal has similarities to the Warkworth Extension 2010, there are a number of important differences and improvements. These were developed with consideration to, amongst other matters, feedback received during stakeholder engagement for the proposal and the L&E Court judgement. Further, significant operational improvements, particularly regarding noise and dust management, have been made since the 2010 application (Chapter 4).

Of importance, a number of changes to legislation and policies have occurred since the 2010 application that clarifies the considerations required by decision makers. The most significant of these are the amendments to the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (the Mining SEPP) which operates to make the 'significance of the resource' the principal consideration of the matters the Minister is to consider under Part 3 of the Mining SEPP. The proposal, which has considered and is consistent with the contemporary legislative and policy framework, is described in Chapter 2.

Chapter 2

The proposal

Chapter 2 — The proposal

2 The proposal

2.1 Background

Warkworth Mine is an open cut coal mine approximately 8 kilometres (km) south-west of Singleton in the Hunter Valley. The mine has been operational for over 30 years, having commenced mining in 1981 and is within the Singleton LGA.

The area immediately surrounding the mine is dominated by coal mines and associated infrastructure and other industry. The Hunter Valley Operations and Redbank Power Station, and Wambo Mine are to the north and north-west, respectively, and the MTO and Bulga Coal Complex are to the south. The village of Bulga and the Wollemi and Yengo National Parks are to the west, and Mount Thorley Industrial Estate (MTIE) is to the east (see Figures 2.1 and 2.2).

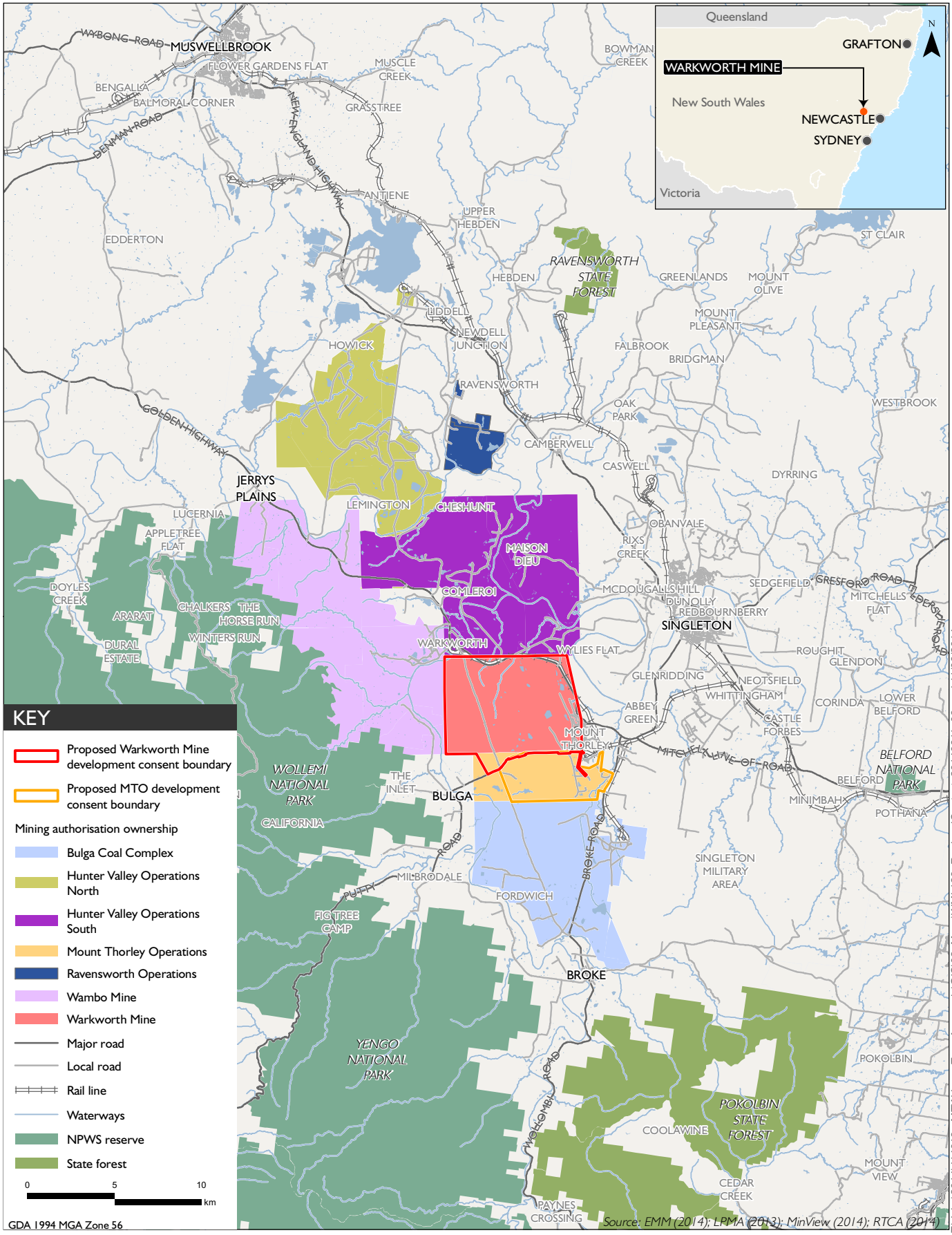
Since 2004, Warkworth Mine and MTO have integrated at an operational level and are known as MTW, with a single management team responsible for all the operations. Ownership of the two mines remains separate, with Warkworth Mine owned by Warkworth Mining Limited (WML). This is reflected by way of each mine having its own standalone mining leases and development consent. A single management team for the adjoining mines permits various cost savings across each operation by way of integration. Equipment, personnel, water, rejects and coal preparation are all shared between the mines. MTW has a workforce of approximately 1,300 persons on average including contractors.

Warkworth Mine currently operates under Development Consent No. DA 300-9-2002-i (the development consent) issued by the then Minister for Planning in May 2003 under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). It also operates under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approvals – EPBC 2002/629 and EPBC 2009/5081, the latter being for the action the subject of the current development application (DA).

Warkworth Mine currently operates three integrated open cut mining areas, namely North, West and South pits, with the West and North pits being the focus of production. Run-of-mine (ROM) coal from Warkworth Mine is transported to either the Warkworth or MTO coal preparation plants (CPP) for processing. Product coal from the Warkworth CPP is transported via conveyor to either the Mount Thorley Coal Loader (MTCL) or to the Redbank Power Station. Coal loaded onto trains at the MTCL is transported to the Port of Newcastle for export.

The proposal seeks to extend mining beyond the current spatial limits of the development consent to ensure that MTW remains economically viable.

The proposal would enable employment levels at MTW to be maintained in what is a challenging environment for the Australian coal industry, and as substantiated in Chapters 9 and 21, allow the important regional and local economic and social benefits from the mine's operation to continue. It would also provide for the continued accrual of economic benefits to the local area and Hunter Valley region from business expenditure, to the NSW Government in the form of royalties, and to the Commonwealth Government in the form of company and income taxes. The need for the proposal is detailed in Chapter 3.



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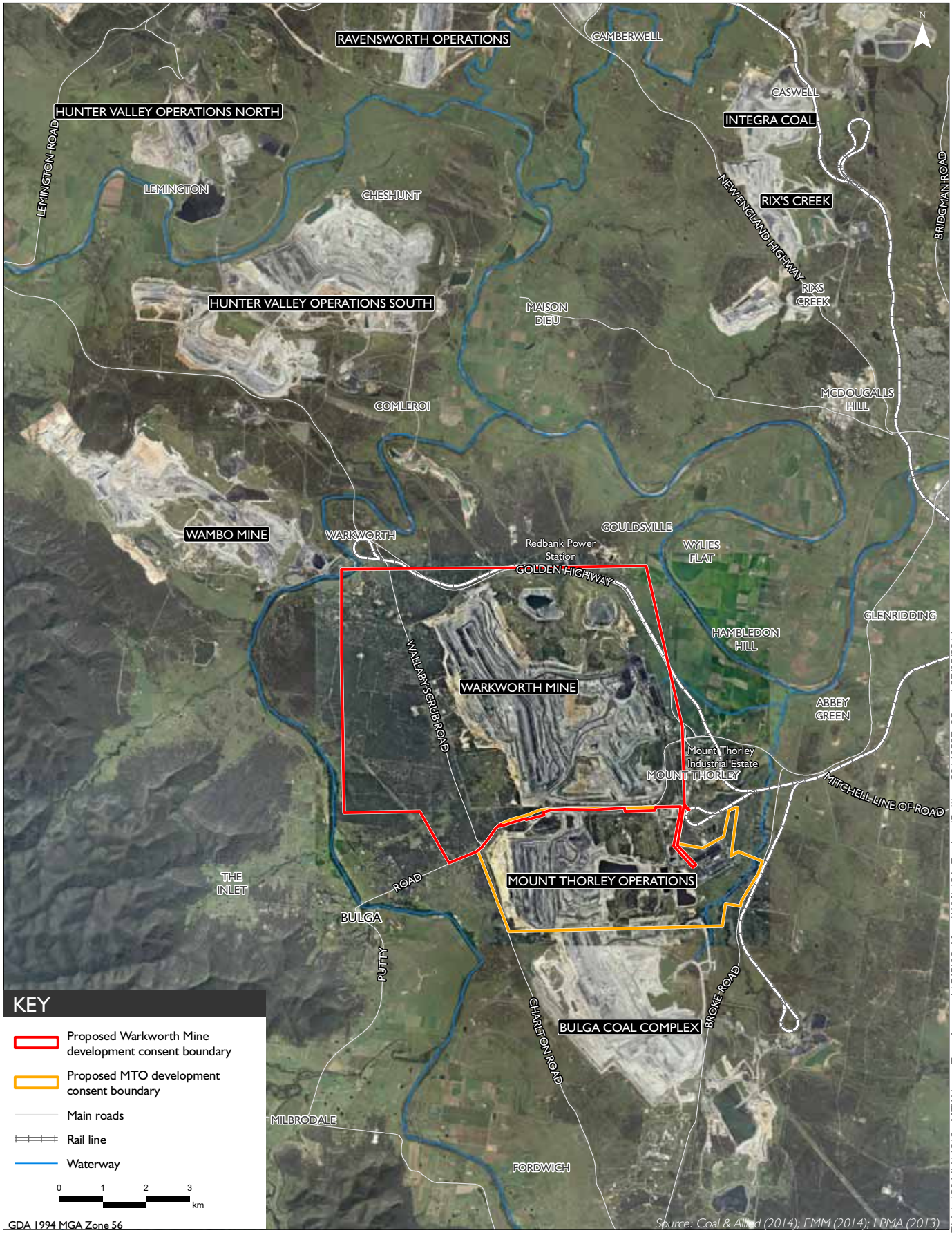
Regional context

Warkworth Continuation 2014
Environmental Impact Statement

Figure 2.1



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Regional setting

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Environmental Impact Statement

Figure 2.2

As noted in Chapter 1, in 2010 an application was made for an extension of the Warkworth Mine to the west of the current pit wall (North and West pits). This included measures to address biodiversity offset matters. Further detail on the former application is provided in Section 4.2. Project approval (PA 09_0202) was issued on 3 February 2012 by the Planning Assessment Commission (PAC), as delegate of the Minister.

The Commonwealth Minister for the Environment approved the extension under the EPBC Act on 9 August 2012 (EPBC 2009/5081). The EPBC approval (EPBC 2002/629) that covered the 2003 extension was modified on 13 July 2012 as part of the 2010 extension to relocate the 2003 Commonwealth offsets.

Subsequently, the NSW project approval was appealed in the L&E Court. On 15 April 2013, the appeal was upheld by the L&E Court and the application was disapproved. Notwithstanding, Warkworth Mine retains Commonwealth approval for the extension.

Since the L&E Court judgment WML has invested substantial time and effort in reviewing options for Warkworth Mine and planning for its future. Numerous design alternatives have been canvassed, providing consideration to, amongst other matters, feedback received during stakeholder engagement for the mine, Warkworth Extension 2010, the L&E Court judgement and from the PAC determination of the most recent modification of the development consent, Modification 6, approved on 29 January 2014. The proposal incorporates a number of differences and improvements from Warkworth Extension 2010, as described in Chapter 4.

The approval of Modification 6 has enabled the mine to continue to operate as close as possible to current production and employment levels in the short-term. Its approval has also allowed for the planning and development of the current proposal, assessment of its potential impacts, stakeholder engagement and lodgement of this EIS for public exhibition while maintaining the current level of employment.

The proposal is required to enable West Pit to be mined at its full strike length and for both North and West Pit to continue down dip. Mining at full strike length is required to continue mining at economically viable production rates.

This chapter describes the proposal which is the subject of this environmental impact statement (EIS). This EIS has been prepared to accompany a new DA for Warkworth Mine submitted by WML. The DA and EIS have been submitted to NSW Department of Planning and Environment (DP&E).

2.2 Proposal objectives

The proposal seeks a continuation of all aspects of Warkworth Mine as it presently operates and extends or alters them as described in this chapter. Existing operations at Warkworth Mine, for which continued approval is sought, are described in Chapter 6.

The objectives of the proposal are to:

- ensure the economic viability of the mine;
- maintain the current workforce at MTW of 1,300 jobs on average;
- minimise impacts on near neighbours to the greatest extent possible using all reasonable and feasible measures while maintaining an economically viable mine plan;

- maximise return on the substantial capital invested in the mine since it commenced in the 1981 using existing infrastructure such as road, rail and port;
- ensure all government policies are met; and
- continue to provide economic benefits to local, regional, state and national economies.

To enable the objectives to be met, the key components of the proposal comprise:

- an extension of the approved mining disturbance footprint by approximately 698ha to the west of current operations (referred to herein as the proposed 2014 disturbance area);
- the ability to transfer overburden to MTO to complete MTO's final landform;
- the closure of Wallaby Scrub Road;
- an option to develop an underpass beneath Putty Road for the third bridge crossing yet to be constructed (while retaining the current approval for an overpass);
- minor changes to the design of the Northern out-of-pit (NOOP) dam; and
- the continued use of secondary access gates to the mine site and offsets for activities such as drilling, offset management, and equipment shutdown pad access amongst other things.

The proposal would also enable the provision of a fully contemporised development consent for the Warkworth Mine.

Under the development consent granted in 2003, Warkworth Mine has approval to operate until 19 May 2021. The proposal seeks a 21 year development consent period from the date of any approval. If approval is granted in late 2014, operations at Warkworth Mine are forecast to continue to 2035, a 14 year extension over the current approval. Figure 2.3 shows the proposal. It is noted that the proposed 2014 disturbance area includes the proposed western extension of mining (referred to herein as 'proposed extension area') and the services corridor (see Section 2.4.2iv).

Approximately 63ha of land approved to be mined by MTO in accordance with its development consent (DA 34/95) is within the Warkworth Mine's proposal footprint (see Section 2.4.2.i). Given it is already approved to be cleared, and would otherwise be mined by MTO, this area is not included within the disturbance boundary for offsetting purposes in Chapter 12. The area is included within the development consent boundary as amended under the proposal and has been considered in the proposal's noise, air quality and visual assessments. This area is shown in Figure 2.4.

The majority of the area within the proposed development consent boundary (referred to herein as the Site) is owned by WML and Miller Pohang Coal Company Pty Limited. A schedule of lands for the Site is in Appendix A.

A summary of the key components of the proposal compared to current approved mining operations is provided in Table 2.1. Existing operations are shown in Figure 2.5.

Photograph 2.1 shows the current operations looking towards West and North pits in a northerly direction, inclusive of pre-clearing activities for the recently approved Modification 6 area. It illustrates the offset of North and West pits which is a consequence of the delay associated with disapproval of Warkworth Extension 2010.

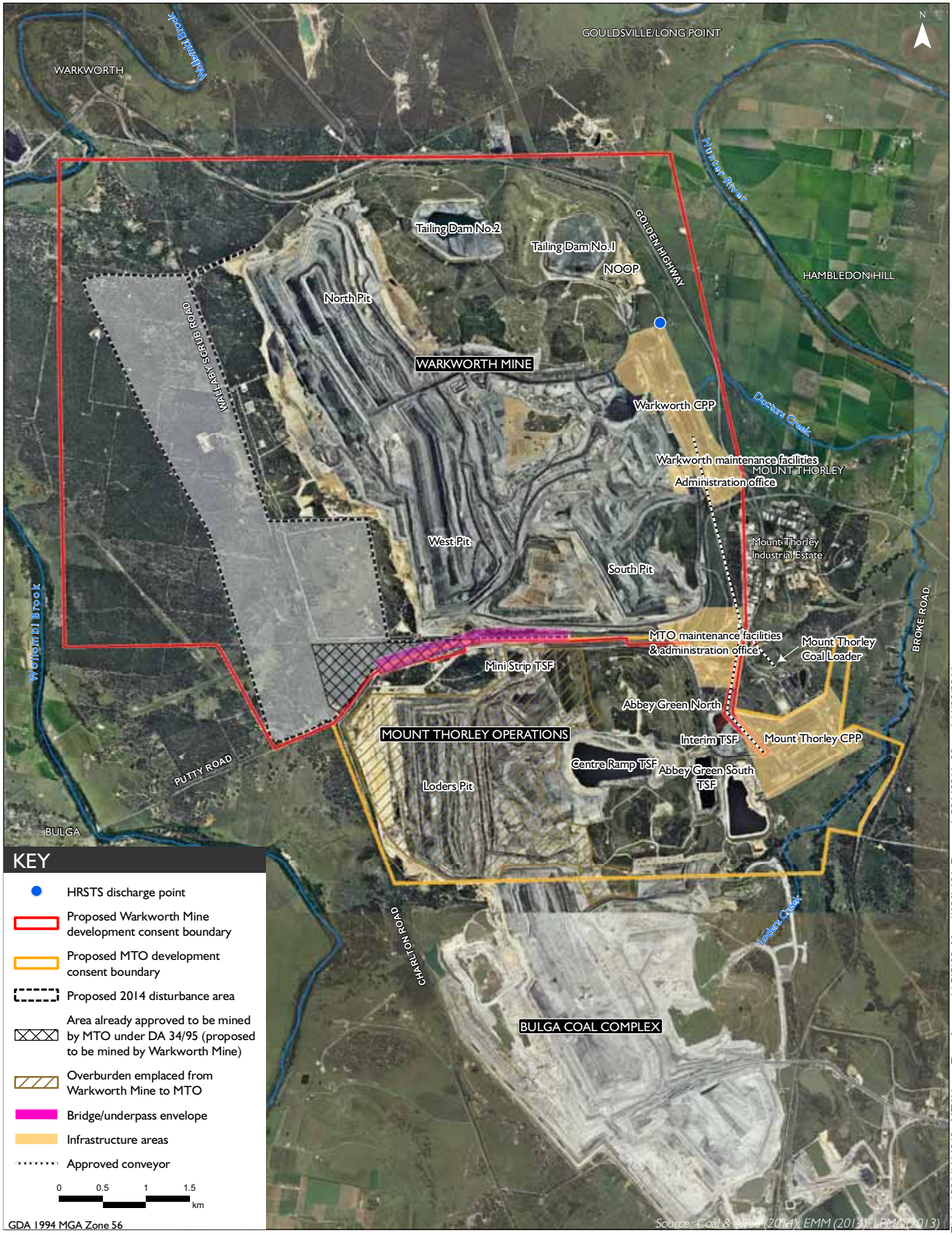
Photograph 2.1 Current operations (February 2014)

Table 2.1 Comparison of key components of the proposal with existing operations

Key component	Existing operations	The proposal
Approval timeframes	• Operations at Warkworth Mine are approved until 19 May 2021.	• Extend operations at Warkworth Mine for a period of 21 years from the date of approval, which would nominally be until 2035 assuming approval is granted in 2014.
Mining areas	• The extent of approved mining at Warkworth Mine can be seen in Figure 2.5.	• Extend mining at Warkworth Mine to the west as shown in Figure 2.3. Surface Mining Lease extensions would be sought by WML (CCL 753) to support the proposal.
Production	• Warkworth Mine has approval to extract up to 18 million tonnes per annum (Mtpa) of ROM coal. • The ROM/product coal may be transported between Warkworth Mine and MTO for processing at either CPP. • Product coal may be loaded out via the MTCL or transported to the Redbank Power Station.	• No change to the maximum rate of ROM coal extraction. • No changes to transport of ROM/product coal. • No change to load out of product coal.

Table 2.1 Comparison of key components of the proposal with existing operations

Key component	Existing operations	The proposal
Overburden emplacement	• Overburden material emplaced within Warkworth Mine. • Construction of a third bridge crossing over Putty Road.	• Overburden material would continue to be emplaced at Warkworth Mine and, in addition, would be transferred from Warkworth Mine to MTO to assist in the development of the final landform for MTO. • An option to develop an underpass beneath Putty Road for the third bridge crossing yet to be constructed (while retaining the current approval for an overpass).
Coal processing	• Warkworth CPP has the capacity to process up to 13Mtpa of ROM coal. • The ROM coal extracted at Warkworth Mine may be transferred for processing at MTO CPP and similarly ROM coal from MTO may be processed at Warkworth CPP.	• No change to the maximum Warkworth CPP throughput. • Continuation of the movement of ROM coal and processing between Warkworth Mine and MTO.
Coarse reject	• Coarse reject produced at the Warkworth and MTO CPPs is co-disposed within overburden emplacement areas within MTW, that is, in overburden emplacements in either Warkworth Mine or MTO.	• No change to coarse reject management.
Tailings	• Tailings produced at Warkworth and MTO CPPs is disposed at tailings storage facilities (TSFs) within MTW, that is, tailings can be disposed of at TSFs in either Warkworth Mine or MTO.	• No change to tailings management.
Infrastructure	• Infrastructure includes: workshops; vehicle washing facilities; bulk oil and fuel storages; water management infrastructure; coal bed methane gas wells and ancillary infrastructure; storage hoppers and crushers; coal stockpiles; CPP; erection pads; bathhouse; general stores; office building; and other facilities and incidental activities.	• Potential minor upgrades to infrastructure.
Operating hours	• Continuous operations, 24 hours per day, seven days per week.	• No change to operating hours.
Rehabilitation	• Progressive rehabilitation. • Final land use and final landform described in a number of approval documents.	• Continuing progressive rehabilitation. • Amended proposed final land use and final landform based on a 'whole-of-mine' approach to provide improved agricultural and biodiversity benefits.



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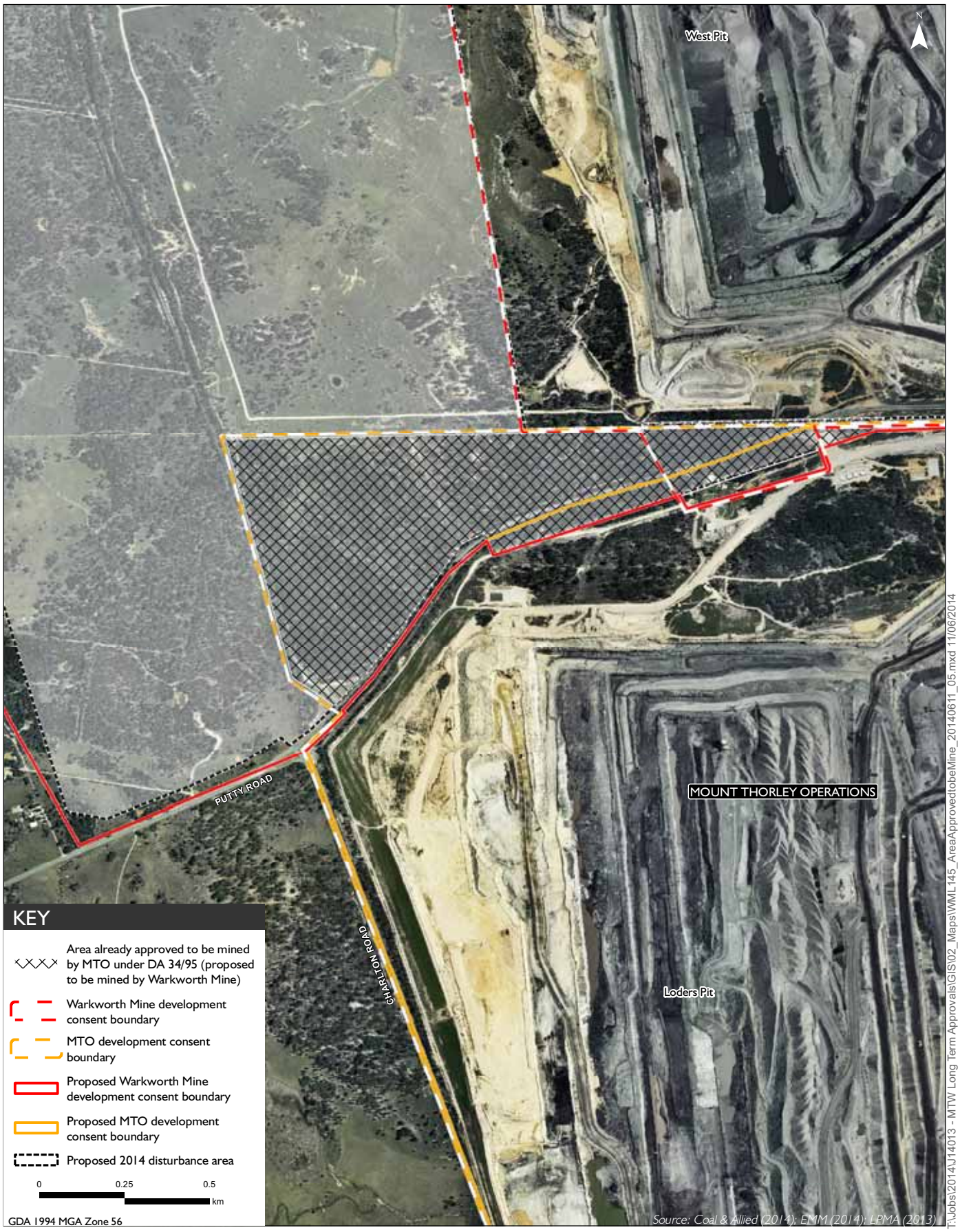
The proposal

Warkworth Continuation 2014
Environmental Impact Statement

Figure 2.3



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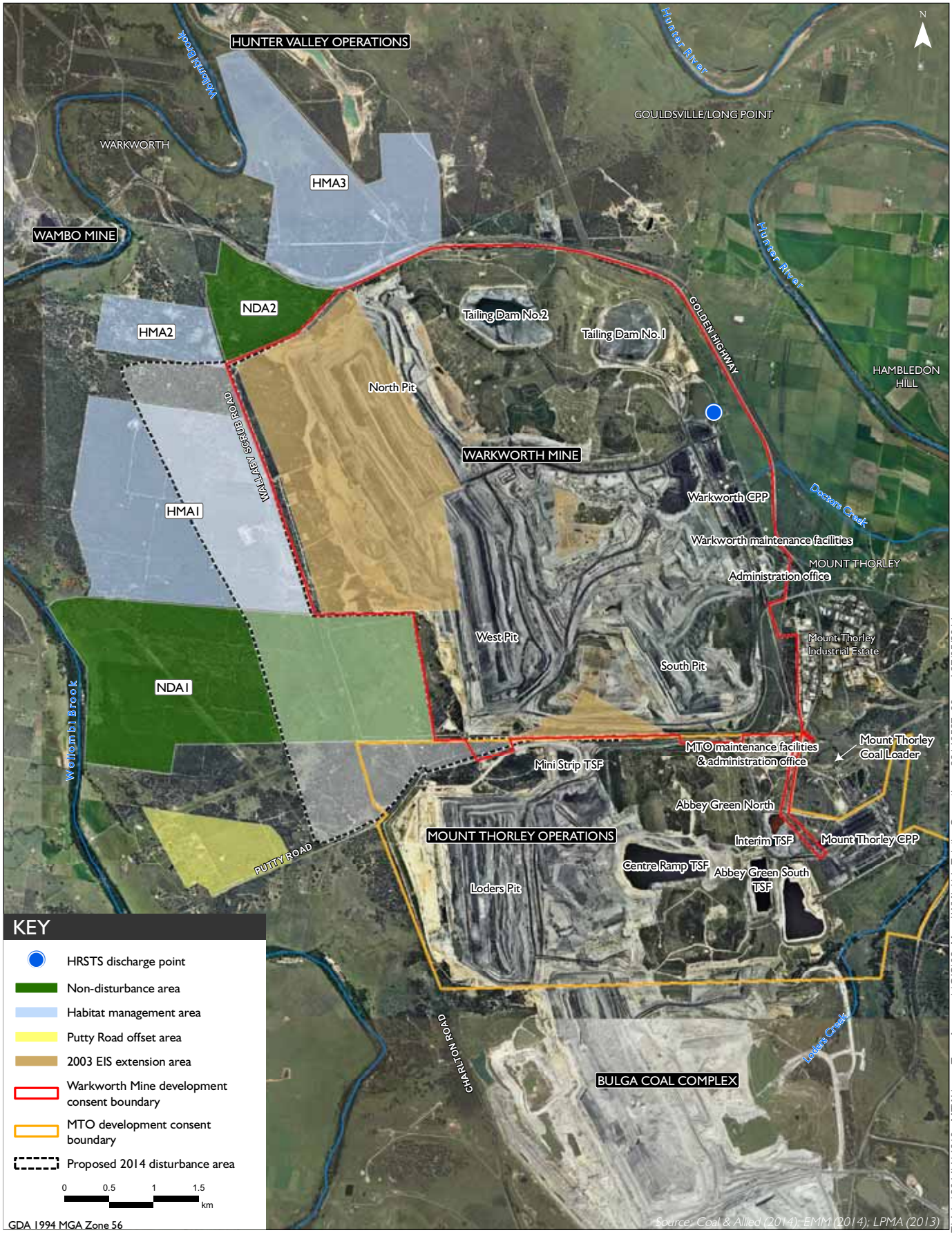
Area already approved to be mined by MTO under DA 34/95

Warkworth Continuation 2014
Environmental Impact Statement
Figure 2.4



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Existing operations
Warkworth Continuation 2014
Environmental Impact Statement
Figure 2.5

2.3 Purpose of the application and EIS

The purpose of this EIS is to accompany a DA by WML for the continued mining of Warkworth Mine beyond current consent limits in accordance with Part 4, Division 4.1 of the EP&A Act.

This document provides a description of the existing environment, an assessment of the potential impacts resulting from the proposal and details measures that would be implemented, subject to approval, to avoid, minimise and/or compensate potential impacts. The EIS provides information to allow DP&E, in consultation with NSW Government authorities, to assess the merits of the proposal and make a recommendation to the Minister for Planning as to whether or not to grant approval.

This EIS was prepared by EMGA Mitchell McLennan Pty Limited (EMM), with input from a number of external technical specialists. The study team is provided in Appendix B.

A separate DA for MTO under Part 4, Division 4.1 of the EP&A Act is to be lodged concurrently with the DA for the proposal. This application, referred to as Mount Thorley Operations 2014, relates to a continuation of the development consent beyond its current 2017 expiry to enable more time for the completion of existing, approved mining, while aligning the consent life with the timeframe contemplated under the proposal to enable the continued integration of infrastructure and other operations at MTW.

2.4 Proposal description

2.4.1 Avoidance

Open cut mining projects cannot readily avoid impacts as mineral resources are in fixed locations. However, wherever possible and consistent with the L&E Court judgement (par. 69), avoidance was applied as a guiding principle for the proposal's development.

As was the case with the Warkworth Extension 2010, development of the proposal considered different options and alternative plans to avoid or minimise impacts on sensitive features, including those on ecology, whilst needing to satisfy the economic and financial viability requirements of the operation in the longer term.

In this context, the development of the proposal design has incorporated features of the Warkworth Extension 2010 and, importantly, includes some key differences and improvements. These are outlined in Chapter 4. Options considered, but not included for various reasons as part of the proposal in the design process are described in Chapter 23.

The design of the proposal has considered avoidance of environmental impacts where feasible. Technical specialists for aspects such as ecology, noise, air quality and surface water worked closely with Rio Tinto Coal Australia's mine planners to test a range of design approaches and measures to avoid off-site impacts in the first instance, before mitigation and monitoring were considered. For example:

- The proposed closure of Wallaby Scrub Road, rather than its relocation. This option has resulted in the reduction of the level of clearing associated with the proposal by approximately 30ha, resulting in avoidance to the Warkworth Sands Woodland (WSW) endangered ecological community (EEC) and other listed vegetation communities.

- While economic coal is known to be north beyond the current approved mining limit, this area has been avoided. In isolation, the volume of coal does not provide sufficient replacement to the proposal and, therefore, the mine would not be economically viable under this scenario if it were to replace the proposal. It is noted, however, that it could provide a source of additional coal to that proposed for extraction under the proposal. This area does not form part of the proposal to enable its continued use as offsets as part of the Southern Biodiversity Area (SBA) and, therefore, avoids impacts on ecology (including an area of WSW) and items of Aboriginal cultural significance.

- The majority of the proposed mining would be within the footprint of CCL 753, while the south part of West Pit would be within CL 219 (MTO mining lease). As noted in Section 2.2 and shown in Figure 2.4, a portion of this southern area (generally an area bounded by CCL 753 in the north, Putty Road in the south and Wallaby Scrub Road to the west) has planning approval for mining operations as part of the development consent for MTO (ie DA 34/95). Accessing this coal from Warkworth Mine under the proposal would avoid the need to relocate Putty Road, as approved under DA 34/95, if the coal was to be accessed by MTO. The existing mining leases for Warkworth Mine and the adjacent MTO are shown in Figure 2.6 and described in Table 2.2.

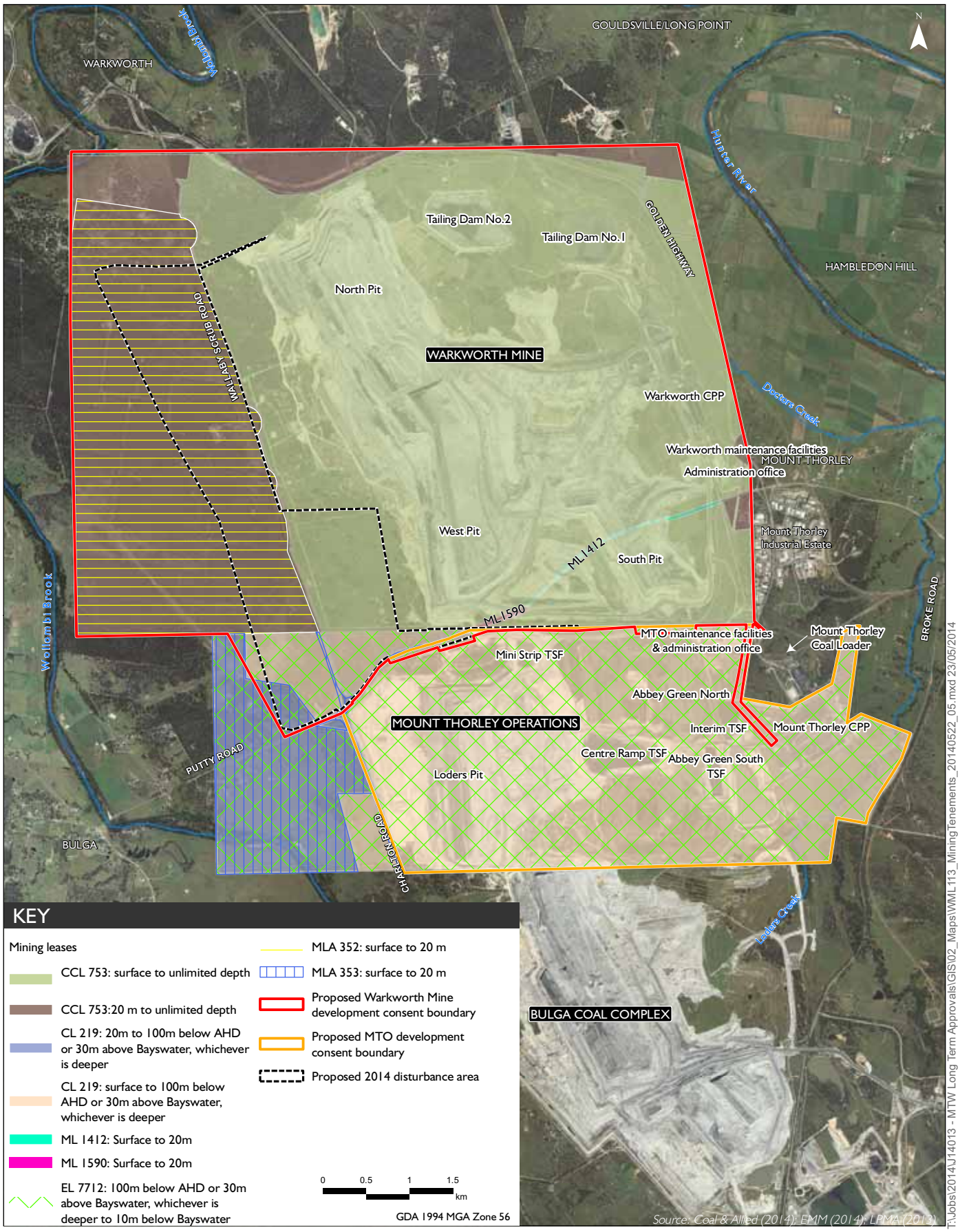
- Acoustic and air quality amelioration measures were incorporated into the mine design where practicable. The effectiveness of these measures was continually tested in an iterative process with mine planners until adverse modelling predictions were avoided and an appropriate outcome achieved.

- A water management system (WMS) has been developed that minimises the risk of adverse impacts occurring; for example, managing catchments to ensure the diversion of clean surface water runoff away from disturbed areas to minimise the volume of water captured in the Site and, thereby, reducing the potential requirement for discharges.

From an operational perspective avoidance is inherently linked to MTW's noise and dust management regime. For example, through a range of existing acoustic management and monitoring procedures which are implemented on a continuous (standard) basis, the requirement to modify operations to avoid potential impacts is identified.

In 2014, year to date, this includes equipment stoppage on 43 separate nights, (resulting in over 8,000 hours of equipment stoppage), and eight site shutdowns (with the exception of dragline operations and some ancillary equipment activity) equating to millions of dollars in lost working time. This significant level of operational disruption demonstrates MTW's commitment to minimising impacts and maintaining compliant operations.

An assessment of monitoring data (publically available via the Rio Tinto Coal Australia website www.riotintocoalaustralia.com.au) demonstrates that a high level of compliance with noise criteria has been achieved throughout the life of the mine. Non-compliant noise measurements account for only 0.39 per cent of the monitoring dataset (10 non-compliances measured from 2,540 individual assessments undertaken).



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Mining leases
Warkworth Continuation 2014
Environmental Impact Statement
Figure 2.6

Both proactive and reactive operational control strategies and measures are implemented to effectively manage air quality impacts from the mine. Proactive measures would be further enhanced following the implementation of a predictive dust risk forecasting tool to assist operational personnel to make the optimal management decisions on a day to day basis. The tool utilises predictive meteorological forecast data coupled with detailed mine activity (mine plan) data to determine the most likely times during the upcoming day that dust lift off and air dispersion conditions may be unfavourable. This advance warning allows mine staff time to be better prepared in the event that such conditions occur. The tool is currently being developed, and would be integrated into day-to-day operations during 2014. This would further assist in avoiding potential dust impacts.

A description of the proactive and reactive operational noise and air quality management measures implemented at Warkworth Mine is given in Sections 10.3 and 11.2.3, respectively.

2.4.2 Indicative mine plans

i Overview

Current operations, inclusive of the recent Modification 6, are close to the development consent limits in West Pit. This proposal is seeking to extend the spatial limit approved under the development consent to enable the mining in West Pit along the full strike length and, subsequently, enable the two main pits, North and West Pit, to advance down dip to the west. Rather than seek piecemeal changes to environmental planning approvals over time, the proposal has been developed based on a footprint (at maximum production rate) for a 21 year development consent period.

The North and West pits would continue west beyond current consent limits across Wallaby Scrub Road. West Pit would also continue south to, but would not impact on, Putty Road (see Figure 2.3).

The majority of the proposed mining would be within the footprint of CCL 753, while the south part of West Pit would be within CL 219 (MTO's mining lease). As noted in Section 2.2, a portion of this southern area has planning approval for mining operations as part of the development consent for MTO (ie DA 34/95). Accessing this coal from Warkworth Mine under the proposal would avoid the need to relocate Putty Road, as approved under DA 34/95, if the coal was to be accessed by MTO. The existing mining leases for Warkworth Mine and the adjacent MTO are shown in Figure 2.6 and described in Table 2.2.

Figure 2.6 also depicts MLA 352 and MLA 353, which are the current mining lease application from surface to 20m below for Warkworth Mine and MTO, respectively.

Table 2.2 Mining leases

Mining leases	Description	Date of issue	Date of expiry
CCL 753	Consolidated coal lease (comprised of CL 276 granted on 23 April 1986 and CL 205 granted on 18 February 1981)	Granted 23 May 1990 Renewed 18 February 2002	17 February 2023
CL 219	Coal lease	23 September 1981	22 September 2023
ML 1412	Prospecting and mining coal	11 January 1997	10 January 2018
ML 1590	Prospecting and mining coal	27 February 2007	26 February 2028

The proposal would continue existing operational practices including use of draglines, shovels, excavators, loaders, dozers and truck fleets. These practices have proved appropriate for the geological conditions encountered at the mine and the required production rates for economic operations. In addition, Warkworth Mine has, in recent years, made substantial capital investment in fleet and equipment (see Chapter 4), and the drill, truck, dozer and excavator fleet would continue to be sound attenuated with completion expected by the end of the 2016 calendar year.

The North and West pits are managed as an integrated pit, typically utilising draglines to make best use of the available strike length. North and West pits would progress westward in a manner so that the highwalls are generally on a north-west to south-east axis parallel to the strike of the coal seams. Mining would continue to progress down dip towards the west.

The western surface disturbance limit of mining (ie the highwall crest) is defined by a 14 year mine plan at maximum production rates with a proposed 21 year mine life to allow for deeper mining within the footprint (ie pre-strip reaches western limit at 14 years and then mining progresses deeper to established highwall spatial limits), production rate flexibility as well as progressive rehabilitation and final landform shaping of disturbed areas within the development consent life. The northern limit of mining is defined by the general alignment of existing operations (see Section 2.4.1). The southern limit is defined by Putty Road.

ii Indicative mine plans

Indicative mine plan snapshots showing the proposal's operations in Year 3 (nominally 2017), Year 9 (nominally 2023) and Year 14 (nominally 2028) can be seen in Figures 2.6, 2.7 and 2.8, respectively. Figure 2.9 shows the Year 21 (nominally 2035) mine plan. The final landform is shown in Figure 2.15.

The indicative Year 3, 9 and 14 mine plans were chosen as representative mining snapshots as the basis for technical assessments. The mine plans show the different activities being undertaken within the footprint during that indicative year, including mining, emplacement and rehabilitation. Overburden would be emplaced at either Warkworth Mine or MTO to create an undulating final landform as shown in each snapshot. Overburden transferred to MTO would also assist in filling the Loders Pit void.

There are three types of rehabilitation areas shown on mine plans: rehabilitation to final landform; active rehabilitation which includes rehabilitation activities for all years between each indicative mine plan snapshot year; and temporary rehabilitation which is rehabilitation on areas which are not yet constructed to final landform but have been temporarily rehabilitated for other reasons, such as dust and visual management purposes.

Indicative Year 3 mine plan (nominally 2017) is early in the proposal timeframe when operations in West Pit have started to encroach on Saddleback Ridge and the western progression of North Pit necessitates the closure of Wallaby Scrub Road. It is generally representative of current operations when residences to the east and north-east are potentially most affected by the proposal. The indicative Year 3 mine plan also includes the mining/construction of the NOOP dam. This water storage has been included as 'mining' as its construction would win a very small amount of coal. It has been incorporated in the indicative Year 3 mine plan to conservatively be representative of the potential worst case impacts on east and north-eastern residences. However, it could be mined and constructed at any time over the life of the proposal. Areas to the north-east of North Pit have generally been rehabilitated to final landform with the exception of the Tailing Dams No. 1 and 2. Active rehabilitation is occurring in areas to the south.

Indicative Year 9 mine plan (nominally 2023) is approximately the halfway point of the proposal timeframe and represents the stage when mining in West Pit is predicted to have progressed through Saddleback Ridge and both North and West pits have progressed across Wallaby Scrub Road. Active rehabilitation is focussed on the eastern portion of the Site and large areas have been rehabilitated to final landform. This indicative mine plan is generally representative of when residences to the west are potentially most affected by the proposal.

Mining has extended to its western most point at indicative Year 14 mine plan (nominally 2028). Rehabilitation to final landform has been completed in South Pit with the exception of its southern most extent (see Section 2.4.2.iii below). Rehabilitation to final landform has also been completed for large areas of North and West pits, with active rehabilitation also occurring. The indicative Year 14 mine plan was the latest year selected for assessment purposes as it is generally representative of the closest extent of mining to residences to the west under the proposal and the majority of equipment and mining activities are at a higher elevation than later in the mine life and, accordingly, afforded less shielding. This enables the assessment of worst case impacts.

For the remaining seven years of the development consent period, mining would continue within the same footprint mining the deeper seams. As shown in the indicative Year 21 mine plan (Figure 2.10), mining has ceased and rehabilitation to final landform has been completed across the majority of the Site.

The mine plans are based on the maximum mining rate of 18Mtpa of ROM coal. If further extensions were not sought and granted, mining activities would decrease from approximately 2030 towards closure in 2035.

During operations, alternative mine plans to the indicative plans above may be used, provided that the environmental impacts remain within the envelope of effects assessed in this EIS. This enables the mining operations to retain some flexibility within the constraints of the identified and assessed environmental envelope.

iii Finalisation of South Pit

A dragline and supporting mining fleet operate in South Pit, in accordance with the current development consent. By approximately the end of Year 1 of the proposal (nominally 2015), dragline operations are scheduled to cease in this area. The southern-most area in South Pit would remain open to enable optionality should future studies into the feasibility of underground mining determine that coal extraction of deeper coal seams at MTW is viable. This matter is discussed further in Chapter 23.

iv Services corridor

A services corridor is proposed west of the highwall, as shown in Figure 2.9. This area could enable the provision of ancillary mining infrastructure including access roads, water management and power reticulation infrastructure and other services. This includes the construction of an appropriate emergency access road between Putty Road and the Golden Highway of the corridor which would occur prior to the closure of Wallaby Scrub Road. This road would be constructed in accordance with the NSW Rural Fire Service's (RFS) access standards prescribed in *Planning for Bush Fire Protection* (RFS 2006) and the NSW Bushfire Coordinating Policy No. 2/2007, and in consultation with emergency services. For the purpose of this EIS, it is assumed the full width which would require clearing.

2.4.3 Coal resources

Mineable coal within the Warkworth Mine is part of the Whittingam Coal Measures. These strata consist of approximately 20 coal seams which are interbedded with shales, siltstones, sandstones and conglomerates (see Figure 2.11). Different seams are suitable for production of either thermal or semi-soft coking coal.

Reserves and resources at the end of 2013 estimated in accordance with the JORC Code 2004 are presented in Table 2.3. The proposal would enable approximately 358Mt of ROM coal to be mined over the life of the operations, approximately 230Mt of which is within the proposed 2014 disturbance area.

Table 2.3 Reserves and resources at the end of 2013

Reserves at end of 2013			Resources at end of 2013			
Proved Mt	**Probable Mt**	**Total Mt**	**Measured Mt**	**Indicated Mt**	**Inferred Mt**	**Total Mt**
203.7	154.7	358.3	6.2	39.2	133.2	178.6

Note: Totals may differ due to rounding.

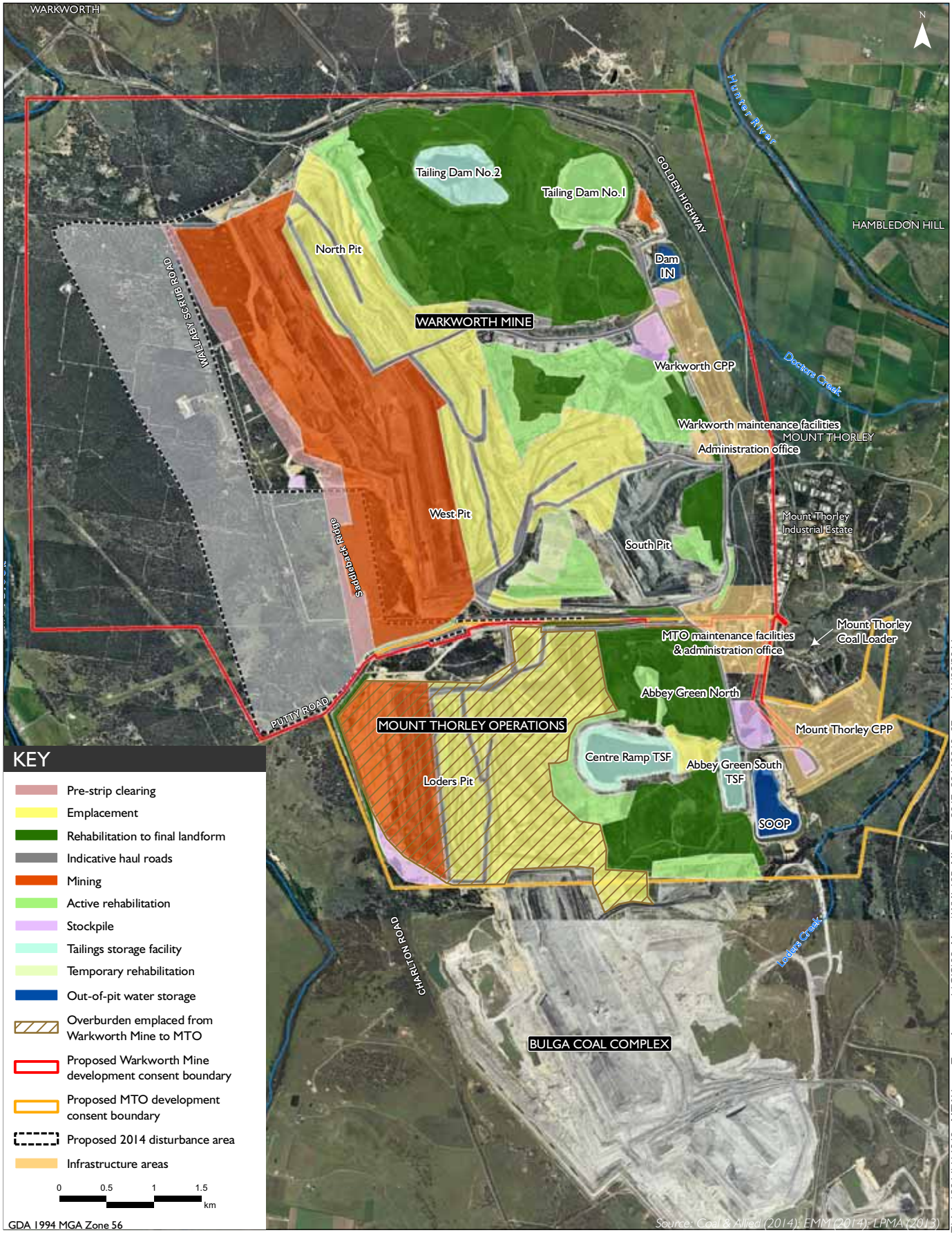
2.4.4 Mining method

i Vegetation clearing and topsoil management

Vegetation removal and topsoil stripping precede mining operations and are implemented in accordance with Coal & Allied's Environmental Management System (EMS), namely the Flora and Fauna procedure and the Topsoil Stripping and Stockpiling Management procedure. Procedure objectives include the appropriate management of any significant flora and fauna species and communities, and to maintain the quality of the topsoil for subsequent use in rehabilitation. The procedures include requirements for flora and fauna impact assessments in pre-development and mining approvals, protocols for pre-clearing and clearing activities, and management measures for weed and pest control.

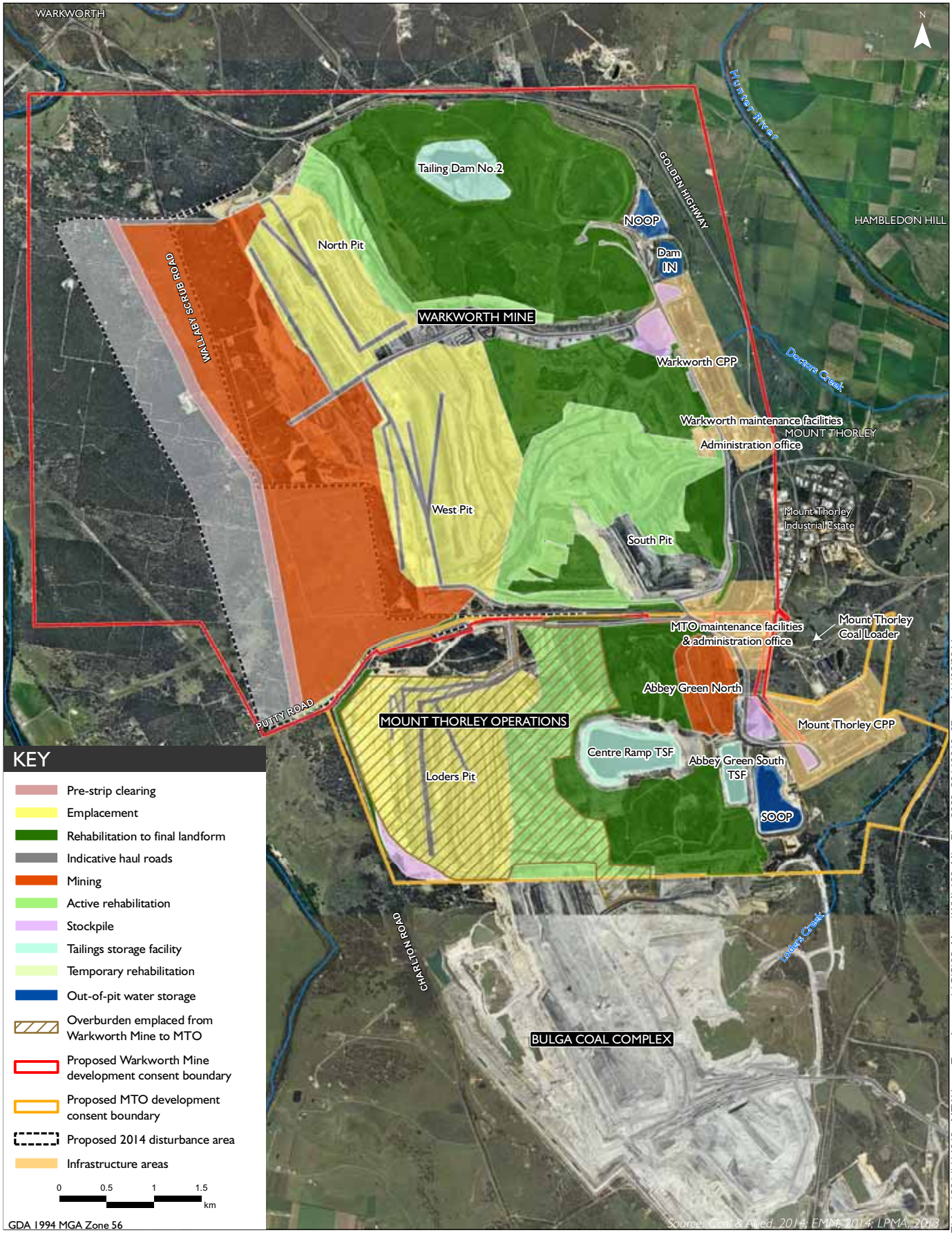
A pre-clearance survey is undertaken before vegetation is removed and topsoil stripped. The purpose of the pre-clearance survey is to identify habitat trees and understory habitats such as fallen logs. Before clearing, trees suitable for timber are selectively marked and removed. Tree stands providing a viable seed source are harvested where practical. Vegetation may be chipped for rehabilitation mulch.

A Mining Operations Plan (MOP) requires mining operators to actively consider the environmental and rehabilitation aspects and to provide management systems for integration with mine planning and production (Environmental Sustainability Unit – Mineral Resources 2013). Further information on the function of a MOP is provided in Section 13.4.6. An integrated MOP applies across MTW.



COAL & ALLIED

Indicative Year 3 mine plan
Warkworth Continuation 2014
Environmental Impact Statement
Figure 2.7

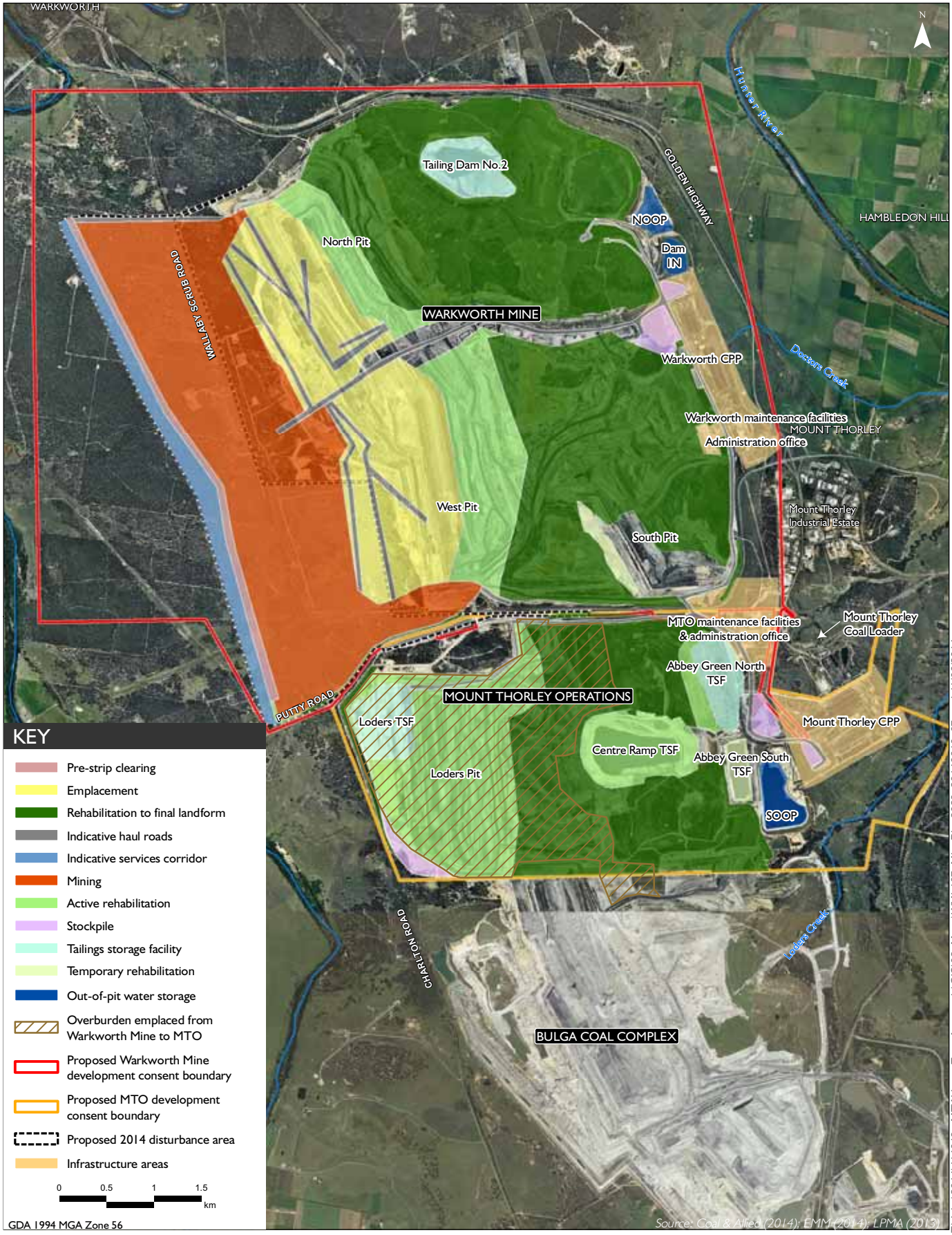


COAL & ALLIED

Indicative Year 9 mine plan

Warkworth Continuation 2014
Environmental Impact Statement

Figure 2.8



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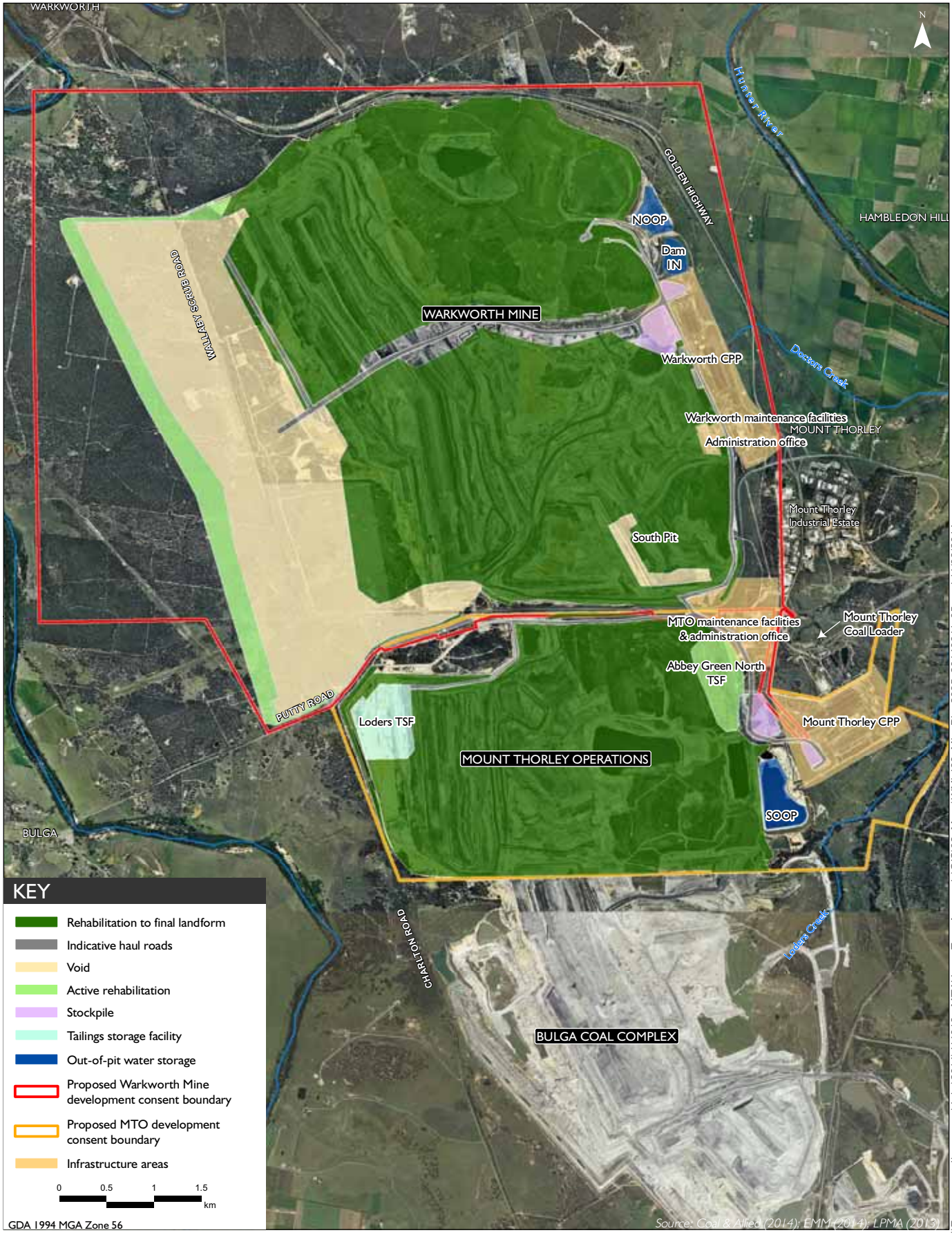
Indicative Year 14 mine plan

Warkworth Continuation 2014
Environmental Impact Statement

Figure 2.9



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Indicative Year 21 mine plan
Warkworth Continuation 2014
Environmental Impact Statement
Figure 2.10

Source: Coal & Allied (2010)

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Managed by Rio Tinto Coal Australia

Regional stratigraphy

Warkworth Continuation 2014
Environmental Impact Statement
Figure 2.11

ii Open cut mining process

Coal extraction at Warkworth Mine uses typical open cut methods incorporating dragline and truck/shovel operations. Overburden is removed using electric rope shovels and excavators, before coal is extracted using front end loaders and excavators. Depending upon thickness, interburden is removed using shovels, excavators or draglines. Draglines are typically tasked with removal of the deeper and thicker interburden zones to expose the deepest coal seam extracted.

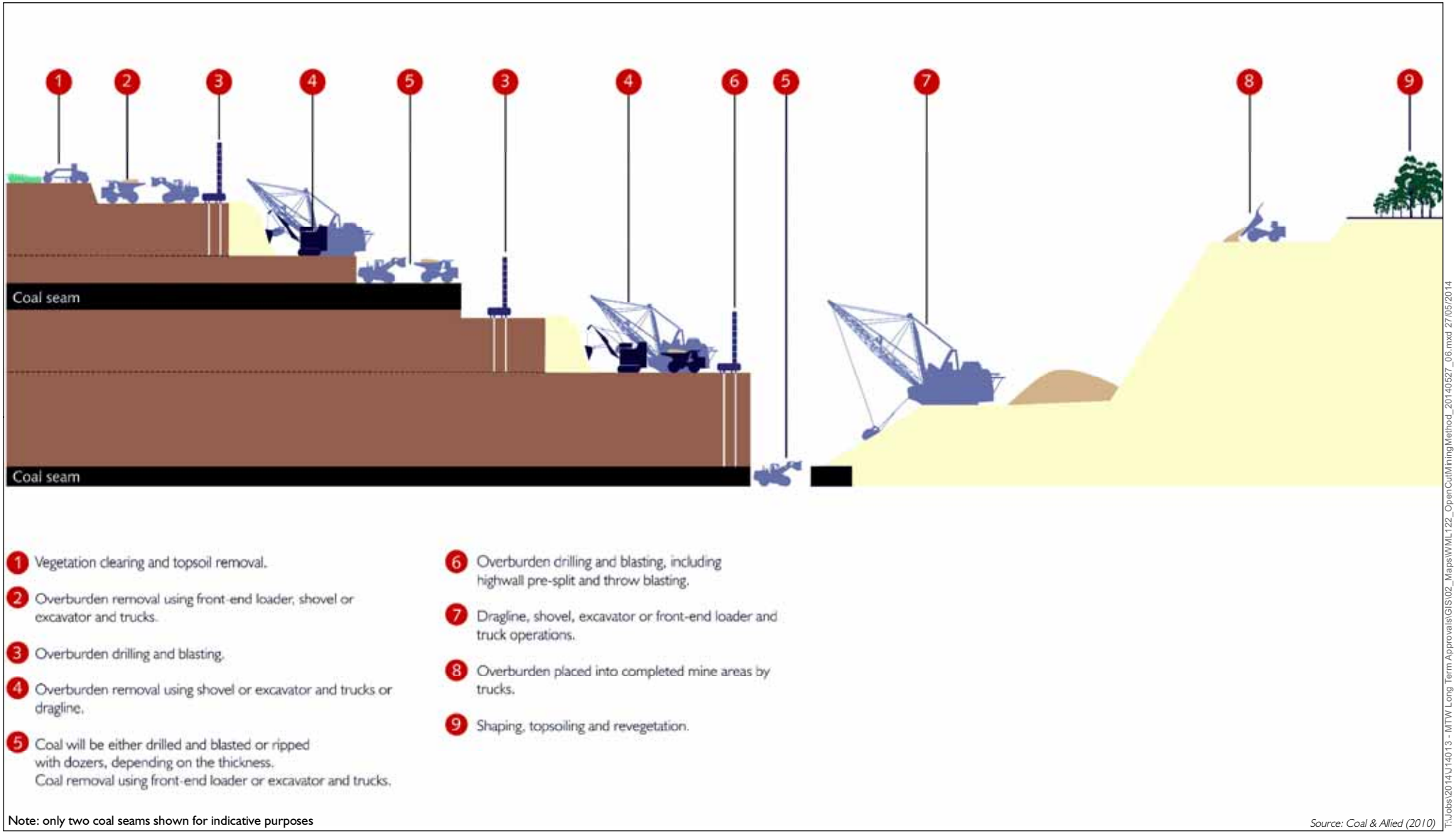
The typical open cut mining process is shown in Figure 2.12.

iii Overburden management

Overburden is the strata between the top-most coal seam and the land surface. Almost all overburden is drilled and blasted. Interburden is a layer of rock between coal seams. Interburden is either ripped or drilled and blasted. Both overburden and interburden are removed by dragline, shovel, excavator or front end loader, depending on the thickness, for haulage to designated emplacements. For the purposes of this EIS, references to overburden generally include both overburden and interburden.

Overburden is transported and disposed of within mined out sections of the open cut pits to create a final landform. The elevation of the final landform is generally higher than the pre-mined elevation due to swelling of the excavated soil that is disposed, which is typically in the order of 20 to 30 per cent of the in-situ volume. The placement of overburden occurs in accordance with the mine plans for each of the pits at Warkworth Mine. Overburden material may also be transferred to MTO, via the bridge/underpass crossings of Putty Road, to assist in creation of the final landform.

Overburden containing potentially acid forming materials, when exposed to oxygen, can lead to acidification of surface water runoff. Net acid producing potential, pH and total sulphur are used to determine the acid generating potential. Testing at MTW indicates that although sulphide materials as pyrite (FeS_2) are known to occur, their content is relatively low (average sulphur content 0.46 per cent). With natural buffering capacity, these materials have low acid forming potential and are within specified acceptable ranges for use as a plant growth medium as part of the rehabilitation of the final landform (see Appendix Q). Overburden management at MTW under the proposal would include the ongoing geochemical characterisation of mined materials and void wall rock to accurately predict risk factors and develop management measures where required. In addition, the proposal would continue the ongoing monitoring of runoff and seepage waters during operations to validate these predictions.



Note: only two coal seams shown for indicative purposes

Source: Coal & Allied (2010)

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Open cut mining method
Warkworth Continuation 2014
Environmental Impact Statement
Figure 2.12

2.4.5 Mining schedule and fleet

Production at Warkworth Mine would continue at a level of around 18Mtpa ROM coal until approximately Year 16 (nominally 2030). Mining activities would decrease beyond Year 16 before concluding in Year 21 (nominally 2035).

An estimate of the indicative fleet required for each snapshot of the proposal (ie indicative Years 3, 9 and 14) used for assessment purposes is provided in the noise and vibration study, Appendix F.

In 2011, Warkworth Mine invested substantial capital for fleet upgrades and replacements (see Chapter 4) to prepare for the anticipated approval of the (now disapproved) Warkworth Extension 2010. As noted in Chapter 4, all drill, truck, dozer and excavator fleet would now be sound attenuated by the end of the 2016 calendar year to minimise noise emissions.

2.4.6 Infrastructure

The proposal is based on the continued use of existing infrastructure. Infrastructure for Warkworth Mine is predominantly at the eastern side of the Site. Most existing infrastructure is within the 'infrastructure envelopes' as shown in Figure 2.3. These facilities include:

- workshops to provide servicing and repair services to the mining fleet;
- vehicle washing facilities for both heavy and light vehicles;
- bulk oil and fuel storages for handling new and waste oil;
- water management infrastructure;
- coal bed methane gas wells and ancillary infrastructure;
- storage hoppers and crushers;
- coal stockpiles;
- CPP;
- erection pads;
- bathhouse;
- general stores;
- office building (including but not limited to the Warkworth Administration, technical services, MTW health centre); and
- other facilities and incidental activities.

Mobile crib and amenity facilities (including sewage treatment facilities) are in open cut areas for employees working in these areas. The facilities are trailer-mounted and near active working areas and are relocated as required as mining progresses.

Other in-pit facilities include water cart fill points, explosives magazine and reload facilities, mobile sub stations, powerlines, fuel storages and other equipment. These in-pit facilities are also positioned near active working areas and would continue to be moved as required as mining progresses under the proposal. The proposal may require the addition or modification of existing infrastructure and mobile and in-pit facilities as described above, as required within the current mining and infrastructure areas for the efficient operation of Warkworth Mine.

The third bridge over Putty Road was approved in 2003 but has yet to be constructed. It is proposed to include the option of constructing an underpass rather than a bridge as well as extend the envelope westward where this bridge or underpass may be constructed. While the final location is yet to be determined, it would be within the envelope shown in Figure 2.3. The underpass or bridge is likely to be a double lane and of reinforced concrete construction capable of accommodating fully laden haul trucks.

2.4.7 Coal washing and processing

Under the proposal, the Warkworth and MTO CPPs would continue to wash and process coal in preparation for its transport to the Port of Newcastle via the MTCL with a small volume transported to Redbank Power Station. A small portion of ROM coal is bypassed and not washed, as further discussed in Section 2.4.8).

These CPPs contain processing equipment that separates the ROM feed coal into various saleable products and rejects. The coal is processed and washed in accordance with market requirements. Washing relies on the physical properties of the coal which has a lower specific gravity than non-coal material and the difference in densities allows the materials to be separated by floatation or centrifugal action. The CPPs separate the raw coal into low ash and high ash products, coarse rejects and fine rejects.

The coarse coal circuit relies on relatively simple gravity separation, with coal particles floating in a magnetite and water mixture known as a dense medium. The heavier non-coal material sinks while the coal remains in solution. The separation is enhanced for coarse coal particles by pumping dense medium and ROM coal together through dense medium cyclones. The Warkworth CPP also comprises a beneficiated dewatered tailings (BDT) plant which further extracts fine coal fraction through a floatation process.

Fine ROM coal is cleaned in a process circuit that does not use a dense medium. It is mixed with water and pumped through classifying cyclones to remove the very fine particles, which generally contain a very high proportion of non-coal materials including clays. It is then fed into spiral separators, which separate materials by gravity, taking advantage of the differing centrifugal effects produced by coal and non-coal particles as they wind their way down the spiral pathways.

After thickening in coal cyclones, the coal product streams are de-watered in centrifuges prior to stockpiling. Stockpiles are located within the infrastructure areas identified in Figures 2.7 to 2.10.

2.4.8 Coal transport

i ROM coal

The currently approved maximum extraction rate of 18Mtpa of ROM coal would be maintained under the proposal. Extracted coal would continue to be transported from the active working areas to the handling facilities at the Warkworth and MTO CPPs by truck. It would also continue to be transferred between Warkworth Mine and MTO via internal haul roads utilising one of two existing bridge crossings over Putty Road (it may also be transferred over the third approved crossing that is not presently constructed). The coal would be delivered directly to the ROM dump hoppers or the ROM stockpile (see Figure 2.13).

Coal would continue to be generally delivered directly to ROM receival dump hoppers which have been upgraded at the Warkworth CPP to incorporate dust hoods over the hoppers. A hardstand area adjacent to the dump hoppers is used as a contingency stockpile area for ROM coal, to minimise the effect of production variations or inclement weather on the continuity of supply to the CPPs. Coal is transferred from the contingency ROM coal stockpile by truck/front-end loader to the dump hoppers as required.

The raw coal in the dump hoppers would then be crushed before being either fed directly into the CPPs or selective stockpiling on the raw product stockpiles. Upon reclaiming, the raw coal can be blended before being conveyed to surge bins.

Some ROM coal which is suitable to be sold without washing can bypass the CPP directly to product stockpiles. The process is shown in Figure 2.13.

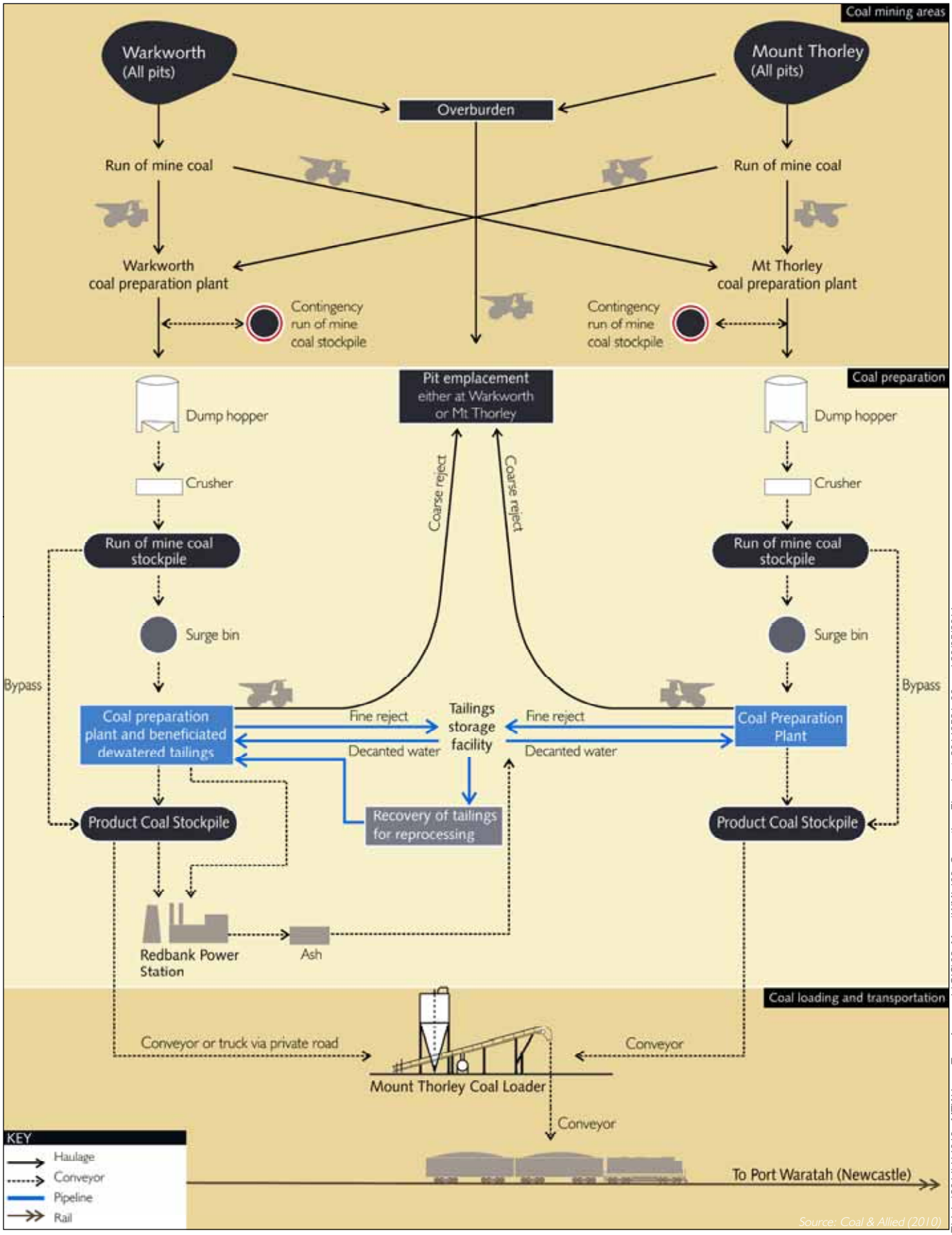
ii Product coal

Under the proposal, product coal from Warkworth CPP would continue to be transported to the locations listed below as shown in Figure 2.14:

- product coal stockpiles by conveyor;
- MTCL via overland conveyor;
- MTCL by truck using internal haul roads; and
- Redbank Power Station by overland conveyor.

With the exception of coal delivered to Redbank Power Station for domestic purposes, all product coal would be loaded and transported via MTCL. In case of emergency, such as conveyor failure, coal may be transported to Redbank Power Station via road for short periods, subject to regulatory approval in each instance.

The majority of the product coal from Warkworth CPP would continue to be transported approximately 2km by overland conveyor to the MTCL for transport to the Port of Newcastle, with some product coal transported by truck along internal haul roads. At the MTCL, coal is fed into rail loading storage silos owned by Warkworth Mine. The coal is then dispatched to the Warkworth Mine train loading bin situated on the nearby rail loop. Trains of varying capacity from 2,000 tonnes (t) to 8,000t are then loaded with coal for transport to ship loading facilities at the Port of Newcastle.



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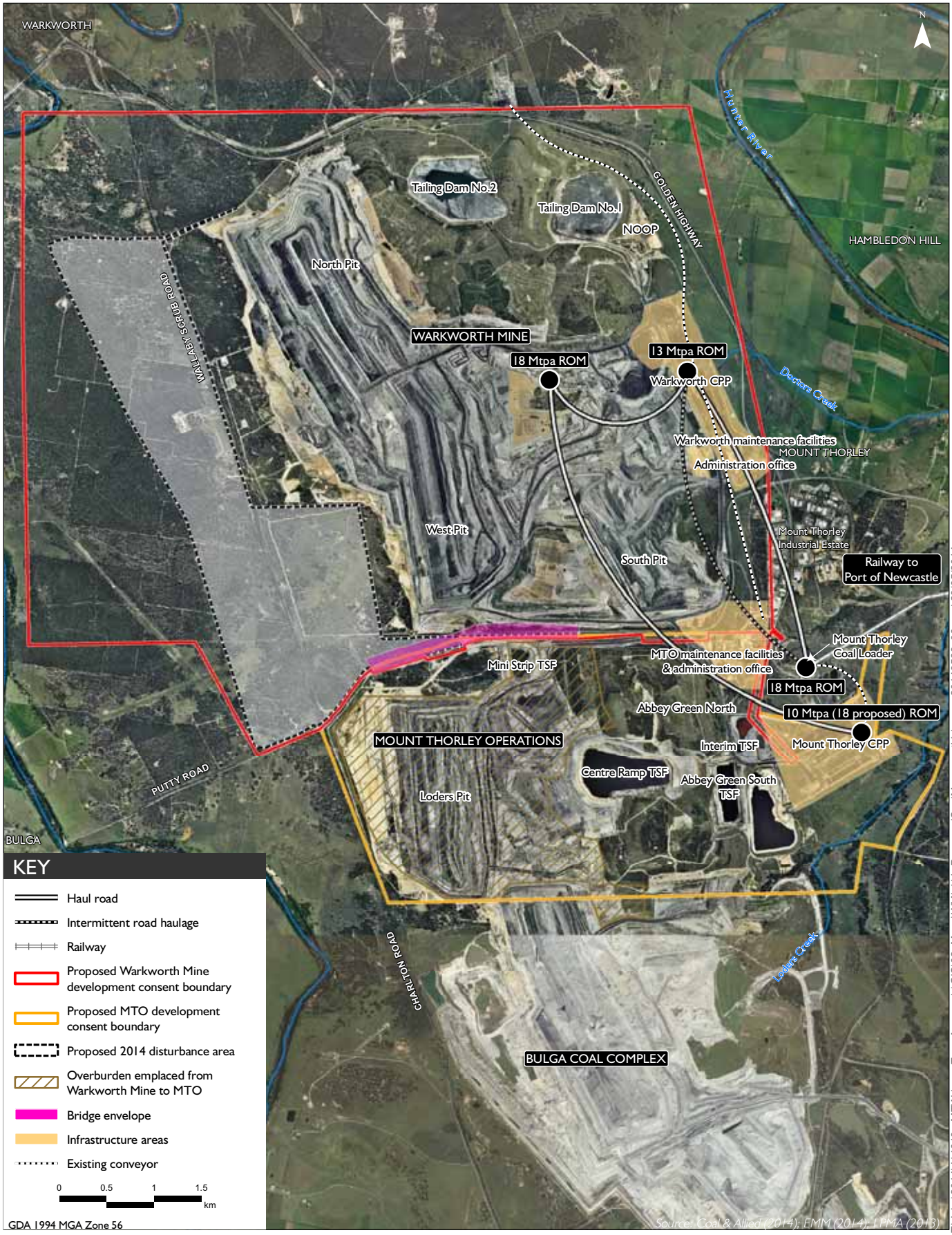
Flowchart of operations
Warkworth Continuation 2014
Environmental Impact Statement
Figure 2.13



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COAL & ALLIED

Proposed coal movement volumes

Warkworth Continuation 2014
Environmental Impact Statement
Figure 2.14

The existing and approved bridge crossings of Putty Road between Warkworth Mine and MTO would continue to be used under the proposal. This includes the existing smaller bridge over Putty Road designed for B-double vehicles, but not for heavy mining equipment fleet, and provides for the transport of product coal from the Warkworth CPP to the MTCL via internal haul roads.

A second bridge over Putty Road has been constructed and a third crossing over Putty Road which has been approved but not yet constructed may be used to facilitate the haulage of coal and also the transfer of mining equipment and overburden between Warkworth Mine and MTO. Both of these crossings are designed for heavy mining equipment fleet. As described in Section 2.4.6, the proposal includes the option of constructing an underpass rather than the third bridge over Putty Road.

The use of conveyors to transport coal from the two CPPs would continue under the proposal. A 3.7km conveyor is used to transport product coal from Warkworth CPP to the Redbank Power Station. The conveyor passes under the Golden Highway. Product coal from MTO CPP is transported directly to MTCL by conveyor.

Both the Warkworth and MTO CPPs would continue to operate continuously 24 hours per day, seven days per week.

2.4.9 Waste management

i Overview

Waste is classified and segregated into separate streams onsite and Coal & Allied environmental management protocols and procedures are implemented to ensure they are managed appropriately. The implementation of these would continue under the proposal.

The waste management systems at Warkworth Mine and MTO are integrated. Waste streams at MTW include overburden, rejects and tailings, liquid waste, hazardous waste, general waste (both putrescibles and non-putrescibles), vegetation waste and minor amounts of special waste (such as tyres).

The MTW waste management strategy includes the following commitments:

- all sampling and classification results are retained for the life of the operations in accordance with the EPA's *Waste Classification Guidelines* (DECCW 2009). It should be noted that most waste classifications for the operations are clear and do not require a sampling regime, however where unidentifiable waste is encountered (ie liquid waste), testing would be undertaken prior to acceptance and disposal;

- where relevant and in accordance with EPA's requirements, notification and tracking of waste is undertaken;

- all waste management protocols and procedures are regularly updated to include relevant contemporary legislative requirements (for example, Resource Recovery Exemptions); and

- contingency planning is undertaken for events that affect operations at the mines that may result in environmental harm, such as hazardous substances spills or failure of TSFs. These are detailed in the MTW Environmental Pollution Incident Response Management Plan.

The following sections describe the waste management strategy for MTW that would continue under the proposal. Appendix R provides relevant waste management protocols and procedures implemented at MTW as well as the reported waste recycled (86 per cent) and disposal (14 per cent) quantities for 2013, which are considered to be representative of waste streams expected during the life of the proposal.

ii Overburden emplacement

Overburden material would continue to be emplaced at Warkworth Mine and, in addition, would be transferred from Warkworth Mine to MTO to assist in the development of an improved final landform for MTO. Overburden would be transferred to MTO via existing road crossings over Putty Road and either the yet to be constructed bridge or underpass.

Overburden emplacement methods are described in Section 2.4.3.iii.

iii Rejects and tailings disposal

The integrated management (ie generation and disposal) of rejects and tailings for MTW would continue under the proposal. It is managed through implementation of Coal & Allied's environmental procedure *EP6.02 – Coarse Rejects and Tailings Disposal*, which is provided in Appendix R. The TSFs, shown in Figure 2.3, are designed to ensure that rejects and tailings are adequately managed, handled and disposed of in a manner that would minimise potential effects on the surrounding environment. These design measures include selecting appropriate locations (in-pit locations are preferred) that take into account topography, including drainage lines, groundwater and downstream infrastructure. The TSFs also include appropriate erosion, sediment and leachate control measures which are detailed in the MTW WMS.

Reject material is produced as a by-product of the coal washing process. Extracted coal contains part of the rock strata above and below the coal seam. This rock is removed from the product coal through the washing process in the CPPs. As a result, two types of rejects are generated: coarse and fine reject.

Coarse reject is made up of larger rock which is drained, rinsed and directed to a rejects bin. The reject would continue to be transported by haul truck and disposed at in-pit emplacement areas. The emplacement areas are capped by overburden material.

Fine reject (or tailings) has a high water content and is pumped to TSFs across MTW for settling and dewatering. Water from the TSFs would be retrieved and reused in the integrated WMS, such as water supply for the CPPs and dust suppression for haul roads and other exposed areas. When these TSFs reach capacity, they would be allowed to dry out and consolidate. When the TSFs are no longer required they would be capped with overburden and rehabilitated.

Under the proposal, ash generated by Redbank Power Station would continue to be delivered to Warkworth Mine by pipeline and deposited at TSFs. The BDT plant at the Warkworth CPP may continue recovery of fine coal that would otherwise be lost in the waste stream. The BDT plant may also be used to reprocess rejects (and recover fine coal) extracted from historical TSFs. To recover the fine coal fraction, fine rejects can be extracted from TSFs using a range of processes including truck/excavator, dredging or through a process known as hydromining. Hydromining is undertaken by using a high pressure water cannon to generate a slurry inside the TSF that can then be pumped directly from the TSF to the BDT plant. All three processes have been used at Warkworth Mine.

iv Hazardous waste and dangerous goods

Hazardous waste and dangerous goods are regulated under the NSW *Work Health and Safety Act 2011* and NSW *Explosives Act 2003.* Warkworth Mine would continue to comply with regulatory requirements in relation to dangerous goods management. The storage of explosives or explosive precursors is managed in accordance with MTW's *Major Hazard Management Plan - Explosives and security sensitive dangerous substances (SSDS) security plan*, prepared in accordance with the requirements of NSW Workcover. These internal MTW documents are regularly updated and would incorporate the proposal should approval be granted.

v Other waste

The management of other waste, inclusive of construction waste, putrescibles and non-putrescibles waste, liquid and special waste (such as tyres) is undertaken through the implementation of Coal & Allied's environmental work instruction *CNA-10-EWI-SITE-E7-008 – Non-mineral Waste Management*, which is provided in Appendix R.

Non-mineral waste management at the mines meets all regulatory requirements and relevant Rio Tinto standards. The management of non-mineral waste is guided by planning, process design and purchasing that result in the maximum reuse and recycling of materials. Each category of non-mineral waste is subject to appropriate segregation, collection, handling, transport and disposal to minimise environmental impacts. These non-mineral wastes are stockpiled in accordance with the environmental work instruction (see Appendix R), such as waste liquids stored in tanks or sumps.

It should be noted that only minor construction activity (ie activities not associated with continued mining at MTW) would result from the proposal (see Section 2.4.6), with the exception of the underpass/bridge over Putty Road. Construction of this crossing is not expected to generate large volumes of construction waste relative to waste currently managed onsite. Waste generated from this activity would be managed in accordance with the relevant MTW waste management protocols and procedures.

vi Offsite waste transportation

All transportation of regulated wastes is managed strictly in accordance with EPA's requirements to ensure that it does not pose a risk to human health or the environment. Waste transport certificates are issued and uploaded electronically to EPA by MTW's waste contractor. These records are kept in secure storage for the life of the operations in compliance with EPA's *Waste Classification Guidelines* (DECCW 2009). Details regarding the transportation of waste offsite are provided in Appendix R.

2.4.10 Public safety

i Site access

Public safety at MTW would continue to be managed primarily through the implementation of Rio Tinto's Health, Safety, Environment and Quality (HSEQ) standards, procedures and daily security inspections. Fencing, signposting, restricted access areas and locked external gates form part of the safety measures to ensure the safety of the public. In addition, there is no public access from the mine entrance to pit areas as part of the constraint on public access.

ii Bushfire management

Bushfire hazard management onsite is currently monitored and managed onsite through implementation of the MTW Bushfire Management Plan and regular communications and consultation with the NSW RFS. The RFS communicate regularly with mining operations in the Hunter Valley regarding bushfire hazard management, including fuel load (ie management of vegetation).

In 2012, the RFS advised mining operations in the Hunter Valley to undertake a programme of fuel load reduction to manage bushfire risk in the region. This programme was implemented by MTW on Coal & Allied-owned land, excluding areas within the mining footprint and areas designated as biodiversity offsets). These Coal & Allied-owned lands include areas west of the current operations. It should be noted that bushfire hazard management within biodiversity offset areas are managed through the implementation of the Green Offsets Strategy (ERM 2002a).

Annual inspections of Coal & Allied-owned lands, including those leased to residential and commercial tenants are undertaken to identify and assess bushfire risk for public safety and, if required, implement appropriate risk reduction measures such as vegetation pruning or establishment of fire breaks.

As described in Section 2.4.4, measures such as vegetation removal and topsoil stripping precede mining operations and in-pit use of equipment such as explosives magazine and reload facilities and fuel storages would continue to be implemented under the proposal. These activities also reduce bushfire risk resulting from mining operations.

The MTW Bushfire Management Plan is reviewed regularly and would continue to be implemented under the proposal and updated to incorporate the proposal, should approval be granted.

iii Offsite

Public safety offsite would continue to be managed in accordance with industry best practice primarily through the implementation of Rio Tinto's HSEQ standards, procedures and daily security inspections. The proposal has specifically assessed the following elements of offsite public safety:

- vibration (see Section 10.4.9);
- dust (see Section 11.3);
- blast fume (see Section 11.3); and
- traffic (see Section 20.3.2.iii.d).

These technical studies concluded that the proposal, with the continued implementation of existing mitigation measures, would not affect public safety offsite.

2.4.11 Rehabilitation

Rehabilitation would continue to be undertaken progressively across the mined area under the proposal. The requirements for rehabilitation would be determined in consultation with relevant government agencies and stakeholders and be concluded in accordance with the MTW MOP as required by the NSW *Mining Act 1992* (Mining Act).

Rehabilitation objectives and the domain types are provided in Chapter 13.

i Final landform

The existing Warkworth Mine has resulted in alterations to the local landform and includes overburden emplacements, final voids, TSFs, roads and infrastructure. Some of the overburden emplacement areas have already been rehabilitated to pasture and trees.

The proposal requires revision of previously planned and approved final landforms described in past environmental impact assessments and MOPs. The final landform considered these previous landform designs and surrounding land uses, external and internal planning requirements, existing management measures and the existing rehabilitated landforms. Final landform cross-sections are provided in Figure 2.15. Ecological and sustainability values were also an important consideration in the development of the conceptual final landform shown in Figure 2.16. Figure 2.16 also shows the cross-section locations provided in Figure 2.15.

The indicative post-mining landform is described further in Chapter 13.

ii Final landuse

The applicant acknowledges that final landuses need to integrate with the rehabilitation undertaken by the surrounding mining operations, existing agricultural land and areas containing remnant vegetation, ultimately providing for sustainable end land uses agreed by a range of stakeholders. The conceptual final landuse is shown in Figure 2.16.

The final landuse under the proposal aims to provide ongoing agricultural benefits, with cattle grazing permitted in areas of rehabilitated grassland, whilst creating complementary areas of biodiversity. This would enable productive agriculture, an increase in habitat and biodiversity values and the establishment of vegetation cover that creates corridors to link surrounding native vegetation. This would enhance local and regional ecological linkages to provide for a sustainable final land use.

The indicative location of the biodiversity corridor is shown in Figure 2.17. It is compatible with long-term rehabilitation plans for adjacent land uses in the vicinity of Warkworth Mine. The final landuse forms a north/south connecting corridor of vegetation between the existing vegetation to the north of the proposed 2014 disturbance area, through the rehabilitation areas of MTO and Bulga Coal Complex, and remnant vegetation within the Singleton Military Area further south.

Final landuse is discussed further in Chapter 13.

2.4.12 Water management

Potential surface water effects of the proposal would be managed in accordance with the MTW Water Management Plan (WMP), prepared in consultation with the NSW Office of Water (NOW) and NSW EPA for the integrated MTW operations. The plan requires:

- diversion of clean water runoff around areas of mining disturbance;
- collection and treatment of sediment-laden runoff from disturbed areas prior to discharge;
- collection of groundwater inflows and runoff from active mining areas within the MTW WMS;
- collection and treatment storage of potentially contaminated mine water prior to discharge to the MTW WMS;

- minimisation of water supply requirements from external sources by utilising on-site water for dust suppression and coal processing; and
- discharging excess mine water from the site based on existing entitlements under the Hunter River Salinity Trading Scheme (HRSTS).

Minor changes to the design of the NOOP dam (a saline water storage located to the south-east of Tailings Dam No.1) to support a capacity of approximately 740ML are proposed. This and other changes to the MTW WMS as a result of the proposal are described in Chapter 17.

2.4.13 Closure of Wallaby Scrub Road

Wallaby Scrub Road is managed and maintained by Singleton Council. Continuation of mining westwards would necessitate the closure of Wallaby Scrub Road. By Year 2 (nominally 2016) mining would be within 500m of the road, requiring its closure.

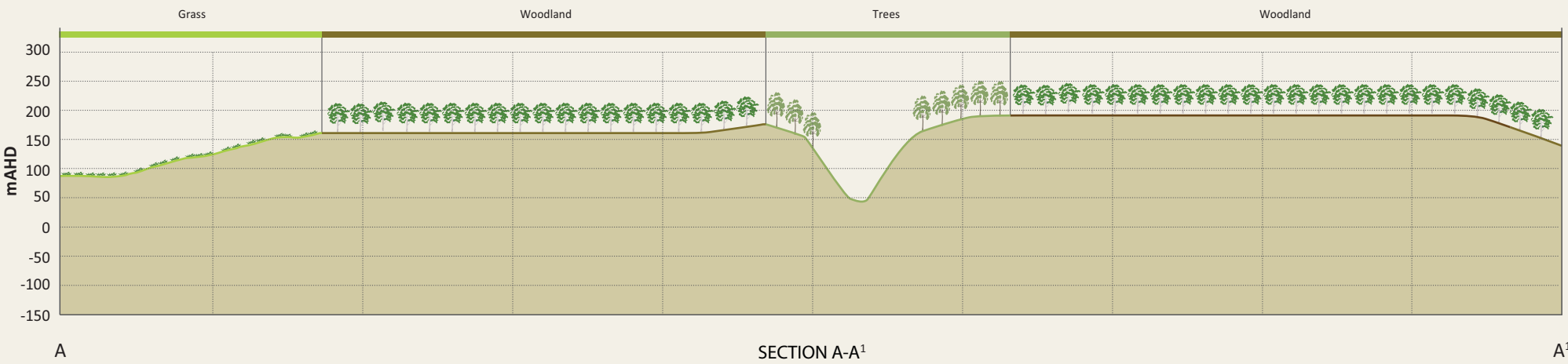
The applicant would engage with Singleton Council in relation to closure of the road.

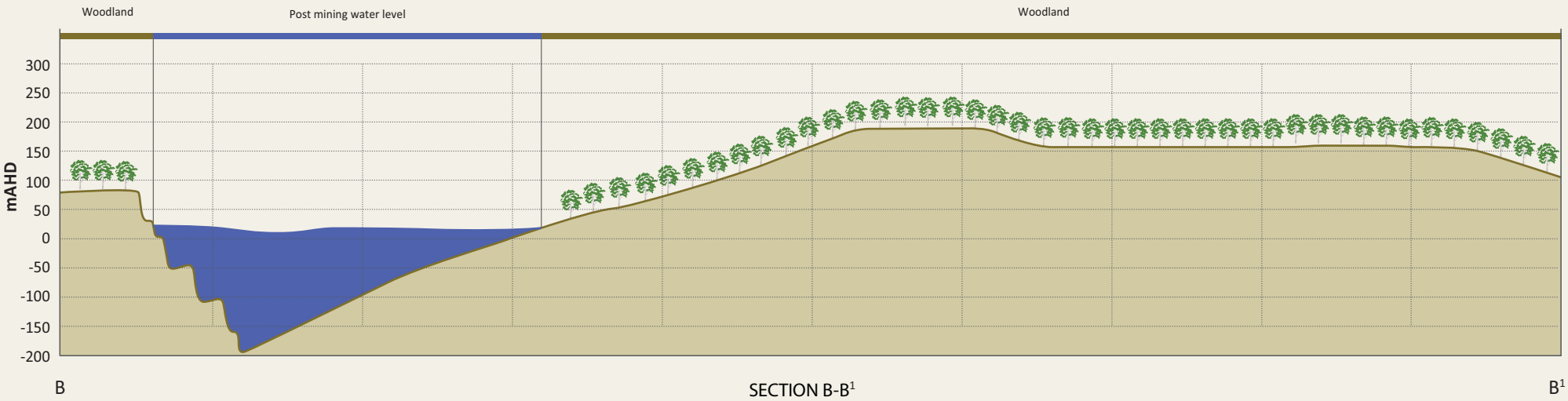
As noted in Section 2.4.2.iv, an appropriate emergency access road between Putty Road and the Golden Highway would be constructed prior to the closure of Wallaby Scrub Road in accordance with the RFS's relevant access standards, and in consultation with emergency services.

Closure of the road is addressed in Chapter 20.

2.4.14 Secondary access gates

The proposal also includes the maintenance of existing secondary access gates to Warkworth Mine from Wallaby Scrub Road, Golden Highway and Putty Road to allow for infrequent traffic movements in and out. It is expected that these access gates would be used to enable activities such as drilling, shutdown equipment, pad access and transportation of equipment. Similarly, existing secondary access gates to biodiversity offset areas would also be maintained as part of the proposal. Access would allow for biodiversity offset management activities.





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Final landform cross-sections

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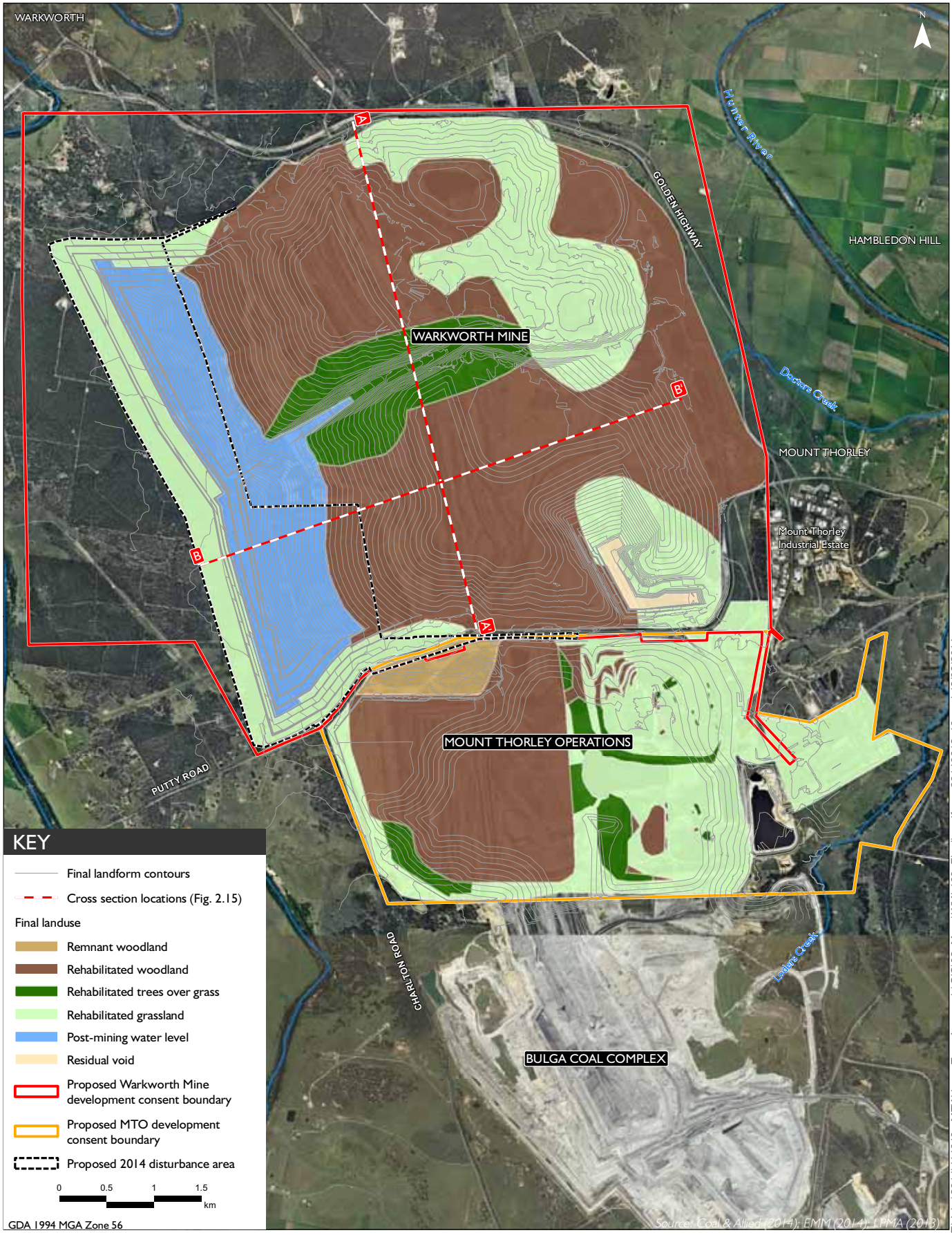
Environmental Impact Statement
Figure 2.15



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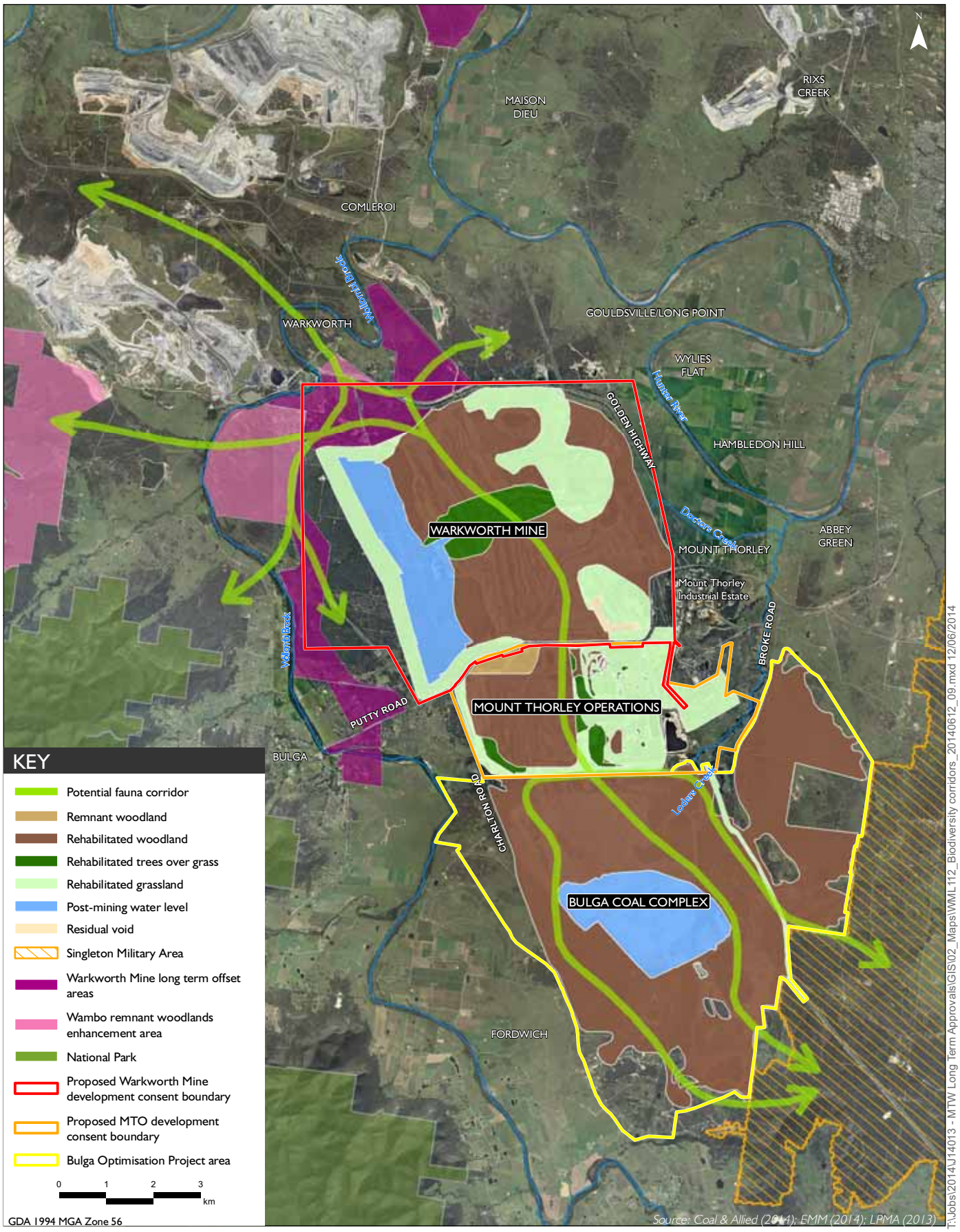
Final landuse and contours
Warkworth Continuation 2014
Environmental Impact Statement
Figure 2.16



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Biodiversity corridors
Warkworth Continuation 2014
Environmental Impact Statement
Figure 2.17

2.4.15 Workforce and operational hours

i Operational workers

The average workforce currently employed at MTW is approximately 1,300 persons. Although Warkworth Mine and MTO are integrated at an operational level and workforce numbers are difficult to assign to the respective development consents, an estimate of 63 per cent (819 persons on average) could be attributed to activities under the Warkworth Mine development consent and 37 per cent (481 persons on average) under the MTO development consent.

The total long-term workforce for the continuation of MTW is estimated to be the same, ie a workforce of 1,300 persons on average. Again although difficult to assign workforce numbers to respective development consents, the development applications for the proposal and Mount Thorley Operations 2014 proposal would result in similar workforce proportions as presently occur until completion of mining at MTO. At this time, an estimate of 96 per cent (around 1,187 persons on average) would be attributable to the Warkworth Mine development consent and 4 per cent (52 persons on average) attributed to the MTO development consent.

The actual workforce numbers would vary from year to year depending on the mine planning and market requirements.

The economic study, Appendix E, considers a proposal case with a reference case. The proposal case reflects the long-term average and proportions as described above. The reference case is based on operations at Warkworth Mine and MTO concluding in 2021 and 2017, respectively. The average workforce under the reference case is lower than the proposal case as it assumes the respective mines decrease mining activities to closure. The average workforce under the reference case is approximately 987 persons.

The reference case is provided as a basis for conservatively evaluating the incremental value of the project. However, the reference case is not likely to eventuate as mining under this scenario would not be economically viable due to extraction constraints from the reduced strike length in West Pit.

ii Construction workers

With the exception of the Putty Road underpass/bridge crossing, no new infrastructure is anticipated. Construction of the underpass/bridge crossing would require a small construction force only.

As noted in Section 2.4.6, changes to infrastructure within the infrastructure areas shown in Figures 2.7 to 2.9 may be required during the proposed development consent period. These changes would be minor and not necessitate construction workforce beyond current workforce numbers.

iii Operational and construction hours

Warkworth Mine would continue to operate 24 hours a day, seven days a week and any construction activities would also be conducted during these operational hours.

Chapter 3

Proposal need

Chapter 3 — Proposal need

3 Proposal need

3.1 Overview

Warkworth Mine has been operating for over 30 years in the Hunter Valley. It is a large-scale business built on hundreds of millions of dollars of investment, which requires the efficient extraction of 18Mt of ROM coal to remain viable in the current economic environment. The MTW operation has a workforce of approximately 1,300 persons on average, which includes full-time contractors.

The proposal is needed to:

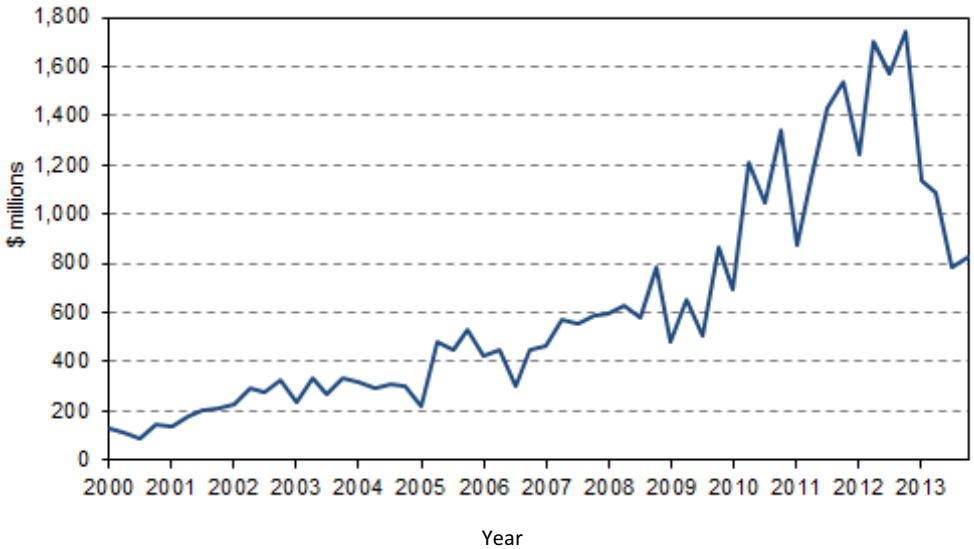
- maintain strike length to enable the mine to remain economically viable in 2015 and beyond;
- maintain jobs and ensure the mine's economic and social benefits continue; and
- enable continued supply of a resource necessary for energy generation and steel production.

These matters are discussed in the sections below.

3.2 Background

3.2.1 Mining slowdown

The economic study (Chapter 9 and Appendix E) suggests through a number of indicators that while mining activity has been historically very high, significant declines in Australian thermal coal prices over the past two years, amongst other factors, have had a negative impact on capital expenditure in NSW. This is shown in Figure 3.1. Investment in new tangible assets has fallen by more than half between December 2012 and December 2013. These trends are consistent with the expectation by the Hunter Valley Research Foundation (HVRF 2013a,b) that few additional mining investment proposals will progress in the medium term, except extension of existing mines to remain viable and that require little capital.



Source: ABS (2014)

Figure 3.1 New capital expenditure in the NSW mining industry (current prices)

The effects of the mining slowdown are also being observed in the labour market. In a reversal of trend of the recent past, there is now an excess of qualified mining engineers in NSW (Australian Journal of Mining 2014), as well as a shortage of positions for mining apprentices and trainees in the Hunter Valley (Australian Mining 2013). This is reflected in the unemployment rate in the Hunter Valley which has increased notably since 2011: 5.2 per cent in 2011 to 5.6 per cent in September 2013.

3.2.2 Regional impacts

The HVRF's measure of employment intentions suggest that further weakness in the Hunter Valley labour market can be anticipated. Employment intentions have declined since December 2011 with HVRF's most recent measures lower than those during the Global Financial Crisis of 2008. Similar trends are also evident in the HVRF's (2013b) Household Survey, which suggests that consumer confidence and purchasing intentions in the Hunter Valley remains negative. Overall, HVRF (2013b) conclude that the economic outlook for the Hunter Valley reflects the end of the previous expansion phase combined with a drive to achieve efficiencies, the effects of which are now being felt by local suppliers, contractors and operational employees.

Recent job losses have also occurred in the wider industry, with approximately 1,500 direct mining jobs lost in the Hunter Valley over the last 18 months (NSW Mining 2014) including the recent announcement of a further 500 job losses at Integra Coal Operations. These job losses and their respective flow-on effects are representative of the indicators described above.

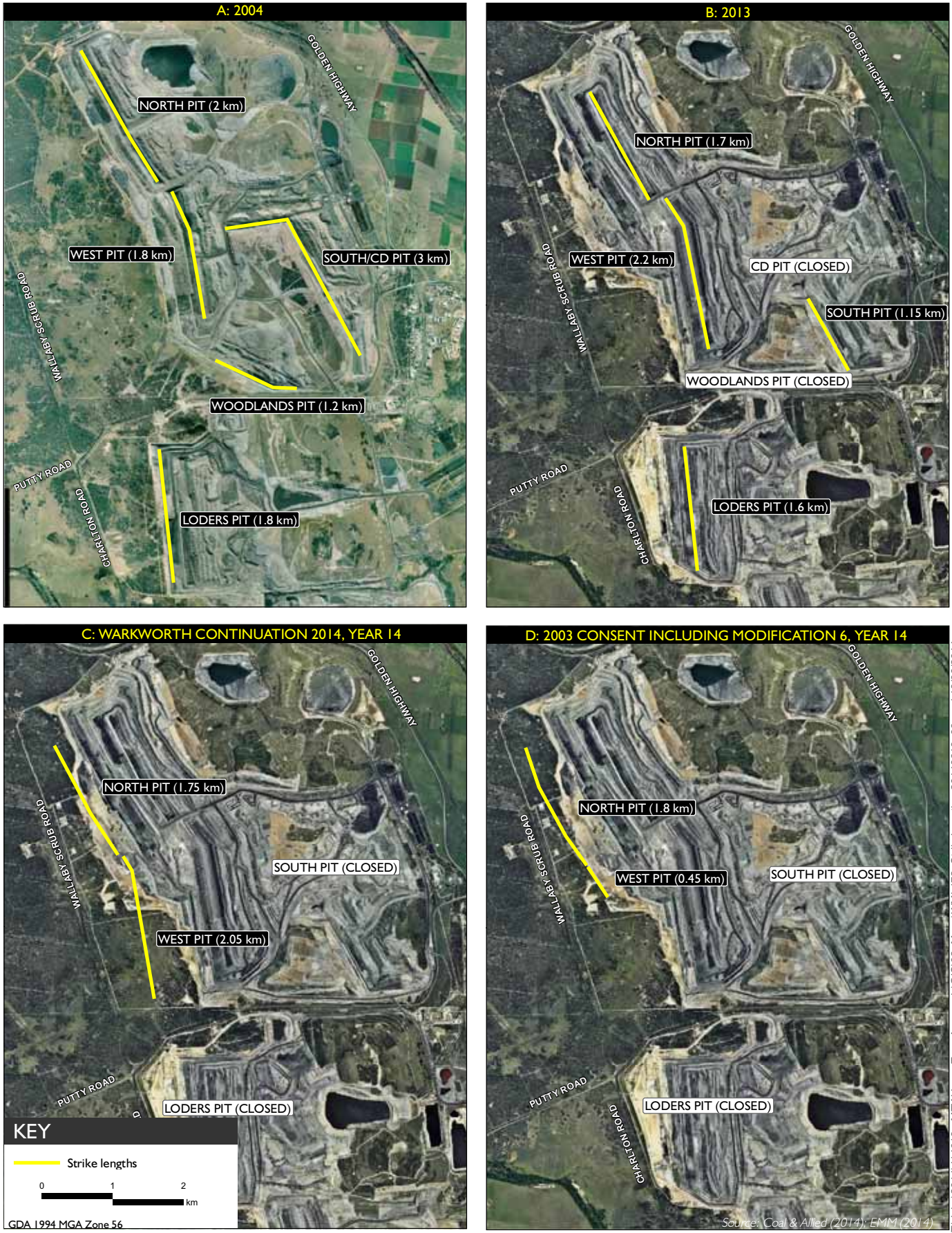
3.3 Mining constraints

As described in Section 2.1, Warkworth Mine and MTO commenced mining in 1981 as separate operations. Warkworth Mine commissioned a Bucyrus 1370 dragline in 1981 and MTO commissioned a Marion 8200 dragline in 1983. The primary reason for the selection of draglines as the preferred mining method was their low operating costs. Draglines are high capital investments but have relatively short payback periods due to their low operating costs. In 1999, Warkworth Mine commissioned a second dragline, a P&H 9020. All of these draglines are still in operation.

As Warkworth Mine progresses down-dip, the strip ratio (ratio of waste material to coal) increases steadily over time. To keep the Warkworth Mine (and MTW as a whole) profitable, the draglines form a vital part of the operation as they move overburden significantly cheaper than conventional truck and shovel methods, enabling extraction costs to be minimised. In addition to the above, the coal seams mined at MTW are regular and dip to the west at a consistent, relatively shallow grade, lending them to the dragline operation as the primary overburden stripping method.

The available strike length of the two mines makes them suitable for dragline operations. Strike length refers to the total horizontal distance (or strike) available for the draglines to work. Longer strike length allows time for other operations above to release strips for draglines to dig (for example, drill and blast of overburden, truck and shovel overburden stripping and decoaling operations) (see Figure 2.12), thereby keeping the draglines highly utilised with minimal or no park idle or 'park up' time.

The drawback of dragline operations is their inflexibility with relation to mining method. To maximise utilisation of the dragline fleet the deposit needs to be mined in strips, with truck and shovel fleets pushing back upper benches as far as required to release strips for draglines to dig. A shorter strike length means the dragline will have periods of poor utilisation while it waits for these other processes to occur. This increases unit costs for each tonne of coal produced.



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Historic and proposed MTW dragline strike lengths

Warkworth Continuation 2014

Environmental Impact Statement

Figure 3.2

Through years of technical analysis by mine planning engineers it has become evident that to remain a profitable, Warkworth Mine and MTO need to maintain as much dragline strike length as possible. This enables operating costs to be kept low, as well as maintaining a production profile of at least 18Mtpa of ROM coal across the two mines. This level of extraction is the threshold critical to generate sufficient revenue to offset high fixed costs (including labour, fuel, explosives, parts and consumables) in the current economic environment.

MTW currently operates three draglines that move approximately 25 per cent of the mines' total prime waste (overburden not including rehandle waste), with a total available strike length of 6.65km. In 2004, the three draglines moved approximately 75 per cent of MTW's prime waste, with an available strike length of 9.8km (Figure 3.2a).

As shown in Figure 3.2b, by the end of 2013 dragline strike length had been reduced to 6.65km, due to the closure of CD Pit and Woodlands Pit. Analysis at MTW has shown that maintaining as much strike length as possible is the best mechanism to sustain a viable, economic operation into the future.

The closure of South Pit in approximately 2016 and Loders Pit in approximately 2020 reduces dragline strike length further, to 3.8km. At this point, MTW's only two operating pits are North Pit and West Pit. Figure 3.2c shows MTW's dragline strike length in Year 14, nominally 2023 under the proposal.

Figure 3.2d shows the total dragline strike length available should the Warkworth Mine stay within the spatial limits approved under the existing development consent (which includes Modification 6). South Pit will close in approximately 2016 and Loders Pit in approximately 2020. By 2021, the strike length has decreased to 2.25km. At the point where West Pit strike length reduces, the lower dragline horizon is no longer viable. This would result in one of the draglines parking up as there is not enough overburden available for mining to keep it operational.

The steady decline of dragline strike length over the last ten years is illustrated in Figure 3.3. The figure also shows the increase in saleable coal required to offset the declining dragline strike length and associated lower operating costs as well as the high fixed costs of MTW.

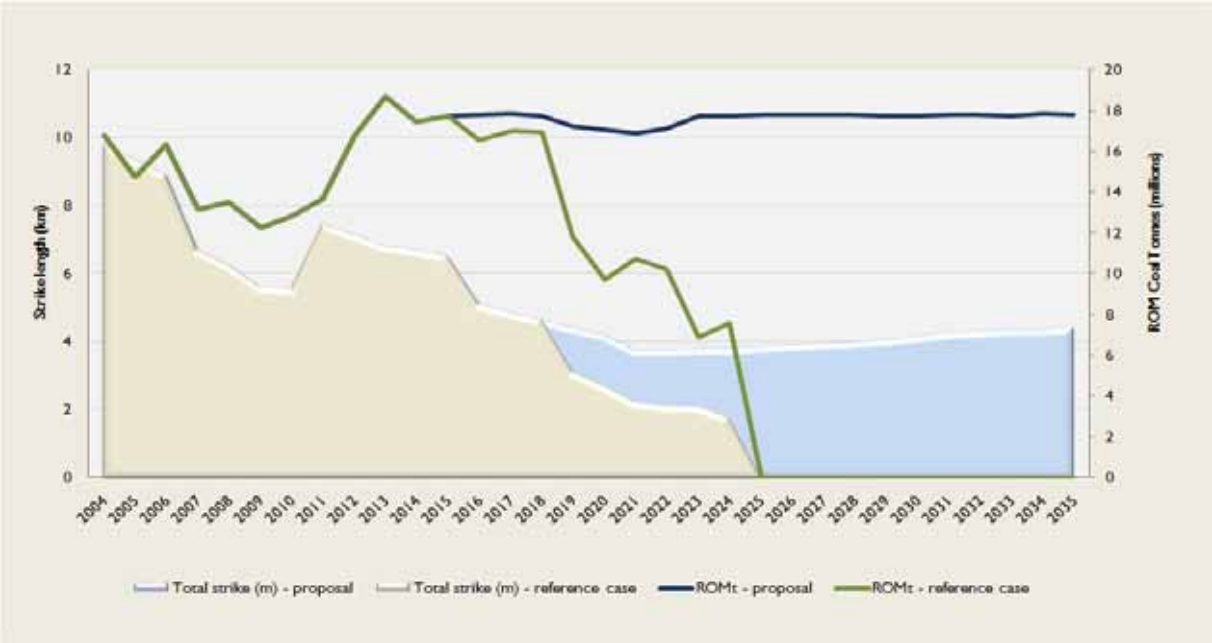


Figure 3.3 Strike length and extraction volumes

While the dragline component of prime waste movement at MTW has declined over the past decade, they form a vital part of the operation as waste removal by this method is significantly cheaper than truck and shovel methods and, therefore, minimises operating costs at MTW. The draglines access the two lowest seams mined at MTW, Bowfield and Warkworth/Mount Arthur in North Pit and West Pit. Mining of the upper benches by truck and shovel takes approximately two years to allow sufficient working room for draglines.

To reduce operating costs and maintain extraction at 18Mtpa of ROM coal with existing fleet in 2020 and beyond, strike length under the proposal would be maximised by 'fanning out' the North Pit and West Pit endwalls. This would allow higher utilisation of the draglines and hence lower operating costs. If, for example, the existing North and West Pit endwall alignments were maintained and not fanned out, additional truck and shovel resources would be required to enable extraction of 18Mtpa of ROM coal. Under this scenario MTW is not economically viable as draglines would be utilised less due to insufficient strike length, resulting in much higher operating costs.

With the completion of Loders Pit in 2020, one of the draglines would be parked up with not enough strike length to feasibly remain operational, which would occur regardless of the outcome of the proposal and the Mount Thorley Operations 2014, however the operation would still remain economically viable. This leaves the two remaining draglines cycling between North and West Pits. In North Pit the draglines would dig one overburden pass (i.e. the waste material between two coal seams), and in West Pit two overburden passes. The coal uncovered by these overburden passes represents approximately one third of the total coal uncovered across the Warkworth Mine operation per year at an extraction rate of 18Mtpa of ROM coal and is the lowest cost coal uncovered at Warkworth Mine.

Should the proposal in its current form not be approved, strike length drops dramatically in West Pit to the point that the draglines can no longer dig the lower overburden pass in West Pit due to insufficient working room for the dragline, dragline spoil emplacement limitations and the inability to access the coal due to no room for an access ramp for coaling trucks.

At this time another dragline would be parked up because there would not be enough strike length to keep it utilised at a reasonable level. This is best illustrated by Figure 3.4.

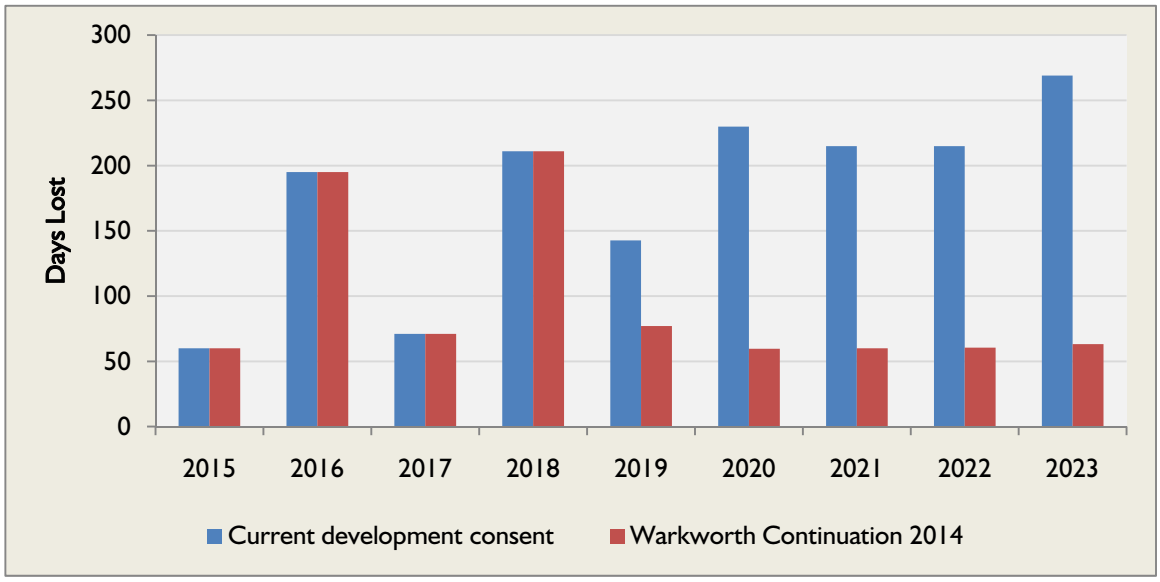


Figure 3.4 Total dragline park-up days due to unavailability of dig areas

Under the proposal there are spikes of around 200 parked up days for the draglines in 2016 and 2018. This is due to the inability to mine through the Saddleback Ridge as part of the current consent conditions over the past two years. This is the direct consequence of the disapproval of the Warkworth Extension 2010. The ramifications of not being able to lay the prestrip benches back in this area are not projected to materialise for approximately two years. This is the amount of time it takes the prestrip fleet to expose one dragline strip in West Pit.

Should the proposal be approved, the layback of the prestrip benches gets to steady state and the two draglines would be able to progress with minimal delays post 2018 (as shown in Figure 3.4).

Should the proposal not be approved and, accordingly, the applicant is unable to mine through the Saddleback Ridge area in West Pit South, on average dragline parked up days are projected to be over 200 per year from 2018 to 2023 (hypothetically adopted for comparison purposes). As such, the amount of coal uncovered by draglines would decrease dramatically (as shown by Figure 3.5) and, in turn, additional prestrip capacity would be required to make up the deficit at a much higher cost. Critically, this would reduce mining below economically viable production rates.

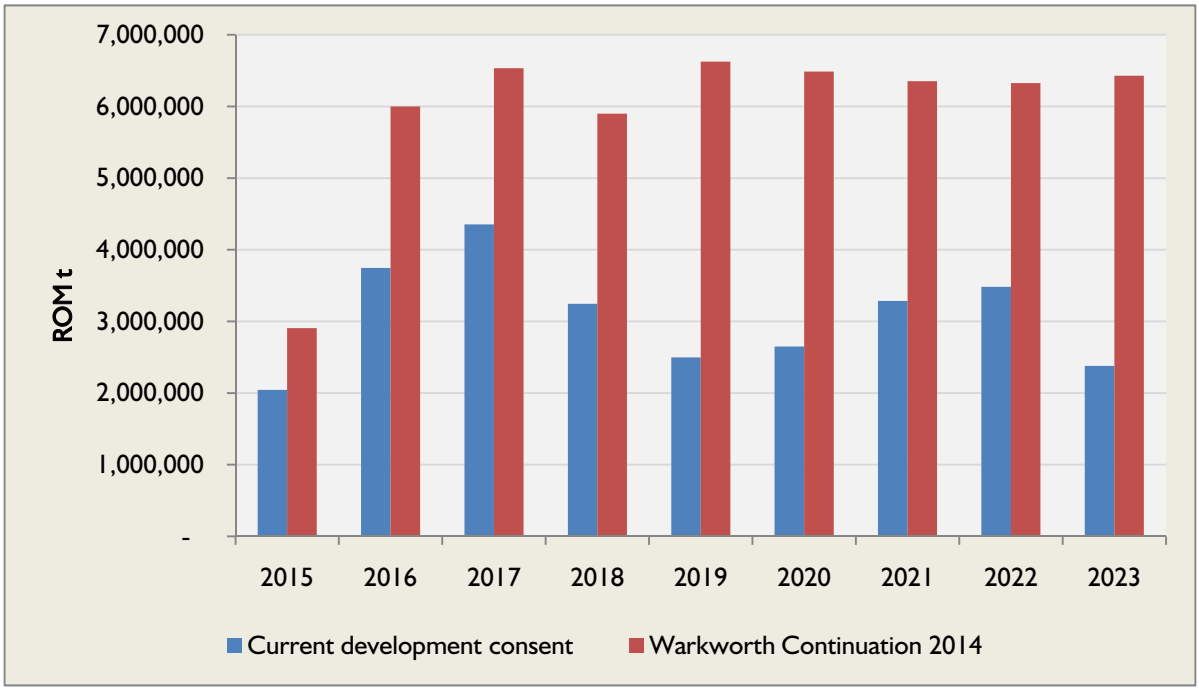
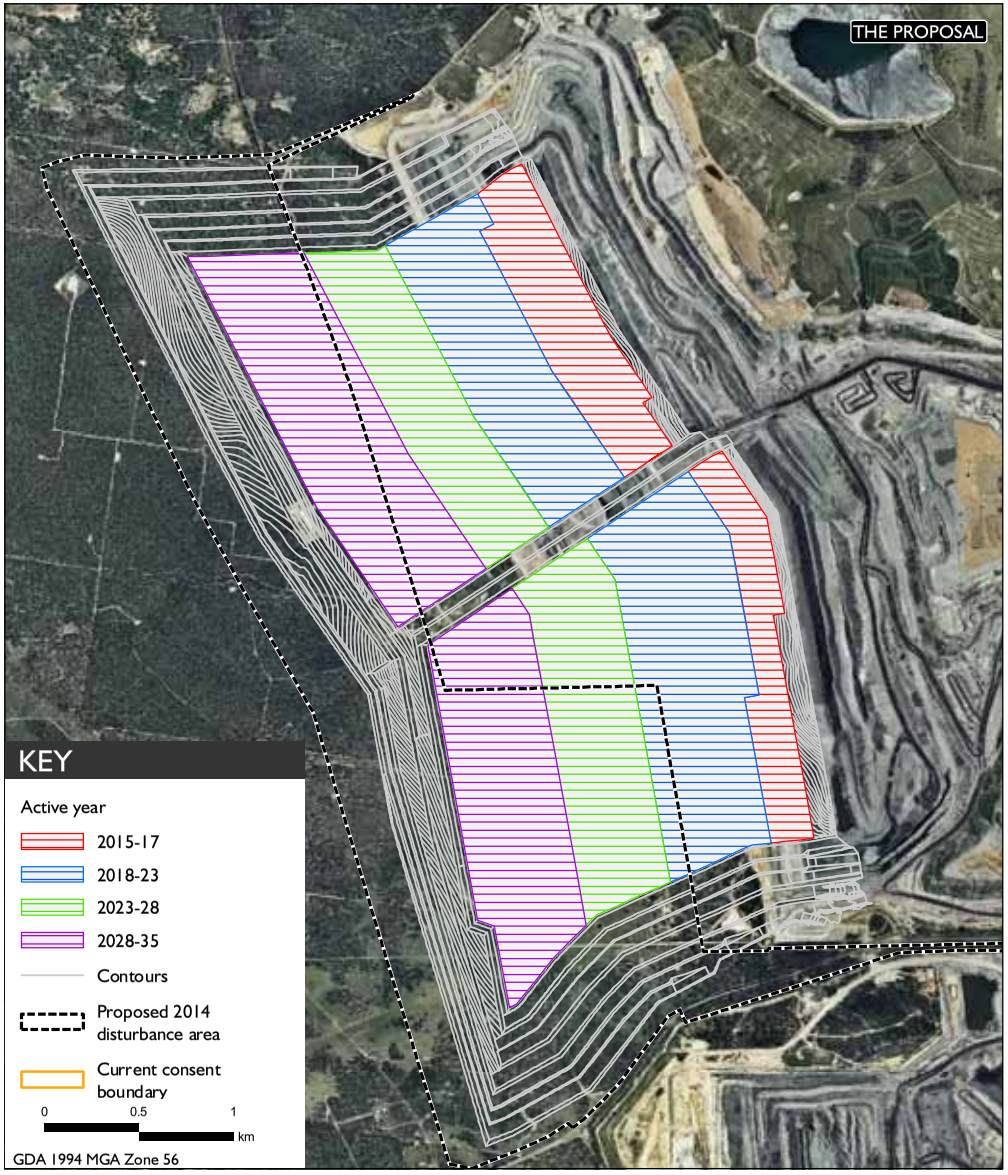
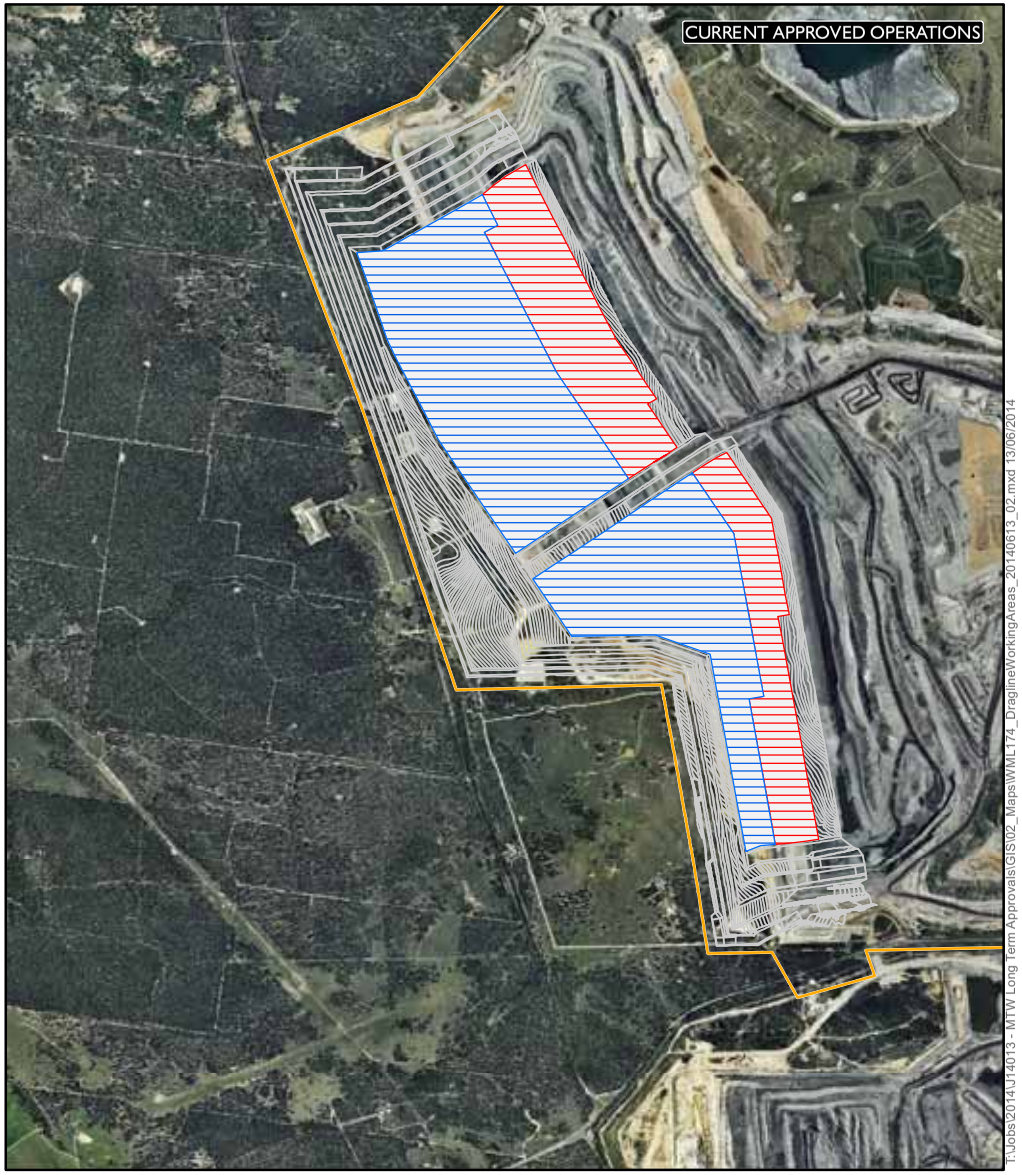


Figure 3.5 ROM coal tonnes uncovered by draglines

Figure 3.6 shows the impact on dragline working areas available should the proposal not be approved. Draglines working areas as proposed are shown in the left hand image and those currently approved in the right hand image. By 2019, MTW would be operating with a single dragline and producing significantly less coal at much greater cost. As described above, it is unlikely that the operation would continue to the western limit of the existing development consent boundary due to significant cost in getting the prestrip wall out to the final highwall limit in North Pit.

The economic study (see Chapter 9 and Appendix E) compares the reference case (or proposal disapproved case) to the proposal approved case. Under the reference case, coal production would decline from 2016 onwards and would end by 2021.





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Dragline working areas under the proposal and as currently approved

Warkworth Continuation 2014
Environmental Impact Statement
Figure 3.6

It is important to note that the economic study is a conservative assessment against a reference case. As described above, the reference case is not likely to eventuate as mining under this scenario would not be economically viable due to extraction constraints from a reduced strike length in West Pit.

3.4 Employment and other economic and social benefits

The continued operation of MTW has significant social and economic benefits in the form of continuing employment for a workforce of approximately 1,300 persons on average, net economic benefits of some $1.5billion and royalties of some $617million. The economic benefits attributable to the Warkworth Mine include continuing employment for a workforce of some 1,187 persons, $1.34billion in net economic benefits and some $567million in royalties. These include additional annual employment of around 191 full-time equivalent workers in NSW and 198 full-time equivalent workers in the Mid and Upper Hunter region, and an increase in the gross state product by approximately $406million beyond the reference case. Further, the Commonwealth Government would benefit from company and income taxes generated under the proposal. The proposal's economic benefits are discussed further in Chapter 9.

The proposal would support the continuation of initiatives such as the Coal & Allied Community Development Fund (CDF) which has committed $4.5million for eligible community projects between January 2012 and December 2014 and the MTW Site Donation Committee. The aim of the CDF fund is to support projects and programmes that will create opportunities with a long lasting benefit to the wider community. The proposal's social benefits and disbenefits are discussed in Chapter 21.

The proposal incorporates significant improvements and a number of changes from the Warkworth Extension 2010 which take account of, amongst other matters, feedback received during stakeholder engagement for the mine and L&E Court judgement of the previous application and also feedback from the PAC determination of Modification 6. These improvements are discussed in Chapter 4. Certainty provided by the proposal's approval, would ensure these improvements are implemented, such as the programme of mining fleet noise attenuation, with all drills, trucks, dozers and excavators to be attenuated by the end 2016.

The proposal would also enable the provision of a fully contemporised development consent for the Warkworth Mine.

In summary, the proposal would provide the best opportunity for the continuation of direct and indirect employment associated with Warkworth Mine and would enable the operations local, State and National benefits to continue.

3.5 Importance of the resource

The proposal would enable extraction of additional ROM coal of approximately 230Mt at Warkworth Mine during the proposed consent period. Approximately 75 per cent and 25 per cent of coal produced at the mine is thermal and semi-soft coking coal (metallurgical coal), respectively. These types of coal are important for energy generation and steel making. The need for these resources is discussed below.

The proposal would allow continued supply of these important resources and contribution to export sales and associated earnings for Australia.

Approximately 0.5Mtpa of product coal processed at the Warkworth CPP is currently conveyed to the nearby Redbank Power Station for domestic purposes.

3.5.1 Electricity

Electricity is essential for modern life providing light for houses, buildings and street, domestic and industrial heat, and powers most equipment used in homes, offices, machinery in factories and electric cars. Improving access to electricity worldwide is critical to alleviating poverty and improving quality of life.

Coal plays a vital role in electricity generation worldwide. It provides just under 30 per cent of global primary energy needs. In 2012, coal-fired power plants fuelled 41 per cent of global electricity (World Coal Association 2013b) with a much higher percentage in some countries as shown in Table 3.1.

Table 3.1 Coal in electricity supply

Country	Percentage	Country	Percentage	Country	Percentage
Australia	69	Poland	86	China	81
South Africa	94	Israel	59	India	68
Mongolia	98	Indonesia	44	United Kingdom	29
Japan	27	USA	43	Germany	43

Source: International Energy Agency 2012b.

There are strong incentives to develop alternative sources of energy. By 2040, the International Energy Agency (2012a) reports that global energy demand will be around a third greater than current levels with China, India and the Middle East expected to account for 60 per cent of the increase.

3.5.2 Steel

Steel is an essential material for modern life. The manufacture of steel helps deliver the goods and services that our society needs including healthcare, telecommunications, improved agricultural practices, better transport networks, clean water and access to reliable and affordable energy.

Seventy per cent of the steel produced today uses coking coal which is a vital ingredient in the steel making process. Global steel production is dependent on coal of which approximately 1.4 billion tonnes was produced in 2011. Around 721Mt of coking coal was used in the steel production (World Coal Association 2013a).

Despite current difficulties, future scenarios for the steel industry have an optimistic starting point. Urbanisation and population growth will support industry growth for a considerable time. The world's population is increasingly urban with around half of the world's population living in towns or cities in 2010. According to the World Steel Association (2012), by 2050 the world's population will be more than nine billion (an increase of approximately 1.8 billion people from today's levels) and it is expected that approximately 70 per cent of the population will live in cities. To handle this migration, expanding cities will require substantial volumes of building materials, including steel.

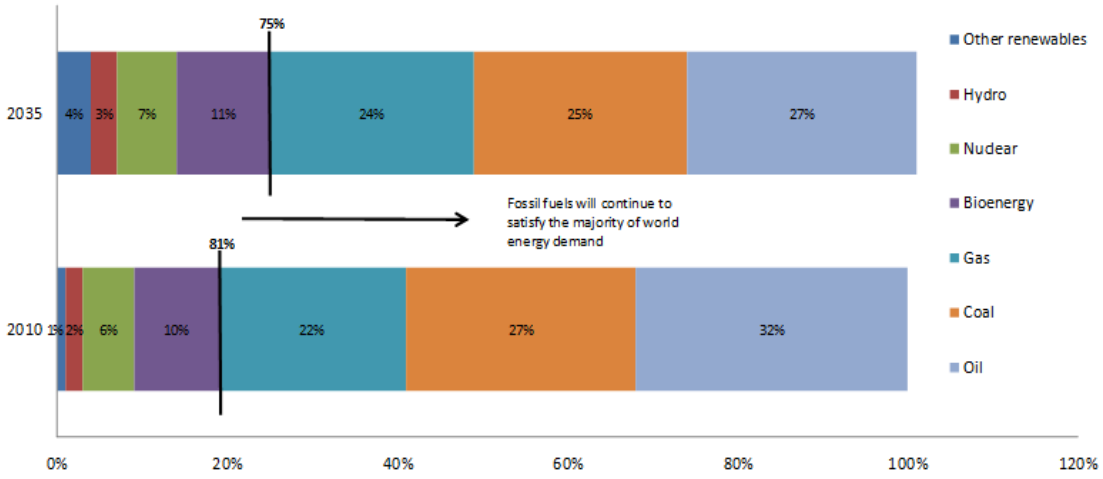
Opportunities to expand coking coal exports to a number of countries are strong with imports forecast to increase in many countries. As reported by Ernst and Young (2014), these include:

- in China, coking coal imports from 2012 are forecast to increase at an average rate of 12 per cent per year to reach 80Mt by 2018;
- in India, consumption of coking coal between 2013 and 2017 is set to increase by 30 per cent to 59Mt of which almost 70 per cent will be imported; and

- in Brazil, it is expected that average growth in steel production will be around 3.3 per cent per year. As a result, imports of coking coal will increase over the same period at an average rate of 6 per cent per year to reach 16Mt in 2018.

3.5.3 Global energy demand

Despite efforts to diversify energy sources, coal remains an important resource for many economies. Since 2000, apart from renewable energy sources, it has been the fastest growing global energy source. Coal is the second largest source of primary energy after oil providing 27 per cent of global primary energy needs in 2010. Coal is expected to remain an important source, supplying a projected 25 per cent of global energy needs in 2035 as shown in Figure 3.7 (Oxley and Rae 2013). It is noted that, owing to rounding, the fossil fuel percentage shares in 2035 do not sum to 75 per cent.



Source: IEA, World Energy Outlook 2012, Table 2.2
NB: that owing to rounding the fossil fuel percentage shares in the right hand bar do not sum to 75 per cent

Figure 3.7 Global energy mix – primary demand in 2010 and 2035

Chapter 4

Improvements and differences from the Warkworth Extension 2010

Chapter 4 — Improvements and differences from the Warkworth Extension 2010

4 Improvements and differences from the Warkworth Extension 2010

4.1 Introduction

This chapter provides a summary of the proposal's differences to the Warkworth Extension 2010 lodged with the former Department of Planning (now DP&E) in 2010, and disapproved by the L&E Court in 2013, and outlines operational improvements at MTW made since. It also describes changes in government policy and legislation made since 2010 that apply to the proposal.

4.2 Warkworth Extension 2010

In 2010, an extension of the Warkworth Mine to the west of the current pit wall (North and West pits) was sought. The project application comprised the following key activities:

- an extension of the mine in a westward progression from the currently approved mining area;
- mining through some areas that have previously been established as habitat management areas (HMAs) and non-disturbance areas (NDAs) (see Section 4.4.2.i);
- incorporation of other areas previously established as HMA/NDA into a wider series of biodiversity conservation areas;
- the relocation or closure of Wallaby Scrub Road;
- transfer and disposal of overburden to MTO after coal is mined under the existing MTO development consent;
- replacement of ageing equipment fleet to allow for improved mining efficiencies; and
- upgrading some support infrastructure within existing or proposed disturbance footprints such as a vehicle bridge over Putty Road and potentially the Warkworth Mine workshop.

As described in Chapter 1, the Warkworth Extension 2010 was approved by the PAC in February 2012 and received approval under the EPBC Act from the Commonwealth Minister for the Environment in mid 2012. Subsequently, the project approval was appealed in the L&E Court. On 15 April 2013, 14 months after the approval was granted by the PAC, the appeal was upheld by the L&E Court and the application was disapproved. The decision was appealed on administrative law grounds by WML and in April 2014 the NSW Supreme Court rejected this appeal, effectively upholding the original decision by the L&E Court. It should be noted that the appeal to the NSW Supreme Court was limited to points of law and, accordingly, while it was found that the process undertaken by the L&E Court was lawful they did not comment on or find anything further in respect of the merits of the L&E Court judgement. Notwithstanding, Warkworth Mine retains Commonwealth approval for the extension.

4.3 Review of changes to legislation and government policy

Since the preparation and assessment of the Warkworth Extension 2010 and its disapproval by the L&E Court on 15 April 2013 there have been a number of important changes to legislation and government policies that apply to the proposal, namely:

- repeal of Part 3A of the NSW EP&A Act;

- amendments to the Mining SEPP;
- introduction of the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a) and the *Draft Framework for Biodiversity Assessment* (the FBA, OEH 2014b) and the *Upper Hunter Strategic Assessment Interim Policy* (UHSA);
- release of the *Strategic Regional Land Use Policy* (SRLUP) (DP&I 2012a) and sub-plans, including the Upper Hunter Strategic Regional Land Use Plan; and
- introduction of the *NSW Aquifer Interference Policy* (AIP).

Each of these is addressed below.

4.3.1 Repeal of Part 3A

In 2011 the NSW Government repealed Part 3A of the EP&A Act and stopped accepting any new projects in the Part 3A assessment system. This system was replaced by the State significant development (SSD) and infrastructure assessment systems under Division 4.1 of Part 4 (SSD) and Part 5.1 (State significant infrastructure) which commenced on 1 October 2011.

A range of development types such as mines and manufacturing plants as well as warehousing, waste, energy, tourist, education and hospital facilities are considered to be SSD if they are over a certain size or in an environmentally sensitive area. Some projects are also considered SSD because they are in precincts regarded as important by the NSW Government (ie Sydney Olympic Park).

A full list of SSD development types and specified sites can be found in Schedules 1 and 2 of the State Environmental Planning Policy (State and Regional Development) 2011 (the SRD SEPP).

The key differences between Part 3A and SSD are:

- the matters for considerations in section 79C of the EP&A Act are now relevant (whereas they were not relevant under Part 3A) except for council's development control plans;
- the development must be at least partly permissible under the applicable environmental planning instruments. If it is wholly prohibited then the PAC will be involved in considering any concurrent rezoning;
- that modifications to any approval must be 'substantially the same development'; and
- an EIS must be prepared in accordance with the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) and the Director-General's requirements.

The legislative framework relevant to the proposal is detailed in Chapter 7.

4.3.2 Mining SEPP

The Mining SEPP provides that a consent authority must consider various matters when determining a development application for a mining development. These provisions did not apply to applications under Part 3A of the EP&A Act but now apply to development applications under the SSD provisions.

Further, in July 2013, the NSW Government exhibited proposed amendments to the Mining SEPP aimed to:

- ensure the significance of the resources (major or minor) must be considered;
- stipulate the key environmental, ecological and amenity criteria to protect water resources, habitat and amenity;
- require the economics and environmental issues mentioned above are properly balanced; and
- evaluate the importance of the NSW Office of Environment and Heritage (OEH) in the assessment process, by ensuring that a consent authority must consider OEH's certification of biodiversity mitigation and offset measures.

The NSW Government stated that the amendments aim to increase confidence for investors and the community about how decisions are made on mining. These exhibited amendments were gazetted on 4 November 2013.

Section 7.2.3 provides further details as to the operation of these provisions.

4.3.3 NSW Biodiversity Offsets Policy for Major Projects, the Framework for Biodiversity Assessment and the Upper Hunter Strategic Assessment Interim Policy

In March 2014, OEH released the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a) to clarify, standardise and improve biodiversity offsetting for major project approvals under the NSW planning system. Previously, there was no standard method for assessing impacts of major projects on biodiversity, which had the potential to lead to subjective assessments around the adequacy of offsets and its outcomes. The policy has three key objectives:

- to provide clear, efficient and certain guidance for stakeholders;
- to improve outcomes for the environment and communities; and
- to provide a practical and achievable offset scheme for applicants.

The policy is in draft form and has recently completed its public exhibition period with an anticipated transitional period likely to commence in the latter half of 2014 prior to its full implementation.

The FBA (OEH 2014b) was also released in March 2014 and it sets out the detailed operation of the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a). The FBA contains the assessment methodology to quantify and describe the impact assessment requirements and offset guidance that applies to major projects, such as the proposal.

The FBA comprises three broad stages under the offset policy that set out the biodiversity assessment requirements and offset practices for the proposal:

- Stage 1 – Biodiversity assessment requirements – this sets out the requirements and survey methods to be undertaken to identify and characterise the ecology of the proposal site and, if proposed, the offset site.

- Stage 2 – Impact assessment of a major project – this describes the methods to quantify, expressed as biodiversity credit requirements, the direct and indirect effects to biodiversity from the proposal.

- Stage 3 – Biodiversity offset strategy requirements – this provides guidance on available options to fulfil offset requirements. These include establishing an offset site, rehabilitate degraded land and purchasing biodiversity credits generated by a landowner with an offset site.

In addition, the proposal intends to use the UHSA as part of the biodiversity offset strategy. The UHSA was initiated by the NSW and Commonwealth governments in 2012 to provide a strategic biodiversity assessment process for acquiring and managing future mining offsets for the Upper Hunter Valley coalfields.

Specifically, the purpose of the UHSA is to implement a coordinated assessment of the current biodiversity values and current and future impacts of coal mining in the Upper Hunter Valley coalfields, in order to inform the Upper Hunter Biodiversity Plan, to be prepared pursuant to section 146 of the EPBC Act. It is intended that the Upper Hunter Biodiversity Plan would fulfil all biodiversity impact assessment requirements at both the State and Commonwealth levels. It should be noted that the proposed 2014 disturbance area already has Commonwealth approval (EPBC 2009/5081).

This is a voluntary process, of which Coal & Allied is a participant, and is required to survey and assess the area of land nominated as a 'Biodiversity Assessment Area' (BAA). The DP&E has issued the *Upper Hunter Strategic Assessment Interim Policy* (October 2012) to provide guidance for preparation of assessments for development applications of participants relevant to the UHSA, such as the proposal. The proposal is included within Warkworth Mine's BAA and a Biodiversity Assessment Report is being prepared, and would be submitted to OEH for review. All Biodiversity Assessment Reports and data layers created would be incorporated into the Upper Hunter Biodiversity Plan to set out the offsetting framework for future mining proposals of participating companies in the Upper Hunter Valley. This is expected to largely comprise the establishment of and contribution to, the Upper Hunter Offset Fund that would be used to secure offset lands and fund ongoing management.

The proposal has considered the principles and strategies specified in the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a), the FBA (OEH 2014b) and the UHSA.

Further information is provided in Chapter 12 and Appendix H.

4.3.4 Strategic Regional Land Use Policy

The NSW Government released the SRLUP (DP&I 2012a) which aims to protect strategic agricultural land and valuable water resources in areas of regional NSW where mining and coal seam gas resources are prevalent. Under the SRLUP, the Upper Hunter SRLUP was prepared and released in September 2012 and applies to the proposal.

The proposal includes land that requires a mining lease (surface to 20m depth) for the majority of the proposed 2014 disturbance area. In accordance with clause 50A of the EP&A Regulation, either a gateway certificate or site verification certificate is required before lodgement of a development application. The closest mapped biophysical strategic agricultural land (BSAL) is greater than 3km away from the proposed 2014 disturbance area.

A site verification certificate report was prepared for the area requiring a mining lease (surface to 20m depth). The report was prepared in accordance with the *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (OEH 2013), which concluded the land did not satisfy the requirements for biophysical strategic agricultural land. A site verification certificate was issued by the Secretary in June 2014 enabling the lodgement of the DA for the proposal, and is provided in Appendix D. Therefore, a gateway certificate is not required for the proposal.

Further information is provided in Chapter 14.

4.3.5 Aquifer Interference Policy

The AIP was released by the NOW in September 2012. The policy requires that aquifer interference activities obtain the relevant approvals under the NSW *Water Management Act 2000* (WM Act) or NSW *Water Act 1912* (Water Act) where a water sharing plan is not in place under the WM Act.

As described in Chapter 7, the AIP requires applicants to provide specific information to assess the proposal's aquifer interference activities.

The groundwater study of the proposal has been prepared in accordance with the requirements of the AIP. This is described further in Chapter 16 and Appendix K.

4.4 Proposal differences

Subsequent to the disapproval of the Warkworth Extension 2010, planning for the future of Warkworth Mine was undertaken in an effort to ensure the economic viability of the operations and maintain current levels of employment. An objective of the mine planning has been to maximise efficient and economic resource extraction in accordance with WML's obligations with respect to the existing mining leases (CCL 753, ML 1412 and ML 1590).

As noted in Section 2.1, many design alternatives have been canvassed, providing consideration to, amongst other matters, feedback received during stakeholder engagement for the mine and the L&E Court judgement made in 2013. The proposal incorporates a number of differences from the Warkworth Extension 2010. A number of important operational improvements have also been implemented at the mine since the previous application was lodged. These are described in the sections below.

4.4.1 Proposal components

The components of the proposal (see Chapter 2) different to those in the Warkworth Extension 2010 are:

- Mining method – the mining method to be employed in North and West pits would be different, employing a dragline tandem offset method rather than a continuous dragline operation. The pits were aligned at the time of the previous application. The loss of pit alignment enabling contiguous dragline operations identified in the Warkworth Extension 2010 has materialised, resulting in a strip-misalignment of the North and West pits. This means the dragline tandem offset method must now be implemented at the Site.

- Underpass of Putty Road – the proposal includes the option of constructing an underpass of Putty Road instead of the approved but yet to be constructed bridge crossing. Only one of the approved bridge crossing or proposed underpass would be built as part of the proposal. If the underpass was built it would be less visible to traffic on Putty Road when compared to the bridge crossing. The proposal also seeks to extend the envelope further westwards than its currently approved and previously proposed location.

- South Pit open void – the proposed mine plan would leave a small open void in South Pit to provide the potential for future underground mining access of deeper seams. Investigative studies of these deeper seams, including exploration drilling are ongoing regarding the potential for future underground mining at MTW. Long-term mine planning requires that potential access point be accessible in the proposal's mine plan should these investigations demonstrate feasibility and planning approval is ultimately achieved. If the South Pit open void is not required for underground mining access, it would be used for emplacement of overburden and/or tailings.

- Waste management – the proposal includes changes to the integrated MTW management of tailings. A section of Loders Pit at MTO is proposed to be used as a TSF following its completion of mining.

- Water management – the proposal includes changes to the integrated MTW management of water. The proposal seeks an increase in the size of the NOOP dam and other minor changes to water management infrastructure. The components increase flexibility in water management across MTW as well as reduce the operational risk of uncontrolled spillages and storage of water in active mining areas following high rainfall events.

- Final landform – the proposed final landform includes more rehabilitated land at Warkworth Mine (2,673ha) than that previously proposed (2,311.5ha), with a more undulating landform in general, at both Warkworth Mine and MTO.

It is also noted that a separate development application for Warkworth Mine's continuation of mining has been prepared rather than a combined development application with MTO. A separate development application has also been prepared for MTO's continuation of operations which, if both are approved, will align the development consent life of the two operations. Two separate development consents would be retained due to separate ownership.

As described in Chapter 2, the two operations have integrated management of tailings, coal and water which is proposed to continue under both proposals. A further aspect of integration, the management and transfer of overburden, is proposed with each development application. Notwithstanding the existing integrated aspects of the two operations, the two development applications will be assessed separately by the consent authority.

4.4.2 Proposal assessment and commitments

i Ecology study

a. Policy considerations

The ecology study, provided in Chapter 12 and Appendix H, varied from that previously undertaken in a number of ways. Specifically, the study:

- used the recently released *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a) and FBA (OEH 2014b), including its primary tools the Biodiversity Certification Assessment Methodology (BCAM) and BioBanking Assessment Methodology (BBAM), in developing the offset strategy;

- assessed an offset strategy comprising three discrete components:

    - reallocation of the Green Offsets from the current development consent;

- offsetting the impacts of the proposed 2014 disturbance area; and

- offsetting the non-WSW vegetation impacts of the proposed 2014 disturbance area.

The FBA, a subset of the policy, outlines where further consideration is given to impacts that are complicated and cannot be easily offset, such as those to WSW and the reallocation of the Green Offsets. In these cases, supplementary measures can be provided to mitigate the impact.

As outlined above, the proposal involves the removal of areas designated as offsets, known as Green Offsets, solely for biodiversity purposes as part of the currently approved operations. These Green Offsets consist of areas termed NDAs and HMAs, west of the Warkworth Mine. The intent of the HMAs was for the temporary preservation of ecological values as economic coal resources were known to occur beneath these areas. The intent of the NDAs was for long-term preservation. Both are managed in accordance with the Green Offsets Strategy (ERM 2002a).

The Green Offsets compensated for impacts on WSW and non-WSW vegetation mainly consisting of ironbark communities. The offset for the WSW (approximately 78ha) are secured locally within the SBA and Northern Biodiversity Area (NBA). These WSW offsets would be unaffected and remain as part of the proposal.

It is proposed to reallocate the Green Offsets for non-WSW vegetation to ensure their biodiversity values are protected in the long-term and that coal reserves are not sterilised. The proposed reallocation of these offsets has been assessed using BCAM. In addition, the BBAM has been used to confirm the suitability of the reallocated offset sites. It is anticipated that this process would be included in Warkworth Mine's BAA and used for the UHSA under that process.

The proposal includes the removal of 72ha of WSW. As described in Chapter 12, the proposal would conserve the remaining 75.5ha of WSW and 159ha of Warkworth Sands Grassland (WSG) in both these biodiversity offset areas. Chapter 12 describes the adequacy of the offsets for the proposed 2014 disturbance area in accordance with contemporary government policy including the principles and strategies of the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a). With respect to the WSW, additional supplementary measures proposed include preparation of an integrated management plan for the WSW and the development of completion criteria for the re-establishment of this community.

ii Noise and vibration study

The approach to the noise study, provided in Chapter 10 and Appendix F, varied from that previously undertaken in a number of ways. Specifically, the study:

- applied the outcomes of further background assessments for Bulga village to determine background noise levels in accordance with the NSW Industrial Noise Policy (INP);

- defined intrusive criteria, ie background plus 5dB, from the INP. When compared to the amenity criteria, the intrusive criteria are the limiting criteria or project specific noise levels (PSNL) for the proposal. The PSNL are assessed for the Warkworth Mine as opposed to the MTW complex criteria outlined in the Warkworth Extension 2010;

- provided a complete INP assessment of noise levels to be experienced by surrounding assessment locations, as well as specific assessments for low frequency noise and sleep disturbance. The assessment of low frequency noise used a variety of different methods, including the INP-prescribed method;

- assessed residual impacts of the proposal (ie those levels above PSNL) in accordance with Section 8.2.1 of the INP. The operational noise levels were predicted to comply with the INP's PSNLs for all but two assessment locations during calm meteorological conditions for day, evening and night periods. During prevailing meteorological conditions, operational noise levels are predicted to significantly exceed the PSNL at four assessment locations;

- modelled mine plan scenarios applying all reasonable and feasible mitigation measures, including plant attenuation on all trucks, drills, dozers and excavators, as well as utilisation of recently implemented operational controls/ measures, all of which incur an economic cost to the operations;

- incorporated more recent meteorological data in the assessment of noise generation from the proposal under all weather conditions; and

- assessed the proposal's impacts on the surrounding environment with an updated sensitive assessment location identification list.

The noise and vibration study has also undergone a third party peer review. The peer review is appended to the noise study.

iii Air quality and greenhouse gas study

The air quality and greenhouse gas study, provided in Chapter 11 and Appendix G, comprised a number of differences and additional elements to that previously undertaken. Specifically, the assessment:

- developed an air dispersion model, using a combination of the CALPUFF Modelling System and TAPM (a meteorological model), in accordance with the *Generic Guidance and Optimum Model Setting for the CALPUFF Modelling System for Inclusion into the Approved Methods for Modelling and Assessment of Air Pollutants in NSW* (TRC Environmental Corporation 2011). This contemporary model represents an improvement in modelling technology and was used instead of the previously applied ISCMOD. The CALPUFF model is an advanced 'puff' model which can better deal with the effects of complex local terrain on the dispersion meteorology over the entire modelling domain in a three-dimensional, hourly varying time step. This capability, which was not readily available in 2010, is particularly suited to this proposal, given the complex surrounding environment;

- incorporated more recent and representative meteorological data in the assessment of dust generation from the proposal under all weather conditions; and

- assessed the proposal's impacts on the surrounding environment with an updated larger sensitive assessment location identification list.

iv Groundwater study

The groundwater study, provided in Chapter 16 and Appendix K, was prepared in accordance with the AIP (see Section 4.3.5) and included the following additions in comparison to the previous application:

- update of the existing groundwater numerical model generally in accordance with the *Australian Modelling Guidelines* (Barnett *et al*. 2012) to produce required modelled outputs to measure effects on regional and local groundwater systems resulting from the proposal; and

- preparation of an uncertainty analysis of the model predictions sensitivity to changes in the calibrated parameters of the numerical model.

The groundwater study has also undergone a peer review by a third party in accordance with the requirements of the AIP (see Chapter 16 for further information).

v Aboriginal cultural heritage study

The Aboriginal cultural heritage study, provided in Chapter 18 and Appendix M, included the outcomes of the assessment and continued consultation process undertaken by the applicant regarding the proposal. As described in the study, the proposal includes additional area within the Wollombi Brook Aboriginal Cultural Heritage Conservation Area (WBACHCA). The area provides the Aboriginal community with a measure of surety for the integrity and protection of the eastern portion of the Bulga Bora Ground and other regionally important cultural heritage places associated with the Wollombi Brook (see Chapter 18).

vi Historic heritage study

The historic heritage study, provided in Chapter 19 and Appendix N, was undertaken to understand the historic heritage values of the local area in response to feedback from a variety of stakeholders. This included completing background research and a five day field survey to document all historic heritage features within the Warkworth Mine and MTO mining lease areas and their surrounds. A number of Conservation Management Plans (CMPs) have also been prepared for the former RAAF Base Bulga Complex and Great North Road Complex have been completed. Archival recording has also been undertaken of the historic features of the former RAAF Base Bulga Complex. As part of the proposal, Coal & Allied has committed to:

- implementing the measures of existing CMPs for the former RAAF Base Bulga Complex and the Great North Road Complex;
- preparing a new CMP for Springwood, a timber slab building constructed in the mid 1800s, on top of Wollombi Brook and the Brick Farm House;
- ongoing consultation through the Coal & Allied Community Heritage Advisory Group (CHAG); and
- implementation of a Local Community Historic Heritage Conservation Initiative comprising two historic heritage conservation funds; the Mount Thorley Warkworth Historic Heritage Conservation Fund and the Mount Thorley Warkworth Great Northern Road Conservation Fund.

vii Traffic and transport study

The traffic and transport study, provided in Chapter 20 and Appendix O, considered the current road network surrounding the proposal, inclusive of recently proposed large traffic-generating developments such as the nearby proposed Bulga Optimisation Project at the Bulga Coal Complex. The study included recent traffic count data for the affected roads in the local network, including Wallaby Scrub Road, and an origin-destination survey. Emergency vehicle access to areas west of Wallaby Scrub Road would be maintained by the construction of an appropriate emergency access road/fire trail between Putty Road and the Golden Highway (see Section 2.4.13).

A rail study using the latest Australian Rail Track Corporation (ARTC) strategy documentation assessed the proposal's continued transportation of produced coal to the Port of Newcastle via the MTCL.

viii Visual amenity study

In response to stakeholder feedback, the proposal includes a commitment to undertake site-specific visual assessments (SSVAs) of residences in Bulga village upon request from the landowner to establish the need for and design of appropriate site visual screening if impacts are assessed as high. As the extent of existing screening is specific to each residence due to its elevation, orientation and layout, it is not possible to determine with any certainty the extent of impact on any individual residence without undertaking SSVAs. These assessments would determine the level of significance of the visual impact and potential suitable mitigation measures, if any, to reduce the impact on the view.

When vegetation screens are deemed necessary, the design would be undertaken in consultation with the property owner. Designs would be in keeping with the character and design of the residence. All designs would be agreed and signed-off by the landowner prior to implementation. The screening would be implemented as early as practicable during the proposal life so as to allow a period for establishment of an effective screen. Plant species would be selected for their suitability for the local area as well as their aesthetic properties.

Further discussion on visual mitigation measures is provided in Chapter 15 and Appendix J.

ix Economic study

The economic study of the proposal, provided in Chapter 9 and Appendix E, included a cost benefit analysis (CBA) and regional economic impact assessment (REIA). The CBA is considered to be the centrepiece of an economic impact assessment, and was prepared in accordance with the NSW Government Guideline for the use of *Cost Benefit Analysis in Mining and Coal Seam Gas Proposals* (2012).

Within the study, identified proposal externalities are considered in terms of their materiality and explained succinctly in the CBA. No choice modelling was undertaken as part of the study.

x Social study

A detailed social study of the proposal, provided in Chapter 21 and Appendix P, used a variety of data collection techniques. The assessment considered:

- a socio-economic profile comprising objective evidence on the proposal, operational and community context, together with a series of one-on-one consultation sessions to gather experiential evidence on current operations and potential impacts from the proposal;
- intended or unintended changes to one or more aspects of people's lives as a result of the proposal: people's way of life, their culture, community, political systems, environment, health and well-being, personal and property rights, fears and aspirations;
- changes to the make-up of the existing community based on objective and experiential evidence – also considering impacts if the proposal does not proceed; and
- a suite of ongoing and proposal specific strategies to improve communications generally and to manage/ mitigate or enhance these proposal-related impacts and opportunities.

4.5 Ongoing operational improvements

Important ongoing operational improvements that have been implemented or are being implemented by programmes established since 2010 are described below.

The proposal includes a number of social impact management/mitigation measures which are in addition to, or build on, current measures undertaken by Coal & Allied as part of existing MTW operations. In particular, a social impact management plan (SIMP) would be developed for the proposal to further develop these management and mitigation measures and detail a plan of implementation including responsibilities, timing, performance indicators/targets and monitoring measures. The SIMP would be prepared in consultation with key stakeholders, following the EIS/SIA, public exhibition and submissions process.

4.5.1 Noise

As described earlier, attenuation of the mine's existing truck, drill, dozer and excavator mining fleet has continued and all new haul trucks purchased for use at MTW are noise suppressed (or attenuated) units with attenuation of all heavy mining fleet a commitment of this proposal. As per the current MTW noise management plan, the operation also undertakes identification and rectification of defects to sound attenuation equipment through the normal maintenance process.

The following measures are adopted at MTW:

- operational management supported by real-time monitoring and predictive modelling, as well as dedicated community response officers on each night shift;
- active dump management to respond to current and predictive meteorological conditions;
- continued use of hydraulic snubbers to electric rope shovels to reduce specific noise generated by shovel doors; and
- noise attenuated plant deployed preferentially to locations relevant to sensitive locations.

As of 2012, all mining fleet comprised 'quacker' style reverse alarms, eliminating the traditional tonal versions.

Warkworth Mine has also implemented a range of operational control strategies and measures to effectively manage noise to achieve compliance with noise criteria at residences. A hierarchy of control is followed by MTW's operational staff.

A part of the hierarchy of control is the successful implementation of a real-time noise alarm system which uses a set of rules to alert operational personnel to emerging noise levels in real-time. A programme of targeted supplementary attended noise monitoring is operated at Warkworth Mine to support the real-time directional monitoring network and ensure the highest level of noise management is maintained.

As part of the Warkworth Extension 2010, MTW committed to investigation of alternate noise monitoring technologies. During 2012 MTW committed capital funding to build and install a first of class directional noise monitor, known as an 'environmental noise compass' (ENC) in the Bulga village area, which was completed in late 2013.

The ENC aims to accurately pinpoint and identify noise emissions from multiple sources in real-time, to a greater level of accuracy than existing directional noise monitoring technology. This technology is expected to provide additional noise management value to MTW and is considered a first in noise management in NSW.

Predictive modelling interface (PMI), which allows for proactive planning of mining operations and weather conditions as a leading measure for managing noise emissions, is in the process of being developed at MTW. The PMI utilises predictive meteorological forecast data coupled with detailed mine plans and equipment sound power level information to predict noise levels at residences. The PMI is currently being refined and is expected to be fully integrated into day-to-day operations. Further discussion on these aspects and their role in the proposal is provided in Chapter 10 and Appendix F.

4.5.2 Air quality

Operational control strategies and measures to effectively manage air quality impacts are detailed in the MTW air quality management plan. A number of improvements were introduced, or continued to be implemented, in 2012 which included:

- installation of ROM dump hopper barrier hoods and water sprays at the Warkworth CPP;
- installation of dust aprons on drill rigs;
- construction of six new high flow, high capacity water cart fill points designed and located to maximise time available for water spraying to active mining areas;
- acquisition of four new water carts to replace older, smaller water carts and to increase the overall number onsite;
- continuation of the aerial seeding programme to provide temporary rehabilitation to active mining areas pending their full rehabilitation;
- continuation of operational management systems supported by real-time and predictive monitoring networks, including dedicated community response officers on each night shift;
- continuation of active dump management to respond to current and predicted meteorological condition; and
- commencement of capping of Tailings Dam No.1.

A focus of improvements in 2013 were activities associated with EPA's (2011) *Coal Mine Particulate Matter Control Best Practice – Site-specific Determination Guideline* (dust pollution reduction programme), which targeted wheel generated dust.

During 2013, a proactive air quality management system (Dust Risk Management System) was also implemented. Use of a proactive system is considered industry leading practice and Stage One of the Dust Risk Management System was successfully tested by Coal & Allied Environmental Services staff in mid 2013. Further stages involving predictive forecasting tools would be implemented in 2014.

A network of early warning units (EWUs) is used for supplementary monitoring. The EWUs are semi-portable, and able to be relocated as required to support operational control. In addition, MTW has installed two cameras (one on the Warkworth maintenance building and the other on Charlton Ridge) to observe dust on Putty Road. These cameras are streamed onsite via wireless telemetry, operate remotely and may be rotated 360 degrees to monitor/view dust emissions and sources to enable operational control by MTW staff.

Coal & Allied is in the process of implementing a predictive dust risk forecasting tool to assist operational personnel to make the optimal management decisions on a day to day basis. The tool utilises predictive meteorological forecast data coupled with detailed mine activity (mine plan) data to determine the most likely times during the upcoming day that dust lift off and air dispersion conditions may be unfavourable.

Further discussion on these aspects and their role in the proposal is provided in Chapter 11 and Appendix G.

4.6 Summary

The proposal represents the outcomes of the planning and development for the future of Warkworth Mine following the disapproval of the previous application in April 2013. This planning and development has resulted in changes in the mine design and commitments aimed at minimising and offsetting the proposal's interactions with the community and environment and making a positive contribution where possible.

As described, a number of important changes to legislation and government policy have been made since the Warkworth Extension 2010. The proposal has considered and as is consistent with the changed legislative framework.

Chapter 5

The applicant and assessment requirements

Chapter 5 — The applicant and assessment requirements

5 The applicant and assessment requirements

5.1 The applicant

The applicant for the proposal is WML, the operator of Warkworth Mine as appointed by the participants in the Warkworth Joint Venture.

Ownership of WML is as follows:

- CNA Warkworth Australasia Pty Limited (26.824 per cent);
- CNA Resources Limited (28.750 per cent);
- Mitsubishi Development Pty Limited (28.898 per cent);
- Nippon Steel Australia Pty Limited (9.528 per cent); and
- Mitsubishi Materials (Australia) Pty Limited (6 per cent).

The WML is managed by Coal & Allied, which in turn receives management services from Rio Tinto Coal Australia Pty Ltd. The ownership and management structure for Warkworth Mine is shown below.

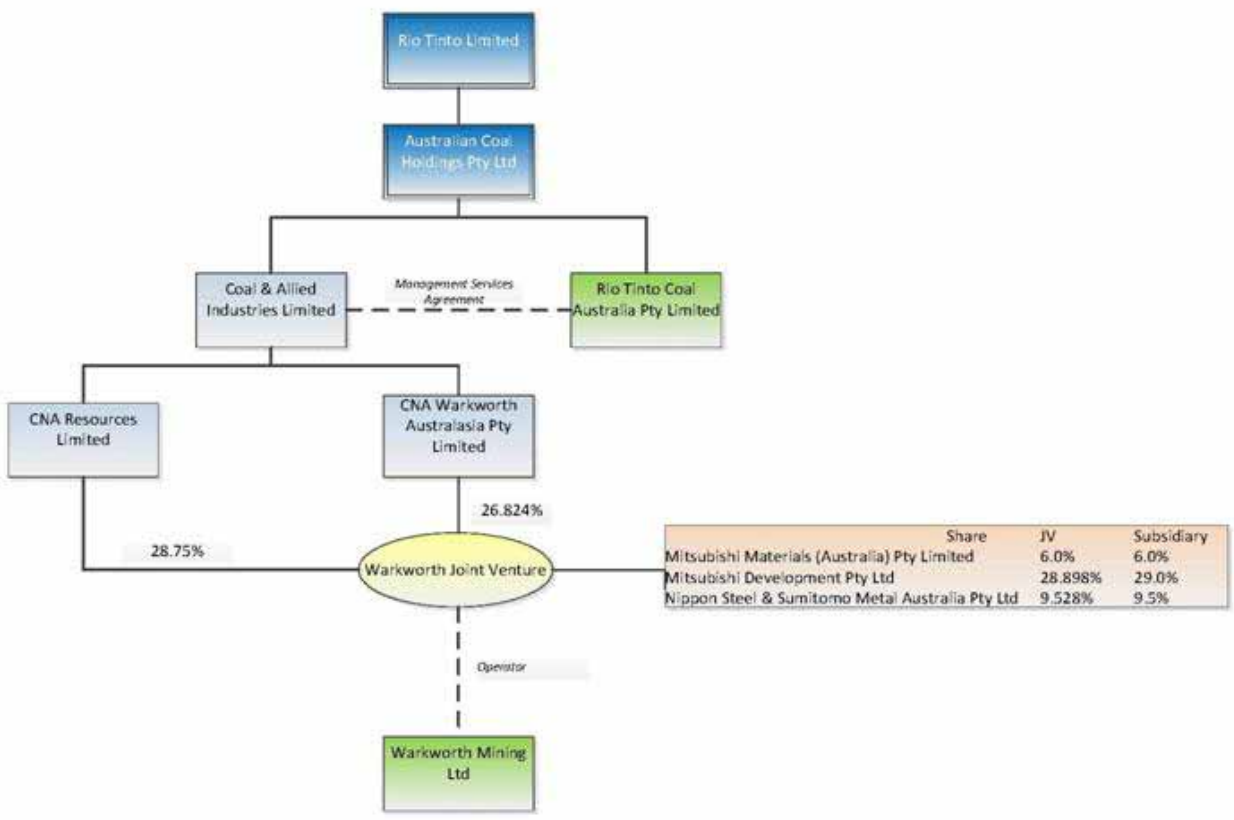


Figure 5.1 Warkworth Mine ownership and management structure

5.2 Secretary's requirements

A request for environmental assessment requirements was submitted to the Director-General of the DP&E on 1 April 2014. The Secretary's requirements were issued on 22 May 2014 and are attached as Appendix D of this EIS.

As required under section 78A of the EP&A Act, this EIS has been prepared in accordance with the Secretary's requirements and matters raised during stakeholder engagement; however, it also addresses matters raised in the L&E Court judgement. It is noted that the EIS, inclusive of technical studies, was progressed on the basis of contemporary environmental assessment requirements for open cut mining projects in the Hunter Valley, environmental assessment requirements issued for the Warkworth Extension 2010, and contemporary policies. Prior to finalisation the EIS, inclusive of technical studies, was considered against the proposal specific Secretary's requirements. A list of matters that must be addressed, as prescribed in the Secretary's requirements, and the relevant sections of the EIS where these have been considered are provided in Table 5.1. It is noted that 'haulage of sand and gravel from the site' referenced under 'traffic' does not form part of the proposal.

Table 5.1 Summary of Secretary's requirements

Requirement	EIS reference
General requirements	
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000.	Table 7.1
In particular, the EIS must include:	
• a full description of the development, including:	Chapter 2
- the resource to be extracted, demonstrating efficient resource recovery within environmental constraints;	Section 2.4.3
- the mine layout and scheduling;	Section 2.4.2
- minerals processing;	Section 2.4.7
- a waste (overburden, tailings, etc.) management strategy, dealing with the EPA's requirements (see Attachment 2);	Section 2.4.9
- a water management strategy, dealing with the EPA's and NSW Trade and Investment's requirements (see Attachment 2);	Sections 2.4.12 and 17.3.2, Appendix L
- a rehabilitation strategy, dealing with NSW Trade and Investment's requirements (see Attachment 2); and	Section 13.4
- the likely interactions between the development and any other existing, approved or proposed mining development in the vicinity of the site;	Sections 2.4 and 6.3
• a list of any approvals that must be obtained before the development may commence;	Section 7.6
• an assessment of the likely impacts of the development on the environment, focussing on the specific issues identified below, including:	Chapters 9 to 21
- a description of the existing environment likely to be affected by the development, using sufficient baseline data;	
- an assessment of the likely impacts of all stages of the development, including any cumulative impacts, taking into consideration any relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice;	
- a description of the measures that would be implemented to mitigate and/or offset the likely impacts of the development, and an assessment of:	
o whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented;	

Table 5.1 Summary of Secretary's requirements

Requirement	EIS reference
○ the likely effectiveness of these measures; and ○ whether contingency plans would be necessary to manage any residual risks; - a description of the measures that would be implemented to monitor and report on the environmental performance of the development if it is approved;	
• a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS;	Table 22.1
• consideration of the development against all relevant environmental planning instruments (including Part 3 of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007); and	Section 7.2.3
• the reasons why the development should be approved having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development.	Section 24.1
In addition to the matters set out in Schedule 1 of the Environmental Planning and Assessment Regulation 2000, the development application must be accompanied by a signed report from a suitably qualified expert that includes an accurate estimate of the: • capital investment value (as defined in Clause 3 of the Environmental Planning and Assessment Regulation 2000) of the development, including details of all the assumptions and components from which the capital investment value calculation is derived; and • jobs that would be created during each stage of the development.	The signed report by a suitably qualified expert is provided separately to DP&E and not included in the EIS documentation
Specific issues The EIS must address the following specific issues:	
• **Noise & Blasting** – including: - an assessment of the likely operational noise impacts of the development (including construction noise) under the NSW Industrial Noise Policy, paying particular attention to establishing accurate background noise levels in the surrounding area, the effect of removing Saddleback Ridge and the obligations in chapters 8 and 9 of the policy; - if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the Interim Construction Noise Guideline; - an assessment of the likely road noise impacts of the development under the NSW Road Noise Policy; and - an assessment of the likely blasting impacts of the development on people, animals, buildings and infrastructure, and significant natural features, having regard to the relevant ANZEC guidelines;	Appendix F, Chapter 10
• **Air** – including: - an assessment of the likely air quality impacts of the development in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW and the EPA's additional requirements (see Attachment 2); and - an assessment of the likely greenhouse gas impacts of the development, dealing with the EPA's requirements (see Attachment 2);	Appendix G, Chapter 11
• **Biodiversity** – including: - an assessment of the likely biodiversity impacts of the new development, having regard to the principles and strategies in the draft NSW Biodiversity Offsets Policy for Major Projects and the Upper Hunter Strategic Assessment – Interim Policy, using the Biodiversity Certification Assessment Methodology as amended by the Upper Hunter Strategic Assessment for credit calculation, and the Biobanking Assessment Methodology as amended by the Upper Hunter Strategic Assessment for calculating the credits of any offsets;	Appendix H, Chapter 12

Table 5.1 Summary of Secretary's requirements

Requirement	EIS reference
- specific assessment of the likely impacts of the new development on the Warkworth Sands Woodland endangered ecological community; and - the provision of alternate offsets for the disturbance area approved under the 2003 development consent, using the Biodiversity Certification Assessment Methodology as amended by the Upper Hunter Strategic Assessment for credit calculation and the Biobanking Assessment Methodology as amended by the Upper Hunter Strategic Assessment for calculating the credits of any offsets;	
• **Water** – including: - an assessment of the likely impacts of the development on the quantity and quality of the region's surface and groundwater resources, having regard to the EPA's and NSW Trade and Investment's requirements (see Attachment 2); - an assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, and other water users; and - an assessment of the likely flooding impacts of the development;	Appendices L and M, Chapters 16 and 17
• **Land** – including: - an assessment of the likely impacts of the development on the soils, land capability, and landforms (topography) of the site; and - an assessment of the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements in Clause 12 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007;	Chapters 7 and 14
• **Heritage** – including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development having regard to OEH's requirements (see Attachment 2), and paying particular attention to the likely impacts on the Bulga Bora Ground, Great North Road, and former air strip on the site;	Appendices N and O, Chapters 18 and 19
• **Traffic** – including: - an assessment of the likely impacts of the closure of Wallaby Scrub Road, particularly on the provision of emergency services; and - an assessment of the likely traffic impacts of the development on the capacity, condition, safety and efficiency of the local and State road network, including the impacts associated with the potential tunnel under Putty Road and the haulage of sand and gravel from the site;	Appendix O, Chapter 20
• **Visual** – including an assessment of the likely visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, paying particular attention to the removal of Saddleback Ridge, the creation of new landforms (overburden dumps, bunds, etc.), and minimising the lighting impacts of the development;	Appendix J, Chapter 15
• **Public Safety** – including an assessment of the likely risks to public safety off-site, paying particular attention to bushfire risks and the handling and use of any dangerous goods;	Section 2.4.10
• **Social & Economic** – including: - an assessment of the likely social impacts of the development (including perceived impacts), paying particular attention to any impacts on Bulga village; and - an assessment of the likely economic impacts of the development, paying particular attention to: o the significance of the resource; o economic benefits of the project for the State and region; and o the demand for the provision of local infrastructure and services.	Appendices F and Q, Chapters 9 and 21

Table 5.1 Summary of Secretary's requirements

Requirement	EIS reference
Consultation	
During the preparation of the EIS, you must consult with relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners.	Chapter 8
The EIS must describe the consultation that was carried out, identify the issues raised during this consultation, and explain how these issues have been addressed in the EIS.	

5.3 Environmental risk assessment

5.3.1 Method

In accordance with the Secretary's requirements and Rio Tinto Coal Australia's standard practices, an environmental risk assessment was completed for the proposal.

Numerous workshops were held between relevant internal stakeholders subsequent to the disapproval of the Warkworth Extension 2010 to develop a proposal that meets WML's objectives and ensure environmental risks were considered during its design.

Following the preparation of the preliminary mine design an information gap analysis was completed by the study team to aid in the definition of technical study scopes and enable an informed preliminary risk assessment workshop.

A preliminary environmental risk workshop was held and attended by Rio Tinto Coal Australia, EMM and project approval, social and communications specialists, mine planners and technical specialists for all of environmental attributes. The key objective of the workshop was to determine the proposal's potential environmental impacts, the likelihood of them occurring and the consequences of occurrence.

Risks were determined using standard safeguards, design or management measures applied at all Coal & Allied operations. Three levels of risk rating were established: low, medium and high. Each of the risk sources were then allocated an issue prioritisation category based on their considered likelihood and consequence of occurrence. Together with the Secretary's requirements and the outcomes of stakeholder engagement (see Section 4.2 and Chapter 8, respectively) these were used to determine environmental impact assessment priorities for this EIS.

The risk workshop also enabled the identification of further amelioration measures that could be incorporated into the proposal design to reduce the level of risk.

5.3.2 Environmental issue prioritisation

Based on the outcomes of the workshop, the following broad qualitative risk prioritisation categories were assigned to each environmental attribute:

- High – noise and vibration, air quality and greenhouse gases and ecology;
- Medium – traffic and transport, surface water, groundwater, Aboriginal cultural heritage and visual; and
- Low – land and soils capability, historic heritage, final landform and rehabilitation.

Assessments for each of the attributes listed above have been undertaken as part of this EIS, commensurate with risk. The risk assessment process only considered potentially adverse incremental environmental impacts; however, the proposal would have a number of substantial benefits, including economic and social benefits which are further detailed in the respective chapters.

Chapter 6

Existing operations

Chapter 6 — Existing operations

6 Existing operations

6.1 Approvals history

A brief overview of the Warkworth Mine's approval history is given in Section 2.1. As noted, approval for an extension of mining activities (DA 300-9-2002-i) was granted on 19 May 2003 by the then Minister for Planning. The main elements of that extension comprised:

- the extraction of approximately 160Mt of ROM coal by open cut mining at a maximum rate of 18Mtpa;
- an extension of two pits (North and West pits) westwards towards Wallaby Scrub Road, and one pit (Woodlands Pit) southwards towards Putty Road;
- the construction of a conveyor to the MTCL and the MTO CPP;
- the construction of two bridges over Putty Road between the two mines to transfer coal, tailings, coarse rejects and mining equipment; and
- the identification of Green Offsets.

Six modifications have been subsequently made to the development consent, with the most recent granted 29 January 2014. An overview of the modifications is provided in Table 6.1 below.

Table 6.1 Overview of modifications to DA 300-9-2002-i

Project	Year	Overview	Supporting information
Modification 1	2004	To allow for construction of a new reject bin and alterations of the rejects conveyor from the CPP to allow for rejects to be directly loaded onto the fleet.	SEE
Modification 2	2007 (February)	To allow for revision of the land schedule.	SEE
Modification 3	2007 (October)	To allow for upgrade of the electrical switching yard comprising the replacement of redundant equipment to ensure the ongoing supply of electricity to the operation.	SEE
Modification 4	2008	To allow for installation and operation of up to six gas wells and flaring equipment in areas ahead of mining for the extraction of coal bed methane prior to future mining.	EA
Modification 5	2009	To allow for relocation of the explosives reload facility and light vehicle wash bay.	Letter, with supporting documentation
Modification 6	2014	To allow for a 350m extension of West Pit's disturbance limit.	EA

Notes: *SEE: Statement of Environmental Effects.*
EA: Environmental Assessment.

All activities proposed under DA-300-9-2002-I via the original application and the subsequent modifications and supporting documents listed above are continued under this proposal. It is assumed that a condition would be included in any approval for the proposal requiring the surrender of DA-300-9-2002-I at an appropriate time.

6.2 Approved operations

Chapter 2 provides detail on the existing operations at Warkworth Mine that would be continued under the proposal including mining methods, infrastructure, coal washing and processing, coal transport, waste management, final landuse, final landform and rehabilitation. Therefore, this information is not repeated here.

6.3 Existing interactions with associated facilities and other operations

6.3.1 Warkworth Mine and Mount Thorley Operations

As noted previously, Warkworth Mine and MTO are integrated at an operational level with a single management team responsible for the management of all operations on either side of Putty Road and a single workforce and equipment fleet which may be allocated across any part of MTW as required. Interactions between the two mines are described in Chapter 2.

6.3.2 Warkworth Mine and Hunter Valley Operations

Hunter Valley Operations is a coal mine north of Warkworth Mine, approximately 20km north-west of Singleton. The mining and processing activities at Hunter Valley Operations are geographically divided by the Hunter River into Hunter Valley Operations North and Hunter Valley Operations South. While Hunter Valley Operations is managed as one operation, Hunter Valley Operations North and Hunter Valley Operations South each have separate planning approvals.

Warkworth Mine and Hunter Valley Operations are separate operations with different ownership, although both are managed by Coal & Allied. Interactions between the operations are limited to the transfer of water and the movement of heavy equipment including draglines, trucks, shovels and dozers. This is made possible through the Hunter Valley Operations South Project Approval 06_0261 as described in the ERM (2008) *Hunter Valley Operations South Environmental Assessment*.

The South Lemington Pit 1 void at Hunter Valley Operations is currently used for temporary storage of mine water from both Hunter Valley Operations and Warkworth Mine (together with MTO). A water main links the operations allowing for water to be pumped in either direction and this occurs on a routine basis.

Approximately three haul trucks per year, on average, are transferred between the operations. Trucks are driven between the mines via a bridge over the Wambo rail spur (at the end of the private Lemington haul road).

6.3.3 Warkworth Mine and Bulga Coal Complex

Bulga Coal Complex is a coal mine south-east of Warkworth Mine, approximately 12km south-west of Singleton. Mining activities at Bulga Coal Complex are split between the open cut operations (Bulga Surface Operations) and the underground operations (Bulga Underground Operations), with shared coal preparation and rail loading infrastructure.

Water transfer has historically occurred between the Bulga Coal Complex void and MTO, as documented in the Mount Thorley Operations 2002 SEE (ERM 2002c), as is set to continue as part of the Mount Thorley Operations 2014 proposal. As noted previously, Warkworth Mine and MTO are integrated at an operational level, which includes water management across the sites. Thus, water transfer between Warkworth Mine and Bulga Coal Complex may occur as a result of the integrated WMS.

As described in Chapter 2, overburden from both MTO and Warkworth Mine would be emplaced at MTO throughout the life of the development consent (ie 21 years) as part of the proposal and the Mount Thorley Operations 2014 proposal. The development consent for the surface operations at the Bulga Coal Complex (DA 41-03-1999, as modified) allows for the development of a common landform with MTO and may require emplacement of overburden from the surface operations at Bulga Coal Complex to MTO and overburden from MTO to the Bulga Coal Complex. This exchange of overburden between MTO and Bulga Coal Complex is the subject of the DA for the Bulga Optimisation Project (SSD-4960) currently being assessed by DP&E (also contemplated under the subject proposal and the Mount Thorley Operations 2014 proposal).

6.3.4 Warkworth Mine and Wambo Mine

Wambo Mine is an open cut and underground coal mining operation north-west of Warkworth Mine, approximately 15km west of Singleton. Subject to agreement and regulatory approval Warkworth Mine proposes to import mine water from neighbouring operations, including Wambo Mine. The transfer of water from Wambo is addressed in DA 305-7-2003 and Sections 2.10 and 4.6.1 of the associated EIS. Transfer from Wambo Mine would be via Hunter Valley Operations by an existing pipeline.

6.3.5 Warkworth Mine and Redbank Power Station

The Redbank Power Station was commissioned in September 2000. Coal from Warkworth Mine is transferred by a 3.7km overland conveyor to the Redbank Power Station for use in power generation. The total annual fuel requirement for Redbank Power Station is in the order 13 million gigajoules (MGJ). Ash generated from the power station is disposed in the Warkworth Mine Tailings Dam No.2 via a pipeline, as described in Section 2.4.9.

6.4 Environmental management

Environmental aspects of the integrated operations are managed under Rio Tinto Coal Australia's accredited ISO 14001 EMS which forms part of the HSEQ Management System.

The HSEQ Management System enables the operations to apply specific tools that support the implementation, execution and effectiveness of the Rio Tinto health, safety and environmental performance standards.

The HSEQ Management System is designed on the principles of continuous improvement and generally follows the layout of common international standards (including ISO14001) and the Plan, Do, Check and Review cycle:

- Plan – identify what is required;
- Do – implement the activities;
- Check – monitor performance through checking and corrective action; and
- Review – evaluate the suitability, adequacy and effectiveness of the system through the management review.

The EMS relies upon an environmental policy, risk register, objectives and targets, a series of regulatory required management plans, a monitoring programme and environmental standards and procedures. The EMS forms the basis for rigorous and consistent environmental management. The EMS is subject to independent compliance audits every three years. The effectiveness of the system has been demonstrated through audits, which have shown a consistent trend in environmental improvement throughout the business, including Warkworth Mine.

As part of the EMS, the mining operations at Warkworth Mine are managed and monitored as the integrated MTW operations. An overview of existing management and monitoring procedures for the various environmental attributes are provided as appropriate in respective chapters in this EIS. This includes Sections 10.8 and 11.5 which describe operational management of noise and dust emissions, respectively.

Independent environmental audits are to be undertaken every three years (with the first by 31 December 2015) to assess the environmental performance of the development and determine whether it is complying with the requirements of the development consent and any other relevant approvals, EPLs and mining leases, including any assessment, plan or programme required under these approvals. The audits are also to review the adequacy of any strategy, plan or programme required under the abovementioned approvals and recommend measures or actions to improve the environmental performance of the development and/or any strategy, plan or programme. The audits are to be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Director-General and include consultation with relevant agencies.

An annual review is produced each calendar year in accordance with the existing consent conditions. The operations environmental performance with respect to the relevant monitoring requirements is documented in the annual review and made available to the community on the Coal & Allied website.

Some of the environmental improvement initiatives at MTW in recent years are described in Chapter 4.

Chapter 7

Legislative considerations

Chapter 7 — Legislative considerations

7 Legislative considerations

7.1 Overview

This chapter describes the relevant State and Commonwealth legislation and regulatory framework under which the proposal will be assessed and determined.

7.2 Environmental Planning and Assessment Act 1979

The EP&A Act and the EP&A Regulation form the statutory framework for planning approval and environmental assessment in NSW. Implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils. It contains three parts that impose requirements for planning approval:

- Part 4 which provides for control of 'development' that requires development consent from the relevant consent authority. A division of Part 4 (Division 4.1) provides for control of SSD where the Minister for Planning (or delegate) is the consent authority.
- Part 5 which provides for control of 'activities' that do not require approval or development consent under or Part 4.
- Part 5A which provides for control of State significant infrastructure that do not require approval or development consent under Part 4.

The requirement for development consent is set out in environmental planning instruments (EPIs); SEPPs, regional environmental plans (REPs) or local environmental plans (LEPs).

7.2.1 State significant development provisions

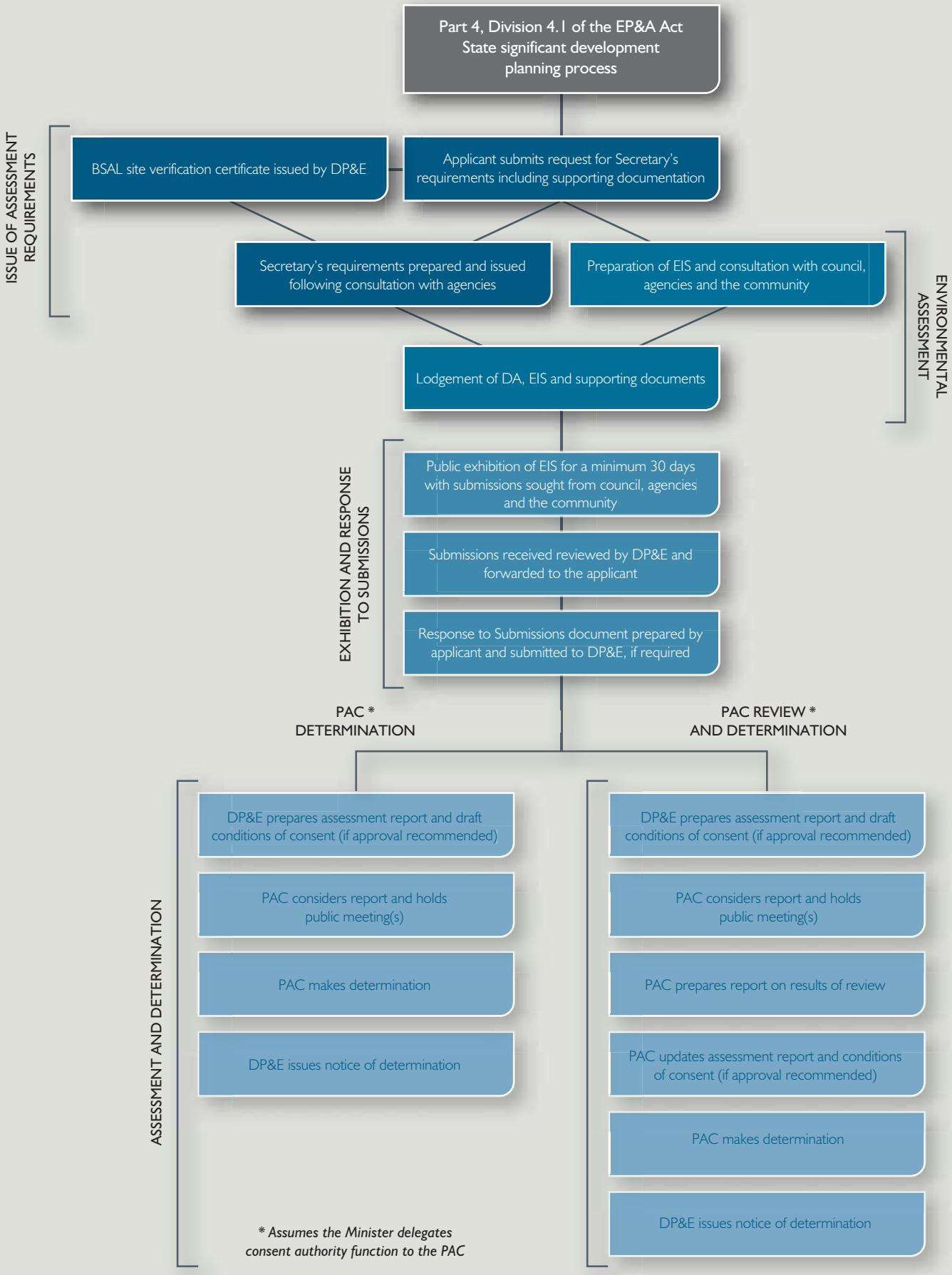
Division 4.1 of the EP&A Act specifically relates to the assessment of development deemed to be significant to the State (ie SSD). The planning process under this part of the EP&A Act is presented in Figure 7.1.

Section 89C(2) of the EP&A Act states that a:

> State environmental planning policy may declare any development, or any class or description of development, to be State significant development.

Schedule 1 of the SRD SEPP declares certain categories of development to be SSD. Relevantly, development for the purpose of coal mining is declared as SSD and, accordingly, Part 4.1 of the EP&A Act applies to the proposal.

Under section 89D of the EP&A Act, the Minister for Planning is the consent authority for SSD. However, it should be noted that pursuant to section 23 of the EP&A Act, the Minister may delegate the consent authority function to the PAC, the Director-General or to any other statutory authority.



COAL & ALLIED
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Planning approval process

Warkworth Continuation 2014 Environmental Impact Statement

Figure 7.1

A DA for SSD must be accompanied by an EIS, prepared in accordance with the EP&A Regulation. Before lodging an EIS, an applicant must request Secretary's requirements which are essentially terms of reference that specify what must be addressed in an EIS. The Secretary's requirements for the proposal were issued on 22 May 2014 and are provided in Appendix D. The sections of the EIS where the Secretary's requirements have been addressed are identified in Table 5.1.

Section 89E of the EP&A Act is the primary provision in the Act giving the Minster (or delegate) the power to determine a DA for SSD. Section 89E(1) states:

> The Minister is to determine a development application in respect of State significant development by:
>
> (a) granting consent to the application with such modifications of the proposed development or on such conditions as the Minister may determine, or
>
> (b) refusing consent to the application.

The relevant factors in the assessment and determination of the proposal are addressed below.

7.2.2 Objects of the Act

The objects of the EP& Act are specified in section 5. It states:

> The objects of this Act are:
>
> (a) to encourage:
>
> (i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,
>
> (ii) the promotion and co-ordination of the orderly and economic use and development of land,
>
> (iii) the protection, provision and co-ordination of communication and utility services,
>
> (iv) the provision of land for public purposes,
>
> (v) the provision and co-ordination of community services and facilities, and
>
> (vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and
>
> (vii) ecologically sustainable development, and
>
> (viii) the provision and maintenance of affordable housing, and
>
> (b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and
>
> (c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

An assessment of the proposal against the objects of the EP&A Act is provided below.

> To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.

Warkworth Mine and MTO contain a substantial coal resource supported by existing extensive physical and human infrastructure. The proposal would facilitate proper development and the orderly use of these resources, thus promoting social and economic welfare. It would also not unduly compromise or prejudice the conservation of natural resources.

> To encourage the promotion and co-ordination of the orderly and economic use and development of land.

The proposal is for the continued development of a natural mineral resource on land within the footprint of existing mining leases owned by WML and Miller Pohang Coal Pty Limited. It would constitute an orderly and economic use of land and the resources contained within it.

> To encourage the protection, provision and co-ordination of communication and utility services.

This object is not applicable to the proposal.

> To encourage the provision of land for public purposes.

With the exception of the Wallaby Scrub Road corridor, all the elements of the proposal would be constructed on privately-owned land within the footprint of existing mining leases. Contributions would be agreed to with Singleton Council regarding closure of the road. The conservation areas proposed to offset ecological and heritage impacts provide land for public purposes.

> To encourage the provision and co-ordination of community services and facilities.

The proposal enables jobs to be maintained; it does not seek to increase MTW's workforce. Accordingly, there is unlikely to be any demand for additional community services. Ongoing operations would enable continued support of the community through initiatives such as the Coal & Allied Community Development Fund. Royalties generated by the continued operation of MTW (estimated to be around $617million in net present value (NPV) terms) go to State revenue to provide for community services and facilities.

In addition, the proposal includes the establishment of a Local Community Historic Heritage Conservation Initiative, comprising two conservation funds; the Mount Thorley Warkworth Historic Heritage Conservation Fund and the Mount Thorley Warkworth Great North Road Conservation Fund.

> To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.

The proposal takes into account this objective. Mining the coal resources would require the progressive clearing of threatened woodland and open forest communities which provide habitat for several threatened fauna species, the disturbance of Aboriginal sites and the take of water from groundwater and surface water sources. However, to offset ecological and heritage impacts, conservation areas are proposed which would provide long-term protection and conservation of native animals, plants and cultural heritage. Additional water entitlements would be sourced to offset take from groundwater sources.

To encourage ecologically sustainable development.

The Commonwealth Government's (1992) *National Strategy for Ecologically Sustainable Development* defines ESD as 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'.

The proposal would enhance community resources by providing considerable employment and public revenues through royalties and taxes. In this way it would contribute to improvements in the local, State and National economies and contribute to an overall increase in quality of life. Also, the proposal would conserve community resources directly through the establishment of conservation areas and indirectly through effective impact mitigation.

Proposed rehabilitation of disturbed land, in combination with the protection of nearby areas for biodiversity and cultural heritage, would improve and maintain environmental quality now and for the future. The proposal would make a negligible contribution to global greenhouse gases (Scope 1 and 2). Less efficient energy production from low quality coal and/or less efficient mining would involve a higher contribution.

The principles of ESD are outlined in section 6 of the POEO Act and Schedule 2 of the EP&A Regulation. The proposal is consistent with ESD and its principles as discussed in Section 24.1.3.

To encourage the provision and maintenance of affordable housing.

As the proposal utilises the same workforce, there would not be an increase in the demand on housing.

To promote the sharing of the responsibility for environmental planning between the different levels of government in the State.

All relevant State and local government agencies have been consulted during the preparation of the EIS. Further consultation will occur during the response to submissions following exhibition and pre-determination phases.

To provide increased opportunity for public involvement and participation in environmental planning and assessment.

Extensive community consultation was undertaken as part of the social impact study for the proposal. Feedback received through the consultation process has been considered in the preparation of the EIS. Public involvement and participation will also be provided through the public exhibition process of this EIS.

7.2.3 Section 79C matters for consideration

i General

When assessing a DA for SSD, the consent authority is required to take into consideration the matters outlined in section 79C of the EP&A Act. This states:

(1) Matters for consideration – general

In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:

(a) the provisions of:

(i) any environmental planning instrument, and

(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Director-General has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and

(iii) any development control plan, and

(iiia) any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F, and

(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph), and

(v) any coastal zone management plan (within the meaning of the Coastal Protection Act 1979),

that apply to the land to which the development application relates,

(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,

(c) the suitability of the site for the development,

(d) any submissions made in accordance with this Act or the regulations,

(e) the public interest."

(2) Compliance with non-discretionary development standards—development other than complying development.

If an environmental planning instrument or a regulation contains non-discretionary development standards and development, not being complying development, the subject of a development application complies with those standards, the consent authority:

(a) is not entitled to take those standards into further consideration in determining the development application, and

(b) must not refuse the application on the ground that the development does not comply with those standards, and

(c) must not impose a condition of consent that has the same, or substantially the same, effect as those standards but is more onerous than those standards,

and the discretion of the consent authority under this section and section 80 is limited accordingly.

(3) If an environmental planning instrument or a regulation contains non-discretionary development standards and development the subject of a development application does not comply with those standards:

(a) subsection (2) does not apply and the discretion of the consent authority under this section and section 80 is not limited as referred to in that subsection, and

(b) a provision of an environmental planning instrument that allows flexibility in the application of a development standard may be applied to the non-discretionary development standard.

The above matters are considered below and throughout this EIS. Notwithstanding the contents of section 79C(1)(iii), clause 11 of the SRD SEPP states that development control plans do not apply to SSD.

ii Environmental planning instrument framework

a. State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

Aims

Clause 2 of the Mining SEPP sets out its aims. It states:

> The aims of this Policy are, in recognition of the importance to New South Wales of mining, petroleum production and extractive industries:
>
> (a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and
>
> (b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and
>
> (b1) to promote the development of significant mineral resources, and
>
> (c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources, and
>
> (d) to establish a gateway assessment process for certain mining and petroleum (oil and gas) development:
>
> (i) to recognise the importance of agricultural resources, and
>
> (ii) to ensure protection of strategic agricultural land and water resources, and
>
> (iii) to ensure a balanced use of land by potentially competing industries, and

(iv) to provide for the sustainable growth of mining, petroleum and agricultural industries.

For the reasons set out in the chapter, the proposal is considered to be consistent with these aims.

Permissibility

The proposal is permissible with consent by virtue of clause 7(1)(b) of the Mining SEPP which states that development for the purposes of mining may be carried out:

(i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or

(ii) on land that is, immediately before the commencement of this clause, the subject of a mining lease under the *Mining Act 1992* or a mining licence under the *Offshore Minerals Act 1999*,

The proposal would be carried out on land where development for the purposes of agriculture or industry may be carried out with consent. This is because the Site is zoned RU1 Primary Production under the Singleton Local Environmental Plan 2013 (LEP 2013). Development permitted with consent in this zone includes open cut mining, as well as agriculture and industry.

Matters for consideration

Part 3 of the Mining SEPP sets out a number of matters the consent authority must consider before determining an application for consent for development for the purposes of mining. These matters include the significance of the resource (clause 12AA), non-discretionary development standards for mining (clause 12AB), the compatibility of the mine with other land uses (clause 12), compatibility of proposal with mining (clause 13), natural resource management and environmental management (clause 14), resource recovery (clause 15), transport (clause 16) and rehabilitation (clause 17).

These matters are addressed below.

Significance of the resource

Clause 12AA of the Mining SEPP states:

(1) In determining an application for consent for development for the purposes of mining, the consent authority must consider the significance of the resource that is the subject of the application, having regard to:

(a) the economic benefits, both to the State and the region in which the development is proposed to be carried out, of developing the resource, and

(b) any advice by the Director-General of the Department of Trade and Investment, Regional Infrastructure and Services as to the relative significance of the resource in comparison with other mineral resources across the State.

(2) The following matters are (without limitation) taken to be relevant for the purposes of subclause (1)(a):

(a) employment generation,

(b) expenditure, including capital investment,

(c) the payment of royalties to the State.

(3) The Director-General of the Department of Trade and Investment, Regional Infrastructure and Services is, in providing advice under subclause (1)(b), to have regard to such matters as that Director-General considers relevant, including (without limitation):

(a) the size, quality and availability of the resource that is the subject of the application, and

(b) the proximity and access of the land to which the application relates to existing or proposed infrastructure, and

(c) the relationship of the resource to any existing mine, and

(d) whether other industries or projects are dependent on the development of the resource.

(4) In determining whether to grant consent to the proposed development, the significance of the resource is to be the consent authority's principal consideration under this Part.

(5) Accordingly, the weight to be given by the consent authority to any other matter for consideration under this Part is to be proportionate to the importance of that other matter in comparison with the significance of the resource.

(emphasis added)

Clause 12AA of the Mining SEPP operates to make the 'significance of the resource' the principal consideration of the matters the Minister is to consider under Part 3 of the Mining SEPP. The operation of clause 12AA is therefore limited to considerations under Part 3 of the Mining SEPP. Clause 12AA does not operate to make the 'significance of the resource' the principal consideration of the matters contained within section 79C.

Matters relating to the economic benefits, both to the State and the region in which the development is proposed to be carried out, of developing the resource are detailed in Chapter 9. This chapter provides a summary of an economic study that has been prepared which describes the direct and flow-on economic benefits of the proposal as well as the aggregated benefits with the Mount Thorley Operations 2014. It considers the incremental, or net, impacts relative to the counterfactual that both proposals are not approved and MTW ceases operating at the end of the respective development consents.

The economic study has two components, a CBA and a REIA. The CBA considers the direct costs and benefits accruing in NSW from the proposals, for instance, from additional value added in the form of wages and salaries paid to employees and contractors. Flow-on effects of the proposals, such as the effects on regional income, employment or value added, are assessed in the REIA.

As clause 12AA(2) states, the matters relevant in considering economic benefits, both to the State and the region in which the development is proposed to be carried out, of developing the resource are employment generation, expenditure, including capital investment, and the payment of royalties to the state. These matters are addressed below.

- **Employment generation:** As stated in Chapter 2, the current integrated Warkworth Mine and MTO workforce is approximately 1,300 people, on average. The annual average employment directly attributable to Warkworth Mine approximately 1,187 persons. The proposal would provide the mine with its best opportunity of maintaining its current workforce and extending it for a further 14 years beyond the existing approval period (ie from 2021, assuming the project is determined by end of 2014 to 2035).

The economic study demonstrates that the proposal is expected to have positive flow-on effects on the NSW, regional and local economies based on the significant projected expenditures on wages and salaries, as well as other mining inputs by MTW. The initial aggregated flow-on effects are estimated to generate additional annual employment of around 206, 214, and 61 full-time equivalent workers in NSW, the Mid and Upper Hunter region, and Singleton LGA, respectively. Of these, Warkworth Mine would contribute 191, 198 and 57 full-time equivalent workers for NSW, the Mid and Upper Hunter region, and Singleton LGA, respectively.

- **Expenditure, including capital investment:** Note: that the BCA estimates operating expenditures for Warkworth Mine at around $3.7billion in NPV terms. The aggregated operating expenditures for the proposals are estimated at $3.8billion in NPV terms. This excludes capital expenditure. The economic impact has been evaluated with reference to its contribution to NSW gross state product (GSP). In calculating GSP, the income flows accruing to the factors of production are required, including the share of income from production that can be attributed to capital inputs for incorporated businesses, which is also known as the gross operating surplus (GOS). GOS is calculated as output valued at producer prices, net of intermediate consumption (operating expenditure), net of employee compensation, and net of taxes on production (ABS 2013). Calculating the GOS requires that certain Australian System of National Accounts (ASNA) conventions are followed. Expenditures on assets that are not 'used up' in the course of the production process and which yield benefits beyond the period in which they are purchased (ie capital expenditure) are not included in the calculation to derive GOS.

- **The payment of royalties to the State:** The economic study demonstrates that in NPV terms, the proposal would deliver net benefits to NSW of around $1.34billion, including around $567million in additional coal royalties paid to the NSW Government. The aggregated net benefits of the proposals to NSW would be around $1.5billion, including around $617million in additional coal royalties paid to the NSW Government and about $259million in payroll taxes, council rates and other payments that accrue to different levels of Government.

Matters relating to the significance of the resource are detailed in Chapters 2 and 6. They are summarised below.

- **Size, quality and availability of the resource:** At the end of 2013, measured, indicated and inferred open cut coal resources estimated were 6.2, 39.2 and 133.2Mt, respectively, with a total of 178.6Mt. The proved and probable open cut coal reserves were estimated at 203.7 and 154.7Mt, respectively, with a total of 358.3Mt. The proposal would enable approximately 358Mt of ROM coal to be mined over the life of the operations, approximately 230Mt of which is located within the proposed 2014 disturbance area.

Mineable coal consists of approximately 20 coal seams which are suitable for production of either thermal or semi-soft coking coal. This coal is mineable by an extension of existing open cut mining practices, including the use of draglines, shovels, excavators, loaders, dozers and truck fleets. These practices have proved appropriate for the geological conditions encountered at the mine and the required production rates.

- **Proximity and access to existing or proposed infrastructure:** The land to which the application relates is owned by WML and Miller Pohang Coal Pty Limited and contained within the footprint of existing mining leases (predominantly CCL 753 and CL 219). The land is contiguous with existing mining areas and has direct access to existing infrastructure. This infrastructure has been listed in Section 2.4.6 and includes everything required for the processing and transportation of coal.

- **Relationship of the resource to any existing mine:** The resource proposed to be mined is associated with Warkworth Mine and MTO and enables the continued integrated operation of MTW.

- **Other industries or projects are dependent on the development of the resource:** There are a number of other industries that would be adversely impacted if the proposal does not proceed. These include upstream industries that supply goods and services to Warkworth Mine and downstream industries that utilise the coal produced at the mine.

  In 2013, MTW spent $573million with 803 suppliers in Australia. Of this, $147million was spent on 377 suppliers in NSW, and $188million was spent on 228 local suppliers (ie from Upper Hunter, Muswellbrook, Singleton, Maitland and Cessnock LGAs). This correlates to an average spend of $820,000 per local supplier.

  Downstream industries that utilise the coal include domestic (Redbank Power Station) and overseas energy producers and steel makers.

Non-discretionary development standards

Clause 12AB of the Mining SEPP sets out a number of non-discretionary development standards for the purposes of section 79C(2) and (3) of the EP&A Act in relation to the carrying out of development for the purposes of mining. These standards relate to cumulative noise level, cumulative air quality level, airblast overpressure, ground vibration and aquifer interference. These standards are addressed in Section 7.2.1.iii.d.

Compatibility of the mine with other land uses

Clause 12 of the Mining SEPP states that:

> Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:
>
> (a) consider:
>
> (i) the existing uses and approved uses of land in the vicinity of the development, and
>
> (ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and
>
> (iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and
>
> (b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a)(i) and (ii), and
>
> (c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a)(iii).

These matters are addressed below.

> Consider the existing uses and approved uses of land in the vicinity of the development.

The area immediately surrounding Warkworth Mine is dominated by coal mines and associated infrastructure and other industry. This includes the Hunter Valley Operations, Wambo Mine and Redbank Power Station to the north and north-west, MTO and Bulga Coal Complex to the south, and MTIE to the east. There is also extensive rail and electricity infrastructure in place. Bulga Coal has applied to the Minister for Planning for development consent to continue operations at the Bulga Coal Complex (referred to as the Bulga Optimisation Project).

There are number of rural and rural/residential properties located to the north-east and south-west of the mine. The villages of Bulga and Warkworth are located to the south-west and north-west, respectively. Further to the west are the Wollemi and Yengo national parks.

In light of the surrounding land uses it is considered that the proposal is appropriate to the existing and approved uses of land in the vicinity.

> Consider whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development.

It is a matter for the consent authority to determine the preferred uses of land in the vicinity of the proposal, having regard to land use trends. This EIS has considered the likely impacts of proposal on the existing land uses, particularly on the rural/residential land uses identified above. As discussed in Chapter 24, subject to the application of the commitments, the proposal is unlikely to have a significant impact on these existing land uses.

> Consider any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses.

The proposal is a continuation of an existing mining operation which has been in operation since 1981. It is considered to be broadly compatible with surrounding land uses, particularly the mining and industrial land uses.

> Evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a)(i) and (ii).

The evaluation and comparison of the respective public benefits of the development and existing, approved and preferred land uses is a matter for the consent authority. However, there are clear public benefits associated with the continuation of mining within the footprint of existing mining leases. One tool the consent authority can use in making this evaluation and comparison is the economic study which describes the direct and flow-on economic benefits of the proposal and the Mount Thorley Operations 2014 (aggregated) for the Singleton LGA, Mid and Upper Hunter region and for NSW. As previously stated, it considers the incremental or net impacts relative to the counterfactual that both proposals are not approved and MTW ceases operating at the end of 2021.

In NPV terms, the proposal would deliver net benefits to NSW of around $1.34billion. These net benefits take the form of:

- the additional disposable income received by employees and long-term contractors who live in NSW, around $346million;
- the additional coal royalties paid to the NSW Government of around $567million; and
- additional payroll taxes, council rates and other payments that accrue to different levels of government, and which amount to around $225million.

Almost three quarters of MTW employees and long-term contractors live in the Mid and Upper Hunter region. Around $227million in NPV terms in additional disposable income would flow to that region.

In addition to the direct effects described above, the proposal is expected to have positive flow-on effects on the NSW, regional and local economies. These flow-on effects are a reflection of the significant projected expenditures on wages and salaries, as well as other mining inputs by Warkworth Mine. The initial flow-on effects are estimated at:

- around $346million, $204million and $75million in additional income (in NPV terms) for NSW, the Mid and Upper Hunter region and Singleton LGA, respectively;
- additional annual employment of around 191, 198, and 57 full-time equivalent workers in NSW, the Mid and Upper Hunter region and Singleton LGA, respectively; and
- an increase in the GSP of NSW of around $450million in NPV terms ($39million annually).

> Evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a)(iii).

A range of commitments have been made by WML to mitigate potential impacts of the proposal on surrounding land uses. These commitments are summarised in Chapter 22. Subject to the application of the commitments, the proposal is unlikely to have a significant impact on these land uses.

Compatibility of proposal with mining

Clause 13 of the Mining SEPP relates to matters a consent authority must take into consideration when determining applications for development that is:

- in the vicinity of an existing mine, petroleum production facility or extractive industry;
- identified on a map as being the location of State or regionally significant resources of minerals, petroleum or extractive materials; or
- identified by an environmental planning instrument as being the location of significant resources of minerals, petroleum or extractive materials.

Clause 13(2) states:

> Before determining an application to which this clause applies, the consent authority must:
>
> (a) consider:
>
> (i) the existing uses and approved uses of land in the vicinity of the development, and
>
> (ii) whether or not the development is likely to have a significant impact on current or future extraction or recovery of minerals, petroleum or extractive materials (including by limiting access to, or impeding assessment of, those resources), and
>
> (iii) any ways in which the development may be incompatible with any of those existing or approved uses or that current or future extraction or recovery, and
>
> (b) evaluate and compare the respective public benefits of the development and the uses, extraction and recovery referred to in paragraph (a) (i) and (ii), and

(c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).

Therefore, this clause requires the consent authority to consider the proposal's potential impact on other mining, petroleum production and extractive industries within the local area.

The proposal would be undertaken within the footprint of existing mining leases. Mine planning has ensured that it maximises the extraction of coal resources. It would not impact on surrounding mines, or their ability to extract target resources. Further, it is noted that the Mount Thorley Operations 2014 proposal is critical to the viability of Warkworth Mine as it would enable the ongoing provision of integrated services. Similarly, the proposal is critical to the viability of MTO as it would provide the necessary overburden volumes to complete the final landform.

Natural resource and environmental management

Clause 14 of the Mining SEPP relates to natural resource and environmental management. It states:

(1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:

(a) that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,

(b) that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,

(c) that greenhouse gas emissions are minimised to the greatest extent practicable.

(2) Without limiting subclause (1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.

(3) Without limiting subclause (1), in determining a development application for development for the purposes of mining, the consent authority must consider any certification by the Chief Executive of the Office of Environment and Heritage or the Director-General of the Department of Primary Industries that measures to mitigate or offset the biodiversity impact of the proposed development will be adequate.

The drafting of any prospective conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner in relation to water resources, threatened species and biodiversity and greenhouse gases is a matter for the consent authority.

The results of the surface water and groundwater studies indicate that impacts are likely to be minor and manageable through licensing arrangements.

The proposal would require the progressive clearing of threatened woodland and open forest communities, which provide habitat for several threatened fauna species. In accordance with the Draft NSW Biodiversity Offsets Policy for Major Projects (OEH 2014a), to offset these impacts, conservation areas are proposed which would provide long-term protection and conservation of threatened species and biodiversity.

The greenhouse gas assessment has estimated that annual average greenhouse emissions over the 21 year life of the proposal (Scope 1 and 2) are negligible, representing approximately 0.18 per cent and 0.63 per cent of Australia's and NSW emissions, respectively.

Details on potential impacts on groundwater and surface water resources are provided in Chapters 16 and 17. Details on potential impacts on threatened species and biodiversity are provided in Chapter 12. Details on greenhouse gas emissions are provided in Chapter 11.

Resource recovery

Clause 15 of the Mining SEPP states:

> (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery.
>
> (2) Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material.
>
> (3) The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.

Warkworth Mine has been operating for over 30 years. The geology, mining methods and mining equipment required to maximise both the quantum and efficiency of the extraction of the available resources are well understood. Mine plans have been prepared which continue existing mining methods westwards. As previously stated, North and West pits are managed as an integrated pit, typically utilising draglines to make best use of the available strike length. Whilst the ability to enable a continuous dragline operation in these two pits (as previously proposed) has been lost, North and West pits would progress westward in a manner so that the highwalls are generally on a north-west to south-east axis parallel to the strike of the coal seams. This would extend the spatial limit approved under the current development consent to enable mining in West Pit along the full strike length and, subsequently, enable the two main pits, North and West pits, to advance down dip to the west.

Transport

Clause 16(1) of the Mining SEPP states:

> Before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following:
>
> (a) require that some or all of the transport of materials in connection with the development is not to be by public road,
>
> (b) limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,
>
> (c) require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.

Existing infrastructure at MTW allows the operations to be undertaken in accordance with the requirements of this clause. All coal produced at Warkworth Mine is transported by conveyor to Redbank Power Station, or rail to the Port of Newcastle. Coal is only transported to Redbank Power Station via road for short periods in the case of emergency, such as conveyor failure. Further details on transport matters are provided in Chapter 20.

Rehabilitation

Clause 17 of the Mining SEPP states:

> (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development.
>
> (2) In particular, the consent authority must consider whether conditions of the consent should:
>
> (a) require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or
>
> (b) require waste generated by the development or the rehabilitation to be dealt with appropriately, or
>
> (c) require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under section 145C of the Act and the *Contaminated Land Management Act 1997*), or
>
> (d) require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.

The primary objective of final rehabilitation at Warkworth Mine is to create a stable, free draining landform able to maintain viable land uses where the post-mining rehabilitated areas are integrated with the surrounding landscape.

Rehabilitation would continue to be undertaken progressively across the mined area under the proposal. The requirements for rehabilitation would be determined in consultation with relevant Government agencies and stakeholders and in accordance with regulatory requirements. The objectives of the rehabilitation domains of mined areas at Warkworth Mine are to:

- re-create approximately 1,617ha of EEC woodland communities to a standard comparable to similar reference EEC communities (analogue site);
- create approximately 222ha of trees over grass not conforming to any particular community, creating treed corridors to ensure connectivity of woodland community areas;
- recreate some 848ha of grassland;
- establish improved pasture and some productive grazing;
- provide additional habitat for threatened species; and
- create an additional north/south wildlife corridor providing connectivity to other habitat.

Rehabilitation and final landform are discussed further in Chapter 13.

Mining on strategic agricultural land

Part 4AA of the Mining SEPP applies to 'mining or petroleum development' on strategic agricultural land.

Clause 17A provides a definition of mining and petroleum development for the purposes of Part 4AA. It states:

> (1) In this Part, mining or petroleum development means:
>
> (a) development specified in clause 5 (Mining) of Schedule 1 to State Environmental Planning Policy (State and Regional Development) 2011, but only if:
>
> (i) a mining lease under the Mining Act 1992 is required to be issued to enable the development to be carried out because:
>
> (A) the development is proposed to be carried out outside the mining area of an existing mining lease, or
>
> (B) there is no current mining lease in relation to the proposed development, or

The proposal is development specified in clause 5 of the SRD SEPP (see below) and an extension to mining leases are required because the proposal is to be carried out outside of the vertical extent of existing mining leases. As previously stated, the majority of proposal area is within CCL 753, with the southern part within CL 219. Within the proposed extension area, CCL 753 and the section of CL 219 are subsurface mining leases granted in 1981. These mining leases do not include the surface to 20m depth. Mining Lease Applications 352 and 353 cover the surface to 20m depth required for the proposal, however these are yet to be approved and cannot be without an appropriate development consent being in place in respect of them.

Therefore, Part 4AA of the Mining SEPP applies to the proposal.

Site verification certificates

Division 3 of Part 4AA relates to site verification certificates. The note to this division states:

> Note. Clause 50A of the *Environmental Planning and Assessment Regulation 2000* requires that a development application for consent to mining or petroleum development on certain identified land (including land shown on the Strategic Agricultural Land Map) must be accompanied by:
>
> (a) a gateway certificate, or
>
> (b) a site verification certificate that certifies that the land on which the proposed development is to be carried out is not biophysical strategic agricultural land.

Clause 50A of the EP&A Regulation states:

> (1) This clause applies to a development application that relates to mining or petroleum development (within the meaning of Part 4AA of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007) on the following land:
>
> (a) land shown on the Strategic Agricultural Land Map,
>
> (b) any other land that is the subject of a site verification certificate.

(2) A development application to which this clause applies must be accompanied by:

(a) in relation to proposed development on land shown on the Strategic Agricultural Land Map as critical industry cluster land—a current gateway certificate in respect of the proposed development, or

(b) in relation to proposed development on any other land:

(i) a current gateway certificate in respect of the proposed development, or

(ii) a site verification certificate that certifies that the land on which the proposed development is to be carried out is not biophysical strategic agricultural land.

The Strategic Agricultural Land Map that covers Warkworth Mine (Sheet STA_004) indicates that a small portion of the eastern portion of CCL753 is biophysical strategic agricultural land (BSAL). The proposed extension area is not mapped as BSAL.

A site verification certificate report was prepared and lodged by the applicant with a certificate issued in June 2014 confirming the absence of BSAL. This application has been made in accordance with clauses 17C and 17D which stipulates the requirements for the applications for site verification certificates and the *Interim Protocol for site verification and mapping of biophysical strategic agricultural land* (the Interim Protocol) (OEH 2013). Details on the Interim Protocol are provided in Section 7.4.1.

Soils and land capability are discussed further in Chapter 14.

b. State Environmental Planning Policy (State and Regional Development) 2011

The SRD SEPP, amongst other matters, defines certain development that is SSD. Clause 8 of the SRD SEPP states:

(1) Development is declared to be State significant development for the purposes of the Act if:

(a) the development on the land concerned is, by the operation of an environmental planning instrument, not permissible without development consent under Part 4 of the Act, and

(b) the development is specified in Schedule 1 or 2.

Schedule 1 of the SRD SEPP defines a range of general SSDs, including mining. Clause 5 (Mining) of Schedule 1 states:

(1) Development for the purpose of mining that:

(a) is coal or mineral sands mining, or

(b) is in an environmentally sensitive area of State significance, or

(c) has a capital investment value of more than $30million.

The proposal meets both the requirements of clause 8 of the SRD SEPP as it is not permissible without development consent under the Mining SEPP and is development specified in Schedule 1. Therefore, the proposal is declared SSD for the purposes of the EP&A Act.

c. State Environmental Planning Policy No 33 – Hazardous and Offensive Development

State Environmental Planning Policy No 33 – Hazardous and Offensive Development (SEPP 33) requires the consent authority to consider whether a proposal is a potentially hazardous or offensive industry. While coal handling is identified as a potentially hazardous industry, the existing operations at Warkworth Mine are not classed as hazardous or offensive development under SEPP 33. The proposal does not propose any changes to current operations that would be potentially hazardous or offensive. Therefore, SEPP 33 does not apply to the proposal.

d. State Environmental Planning Policy No 44 – Koala Habitat Protection

State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44) applies to the extent that a consent authority is restricted from granting approval for a development proposal on land identified as core koala habitat without the preparation of a plan of management. The ecological study found that no areas of core koala habitat exist and, therefore, SEPP 44 does not place any constraints on the proposal (see Chapter 12).

e. State Environmental Planning Policy No 55 – Remediation of Land

State Environmental Planning Policy No 55 – Remediation of Land (SEPP 55) requires that a consent authority not grant consent to the carrying out of development on land unless it has considered any potential contamination issues. The Site was previously assessed as part of the Warkworth Extension 2010 (EMM 2010a) which did not identify any potential contamination issues. Therefore, SEPP 55 does not place any constraints on the proposal.

f. Singleton Local Environmental Plan 2013

The Site is zoned RU1 Primary Production under the Singleton LEP 2013. Development permitted with consent in this zone includes open cut mining, as well as agriculture and industry. The objectives of the RU1 zone are:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base;
- to encourage diversity in primary industry enterprises and systems appropriate for the area;
- to minimise the fragmentation and alienation of resource lands; and
- to minimise conflict between land uses within this zone and land uses within adjoining zones.

The proposal is considered to be compatible with the above objectives given that it involves the continuation and extension of an existing mining operation.

iii Planning agreements

One of the matters of consideration under section 79C is the relevant provisions of any planning agreements. Section 93F of the EP&A Act relates to planning agreements, which:

> ... is a voluntary agreement or other arrangement under this Division between a planning authority (or 2 or more planning authorities) and a person (the developer):
>
> (a) who has sought a change to an environmental planning instrument, or
>
> (b) who has made, or proposes to make, a development application, or
>
> (c) who has entered into an agreement with, or is otherwise associated with, a person to whom paragraph (a) or (b) applies,
>
> under which the developer is required to dedicate land free of cost, pay a monetary contribution, or provide any other material public benefit, or any combination of them, to be used for or applied towards a public purpose.

Section 93F enables the applicant to enter into a Voluntary Planning Agreement (VPA) with planning authorities in lieu of a section 94 contribution.

iv The Regulations

As previously stated, a DA for SSD must be accompanied by an EIS, prepared in accordance with the EP&A Regulation. Schedule 2 of the EP&A Regulation stipulates:

- requirements of the Director-General and approval bodies in relation to EISs;
- general provisions relating to EISs; and
- special provisions relating to State significant infrastructure.

The general provisions specify the form (clause 6) and the content (clause 7) of an EIS. Clause 6 states:

An environmental impact statement must contain the following information:

> (a) the name, address and professional qualifications of the person by whom the statement is prepared,
>
> (b) the name and address of the responsible person,
>
> (c) the address of the land:
>
> (i) in respect of which the development application is to be made, or
>
> (ii) on which the activity or infrastructure to which the statement relates is to be carried out,
>
> (d) a description of the development, activity or infrastructure to which the statement relates,
>
> (e) an assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule,
>
> (f) a declaration by the person by whom the statement is prepared to the effect that:

(i) the statement has been prepared in accordance with this Schedule, and

(ii) the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and

(iii) that the information contained in the statement is neither false nor misleading.

Clause 7 states that an EIS must also include each of the following:

(a) a summary of the environmental impact statement,

(b) a statement of the objectives of the development, activity or infrastructure,

(c) an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure,

(d) an analysis of the development, activity or infrastructure, including:

(i) a full description of the development, activity or infrastructure, and

(ii) a general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and

(iii) the likely impact on the environment of the development, activity or infrastructure, and

(iv) a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and

(v) a list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out,

(e) a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv),

(f) the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4).

Note. A cost benefit analysis may be submitted or referred to in the reasons justifying the carrying out of the development, activity or infrastructure.

The above requirements and where they are addressed in the EIS are set out in Table 7.1.

Table 7.1 Schedule 2 requirements for an EIS

Requirement	Where contained in the EIS
Name, address and professional qualifications of the person(s) who prepared the EIS	Front cover
Name and address of the responsible person (the applicant)	Section 5.1
Address of land	Section 2.1
Description of development	Chapter 2
Assessment of the environmental impact	Chapters 9 – 21
Declaration that the EIS has been prepared in accordance with this Schedule, contains all available information that is relevant to the environmental assessment of the development and that the information contained in the statement is neither false nor misleading	Front cover
Summary of the EIS	Executive summary
A statement of the objectives of the development	Chapter 1
An analysis of feasible alternatives, having regard to its objectives, including the consequences of not carrying out the development	Chapter 23
A full description of the development	Chapter 2
A general description of the environment likely to be affected by the development	Chapters 9 – 21
The likely impact on the environment of the development	Chapters 9 – 21
A full description of the measures proposed to mitigate any adverse effects of the development	Chapters 9 – 21
A list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out	Section 7.6
A compilation of the measures referred to in item (d) (iv)	Table 22.1
The reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development	Chapter 24

v Likely impacts of the development

This EIS comprehensively describes the likely impacts of proposal, including likely environmental impacts on both the natural and built environments, and social and economic impacts in the locality. It also describes commitments proposed by WML to mitigate, manage, offset and/or compensate for these impacts. These descriptions are based on technical studies, prepared by specialists, which are appended to this EIS. The technical studies were prepared using the most recent and accurate scientific data relevant to the proposal, in consideration of current policies and legislation. In addition, they adopted conservative assumptions to enable the upper limit of likely impacts to be determined.

Likely impacts on both the natural and built environments are described in Chapters 10 to 20, based on technical studies appended in Appendices G to P. Likely economic and social impacts are described in Chapters 9 and 21, respectively, based on technical studies appended in Appendices F and Q.

vi Suitability of the site for the development

As previously stated, the area immediately surrounding the mine is dominated by coal mines and other industry, including Hunter Valley Operations, Wambo Mine and Redbank Power Station to the north and north-west, MTO and Bulga Coal Complex to the south, and MTIE to the east. The area also includes associated infrastructure such as rail lines and high voltage electricity powerlines.

The proposal would facilitate the recovery of significant coal reserves within footprint of the existing mining leases granted under the Mining Act and on privately-owned land zoned for open cut mining. It is considered to be broadly compatible with surrounding land uses, particularly the mining and industrial land uses. A range of commitments have been made by WML to mitigate potential impacts of the proposal on surrounding land uses. Subject to the application of the commitments, the proposal is unlikely to have a significant impact on these land uses.

The Site is, therefore, considered suitable for the continuation of the existing mining operations under the proposal.

vii Submissions

This EIS will be placed on public exhibition for a minimum of 30 days by DP&E and submissions will be sought from Singleton Council, government agencies and the community. Any submissions received by DP&E will be reviewed and forwarded to WML to consider and respond to (via a Response to Submissions report).

Following receipt of the Response to Submissions, DP&E will prepare its assessment report considering this EIS, all submissions received during the exhibition process and the Response to Submissions.

viii Public interest

To assist the consent authority in determining whether the proposal is in the public interest, this EIS provides a justification for the proposal, taking into consideration its potential environmental impacts, and the suitability of the Site. It also considers the proposal against the principles of ESD, consistent with the L&E Court judgement (par. 59). The consent authority will also be required to consider all submissions received during the public exhibition of the EIS.

7.2.4 Non-discretionary development standards

i General

Clause 12AB of the Mining SEPP identifies non-discretionary development standards for mining relating to cumulative noise, cumulative air quality, airblast overpressure, ground vibration and aquifer interference.

Clause 12AB(1) states that if a proposed development for the purposes of mining satisfies a development standard set out in this clause, the consent authority cannot require more onerous standards for those matters but does not prevent the consent authority granting consent even though any such standard is not complied with.

Clause 12AB(2) states that the non-discretionary development standards are standards for the purposes of section 79C (2) and (3) of the EP&A Act. These sections of the Act have been provided earlier.

The proposal satisfies the majority of the non-discretionary development standards for mining as detailed below and described further in the relevant chapters and technical studies.

ii Cumulative noise level

Clause 12AB(3) provides non-discretionary development standards relating to cumulative noise. It states:

> The development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.1 of the Industrial Noise Policy, for residences that are private dwellings.

A noise and vibration study was prepared (Appendix F) which assessed the potential for noise and vibration impacts on residences surrounding the mine over the lifespan of the proposal. Operational noise at residences was predicted under varying meteorological conditions prevalent at the Site including calm and prevailing winds and temperature gradient conditions. Predictions show that the proposal would not result in a cumulative amenity noise level greater than the acceptable noise levels at all privately-owned assessment locations not already afforded acquisition rights by neighbouring mines due to their predicted incremental impacts.

A detailed assessment of noise impacts of the proposal is provided in Chapter 10.

iii Cumulative air quality level

Clause 12AB(4) provides non-discretionary development standards relating to cumulative air quality. It states:

> The development does not result in a cumulative annual average level greater than 30µg/m^3 of PM_{10} for private dwellings.

An air quality and greenhouse gas study was prepared (Appendix G) which assessed the potential air quality impacts on residences surrounding the mine over the lifespan of the proposal. The study found that the proposal would not result in cumulative annual average levels greater than 30 µg/m^3 of PM_{10} at privately-owned dwellings not already afforded acquisition rights by neighbouring mines.

A detailed assessment of the air quality impacts of the proposal is provided in Chapter 11.

The noise and vibration study provided in Appendix F, assessed potential impacts from ground vibration levels under the proposed.

iv Airblast overpressure

Clause 12AB(5) provides non-discretionary development standards relating to air blast overpressure. It states:

> Airblast overpressure caused by the development does not exceed:
>
> (a) 120dB (Lin Peak) at any time, and
>
> (b) 115dB (Lin Peak) for more than 5 per cent of the total number of blasts over any period of 12 months,
>
> measured at any private dwelling or sensitive receiver.

The noise and vibration study provided in Appendix F, assessed airblast over pressure levels under the proposal. Predictions show that the proposal would not result in airblast overpressure levels greater than the above limits at all privately-owned assessment locations.

A detailed assessment of impacts of the proposal relating to air blast overpressure is provided in Chapter 10.

v Ground vibration

Clause 12AB(6) provides non-discretionary development standards relating to ground vibration. It states:

> Ground vibration caused by the development does not exceed:
>
> (a) 10mm/sec (peak particle velocity) at any time, and
>
> (b) 5mm/sec (peak particle velocity) for more than 5% of the total number of blasts over any period of 12 months,
>
> measured at any private dwelling or sensitive receiver.

The noise and vibration study provided in Appendix F, assessed potential impacts from ground vibration levels under the proposed. Predictions show that the proposal would not result in ground vibration levels greater than the above criteria at all privately-owned assessment locations.

A detailed assessment of vibration impacts of the proposal is provided in Chapter 10.

vi Aquifer interference

Clause 12AB(7) provides non-discretionary development standards relating to aquifer interference. It states:

> Any interference with an aquifer caused by the development does not exceed the respective water table, water pressure and water quality requirements specified for item 1 in columns 2, 3 and 4 of Table 1 of the Aquifer Interference Policy for each relevant water source listed in column 1 of that Table.
>
> Note. The taking of water from all water sources must be authorised by way of licences or exemptions under the relevant water legislation.

The standard refers to the AIP's minimal impact considerations for aquifer interference activities on the water table, water pressure and water quality of alluvial water sources. The potential groundwater impacts of the proposal have been assessed against these minimal impact considerations in the groundwater study (Appendix K). The study found that the proposal would take water indirectly from the Wollombi Brook alluvium and the Hunter River alluvium and directly from the Permian coal measures. This take would occur during the proposed mining period and post closure. The applicant would be required to hold relevant licenses from each water source to cover these predicted water takes.

The salinity levels of nearby water courses are not predicted to increase beyond the 1 per cent criteria stipulated in the AIP.

Therefore, the non-discretionary development standards relating to aquifer interference would be met.

A detailed assessment of the proposal's impact on groundwater is provided in Chapter 16.

7.2.5 Other relevant sections of the EP&A Act to the assessment and determination of the proposal

i Threatened species, populations and ecological communities

Section 5A of the EP&A Act relates threatened species, populations and ecological communities. It requires a number of factors to be taken into consideration in deciding whether a proposed action is likely to have a significant effect on threatened species, populations or ecological communities, or their habitats. These factors are listed in section 5A(2), as follows:

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

  (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

  (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

(d) in relation to the habitat of a threatened species, population or ecological community:

  (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

  (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

  (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

ii Authorisations not required or which cannot be refused for State significant development

Under section 89J of the EP&A Act the following authorisations are not required for SSD that is authorised by a development consent:

(a) the concurrence under Part 3 of the *Coastal Protection Act 1979* of the Minister administering that Part of that Act;

(b) a permit under section 201, 205 or 219 of the *Fisheries Management Act 1994*;

(c) an approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977*;

(d) an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974*;

(e) an authorisation referred to in section 12 of the *Native Vegetation Act 2003* (or under any Act repealed by that Act) to clear native vegetation or State protected land;

(f) a bush fire safety authority under section 100B of the *Rural Fires Act 1997*; and

(g) a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000*.

Should development consent be granted for the proposal, there are two authorisations which would have otherwise been necessary, but are not required due to the operation of section 89J, including:

- an authorisation referred to in section 12 of the *Native Vegetation Act 2003* (or under any Act repealed by that Act) to clear native vegetation; and
- an Aboriginal heritage impact permit under section 90 of the NP&W Act for impacts on number of Aboriginal sites.

While these authorisations are not required, impacts have been assessed in respect of these for the proposal and are provided in Chapter 12 and 18, respectively.

While applications for zero share water access licences are required under section 61(1)(b) of the WM Act, and additional water licence entitlements are required for predicted take from regulated water sources, no approvals are required under sections 89, 90 or 91 of the WM Act.

Further, under section 89K of the EP&A Act, the following authorisations cannot be refused if it is necessary for carrying out SSD that is authorised by a development consent, and are to be substantially consistent with that development consent:

(a) an aquaculture permit under section 144 of the *Fisheries Management Act 1994*,

(b) an approval under section 15 of the *Mine Subsidence Compensation Act 1961*,

(c) a mining lease under the *Mining Act 1992*,

(d) a production lease under the *Petroleum (Onshore) Act 1991*,

(e) an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act),

(f) a consent under section 138 of the *Roads Act 1993*,

(g) a licence under the *Pipelines Act 1967*.

Should development consent be granted for the proposal, the following authorisations must be granted consistently with an SSD approval due to the operation of section 89K, including:

- an extension to existing mining leases under the Mining Act to cover the surface to 20m depth required for the proposal (Mining Lease Applications 352 and 353 have already been lodged for these extensions); and

- consents under section 138 of the Roads Act 1993 (the Roads Act) for the construction of an underpass beneath Putty Road and for connection of private access roads to Golden Highway should this option be preferred.

iii Remaining provisions

Other sections of the EP&A Act which may be relevant to the proposal include:

- Section 23D which states the functions of the PAC including a request by the Minister or Director-General to 'review any (or any aspect or part of any) development, activity, infrastructure or project to which this Act applies' and 'hold a public hearing into any matter the subject of any such advice or review';

- Section 80 which states that the consent authority can determine a development application by either granting consent (unconditional or subject to conditions) or refusing consent;

- Section 80A which relates to the impositions of conditions of a development consent. This section provides that conditions may be imposed on a development consent if:

  - it relates to any matter referred to in section 79C(1) of relevance to the development the subject of the consent, or

  - it requires the modification or surrender of a consent granted under this Act or a right conferred by Division 10 in relation to the land to which the development application relates, or

  - it requires the modification or cessation of development (including the removal of buildings and works used in connection with that development) carried out on land (whether or not being land to which the development application relates), or

  - it limits the period during which development may be carried out in accordance with the consent so granted, or

  - it requires the removal of buildings and works (or any part of them) at the expiration of the period referred to in paragraph (d), or

  - it requires the carrying out of works (whether or not being works on land to which the application relates) relating to any matter referred to in section 79C(1) applicable to the development the subject of the consent, or

  - it modifies details of the development the subject of the development application, or

  - it is authorised to be imposed under section 80(3) or (5), subsections (5)–(9) of this section or section 94, 94A, 94EF or 94F.

- Section 94 which enables the consent authority to impose a condition requiring the applicant to provide a development contribution if the consent authority "is satisfied that development for which development consent is sought will or is likely to require the provision of or increase the demand for public amenities and public services within the area". As noted previously, section 93F enables the applicant to enter into a VPA with planning authorities in lieu of a section 94 contribution;

- Section 97 which states that an applicant who is dissatisfied with a determination can lodge an appeal in the L&E Court within six months after determination. If the appeal is against a deemed refusal under section 82(1), the appeal must commence within six months after the expiration of the relevant period; and

- Section 98 which allows an objector to appeal against a consent authority's decision to grant consent within 28 days of the notice of determination. Section 23F states that a decision made by the PAC cannot be challenged if it was made after a public hearing.

7.3 Other State legislation

7.3.1 Mining Act 1992

The Mining Act regulates the granting of mining leases and mining activities generally and, amongst other legislative instruments, places controls on methods of exploration and mining, the disposal of mining waste, and rehabilitation and environmental management activities.

The proposal applies to land within the footprint of existing leases under the Mining Act; namely, CCL 753, ML 1412 and ML 1590 held by WML, and CL 219 held by Miller Pohang Pty Limited. The majority of the proposed extension area is within CCL 753, with the southern part within CL 219. Within this area, CCL 753 and the section of CL 219 are subsurface mining leases granted in 1981. These mining leases do not include the surface to 20m depth. Mining Lease Applications 352 and 353 cover the surface to 20m depth required for the proposal; however, these are yet to be approved.

As previously stated, under section 89K of the EP&A Act, an application for a mining lease under the Mining Act cannot be refused if it is necessary for carrying out SSD that is authorised by a development consent.

The existing MOPs for these mining leases would be reviewed and updated as required in accordance with the proposal.

7.3.2 Protection of the Environment Operations Act 1997

The POEO Act is the principal NSW environmental protection legislation and is administered by the EPA. Schedule 1 of the POEO Act lists the 'scheduled activities' which are to be regulated by an EPL which includes criteria and monitoring requirements for licensed activities. Warkworth Mine currently holds EPL 1376 under the POEO Act. No variation to this license would be required under the proposal.

7.3.3 Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002

The HRSTS was introduced by the NSW Government to reduce salinity levels in the Hunter River, and operates under the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*. The integrated MTW is currently a Licence Holder and Scheme Participant of the HRSTS. Coal & Allied currently holds 146 credits (68 credits for Warkworth Mine and 78 credits for MTO) which entitles MTW to discharge to the Hunter River 14.6 per cent of the total allowable discharge of salt for a given period. The proposal would not require additional HRSTS credits to be purchased.

7.3.4 Roads Act 1993

The Roads Act regulates activities that may impact on public roads in NSW. Approval is required under section 138 of the Roads Act to carry out works in, on or over a public road. The applicant would require approval under section 138 for the construction of an underpass beneath Putty Road and for connection of private access roads to Golden Highway should this option be preferred. Both Putty Road and Golden Highway are classified roads administered by the Roads and Maritime Services (RMS). As identified above in Section 7.2.5.ii, consents under section 138 of the Roads Act cannot be refused and are to be substantially consistent with a development consent for SSD.

The proposal includes closure of Wallaby Scrub Road between Putty Road and Golden Highway (see Section 2.4.13). Under section 34(1) of the Roads Act, applications for the closure of a public road (other than a freeway) may be made:

(a) in the case of a Crown road, by any person, and

(b) in the case of any other public road, by the roads authority for the road or by any other public authority.

Wallaby Scrub Road is a public road for which the roads authority is Singleton Council. Should the proposal be approved, Coal & Allied would request that Singleton Council apply to the Minister for Roads and Ports to close Wallaby Scrub Road.

7.3.5 Dams Safety Act 1978

The NSW *Dams Safety Act 1978* (DS Act) applies to prescribed dams in NSW and establishes the Dam Safety Committee (DSC) responsible for ensuring the safety of such dams. The proposed extension area is outside of the notification areas for prescribed dams at MTW; however, proposed minor upgrades to water management infrastructure are within these notification areas.

7.3.6 Water Act 1912 and Water Management Act 2000

The Water Act regulates the issue and trade of water licences in NSW water sources where water sharing plans have not yet commenced. This includes a water licence or authority to extract groundwater under Part 5 of the Water Act.

The WM Act regulates the use and interference with surface and groundwater in NSW and applies to those water sources which are managed by an operational water sharing plan. The proposal is within the Lower Wollombi Brook water source to which the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009 applies.

Water use and water management work approvals under sections 89 and 90, respectively, of the WM Act apply to the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009; however, these approvals are not required in respect of SSD. Activity approvals, including aquifer interference approvals, under section 91 of the WM Act do not currently apply to the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009.

Water licensing is addressed in Chapters 16 and 17, respectively.

7.3.7 National Parks and Wildlife Act 1974

The NSW *National Parks and Wildlife Act* 1974 (NP&W Act), administered by OEH, aims to conserve nature and objects, places or features of cultural value. An Aboriginal heritage impact permit is required under section 90 of the NP&W Act to knowingly destroy, deface of damage or knowingly cause or permit the destruction or defacement of or damage to, a relic or Aboriginal place.

The proposal would impact a number of Aboriginal sites (see Chapter 18). However, as identified above in Section 7.2.5.ii, an Aboriginal heritage impact permit under section 90 of the NP&W Act is not required for SSD.

7.3.8 Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act 1995* (TSC Act) aims to conserve biological diversity in NSW through the protection of threatened and endangered flora and fauna species and EECs. The potential impacts of the proposal on threatened species and EECs listed under the TSC Act are discussed in Chapter 12.

Part 7AA of the TSC Act establishes the biodiversity certification process for land within NSW. The BCAM (DECCW 2011a) was established under section 126S of the TSC Act. An application for biodiversity certification under the TSC Act may be made to the Minister by any planning authority. Further information on the BCAM process in relation to the proposal is provided in Chapter 12.

7.3.9 Native Vegetation Act 2003

The NSW *Native Vegetation Act 2003* (NV Act) frames the way native vegetation is managed in NSW by preventing broadscale clearing unless it improves or maintains environmental outcomes. Section 12 of the NV Act states:

> Native vegetation must not be cleared except in accordance with:
>
> (a) a development consent granted in accordance with this Act, or
>
> (b) a property vegetation plan.

The proposal would require the clearance of native vegetation (see Chapter 12). However, as identified above in Section 7.2.5.ii, an approval under section 12 of the NV Act is not required for SSD.

7.4 State plans and policies

7.4.1 Strategic Regional Land Use Policy

The NSW Government has released the SRLUP (DP&I 2012a) which aims to protect strategic agricultural land and valuable water resources in areas of regional NSW where mining and coal seam gas resources are prevalent. Seven regions in NSW to which the policy will apply have been identified; with a strategic regional land use plan will be prepared for each of these. The Upper Hunter Strategic Regional Land Use Plan was released in September 2012 and applies to the Site.

The Upper Hunter Strategic Regional Land Use Plan references the gateway process for SSD applications for mining on strategic agricultural land that require a new or extended lease. It states that gateway process is given statutory force through the Mining SEPP.

In April 2013, the NSW Government released the Interim Protocol (OEH 2013) which introduced a site verification process to enable mining and coal seam gas operators, and in some circumstances landowners, to verify if land is classified as BSAL. The Interim Protocol states that it was recognised that the strategic agricultural land map show BSAL at a regional scale, and because of this, it is important that appropriate processes are in place to provide for verification that particular sites are in fact BSAL.

Verification can apply to both mapped and unmapped BSAL areas. For applicants for State significant mining and coal seam gas proposals that are not located on mapped BSAL, the applicant may:

- apply for a site verification certificate to determine if any part of the project area meets the BSAL site criteria and would therefore be subject to the Gateway process; or
- elect to proceed straight to the Gateway process on the basis that their project area or part of the project area does contain BSAL.

The Interim Protocol was produced to outline the process for applying for a site verification certificate.

The strategic agricultural land map (Map 6) within the Upper Hunter Strategic Regional Land Use Plan indentifies a small portion of the eastern portion of CCL 753 as BSAL. As stated previously, a site verification certificate was issued confirming that the proposed extension area does not constitute BSAL. This application has been made in accordance with clauses 17C and 17D of the Mining SEPP and the process outlined in the Interim Protocol (OEH 2013).

7.4.2 Aquifer Interference Policy

The NOW released its AIP in 2012 which clarifies the requirements for obtaining water licences for aquifer interference activities under NSW water legislation including the Water Act and WM Act. The AIP considers and defines minimal harm criteria for productive and less productive aquifers. The purpose of the AIP is assist proponents/applicants of aquifer interference activities in preparing the necessary information and studies to be used by the Minister in the assessment of project proposals that have some level of aquifer interference. Furthermore, the AIP forms the basis of the assessment and subsequent advice provided by the Minister (or NOW) at the various stages of an assessment under the EP&A Act. The AIP is associated with the SRLUP, discussed above, and can be used to inform the gateway process. Consideration of the proposal against the requirements of the AIP is provided in Chapter 16.

7.4.3 Hunter-Central Rivers Catchment Action Plan

The Hunter-Central Rivers Catchment Management Authority released its updated Catchment Action Plan in 2013. The Plan aims to deliver healthy and productive catchments and identifies actions to be implemented over a 10 year period. The Hunter-Central Rivers region covers 3.7 million ha and includes the Site. Accompanying the Plan are a number of 'regional assessment maps' which map key focus areas relating to land and soils, freshwater, biodiversity, estuaries and marine areas.

The Site is mapped as a 'Soil Degradation Risk Area', as is a large portion of the region. Soil degradation is taken to mean a reduction in the physical and chemical qualities of the soil which may lead to those soils becoming less useful to agriculture or biodiversity or which may lead to the loss of these soils through erosion. In addition, the degradation and erosive processes may have downstream impacts on water quality and the viability of ecosystems in receiving waters. The proposal's ecological, agricultural, groundwater, and surface water impacts have been assessed in Chapters 12, 14, 16 and 17, respectively.

Part of the Site is also mapped as a 'Vegetation Connectivity Focus Area' which are areas within the region where actions can be undertaken to improve vegetation connectivity. The proposal's impacts on habitat connectivity are assessed in Chapter 12.

7.5 Commonwealth legislation

7.5.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act aims to protect matters deemed to be of national environmental significance (MNES) including:

- world heritage properties;
- places listed on the National Heritage Register;
- Ramsar wetlands of international significance;
- threatened flora and fauna species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- nuclear actions (including uranium mining); and
- actions of development for coal seam gas or large coal mining on water resources.

If an action (or proposal) would, or is likely to, have a significant impact on any MNES, it is deemed to be a Controlled Action and requires approval from the Commonwealth Environment Minister or the Minister's delegate. To determine whether a proposed action would, or is likely to, be a Controlled Action, an action may be referred to the Department of the Environment.

As discussed in Section 2.1, there are two approvals under the EPBC Act in place for Warkworth Mine comprising EPBC 2002/629 and EPBC 2009/5081. Approval of EPBC 2009/5081 was granted for the Warkworth Extension 2010 and its predicted impacts on listed threatened species and communities and listed migratory species. Disturbance and required offsets associated with the proposal are covered by EPBC 2009/5081. The proposal is exempt from requiring approval under the EPBC Act for impacts on water resources as it relates to an action approved by the Minister under Part 9 of the EPBC Act before 22 June 2013. Regardless, the proposal is not likely to have significant impacts on water resources as detailed in Chapters 16 and 17.

7.5.2 Native Title Act 1993

The *Native Title Act 1993* establishes that some Aboriginal and Torres Strait Islander people have rights and interests to their land that comes from their traditional laws and customs. The National Native Title Tribunal is responsible for maintaining a register of native title claimants and bodies to whom native title rights have been granted. Proposed activities or development that may affect native title are called 'future acts'. Claimants whose native title claims have been registered have the right to negotiate about some future acts, including mining and the granting of a mining lease, over the land the subject of their native title claim. All native title claim applications are subjected to a registration test and claims would only be registered if claimants satisfy a number of conditions. Where a native title claim is not registered a development can proceed through the mediation and determination processes, though claimants would not be able to participate in future act negotiations.

There are no native title claims or indigenous land use agreements relating to the Site. There is currently an unregistered claimant application (NC2013/006, NSD 1680/2013) which encompasses the entire Hunter Valley including the Site. As the proposal is within an existing mining lease, the future acts process under the *Native Title Act 1993* would not be triggered if this claim is accepted.

7.6 Summary of approval requirements

In summary, the proposal requires the following approvals:

- development consent under Part 4, Division 4.1 of the EP&A Act and subsequent approval of any management plans required under any development consent;
- new mining leases under the Mining Act to cover the surface to 20m depth required for the proposal (Mining Lease Applications 352 and 353 have already been lodged for these);
- update to the MOPs for mining leases held under the Mining Act in accordance with the proposal;
- additional water access licence entitlements under the WM Act for predicted take from the Hunter Unregulated and Alluvial Water Sources;
- approvals under section 138 of the Roads Act for construction of an underpass beneath Putty Road and for connection of private access roads to Golden Highway should this option be preferred; and
- an application to be made by Singleton Council to the Minister for Roads and Ports for closure of Wallaby Scrub Road.

Chapter 8

Stakeholder engagement

Chapter 8 — Stakeholder engagement

8 Stakeholder engagement

8.1 Introduction

This chapter provides an overview of the ongoing stakeholder engagement conducted by Coal & Allied and summarises the stakeholder engagement programme developed for both the proposal and the Mount Thorley Operations 2014 and the outcomes of its implementation.

8.2 Overview

There has been a long history of consultation between Coal & Allied and key stakeholders as part of its existing mining operations and previous Warkworth Mine proposals in 2003 and 2010. During this time, Coal & Allied has built robust relationships with the communities in which it operates and has assisted in the contribution to their long-term sustainability.

A comprehensive stakeholder engagement strategy is in place for MTW and is implemented by Rio Tinto Coal Australia's Community Relations team. The key goals of the stakeholder engagement strategy are to ensure the timely provision of relevant and clear information and to create a process that provides opportunities for stakeholders to express their views and allows timely feedback on any matters raised.

Engagement tools implemented by Coal & Allied on an ongoing basis include:

- shopfronts in Singleton and Muswellbrook and a freecall information line (1800 727 745) to provide the community with the opportunity to provide feedback, both positive and negative, relating to Coal & Allied's operations in the Hunter Valley;
- Coal & Allied's website (www.riotintocoalaustralia.com.au) which contains information on mine operations and management, environmental monitoring results, project applications, community engagement and contact details;
- quarterly newsletters distributed to all residents within the Singleton LGA which provide information on Coal & Allied's mining operations in the LGA, including upcoming projects; and
- MTW's Community Consultative Committee (MTWCCC), which meets regularly to discuss mining operations and environmental performance, and comprises representatives of the community, Singleton Council and Coal & Allied.

An extensive consultation programme specifically for the proposals has been carried out. The programme and its outcomes are discussed further in this chapter.

8.3 Consultation requirements

The consultation programme implemented for the proposal was undertaken with consideration of the then Department of Planning's (now DP&E) *Guidelines for Major Project Community Consultation* (2007).

The Secretary's requirements for the proposal also required consultation with relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners.

8.4 Stakeholder engagement process

8.4.1 Stakeholder identification

The list of all stakeholders previously engaged through implementation of the MTW stakeholder engagement strategy was updated to include new stakeholders likely to be relevant to the proposal. Key stakeholders engaged as part of the consultation process were:

- near neighbours;
- community/interest groups;
- business groups and local businesses;
- mining industry employees/suppliers;
- Aboriginal/cultural heritage stakeholders;
- environmental groups;
- MTW employees/suppliers;
- local Government;
- State Government;
- non-government organisations (NGOs) and not-for-profit (NfP) organisations;
- media;
- health, education, community, emergency services; and
- other.

Subsequent to the identification of the stakeholders, they were assessed to further understand the extent to which the various parties were likely to be affected by and/or have an interest in the proposal. The results were used to inform the development and timing of appropriately tailored engagement strategies.

8.4.2 Stakeholder engagement

The stakeholder groups identified and the engagement activities used are presented in Table 8.1. A range of formal and informal stakeholder engagement tools were applied, including phone calls, emails, meetings and briefing sessions, community information sessions and a fact sheet. This engagement builds on stakeholder engagement that has been ongoing since August 2009 in relation to extension of mining at Warkworth Mine.

Table 8.1 Stakeholders and engagement activities

Stakeholders	Engagement activities
Near neighbours and communities	• One-on-one meetings • Drop-in information sessions • Project fact sheet • Phone and email correspondence • Community information session at Bulga Community Hall
Government agencies	• Face-to-face meetings • Briefing sessions • Letter, email and phone correspondence
State and Federal political members	• Face-to-face meetings
Local Government (including mayor, individual councillors and council officers)	• Face-to-face meetings • Briefing sessions • Email and phone correspondence • Project fact sheet
MTW employees	• Employee survey • Face-to-face meetings • Project fact sheet • Drop-in information sessions
Singleton LGA residents, local business and community groups and organisations	• Supplier survey • Face-to-face meetings • Drop-in sessions • Project fact sheet • Briefing sessions • Phone correspondence • Community information session at Coal & Allied's Singleton shopfront • Phone correspondence • Community information session
Service providers (utilities, emergency services, employment and training)	• Face-to-face meetings • Drop-in information sessions • Email and phone correspondence • Project fact sheet • Community information session
Local environmental groups	• Face-to-face meetings • Project fact sheet • Phone correspondence • Community information session
Aboriginal heritage groups	• Face-to-face meetings • Briefing sessions • Letter, email and phone correspondence • Community information session • Site visit

Table 8.1 Stakeholders and engagement activities

Stakeholders	Engagement activities
European heritage groups	• Face-to-face meetings • Briefing sessions • Letter, email and phone correspondence • Community information session • Site visit
Other NGOs and NfP organisations	• Face-to-face meetings • Drop-in sessions • Briefing sessions • Project fact sheet

8.5 Community consultation

8.5.1 General

As outlined in Section 8.2, an engagement programme with the local community was developed by Coal & Allied to promote open and transparent communication and consultation processes throughout the preparation of this EIS.

The engagement programme enabled any stakeholder interested in or with feedback on the proposal or the EIS process to notify Coal & Allied about their matters of interest via a freecall phone number or dedicated email inquiry line, which were advertised on all communication materials. Any matters raised were recorded in a central database and followed up by the Rio Tinto Coal Australia & Allied Communities Relations team, and where relevant, the social impact assessment specialists, to discuss or respond to the matter.

8.5.2 One-on-one consultations

One-on-one consultations were carried out primarily with near neighbours and community members to assess social impacts and opportunities and to help formulate mitigation strategies (see Chapter 21). The one-on-one consultations were carried out during preparation of the EIS.

Matters raised during these sessions can be found in Table 8.3.

8.5.3 Newsletters

An information factsheet on the proposal was developed and distributed to all households in the Singleton LGA from 22 March 2014. The factsheet provided notification and overview of the proposal and assessment process and outlined the forthcoming consultation programme. Complementary to this information fact sheet, regular media releases and articles were also used to notify local communities of the proposal, assessment details and consultation activities.

8.5.4 Local social surveys

Two drop-in sessions were held on 27 March 2014 (between 12pm and 3pm at the Bulga Community Hall and between 5pm to 8pm at the Singleton Library) and on 28 March (between 8.45am and 12pm at the Singleton Library) to enable member of the community to access information on the proposal and to complete surveys to inform the social assessment.

8.5.5 Community information sessions

Two community information sessions were held during April 2014. The sessions offered stakeholders a chance to provide feedback and input into the social impact assessment (SIA) process.

An attendance register was set up at the entrance of the venues to record attendees and feedback forms were distributed to provide a formal mechanism for receiving comments and also to determine the most appropriate method to further engage with the attendees.

a. Bulga community information session

The first community information session was held at the Bulga Community Hall on 15 April 2014. A total of 43 people attended, mainly from the Bulga village. Feedback was captured on the day with details of the attendee's matter(s) of concern.

b. Singleton shopfront community information session

The second community information session was held at the Coal & Allied Shopfront at Singleton on 16 April 2014. There were no attendees to this session.

Matters raised during both community information sessions are discussed in further detail in Section 8.9.

8.5.6 Coal & Allied community shopfront

Coal & Allied maintains a community shopfront in the main street of Singleton (127 John Street). Information provided in the community information sessions was made available at the shopfront and would remain accessible for the duration of the proposal, together with new and updated information as it becomes available, such as copies of this EIS.

The shopfront is open during normal business hours and is continuously staffed. Access to the shopfront outside normal business hours is facilitated by contacting the Coal & Allied freecall information line on 1800 727 745.

8.5.7 Mount Thorley Warkworth Community Consultative Committee

The MTW CCC meets regularly to provide a forum for open discussion between the community, Singleton Council and Coal & Allied representatives. The MTW CCC discusses matters relating to the mining operation and environmental performance, thus keeping the community informed on these matters.

Members of the MTW CCC were personally contacted by Coal & Allied on 19 March 2014 prior to Coal & Allied's media release announcing its intention to lodge a development application for the proposal. The MTW CCC members were advised of the forthcoming consultation programme including the community information sessions and were encouraged to attend the sessions for further information. The proposals were also discussed at a meeting of the CCC on 12 May 2014. Minutes of this meeting are available on Rio Tinto Coal Australia's website.

8.6 Aboriginal community groups

Aboriginal stakeholders were consulted in accordance with OEH's (2010) *Aboriginal cultural heritage consultation requirements for proponents* and (2005c) *Draft Guidelines for Aboriginal cultural heritage impact assessment and community consultation* and under the auspices of the existing CHWG as part of the Aboriginal cultural heritage study for the proposal. This is discussed further in Chapter 18 and Appendix M.

8.7 Employees

Employees of Coal & Allied, including all employees of MTW, were informed of the proposal through a range of briefings, newsletters and toolbox talks.

In addition to the above, the social impact assessment specialists (EMM) carried out a MTW Supplier and Employee Contribution and Participation Surveys (SECAPS) during preparation of the EIS. The primary objective of the surveys was to gain insights into the ways in which MTW employees' and suppliers' contribute to, and participate in, the Hunter community.

The SECAPS were undertaken as part of the SIA process for the proposals and designed to provide further detail on the social impacts and opportunities of the proposals.

In total, 629 employees and suppliers completed the survey. The key findings of the survey are discussed in Section 21.2.2 and Appendix P.

8.8 Government consultation

In accordance with the Secretary's requirements (see Chapter 5), relevant local, State and Commonwealth government agencies and representatives were consulted to identify important matters to be considered in the EIS and seek guidance on assessment approaches and the application of relevant government policies to the proposal. Consultation undertaken with each level of government is described in the below subsections.

8.8.1 Singleton Council

In addition to ongoing regular consultation that occurs between Singleton Council and Coal & Allied, representatives from Coal & Allied have met with Singleton Council on a number of occasions to specifically discuss the proposal during the preparation of the EIS. The matters discussed with Singleton Council include consideration of other mining designs, consideration of a buffer or bund on the western end of the proposal, and exploring opportunities to increase local residency of MTW's workforce in particular. Council have also raised consideration of alternates to the closure of Wallaby Scrub Road, and an appropriate approach to property acquisition in Bulga village.

Table 8.2 outlines summarises matters discussed with Singleton Council.

Table 8.2 Singleton Council consultation – matters discussed

Matters raised	Addressed in the EIS
Amenity impacts (noise and dust)	Sections 10.3 and 11.3
Vitality of Bulga community	Section 21.4
Health impacts (dust and water)	Sections 11.3.2,16.3 and 17.3
Closure of Wallaby Scrub Road (impact on emergency services) and consideration of alternatives	Section 20.3.2
Loss of WSW	Section 12.3
Loss of Aboriginal cultural heritage places, management of historic heritage	Sections 18.3 and 19.3
Potential for continued mining beyond the proposal limits to current mining lease extent	Section 23.2
Consideration of other mining designs (eg underground, buffers)	Section 23.2
Continued employment and flow-on benefits into Singleton	Section 9.4
Consideration of local employment strategy to increase local residency of workforce	Section 21.4
Appropriate acquisition programme that considers people affected	Sections 10.4 and 11.5
Consideration of water quality programme (ie roof and tank cleaning, filters, provision of town water supply)	Sections 16.4 and 17.5
Consideration of buffer/bund construction	Section 23.2
Rehabilitation, final landform (including final void) and post-mining land use	Chapter 13
Methodology and approach of economic assessment	Section 9.2

8.8.2 State government

As described in the Modification 6 EA, following the L&E Court decision WML undertook a review of its options with respect for Warkworth Mine and planning for the future with an objective to maintain production levels at or as close to existing levels. The DP&E has been consulted regularly prior to and during the preparation of the EIS as part of the longer term mine planning process, with initial briefings commencing in 2013. Initial briefings discussed proposal concepts and identification of key matters. The request for environmental assessment requirements was formally lodged with DP&E on 1 April 2014, with DP&E providing Sectary's requirements on 22 May 2014. Other meetings with DP&E during 2014 have considered and discussed assessment requirements and approach for key matters including ecology, noise, air quality and economics amongst other study areas and also the assessment process, more broadly.

Other agencies have been consulted with as appropriate on key matters including the OEH for biodiversity and the EPA for noise and air quality. Discussions with OEH focused on the new government policies for biodiversity offsetting and calculation of impact credits using BCAM, as amended by the UHSA, which have been developed by OEH to encourage a transparent methodology for calculating biodiversity loss and gain and support the strategic management of biodiversity. Consultation with the EPA has focused on the noise assessment in accordance with the INP, and in particular the determination of background noise levels, and the air quality assessment in accordance with the guidelines.

8.8.3 Commonwealth government

Further approvals under the EPBC Act are not required as the development the subject of this proposal already has EPBC Act approval (EPBC 2009/5081) and, accordingly, consultation with the Commonwealth Government was not undertaken for the proposal. Normal consultation regarding compliance with Warkworth Mine's EPBC Act approvals (EPBC 2009/5081 and EPBC 2002/629) is ongoing.

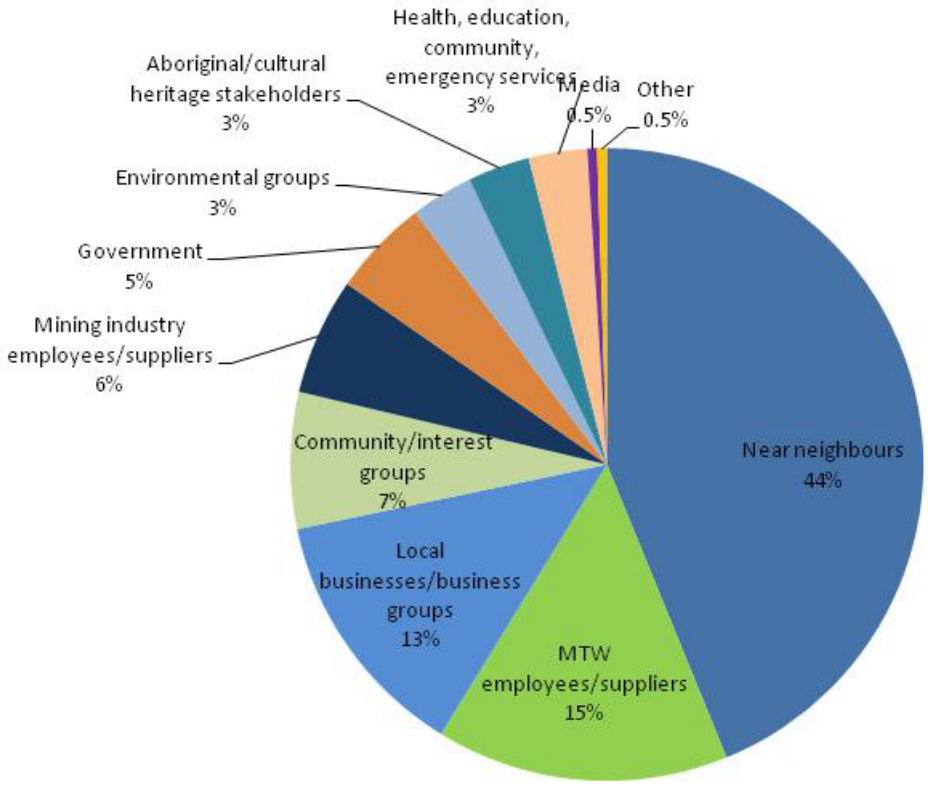
8.8.4 Other stakeholders

In addition to the above, other meetings were held with the following stakeholders:

- various Federal members of Parliament, including the member for Hunter;
- various State members of Parliament, including the member for Upper Hunter;
- neighbouring mines, including Bulga Coal Complex and Wambo Mine; and
- the RFS.

8.9 Matters raised during community consultation

Stakeholder engagement was carried out with a participation of 151 stakeholders. Figure 8.1 shows the range of stakeholder groups who participated in the consultation.



Notes: percentages are based on a total of 151 SIA participants. An individual may represent multiple stakeholder groups.

Figure 8.1 Stakeholder groups represented

A significant portion (51 per cent) of stakeholders that participated in the survey were from Bulga village. Other small villages around Warkworth Mine were also included in the consultation, namely Long Point, Gouldsville, Broke, Milbrodale and Warkworth. Approximately 28 per cent of stakeholders were from the town of Singleton and largely represented by businesses, services or local Government. A total of 21 per cent of the sample were either employees/suppliers of MTW mine or employees/suppliers of other mines in the region.

A summary of the matters raised during consultation and where each matter has been considered in the EIS is provided in Table 8.3.

Table 8.3 Summary of matters raised during consultation

Theme	Matters raised	Addressed in the EIS
Current operations		
	Effectiveness of noise monitoring, management and mitigation	Sections 10.2, to 10. 4
	Noise exceedances	Section 10.4
	Unsuitability of industrial noise limits in a rural area	Section 10.2.1
	Noise modelling and associated acquisition /mitigation zones does not reflect real areas of noise impact	Section 10.3
	Transparency of companies activities within the mining industry	Section 21.4
Social		
	Opportunities for community through retention of workers (and their families)	Section 21.4
	Inability to sell properties, property values, and related impacts on investments/assets	Section 21.4
	Uncertainty surrounding the acquisition process	Section 21.4
	Destruction of Bulga and Long Point/Gouldsville communities and community history	Section 21.4
	Fracturing of community due to property acquisitions and people moving away	Section 21.4
	Declining availability and use of community facilities due to declining population	Section 21.4
	Uncertainty and fear for the future of expanding mine closer to their homes	Section 21.4
	Reducing sense of place/community cohesion with continued declining population	Section 21.4
	Impacts on rural community sustainability/intergenerational equity	Section 21.4
	Increasing cumulative impacts on residential amenity due to removal of Saddleback Ridge and from current and neighbouring operations	Sections 15.3 and 21.4
Noise and vibration		
	Impacts on community from road traffic noise as a result of the closure of Wallaby Scrub Road	Section 10.4.6
	Increasing noise impacts and effects from low frequency noise	Section 10.4.4
	Cumulative noise of Warkworth Mine and surrounding mines adversely affecting assessment locations	Section 10.4.5
	Increasing frequency and scale of blasting/vibrations impacts	Section 10.4.7
Air quality		
	Health impacts from poor air quality (dust) on respiratory illnesses	Section 11.3.2
	Decreasing air quality from increasing dust emissions, unrehabilitated and exposed lands	Sections 11.3.2

Table 8.3 Summary of matters raised during consultation

Theme	Matters raised	Addressed in the EIS
Economic		
	Decreasing property values or complete devaluation of properties making them worthless to sell	Section 21.4
	Increasing loss in family savings or ability to fund retirement and future aged care needs due to decreasing property values	Section 21.4
	Inability to get local real estate agents to value and market their properties	Section 21.4
	Balancing mining needs with other industries in terms of diverse land use and skills base	Section 21.4
	Ensuring sufficient productive lands remain for future use and productivity	Sections 13.3 and 13.4
	Maintaining employment and training opportunities at MTW	Section 21.4
	Continuing economic sustainability of the Singleton and Hunter region	Section 9.4
	Maintaining community sponsorship and investment at MTW	Section 21.4
Traffic and transport		
	Increasing travel times due to closure of Wallaby Scrub Road	Section 20.3.2
	Increasing traffic on perceived accident hotspots areas due to closure of Wallaby Scrub Road	Section 20.3.2
Population, housing, infrastructure and services		
	Maintaining employment to halt declining Singleton LGA population	Sections 1.4.13, 9.4 and 21.4
	Impacts of closure of Wallaby Scrub Road on accessing community services, safety and access	Section 20.3.2
	Increasing population decline and impacts on existing community services	Section 21.4
	Population change and its affect on sense of community and cohesion	Section 21.4
	Increasing numbers of unoccupied dwellings, thus affecting community amenity	Section 21.4
Groundwater		
	Impacts on groundwater systems	Section 16.3
	Impacts on the general hydrogeological system of the Bulga, Milbrodale and Broke areas	Section 16.3
	Subsidence caused by aquifer changes	Section 16.3
Surface water		
	Potential for continued deterioration of the Wollombi Brook and affect on agricultural production and recreational activities	Section 17.4
	Increasing affected watercourse through increased salinity, sediment (through erosion and subsidence) and dust deposition	Sections 11.3 and 17.4
Ecology		
	Loss of WSW	Section 12.3
	Effectiveness of rehabilitation practices	Section 13.4
	Impacts from further land clearing	Section 12.3
	Uncertainty regarding the feasibility of proposed restoration of degraded land in offsets	Section 13.4.2

Table 8.3 Summary of matters raised during consultation

Theme	Matters raised	Addressed in the EIS
Visual and lighting		
	Increasing visual and lighting impacts, especially on elevated properties from vegetation removal	Section 15.3
	Impacts on surrounding viewpoints – designated tourist roads and main roads	Section 15.3
	Potential impact on the nature of the visual character of the surrounding area	Section 15.3
Aboriginal cultural heritage		
	Disturbance and loss of Aboriginal cultural heritage	Section 18.3
	Impacts on cultural heritage values	Section 18.3
Historic heritage		
	Impacts on historic heritage; ie the Great North Road	Section 19.3
Community engagement/relationship		
	Increasing poor relations between community and Coal & Allied	Section 21.4
	Mistrust with NSW Government and DP&E (eg rescinding Deed of Agreement (2003))	Section 21.4
	Positive steps with consultation associated with SIA	Section 21.4

Chapter 9

Economics

Chapter 9 — Economics

9 Economics

9.1 Introduction

This chapter provides a summary of the economic study for the proposal prepared by BAEconomics, which is presented in full in Appendix E. The chapter describes the methodology and results of the two components of the economic study, a CBA and REIA.

The economic study considered the combined economic impacts of both the proposal and the Mount Thorley Operations 2014 proposal (together the 'proposals'). This was done as the two mines, while having separate ownership, are both managed by Coal & Allied. However, the two mines are approved separately and, therefore; the relative contributions of the two mines were also examined.

As described in Chapters 2 and 6, the resource is of economic significance as per the matters outlined in clause 12AA(2) of the Mining SEPP. These matters, as shown in Table 9.1, set the context in which the proposal was assessed in the economic study.

Table 9.1 Matters in clause 12AA(2) of the Mining SEPP regarding the proposal

Entity	Employment generation (Annual average FTEs)	Incremental expenditure ($M NPV)[1]	Incremental royalties ($M NPV)[1]
Warkworth Mine	1,187	5,723	567
Integrated MTW	1,307	6,020	617

Notes: 1. Figures in the table are the differences between the reference case (ie the proposals not being approved) and the proposal (refer to Section 9.2.3). Note this is unlikely to eventuate as the base case is unlikely to be economically viable.

The economic study identified the proposals would deliver combined net benefits to NSW of around $1.5billion. These net benefits would take the form of:

- additional disposable income received by MTW employees and long-term contractors who live in NSW;
- additional coal royalties paid to the NSW Government; and
- additional payroll taxes, council rates and other payments that accrue to State and local government.

The economic study indicates that about 90 per cent of additional income and 93 per cent of additional employment contributed by the combined proposals can be attributed to Warkworth Mine, with the remainder attributable to MTO. The direct economic benefits of Warkworth Mine, in terms of contribution to NSW GSP, amount to $1,339million in NPV terms. The flow-on benefits attributable to Warkworth Mine amount to:

- for NSW, around $346million in additional income in NPV terms, additional annual employment of 191 full-time equivalent workers, and a contribution to NSW GSP of around $406million;
- for the Mid and Upper Hunter region, around $204million in additional income in NPV terms, and additional annual employment of 198 full-time equivalent workers; and

- for the Singleton LGA, around $75million in additional income in NPV terms, and additional annual employment of 57 full-time equivalent workers.

As noted in Section 2.4.15.i, the reference case is provided as a basis for conservatively evaluating the incremental value of the proposal. However, the reference case is not likely to eventuate as mining under this scenario would not be economically viable due to extraction constraints from the reduced strike length in West Pit.

9.2 Methodology

9.2.1 Justification for a combined economic study

Warkworth Mine and MTO are separate mines with different ownership and separate development consents. However, the majority owner of both is Coal & Allied which is also the manager of both mines. Given the same management the mines are able to function as an integrated operation and share the use of a number of resources and infrastructure. These include a joint workforce and management team, water, coal handling and processing plants and reject management infrastructure, as well as other facilities. The proposals would also involve some production of coal within the consent boundary of MTO that can only be economically accessed from Warkworth Mine. From an economic perspective, therefore, the value added generated by the two mines is created jointly.

Preparing separate CBAs for the proposals does not reflect the current operations of the mines, since ROM coal and waste may be processed either at Warkworth Mine or at MTO, depending on circumstances and what is more efficient, and since product coal produced at Warkworth Mine and destined for export is loaded onto trains at MTO. Preparing separate CBAs, therefore, requires additional assumptions about how the two mines would operate and interact in future, the derivation of transfer prices in order to cost the services that MTO would provide to Warkworth Mine, and how shared costs should be allocated to each mining operation. These assumptions involve a degree of judgement.

For the above reasons, one CBA has been prepared for the integrated MTW. However, in order to provide an indication of the respective contributions of the two mines to the economic benefits of the proposals, the direct benefits to NSW and the state, regional and local flow-on effects that can be attributed to Warkworth Mine and MTO have also been separately identified in the economic study in Appendix E.

9.2.2 Components

The CBA considers the direct costs and benefits accruing in NSW from the proposals. For instance, from additional value added in the form of wages and salaries paid to employees and contractors. The REIA identifies the likely incremental flow-on effects of the proposals on the NSW economy, the Mid and Upper Hunter region and Singleton LGA. These effects refer to the adjustments in the local, regional and state economies that follow from initial changes in the level of demand for goods, services and wages that result from the proposals, if they are approved.

The Mid and Upper Hunter region comprises the Singleton, Upper Hunter, Muswellbrook, Cessnock and Maitland LGAs. Around 74 per cent of MTW employees live in the Mid and Upper Hunter region, and 22 per cent live in other LGAs in the Hunter Valley region. Overall, 99 per cent of MTW employees live in NSW.

9.2.3 Scenarios considered

Two scenarios were considered under the economic study to allow for comparison of economic impacts with and without the proposals. These scenarios are as follows:

1. reference scenario – where development applications for the proposals are not approved. Coal production and employment at MTW would begin to decline from 2016 onwards and would end by 2021 (mining at MTO would cease by 2017 as per its existing development consent); and

2. proposal scenario – where development applications for the proposals are approved. Production and employment would continue at the current level until around 2030 and then decline by the end of 2035 when production ceases and operations decrease for expected closure.

It should be noted that mining at Warkworth Mine's West Pit is expected to reach the existing consent limit in 2015, at which point production may no longer be economically viable. The reference case is, therefore, considered to be 'optimistic' as it is unlikely that an economically viable mine would continue operation, and the estimated net benefits can correspondingly be interpreted as being conservative.

9.2.4 Context of economic study

The external effects considered in the economic study were based on the key potential environmental impacts and mitigation measures identified for the proposals. The key environmental impacts and mitigation measures for the proposal alone are detailed in Appendix B of the economic study (see Appendix E). The external effects of the proposal and the approaches adopted in valuing their likely effects are detailed in Section 3.2 of the economic study (see Appendix E).

9.2.5 Limitations of models

i Limitations of input-output analysis

The principal advantage of the impact multiplier method is the simplicity with which levels of mining investment, employment and output can be translated into measures of changes in regional income and employment. However, the accounting conventions that form the basis of input-output models, and hence how multipliers are derived, impose a number of restrictive assumptions. Some of these assumptions pertain to input analysis generally while others relate to the use and interpretation of input-output analysis at a regional/state, as opposed to a national level. The key assumptions are set out in the subsections below.

It is because of these assumptions that it is acknowledged that the economic models are a tool only to assist the consent authority in respect of determining the proposal, which is consistent with the L&E Court judgement (par. 19).

a. Fixed capital stocks

The National Accounts, on which input-output analysis is based, do not explicitly account for fixed capital stocks. This is an issue with input-output analysis generally as fixed capital has a significant impact on how an industry adjusts over time. It also follows that input-output analysis is static in the sense that it takes no account of the time required for the composition of inputs and outputs of production to shift to a changed level in output. Industries that require large amounts of fixed capital and labour adjust slowly, particularly when they are near full employment or when the supply of skilled labour is tight. These dynamics are hard to predict, but the implication over the short- to medium-term is that input-output effects will be overstated to varying degrees across industries.

The fixed nature of the capital stock is a critical issue in REIAs. In moving from the national to a state or regional level, the location of fixed assets becomes increasing important in establishing the goods and services that are supplied locally and those which are imported. Moreover, there is no information as to whether fixed assets are owned locally or whether the owners are outside the region or state. As a consequence, it becomes increasingly difficult to determine the valued added by local industry.

b. Supply constraints

When the initial impact considered is an increase in production, the assumption of fixed production patterns requires that there is a sufficient endowment of resources that is either available in (or able to migrate to) a region, to meet the increase in demand for inputs whose supply is fixed. These inputs include resources such as land and water, as well as labour with adequate skills. If there is a reduction in production, as is the case here in the reference case, some or all of the fixed resources may be deployed elsewhere within or outside the region of interest. The return to these fixed resources is likely to be lower. However, if these next best opportunities are not taken into account, the costs of foregoing the proposals will be overstated, which is consistent with the L&E Court judgement (par. 456).

c. Homogenous and fixed production patterns

The input coefficients that measure inter-industry flows between sectors are 'fixed' in input-output models; at any level of output, an industry's relative pattern of purchases from other sectors is unchanged. These assumptions are likely to be inconsistent with production patterns in the local economy, since the local economy may not have on offer the range of inputs required for a given industry. Therefore, the impact of the change in output on the local economy will differ from that implied by a national multiplier.

d. Fixed prices

Input-output analysis assumes that prices in the economy in question are held constant, so that the additional material and labour inputs are available at existing prices and wage rates. In reality, prices of inputs may change with substantive changes in their demand. To the extent that there is an impact on prices, imputed output effects will be overstated. However, this is only a problem in input-output analysis for projects of a sufficient scale to materially shift the demand for inputs into production and the total supply of industry output.

ii Implications for the REIA

Many of the above assumptions can lead to an overstatement of the impacts of a project; the resulting regional impact estimates should therefore be interpreted as an upper bound of the likely effects.

Furthermore, and while, from a theoretical perspective, the total multiplier is the appropriate choice for calculating flow-on effects (since this measure takes into account the full adjustment of the economy to a change in economic activity), total multipliers are calculated in a manner that compounds any measurement errors and breaches in the assumptions that underpin the analysis. For example, total multipliers are calculated as a progression of first, second and successive round effects, with each embodying any errors in earlier effects. From this perspective, a more conservative approach is to rely only on multipliers that capture first round effects.

As noted above, there are additionally specific issues that arise in deriving value added multipliers. Value added includes profits that are distributed on the basis of ownership of capital assets, which becomes increasingly uncertain as the analysis becomes more granular. The calculation of value added at a regional level is therefore not meaningful.

9.3 Cost benefit analysis

9.3.1 Examining welfare implications on NSW

The *Guideline for the use of Cost Benefit Analysis in mining and coal seam gas proposals* (NSW Government 2012) recommends that applicants for mining and coal seam gas proposals submit a CBA with their applications. The purpose of the CBA is to examine the welfare implications of the application on NSW. The *Guideline for economic effects and evaluation in EIA* (Planning NSW 2002) furthermore recommends that, if a proposal is predicted to have significant economic impacts at a regional or state scale, these regional or state-wide effects should be formally assessed.

From an economic perspective, the extent to which a project contributes to the welfare of a country or state is measured with reference to value added. Value added is the additional value of goods and services newly created in an economy and available for domestic consumption or for export. Value added is a central concept in the Australian System of National Accounts (ASNA), where it is referred to as 'gross value added' to emphasise that this measure is gross of the consumption of fixed capital (that is, depreciation).

Gross value added is the difference between output and intermediate inputs (the value created by production), and equals the contribution of labour and capital to the production process (ABS 2013). Subject to adjustments that need to be made to ensure that valuations are internally consistent by accounting for various taxes and subsidies, the sum of gross value added across all industries in a country or state equals GDP or GSP, respectively. The economic impact of the proposals has therefore been evaluated with reference to its contribution to NSW GSP.

As previously described, the REIA also considers two smaller regions, being the Mid and Upper Hunter region which comprises the Singleton, Upper Hunter, Muswellbrook, Cessnock and Maitland LGAs due to the vast majority of MTW employees living within these areas.

The formula used for deriving GSP is provided in Section 3.1.1 of the economic study (see Appendix E). Essentially it takes into account the change in GSP as a result of the proposals being approved and the incremental benefits accruing to NSW from:

- the additional salaries and wages paid to NSW employees and contractors of MTW;
- the share of MTW's GOS that can be attributed to NSW, including coal royalty payments; and
- the additional payroll taxes and land taxes/shire rates paid to the NSW Government and local government.

The GOS refers to the share of income from production that can be attributed to capital inputs for incorporated businesses.

9.3.2 Distributional effects

A classical CBA assessment does not consider the distribution of impacts across different segments of society. Notwithstanding, information about the distributional impacts of proposed projects (ie, the gains and losses for affected individuals and groups) is of interest to policy makers (Commonwealth Government 2006). Identifying distributional impacts is sometimes difficult because of data limitations; for example, increased corporate profits may be distributed to individual shareholders and to superannuation funds on behalf of other individuals so that the eventual beneficiaries are a diffuse group of individuals. As such, distributional effects are addressed as follows:

- in the context of the CBA, comments are made, where possible, on whether the identified impacts may occur at a local or state-wide level; and
- in the context of the REIA, the estimated flow-on effects are set-out both at a state-wide, and regional and local level.

9.3.3 Cumulative impacts

If the proposals are approved, the economic impacts would occur within a broader context where coal mining is already an important aspect of the local economy. The question then arises whether some of the impacts of the proposals may have broader regional implications that are not adequately captured using a conventional, incremental CBA approach. For instance, this could be an issue in relation to environmental impacts if some critical threshold is exceeded that may lead to wider adverse consequences, or if there are environmental interactions.

It is considered unlikely that cumulative impacts of this type are of concern in the context of the present proposals. Warkworth Mine and MTO have been in operation since 1981, and have been managed by the same management, Coal & Allied and, therefore, operated as an integrated operation since 2004. The impacts of the mining operations on the environment are well understood and are generally local in nature (excluding greenhouse gas emissions). Potential impacts on the WSW have been quantified in accordance with contemporary government policy and their tools and an offset provision has been proposed which would result in the overall long-term protection and enhancement of more than three times the amount of WSW than would be impacted. This would result in a conservation gain for the community in the region, with a net increase in the area of WSW and WSG protected and enhanced in the long-term.

Technical assessments have been prepared to assess these impacts, particularly additional impacts that may arise from the continuation of MTW and are the subject of other sections in this EIS.

9.3.4 Valuation of external effects

A CBA requires a full accounting calculation where the costs and benefits of a project are compared in monetary terms. This requires that costs and benefits should, as far as possible, be valued. As a general matter, CBA relies on the 'opportunity cost' principle to value goods or services (NSW Treasury 2007; Commonwealth Government 2006). In practice, the opportunity cost concept is made operational with reference to the 'willingness-to-pay' (WTP) criterion. For 'conventional', market-based transactions, such as the sale of coal outputs or the purchase of labour and other inputs, the relevant valuation approach is therefore the market price.

The *NSW Treasury Guidelines* (2007) require that 'external effects' (also referred to as 'externalities') are accounted for as part of societal benefits and costs. External effects are spillovers (positive or negative) from the production of a good or service, for example in the form of noise (negative spillovers).

External effects give rise to non-market impacts that are difficult to value. A variety of techniques have been developed to quantify these effects, including surrogate market (revealed preference) valuation techniques and hypothetical market (stated preference) techniques. These techniques aim to elicit estimates of either the WTP or the 'willingness-to-accept' (WTA) for a particular outcome. They differ in a number of ways, including in terms of the amount and detail of data that are required (which may or may not be available) and how reliable the results are (the extent to which they are subject to biases). Stated preference methods, in particular, which rely on surveys to elicit valuations, suffer from a number of well-known biases that often limit their validity and reliability (Pearce *et al.* 2006, Commonwealth Government 2006).

In contrast, and while such approaches cannot be applied in all circumstances and may not precisely capture the effect in question, the strength of revealed preference methods is that they are based on actual decisions made by individuals/households or other decision-makers. The economic study relied on market-based and revealed preference techniques for valuing the external effects associated with the continuation of MTW. The unifying characteristic of both techniques is that they aim to value non-market impacts by observing actual behaviour and are, therefore, considered to be a more reliable indicator of people's preferences.

The approaches adopted in valuing likely external effects of the proposal are detailed in Section 3.2 of the economic study (see Appendix E) and summarised below.

i External effects that can be internalised by MTW

External effects that can be internalised by MTW are non-market costs that can be accounted for through either financial instruments, or the creation of direct offsets.

a. Financial instruments

Financial instruments generally involve the compensation of affected individuals or payments for measures designed to mitigate or remove the impact of the external effect.

External effects that have been valued in this manner are:

- noise and air quality impacts;
- visual amenity impacts; and
- Aboriginal and historic heritage impacts.

Compensation may represent an under or overestimate of the value of the non-market impact on wellbeing. For instance, households predicted to be significantly affected (ie above government-prescribed criteria) by air and noise outcomes would be offered acquisition of their properties, in accordance with a process that generally results in prices that are above market values. In these cases it could be argued that the valuation of the corresponding external effects on that basis overestimates the impacts, although the affected landowners may have a (subjective) perspective of these impacts that may be lower or higher.

There are instances of more or less arbitrary cut-off points, for instance, because noise or dust criteria are exceeded at one location, but not at a different but nearby location. These types of boundary issues are essentially a function of environmental criteria that may deem one level of disturbance to be acceptable, but no longer tolerate a slightly higher level of disturbance. Irrespective of the criteria that may be set down in statutes or regulations, peoples' personal preferences may also vary, so that what may be an acceptable disturbance to some may be considered distressing by others. While these variations in perceived impacts should be acknowledged, there is no way in which they could be measured or assessed in a reliable manner, and the economic study in Appendix E has not attempted to do so. Again, it needs to be understood that the economic assessments are a tool to assist the consent authority which is consistent with the L&E Court judgement (par. 19) and the consent authority would need to consider these issues in their ultimate decision in respect of the proposal.

b. Market-based valuation (offsets)

Direct offsets refer to actions that are taken to deliver an outcome that is equivalent or preferable to the case in which the proposals do not proceed.

The cost of acquiring direct offsets or contributing funds under an established Government biodiversity agreement is pertinent to the valuation of ecological impact (ie progressive clearing of vegetation) including WSW, within the disturbance boundaries.

ii External effects that cannot be internalised by MTW

Some external effects cannot be addressed through direct compensation or offsets, but can be given an appropriate public value.

a. Valuation of traffic impacts

Road user costs have been used to value the impacts of closing Wallaby Scrub Road. Road user costs include the opportunity cost of drivers' travel time, which is estimated on the basis of labour costs and/or stated preference survey techniques; vehicle operating costs, which are typically computed for various representative vehicles; and accident costs, which refer to costs associated with pain and suffering, other economic costs, and various measures of property damage.

b. Publically determined values

The consequences (or outcomes) of government decisions reflect implicit choices or value judgements to achieve an outcome. For example, the price of water licences, as determined by government allocations and revealed through trades, gives an indication of the value attached to the use of scarce water resources.

The incremental effects on groundwater and surface water were valued using the cost of licences that MTW would need to acquire in order to compensate for any external effects. No groundwater or surface water licensing costs were incorporated into the analysis because no additional Permian groundwater licenses would be required in the future and it is highly uncertain whether additional surface water access licenses would be required in the future (ie dependent on future rainfall).

c. Greenhouse gas emissions

If the development applications are approved for the Warkworth Mine and MTO proposals, the mining and associated processes would give rise to an increase in greenhouse gas emissions (GHG).

The additional GHG emissions associated with the proposal and Mount Thorley Operations 2014 have been valued using 'social cost of carbon' (SCC), as determined by the *US Interagency Working Group on Social Cost of Carbon* (2013). The SCC is an estimate of the monetised damages associated with an incremental increase in carbon emissions in a given year. It includes changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change. The NSW share of damages associated with additional GHG emissions has been estimated with reference to the NSW GSP as a percentage of world GDP.

d. Threshold values

Threshold values are costs and benefits that cannot be addressed through direct compensation or mitigation and that cannot be given an appropriate public value. Threshold values provide an indication of the value that the non-market benefits of protecting a resource or asset would need to reach, in order to be in the community's best interest to forego the benefits. No external effects that may be considered to fall under this heading have been identified for the proposals.

9.3.5 Results

This section summarises the results of the CBA. As set out above, the proposals have been evaluated with reference to their impact on NSW GSP.

i Gross operating surplus accruing to MTW

As stated above, one of the components of NSW GSP is the share of MTW's GOS that can be attributed to NSW. Deriving the incremental benefits to NSW if the proposals are approved therefore requires that the net GOS associated with the proposals is identified (see Table 9.2). The GOS is calculated as output valued at producer prices, net of intermediate inputs (operating expenditure), net of employee compensation, and net of taxes on production (ABS 2013). The GOS resembles (but is not the same as) a corporation's earnings before interest payments, taxes and depreciation, and hence includes a number of components that are not explicitly listed in Table 9.2. These components include royalty payments, corporate income taxes, depreciation, interest payments and certain other expenses.

Table 9.2 indicates that the incremental GOS of the proposals is approximately $2.156billion in NPV terms. The relevance of this calculation is that a number of items that are 'costs' to MTW represent 'benefits' to NSW, as described in the subsection below.

Table 9.2 Gross operating surplus of the continuation of MTW

Costs	**NPV[1] ($M real 2014)**	**Benefits**	**NPV[1] ($M real 2014)**
Operating expenditure	$3,812	Value of mining output	$7,527
Compensation of employees and long-term contractors	$1,494		
Other taxes (net of subsidies) on production:	$65		
Total[2]	**$5,372**	**Total**	**$7,527**
Gross operating surplus[3]	**$2,156**		

Notes: 1. NPVs have been derived using a discount rate of 7 per cent.

2. Totals may not sum precisely due to rounding.

3. GOS includes royalty payments of $617million and company tax payments of $355million.

ii Net impacts on NSW gross state product

The net economic benefit of the proposals for NSW is estimated at approximately $1.5billion in NPV terms (see Table 9.3). The key components of these benefits are the additional wages and salaries paid by MTW to NSW employees, royalties, as well as various taxes paid by MTW (which directly or indirectly benefit NSW) which are also material.

Given that 74 per cent of MTW employees currently live locally (within the Mid and Upper Hunter region), an estimated $464million in NPV terms of the additional disposable income generated by the continuation of MTW would benefit the local regional economy, as would the additional land taxes/shire rates paid by MTW (around $10million in NPV terms).

With the exception of those arising from traffic impacts, which have been valued separately, external effects have generally been valued on the basis of the financial payments made by Rio Tinto or on the basis of offsets.

Table 9.3 Incremental (economic) costs and benefits of the proposals for NSW

Costs, NPV	($M real 2014)	Benefits,	NPV ($M real 2014)
Production-related impacts			
		Compensation of employees/ contractors accruing to NSW:	
		Disposable income	$612
		NSW share of personal income tax receipts	$78
		NSW share of Medicare receipts	$2
		Share of MTW GOS accruing to NSW:	
		Royalties	$617
		Income to NSW shareholders of Rio Tinto Coal Australia	$12
		NSW share of company taxes paid by MTW	$116
		Taxes on production and imports:	
		Payroll taxes	$61
		Land taxes/shire rates	$5
Total production-related costs	**$0**	**Total production-related benefits**	**$1,501**
External effects			
Noise and vibration	$15	Zone of mitigation work, noise attenuation	$15
Visual amenity	$2	Visual amenity upgrades	$2
Noise and air (general)	$3	Acquisition of properties	$3
Aboriginal heritage	$1	Cultural Heritage Facility	$1
Ecology	$10	Acquisition of offsets	$10
Traffic impacts	$13	Traffic impacts	$0
Groundwater	$0	N/A	$0
Surface water	$0	N/A	$0
European heritage	$0.5	Heritage trust, Great North Road	$0.5
GHG emissions	$0.5	GHG emissions	$0

Table 9.3 Incremental (economic) costs and benefits of the proposals for NSW

Costs, NPV	($M real 2014)	Benefits,	NPV ($M real 2014)
Total external effects costs	**$45**	**Total external effects benefits**	**$31**
Total societal costs	**$45**	**Total societal benefits**	**$1,533**
Net economic benefits	**$1,488**		

Notes: *NPVs have been derived using a discount rate of 7 per cent.*

Detailed calculations to derive production-related benefits that can be attributed to NSW are set out in Appendix A of the economic impact assessment (see Appendix E).

Description and rationale for the valuation of external effects are set out in Appendix B of the economic impact assessment (see Appendix E).

Totals may not sum precisely due to rounding.

A number of adjustments have been made to ensure that production-related benefits are appropriately attributed to NSW. These adjustments are described in Section 3.3.2 of the economic study (see Appendix E).

9.3.6 Sensitivity analysis

The CBA is based on a number of assumptions around which there is some level of uncertainty. This can be addressed by changing the values of critical variables in the analysis to determine the effect on the results and this is known as a sensitivity analysis.

The sensitivity of the results of the CBA by applying variations to:

- the discount rate;
- coal prices and exchange rates; and
- re-employment assumptions.

Under all sensitivities tested the proposal remains strongly positive in terms of economic contribution to NSW.

i Discount rate

In accordance with the *Guideline for the use of Cost Benefit Analysis in mining and coal seam gas proposals* (NSW Government 2012) discount rates of 4 and 10 per cent per annum were applied to the results of the CBA (a rate of 7 per cent was assumed in the CBA). Application of these rates indicates that material net benefits would accrue to NSW irrespective of which discount rate is used. For example, increasing the discount rate from 7 to 10 per cent (that is, discounting the future more heavily) reduces the overall estimate of the value of the proposal to NSW but even with a high discount rate of 10 per cent the net present value of the proposal remains strongly positive. Lowering the discount rate to 4 per cent increases the NPV of the proposal to NSW to just over $2billion.

ii Coal prices and exchange rates

Most of MTW's coal production is exported overseas, and is priced in US dollars. Different combinations of coal prices and US$/A$ exchange rates would therefore affect MTW's GOS, including corporate income tax payments and royalty payments to NSW.

In the CBA a thermal coal price of US$85 per tonne and an exchange rate of US/A$0.85 was assumed. Accordingly, a number of variations to the coal price and exchange rate assumptions for the CBA were applied to test their sensitivities to the result. For example, if the thermal coal price changed to US$75 per tonne and the exchange rate changed to US/A$975. The results can be seen in Tables 3.5 and 3.6 of the economic study (see Appendix E).

The results of the sensitivity analysis shows that royalties paid to the NSW Government and the production benefits of the proposal are moderately sensitive to variations in exchange rate and coal price assumptions. For example, at a coal price of $US75/t a reduction in the exchange rate from A95c to A75c would lead to an increase in the net present value of royalty payments to the NSW Government of $133million and at an exchange rate of A75c an increase in the coal price from $US75/t to $US95/t would lead to an increase in the net present value of royalty payments of $170million.

iii Re-employment assumptions

A matter referenced in the L&E Court judgement (par. 456) discussed linkages between sectors of the regional economy, particularly with regard to the assumptions made for movement of employment to cater for the proposal. For the CBA, it was assumed that:

- 30 per cent of employees and contractors who would be made redundant by the closure of MTW would find employment elsewhere within NSW in the same year, and 40 per cent of these employees and contractors would find employment in NSW in the year after being made redundant (at the weighted-average wage and salary income reported for the NSW and Mid and Upper Hunter region, respectively, by the ABS for the corresponding LGAs); and

- 70 per cent of any additional employees and contractors employed by MTW may move to MTW from other industries in NSW.

The implications of a number of variations in the re-employment assumptions for the CBA were varied to test their sensitivities to the result. For example, if:

- 50 per cent of employees and contractors who would be made redundant by the closure of MTW find employment elsewhere within NSW in the same year, and none in the year after being made redundant; and

- 100 per cent of any additional employees and contractors employed by MTW move from other industries in NSW.

The results of the sensitivity analysis show that significant employment and other benefits would accrue to NSW irrespective of the precise assumptions that are made about re-employment outcomes, and the extent to which any additional employment at MTW would draw workers from existing positions in NSW. This reflects both the substantial employment that would be generated if the proposals are accepted, and high wage and salary outcomes at MTW relative to average wages and salaries in the Mid and Upper Hunter region.

9.4 Regional economic impact analysis

9.4.1 Choice of analysis used

There are a number of methods that can be used for calculating flow-on effects from mine extensions. The methodology used relies on input-output analysis. The primary reason for selecting this methodology is simplicity and clarity with which the underlying assumptions can be set out and appropriate caveats made. When compared to more complex methods such as general equilibrium (GE) analysis, the gross value of the proposals is small in relation to the Australian and NSW economies. Unlike an input-output analysis, a GE analysis takes into account the price impacts of a project on inputs and outputs. However, given the relatively small size of the proposals (relative to the Australian and NSW economies) under consideration here, material price impacts would not be expected and the difference between the results of a GE and an input-output analysis should also be small.

Given the lack of information about industry structure and trade at a regional and state level, there is no reason to think that one method would be materially more accurate than another. Both GE and input-output analysis depend critically on accurately modelling flows of production and expenditure. As referenced in the L&E Court judgement (par. 19), they are a guide to, but not a determinant of the impacts of the proposals.

9.4.2 Adjusting regional/state industry composition and trade

Regional impact analysis depends, in large part, on adjusting the flows of production and expenditure, as represented by national input-output tables, to represent a state or regional economy. However, industries at a regional or state level have differing compositions of inputs and outputs than is the case for the national average; the same difficulty arises for specific projects within a region. Hence, a consistent set of ancillary information that is specific to national, state and regional economies is required to apportion national aggregates. The most commonly used information for this purpose (which is also recommended by the ABS) is industry employment.

As of 2011, the ABS has conducted a census of employment by industry and at the LGA level. This employment information can be used to calculate location quotients (LQs) to adjust national industry structure and trade flow data to derive the corresponding state and regional aggregates. Employment based LQs are ratios that indicate the percentage of people employed in a particular industry at a state/regional level, relative to the percentage of people employed in that industry in the economy as a whole. In the case of the Mid and Upper Hunter region, for instance, the employment based LQ indicates that the share of employment in the mining sector is significantly larger than it is for the Australian economy as a whole. Employment based LQs are then used to proportionally adjust the contribution of an industry to the use of intermediate inputs in a state or region. The consequent shortfall in intermediate inputs is made up by increasing 'imports' from outside the state or region across all industries.

The use of employment LQs has a critical limitation. Input-output tables do not explicitly account for fixed capital, human or physical, although the returns to these assets are implicitly reflected in wages and operating surpluses (profits). As the impact analysis becomes more granular, the geographic location of these fixed assets can become increasingly important. As identified in the L&E Court judgement (par. 19), a region may simply not have the fixed assets needed to cost-effectively produce the input required by a local industry and as a consequence they would be 'imported' from other regions, states, or from overseas.

9.4.3 Interpretation of input-output multipliers

A change in demand sets the economy in motion as the productive sectors buy and sell goods and services from one another and households earn additional incomes, which gives rise to further flow-on effects (Coughlin *et al.* 1991). These relationships cause the total effects on the regional and state economy to exceed the initial change in demand.

Regional economic impacts can be measured in terms of income, value added and employment, which in turn gives rise to income, value added and employment multipliers. In the case of the proposals:

- the income multiplier refers to the percentage change in total income arising per dollar change in the wages and salaries paid by MTW;
- the employment multiplier corresponds to the change in total employment (in numbers of full time equivalent workers) arising per additional person employed by MTW; and
- the value added multiplier refers to the percentage change in total value added arising per dollar change in the value added created by MTW.

Multipliers are classified into 'types'. Type I multipliers refer only to flow-on effects in the production sectors, while Type II multipliers incorporate subsequent impacts on households. In the case of the proposals:

- Type IA multipliers refer to the 'initial' and 'first round' effects arising from an increase in demand from MTW. The initial effect refers to the additional output from the proposals. The first round effect captures the immediate subsequent impacts on income, employment or value added from all industries whose output is required to produce the additional output from MTW.
- Type IB multipliers refer to the initial and 'production induced' effects, which encompass first round effects and additionally 'industrial support' effects. Industrial support effects capture subsequently induced effects that occur after the first round effects (since the initial output effect from MTW would induce additional output in other industries, which would in turn lead to further rounds of effects and so on).
- Type IIA multipliers incorporate the effects of the initial increase in output of MTW on households, and refer to the sum of production induced and consumption induced effects. Consumption induced effects capture the fact that, as a result of the additional output from MTW and subsequent production induced effects in other industries, wage and salary earners would earn extra income which they spend on goods and services produced by all industries in the state or region.

9.4.4 Limitations of input-output analysis

The limitations of input-output analysis are discussed in Section 9.2.5. The principal advantage of the impact multiplier method is the simplicity with which levels of mining investment, employment and output can be translated into measures of changes in regional income and employment. However, the accounting conventions that form the basis of input-output models and hence how multipliers are derived impose a number of restrictive assumptions. Some of these assumptions pertain to input analysis generally while others relate to the use and interpretation of input-output analysis at a regional/state, as opposed to a national level.

Many of the assumptions can lead to an overstatement of the impacts of a project; the resulting regional impact estimates should therefore be interpreted as an upper bound of the likely effects (Bess and Ambargis 2011, Coughlin *et al.* 1991).

Furthermore, and while, from a theoretical perspective, the total (Type IIA) multiplier is the appropriate choice for calculating flow-on effects (since this measure takes into account the full adjustment of the economy to a change in economic activity), total multipliers are calculated in a manner that compounds any measurement errors and breaches in the assumptions that underpin the analysis. For example, total multipliers are calculated as a progression of first, second and successive round effects, with each embodying any errors in earlier effects. From this perspective, a more conservative approach is to rely only on multipliers that capture first round effects (Type IA multipliers).

As noted above, there are additionally specific issues that arise in deriving value added multipliers. Value added includes profits that are distributed on the basis of ownership of capital assets, which becomes increasingly uncertain as the analysis becomes more granular. The calculation of value added at a regional level is therefore not meaningful.

9.4.5 Results

i Income, employment and value added multipliers

Table 9.4 shows the estimated income, employment and value added multipliers for NSW, the Mid and Upper Hunter region and Singleton LGA for the proposals. Based on this analysis, the approval of the proposals would lead to the following effects on the economy of NSW (Type IA multipliers), ie to calculate the first-round flow-on effects of the proposal and the Mount Thorley Operations 2014, it is necessary to deduct the initial effects from the multipliers (ie the additional expenditure from the proposal compared to the reference case), by subtracting one:

- each additional dollar in wages and salaries paid by MTW induces an additional A$0.63 in total income;
- each additional person employed by MTW induces employment of an additional 0.9 full time equivalent workers; and
- each additional dollar of value added created by the proposals induces an additional A$0.3 in value added.

Table 9.4 Income, employment and value added multipliers for NSW, the Mid and Upper Hunter region and for Singleton LGA

Multiplier	Type		
	IA	IB	IIA
New South Wales			
Income	1.63	2.23	3.54
Employment	1.91	3.81	6.05
Value added	1.30	1.55	2.05
Mid and Upper Hunter region			
Income	1.49	2.09	2.63
Employment	1.76	3.62	4.79
Value added	1.25	1.45	1.71

Table 9.4 Income, employment and value added multipliers for NSW, the Mid and Upper Hunter region and for Singleton LGA

Multiplier	Type		
	IA	IB	IIA
Singleton			
Income	1.67	3.07	4.33
Employment	1.46	1.68	2.37
Value added	1.25	1.39	1.62

ii Net impacts of the proposals

The direct impacts of the proposals relative to the wind-down of MTW in the reference case are summarised in Table 9.5. Annualised values have been used to calculate the flow-on effects on an annual basis.

Table 9.5 Summary of net direct impacts of the proposals

Item	Proposal scenario (NPV, 2014 $M)	Reference scenario (NPV, 2014 $M)	Net change (NPV, 2014 $M)	Amortised net change (annual $M)
Value of output	$13,972	$6,445	$7,527	$664
Input costs	$7,253	$3,441	$3,812	$336
Gross wages and salaries	$2,694	$1,200	$1,494	$132
Gross operating surplus	$3,896	$1,746	$2,150	$190
Taxes on production	$129	$58	$71	$6
Value added + 'imports'	$6,719	$3,004	$3,715	$328

Notes: Expenditures incurred by MTW to mitigate external effects have been excluded from this analysis as they are assumed to equal the costs of the externalities they are intended to mitigate.

Input costs are total operating expenses, excluding wages and salaries. Gross operating surplus is the value of output less intermediate inputs (excluding capital costs). The sum of wages and salaries for employees and long-term contractors, gross operating surplus, taxes on production, and royalties equals value added prior to the deduction of 'imports'. Employment is the average level of FTE employment (employees and long-term contractors) from 2014 to 2035.

Table 9.6 shows the net income benefits and the average annual increase in employment if the proposals are approved, at the state, regional and local level. Apportionment of the change in income and employment associated with the proposals is based on assumptions (refer to Appendix E) and adjustments to account for:

- the size of the MTW workforce residing in NSW, the Mid and Upper Hunter region and in Singleton LGA;
- expectations that some share of workers who would be made redundant in the event the proposals are not approved would be re-employed within NSW, the Mid and Upper Hunter region and in Singleton LGA; and
- expectations that a share of any additional workers employed by MTW would redeployed from within NSW, the Mid and Upper Hunter region and in Singleton LGA.

Given the residence of the MTW workforce, the positive income effects of the proposal are concentrated regionally and locally. It has been assumed that a relatively larger share of MTW workers made redundant would be re-employed within NSW than with either the region or local area. As a consequence, the regional impacts on employment are larger than at the state level.

Table 9.6 Net income benefits, average annual net change in employment and derived 'imports' (MTW)

Area	Net income (NPV, 2014 $M))	Net employment (annual average)	Imports (per cent)
NSW	$612	227	4.9
Mid and Upper Hunter region	$464	282	-
Singleton LGA	$126	133	-

iii Flow-on effects for NSW

To calculate the initial flow-on effects of the proposals for NSW, it is necessary to deduct the direct effects from the multipliers by subtracting one from the first round effect in Table 9.4:

- the initial income multiplier effects are calculated by applying the multiplier to the total value of wages adjusted by the proportion of wages paid to employees living in NSW;
- the initial employment multiplier effects are calculated by applying the multiplier to the total net change in average employment adjusted by the proportion of wages paid to employees living in NSW; and
- initial value added effects for NSW are calculated by first calculating the value added accruing to NSW, and by subsequently deducting imports into mining and then applying the NSW multiplier.

Further, it is necessary to consider the issue of the transfer of labour between industries. The total flow-on income and employment effects have been adjusted to account for the expectation that a share of the FTEs that would be made redundant in the reference case would be re-employed. Total value added (the sum of salaries and wages and GOS) has been adjusted for the corresponding change in incomes. The assumptions made for NSW are consistent with those made in CBA.

Table 9.7 shows the estimated flow-on effects from the proposals for NSW. The estimated net flow-on benefits of the proposals amount to:

- an overall increase in GSP of $450million ($39million per annum), equivalent to about 12 per cent of the net value added of the proposals ($3,715million);
- $385million in additional income ($33million per annum); and
- additional annual employment of around 206 full-time equivalent workers.

Table 9.7 Initial flow-on effects (Type IA) for NSW

	Income (2014 NPV $M)		Employment (FTEs)		Value added (2014 NPV $M)	
	Total	**Annual**	**Total**	**Annual**	**Total**	**Annual**
Flow-on effects	$385	$33	-	206	$450	$39

Warkworth Mine's contribution to the flow-on effects to NSW were calculated as:

- around $406million increase in GSP (NPV terms);
- approximately $346million in additional income (in NPV terms); and
- additional employment of 191 full-time equivalent workers.

iv Flow-on effects for Mid and Upper Hunter region

Table 9.8 shows the estimated flow-on effects from the proposals for the Mid and Upper Hunter region. The net benefits to the Mid and Upper Hunter region are estimated to be:

- around $227million in additional income ($20million per annum); and
- additional annual employment of around 214 full-time equivalent workers.

These effects have similarly been calculated by adjusting the various factors for the percentage of MTW employees living in the Mid and Upper Hunter region. Given the various uncertainties set out above, value added effects have not been calculated on a regional basis.

For the Mid and Upper Hunter region, it has been assumed that:

- 50 per cent of any unemployed workers would leave the Mid and Upper Hunter region workforce;
- 20 per cent would be re-employed within one year (imputed as a loss of one year's wages for 20 per cent of the workforce); and
- an additional 30 per cent would be re-employed in the second year (imputed as a loss of two years' wages for 40 per cent of the workforce).

Table 9.8 Initial flow-on effects (Type IA) for the Mid and Upper Hunter region

	Income (2014 $M)		Employment (FTEs)	
	Total	**Annual**	**Total**	**Annual**
Flow-on effects	$227	$20	-	214

Warkworth Mine's contribution to the flow-on effects to the Mid and Upper Hunter region were calculated as:

- approximately $204million in additional income (in NPV terms); and
- additional employment of 198 full-time equivalent workers.

v Flow-on effects for the Singleton LGA

Table 9.9 shows the estimated flow-on effects from the proposals for the Singleton LGA. The net benefits for the Singleton LGA are estimated to be:

- around $84million in additional income generated ($7million per annum); and
- additional annual employment of around 61 full-time equivalent workers.

These effects have similarly been calculated by adjusting the various factors for the percentage of MTW employees living in the Singleton LGA (35 per cent).

Table 9.9 Initial flow-on effects (Type IA) for the Singleton LGA

	Income (2014 $M)		Employment (FTEs)	
	Total	**Annual**	**Total**	**Annual**
Flow-on effects	$84	$7	-	61

Warkworth Mine's contribution to the flow-on effects to Singleton LGA were calculated as:

- approximately $75million in additional income (in NPV terms); and
- additional employment of 57 full-time equivalent workers.

9.5 Conclusions

The resource the subject of the proposal is of economic significance as per the matters outlined in clause 12AA(2) of the Mining SEPP. The economic study describes the direct and flow-on economic benefits of the proposals for Singleton LGA, the Mid and Upper Hunter region and for NSW. The economic benefits attributable to Warkworth Mine include continuing employment for a workforce of approximately 1,187 persons and $1.34billion in net benefits.

The economic study has been prepared in accordance with relevant NSW Government guidelines, including the *Guideline for the use of Cost Benefit Analysis in mining and coal seam gas proposals* (NSW Government 2012), *the Guideline for economic effects and evaluation in EIA* (Planning NSW 2002), and the *NSW Government Guidelines for Economic Appraisal* (NSW Treasury 2007).

In NPV terms, the proposals would deliver net benefits to NSW of around $1.5billion, of which $1.34billion can be attributed to the proposal. The aggregated net benefits take the form of (see Table 9.3):

- the additional disposable income received by MTW employees and contractors who live in NSW, around $612million;

- the additional coal royalties paid to the NSW Government of around $617million; and
- additional payroll taxes, council rates and other payments that accrue to different levels of government, and which amount to around $259million.

Almost three quarters of MTW employees and contractors live in the Mid and Upper Hunter region. Around $464million in NPV terms in additional disposable income would flow to that region.

The assumptions underpinning the derivation of wages and salary benefits described above are conservative. It has been assumed that, in the event that the proposals are not approved and MTW closes by 2021, most of MTW's employees and long-term contractors would find alternative employment in the Mid and Upper Hunter region.

In addition to the direct effects described above, the proposals are expected to have positive flow-on effects on the NSW economy. These flow-on effects are a reflection of the significant projected expenditures on wages and salaries, as well as other mining inputs by MTW. In NPV terms, the initial flow-on effects are estimated at:

- around $385million in additional income for NSW;
- additional annual employment of around 206 full-time equivalent workers in NSW; and
- an increase in the GSP of NSW of around $450million ($39million annually).

Significant positive flow-on effects are also expected for the Mid and Upper Hunter region. In NPV terms, the initial flow-on effects are estimated at:

- around $227million in additional income would flow to the Mid and Upper Hunter region; and
- additional annual employment of around 214 full-time equivalent workers.

Thirty four per cent of MTW's employees and long-term contractors live in Singleton. In NPV terms, the estimated flow-on effects for the Singleton LGA are:

- around $84million in additional income; and
- additional annual employment of around 61 full-time equivalent workers.

While Warkworth Mine and MTO would continue to operate as an integrated mining complex if the proposals are approved, the relative contributions of the two mines to the benefits that would accrue to NSW has also been examined. The analysis indicates that the direct economic benefit that can be attributed to Warkworth Mine is around $1,339million in NPV terms, or 90 per cent of the contribution of the proposal to NSW GSP. Further, for the flow-on effects, 90 per cent of additional income and 93 per cent of additional employment, respectively, can be attributed to Warkworth Mine.

Chapter 10

Noise and vibration

Chapter 10 — Noise and vibration

10 Noise and vibration

10.1 Introduction

This chapter provides a summary of the noise and vibration study prepared by EMM, which is presented in full in Appendix F.

The chapter describes the existing acoustic environment and existing noise and vibration management, potential impacts at assessment locations, and management and monitoring measures under the proposal.

The study has been prepared in accordance with the INP.

10.2 Noise criteria

As discussed in Section 4.3.2, the Mining SEPP was recently amended and now includes clause 12AB that sets out a number of non-discretionary development standards for mining. These are discussed in Chapter 7. Clause 12AB(3) provides non-discretionary development standards relating to cumulative noise. It states:

> The development does not result in a cumulative amenity noise level greater than the acceptable noise levels, as determined in accordance with Table 2.1 of the Industrial Noise Policy, for residences that are private dwellings.

The Mining SEPP references the acceptable noise level (ANL) from the INP Table 2.1. This is reproduced below in Table 10.1 for residences. Satisfying the ANL implies the noise amenity of the area is not compromised and that the area is habitable commensurate with rural or other respective categories.

Table 10.1 Amenity criteria (residences)

Indicative noise amenity area (residence)	Time of day	Recommended L_{Aeq} noise level, dB(A)	
		Acceptable	Maximum
Rural	Day	50	55
	Evening	45	50
	Night	40	45
Suburban	Day	55	60
	Evening	45	50
	Night	40	45
Urban	Day	60	65
	Evening	50	55
	Night	45	50
Urban/Industrial interface	Day	65	70
	Evening	55	60
	Night	50	55

Source: INP (EPA 2000).

The definitions for the various amenity area categories are described in the INP. Based on these definitions, the centre of Bulga village is a 'suburban' area while most other assessment locations considered in this study reside in 'rural' areas. For this assessment, categorising residences as rural or suburban is inconsequential since the limiting night time amenity criterion is identical for both categories. Outside of the INP, it is acknowledged that feedback from Bulga village residences describe their area as rural rather than suburban.

A relatively small number of residences adjoin the MTIE and, hence, their amenity category is appropriately described as urban/industrial interface according to the INP's definition. Similarly, the two privately-owned residences in Warkworth village are exposed to relatively high industrial noise from Wambo Mine as substantiated in the cumulative assessment presented in Section 10.4.7. These two residential areas are, therefore, appropriately assessed as urban/industrial interface.

It is demonstrated that the non-discretionary Mining SEPP is satisfied for Bulga village residences and this means that the area's amenity is not compromised as it meets the INP's ANL.

10.2.1 Industrial Noise Policy

The noise and vibration study completed includes a full INP assessment. The overall aim of the NSW INP is to allow the need for industrial activity to be balanced with the desire for an appropriate amenity level in the community. One of its specific objectives is to establish noise criteria, or project specific noise levels (PSNL) to protect the community from excessive intrusive noise and preserve amenity for specific land uses.

The assessment procedure for industrial noise sources such as mining has two components:

- controlling intrusive noise impacts in the short-term for residences; and
- maintaining noise level amenity for particular land uses for residences and other land uses.

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the ANL described in Table 10.1. Meeting these noise levels 'will protect against noise impacts such as speech interference, community annoyance and to some extent sleep disturbance' (INP, EPA 2000). In cases where potentially noise-producing industrial developments are proposed for an area, the amenity criteria, which set a cap for the cumulative noise from industry will be more stringent than the intrusive criteria so that the total impact from industry does not cause amenity to deteriorate.

While both criteria must be satisfied to achieve this objective, the more stringent of the intrusive or amenity criteria become the limiting criteria or PSNL. The process by which the two criteria work is shown conceptually in Figure 10.1 and it is noted that the two criteria are measured over different time periods.

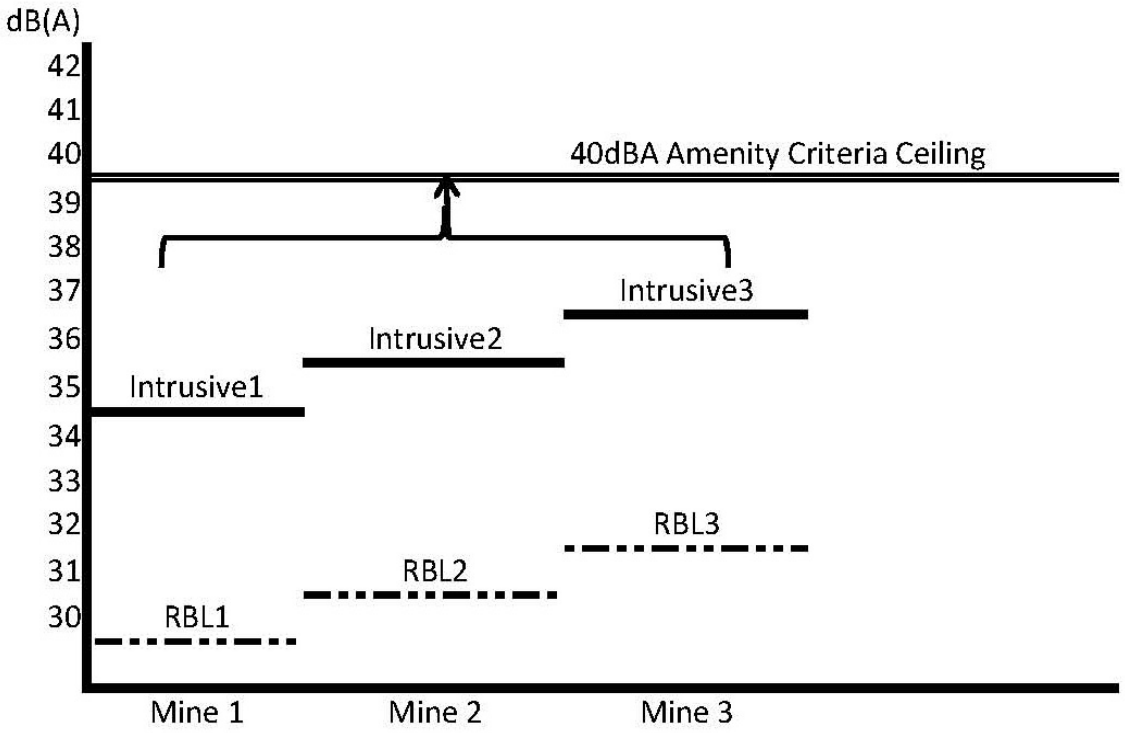


Figure 10.1 Amenity criteria to cap cumulative noise from industry

For Bulga village residences, the amenity, which relates to cumulative noise from all industry, cannot worsen because no new large scale industry would be able to physically exist in a position that could push amenity levels any higher. Further, Bulga Coal Complex is progressing away from Bulga village and coal extraction at MTO is proposed to cease in approximately 2020 at Loders Pit, with only the transfer of overburden from Warkworth Mine continuing in this area of the mine. Hence, if the proposal is granted development consent it is expected that Bulga's amenity would be preserved to levels stated in the Mining SEPP non-discretionary standards (ie the INP's ANL).

The INP requires the assessment of predicted noise levels against PSNLs, which for the proposal, has been determined based on the intrusiveness criteria (rating background level (RBL) plus 5dB(A)). The way in which this was determined is described below.

The objective of the INP's holistic approach to amenity noise is to satisfy the recommended ANLs. The strictest of these is the night time acceptable amenity criterion of 40 dB(A). This criterion has been adopted in this assessment for most residences and from all industrial noise sources, inclusive of Warkworth Mine's contribution, as per the INP. This is a practical approach in the current situation because the neighbouring industrial sites (MTO and Bulga Coal Complex) are changing their noise contribution in the area as described in the respective EISs (EMM 2014a; Umwelt 2013) and the INP supports the inclusion of Warkworth Mine's current contribution as part of the total existing industrial noise levels of the area. The other instrument that supports this holistic approach is the Mining SEPP non-discretionary standard.

Even though the INP supports the inclusion of Warkworth Mine's current contribution to the total noise levels of the area, the study considered several representative assessment locations to demonstrate whether the intrusive or amenity criteria is the more limiting when ignoring the presence of the existing Warkworth Mine operations. This exercise, as shown in Table 10.2 illustrates the holistic method's appropriateness as all the example assessment locations adopted the intrusiveness criteria as the more limiting criteria. In one case (assessment location 58) the two criteria have the same target level, but the intrusive criterion value is the more limiting metric given it is measured over a worst case 15 minute period.

Table 10.2 EPA residential amenity vs intrusiveness criteria test cases

Assessment location	Existing Industrial noise[1]	Amenity Criteria			Intrusive Criteria
(Area)	$L_{eq,9hr}$, dB(A)	ANL $L_{eq,9hr}$, dB(A)	Difference, dB(A)	Adjusted Criteria, $L_{eq,9hr}$, dB(A)	$L_{eq,15min}$, dB(A)
15 (Bulga)	35	40	5	38	35
26 (Bulga)	36	40	4	38	36
44 (Bulga)	36	40	4	38	37
58 (Bulga)	36	40	4	38	38
77 (Warkworth village)	57	50	-7	40	35
128 (Gouldsville)	32	40	8	40	35
146 (Mount Thorley)	36	50	14	50	N/A
150 (Mount Thorley)	36	40	4	38	35

Notes: 1. In deriving 'existing' noise levels from MTO and Bulga Coal Complex, noise levels from the latest noise assessment were adopted. This provides a more realistic quantification of the cumulative impacts when the proposal coincides with neighbouring contributions, which are changing on those of current levels. Existing Wambo Mine noise adopted from 2003 EIS. Where locations do not match those listed, the closest neighbouring location was used. Hunter Valley Operations South monitoring results obtained from the 2003 EIS. An industry accepted approximation between $L_{eq,15min}$ and $L_{eq,9hr}$ of 3dB was adopted.

The INP provides nine steps for noise management at Section 1.4 'Applying the policy'. For reference, these steps are provided in Table 10.3 with references within this EIS as to where these steps have been addressed. Refer to Appendix F for more detail.

Table 10.3 INP steps for noise management

Step		Reference in this EIS
1.	Determining the project specific noise levels for intrusiveness and amenity that are relevant to the site or the area (Section 2)	Section 10.2 and Figures 10.3 and 10.4
2.	Measuring and determining existing background and ambient noise levels, using the method relevant to the expected level of impact (as outlined in Section 3)	Section 10.3
3.	Where the proposed development is expected to produce annoying noise characteristics, adjustments are to be applied to the noise levels produced by the development in question (as outlined in Section 4)	Section 10.4.4
4.	Predicting or measuring the noise levels produced by the development in question, having regard to meteorological effects (such as wind, temperature inversions) (see Section 5)	Section 10.4.2
5.	Comparing the predicted or measured noise level with the project-specific noise levels and assessing impacts (Section 6)	Section 10.4.2
6.	Considering feasible and reasonable noise mitigation strategies where the project specific noise levels are exceeded (Section 7)	Section 10.5

Table 10.3 INP steps for noise management

Step		Reference in this EIS
7.	Negotiation between the regulatory/consent authority and the proponent and between the community and the proponent to evaluate the economic, social and environmental costs and benefits from the proposed development against the noise impacts (Section 8)	Chapter 8
8.	The regulatory/consent authority sets statutory compliance levels that reflect the achievable and agreed noise limits for the development (Section 9)	To be completed by consent authority at the completion of the approval process
9.	Monitoring of environmental noise levels from the development to determine compliance with the consent/licence conditions (Section 11). To be completed post approval for the proposal	Monitoring data for the current operations is considered in Section 10.2.1

10.2.2 Perceived changes in noise

Examples of common noise levels include:

- Inside bedroom (windows closed) – 20-30dB(A).
- Quiet suburban area – 40-50dB(A).
- Busy office – 60dB(A).
- Busy city street at the kerbside – 70-80dB(A).
- Rock concert – 110dB(A).

Table 10.4 provides an indication as to an average person's perception about changes in noise levels. For example, a change in sound level of 3dB is only just perceptible to the average person. Changes of 1 to 2dB are imperceptible.

Table 10.4 Perceived change in noise

Change in sound level (dB)	Perceived change in noise
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times as loud (or quarter) as loud

10.3 Existing environment

10.3.1 Assessment locations

A total of 221 assessment locations have been identified within the proximity of Warkworth Mine that have the potential for exposure to noise from the proposal (refer to Figure 10.2). The assessment locations are considered under two sections below; namely, Bulga and other localities. Other localities comprise Hambledon Hill, Gouldsville, Long Point Road, Mount Thorley and Warkworth village.

10.3.2 Background noise levels

i Bulga

To characterise the existing acoustic environment at the assessment locations in the Bulga area, an extensive process of data gathering and analysis using six real-time noise monitors in Bulga was completed. The six monitoring locations, A to F (refer to Figure 10.2), are well dispersed across the Bulga area and therefore provide representative data for all assessment locations in the area. Accordingly, the data from the six monitoring locations was adopted for all assessment locations of Bulga, depending on a specific property's proximity to influencing noise sources in the environment (for example, the mines to the east, Putty Road and the central part of Bulga village).

The purpose of the monitoring was to quantify the background noise level to enable an impact assessment of the proposal to be completed. For an impact assessment, the INP requires the assessment of noise levels that exclude influence on derived representative background noise from the Site. Noise loggers with directional filtering functionality (the BarnOwl logger from SoundScience) were used to achieve this, which enabled noise influences from Warkworth Mine to be filtered out of the total background noise. This enabled background noise levels excluding Warkworth Mine to be considered.

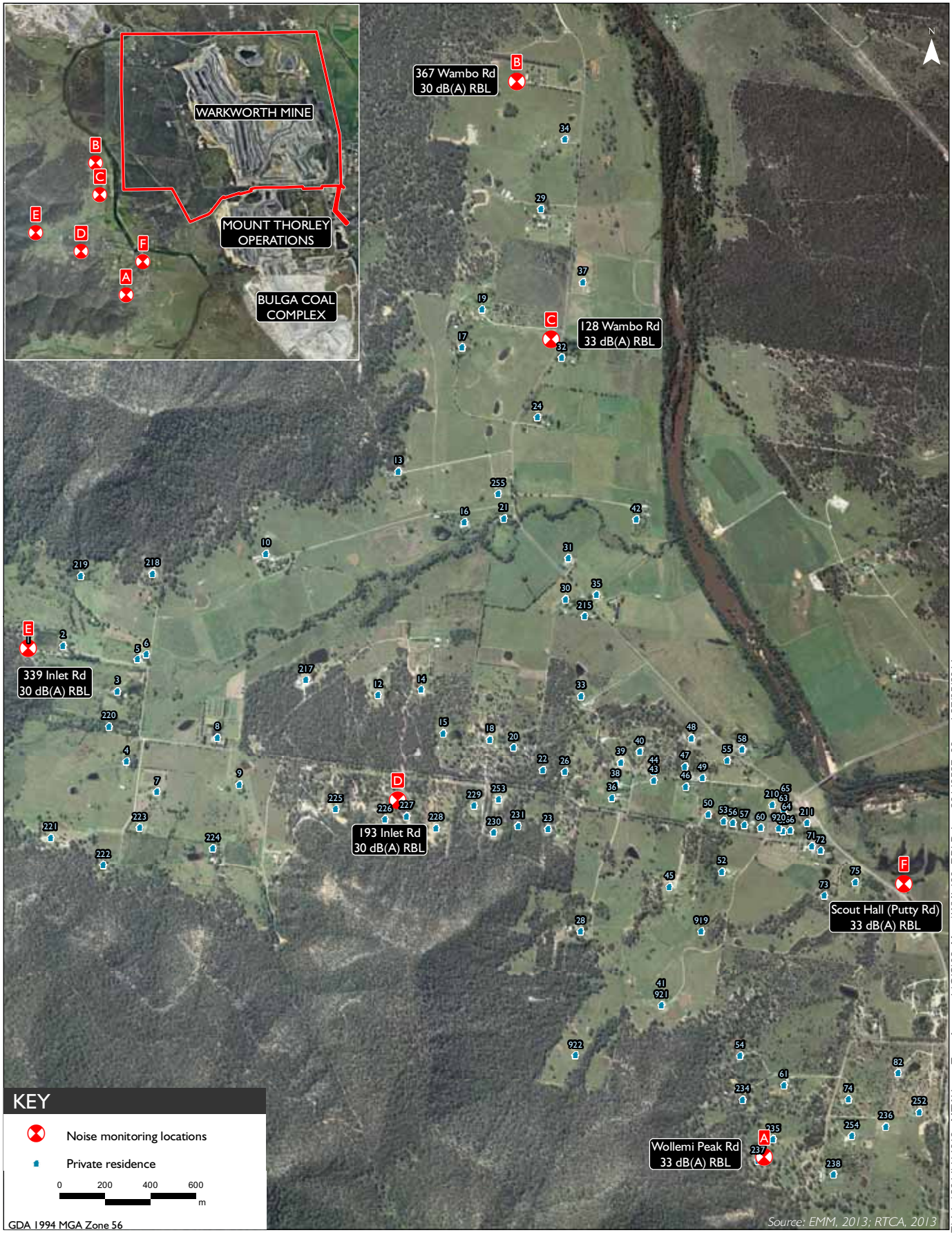
The results of the background noise monitoring presented in Table 10.5 are summarised as RBLs (which are the median of the assessment background levels (ABL)) for the six monitoring locations for the day, evening and night assessment periods. The quantity of data collected for the background noise survey is substantially greater than the INP's required minimum of seven days and therefore provides a much more comprehensive representation of repeatable RBL values. The INP's application notes have been conservatively adopted to determine the final RBL for the six locations, shown in Table 10.5.

Table 10.5 Representative background noise levels for Bulga (RBL as per INP)

Location	Period (Duration)	RBL, dB(A)			Final RBL, dB(A)[2]
		Day	Evening	Night	
A. Wollemi Peak Rd	20/06/13 - 14/08/13 (3 months)	33	33	34	33
[1]B. 367 Wambo Rd	01/12/11 - 29/11/12 (11 months)	30	31	30	30
C. 128 Wambo Rd	29/11/12 - 31/07/13 (8 months)	33	37	33	33
[1]D. 193 Inlet Rd	01/12/11 - 28/05/12 (6 months)	30	32	30	30
[1]E. 339 Inlet Rd	18/03/13 - 30/06/13 (3.5 months)	30	30	30	30
F. Scout Hall (Putty Rd)	01/12/11 - 04/09/12 (10 months)	33	36	35	33

Notes: *1. Locations B, D and E data show RBLs at or below the INP minimum of 30dB(A) for some assessment periods, and hence 30dB(A) was adopted as per the INP across all three assessment periods.*

2. The RBL is as defined in the INP, ie the median value of all ABLs. The ABL is also as per the INP, ie the lower 10th percentile of L_{90} values.



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Long-term background noise monitoring locations in Bulga

Warkworth Continuation 2014
Environmental Impact Statement

Figure 10.2

The data in Table 10.5 demonstrates higher background noise at locations A, C and F. These locations have greater exposure to the surrounding mines, Putty Road or the relatively more active centre of Bulga village than the other three locations (refer to Figure 10.1). Validation of unfiltered RBL data was undertaken to demonstrate the effect of using directional filtering to remove noise from Warkworth Mine from the analysis for establishing background noise levels.

The data in Table 10.5 shows RBLs are marginally higher during the evening or night at some locations as compared to their corresponding daytime values. This is likely a result of enhancement of neighbouring mine noise from influences of weather conditions. This is shown at all but one of the six monitoring locations and therefore strongly supports a proposition that mine noise is enhanced by certain weather conditions, for example, in the presence of temperature inversion conditions.

Of the six locations, three of the locations (B, D and E) have the INP's minimum threshold background value of 30dB(A). These locations are more removed from industrial sources (the mines), local road traffic and are further away from the central part of Bulga village, as compared to the other three locations. The three locations where an RBL of 33dB(A) is found, are consistent with the data adopted in previous assessments for Warkworth Mine.

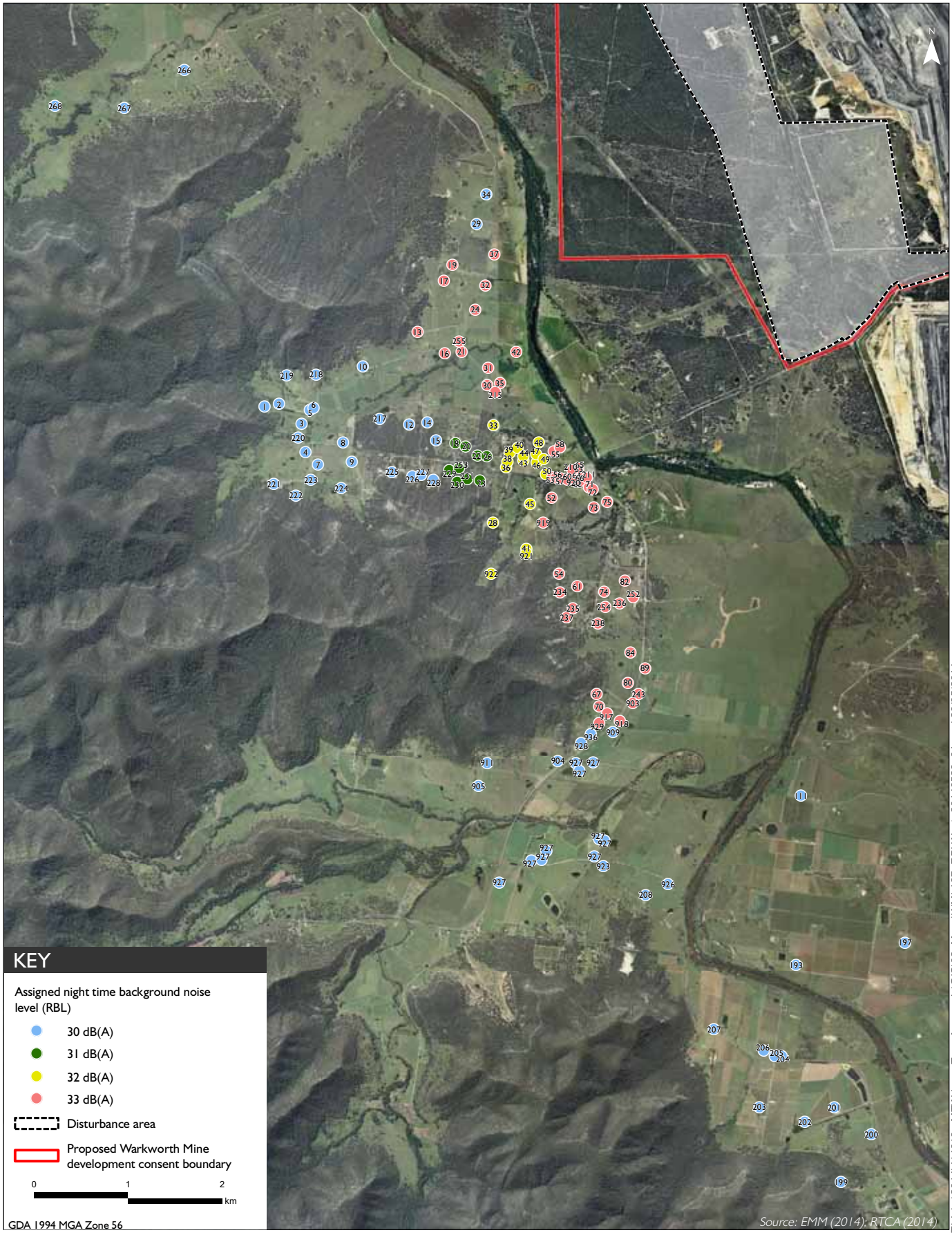
The background noise levels assigned to each assessment location are illustrated in Figures 10.3 and 10.4. Where assessment locations are not in proximity to a noise logger and no data exists, the INP minimum of 30dB(A) is conservatively assumed. Also, given the differences in calculated RBL at locations D and F at Bulga, a transition from higher RBL to lower RBL was developed along this orientation east to west. On the basis that existing mine noise was one of the main influences on background noise in the area, the transition was developed from demonstrated changes in predicted noise levels for MTO and Bulga Coal Complex (as published in their most recent assessments). This results in a relatively smoother transition in RBL values across this area assigns corresponding criteria more evenly between adjoining properties. This approach minimises the situation often found where one property has a marked step increase in RBL and therefore criteria than their immediate neighbour - the problematic 'line-in-the-sand' delineation of criteria which often results in different zones of impact (for example, one property is assigned treatment while their neighbour is not).

ii Other localities

The historic data in the 2002 Warkworth EIS (ERM 2002b) includes RBL data (as per the INP) for Hambledon Hill, Gouldsville, Long Point Road and Warkworth village. The corresponding RBL values for these locations are as follows:

- Hambledon Hill (east of Warkworth Mine) – 30dB(A) day, evening and night;
- Gouldsville Road (north-east of Warkworth Mine) – 33dB(A) day, evening and night;
- Long Point Road (further north-east of Warkworth Mine) – 30dB(A) day, evening and night; and
- Warkworth village (north-west of Warkworth Mine) – 33dB(A) day, evening and night.

For assessment locations at Maison Dieu to the north of Warkworth Mine, in the absence of suitable long-term monitoring data, background noise levels consistent with the INP's minimum threshold value of 30dB(A) have been conservatively adopted. It is probable that background noise levels are higher due to Hunter Valley Operations and other industry to the north of these assessment locations.



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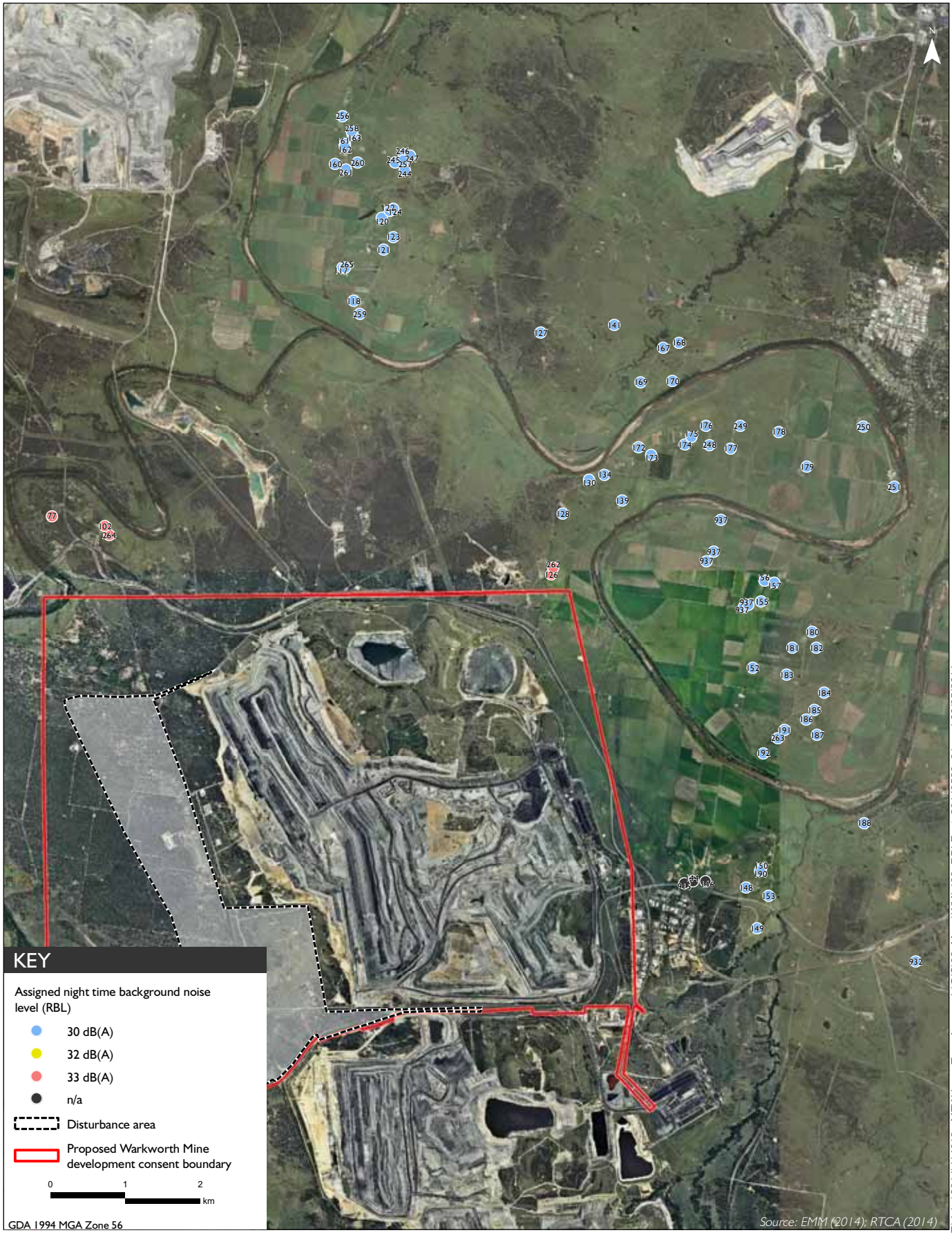
Assigned night time background noise levels - Western and southern assessment locations

Warkworth Continuation 2014
Environmental Impact Statement
Figure 10.3



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Assigned night time background noise levels - Eastern and northern assessment locations

Warkworth Continuation 2014
Environmental Impact Statement
Figure 10.4

The other group of assessment locations considered are in relative proximity to the MTIE to the south-east of Warkworth Mine. Background or RBL data at these locations is not documented in any literature available in the public domain. It is expected that these locations would be influenced by industrial noise from the nearby industrial estate, including the MTCL and associated rail operations, as well as MTO. Further, some assessment locations in this vicinity have existing acquisition rights due to impacts from various mines. These are assessment locations 144, 146 and 915 (915 is on the same lot as 144 and hence the same acquisition limit is adopted). The existing consents for both Warkworth Mine and MTO do not provide an operational limit for these locations. They do, however, provide acquisition conditions. For example, the Warkworth Mine development consent includes an acquisition limit of 44dB(A) for assessment location 144 while the MTO development consent modified in 2012 placed location 144 in an acquisition on request list. Hence, RBL values were not assigned to these locations and assessment completed against acquisition limits. Those properties in this area that do not have existing rights would be assessed conservatively as having the INP minimum threshold RBL of 30dB(A) for day, evening and night.

10.4 Impact assessment

10.4.1 Methodology

Where PSNLs are exceeded, all reasonable and feasible noise mitigation is required to be implemented. The INP Section 7 "Mitigating noise from industrial sources" states there are three main strategies for noise control. These are controlling noise at the source, the transmission path and at the receiver. Initial modelling for unmitigated operations showed that mitigation measures were warranted. Hence, all reasonable and feasible noise mitigation has been included in the modelling, including the following key mitigation strategies:

- Mitigation at the source – the applicant has attenuated 50 per cent of the haul truck fleet, with the commitment to attenuate all trucks by the end of the 2016 calendar year. Further, attenuation packages have been and would continue to be fitted to all mining fleet of dozers, excavators and drills by the end of 2016. The cost of the attenuation programme is in excess of $50million across MTW.

- Operational management – during adverse weather conditions identified 24 hours ahead of planned operations, a relatively small number of plant would be either relocated to in-pit areas or shut down so that total Site noise satisfies criteria. These items are identified in the following sections. This method is common practice for current operations at Warkworth Mine and is used elsewhere in the mining industry. This measure also results in a significant annual cost to the business associated with lost production.

The mine plans that form the basis of the assessment were optimised over many iterations of noise modelling for different operating scenarios. In arriving at the mine plans, alternative noise minimisation techniques were identified and applied. Some potential options, however, were rejected for a number of reasons. For example, reducing the height of night time overburden emplacement activities and acoustically treating the CPP were considered but found to provide minimal acoustic benefit (less than 1 dB(A)).

Noise mitigation along the transmission path such as a large noise bund was also considered and was found to be ineffective for the assessment locations in the Bulga area. The slope of the terrain between the mine and Wollemi Brook to the west would require a bund to be considerable in extent and height and would only provide minimal noise benefit to Bulga residences. Notwithstanding, if line of sight to residences could be obstructed, the benefit would be marginal during adverse weather conditions when it would be needed most. The impractical nature of such a bund includes the need for considerable land area to accommodate the bund's base and would need to be adjacent the Wollombi Brook in the proposed biodiversity offset areas so as not to sterilise coal resources (see Chapter 23).

Further plant relocation to in-pit areas or plant shutdowns to achieve PSNL at all assessment locations in Bulga (ie beyond those described previously) were also considered in the modelling and assessment process. However, these were found not to be reasonable for the Site. For example, the scenario required to achieve PNSL at all assessment locations in Bulga village resulted in one excavator, one dragline, 12 haul trucks, 12 dozers and two drills being relocated or shut down during adverse meteorological conditions. The resultant loss in production from this quantity of plant being disengaged, for the frequency and duration required due to the presence of adverse meteorological conditions, exceeds $100million (real NPV) over the life of the proposal.

As described in Section 3.3, MTW must maintain a production profile of at least 18Mtpa of ROM coal to generate sufficient revenue to remain economically viable in the current economic environment.

To assess the potential for noise impacts on assessment locations, a total of three indicative mine scenarios over the 21 year life of the proposal have been assessed. These three indicative mine plans reflect the worst-case operating scenarios. The indicative mine plans are referred to as Year 3, Year 9 and Year 14, each indicating the approximate time after the anticipated commencement date:

- Indicative Year 3 (nominally 2017) – early in the proposal timeframe when operations have started to encroach on Saddleback Ridge and necessitate the closure of Wallaby Scrub Road. At this stage, extraction at Warkworth Mine is at the currently approved upper limit of 18Mtpa. It is also generally representative of current operations when assessment locations to the east and north-east are potentially most affected by the proposal. Minimal construction activities are planned for the proposal. The most significant construction activities proposed include the Putty Road underpass and construction of the NOOP dam. Noise from these construction activities would be significantly less than that from mining operations and would therefore not contribute to the total overall received noise at surrounding assessment locations. Nonetheless, dam construction was modelled together with indicative Year 3 mining for completeness.

- Indicative Year 9 (nominally 2023) – approximately the half way point of the proposal timeframe and represents the stage when mining is predicted to have mined through Saddleback Ridge. Production at Warkworth Mine has peaked and is supported by the upgraded equipment fleet. For this reason, this stage in the operation is generally worst case for most assessment locations.

- Indicative Year 14 (nominally 2028) – mining (at a sustained maximum production rate of 18Mtpa) has extended to its western most point, some 375m further west than Year 9. Importantly, by this time the plant is operating in mostly below the highwall in relatively shielded areas at the western most parts of the mine. For this reason, noise during this stage is not worst case for Bulga assessment locations. Other activities in this stage include establishment of final landform and rehabilitation areas to the east side of the Site. This would provide shielding to locations east of the Site.

The footprint of the final year of the proposal operation (Year 21) would not extend any further west than Year 14. Between Year 14 and Year 21, the operation continues and mining deepens. Hence, Year 21 was not modelled as plant is shielded from assessment locations more than in any previous years.

Noise modelling was based on three-dimensional digitised ground contours for the surrounding land, mine pits and overburden emplacement areas for indicative mine plans of the proposal. The indicative mine plans represent worst case snapshots and equipment was placed at various locations and heights, representing realistic operating conditions in each of these indicative stages of the mine. Sound power levels adopted in the modelling for equipment used for in-pit earth-moving and overburden emplacement levels are based on measurements at Site, and for the attenuated fleet, supplier in-service commitments. Warkworth Mine has conservatively opted to model the haul trucks with a sound power level of 115dB(A) for this EIS to reflect the level that can be continuously achieved by current sound attenuation technologies.

Operational noise levels were determined for two meteorological conditions: periods with no wind or temperature gradients (referred to as 'calm' conditions), and worst case meteorological conditions (referred to as 'prevailing' conditions). Noise levels at assessment locations may increase or decrease under prevailing conditions compared with noise during calm conditions. Noise levels were predicted under each set of meteorological conditions and assessed against the relevant noise criteria.

Table 10.6 presents the PSNLs for the noise assessment of the proposal. The PSNLs apply to residential properties as per the INP.

Table 10.6 Noise assessment criteria, dB(A)

Locality	Assessment location	Rating Background Level (RBL)[1]	Intrusiveness criteria, PSNL (RBL+5dB), $L_{eq,15min}$[2]	Derivation of RBL
Bulga	13, 16, 17, 19, 21, 24, 30-32, 35, 37, 42, 52-58, 60-67, 70-75, 80, 82, 84, 89, 210, 211, 215, 234-238, 243, 252, 254, 255, 903, 917-920, 929	33	38	Proximity similar to logger at A,C and F
	28, 33, 36, 38-41, 43-50, 921, 922	32	37	RBL set using degradation of noise levels from east to west from MTO and Bulga Coal Complex
	18, 20, 22, 26, 23, 229, 230, 231, 253	31	36	RBL set using degradation of noise levels from east to west from MTO and Bulga Coal Complex
	1-7, 8-10, 12, 14, 15, 29, 34, 217, 218-223, 224-228	30	35	Proximity similar to logger at B, D or E
	266-268, 904, 905, 909, 911, 927, 928, 936	30	35	RBL not available - assumed minimum
Gouldsville/	126, 262	33	38	RBL From 2002 EIS location N2
Long Point	128, 130, 134, 139, 172-179, 248, 249	30	35	RBL assumed from 2002 EIS location N3
	127, 141, 167-170, 250, 251	30	35	RBL not available - assumed minimum

Table 10.6 Noise assessment criteria, dB(A)

Locality	Assessment location	Rating Background Level (RBL)[1]	Intrusiveness criteria, PSNL (RBL+5dB), $L_{eq,15min}$[2]	Derivation of RBL
Hambledon Hill/Wylies Flat	152, 155-157, 180-187, 191, 192, 263, 937	30	35	RBL from 2002 EIS location N6
Maison Dieu	117, 118, 120-124, 160-163, 244-247, 256-261, 265	30	35	From Hunter Valley Operations South Coal Project EA 2008
Milbrodale	111, 193, 197, 199-208, 923, 926	30	35	RBL not available - assumed minimum
Mount Thorley	144, 146, 915	n/a[3]	n/a[3]	RBL not available
	148-150, 153, 188, 190, 932	30	35	RBL not available - assumed minimum
Warkworth	77, 102, 264	33	38	RBL assumed from 2002 EIS location N4

Notes: *1. Rating background level, or RBL, derived in accordance with the INP as described in Section 8.*

2. Intrusiveness criteria is equal to the measured RBL + 5dB.

3. RBLs without influence from the site are not available and existing consent do not specify operational limits (only acquisition limits are provided in the existing consent). These locations have been previously identified as impacted by the site.

10.4.2 Operational noise

i The proposal

Operational noise levels during calm weather were predicted to comply with the PSNLs for all assessment locations during calm meteorological conditions for each of the day, evening and night periods.

A summary of the predicted exceedances is provided in Table 10.7 based on the worst case noise level predicted across the three indicative mining years (ie worst case for all years). The existing impacts are shown in parenthesis, where known. These results are also presented in Figure 10.5 which shows assessment locations to the west of the Site and Figure 10.6 which shows assessment locations to the east of the Site. Results in Figure 10.5 and Figure 10.6 are presented in the form of coloured markers which represent predicted noise levels at assessment locations with respect to PSNLs. These data incorporate all calm and prevailing weather conditions for day, evening and night operations as appropriate.

Table 10.7 Summary of PSNL exceedances at assessment locations

Extent of noise exceedance above PSNL	Number of affected properties			
	Indicative Year 3	Indicative Year 9	Indicative Year 14	All years (Existing)
Bulga and surrounds				
Marginal (1-2dB(A))	9	54	58	60
Moderate (3-5dB(A))	2	5	1	5
Significant (greater than 5dB(A))	0	1	1	1
All other assessment locations (including Warkworth village and Maison Dieu locations to the north-west and north)				

Table 10.7 Summary of PSNL exceedances at assessment locations

Extent of noise exceedance above PSNL	Number of affected properties			
	Indicative Year 3	Indicative Year 9	Indicative Year 14	All years (Existing)
Marginal (1-2dB(A))	18	19	19	21[1]
Moderate (3-5dB(A))	15	10	11	13[1]
Significant (greater than 5dB(A))	1	2	3	3 (3)[2]
Total	**45**	**91**	**93**	**103**

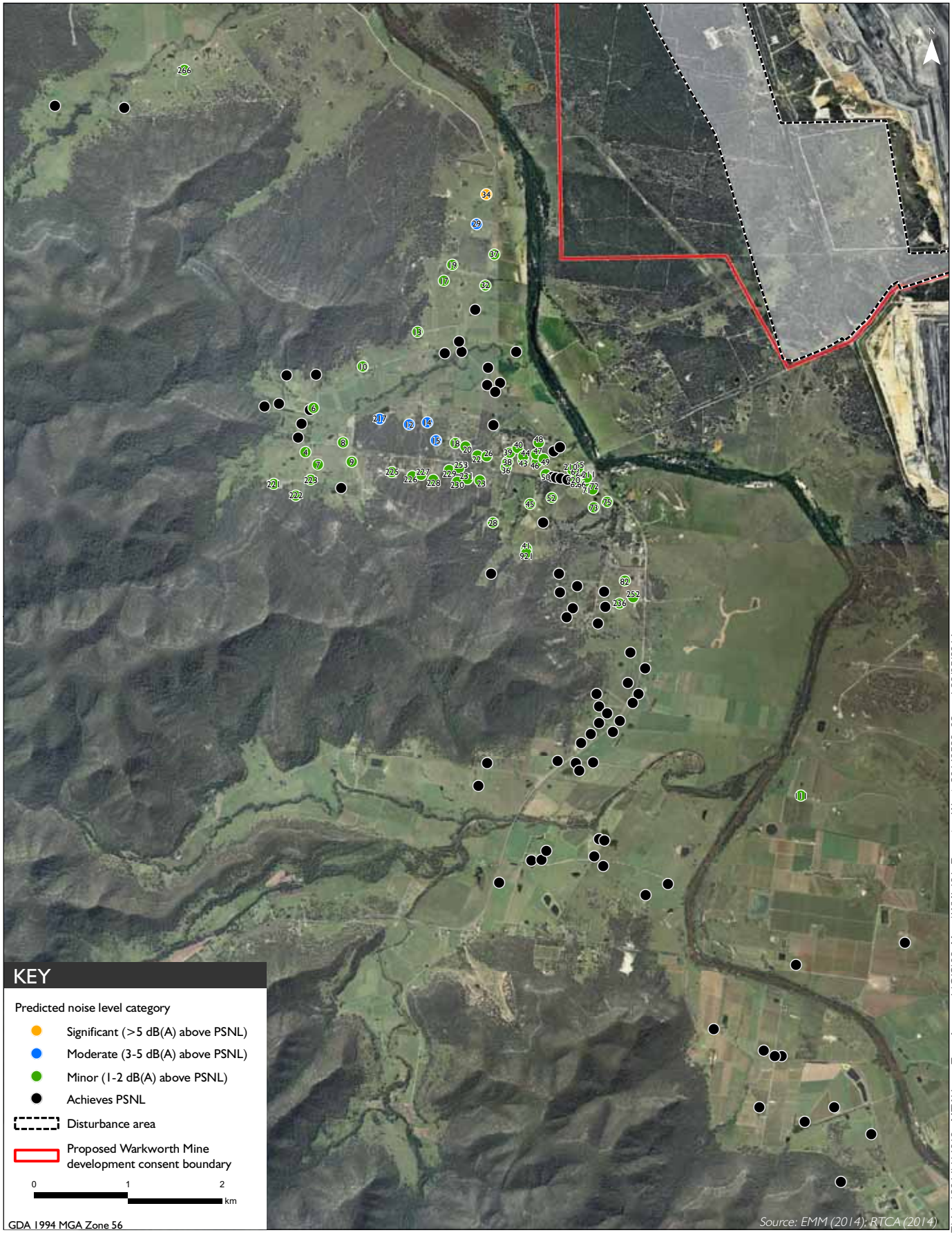
Notes: 1. Six of these properties have had mitigation installed on dwellings.

2. One of the three locations is a non-residence (Warkworth Hall).

Table 10.7 indicates that operational noise levels would exceed the PSNLs by varying amounts at a number of assessment locations as shown during prevailing meteorology.

At Bulga and surrounds, predicted noise levels from the proposal are moderately above PSNLs at up to five assessment locations, during indicative Year 9 operations. These locations are relatively more exposed to prevailing winds (easterly) or on elevated areas than their neighbours. These locations adopt the INP's minimum RBL and therefore minimum criteria. The one assessment location (34) with predicted levels in the significant range (up to 42 dB(A)) is in the northern most area of Bulga on Wambo Road. This assessment location was also assessed using the INP's minimum RBL and corresponding criteria.

At other assessment locations (see Table 10.7), predicted noise levels significantly above PSNLs were identified at three assessment locations, 77, 102 and 264, at Warkworth village north-west of the mine. Of these, assessment location 77 is identified within the current zone of acquisition of a neighbouring mine (Wambo Mine) as per its development consent. The second assessment location (102) is Warkworth Hall, a non-residential location and therefore residential criteria do not apply, and the third is a newly identified assessment location (264), that by virtue of extrapolating predictions from assessment location 77, would also be within Wambo Mine's acquisition zone had it been previously assessed.



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All years worst case day, evening and night operational noise levels, INP weather (Leq,15min dB(A)) – Western and southern assessment locations

Warkworth Continuation 2014
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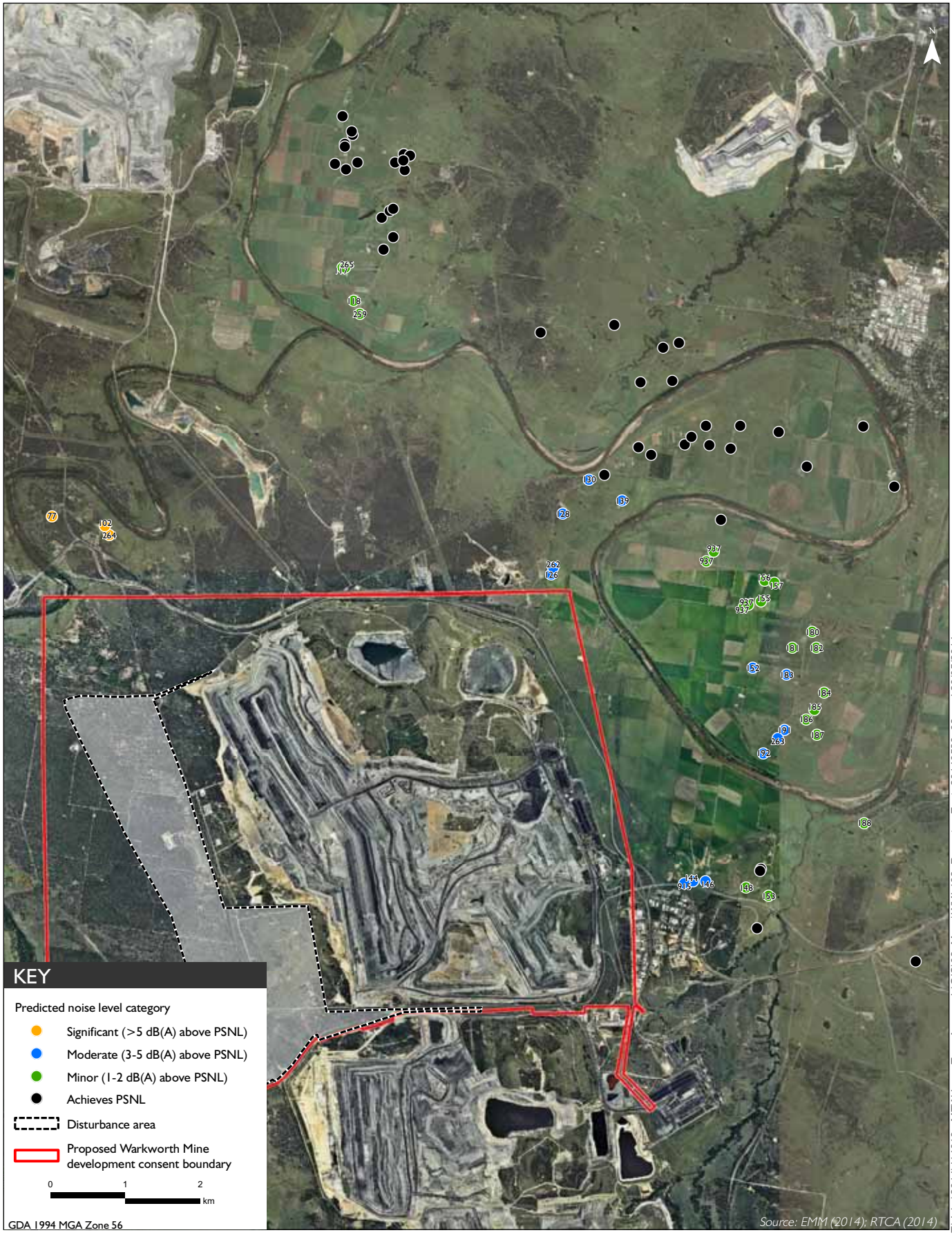
Figure 10.5



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All years worst case day, evening and night operational noise levels, INP weather ($L_{eq,15min}$ dB(A)) – Eastern and northern assessment locations

Warkworth Continuation 2014
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Figure 10.6

ii Existing versus proposal noise level comparison

An assessment was undertaken to demonstrate the benefits of reasonable and feasible mitigation measures by comparison of existing noise and the proposal for similar weather conditions at two representative assessment locations: 58 to the west and 146 to the east. Note that the noise level predicted under the proposal is based on the worst case year of that assessment location and accounts for attenuated plant as described herein. The existing noise level is sourced from *Mount Thorley Warkworth Operations Modification – Proposed Warkworth Extension Acoustic Assessment* (EMM 2010b) for Warkworth Extension 2010. The Year 2 modelled unmitigated level is adopted from that study in each case.

- Assessment location 58 (west, in Bulga):
  - Warkworth Extension 2010 = 37dB(A) (year 2)
  - Proposal = 38dB(A) (Proposal worst case)
- Assessment location 146 (east, in Mount Thorley):
  - Warkworth Extension 2010 = 47dB(A) (year 2)
  - Proposal = 42dB(A) (Proposal worst case)

The above demonstrates that maximum benefit from attenuation of plant would be afforded to assessment locations to the east of the mine, with a predicted reduction of 5dB. At the same time, the noise reduction at source from attenuation of plant almost completely negate any increases in noise due to the westward advancing nature of the proposal, including the removal of Saddleback Ridge, for Bulga residences to the west.

The removal of Saddleback Ridge is accounted for in modelled and predicted noise levels for the proposal in indicative Years 3 and 9. A review of predicted noise levels at assessment locations in Bulga village for these mining years shows that noise levels generally increase by 1 to 2dB(A). For example, assessment locations 14 and 15 west of the Site have predicted noise levels of 36dB(A) in Year 3 and 38dB(A) in Year 9. This minor increase is predominantly due to the reduced distance from mining activity to assessment locations, and to a lesser extent the removal of Saddleback Ridge.

The change in noise from current and approved operations is expected to be marginal for western assessment locations, while a material reduction is predicted for eastern assessment locations as attenuation of plant progresses. The proposed noise suppression and fleet management would mean the advancement westward would not result in a material increase to noise levels.

10.4.3 Sleep disturbance

The most important potential impact of intermittent noise is sleep disturbance of nearby residents. Sleep may be disturbed by intermittent noises such as shovel gates banging, dozer track plates and heavy vehicle reversing alarms. To counter these issues, the applicant has had snubbers fitted to shovel gates, 'quackers' fitted in lieu of reverse alarms and installation of attenuation packages more generally.

While the INP does not specify a criterion for assessing sleep disturbance, various studies including the EPA's *Road Noise Policy* (RNP) (DECCW 2011b) indicate that levels below 50 to 55dB(A) inside homes are unlikely to wake sleeping occupants. The EPA's current position on sleep disturbance, as documented in application notes on the EPA website, is that maximum (L_{max}) noise from industrial sources should not exceed background plus 15dB. Based on a night time RBL of between 30dB(A) to and 33dB(A), this assessment has adopted an external sleep disturbance criterion of 45dB(A) to 48dB(A) L_{max} for residences.

Where the sleep disturbance criterion is satisfied, sleep disturbance is unlikely. But where it is not met, a more detailed analysis is required. The detailed analysis should quantify the extent of impacts, including levels of exceedance above the criterion and the duration and number of events that may occur.

The highest maximum noise levels expected at residences would likely result from haul trucks. The maximum sound power level of unmitigated haul trucks has previously been measured to be typically 125dB(A) L_{max}.

Maximum noise levels were predicted under adverse meteorology at 12 representative assessment locations. Table 10.8 provides the maximum predicted L_{max} noise levels from the proposal. It indicates that predicted noise levels under prevailing weather conditions are within the EPA's conservative sleep disturbance criterion at all representative assessment locations.

Table 10.8 Predicted maximum L_{max} noise from Site (under prevailing meteorology)

Property no.	External L_{max} noise level from on-site plant, dB(A)			L_{max} criterion, dB(A)
	Year 3	Year 9	Year 14	
1	32[1]	34[1]	34[1]	45
34	41[1]	41[1]	41[1]	45
42	37[1]	36[1]	38[1]	48
58	37[1]	38[1]	38[1]	48
72	38[1]	39[1]	38[1]	48
75	38[1]	38[1]	39[1]	48
118	36[1]	37[1]	36[1]	45
126	42	42	44	45
144	43	43	43[1]	45
147	42[1]	41	42	45
148	39	39	39	45
237	35[1]	38[1]	38[1]	45

Notes: 1. The L_{eq} operational noise level prediction from Appendix F has been adopted where it is higher than the predicted L_{max} noise level. This is because it is theoretically impossible to measure an L_{eq} greater than the L_{max}. However, the prediction method adopts the maximum noise level from a single source which can result in an L_{max} prediction less than the overall L_{eq} result, which includes all noise sources.

10.4.4 Low frequency noise

In a letter dated 22 August 2013 the EDO forwarded a complaint on behalf of the Bulga Milbrodale Progress Association Inc. (BMPA), about DP&E's decision to refuse to apply Low Frequency Noise (LFN) data in accordance with the INP and condition of consent for Mount Thorley and Warkworth coal mines, to the NSW Ombudsman.

The results of this complaint, were contained in a letter from the NSW Ombudsman to DP&E dated 22 January 2014. A copy of this was obtained under the *Government Information (Public Access) Act 2009*. An extract from this letter follows:

> As you are aware, Bryce Purches of this office had made inquiries with the DPI and the NSW Office of Environment and Heritage (OEH). Mr Purches has recently left, and the file has been reallocated to me for assessment of the information received by those agencies.
>
> The Ombudsman is primarily concerned to ensure government agencies are fair and reasonable in their dealings. It is clear that opinions, even by experts, may differ. We are unwilling in such situations to question expert opinion, except in those rare cases where the opinion appears so unsupportable that it suggests something improper may have occurred. It is seldom appropriate for us to decide between differing technical views, nor do we have the resources to routinely obtain our own independent expert opinion.
>
> To this end, we sought information from DPI and OEH about the review of the INP, and the application of LFN data to the operations of Mount Thorley Warkworth open cut mine in accordance with the conditions of consent DA 300-9-2002-1.
>
> DPI has provided information and evidence to demonstrate that the (then) DECCW (OEH) had from 2010 made a commitment to revise the INP in relation to low frequency noise, and to review the INP as a whole. While progress on this has been slower than expected, our verbal interactions with OEH has confirmed that they anticipate a review will be completed later this year.
>
> Assessment of LFN appears to be quite contentious, especially in rural settings. I do not propose to develop a view as to which position is most likely accurate, as I have explained above, we do not have that expertise, or the resources to seek that expertise.
>
> It would appear to me, however, that the following points have been agreed by DPI and OEH:
>
> - There may be technical merit as to the difficulty in applying the low frequency modifying factor in rural areas, subject to further study. OEH has commissioned a comprehensive study of LFN as a part of the INP review, titled Low Frequency Noise & Infrasound, still underway;
> - That OEH would not include conditions about LFN in Environment Protection Licences; and
> - A review of the INP would be conducted, and LFN would be a priority issue.
>
> When we receive complaints about compliance and enforcement, failure to take action alone is generally not sufficient grounds to justify an investigation by this office. We look closely at the facts of each case, including the agency's reasons for its decisions.
>
> In this case, there appears to be appropriate consideration of professional advice from qualified staff and experts about LFN that casts doubt as to the practicality of strict enforcement of the condition of consent. Notwithstanding this, OEH has also acknowledged that any review of LFN in the INP will include consultation with NSW Health given the health issues said to be associated with LFN.
>
> Noise monitoring continues to be a high priority issue, and a Noise Management Plan and Noise Monitoring Programme for the whole mining complex are in place. Further, DPI has advised that there will be a requirement to provide separate noise management and monitoring documents for the Mount Thorley and Warkworth mines, in consultation with OEH and DPI due to a Land and Environment Court decision.

> For the reasons outlined above, it appears to me the information and evidence provided by the agencies is sufficient to satisfy me that the DPI has provided adequate reasons for its decision and has properly considered all relevant issues, and there is no other evidence of wrong conduct that requires intervention by this office.
>
> I appreciate why you forwarded this matter to this office, and I acknowledge the importance of noise monitoring and the impacts of noise on the local community. BMPA should continue to engage with the agencies and the mine operators as is appropriate and participate in community consultation and engagement as opportunities arise.

The above confirms that the applicant currently undertakes regular low frequency noise monitoring as part of the noise management regime for Warkworth Mine.

i Review of external noise monitoring data

The applicant currently undertakes regular low frequency noise monitoring as part of the noise management regime for the Site. Monitoring data from the 2013 calendar year was reviewed in detail (total of 46 measurements) to provide a current representation of potential low frequency noise impacts from the Site.

The data was reviewed and assessed against both the INP and 'Broner' assessment methods (see Section 9.8 of Appendix F). The Broner approach is based on a paper by N.Broner as published in the Acoustics Australia Journal (April 2011). The paper provides recommended criteria based on national and international literature research. This method is preferred and considered more comprehensive than an alternate theoretical noise modelling approach, as it provides a 'real-world' representation of noise levels received in the surrounding communities.

The data review was completed for monitoring locations where a mining noise contribution was observed from Warkworth Mine only.

Of the 11 monitoring locations where noise from Warkworth Mine was observed, measurements exceed the Broner criteria at three non-residential locations at the MTIE. Road traffic noise contributions were also observed at these locations and are likely to be contributing to the elevated L_{Ceq} noise level. At the remaining eight locations, the Broner criterion is achieved.

The INP assessment criteria has been exceeded at three locations, in Bulga village (inclusive of Inlet Road West) and Long Point. However, in each case, the overall dB(C) value is below the 'Broner' criteria.

ii DEFRA curve assessment

External and internal noise monitoring was undertaken at a mine owned residence on Putty Road approximately 3km from Warkworth Mine during the night-time on 17 April 2014 to quantify representative internal mine levels and to apply the Department of Environment Food and Rural Affairs (DEFRA) (UK) reference curve to highlight any potential for internal low frequency noise impacts.

Mine noise contribution was clearly audible externally throughout the measurement period.

a. External noise levels

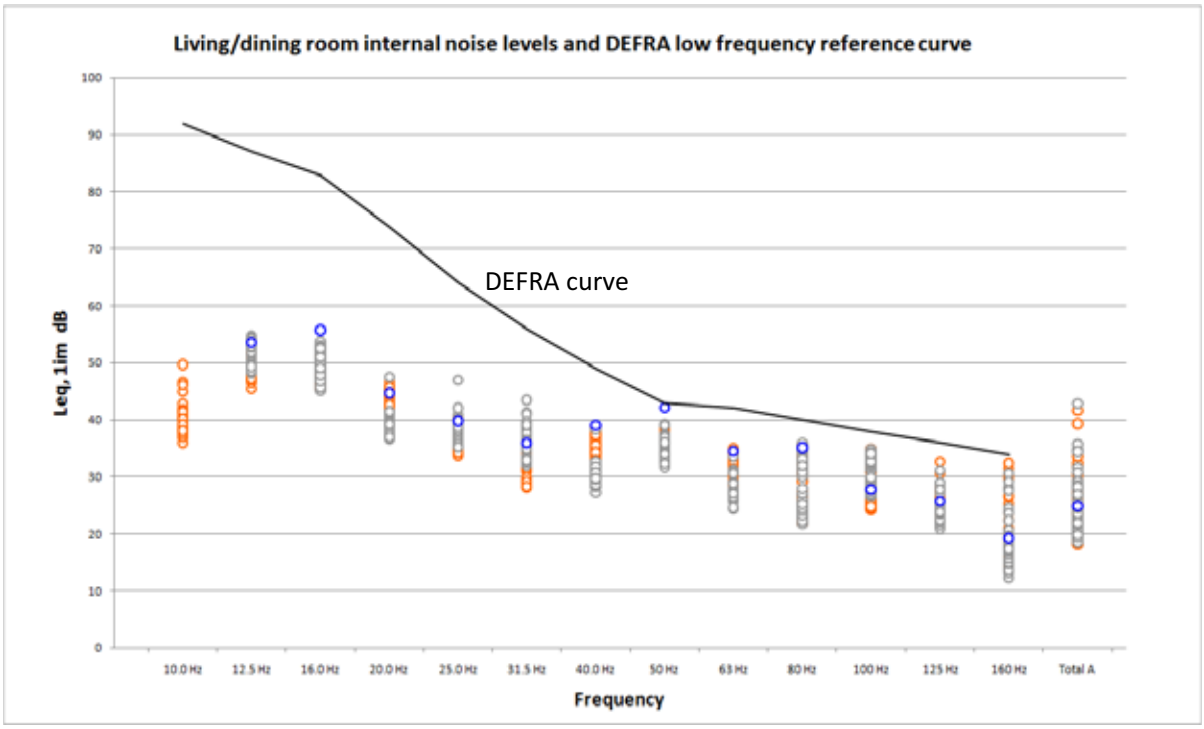
The level of mining noise externally was approximated from measured levels between the third octave frequency range of 10 Hz to 800Hz inclusive (ie low pass). The external low pass noise level was found to be in the range of 59dB(L) to 64dB(L), 54dB(C) to 58dB(C) and 40dB(A) to 44dB(A). It was also found that corresponding dB(C) minus dB(A) readings did not exceed 14 dB throughout the two hours of monitoring. Other noise sources included occasional traffic on Putty Road and natural noise sources such as insect's and crickets.

b. Internal noise levels

Whilst mining noise was audible, measurable and consistent outside this dwelling, internally mining noise was not audible in any areas or rooms.

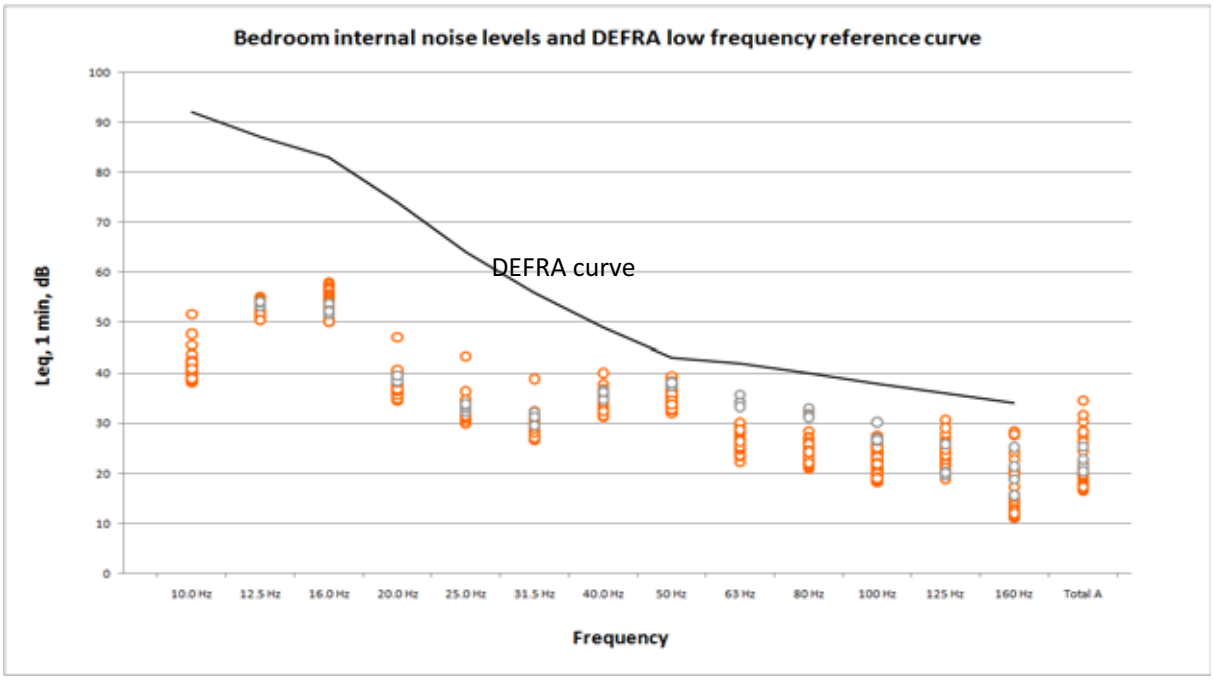
The results from the noise monitoring plotted against the DEFRA low frequency reference curve are provided in Figures 10.7 and 10.8 for the living/dining and bedroom, respectively. The charts exclude samples where extraneous noise was observed. A total of 88 one minute samples in the living/dining room and 51 in the bedroom were captured.

It is clear from the charts that noise levels recorded in the living/ dining and bedroom are below the DEFRA low frequency reference curve for all measurements.



Note: orange marker represents position 1, grey marker represents position 2 and blue marker represents position 3.

Figure 10.7 Internal low frequency noise monitoring results (Living/dining room)



Note: orange marker represents position 1 and grey marker represents position 2.

Figure 10.8 Internal low frequency noise monitoring results (Bedroom)

10.4.5 Amenity criteria – cumulative assessment

This section provides an assessment of cumulative noise from all industrial sites to assess an area's amenity against the Mining SEPP's non-discretionary standards which adopt the INP's ANLs. The amenity criteria provide the over-arching goal that, if achieved, would mean a residence is not compromised and remains habitable.

The ambient noise at assessment locations in the vicinity of the proposal are influenced by other industrial premises, such as Wambo Mine, Hunter Valley Operations, MTO, Bulga Coal Complex, and to some extent, Redbank Power Station.

The level of noise at residences from each of these surrounding industries was referenced from the following documents:

- an EIS for the expansion of Wambo Mine (Resource Strategies 2003);
- an EA Report for Hunter Valley Operations South Coal Project (ERM 2008);
- the EIS prepared for Mount Thorley Operations 2014 being exhibited concurrently with this proposal and corresponding noise assessment (EMM 2014a); and
- the EIS for the Bulga Coal Complex proposal (Bulga Optimisation Project) (Umwelt 2013).

Most of these assessments predict noise levels at residences under both calm and prevailing weather conditions. To assess cumulative impacts, the L_{eq} noise levels predicted by this assessment were combined with the L_{eq} noise levels from relevant mining stages of each of the aforementioned assessments. The assessment method for cumulative impacts had to take into account a range of factors including the location of each of the aforementioned mines and the combined effect of prevailing meteorological conditions.

Twenty representative assessment locations were used to assess cumulative noise impacts (refer to Figure 10.9). The results as provided in Table 10.9 show that the INP's (and Mining SEPP) acceptable night time criteria is satisfied at all but one representative assessment location (77 at Warkworth). Exceedances are predicted at assessment location 77 for indicative Years 3, 9 and 14 of the proposal, being dominated by Wambo Mine operations worst case predictions. This assessment location is already entitled to acquisition by Wambo Mine upon request of the landowner.

Given the magnitude of exceedance at assessment location 77, and being representative of Warkworth village, by extrapolation the amenity criterion is exceeded at neighbouring residential assessment location 264, also due to Wambo Mine (see Section 10.4.2).

It is demonstrated that the non-discretionary Mining SEPP is satisfied for Bulga residences and, therefore, means the area's amenity is not compromised as it meets the INP's ANL.

This outcome is based on noise from the proposal being assessed during indicative worst case operating years and, therefore, the contribution to the cumulative noise environment is not expected to increase beyond indicative Year 14. Further, noise levels predicted from Bulga Coal Complex referenced in the Bulga Optimisation Project (Umwelt 2013) are expected to decrease as mine life progresses. For example, assessment location 266 in Bulga village (as per BOP numbering system) shows upper predicted noise levels over the day, evening and night periods of 36, 35, 34, 33 and 29 dB(A) for mining years 1, 3, 6, 13 and 16, respectively. Noise levels in Bulga village from MTO also decrease throughout the mine life, with all active mining and emplacement activity ceasing by Year 14. For example, predicted noise levels from MTO at assessment location 58 in Bulga village are 39, 35 and 27 dB(A) for mining years 3, 9 and 14, respectively. Therefore, in consideration of the preceding, it is anticipated that the predicted cumulative noise levels presented in Table 10.9 represent worst case cumulative noise levels for the life of the proposal with noise levels decreasing during the remainder of the proposed development consent period.

Further, the amenity, which relates to cumulative noise from all industry, cannot worsen for this area because no new large scale industry would be able to physically exist in a position that could push amenity levels any higher for Bulga residences.

Table 10.9 Cumulative noise at properties, dB(A) $L_{eq,period}$

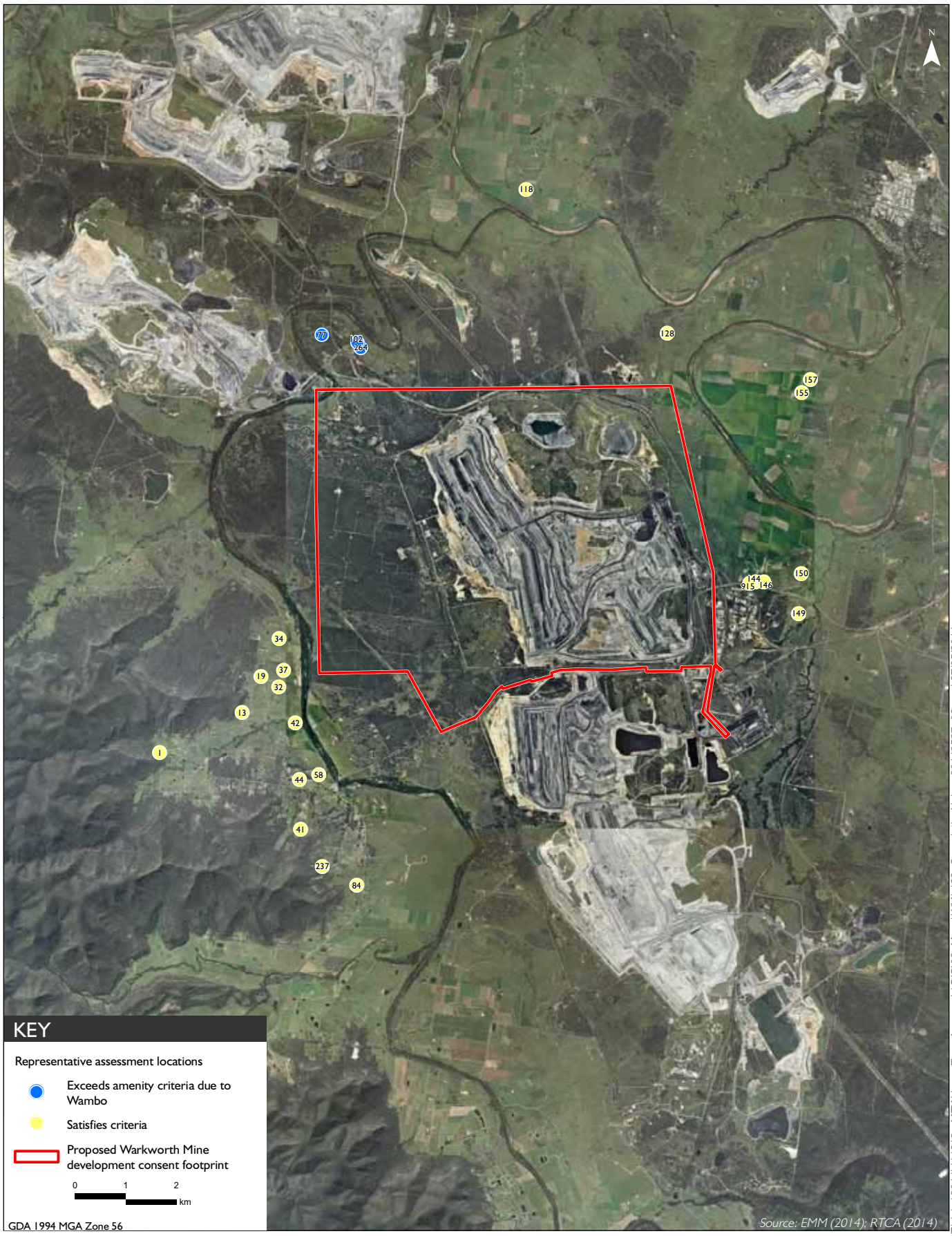
Property no.	Warkworth mine operating years			INP Acceptable Amenity criteria
	Year 3	Year 9	Year 14	
1	26 (33%) - 33 (43%)	25 (46%) - 32 (74%)	23 (74%) - 32 (92%)	40
13	34 (15%) - 38 (46%)	35 (25%) - 38 (70%)	35 (28%) - 36 (87%)	40
19	34 (21%) - 39 (58%)	34 (36%) - 38 (71%)	34 (38%) - 37 (87%)	40
32	32 (29%) - 38 (53%)	33 (41%) - 37 (58%)	33 (43%) - 36 (87%)	40
34	34 (36%) - 38 (72%)	34 (37%) - 40 (83%)	35 (43%) - 38 (92%)	40
37	34 (26%) - 38 (62%)	34 (34%) - 38 (64%)	34 (33%) - 37 (88%)	40
41	29 (36%) - 37 (36%)	29 (58%) - 37 (57%)	27 (90%) - 36 (86%)	40
42	32 (26%) - 38 (40%)	32 (35%) - 37 (44%)	31 (37%) - 36 (86%)	40
44	32 (23%) - 38 (41%)	33 (36%) - 38 (60%)	32 (43%) - 36 (87%)	40
58	32 (24%) - 38 (42%)	33 (37%) - 38 (56%)	32 (43%) - 36 (84%)	40
77	**53** (0%) - **57** (2%)	**53** (0%) - **57** (3%)	**53** (0%) - **57** (2%)	50
84	29 (27%) - 37 (30%)	28 (56%) - 37 (49%)	25 (82%) - 33 (70%)	40
118	29 (22%) - 35 (71%)	28 (19%) - 35 (78%)	28 (8%) - 34 (77%)	40
128	34 (53%) - 39 (77%)	34 (52%) - 37 (68%)	33 (48%) - 37 (76%)	40
146	33 (56%) - 41 (66%)	32 (44%) - 40 (56%)	31 (43%) - 40 (73%)	50
149	34 (3%) - 39 (2%)	35 (3%) - 39 (3%)	31 (4%) - 38 (2%)	40
150	34 (5%) - 37 (3%)	34 (5%) - 36 (7%)	30 (6%) - 35 (3%)	40
155	32 (26%) - 36 (56%)	32 (21%) - 35 (53%)	31 (22%) - 35 (62%)	40
157	32 (22%) - 36 (54%)	32 (24%) - 35 (50%)	31 (23%) - 35 (62%)	40
237	29 (23%) - 38 (22%)	29 (54%) - 37 (53%)	27 (88%) - 36 (83%)	40

Notes: 1. Numbers in bold indicates levels above EPA's night Amenity Criterion.

10.4.6 Rail traffic

The rail loading facility is located east of the Site adjoining MTO and MTIE. The proposal would not result in any net increase in rail traffic above currently approved rail activities servicing Warkworth Mine.

The proposal would not result in any net increase in rail traffic over and above currently approved rail activities servicing the integrated MTW operation. This is because the maximum approved output from MTW would not be increased for the proposal.



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Managed by Rio Tinto Coal Australia

Cumulative noise assessment

Warkworth Continuation 2014
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Figure 10.9

10.4.7 Blasting noise and vibration assessment

i Blasting criteria

Recommended criteria for noise and vibration from blasting are provided in *Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC 1990) (the ANZECC guidelines). The criteria apply to minimise human annoyance and discomfort and were not developed to control possible structural damage. However, if ground vibration peak particle velocities comply with criteria for minimising human annoyance and discomfort, they would also be below levels that may cause structural damage to buildings.

The criteria are generally consistent with the current development consent conditions for the Site and with the non-discretionary standards under clause 12AB(5) and 12AB(6) the Mining SEPP for airblast overpressure and ground vibration, respectively.

ii General blast impacts

The proposed 2014 disturbance area is generally consistent with the disturbance area proposed under the Warkworth Extension 2010. Blasting impacts are not materially different when considering offsite noise and vibration from blasting. Hence the blasting noise and vibration study relies on the assessment undertaken in 2010.

The blast design is actively managed by Warkworth Mine, which enables airblast overpressure and ground vibration to be minimised. MTW's existing blast management procedures ensure appropriate charge masses are used for blasting to enable the airblast overpressure and ground vibration criteria to be achieved.

An assessment of the charge masses (or maximum instantaneous charge, known as MIC) and distance to assessment locations provides a guide to assist blast designers with their assessment of potential impacts at specified distances from assessment locations.

By adopting certain MICs for corresponding separation distances to residences, current blast consent limits would continue to be achieved. The typical MIC used for blasting in mines is up to 1,500kg for coal and 3,000kg for overburden blasts. Ground vibration limits would be achieved during all types of blasts for separation distances of over 3km. Within 3km, blasts would be designed to achieve the appropriate limits and in all cases would be monitored.

Other mitigation options include reducing bench heights and the use of electronic detonators to provide more accurate timing of blasts. Typically, blasting occurs once per day, however it is not uncommon for two blasts to be undertaken in one day at larger mines. Blasts can occur regularly on consecutive days throughout the majority of the year.

The assessment demonstrates that appropriate management of blasts would ensure blast noise overpressure and ground vibration limits are satisfied.

iii Sensitive structures

The potential impact of blasting on structures was also considered. Notwithstanding the closest structures being MTW offices, workshops and other site structures, the focus of the assessment was on Bulga Bridge and St Phillip's Church in Warkworth Village. The Bulga Bridge is a relatively robust structure that carries light and heavy vehicle traffic, which would generate significant levels of vibration on the bridge. Blasting would be at its closest to both the Bulga Bridge and to St Phillip's Church during indicative Year 14 of mining. The separation distance from the indicative Year 14 blast areas to both these structures would be at least 2,500m. Impacts on these structures are considered highly unlikely and would allow for normal blasting practices to continue.

iv Effects on animals

Very little evidence is available in literature on the direct impacts that blast noise has on livestock or animals in general. Blast noise is not a newly introduced source for the area and, therefore, it is expected that livestock and other animals are accustomed to such sources of noise. The current level of noise from blasting is not going to increase significantly under the proposal at the locations assessed. As such, minimal change is expected at locations inhabited by livestock or animals. These include the national park areas west of Bulga, and surrounding grazing land. Impacts to animals as a result of the proposal are therefore expected to be minimal.

10.4.8 Road traffic noise

Modelling of traffic noise impacts resulting from the proposed closure of Wallaby Scrub Road in indicative Year 3 of mining was undertaken using the industry accepted UK Calculation of Road Traffic Noise (CoRTN) algorithm. Traffic information used for the assessment was derived from the proposal's traffic and transport study (Appendix O). As well as classification, speed rating and per cent heavy vehicle data for the road network surrounding Warkworth Mine, an assessment of day and night peak hour traffic volumes was undertaken for two scenarios:

- indicative Year 3 with no proposal and no road network changes (the 'do nothing' scenario); and
- indicative Year 3 with the proposal and Wallaby Scrub Road closed.

Predicted noise levels were assessed against the RNP noise criteria.

The locations most affected by the closure of Wallaby Scrub Road would be assessment locations 144 and 915, approximately 75m from Putty Road (Golden Highway) between Broke Road and Mount Thorley, respectively. These residences are the closest to the Putty Road (Golden Highway) where traffic changes due to the proposal would be most pronounced. It should be noted that these two dwellings have previously been mitigated using architectural treatment.

The total combined L_{eq} noise level received from all surrounding roads was determined based on factors such as its distance and angle-of-view to those roads, and the worst case daily traffic volumes and percentage of heavy vehicles conveyed on those roads.

The current daily traffic movements on this road section are 8,847 vehicles. This is predicted to increase by 609 vehicles in indicative Year 3 which equates to a 6.9 per cent increase in traffic volumes.

The results of noise modelling of the two road traffic scenarios predict that the RNP day and night criteria would be met for both scenarios. The relative change in noise level is also marginal (for example 0.3dB) for assessment locations 144 and 915.

10.5 Reasonable and feasible mitigation

10.5.1 Warkworth noise management system

The MTW noise management plan was developed in accordance with industry best practice with consideration given to the full available range of reasonable and feasible mitigation and their effectiveness in determining the measures to be implemented at the Site. The plan details a range of existing acoustic management and monitoring procedures which are managing the existing operations to comply with the conditions of the development consent. The management measures include those which are implemented on a continuous (standard) basis, as well as both proactive and reactive measures, categorised in accordance with the hierarchy of control for contingency planning to manage residual risks. The hierarchy of control is as follows:

- administrative controls;
- substitution controls;
- engineering; and
- elimination controls.

Together, this suite of management measures and processes comprise the MTW noise management system.

The effectiveness of the MTW noise management system has been tested on a number of occasions in recent years, including formal compliance audits, requests for independent review, ad-hoc supplementary monitoring programmes, and departmental requests for information. MTW continues to demonstrate a position of overwhelming compliance with noise criteria, and a high level of adherence to the measures outlined in the noise management plan.

i Administrative controls

Administrative controls implemented at MTW include:

- Trigger Action Response Process (TARP);
- heavy mining equipment (HME) Sound Power Level (SWL) screening;
- night shift environmental management report; and
- validation surveys of the real-time monitoring network;

Each of these measures is described below.

a. Trigger Action Response Process

The TARP is the key reactive noise control implemented at MTW, and involves the effective and timely response to elevated noise (trigger), irrespective of meteorological conditions.

Triggers are enacted in a number of ways, prompting commencement of reactive processes to validate, quantify and appropriately respond to noise conditions, including:

- receipt of a noise alarm from the real-time, directional noise monitoring network;
- identification of elevated noise through routine supplementary surveillance noise monitoring, undertaken by MTW personnel each night;
- notification of elevated noise through the routine (monthly) attended compliance monitoring regime undertaken by experienced and independent experts; and
- receipt of community complaint in relation to noise.

When a trigger is confirmed (noise levels which are approaching or exceeding the noise criteria in the vicinity of nearby private residences), an appropriate response is implemented to ensure the noise event is resolved within 75 minutes of identification. The response may include substitution or elimination measures, commensurate with the nature and severity of the noise event.

b. HME Sound Power Level screening

Understanding of the sound profile of the mining fleet is critical to effective introduction of both proactive and reactive noise controls. To ensure this information is kept up-to-date and relevant, SWL testing (sound screening) is undertaken on 33 per cent of the attenuated heavy mining equipment (HME) fleet annually. In this way, 100 per cent of attenuated equipment would be screened on a rolling three-year cycle. The results of sound screening would be used for the following:

- to inform MTW of equipment which is experiencing degradation in suppression equipment and requiring repair;
- to inform MTW of fleet types and units which can be preferentially deployed into or removed from noise risk areas; and
- to periodically update the PMI (see Section 10.5.2.i) to increase model accuracy and usefulness.

When one piece of equipment measures greater than 3dB(L) against operational specifications, MTW maintenance staff inspect and assign the piece of equipment to the appropriate maintenance schedule.

c. Nightshift environmental management report

The MTW operational personnel prepare and circulate a report following each night shift which describes the noise management activities undertaken including routine controls, minor changes and equipment shutdowns, if any, during the shift. Where noise enhancing weather conditions are predicted for the shift ahead these are described in the report. Along with the description of the conditions, potential management strategies are also detailed.

d. Validation surveys of the real-time monitoring network

To ensure that the real-time monitoring network adequately assesses and represents all receivers, validation surveys are undertaken on an as-needs basis, involving supplementary noise monitoring in the vicinity of the private residence concerned, and comparison with measured levels from the nearest real-time monitor. Where a survey indicates a change may be required this is reviewed and actioned as appropriate to ensure monitoring systems and reactive triggers remain representative.

ii Substitution controls

Substitution controls are implemented in response to one or more triggers (described in 'administrative controls' above), and are utilised both proactively and reactively. Substitution measures involve the repositioning or replacement of equipment or reassignment of tasks when conditions require. For example, assignment of sound attenuated trucks to higher (noise) risk hauls during noise enhancing conditions ahead of shift, or reactively following a trigger.

iii Engineering measures

In conjunction with their suppliers, MTW has progressed with the attenuation of its fleet of haul trucks and other mining equipment. All new trucks purchased for use on the mines would be commissioned as noise suppressed (or attenuated) units. MTW currently operates a mixture of sound attenuated and non-sound attenuated machines and the existing fleet of trucks are being progressively fitted with suitable noise attenuation packages. Baseline testing has been completed and acoustic engineering is being applied to understand what SWLs are achievable across the fleet. The attenuation programme is being undertaken in a targeted manner, addressing the noisier pieces of equipment as a priority for the operations given the remaining development consent life.

Identification and rectification of defects to sound attenuation equipment is undertaken as required through the normal maintenance process where reasonable and feasible. MTW has also completed works to replace all in-pit reverse alarms with 'quacker' style reverse alarms on its mining fleet.

During 2012, engineering works were undertaken to address noise associated with shovel operations. Engineering controls were introduced including hydraulic snubber brakes, and fitting of self-greasing permalubes to the dipper door pins. Where additional reasonable and feasible opportunities for engineering controls are identified in the future, these would continue to be investigated and trialled as appropriate.

iv Elimination controls

Elimination controls are implemented in response to one or more triggers (described in 'administrative controls' above). Elimination controls, equipment or task shutdown, are implemented as a last resort where other controls have been inadequate.

10.5.2 Continuous improvement

Coal & Allied continues to work with the DP&E to improve the noise management plan, demonstrating commitment to continuous improvement and driving industry best practice noise management. It is expected that the continued implementation and refinement of measures outlined in the noise management plan (as updated from time to time) would enable MTW to effectively manage any noise impacts associated with this proposal, and ensure a high level of compliance is maintained throughout the life of the mine.

Warkworth Mine is currently working towards implementing a PMI and alternative real-time noise monitoring technology as described below.

i Predictive modelling interface

The PMI allows for proactive planning of mining operations and weather conditions as a leading measure for managing noise emissions. The PMI utilises predictive meteorological forecast data coupled with detailed mine plans and equipment sound power level information to predict noise levels at residences. The PMI is currently being refined and is expected to be fully integrated into day-to-day operations. Development and installation of alternate real-time noise monitoring technologies

Coal & Allied is also in the process of investigating alternate noise monitoring technologies to assist with operational control. During 2012 MTW committed capital funding to build and install a first of class directional noise monitor, known as ENC in the Bulga village area. The ENC was installed late December 2013 and is currently collecting data. The ENC aims to accurately pinpoint and identify noise emissions from multiple sources in real-time, to a greater level of accuracy than existing directional noise monitoring technology. This technology is expected to provide additional noise management value to MTW and is considered a first in noise management in NSW. A picture of a typical unit is provided in Figure 10.10.

Figure 10.10 Typical image of the Environmental Noise Compass

10.5.3 Compliance history

Compliance assessment monitoring for the Warkworth Mine has been undertaken in a number of forms during the period 2004 to 2014, including:

- routine compliance assessment (Global Acoustics) – 2004 to present and in more recent years, monitoring has included low frequency noise assessment;
- Long Point supplementary monitoring programme (EMM) – June to October 2011; and
- independent review of noise impacts – Bulga (Sinclair Knight Merz) – December 2011 and January 2012.

An assessment of monitoring data (publically available via the Rio Tinto Coal Australia website www.riotintocoalaustralia.com.au) demonstrates predominant compliance with noise criteria has been achieved throughout the life of the mine. Non-compliant noise measurements account for a small percentage of the monitoring dataset at 0.37 per cent (10 non-compliances measured from 2,689 individual assessments undertaken). These are shown in Table 10.10 and Table 10.11. These tables also demonstrate that there are no sustained exceedances.

Table 10.10 Summary of noise measurements for Warkworth Mine

Total assessments (2004-2014 YTD)	2,689
Total number of exceedances (2004-2013 YTD)	24
Total number of non-compliances (2004-2013 YTD)	10
Percentage of non-compliant assessment (2004-2013 YTD)	0.37

Note: 1. Exceedance refers to a measured result greater than the relevant consent limit, but within the 2dB allowable tolerance listed in Chapter 11 of the INP.

Table 10.11 Yearly breakdown of noise measurements for Warkworth Mine

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total number of assessments	230	276	280	279	292	275	269	290	261	201	36
Total number of exceedances[1]	1	0	1	1	1	8	1	4	4	3	0
Total number of non-compliances	1	0	0	0	0	4	1	2	1	1	0
Non-compliant assessments (%)	0.43	0.00	0.00	0.00	0.00	1.45	0.37	0.69	0.38	1.14	0.00

Note: 1. Exceedance refers to a measured result greater than the relevant consent limit, but within the 2 dB allowable tolerance listed in Chapter 11 of the INP.

When considering the impact of the Warkworth Mine on the area of Bulga village, the level of non-compliant measurements is relatively lower and accounts for 0.12 per cent of the monitoring dataset (two non-compliances measured from 1,643 individual assessments undertaken). This is shown in Table 10.12 and Table 10.13 These tables also demonstrate that there are no sustained exceedances from Warkworth Mine.

Table 10.12 Summary of noise measurements at Bulga village for Warkworth Mine

Total assessments (2004-2013 YTD)	1,643
Total number of exceedances (2004-2013 YTD)[1]	8
Total number of non-compliances (2004-2013 YTD)	2
Percentage of non-compliant assessment (2004-2013 YTD)	0.12

Note: 1. Exceedance refers to a measured result greater than the relevant consent limit, but within the 2 dB allowable tolerance listed in Chapter 11 of the INP.

Table 10.13 Yearly breakdown of noise measurements at Bulga village for Warkworth Mine

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total number of assessments	136	160	160	160	168	160	160	166	211	140	22
Total number of exceedances[1]	0	0	0	0	0	2	0	1	2	3	0
Total number of non-compliances	0	0	0	0	0	1	0	0	0	1	0
Non-compliance assessments (%)	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.71	0.00

Note: 1. Exceedance refers to a measured result greater than the relevant consent limit, but within the 2 dB allowable tolerance listed in Chapter 11 of the INP.

10.6 Residual level of impact

The INP, in Section 8.2.1, lists the matters to be considered if predicted noise levels exceed the PSNLs after reasonable and feasible mitigation has been applied. Table 10.14 provides an assessment of residual noise impacts from the proposal, consistent with the L&E Court judgement (par. 338).

Table 10.14 Residual level of impact

INP factors for consideration	Justification of the proposal
1. Characteristics of the area and receivers likely to be affected —the extent of the areas (including existing, developing or proposed residential, health or education sites) and number of receivers (including groups that may be especially sensitive to noise, such as pre-schoolers, students, the aged, hospital and nursing home patients) likely to be affected by noise levels above the project-specific noise levels —the daily activities of the community (in particular, effects such as sleep disturbance, speech interference, level of annoyance or effects on physical or physiological health) —property values —zoning of land uses affected by noise and the appropriateness of the zoning or land use —the potential change in the ambient noise levels as a result of the proposal; cumulative noise impacts in the area; and whether parts of the area that are already moderately or badly affected by noise will be more or less affected	The majority of the local area surrounding the proposal is characterised by mining and associated infrastructure and agricultural land, mainly pasture, with moderate sized stands of native woodland retained along the steeper hillsides and ridgelines and in patches along creek lines. The applicant owns a substantial area of land surrounding the Site. Warkworth Mine has been in operation since 1981 and the originally approved mine has been modified several times. Immediately to the south of Warkworth Mine is MTO, which also commenced operations in 1981. The integrated operation of MTW has been ongoing since 2004. The Bulga Coal Complex, which is adjacent to the south of MTW, has been operating since the 1980s. Wambo Mine and Hunter Valley Operation South, to the north of MTW, also commenced operations in 1969 and 1971, respectively. The noise and vibration study predicted noise levels at 221 assessment locations surrounding the mine. The predicted noise levels are during worst case INP prevailing meteorological conditions and for the majority of the time actual noise levels are likely to be less than those predicted. Of the 221 assessment locations, a total of 103 assessment locations are predicted with noise levels above PSNLs over the life of the mine. Of these, 81 are predicted to have minor noise level exceedances (1-2 dB(A) above PSNL), 18 are predicted to have moderate noise level exceedances (3-5 dB(A) above PSNL) and four are predicted to have significant noise level exceedances (greater than 5 dB(A) above PSNL). Assessment locations with predicted moderate and significant noise level exceedances account for approximately 9% of the total assessment locations considered. Further, one of the three residential assessment locations (77) predicted with a significant noise level exceedance has previously been identified in an acquisition zone of a neighbouring mine (Wambo Mine). Extrapolating Wambo Mine's noise identifies that one other residential location would be impacted (264). A total of 139 assessment locations within Bulga were considered. Of these, 60 are predicted with minor noise level exceedance, five are predicted with a

Table 10.14 Residual level of impact

INP factors for consideration	Justification of the proposal
—the extent to which biodiversity (especially native birds and other animals) will be affected —the likely variation between individuals in response to the noise —the amenity of areas used for outdoor recreational activities or conservation, heritage or wilderness areas —other industry in the area (including agriculture)	moderate noise level exceedance and one is predicted with a significant noise level exceedance, over the life of the mine. Assessment locations in Bulga with predicted moderate and significant noise level exceedances account for approximately 3% of the total assessment locations considered in Bulga. The change in noise from current and approved operations is expected to be marginal for western assessment locations, while a material reduction is predicted for eastern assessment locations as attenuation of mobile plant progresses. The proposed noise suppression and fleet management would mean the advancement westward would not result in material increases to noise levels. A cumulative noise assessment in accordance with the INP and Mining SEPP demonstrates criteria would be satisfied for all western locations with the exception of those already impacted by other mining operations. There is a very large range of human reaction to noise, including those who are very sensitive to noise. This noise-sensitive sector of the population would react to intruding noises that are barely audible within the overall noise environment, or would have an expectation of very low environmental noise levels. On the other hand, there are those within the community who find living in noisy environments, such as near major industry, on main roads or under aircraft flight paths, an acceptable situation. The bulk of the population lies within these two spectrums, being unaffected by low levels of noise and being prepared to accept levels of noise commensurate with their surroundings.
2. Characteristics of the proposal and its noise or vibrations —the noise characteristics of the activity —the extent to which any remaining noise impact exceeds the project-specific noise levels —the circumstances and times when the project-specific noise levels are likely to be exceeded —the circumstances and times when the source noise levels are likely to be below the project-specific noise levels (for example, when wind blows source noise away from the receiver) —the accuracy with which impacts can be predicted, and the likelihood that the impacts will occur in the manner predicted —the degree to which the character of the noise is new to an area and differs from existing noise sources —the economic benefit and social worth of the proposal for the local area, the region or the nation.	Warkworth Mine is an existing and well established mine in the Hunter Valley. The proposal seeks a continuation of all aspects of Warkworth Mine as it presently operates together with an extension of the approved mining footprint by approximately 698ha to the west of current operations. Warkworth Mine currently invests significantly in the noise management on the mine and would continue to do so under the proposal. For example, attenuation of all major plant would exceed $50million across MTW and would be completed by the end of 2016. Coal & Allied has committed to managing noise levels to within 1-2 dB above PSNL at approximately 90% of properties. Managing noise to this level is reasonable and feasible for the Site. Managing noise to PSNLs at all locations was tested and found not to be reasonable or feasible for the Site as it would result in the mine not being economically viable. The resultant loss in production from the required quantity of plant being disengaged, for the frequency and duration required due to the presence of adverse meteorological conditions under this scenario, exceeds $100million (real NPV) over the life of the proposal. The assessment has identified that noise levels predicted above PSNLs would only occur during worst case prevailing metrological conditions. It has been demonstrated that with continued management of the mine, such as by limiting some plant and equipment operation during adverse meteorological conditions, and implementing equipment fleet with best practice noise suppression, that INP PSNLs can be met for the majority of assessment locations. The noise modelling adopts area specific validation and, therefore, provides added confidence in the accuracy of predictions. Extensive monitoring to measure compliance would be continued under the proposal. The economic assessment for the proposal has identified that the direct economic benefit that can be attributed to Warkworth Mine is around $1.34billion in NPV terms. The economic flow-on effects from WML amount to: • for NSW, around $346million in additional income (in NPV terms), additional annual employment of 191 full-time equivalent workers, and a contribution to NSW GSP of around $406million;

Table 10.14 Residual level of impact

INP factors for consideration	Justification of the proposal
	• for the Mid and Upper Hunter region, around $204million in additional income in NPV terms, and additional annual employment of 198 full-time equivalent workers; and • for the Singleton LGA, around $75million in additional income in NPV terms, and additional annual employment of 57 full-time equivalent workers.
3. The feasibility of additional mitigation or management measures: - Alternative sites or routes for the development - The technical and economic feasibility of alternative noise controls or management procedures	Warkworth Mine is an existing and well established mine in the Hunter Valley and relocation is not reasonable or feasible. The applicant has considered a range of noise management and mitigation measures for the proposal. Those that are considered reasonable and feasible have been included in this assessment. These include a significant investment in providing best practice noise suppression to all equipment fleet (see details in section 10.1.1 of Appendix F) and limiting some plant and equipment operation during worst case meteorological conditions. These measures in combination with the established real-time noise monitoring and management system would assist in keeping noise levels to within or below 1-2dB of PSNL for approximately 90% of the assessment locations considered - this is a reasonable and feasible outcome for the viability of the proposal.
4. Equity issues in relation to: - The costs borne by a few for the benefit of others - The long-term cumulative increase in noise levels - The opportunity to compensate effectively those affected	The applicant would be investing significantly in noise management and mitigation over the life of the proposal which would be of significant benefit to the surrounding communities. The cumulative noise assessment demonstrates that with reasonable and feasible mitigation and management in place that the INP recommended acceptable amenity noise limits can be achieved for the life of the mine. The applicant would appropriately compensate all assessment locations identified with moderate or significant noise level exceedance as negotiated with DP&E and the landowner.

10.7 NSW Land and Environment Court issues

One of the key matters raised in the L&E Court judgement for Warkworth Extension 2010 was noise. The broad noise areas the judgement focussed on are as follows:

1. combining Warkworth Mine and MTO into one assessment (par. 16, 17, 264, 267, 364-367 and 378);
2. representative background noise for Bulga (par. 256);
3. sleep disturbance impacts;
4. low frequency noise (par. 261 and 363);
5. cumulative noise (par. 346); and
6. existing mining noise levels already unacceptable (suggesting, therefore, any new mining proposals should not be allowed) (par. 16).

Each of the above matters has been addressed in more detail in this chapter. A summary for each is provided below and further detail is provided in Appendix F:

1. The current approach does not combine Warkworth Mine and MTO. The two mines are assessed separately in this EIS. Further, the approvals do not overlap and it is clear when a noise source is regulated under the Warkworth Mine development consent and EPL and when it is regulated under the MTO development consent and EPL.

2. An extensive background noise analysis has been completed for Bulga residences as documented in Section 10.3. Six long-term monitoring sites across Bulga were used capturing, in some cases, several months of data. The data reflects consistency with historic (2002) data showing background levels of 30dB(A) to 33dB(A). Further, noise modelling was used to provide much finer allocation of noise background levels for individual residences.

3. Sleep disturbance is addressed in Section 10.4.3.

4. Low frequency noise is addressed in Section 10.4.4.

5. Cumulative noise is addressed in Section 10.4.7. It is demonstrated that the non-discretionary Mining SEPP is satisfied for Bulga residences and means the area's amenity is not compromised as it meets the INP's ANL. Further, the amenity, which relates to cumulative noise from all industry, cannot worsen for this area because no new large scale industry would be able to physically exist in a position that could push amenity levels any higher for Bulga residences.

6. A comprehensive data set of Warkworth Mine's performance with respect to compliance is provided in Section 10.5.3. Further the mine's current and on-going management is described in Section 10.5. It should also be noted that the attenuation to plant is currently at 50 per cent of trucks, and partly commenced on other items, and a commitment to have all major plant attenuated by the end of 2016 would mean an improvement to off-site noise levels on the current situation. As per Item 5, it is demonstrated that the ANL would be satisfied with the proposal.

10.8 Management and monitoring

The MTW would continue to implement its noise management system for the proposal, which is detailed in previous sections. The noise and vibration study has demonstrated that the noise management system would adequately manage noise and vibration impacts due to the proposal.

10.9 Conclusions

The assessment of the potential for noise impacts on 221 residences over the life of the proposal includes predictions of emissions based on an equipment fleet with best practice sound suppression on all major plant, implementation of which has substantially progressed. Further, the Warkworth Mine has developed industry-leading technology in NSW for pre-emptive real-time noise modelling and is using best practice real-time noise monitoring and management techniques. This constitutes all reasonable and feasible mitigation has and would be adopted as part of the proposal.

One of the study's aims was to demonstrate the effectiveness of managing off-site noise to within the INP's requirements and as described below this has largely been achieved.

Operational noise at residences was predicted under varying meteorological conditions prevalent at Site including calm, winds and temperature gradient conditions. Modelling has been validated in the past against monitoring results with strong agreement.

The study developed a fairer approach to background noise level assignment for Bulga residences through monitoring points and transition of RBLs between these.

The assessment concluded that operational noise would comply with the Mining SEPP non-discretionary standards at all locations not already significantly impacted by mining noise. It was also found that operational noise would comply with the INP's operational criteria at all assessment locations during 'calm' weather conditions for day, evening and night periods.

Of the 221 assessment locations, predictions during adverse weather indicated that operational noise levels from the proposal would likely present significant exceedances (ie greater than 5dB(A)) of the PSNLs at a total of four assessment locations (34, 77, 264 and 102). Of these, one (77) has previously been identified as within a zone of acquisition of Wambo Mine; one (264) is newly identified and would also be within Wambo Mine's acquisition zone had it been previously assessed; and one (102) has been identified as non-residential (Warkworth Hall).

Further, the proposal is likely to result in lower noise levels for eastern receivers than current and approved operations due to implementation of plant attenuation. The change in noise from current and approved operations is expected to be marginal for western assessment locations, while a material reduction is predicted for eastern assessment locations as attenuation of plant progresses. The proposed noise suppression and fleet management would mean the advancement westward would not result in a material increase to noise levels.

The cumulative noise assessment demonstrates adherence to the INP's amenity criteria and the non-discretionary Mining SEPP at all properties not previously identified as impacted.

It is demonstrated that the non-discretionary Mining SEPP is satisfied for Bulga residences and means the area's amenity is not compromised as it meets the INP's ANL. Further, the amenity, which relates to cumulative noise from all industry, cannot worsen for this area because no new large scale industry would be able to physically exist in a position that could push amenity levels any higher for Bulga residences. This means that while some residences would be 1–2dB above PSNLs, for example, these houses are habitable and still subject to a rural amenity.

This assessment also concludes that noise impacts are within appropriate criteria for operational blasting activities and increased traffic volumes on public roads due to the detoured traffic resulting from the closure of Wallaby Scrub Road.

Chapter 11

Air quality and greenhouse gas

Chapter 11 — Air quality and greenhouse gas

11 Air quality and greenhouse gas

11.1 Introduction

This chapter provides a summary of the air quality and greenhouse gas study prepared by Todoroski Air Sciences Pty Ltd (TAS), which is presented in full in Appendix G.

The chapter describes the existing air quality environment, predicted emissions, potential impacts at assessment locations, and management and monitoring measures.

11.2 Existing environment

11.2.1 Topography and climate

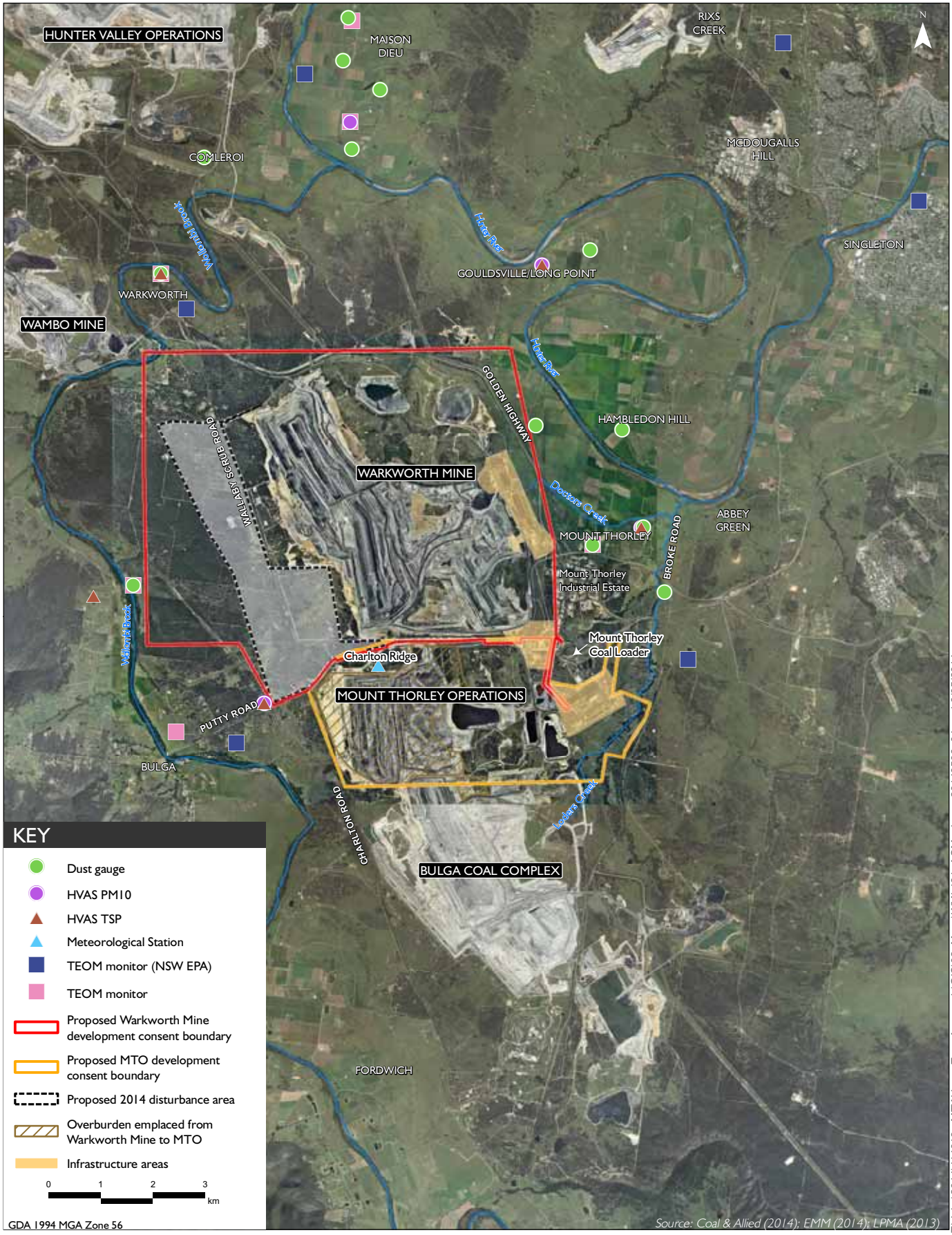
The surrounding landform and local climate will have a bearing on how air in the locality will move and disperse pollution, thus it is important to understand and to accurately consider these factors when conducting an air quality and greenhouse gas study.

The topography surrounding the Site is characterised by the steep escarpment to the west and south which forms part of the Wollemi National Park and the Pokolbin State Forest, respectively. To the north and east, the terrain is generally open to form the Hunter Valley. In the general vicinity of the Site, the terrain is typical of grassland and woodland with moderately hilly terrain. The complex terrain features of the surrounding area influence the local wind distribution patterns.

Long-term climate data was used to characterise the local climatic conditions. The data was collected at the Bureau of Meteorology's (BoM) station at Jerrys Plains Post Office (Station Number 061086), approximately 20km north-west of Warkworth Mine. A summary of the climatic data is provided below:

- January is the hottest month with a mean maximum temperature of 31.7°C and July is the coldest month with a mean minimum temperature of 3.8°C.
- Relative humidity levels exhibit variability over the day and seasonal fluctuations. Mean 9am relative humidity levels range from 59 per cent in October to 80 per cent in June. Mean 3pm relative humidity levels vary from 42 per cent in October to December to 54 per cent in June.
- Rainfall peaks during the summer months and declines during winter. The data show January is the wettest month with an average rainfall of 77.7mm over 6.4 days and August is the driest month with an average rainfall of 36.1mm over 5.2 days.
- Wind speeds during the warmer months have a greater spread between 9am and 3pm compared to the colder months. The mean 9am wind speeds range from 8.6km/h in April to 11.7km/h in September. The mean 3pm wind speeds vary from 11.0km/h in May to 14.7km/h in September.

The Charlton Ridge meteorological station (see Figure 11.1) is operated by MTW to assist with environmental management of operations.



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Air quality monitoring locations

Warkworth Continuation 2014
Environmental Impact Statement

Figure 11.1

Annual and seasonal windroses for the area show that the most common winds on an annual basis are from the south-southeast and south with very few winds originating from the north-east and south-west sectors. Dominant seasonal winds are south-southeast in the summer, south-southeast and north-west in winter, and south-southeast with varied winds from east-southeast, south and north-west in spring. The autumn distribution is similar to the annual distribution pattern.

Based on a long-term meteorological analysis, the 2012 calendar year was chosen as a representative meteorological year. The annual and seasonal windroses for 2012 are shown in Figure 11.2.

11.2.2 Ambient air quality

The main sources of particulate matter in the wider area include active mining, agricultural activities, emissions from local anthropogenic activities such as motor vehicle exhaust and domestic wood heaters, urban activity and various other commercial and industrial activities. Particulate matter consists of dust particles of varying size and composition, which are referred to as deposited dust, total suspended particulate matter (TSP), and TSP particles which have a diameter of 10 micrometres (µm) or less (PM_{10}) or 2.5µm or less ($PM_{2.5}$).

Other air pollutant emissions considered in the study include carbon monoxide (CO) and nitrogen dioxide (NO_2) which can potentially arise from mining operations such as the diesel powered equipment used onsite and methane flaring operations, and power generation, including the Liddell, Bayswater and Redbank power stations.

i Air quality goals

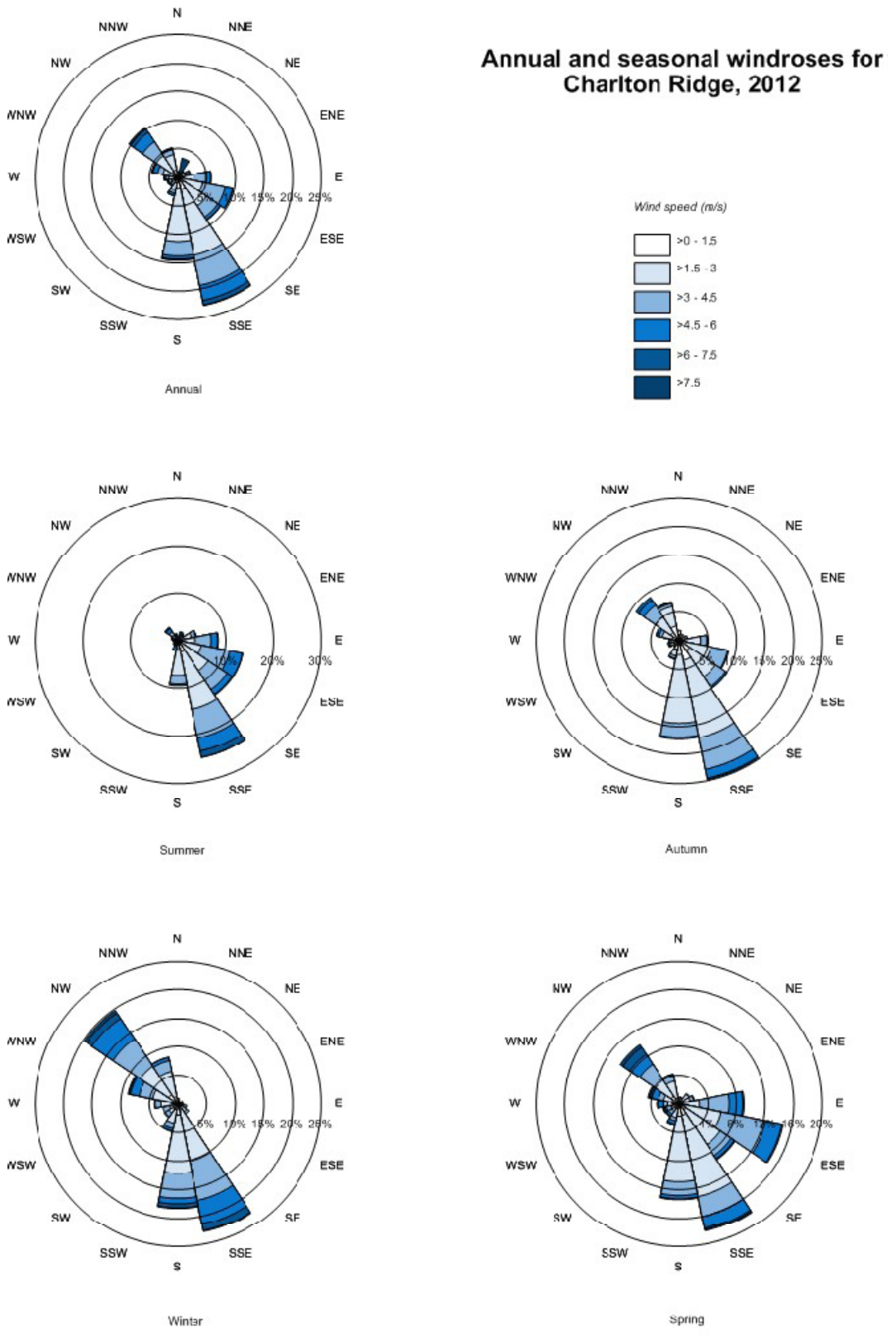
Air quality goals are benchmarks set to protect the general health and amenity of the community in relation to air quality. The air quality goals relevant to the study are outlined in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (the EPA Approved Methods, DEC 2005) and summarised in Table 11.1. The EPA currently does not have impact assessment criteria for $PM_{2.5}$ concentrations; however, the National Environment Protection Council (NEPC) has released a variation to the *National Environment Protection Measure* (NEPC 2003) to include advisory reporting standards for $PM_{2.5}$, which are included in Table 11.1.

The Mining SEPP non-discretionary standard with respect to cumulative air quality at private dwellings of PM_{10} annual average criterion of 30µg/m^3 is equivalent to the EPA annual average PM_{10} criterion.

Table 11.1 Impact assessment air quality goals

Pollutant	Averaging Period	Impact	Criterion
TSP	Annual	Total	90µg/m^3
PM_{10}	Annual	Total	30µg/m^3
	24 hour	Total	50µg/m^3
Deposited dust	Annual	Incremental	2g/m^2/month
		Total	4g/m^2/month
$PM_{2.5}$*	24 hours	-	25µg/m^3
	Annual	-	8µg/m^3
Carbon monoxide (CO)	15 minute	-	100mg/m^2
Nitrogen dioxide (NO_2)	1 hour	-	246µg/m^3
	Annual	-	62µg/m^3

Source: Approved Methods (DEC 2005).



**National Environment Protection Council advisory standard, National Environment Protection Measure (NEPC 2003).*

Figure 11.2 Annual and seasonal windroses for Charlton Ridge weather station (2012)

Acquisition and negotiated agreements with private residential landowners are generally required by DP&E if there are systemic exceedances of the impact assessment goals outlined in Table 11.1. In the context of impact assessments for approval of new proposals and modifications to existing projects, this is interpreted to mean where the EPA criterion is exceeded on more than five days in any year (a 98.6 percentile level of compliance).

ii Monitoring data

To quantify ambient air quality near the Site, data was collected from a number of monitoring locations in the vicinity of the Site (see Figure 11.1) including 12 Tapered Element Oscillating Microbalances (TEOMs), 11 High Volume Air Samplers (HVAS) measuring either TSP or PM_{10}, 13 dust deposition gauges and three NO_2 monitors. A summary of the available and reviewed ambient monitoring data relevant to the proposal is provided below.

- Annual average PM_{10} concentrations are below the relevant criterion of 30µg/m³.
- Maximum 24-hour average PM_{10} concentrations are on occasion above the relevant criterion 50µg/m³ at some of the monitoring locations.
- The annual trends seen in the TEOM monitoring data indicate that PM_{10} concentrations are generally highest in the spring and summer months with the warmer weather raising the potential for drier ground elevating the occurrence of windblown dust, bushfires and pollen levels.
- Annual average TSP concentrations are below the relevant criterion of 90µg/m³.
- Annual average dust deposition concentrations are below the relevant criterion of 4g/m^2/month.
- Maximum daily 1-hour average NO_2 concentrations are below the relevant criterion of 246µg/m³.

The MTW air quality monitoring network is described in Section 11.5.1.ii.

11.2.3 Compliance history

Reporting of air quality monitoring results in the 2012 and 2013 annual reviews for MTW show that current dust generation has met the relevant criteria given in Table 11.1. This is despite dust generation recorded in 2012 being generally higher than for previous years, attributed to lower rainfall. A summary of the 2012 and 2013 dust monitoring results presented in the respective annual reviews is provided below.

- Monthly dust deposition concentrations at all monitoring locations were below 1.25g/m^2/month, indicating compliance with the criteria of 2g/m^2/month.
- Maximum total dust deposition concentrations at all monitoring locations for both years were below 3.5g/m^2/month, indicating compliance with the criteria of 4g/m^2/month.
- Exceedances of dust deposition criteria recorded at a number of sites were determined to be contaminated by non-mine sources such as bird droppings, insects and vegetation.
- Annual average TSP concentrations were below the criteria of 90µg/m^3 with recorded levels being generally 60µg/m^3, with the exception of recorded levels of approximately 85µg/m^3 at the most impacted monitoring location WML-HV1 in 2012.

- 24-hour PM_{10} concentrations above the EPA criteria of 50µg/m^3 were recorded on eight days in 2012 and ten days in 2013; however, investigation of wind direction and location identified that the elevated levels on these days were predominantly due to other sources of particulate matter, such as bushfires and regional dust events. Therefore, there were no non-compliances with, or sustained exceedances of, the PM_{10} 24-hour criterion in 2012 and 2013 attributable to MTW.

- Annual average PM_{10} concentrations were below the EPA criterion of 30µg/m^3. For most of the monitoring locations the annual average concentrations were approximately 20µg/m^3, with the exception of one monitoring location (MTIE), which recorded a concentration of approximately 28µg/m^3 in 2012 and approximately 26µg/m^3 in 2013 (below criteria).

11.3 Impact assessment

11.3.1 Methodology

The methodology for this work included an initial, high level risk assessment of the conceptual mine plan, with the key specialists and the mine planning engineers; adjustments to the conceptual plan to minimise the potential for dust (and other) effects; and a conventional air dispersion modelling assessment based on the optimised mine plan. The modelling assessment approach is described in more detail below.

i Air assessment approach

The study considered existing mining areas and the proposed extension area. To adequately assess the potential impacts resulting from the proposal, the assessment methodology incorporated all of the existing and approved Warkworth Mine operations. The assessment results thus represent the potential impacts resulting from the whole of Warkworth Mine including the changes resulting from the proposal. Consequently, some of the predicted effects are due to the activities from operations already approved, irrespective of the proposal.

The modelling assessment also includes dust from all nearby existing and proposed mining projects including MTO, Wambo Mine, Hunter Valley Operations, Rix's Creek and Bulga Coal Complex. The assessment uses the best available data to incorporate the presently proposed Bulga Optimisation Project and Rix's Creek West Pit extension.

The study was prepared in general accordance with the EPA Approved Methods which set out the applicable criteria, and detailed guidelines on how to conduct an air quality impact assessment.

The study investigated the potential for adverse air quality impacts to occur at surrounding assessment locations as a result of the proposal through the use of air dispersion modelling. Assessment locations used in the study are shown in Figure 11.3.

The modelling approach was a combination of the CALPUFF Modelling System for dispersion modelling and the CSIRO meteorological model TAPM. The CALPUFF model is an advanced 'puff' model that deals with the effects of complex local terrain on dispersion meteorology. It allows for spatial variation of meteorology, such as wind patterns, over a three-dimensional modelling domain in an hourly varying time step. The CALPUFF approach is accepted by the EPA as an appropriate modelling system for open cut coal mines in NSW. The potential impacts of the proposal were modelled using local topographical and meteorological data.

Estimated maximum dust emissions from the proposal, and all nearby mines were added to existing air quality levels to determine the total impacts that may arise. The calculated dust concentrations at the assessment locations were then compared with the air quality criteria presented in Table 11.1 to determine whether compliance was achieved. Several rounds of modelling assessment were completed as part of work with the mine planners in order to minimise potential emissions and impacts. The refined mine designs were put forward and assessed in the study.

The study considers three indicative mine plan years (Year 3, 9 and 14) chosen to represent a range of potential impacts over the 21 year life of the proposal by reference to the location of the operations and the potential to generate dust in each year. It is noted that later years were not modelled as, between Year 14 and Year 21, the mining footprint would not extend any further west and would only deepen which would shield plant from assessment locations more than in any previous years.

The cumulative air quality environment in the vicinity of Bulga village and for the assessment locations generally to the west and south-west of the proposal is likely to improve beyond Year 14. This arises as the dust emissions predictions from the other mines in the area for these years show reductions in emissions and/ or move further away from the assessment locations.

The emissions reductions beyond Year 14 occur as mining activity/ footprints reduce and also as some of the mines consents expire. It should be noted, however, that all of the neighbouring mines were conservatively included in the modelling assessment for Year 14 (even those without a development consent or known plans to operate at this time, as described earlier in this section).

Dust emissions and impacts from the Bulga Coal Complex would progressively reduce at the majority of the assessment locations as the proposed operation moves to the east (away from assessment locations) and its emissions and footprint reduce over time (Umwelt 2013).

For each of the three indicative years, the rate of dust emission was calculated by analysing the various types of dust generating activities taking place in each year and applying suitable emission factors sourced mainly from studies supported by the US EPA and from Australian studies and site-specific data where possible. The estimated dust emissions reflect the application of best practice dust mitigation currently being implemented at MTW in accordance with its Air Quality and Greenhouse Gas Management Plan (AQMP) and pollution reduction programme (PRP) (see Section 11.5.1.i).

ii Cumulative assessment

In addition to the estimated dust emissions from the proposal, emissions from all nearby approved, and proposed mining operations were also modelled, per their current consent (or current proposed project), to assess potential cumulative dust effects. Emission estimates from these sources were derived from information provided in the air quality assessments available in the public domain at the time of modelling. These estimates are likely to be conservative as, in many cases, mines do not continually operate at the maximum extraction rates assessed in their respective EAs. Further, it was conservatively assumed that all mines would continue to operate until 2035, the life of the proposal.

Other dust generating activities in the surrounding area would also contribute to existing dust levels and an allowance for this contribution as well as contributions from other non-modelled dust sources was included in the assessment. The contribution to the prevailing background dust levels of other non-modelled dust sources was estimated by modelling the past (known) mining activities during 2012 and comparing model predictions with the actual measured data from the corresponding monitoring stations. The average difference between the measured and predicted PM_{10}, TSP and deposited dust levels from each of the monitoring points was considered to be the contribution from other non-modelled dust sources, and was added to the future predicted values to account for the background dust levels.

The assessment of cumulative impacts used PM_{10} data collected from TEOM monitors at Warkworth Mine and Hunter Valley Operations during 2012. This period was chosen as it corresponded with a period of representative meteorological data for this area, and also as it has the highest baseline PM_{10} levels measured in Bulga village but does not contain the anomalous high peaks that occurred during the bushfire period in late 2013 or the relatively low levels that occurred in Bulga village in 2013. The use of this data is likely to result in a generally conservative (ie an overestimate) of the potential cumulative air quality impacts which may be predicted to occur in this area.

11.3.2 Predicted impacts

i Dispersion modelling predictions

The dispersion model predictions for each of the indicative mine plan years are presented in this section. The results show the estimated maximum 24-hour and annual average PM_{10} concentrations. Annual average TSP concentrations and annual average dust (insoluble solids) deposition rates for the proposal operating in isolation (the incremental impact) and with other sources (the total (cumulative) impact) are within the PM_{10} zone of effect and do not affect the outcomes of the study.

The privately-owned assessment locations where impacts are predicted to exceed relevant assessment criteria are summarised in Table 11.2 showing the year(s) of impact and the level of impact (see Appendix G for all receptor locations). The mine-owned (MTW or other mines) assessment locations where impacts are predicted to exceed relevant assessment criteria are summarised in Table 11.3. Contours of the all years, worst case modelling predictions (ie 100 percentile) with respect to all assessment locations are shown in Figure 11.3.

Table 11.2 Summary of modelled predictions where predicted impacts exceed assessment criteria at privately-owned assessment locations

Assessment location ID	PM_{10}			TSP	Dust deposition	
	Incremental 24-hour average		Total annual average	Total annual average	Incremental annual average	Total annual average
	Criterion 50µg/m³		Criterion 30µg/m³	Criterion 90µg/m³	Criterion 2g/m²/month	Criterion 4g/m²/month
	Year of impact (level of impact - µg/m³)	No. of days above 50µg/m³	Year of impact (level of impact - µg/m³)	Year of impact (level of impact - µg/m³)	Year of impact (level of impact - g/m²/month)	
77*	Year 9 (59)	2	Year 3 (32)	-	-	-
	Year 14 (78)	7	Year 9 (36)			
			Year 14 (35)			
102#	Year 9 (82)	8	Year 3 (31)	-	-	-
	Year 14 (96)	3	Year 9 (31)			
264##	Year 9 (86)	10	Year 3 (31)	-	-	-
	Year 14 (99)	3	Year 9 (32)			

Notes: **Assessment location is within Wambo Mine's acquisition zone.*

 # Assessment location is a non-residence: Warkworth Hall.

Assessment locations inferred to be within Wambo Mine's acquisition zone.

Three privately-owned assessment locations (77, 102, and 264) all in Warkworth village may experience concentrations above the relevant criteria for 24-hour average and annual average PM_{10}. Of these: assessment location 77 is within Wambo Mine's current acquisition zone; assessment location 102 is the Warkworth Hall, a non-residential location; and assessment location 264 is newly identified and would have been within Wambo Mine's acquisition zone had it been previously assessed.

Therefore, the cumulative air quality level of 30µg/m³, as set in clause 12AB(a) of the Mining SEPP, is met at all but two residential assessment locations (77 and 264), both of which are already significantly affected by a neighbouring mine (Wambo Mine).

Table 11.3 Summary of modelled predictions where predicted impacts exceed assessment criteria at mine-owned assessment locations

Assessment location ID	PM_{10}			TSP	Dust deposition	
	Incremental 24-hour average		Total annual average	Total annual average	Incremental annual average	Total annual average
	Criterion 50µg/m³		Criterion 30µg/m³	Criterion 90µg/m³	Criterion 2g/m²/month	Criterion 4g/m²/month
	Year of impact (level of impact - µg/m³)	No. of days above 50µg/m³	Year of impact (level of impact - µg/m³)	Year of impact (level of impact - µg/m³)	Year of impact (level of impact - g/m²/month)	
78	Year 9 (105) Year 14 (147)	68 94	Year 3 (32) Year 9 (55) Year 14 (57)	Year 9 (110) Year 14 (117)	Year 9 (2.4) Year 14 (2.8)	Year 9 (4.9) Year 14 (5.2)
79*	Year 9 (55) Year 14 (77)	2 4	Year 3 (32) Year 9 (35) Year 14 (34)	-	-	-
83*	Year 9 (55) Year 14 (74)	2 3	Year 3 (32) Year 9 (34) Year 14 (33)	-	-	-
90	Year 9 (64) Year 14 (72)	2 3	Year 9 (32)	-	-	-
91*	Year 9 (64) Year 14 (76)	3 3	Year 9 (32)	-	-	-
93	Year 9 (71) Year 14 (83)	5 4	Year 9 (33)	-	-	-
94*	Year 9 (68) Year 14 (78)	3 3	Year 9 (31)	-	-	-
96*	Year 9 (73) Year 14 (86)	6 3	Year 9 (31)	-	-	-
99*	Year 9 (80) Year 14 (95)	7 3	Year 9 (32)	-	-	-
100	Year 14 (53)	1	-	-	-	-
101	Year 14 (51)	1	-	-	-	-
104	Year 14 (58)	2	-	-	-	-

Table 11.3 Summary of modelled predictions where predicted impacts exceed assessment criteria at mine-owned assessment locations

Assessment location ID	PM_{10}			TSP	Dust deposition	
	Incremental 24-hour average		Total annual average	Total annual average	Incremental annual average	Total annual average
	Criterion 50µg/m³		Criterion 30µg/m³	Criterion 90µg/m³	Criterion 2g/m²/month	Criterion 4g/m²/month
	Year of impact (level of impact - µg/m³)	No. of days above 50µg/m³	Year of impact (level of impact - µg/m³)	Year of impact (level of impact - µg/m³)	Year of impact (level of impact - g/m²/month)	
105	Year 3 (58) Year 9 (62) Year 14 (78)	2 3 1	-	-	-	-
106	Year 14 (83)	16	-	-	-	-
107	Year 14 (62)	5	-	-	-	-
108	Year 9 (76) Year 14 (160)	14 42	-	-	-	-
109*	Year 3 (162) Year 9 (165) Year 14 (92)	153 27 2	Year 3 (61) Year 9 (35)	Year 3 (125)	Year 3 (3.0)	Year 3 (5.3)
110	Year 9 (60) Year 14 (95)	2 21	-	-	-	-
112	Year 9 (143) Year 14 (313)	16 79	Year 3 (37) Year 9 (34) Year 14 (43)	-	-	-
114	Year 3 (64)	1	-	-	-	-
145*	-	-	Year 3 (36) Year 9 (41)	-	-	-
209*	-	-	Year 3 (32) Year 9 (35)	-	-	-
271*	-	-	Year 3 (44) Year 9 (46) Year 14 (46)	Year 9 (92) Year 14 (92)	-	-
941*	Year 9 (82) Year 14 (96)	9 3	Year 9 (31)	-	-	-

Notes: **Other, non MTW, mine-owned property.*

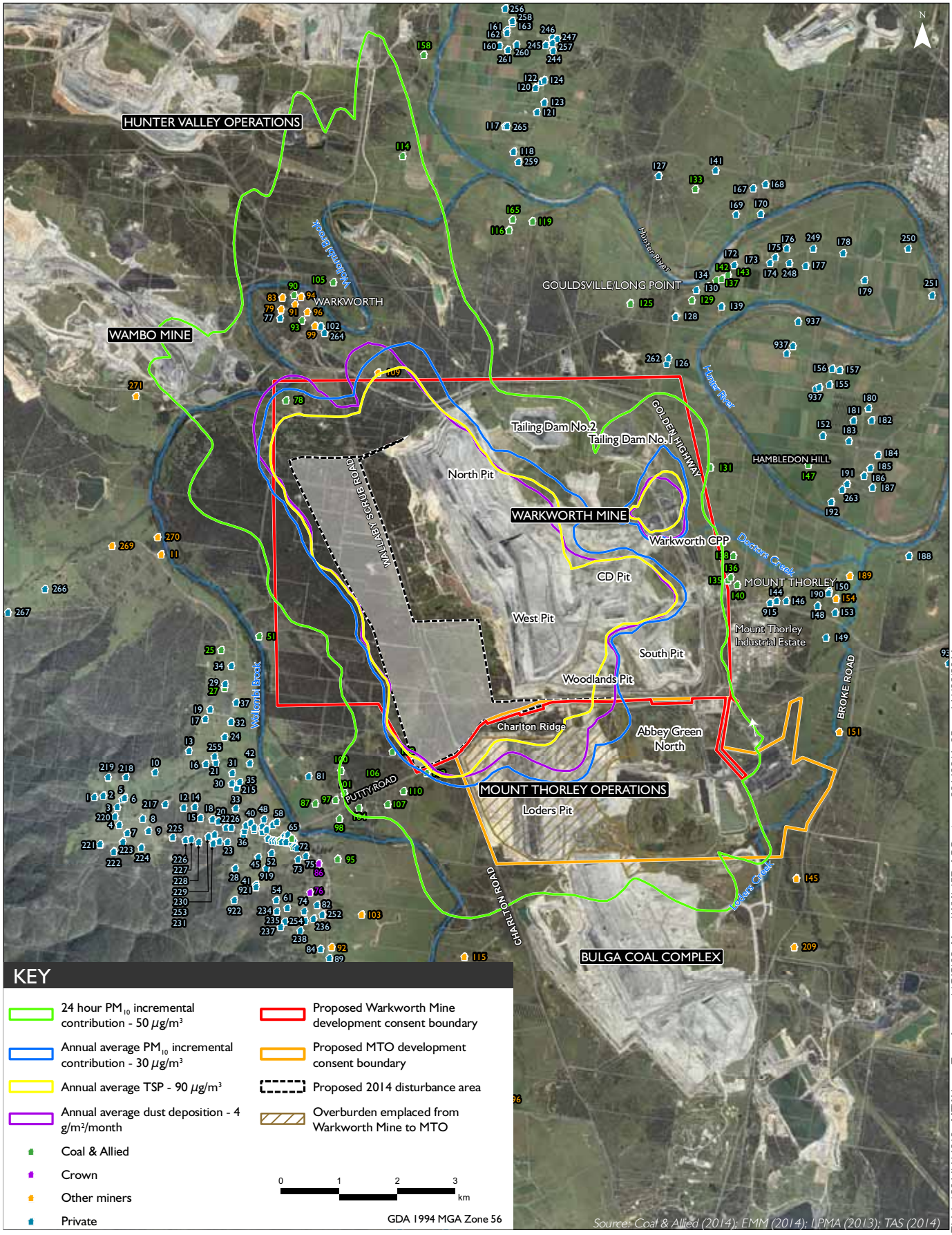


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Figure 11.3

Twenty four mine-owned assessment locations may experience concentrations above the relevant criteria for 24-hour average and annual average PM_{10}. A subset of these assessment locations may also experience concentrations above the relevant criteria for annual average TSP (78, 109, and 271), incremental and total annual average dust deposition (78 and 109).

It should be noted that mine-owned assessment locations 145, 209 and 271 are predominantly influenced by other dust sources in the area and are largely unaffected by activity from the proposal.

ii Maximum 24-hour average PM_{10} contemporaneous assessment

The Level 2, EPA contemporaneous assessment method (outlined in Section 11.2 of the EPA Approved Methods (DEC 2005)) was also applied to examine the potential maximum (cumulative) 24-hour average PM_{10} impacts for the proposal. The EPA method uses the measured background data for each day of the year and on each day, adds the additional effect (the change in dust level) that may result from the proposal to determine the cumulative effect.

As the proposal interacts with MTO, future MTO activities were included as part of the total cumulative assessment of likely future impacts.

The analysis focused on locations that represent the assessment locations surrounding the Warkworth Mine, at which the data required to conduct this assessment are available. These locations correspond with the five monitoring stations (MTW TEOM stations at Bulga, Wallaby Scrub Road, Warkworth, MTIE and Knodlers Lane – see Figure 11.1 for locations) where suitable ambient monitoring data is available.

Generally, these monitoring locations are representative of the most impacted receptors in the surrounding assessment locations as they are typically closer to the mining activity and hence are likely to experience greater impacts. The predicted cumulative 24-hour average PM_{10} levels assessed at the monitor locations can be therefore be considered a reasonable, conservative measure of the potential 24-hour average PM_{10} impacts that may arise across the representative assessment locations.

Maximum background levels of 24-hour average PM_{10} have in the past reached levels near the relevant criterion (depending on the monitoring location and time). As a result, the Level 1 EPA approach of adding maximum background levels to maximum predicted proposal only levels would show levels above the criterion. In such situations, more detailed assessment is required. The Level 2 EPA approach in this regard sets out a more thorough assessment whereby the measured background level on a given day is added contemporaneously with the corresponding predicted proposal only level using the same day's weather data. This method factors into the assessment the spatial and temporal variation in background levels affected by the weather and existing sources of dust in the area on a given day.

A summary of the findings of the contemporaneous assessment at each monitoring location is provided in Table 11.4.

Table 11.4 EPA maximum 24-hour average PM_{10} contemporaneous assessment results (number of additional days above criteria as a result of the proposal)

Location	Year 3	Year 9	Year 14
Bulga	0	0	0
Wallaby Scrub Road	0	0	0
Warkworth	1	6	4
Knodlers Lane	0	2	1
MTIE	0	3	0

The results indicate that it is unlikely that cumulative impacts would arise at the assessment locations near the Bulga and Wallaby Scrub Road monitoring locations during the years assessed.

There is potential for cumulative impacts to arise near the Warkworth, Knodlers Lane and MTIE monitoring stations. The potential risk of cumulative impacts at the Knodlers Lane and MTIE monitors is relatively low with only two and three additional days, respectively, of predicted impact above the relevant criterion in Year 9 and only one day for Knodlers Lane in Year 14.

The potential risk of cumulative impacts near the Warkworth monitor is greater with one, six and four additional days predicted to exceed the relevant criterion in Years 3, 9 and 14, respectively. These impacts are as would be expected as prevailing winds would transport material along the mine pit and project dust northwards. As the mine progresses westwards, the impacts to the north of the mine move closer to Warkworth, as represented in the indicative mine plan years assessed. The majority of receptors at Warkworth are mine-owned or currently afforded acquisition rights.

iii Cumulative $PM_{2.5}$

The nearest available $PM_{2.5}$ data is collected at the Upper Hunter Air Quality Monitoring Network station at Singleton. This data shows a trend of increasing $PM_{2.5}$ levels in the winter and reduced levels in the summer which is likely due to the influence of urban sources of fine particulate matter. A recent study conducted by the CSIRO to characterise this fine particulate matter found that wood burning activities in winter made up an average of 38 per cent of the $PM_{2.5}$ in Singleton.

Examination of the available $PM_{2.5}$ measurement data for Singleton shows that during 2012 the annual average $PM_{2.5}$ level is approximately 8µg/m³, the 70th percentile 24-hour average maximum levels are approximately 9.6µg/m³ and maximum 24-hour average levels are below 25µg/m^3.

It is considered that background levels of $PM_{2.5}$ at the Site would be significantly lower than the levels in Singleton, given the concentration of wood heaters, people and cars is considerably less in the near vicinity of the Site.

Given background $PM_{2.5}$ data does not exist at the Site and in the absence of assessment methodology guidance in NSW, a method used by the Victorian EPA was utilised to determine likely cumulative $PM_{2.5}$ levels for assessment locations in proximity to the Site. As stated in the Victorian State Environment Protection Policy (Air Quality Management):

> Proponents required to include background data where no appropriate hourly background data exists must add the 70th percentile of one year's observed hourly concentrations as a constant value to the predicted maximum concentration from the model simulation. In cases where a 24-hourly averaging time is used in the model, the background data must be based on 24-hour averages.

In the case of the proposal, if the incremental (proposal only) results for annual and 24-hour $PM_{2.5}$ were added to the estimated annual average background $PM_{2.5}$ levels, or the 70th percentile 24-hour maximum levels, then no assessment location (that would comply with the criteria for other pollutants) would experience cumulative $PM_{2.5}$ level above the NEPM advisory reporting standards.

iv Diesel emissions

The modelling predictions for NO_2 emissions found that in Years 3, 9 and 14 all assessment locations are predicted to experience maximum 1-hour average and annual average NO_2 concentrations below the criteria of 246µg/m³ and 62µg/m³, respectively.

The ambient air quality goals for CO are set at higher concentration levels than the NO_2 goals. Based on the NO_2 monitoring data which are low compared to the goals, and consideration of the typical mix of ambient pollutant levels and associated emissions of CO, the indication is that predictions of CO would be well below the air quality goals.

v Blast fume emissions

Blast fume emissions (NO_2) were estimated on the basis of emission levels presented in a CSIRO study of Hunter Valley blasts (Attala et al. 2008). Dispersion modelling of the potential blast fume emissions was conducted for each indicative mine plan year. The model was set up to generate a blast in each pit during each hour of the day when blasting is permitted. The modelling was done with/ and without application of the existing blast restrictions that set out the permissible conditions under which a blast may be triggered. This comparison was conducted to determine the effects of these permissions in limiting potential impacts. Isopleth diagrams demonstrating the contours of the assessed maximum 1 hour average NO_2 concentrations during each potential blast hour of each year are provided in the air quality and greenhouse gas study (see Appendix G).

The modelling results show that during the middle daytime hours no impacts due to blasting fume emissions are predicted to occur. During these times, the blast restrictions have a relatively small effect because there would not be any appreciable impact to mitigate. However, in the early evening, when there is potential for impacts to arise offsite, the results show that application of the blasting restrictions would avert such potential impacts for most assessment locations.

As the proposal moves west the potential for blast fume impacts to the west increases. This means that potential impacts at assessment locations to the west would need to be managed in the later years of mining.

It is noted that in this regard MTW is currently implementing a predictive management system to aid with management of blasting operations. Such a system uses actual conditions for each blast to predict the potential impact which may occur. The prediction is made on the basis of forecast weather data, allowing operators to schedule a blast to the time of least impact over the course of the upcoming day. In effect the system updates the blasting restrictions for each individual blast on the basis of predicted impact. The system thus deals with the spatially and time varying weather and terrain influences and is generally more reliable than relying on a fixed set of wind speed and wind direction restrictions.

Overall, it is anticipated that with implementation of the protocols outlined in the MTW Blast Management Plan (BMP) (see Section 11.5.1.iii) potential blast impacts would be averted.

vi Health effects

The air quality and greenhouse gas study (see Appendix G) included a detailed review of the available studies that relate to health effects associated with exposure to particulates. Finer particles (smaller than 10µm, termed 'respirable') tend to be of more concern when considering health risks related to air quality as these particles can penetrate into the lungs whereas larger particles would, if inhaled, be trapped in the upper respiratory system and not reach the lungs. Health effects related to air quality vary depending on the length of exposure and whether those exposed are within a susceptible group (for example the elderly, infants, and persons with chronic cardiopulmonary disease, pneumonia, influenza or asthma).

Studies that identify the potential health risks of human exposure to particulate matter generally relate to large cities, where a larger portion of the particulates are in the fine fraction that would penetrate into the lung, and also where a greater portion of the particulate matter is from combustion sources, which carries with it other individually toxic substances that are damaging to human health. Rural populations are too small for conclusive epidemiological studies to be conducted in those areas, and insufficient alternative data is available for rural areas to identify specific issues that health experts can agree on. Therefore, as a matter of precaution, the findings for urban areas are extrapolated to cover rural areas in order to have a basis for managing exposure to particulate matter for rural populations.

It is important to note that the majority of particulate emissions from mining are dust which originates from the soil. Due to the extreme forces required at the micro level to break down a particle of dust into smaller particles in the fine fraction, mining techniques used at coal mines generally cannot breakdown rock, coal or soil material into these very fine fractions. As a result emissions from mines are predominantly in the coarse size fraction which would not penetrate as deeply into the lung, or carry additional toxic combustion substances.

On average it has been measured that approximately 5 per cent of the total dust (TSP) from mining is in the $PM_{2.5}$ size fraction, and approximately 12 per cent of PM_{10} from mining is in the $PM_{2.5}$ fraction (SPCC 1986). In contrast, in the urban areas in which the majority of the health studies have been conducted, approximately 50 per cent of the PM_{10} is comprised of particles in the $PM_{2.5}$ size range, and most of these are from combustion.

In many rural areas domestic wood smoke is a key issue of health impact. Wood smoke warrants close attention in any evaluation of health impact as it can be a significant, highly localised source of toxic pollution in the winter period for rural communities and individuals. Wood heaters are also inside living rooms and their chimneys closer to residents than coal mines, which means the air that the population breathes will usually be affected by wood heater emissions to a much greater degree than more distant particle sources. Recent studies by the CSIRO (CSIRO 2013) into the composition of particulate matter in the Hunter Valley found that a key source of fine particulate is wood smoke. An initiative to target particulates in the Hunter Valley has recently been launched by the EPA, and a key action relates to management of wood smoke in the urban areas (EPA 2013).

11.4 Greenhouse gas emissions

11.4.1 Methodology

The GHG emissions were predicted in accordance with the National Greenhouse Accounts (NGA) Factors document published by the Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICSRTE 2013a). The NGA Factors document defines three scopes (Scopes 1, 2 and 3) for different emission categories based on whether the emissions generated are from 'direct' or 'indirect' sources.

Scope 1 emissions encompass the direct sources from an activity and Scope 2 and 3 emissions occur due to indirect sources. To quantify the amount of carbon dioxide equivalent (CO_2-e) material generated from the proposal, emission factors were obtained from the NGA Factors document and other sources as required.

Scope 1 and 2 GHG emission sources identified from the operation of the proposal are the onsite combustion of diesel fuel, petrol fuel, petroleum based greases and oils, explosives, emissions of methane from the exposed coal seams, gaseous fuels and onsite consumption of electricity. Estimated quantities of materials that have the potential to be Scope 1 and 2 emissions were based on a conservative upper limit of the assumed maximum production throughout the life of the proposal.

Scope 3 emissions can often result in a significant component of the total emissions inventory; however, these emissions are generally not directly controlled by the proposal. These emissions are generally considered to be the Scope 1 emissions from other various organisations related to the proposal. The primary contribution of the Scope 3 emissions from the proposal occurs from the end use of the product coal and the transportation of the product coal. Specifically these emissions result from the purchase of diesel, petrol, petroleum based greases and oils, electricity for use onsite, the transport of product coal to its final destination, and the final use of the product coal.

Estimated Scope 3 emissions were derived from emission factors for the transport modes of rail and shipping and the associated average weighted distance travelled for the export coal, though they have the potential to vary in the future depending on the market situation at the time. The approximate rail distance was taken to be 166km (return distance) and the approximate shipping distance was taken to be 13,000km (return distance), based predominately on destinations in the Asian market. The emissions generated from the end use of product coal assumed that 5 per cent of the product coal is consumed at Redbank Power Station and the remaining quantity is to be used in power generation and steel manufacturing.

11.4.2 Impact assessment

The predicted Scope 1, 2 and 3 emissions associated with the proposal are summarised in Table 11.5. The estimates in the table below are based on a conservative scenario of applying the maximum proposed rate of extraction for the duration of the proposal rather than year to year production rates which may be lower in some years.

Table 11.5 Summary of CO_2-e emissions per scope (t)

Period	Scope 1	Scope 2	Scope 3
Annual	882,058	156,336	39,447,215
Total	**18,523,223**	**3,283,063**	**828,391,507**

The estimated annual greenhouse emissions for Australia for the period October 2012 to September 2013 was 567.5Mt CO_2-e (DoE 2014). The estimated greenhouse emissions for NSW in the 2010/2011 period are 159Mt CO_2-e (DIICSRTE 2013b). The conservative estimated annual average greenhouse emissions over the 21 year life of the proposal are 1.038Mt CO_2-e (Scope 1 and 2), which represents approximately 0.18 per cent and 0.65 per cent of Australia's and NSW emissions, respectively.

11.5 Management and monitoring

11.5.1 MTW integrated management system

The management of air quality is integrated across Warkworth Mine and MTO and is undertaken in accordance with the MTW Air Quality and Greenhouse Gas Management Plan (AQMP). The MTW AQMP was prepared in accordance with the requirements of Schedule 4, Condition 18 of the development consent and Schedule 3, Condition 27 of MTO's development consent to manage project specific and cumulative air quality emissions associated with MTW mining operations. The MTW AQMP was developed in accordance with industry best practice with consideration given to the full available range of reasonable and feasible mitigation and their effectiveness in determining the measures to be implemented at the Site. It was submitted to DP&E for approval on 28 March 2014.

Air quality management and monitoring would continue to be undertaken in accordance with the MTW AQMP under the proposal.

Dust management practices in place at MTW aim to ensure compliance with prescribed criteria and to respond to government and community concerns regarding the impacts of mining on regional air quality in the Hunter Valley. Compliance results shown in Section 11.2.3 demonstrate the effective dust management measures implemented on site.

The MTW AQMP applies reasonable and feasible air quality mitigation measures to achieve a standard of mine operation consistent with current best practice for the control of dust emissions from coal mines in NSW. The measures reflect those outlined in *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Katestone Environmental 2010), and those imposed on mines by the EPA through application of Pollution Reduction Programmes (PRPs) that relate to haul road emissions, and dust mitigation in response to adverse weather conditions.

The PRPs apply to all Hunter Valley Coal mines, including the Warkworth Mine. The best practice controls currently implemented were considered in the assessment and, where applicable, applied in the dust emission estimates.

11.5.2 Monitoring network

The air quality monitoring network at MTW involves monitoring of dust deposition, TSP, PM_{10} and meteorological conditions according to relevant Australian Standards. Monitoring is supported by cameras (see Section 4.5.2) and physical inspection by appropriately trained mine personnel (see Section 11.5.1.v). Air quality monitoring locations (including some monitoring locations maintained by Hunter Valley Operations) are shown in Figure 11.1. The monitoring network consists of the following:

- nine dust deposition gauges representative of residences on privately-owned land;
- five HVAS to measure TSP;
- five HVAS to measure PM_{10};
- five TEOM monitors that transmit live data (real-time PM_{10}) to MTW personnel via the SCADA (supervisory control and data acquisition) system;
- one meteorological monitoring station; and
- three relocatable 'early warning unit' PM_{10} monitors, positioned nearer to mining operations, which are currently in their testing phase with the intent to use them as supplementary monitors to alert MTW staff of deteriorating air quality conditions should testing prove successful.

Alarms, based on data from the real-time PM_{10} monitoring units, are used to inform the operation of potentially adverse weather conditions. Following receipt of an alarm the shift coordinator undertakes (or delegates) a site inspection and implements additional controls as required.

11.5.3 Blasting

Air quality impacts of blast operations at Warkworth Mine are managed under the MTW BMP. The purpose of the MTW BMP is to ensure that blasting operations comply with all relevant requirements particularly noise, overpressure, vibration, blast fume and dust effects.

The MTW BMP applies a blasting permissions flowchart to guide operators on the suitability of various factors including the current weather conditions for blasting. The MTW BMP takes into consideration meteorological factors such as wind speed and direction which can affect the scale of potential blast impacts at assessment locations.

Weather forecasts are used to schedule blast events to the least-risk time of the day where feasible. This approach minimises the risk of any offsite impact occurring, and is based on hourly forecast weather conditions that may affect the dispersion of blast emissions.

11.5.4 Greenhouse gases

Current GHG management practices to minimise the overall generation of CO_2-e emissions would continue under the proposal. The MTW, through the operator's larger climate change programme, has objectives in four key areas delivered through ongoing integration into existing business processes:

- supporting research and promotion of technologies that reduce carbon dioxide emission from the use of coal;
- improved use of energy at operations, projects and supply chain;
- designing future projects with energy efficiency and climate change risks considered; and
- raising awareness amongst stakeholders that climate change is an issue that requires us all to change how we currently operate.

Research programme funding is also provided by MTW for the COAL21 Fund, the Australian Coal Association Research Programme, and the Cooperative Research Centre for Greenhouse Gas Technologies to support and develop the research of low emissions coal technologies.

11.5.5 Warkworth Mine dust management system

Site specific best practice measures to manage dust emissions would continue to be applied under the proposal. A range of improvements in this regard have been made at the site in recent years, including mine infrastructure to improve the watering of haul roads, such as six new fill points and four new water carts to replace smaller carts, aerial seeding programmes to better stabilise mine areas prior to full rehabilitation, installation of dust hoods on hoppers into which the trucks unload coal, and community response officers on each night shift to assist with operational control.

Operational control strategies and measures to effectively manage air quality impacts are detailed in the MTW AQMP. Such measures, both proactive and reactive, are categorised in accordance with the hierarchy of control for contingency planning to manage residual risks. The hierarchy of control is as follows:

- administration;
- engineering;
- substitution; and
- elimination.

Further information on these controls is provided below.

i Administrative controls

The management of dust at Warkworth Mine is supported by the application of Trigger Action Response Plans (TARPs). A TARP defines the minimum set of actions required by MTW personnel in response to the deviation in mine conditions from normality. Triggers related to air quality are set below criteria and are enacted in the following ways:

- elevated PM_{10} is measured via the real-time monitoring network;
- supplementary 'early warning monitors' detect increasing PM_{10} trends close to active areas;
- meteorological monitoring identifies increased dust risk conditions (alerts triggered based on elevated wind speeds); and
- excessive dust producing activities are observed and communicated by operators.

When a trigger is enacted to warn operational personnel of potentially deteriorating air quality conditions, the initial response is an inspection of operational areas and surrounds, and supporting check of monitoring systems and conditions. This can be undertaken in a number of ways, including:

- use of cameras, one on the Warkworth maintenance building roof and the other on Charlton Ridge, to view active areas and potential impacts on surrounding public roads;
- interrogation of available meteorological and real-time PM_{10} data (both MTW monitoring system and publically available Upper Hunter Air Quality Monitoring Network); and/or
- physical inspection by appropriately trained MTW personnel.

Where the inspection identifies dust emissions that have the potential to exceed limits/practices from operating areas, a response is initiated to appropriately address the matter, which may include:

- request for additional dust suppression (water cart mobilisation); and/or
- temporary cessation of work, for a specific part, or all of the Warkworth Mine, as necessary.

Operational personnel prepare and circulate a shift change handover report to the incoming shift. The handover report describes air quality management activities undertaken during the previous shift including routine controls, minor changes or adaptations, equipment shutdowns, and any proactive controls recommended or required to be implemented during the upcoming shift. If predicted for the subsequent shift, unfavourable dust conditions are described in the report together with potential management strategies.

Coal & Allied is in the process of implementing a predictive dust risk forecasting tool to assist operational personnel to make the optimal management decisions on a day to day basis. The tool utilises predictive meteorological forecast data coupled with detailed mine activity (mine plan) data to determine the most likely times during the upcoming day that dust lift off and air dispersion conditions may be unfavourable. This advance warning allows mine staff time to be better prepared in the event that such conditions occur. The tool is currently being developed, and would be integrated into day-to-day operations during 2014.

ii Engineering controls

Engineering controls for dust management are installed and implemented on major dust sources at MTW on a 'reasonable and feasible' basis. Recent examples include:

- installation of ROM dump hopper barrier hoods and water sprays at the Warkworth CPP;
- upgrade of 'fast fill' water fill points for the fleet of water carts;
- installation of dust aprons on drill rigs;
- construction of new high flow, high capacity water cart fill points designed and located to maximise time available for water spraying to active mining areas;
- acquisition of new water carts to replace older, smaller water carts and to increase the overall number onsite;
- continuation of aerial seeding programme to provide temporary rehabilitation to active mining areas pending their full rehabilitation;
- continuation of operational management systems supported by real-time and predictive monitoring networks, including dedicated community response officers on each night shift;
- continuation of active dump management to respond to current and predicted meteorological condition; and
- closure/rehabilitation of capping of Tailings Dam No.1 identified as a potential dust source.

iii Substitution controls

Substitution controls for dust are implemented in response to one or more triggers described above, and are utilised both proactively and reactively. Substitution measures generally involve the postponing of tasks such as blasting or dozing operations when conditions require, or the prioritisation of a water cart for dust suppression purposes to a discrete area of the mine in response to a dust issue.

iv Elimination controls

Elimination controls are implemented in response to one or more triggers described above. Elimination controls, equipment or task shutdown, are implemented as a last resort where other controls have been inadequate, or in the event of an 'extreme' dust day, characterised by heavily restricted visibility and elevated air quality on a regional level.

v Continuous improvement

In accordance with the requirements of the Rio Tinto Coal Australia's HSEQ Management System, MTW would continuously seek to improve air quality management by way of improving existing controls and investigating new and emerging technologies, implementing new controls where required, and thoroughly investigating and responding to any exceedance and non-compliance events.

11.6 Conclusions

Dust amelioration measures were incorporated into the conceptual mine design through discussions between air quality experts and mine planning engineers. This process resulted in an optimised mine plan that would deliver improved environmental outcomes, as reflected in the study predictions.

The study undertaken for the proposal predicted dust emissions at all known assessment locations in the vicinity of the Site using contemporary air dispersion modelling methods in accordance with the EPA guidelines.

The assessment considered, the optimised mine plan, and where possible, a range of improvements that have been made at the site in recent years, including infrastructure to improve the watering of haul roads, such as new fill points and new water carts to replace smaller carts, aerial seeding programmes to better stabilise mine areas prior to full rehabilitation, installation of dust hoods on hoppers into which the trucks unload coal, and community response officers on each night shift to assist with operational control.

The assessment results show that twenty four mine-owned assessment locations may experience concentrations above the relevant criteria for 24-hour average and annual average PM_{10}. A subset of these assessment locations may also experience concentrations above the relevant criteria for annual average TSP, incremental and total annual average dust deposition, and 24-hour average $PM_{2.5}$.

It is noted that three assessment locations are predominantly influenced by other dust sources in the area and largely unaffected by activity from the proposal.

Three privately-owned assessment locations (77, 102, and 264) may experience concentrations above the relevant criteria for 24-hour average and annual average PM_{10} and the Mining SEPP's cumulative air quality non-discretionary standard. Of these: assessment location 77 is within Wambo Mine's current acquisition zone; assessment location 102 is the Warkworth Hall, a non-residential location; and assessment location 264 is newly identified and would have been within Wambo Mine's acquisition zone had it been previously assessed.

Where impacts cannot be controlled, property owners would be afforded acquisition rights and site specific best practice measures to mitigate dust emissions would be applied.

No impacts are predicted from emissions resulting from the use of diesel powered equipment. Impacts from blast fume emissions are expected to be manageable with the operation implementation of MTW's BMP.

Dust from mining is generally coarse in fraction (> $PM_{2.5}$) whereas the fine fraction of dust (< $PM_{2.5}$) of concern to human health typically originates from combustion sources. Wood smoke in rural areas is a problematic source of fine particulate with potential health impacts, and recently initiatives to specifically target these particulates have been launched in the Hunter Valley.

A comprehensive integrated air quality management system, including an extensive monitoring network, is currently in place for mining operations at MTW which incorporates best practices for the control of dust emissions from coal mines. Predicted air quality impacts resulting from the proposal would be managed and mitigated under the current management system.

Estimates of Scope 1, 2 and 3 GHG emissions were predicted using the NGA Factors document. The annual average GHG emissions over the 21 year life of the proposal were conservatively estimated to represent approximately 0.18 per cent and 0.65 per cent of Australia's and NSW emissions, respectively. Current GHG management measures would continue to be employed to minimise the overall generation of CO2-e emissions at Warkworth Mine.

Overall, the assessment shows that the project would be able to operate within applicable criteria at all privately-owned receptors, apart from three locations in Warkworth village including two private residences (77 and 264) and the Warkworth Hall (102).

Chapter 12

Ecology

Chapter 12 — Ecology

12 Ecology

12.1 Introduction

This chapter provides a summary of the ecology study for the proposal prepared by Cumberland Ecology, which is presented in full in Appendix H.

The chapter sets out the requirements and survey methods undertaken by the proponent to identify, map and describe the native plant community types, threatened species and threatened species habitat that occur at the Site. The chapter presents an assessment of direct and indirect impacts on biodiversity including measures to avoid and minimise potential impacts from the proposal. It includes a Biodiversity Offset Strategy to compensate for the loss of threatened ecological communities (TECs), woodland habitat and threatened species.

The impacts of the proposal have been separated into the following components in accordance with the Secretary's requirements (see Chapter 4):

- Component 1: WSW/WSG vegetation impacted by the proposal;
- Component 2: Non-WSW/WSG vegetation impacted by the proposal; and
- Component 3: Non-WSW/WSG vegetation impacted by the 2003 extension.

The study has categorised the WSW and Warkworth Sands Grassland (WSG) (termed WSW/WSG) separately from the non-WSW/WSG vegetation given the limited distribution of the WSW community.

The proposed 2014 disturbance area for the proposal is encompassed within the Biodiversity Assessment Area (BAA) for the Warkworth Mine, which would be included as part of the UHSA. The UHSA is a joint initiative between the NSW and Commonwealth Governments to implement a coordinated assessment of the current biodiversity values and current and future impacts of coal mining in the Upper Hunter Valley coalfields.

The *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a) was released in March 2014 to guide the assessment and quantification of offset requirements for major projects. The biodiversity assessment and offsetting approach for the proposal follows the principles and guidelines outlined in the *Draft NSW Biodiversity Offsets Policy for Major Projects* and the accompanying FBA as described below and shown in Figure 12.2:

- Stage 1 Biodiversity Assessment Requirements: the ecology study includes information on native vegetation, threatened ecological communities, landscape features and threatened species and populations.
- Stage 2 Impact Assessment Requirements: the ecology study includes information on how impacts have been avoided and minimised. The study then determines the remaining direct and indirect impacts and calculates credit requirements for these. As the FBA calculator described in the policy is still under development, the recognised BCAM, as modified by the UHSA, has been used to calculate credit requirements.

- Stage 3 Biodiversity Offset Strategy: the ecology study considers offset delivery options for the proposal, including:
    - establishing offset sites; and/or
    - the purchase of credits from the market/retiring credits; and/or
    - undertaking mine site rehabilitation; and/or
    - undertaking supplementary measures.

To address key matters in the L&E Court judgement, the ecology study has considered:

- par. 146 and 147: options to avoid, mitigate and then offset biodiversity impacts have been identified in accordance with the *Draft NSW Biodiversity Offsets Policy for Major Projects* and FBA;
- par. 202, 206 and 207: conservation gains have been measured to ensure sufficiency using a reliable and quantitative assessment (ie BBAM);
- par. 205: the impact assessment and Biodiversity Offset Strategy is consistent with *Draft NSW Biodiversity Offsets Policy for Major Projects* and FBA ; and
- par. 210 and 211: the biodiversity values of extant habitat in the offsets and long-term values of rehabilitation have been accounted for through the use of the BCAM and the UHSA.

As previously described in Chapter 2, the proposal has the same footprint as that currently approved under the EPBC Act (EPBC 2009/5081) for the Warkworth Extension 2010 and no further approval for clearing is required under the EPBC Act.

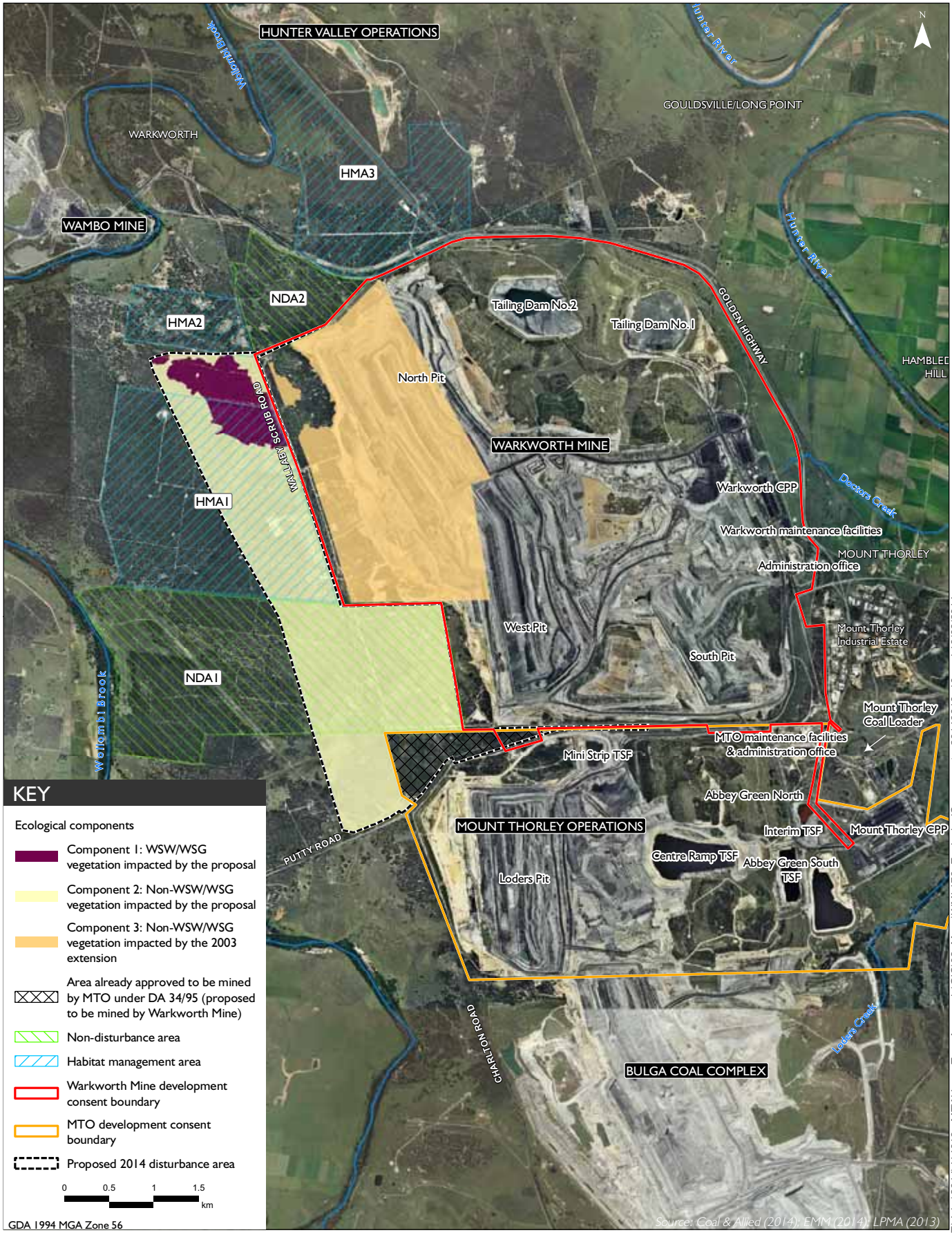
12.2 Stage 1: Biodiversity assessment requirements

The Site and its surrounds have been extensively studied since the 1990s, with a range of field surveys conducted since then and as recently as late 2013. As part of the Warkworth Extension 2010, an ecology study was completed by Cumberland Ecology which included detailed review of previous work, as well as the results of additional field surveys on the Site.

12.2.1 Native vegetation and TEC's

i Native vegetation

The vegetation at the Site primarily consists of dry sclerophyll woodland, regrowth woodland and grassland. Four native woodland communities have been recorded at the Site, with each meeting the description of three listed EECs (Table 12.1).



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Ecological components

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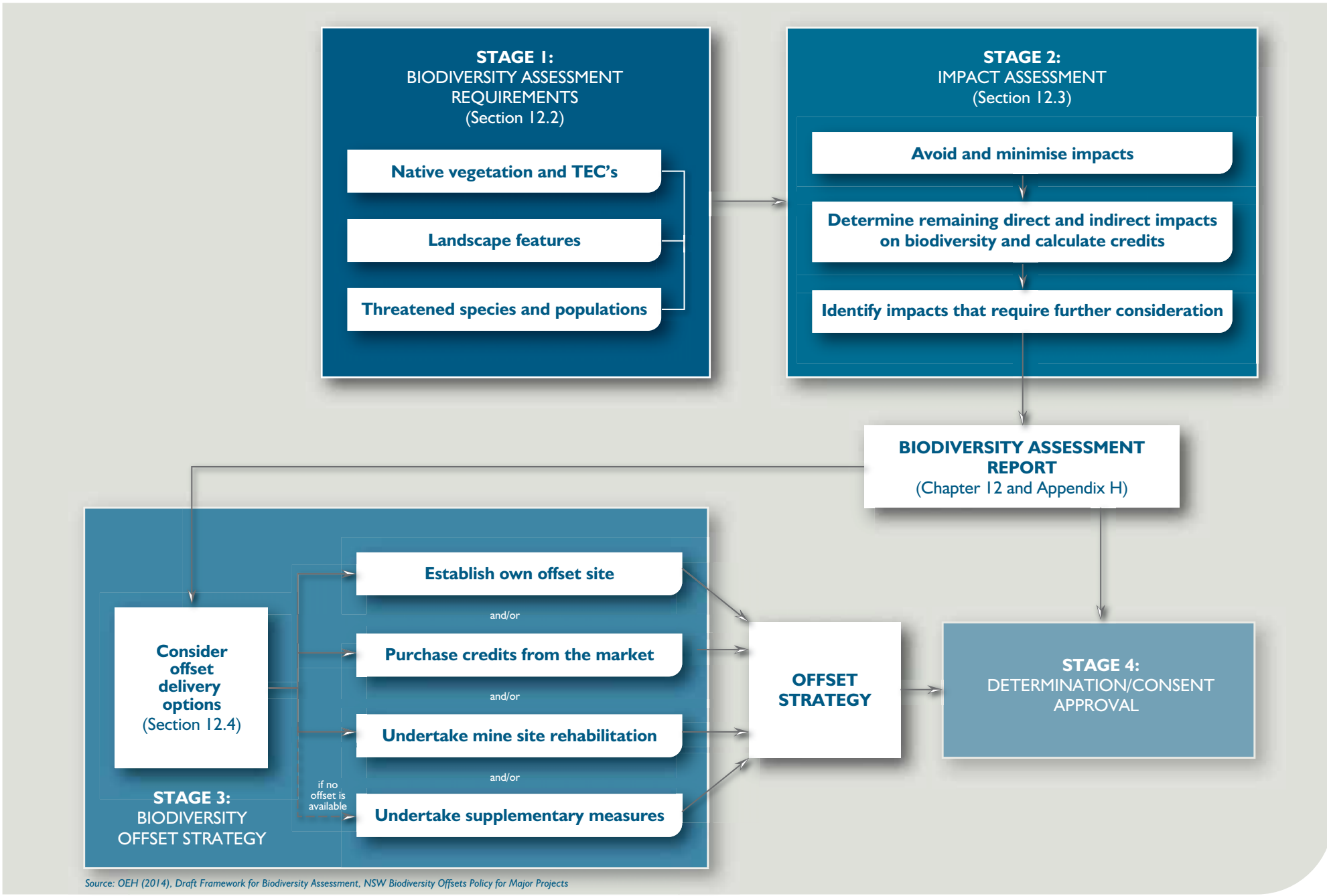
Figure 12.1



Source: OEH (2014), Draft Framework for Biodiversity Assessment, NSW Biodiversity Offsets Policy for Major Projects

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Biodiversity impact assessment and offset strategy approach

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Environmental Impact Statement

Figure 12.2

A summary of the additional vegetation communities to be cleared for the proposal is provided in Table 12.1 and illustrated in Figure 12.3. WSW in the proposed 2014 disturbance area is shown in Figure 12.4.

Table 12.1 Additional vegetation communities impacted by the proposal

Vegetation community	Area (ha)[1]	TSC Act status
Central Hunter Grey Box – Ironbark Woodland	365.5	Central Hunter Grey Box – Ironbark Woodland EEC
Regenerating Central Hunter Grey Box – Ironbark Woodland	6.5	Central Hunter Grey Box – Ironbark Woodland EEC
Central Hunter Ironbark – Spotted Gum – Grey Box Forest	15	Central Hunter Ironbark – Spotted Gum – Grey Box – Woodland EEC
Warkworth Sands Woodland	72	Warkworth Sands Woodland EEC
Sub-total forest and woodland	*459*	
Warkworth Sands Grassland	0.5	N/A
Central Hunter Grey Box – Ironbark Derived Grassland	151.5	N/A
Sub-total grassland	*152*	
Total	**611**	

Notes: 1. Rounded to the nearest 0.5ha.

A total of 611ha of additional vegetation would be cleared for the proposal. It should be noted that roads and infrastructure account for approximately 20ha within the proposed 2014 disturbance area. In addition, approximately 63ha of land approved to be mined by MTO under DA 34/95 and 4ha of land inclusive of Putty Road and some land immediately to its south are also included within the development application area but not included within disturbance calculations. This is reflected in the information presented in Table 12.1 and the ecology study (see Appendix H).

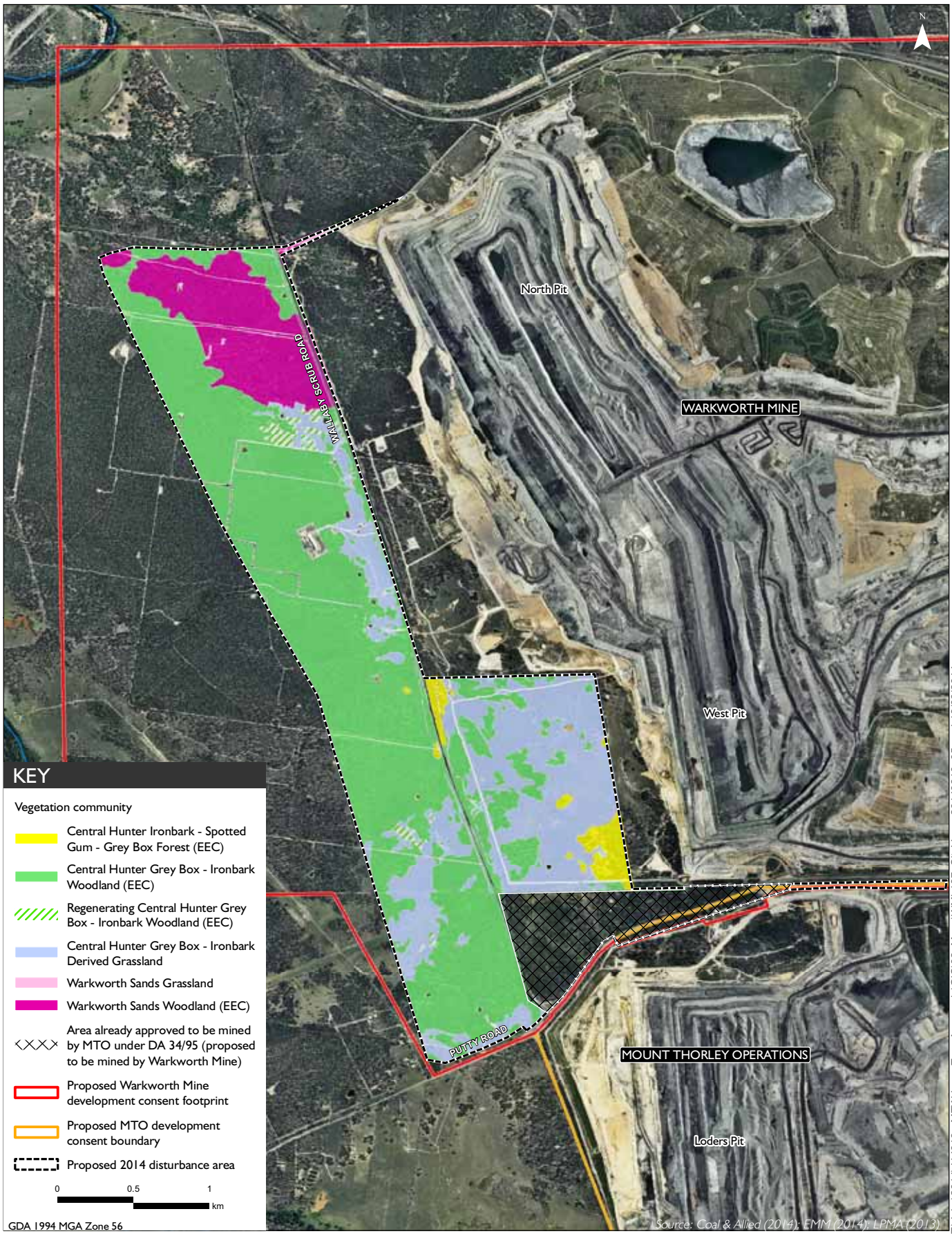
ii Groundwater dependent ecosystems

No permanently flowing rivers occur at the Site and, therefore, the only likely GDEs present would be terrestrial vegetation that may depend on shallow groundwater to varying degrees. Within the wider Warkworth area (ie outside the proposed 2014 disturbance area), two vegetation communities are likely to represent potential GDEs:

- Hunter Valley River Oak Forest occurs directly adjacent to the ephemeral Wollombi Brook west of the proposed 2014 disturbance area and may rely on groundwater baseflows and shallow groundwater adjacent to the creek; and

- River Red Gum Floodplain Woodland occurs on the floodplain of Wollombi Brook west of the Site and may rely on shallow groundwater adjacent to the creek.

An ephemeral perched aquifer, recharged by rainfall, is also present in the Aeolian Warkworth sands that support the WSW EEC in the north-east, west and north of the proposed 2014 disturbance area (see Figure 12.4). This aquifer is not in direct hydraulic connection with the underlying Permian fractured rock (AGE 2014).



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Vegetation communities within the proposed 2014 disturbance area

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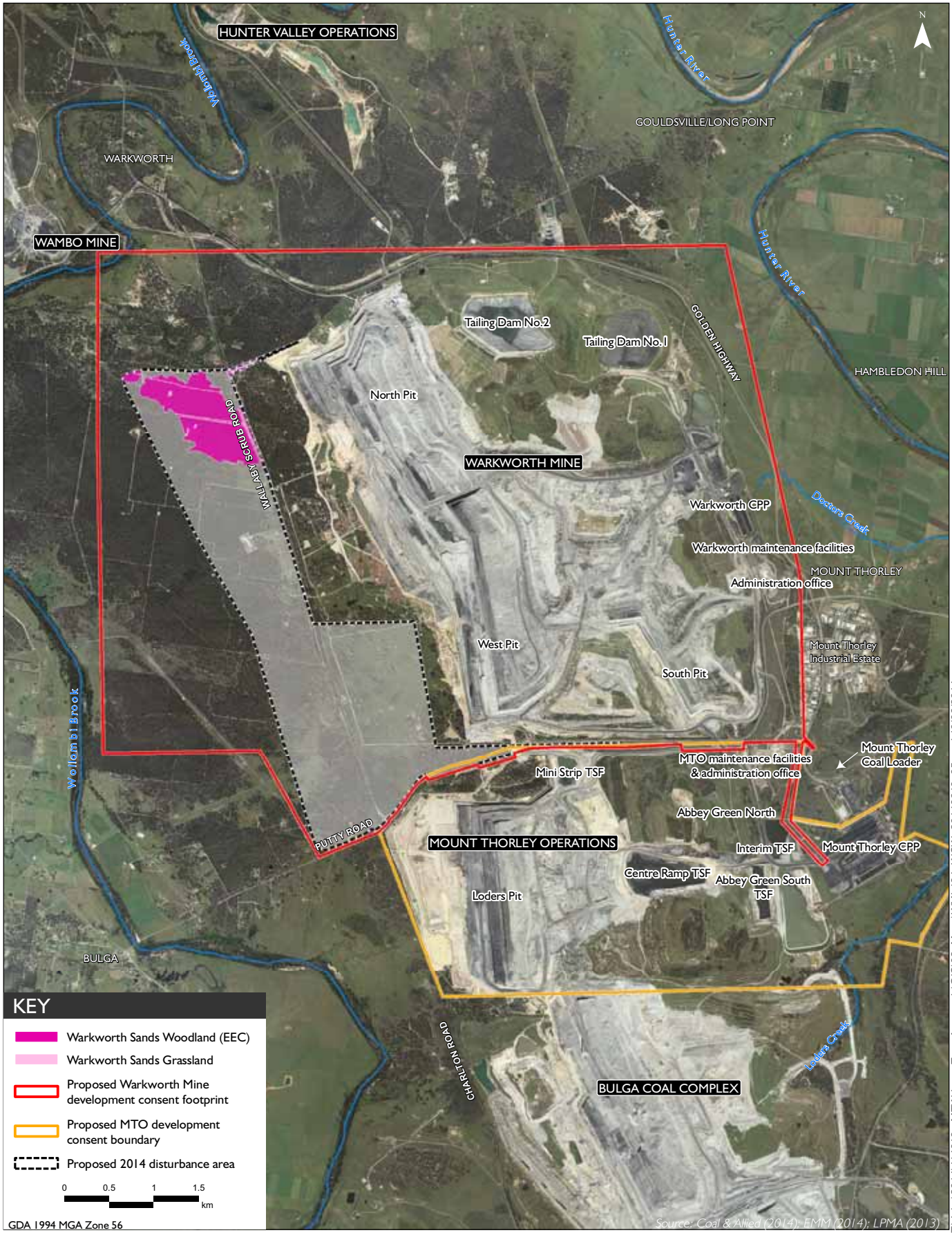
Environmental Impact Statement
Figure 12.3



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Warkworth Sands Woodland within the proposed 2014 disturbance boundary

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Figure 12.4

12.2.2 Landscape features

The Warkworth area has undergone large-scale clearing for agriculture in the past, with much of the remnant open forest and woodland vegetation comprising regrowth, with some scattered remnant large trees. The primary fauna habitats within the proposed 2014 disturbance area are:

- Open forest communities (Central Hunter Ironbark – Spotted Gum – Grey Box Forest);
- Woodland communities (WSW, Central Hunter Grey Box – Ironbark Woodland);
- Derived native grassland; and
- Permanent and ephemeral water bodies such as dams and creeks.

Fauna habitats provide abundant resources for common and threatened fauna species with the following recorded in the proposed 2014 disturbance area:

- 13 amphibian species;
- 18 reptile species;
- 146 bird species; and
- 15 native and seven exotic mammal species (with eight being microchiropteran bat species).

The existing vegetation in the proposed 2014 disturbance area contributes to wildlife corridor values for a range of faunal groups at both a local and regional scale. Locally, forest, woodland and grassland communities provide suitable shelter and foraging habitat for small mobile species such as woodland birds that forage throughout the area in groups of mixed species during non-breeding periods.

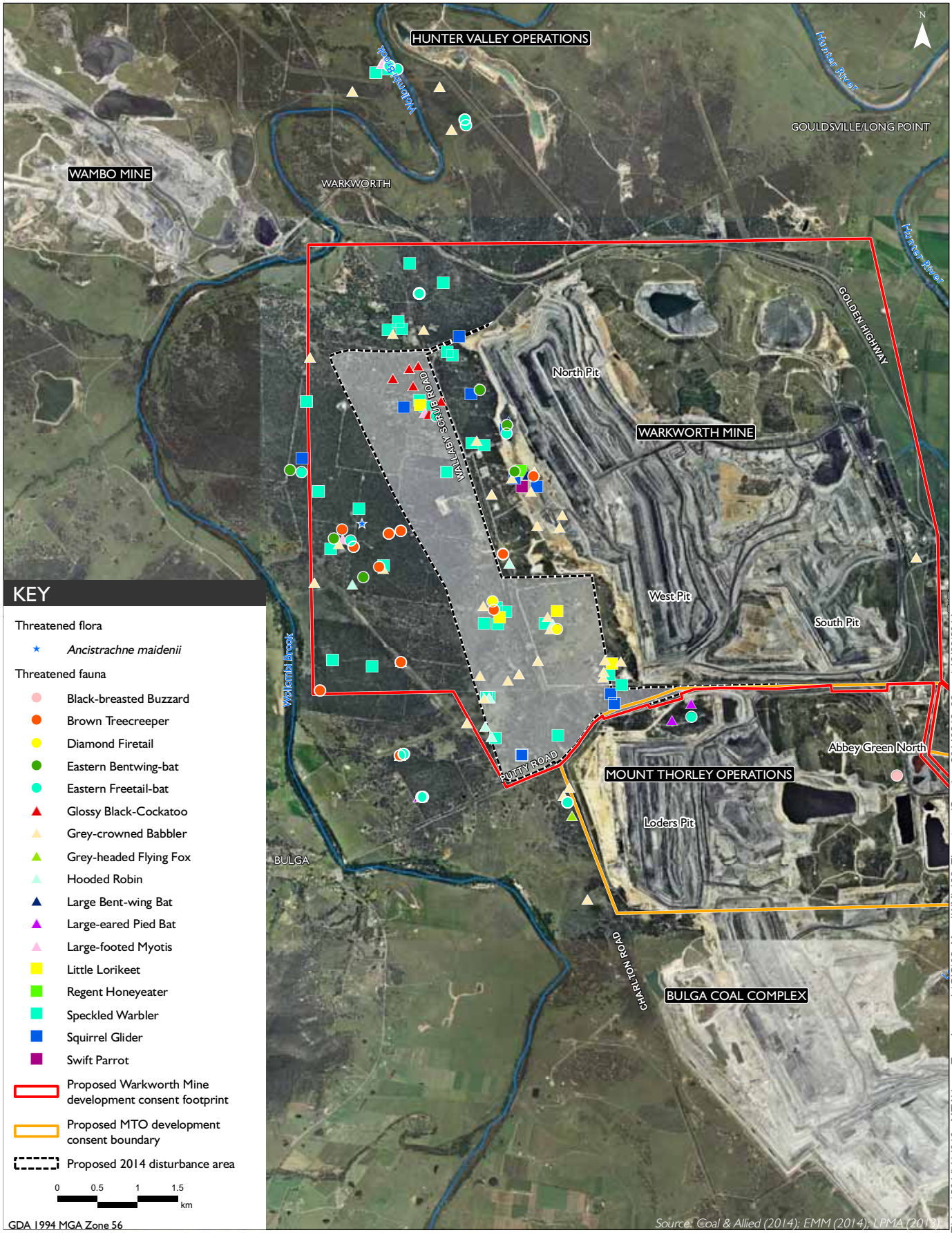
On a regional scale, the vegetation communities provide values for migratory and nomadic species, particularly birds. Scarce records of both the Regent Honeyeater and the Swift Parrot indicate that the Warkworth area occasionally supports seasonal foraging habitat for both species as they move through the region.

12.2.3 Threatened species and populations

No threatened flora species have been recorded in the proposed 2014 disturbance area.

Three threatened flora have been recorded in the wider study area (the land which flora and fauna studies have been conducted for the proposal including the Site see Appendix H/Figures A.1 to A.3):

- *Ancistrachne maidenii* (a grass), listed as vulnerable under the TSC Act has been recorded in the Warkworth area, being recorded in the Central Hunter Grey Box – Ironbark Woodland approximately 500m west of the proposed 2014 disturbance area (see Figure 12.5).
- Records for the threatened Slaty Red Gum (*Eucalyptus glaucina*), occur adjacent to the western boundary of the study area. The species has never been confirmed, despite the numerous flora surveys that have been conducted in the study area since the initial recording in 1998.



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Threatened species records

Warkworth Continuation 2014
Environmental Impact Statement

Figure 12.5

- Several River Red Gum (Eucalyptus camaldulensis) individuals, which form an endangered population in the Hunter Valley, were recorded in the study area in the riparian corridor of Wollombi Brook.

Six regionally significant flora species have also been recorded in the area:

- Variable Smoke-bush (*Conospermum taxifolium*);
- *Grevillea montana*;
- Woolly Mat-rush (*Lomandra leucocephala subsp. leucocephala*);
- *Macrozamia flexuosa*;
- Bulga Wattle (*Acacia bulgaensis*); and
- Hairy Clerodendrum (*Clerodendrum tomentosum*).

A number of threatened fauna species have been recorded or have the potential to occur in the proposed 2014 disturbance area, including 23 birds and 11 mammal species (six of these being bat species) (see Table 12.2 and Figure 12.5).

Table 12.2 Threatened fauna species recorded or with the potential to occur

Species	TSC Act status	Recorded in the proposed 2014 disturbance area?
Birds		
Barking Owl (*Ninox connivens*)	Vulnerable	No
Black Bittern (*Ixobrychus flavicollis*)	Vulnerable	No
Black-breasted Buzzard (*Hamirostra melanosternon*)	Vulnerable	Yes
Black-chinned Honeyeater (*Melithreptus gularis*)	Vulnerable	No
Brown Treecreeper (*Climacteris picumnus*)	Vulnerable	Yes
Diamond Firetail (*Stagonopleura guttata*)	Vulnerable	Yes
Gang Gang Cockatoo (*Callocephalon fimbriatum*)	Vulnerable	No
Glossy Black-cockatoo (*Calyptorhynchus lathami*)	Vulnerable	Yes
Grey-crowned Babbler (*Pomatostomus temporalis*)	Vulnerable	Yes
Hooded Robin (*Melanodryas cucullata*)	Vulnerable	Yes
Little Eagle (*Hieraaetus morphnoides*)	Vulnerable	Yes
Little Lorikeet (*Glossopsitta pusilla*)	Vulnerable	Yes
Masked Owl (*Tyto novaehollandiae*)	Vulnerable	No
Powerful Owl (*Ninox strenua*)	Vulnerable	No
Regent Honeyeater (*Anthochaera phrygia*)	Endangered	Yes
Scarlet Robin (*Petroica boodang*)	Vulnerable	Yes
Speckled Warbler (*Chthonicola sagittata*)	Vulnerable	Yes
Spotted Harrier (*Circus assimilis*)	Vulnerable	Yes
Square-tailed Kite (*Lophoictinia isura*)	Vulnerable	No
Swift Parrot (*Lathamus discolor*)	Endangered	Yes
The Painted Honeyeater (*Grantiella picta*)	Vulnerable	No
Turquoise Parrot (*Neophema pulchella*)	Vulnerable	No

Table 12.2 Threatened fauna species recorded or with the potential to occur

Species	TSC Act status	Recorded in the proposed 2014 disturbance area?
Varied Sittella (*Daphoenositta chrysoptera*)	Vulnerable	Yes
Mammals		
Brush-tailed Phascogale (*Phascogale tapoatafa*)	Vulnerable	No
Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)	Vulnerable	Yes
Eastern Free-tail Bat (*Mormopterus norfolkensis*)	Vulnerable	Yes
Eastern Pygmy-possum (*Cercartetus nanus*)	Vulnerable	No
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Vulnerable	Yes
Koala (*Phascolarctos cinereus*)	Vulnerable	No
Large-eared Pied Bat (*Chalinolobus dwyeri*)	Vulnerable	Yes
Southern Myotis (*Myotis macropus*)	Vulnerable	Yes
Little Bent-wing Bat (*Miniopterus australis*)	Vulnerable	Yes
Spotted-tail Quoll (*Dasyurus maculatus*)	Endangered	No
Squirrel Glider (*Petaurus norfolcensis*)	Vulnerable	Yes

12.3 Stage 2: Impact assessment

12.3.1 Impact avoidance and minimisation

Open cut mining projects cannot readily avoid impacts where mineral resources are beneath flora and fauna habitats. However, impacts have been avoided, where possible, through modification of the design and relocation of mine associated infrastructure, as required under the L&E Court judgement (par. 146 and 147).

Avoidance of listed species and communities was carefully considered during the planning process. The mine design considered a series of mine plan options that may have delivered substantially more coal from areas adjacent to the current mine plan. The existing mine plan delivers resource recovery while maintaining production and employment that is viable.

In addition, Wallaby Scrub Road is proposed to be closed rather than relocated (see Chapter 2 and 23), to reduce the level of clearing. This avoids clearing of approximately 30ha of vegetation, including the WSW EEC, White Box Yellow Box Blakely's Red Gum Woodland EEC and Central Hunter Grey Box – Ironbark Woodland EEC.

Further information on the alternatives investigated to avoid and minimise impacts are included in Chapter 23.

Biodiversity at Warkworth Mine is managed in accordance with a number of plans, strategies and procedures. Together, these provide a rigorous management regime and ensure Warkworth Mine is aligned with Rio Tinto Coal Australia's biodiversity commitments, which aims to have a net positive effect on biodiversity. This includes:

- procedures to minimise clearing and avoid unnecessary disturbance;
- pre-clearance surveys;

- clearing protocols to minimise impacts on fauna;
- relocation habitat features;
- seed collection and propagation;
- weed and feral animal control measures;
- erosion and sedimentation control measures; and
- specifications for re-planting native trees where appropriate.

The MOP and Local Offset Management Plan (LOP) would be prepared for the proposal in accordance with industry best practice with consideration given to the full available range of reasonable and feasible mitigation and their effectiveness in determining the measures to be implemented. The revised plans would outline the management techniques and monitoring that would be undertaken in the proposed 2014 disturbance area and the offset sites, as well as outline the objectives and performance criteria for each area. The plans would ensure that the proposal's conservation objectives are met and that impacts to biodiversity are adequately managed for the life of the proposal.

In order to ensure the management strategies are achieving the desired objectives, the plans would prescribe monitoring to be undertaken of all rehabilitation, vegetation enhancement and re-establishment works. Results of the monitoring would be assessed against performance criteria and key performance indicators to determine if the management objectives are being met. In the case vegetation enhancement and re-establishment key performance indicators would be determined through comparison with pre-determined and permanent analogue sites. Rehabilitation objectives and performance criteria are described further in Section 13.4.1.

12.3.2 Remaining impacts to biodiversity and credits calculated

i Direct impacts

a. Native vegetation and TEC's

The primary impact from the proposal would be the clearing of vegetation in the proposed 2014 disturbance area. Approximately 611ha of additional native forest, woodland and grassland would be progressively cleared over the 14 years, when mining reaches its western most extent.

A total of 365.5ha of Central Hunter Grey Box – Ironbark Woodland and 6.5ha of Regenerating Central Hunter Grey Box – Ironbark Woodland, which meets the description of the Central Hunter Grey Box – Ironbark Woodland EEC, is proposed to be progressively cleared under the proposal. This represents a loss of approximately 3 per cent of the community within the Central Hunter region (Peake, 2006) and 3 per cent of the known distribution of the community.

A total of 15ha Central Hunter Ironbark – Spotted Gum – Grey Box Forest, also meeting the description of the Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC, would be progressively cleared in scattered and isolated patches within the south-east portion of the proposed 2014 disturbance area. This represents only 0.2 per cent of the remaining extent of its regional distribution (Peake 2006).

Approximately 72ha of WSW EEC would be progressively cleared for the proposal, consisting of high and medium quality vegetation (see Figure 12.4 and Figure 12.9). Estimates on the regional extent from the L&E Court judgement adopt a conservative 465ha (L&E Court judgement par. 98), which has been used for the ecology study (see Appendix H). Therefore, the proposal would impact approximately 15.5 per cent of this extent of the community.

Direct impacts on identified GDEs, Hunter Valley River Oak Forest and River Red Gum Forest, would not occur as these communities occur outside the proposed 2014 disturbance area and would not be impacted under the proposal. Perched aquifers at the proposed 2014 disturbance area associated with WSW/WSG are not in direct hydraulic connection with the underlying Permian fractured rock (AGE, 2014). Therefore the proposal would not indirectly impact on the Aeolian Warkworth sands ephemeral aquifer or associated vegetation communities outside the proposed 2014 disturbance area.

b. Landscape features

Approximately 459ha of additional forest and woodland and 152ha of grassland would be removed progressively over 14 years as a result of the proposal. This habitat forms part of a fauna corridor within the region. The landscape is already highly fragmented, and the increased fragmentation from the proposal is likely to exacerbate the existing impacts on this corridor. At a local scale, the proposal would result in the gradual removal of dispersal habitat, foraging habitat and 'stepping stone' corridor values for a range of fauna groups, particularly woodland birds and small mammals. Parts of these identified corridors would be impacted by the proposal, but would be progressively replaced by rehabilitation.

c. Threatened species and populations

No significant impact is predicted for threatened flora species, populations, or the six regionally significant species recorded from the Warkworth area, despite some potential habitat being impacted by the proposal.

The proposal would result in the removal of forest, woodland and adjacent derived native grassland vegetation communities that provide foraging, shelter and breeding habitat for threatened fauna species. With the implementation of the proposed mitigation measures, the proposal is not predicted to significantly impact on any threatened fauna species listed in Table 12.2.

ii Indirect impacts

In addition to direct impacts of vegetation clearing and loss of habitat, the proposal may have indirect impacts on retained vegetation and, therefore, habitats in and adjacent to the disturbance boundary, including:

- noise levels;
- dust levels;
- incidences of vehicle strike;
- light levels at night;
- potential changes in wind or water erosion due to clearance of ground vegetation;
- reduction in area of interior habitat of remaining woodland;

- edge effects due to changes in patch configuration and/or habitat fragmentation; and
- potential increase in weed invasion and feral pest impacts.

Mitigation measures have been devised to minimise adverse impacts from indirect impacts on biodiversity.

iii Measurement of credit requirements for biodiversity offsetting

A quantitative assessment of the loss of vegetation communities, as required under the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a) and recommended in the L&E Court judgment (par. 202, 206 and 207), has been adopted for the study through the use of the BCAM. The BCAM tool also quantifies the value of fauna habitats provided by vegetation communities, particularly for threatened fauna species.

In accordance with the three assessment components, credit calculations were completed for:

- Component 1: WSW/WSG vegetation impacted by the proposal;
- Component 2: Non-WSW/WSG vegetation impacted by the proposal; and
- Component 3: Non-WSW/WSG vegetation impacted by the 2003 extension.

Component 3 has been included within the BCAM assessments, as the proposal would impact portions of HMAs and NDAs established for the 2003 extension. As such, the proposal includes the provision of alternative offsets to compensate for the BCAM credit requirement for the impacts to non-WSW/WSG vegetation for the 2003 extension.

Ecosystem credits were calculated to quantify impacts on vegetation and fauna habitat. The potential loss and gain on threatened species habitat is generally included in the ecosystem credits generated for a proposal under the BCAM. However, species credits were also generated for those threatened species that cannot be reliably predicted to use an area of land based on habitat values.

The BCAM baseline calculations would be subject to review and certification by OEH, either under the UHSA or in accordance with *Draft NSW Biodiversity Policy for Major Projects* (OEH 2014a). The figures presented in this chapter and the ecology study (Appendix H) are therefore indicative and may be updated pending review by OEH.

a. Component 1: WSW/WSG vegetation impacted by the proposal

A total of 2,950 ecosystem credits are required to compensate for the disturbance from the proposal to WSW/WSG (Table 12.3). Only the woodland form of this community is considered to meet the description of the TSC Act-listed TEC. In addition, species credits are required to compensate for the impacts of the proposal on habitat for the Regent Honeyeater (*Anthochaera phrygia)* (1,923 credits) and breeding habitat for the Southern Myotis (*Myotis macropus*) (875 credits) (Table 12.3).

Table 12.3 Credit requirements for Component 1: WSW/WSG

Aspect	Area (ha)[1]	Credits required
Ecosystem Credits		
Warkworth Sands Woodland	72.0	2,935
Warkworth Sands Grassland	0.5	15
Total Ecosystem Credits		*2,950*
Species Credits		
Regent Honeyeater	72.0	1,923
Southern Myotis (breeding habitat)	11.5	875
Total Species Credits		*2,798*
Total credit requirements		**5,748**

Notes: 1. Rounded to the nearest 0.5ha.

b. Component 2: Non-WSW/WSG vegetation impacted by the proposal

A total of 15,983 ecosystem credits are required to compensate for the disturbance on non-WSW/WSG vegetation from the proposal (Table 12.4). In addition, species credits are required for impacts on foraging habitat for the Regent Honeyeater (10,326 credits) and breeding habitat for the Southern Myotis (11,810 credits) (Table 12.4).

Table 12.4 Credit requirements for Component 2: Non-WSW/WSG vegetation for the proposal

Aspect	Area (ha) [1]	Credits required
Ecosystem Credits		
Central Hunter Grey Box - Ironbark Woodland	365.5	13,644
Regenerating Central Hunter Grey Box - Ironbark Woodland	6.5	240
Central Hunter Grey Box - Ironbark Derived Grassland	151.5	1,546
Central Hunter Ironbark - Spotted Gum - Grey Box Forest	15.0	553
Total Ecosystem Credits		*15,983*
Species Credits		
Regent Honeyeater	387.0	10,326
Southern Myotis (breeding habitat)	153.5	11,810
Total Species Credits		*22,136*
Total credit requirements		**38,119**

Notes: 1. Rounded to the nearest 0.5ha.

c. Component 3: Non-WSW/WSG vegetation impacted by the 2003 extension

A total of 11,575 ecosystem credits are required to compensate for the disturbance to non-WSW/WSG vegetation from the 2003 extension (Table 12.5). In addition, species credits are required for impacts on the breeding habitat for the Large-eared Pied Bat (*Chalinolobus dwyeri*) (139 credits) and Southern Myotis (5,538 credits), and foraging habitat for the Regent Honeyeater (6,683 credits) (Table 12.5).

Table 12.5 Credit requirements for Component 3: Non-WSW/WSG vegetation for the 2003 extension

Aspect	Area (ha)[1]	Credits required
Ecosystem credits		
Central Hunter Ironbark - Spotted Gum - Grey Box Forest	1.5	56
Central Hunter Grey Box - Ironbark Woodland	249.0	8,974
Central Hunter Grey Box - Ironbark Derived Grassland	227.0	2,545
Total ecosystem credits		*11,575*
Species credits		
Regent Honeyeater	250.5	6,683
Large-eared Pied Bat (breeding habitat)	10.5	139
Southern Myotis (breeding habitat)	72.0	5,538
Total species credits		*12,360*
Total credit requirements		**23,935**

Notes: 1. Rounded to the nearest 0.5ha.

12.3.3 Matters for further consideration

The WSW EEC is a woodland to open forest community that is confined to Aeolian sand deposits in the vicinity of Warkworth, south-east of Singleton in the mid Hunter Valley (NSW Scientific Committee 2011). It is a geographically restricted community, with approximately 465ha of WSW in a woodland form (L&E Court judgement par. 98). Therefore opportunities for land-based offsets to compensate for impacts on WSW are limited.

The proposal therefore aims to compensate for impacts on WSW/WSG via a range of land-based and supplementary measures to maximise the long-term viability of the EEC. This includes the protection and enhancement of extant areas of WSW, regeneration of WSG to the woodland form and funding for management and recovery of the community. These are described in further detail in Section 12.4 and in the ecology study (Appendix H).

12.4 Stage 3: Biodiversity offset strategy

12.4.1 Overview

In order to offset the impacts of the proposal that have been quantified using BCAM, the following Biodiversity Offset Strategy has been developed. The strategy includes:

- establishing offset sites; and/or
- undertaking mine site rehabilitation; and/or
- undertaking supplementary measures (for WSW/WGS only given its restricted distribution); and/or
- retiring of credits under the UHSA or purchasing credits on the open market.

A combination of these offset measures above is provided in the following sections for offsetting each of the components assessed using BCAM.

i Land-based offset sites

Land-based offsets would be established in two areas, the Southern Biodiversity Area (SBA) and the Northern Biodiversity Area (NBA) (Figure 12.6). The SBA and NBA contain a suite of strategic values including:

- WSW EEC and other EECs suitable for offsetting the communities predicted to be impacted by the proposal;
- the presence of known and potential habitat for relevant threatened flora and fauna species that could be impacted by the proposal;
- linkages to sustainable ecological features (particularly permanent water sources such as the Hunter River and Wollombi Brook);
- the potential to form new, or improve existing ecological corridors; and
- provision of land that adjoins other existing offsets increasing long-term patch size.

Over 1,000ha of woodland and forest are available as offsets for this proposal in the SBA and NBA, with 705ha available in the SBA and 303ha in the NBA (see Figures 12.7 and 12.8). This includes 502.5ha of Central Hunter Grey Box - Ironbark Derived Grassland EEC (including regenerating vegetation), with an additional 167ha of Central Hunter Grey Box - Ironbark Derived Grassland to be enhanced and protected (Table 12.6).

Table 12.6 Vegetation communities in the SBA and NBA available for offsets

Vegetation Community	Offset area (ha)[1]		TSC Act status
	SBA	NBA	
Warkworth Sands Woodland	56	19.5	EEC
Central Hunter Grey Box - Ironbark Woodland	380	104	EEC
Regenerating Central Hunter Grey Box - Ironbark Woodland	18.5	0	EEC
White Box Woodland	28	0	CEEC
Yellow Box Woodland	7	0	CEEC
Hunter Valley Vine Thicket	0.5	0	EEC
Hunter Lowlands Redgum Forest	32.5	0	EEC
River Red Gum Floodplain Woodland	9.5	0	EEC
Hunter Valley River Oak Forest	25.5	0	
Regenerating Hunter Valley River Oak Forest	1	0	
Sub-total forest and woodland	*558.5*	*123.5*	
Warkworth Sands Grassland	2.5	156.5	
Central Hunter Grey Box - Ironbark Derived Grassland	144	23	
Sub-total grassland	*146.5*	*179.5*	
Total	*705*	*303*	

Notes: 1. Rounded to the nearest 0.5ha.

Approximately 705ha are available of the SBA in close proximity to the proposed 2014 disturbance area .It contains 558.5ha of woodland communities, including approximately 532ha of listed TECs (Figure 12.6). The SBA contains River Red Gums (*Eucalyptus camaldulensis*), which form an endangered population in the Hunter Valley. It also forms known habitat for the threatened woodland birds and microchiropteran bats and potential habitat for numerous other species including the Squirrel Glider, Regent Honeyeater and Swift Parrot.

Parts of the SBA also form the WBACHCA, which provides for the protective management and cultural maintenance of the Bulga Bora Ground and associated cultural landscape and other places (see Chapter 18). Management and maintenance of the SBA would be undertaken in a manner that would not impact the heritage values of the WBACHCA.

The NBA occurs 7km to the north of the Warkworth Mine. The NBA has historically been used for grazing, with remnant native vegetation currently highly fragmented at the property. It contains more than 300ha of native woodland and grassland, with large areas of Central Hunter Grey Box - Ironbark Woodland EEC (Figure 12.8). The NBA contains known habitat for threatened birds and microchiropteran bats recorded in the 2003 extension and also contains the threatened Tiger Orchid (*Cymbidium canaliculatum*).

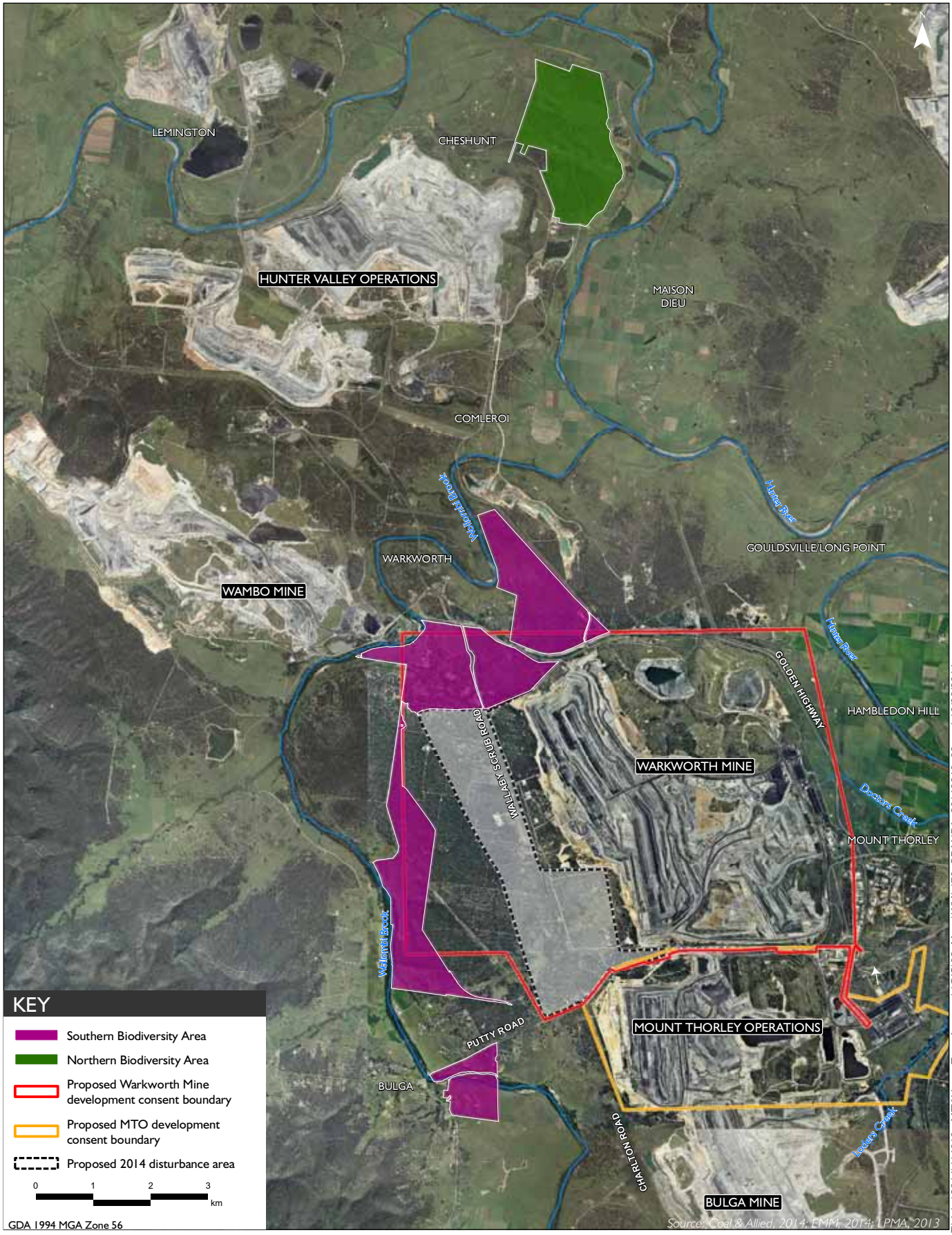
ii Rehabilitation objectives and framework

Up to 2,100ha of mining areas would be rehabilitated as Central Hunter Grey Box - Ironbark Woodland EEC, to meet the credit requirements of the 2003 extension and the proposal (as outlined above). The objectives of mine rehabilitation would be to:

- re-create woodland and forest communities;
- provide additional habitat for threatened species; and
- create an additional north/south wildlife corridor.

Rehabilitation would re-create woodland and forest communities, providing fauna habitat and enhancing and creating fauna corridors. Mine rehabilitation would be guided by leading-practice knowledge and research previously undertaken by the UNE. Chapter 13 describes the rehabilitation objectives of the final landform and provides a breakdown of the different rehabilitation domains, these being woodland, trees over grass and grassland. Rehabilitation is further described in Chapter 13.

A north/south corridor connecting remnant vegetation to the north of the proposed 2014 disturbance area, through the rehabilitation areas of MTO and the Bulga Coal Complex, and in the future, connecting to the Singleton Military Training Area would be established through the mine rehabilitation (see Figure 2.17). This includes the large area of extant vegetation in the SBA and the vegetation associated with the Putty Road offset area, which connects with vegetation to the west associated with the Wollemi National Park.



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Location of Northern Biodiversity Area and Southern Biodiversity Area

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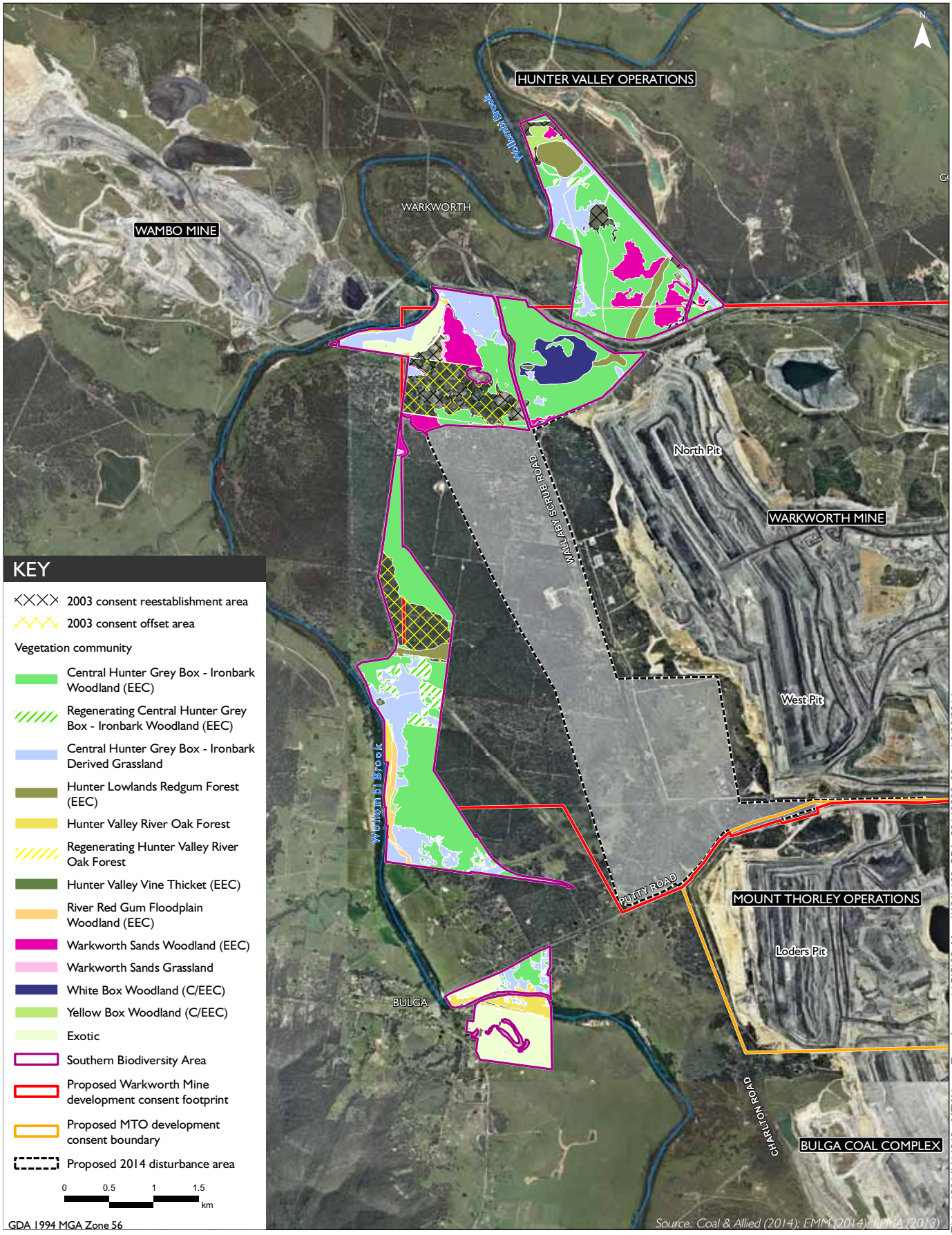
Figure 12.6



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Vegetation communities in the Southern Biodiversity Area

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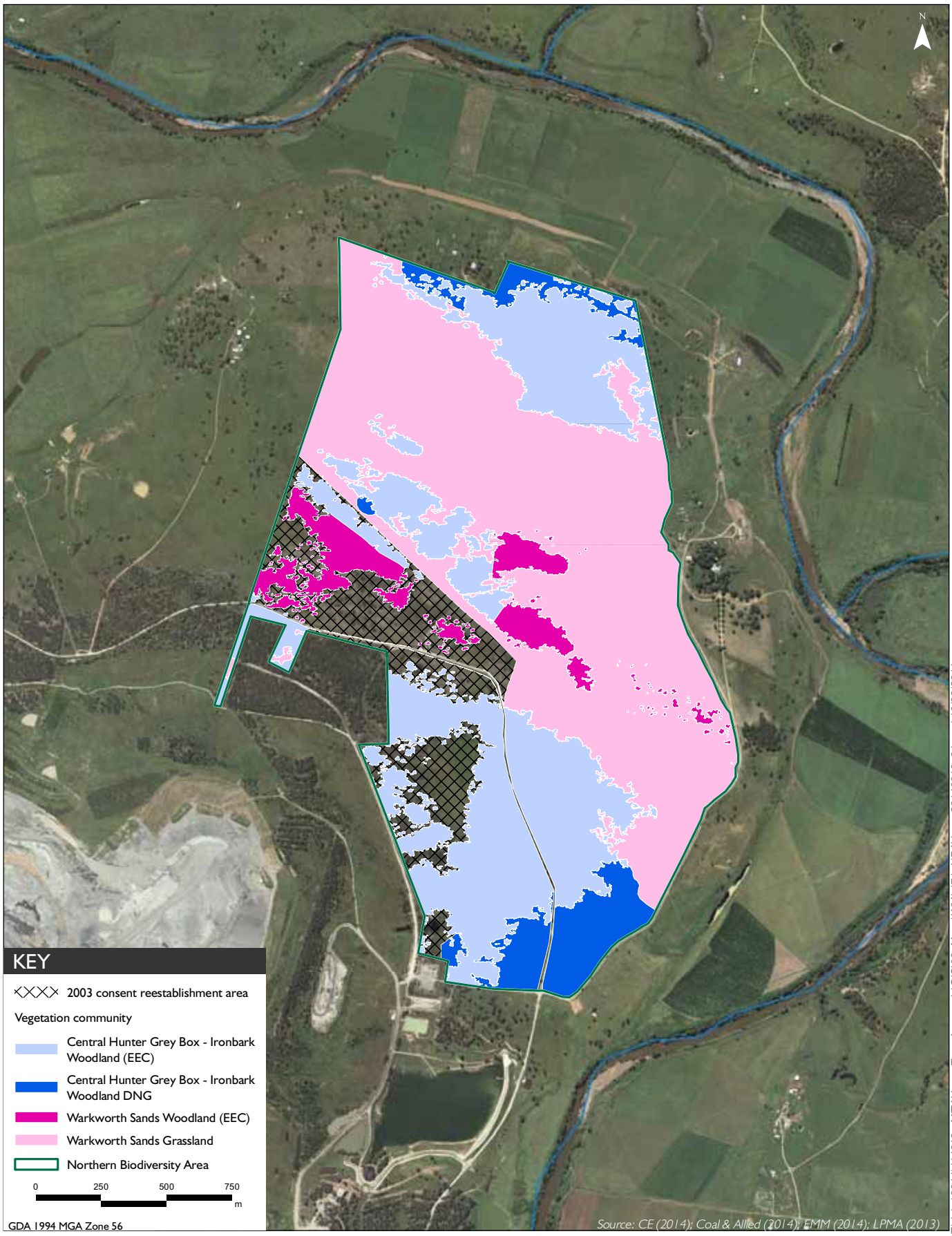
Figure 12.7



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Vegetation communities in the Northern Biodiversity Area

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Figure 12.8

iii Supplementary measures

Supplementary measures are actions other than the acquisition of land, which are taken to improve biodiversity or other relevant environmental values. These include financial contributions to management actions or targeted research for communities or species. Given the restricted distribution of WSW/WSG, supplementary measures have been incorporated into the biodiversity offset strategy to meet the offset requirements for Component 1 (WSW/WSG impacted by the proposal).

iv Retiring of credits under the UHSA or purchasing credits on the open market

Residual credit requirements would be retired under the rules of the UHSA or, in the case of Component 3, purchased on the open market. The UHSA provides an option to contribute to the Upper Hunter Offset Fund that would be used to secure and fund the ongoing management of offset lands.

v Summary of offset outcomes

The offsets for the proposal would be met through a combination of land-based offsets, mine rehabilitation, supplementary measures and the retirement of credits under the UHSA or purchased on the open market. A summary of the offset outcomes for each of the three components is provided in Table 12.7.

A total of 34,499 credits would be required to be retired under the rules of the UHSA comprising:

- 2,930 for Component 1 WSW/WSG vegetation for the proposal; and
- 31,569 for Component 2 non-WSW/WSG vegetation for the proposal.

Further, remaining credits (7,689 credits) for the Component 3 non WSW/WSG for the 2003 extension would either be provided through further land-based offsets or purchased on the open market.

Table 12.7 Summary of the offset outcomes for each component

Element	WSW/WSG vegetation for the proposal (Component 1)	Non-WSW/WSG vegetation for the proposal (Component 2)	Non-WSW/WSG vegetation for the 2003 extension (Component 3)
Ecosystem credits			
Total credits required	**2,950**	**15,983**	**11,575**
Credits supplied through land-based offsets	2,303	TBC[1]	6,921
Credits supplied through mine rehabilitation	0	6,550	4,654
Will supplementary measures be provided?	Yes	No	No
Remaining credits to be retired by the rules of the UHSA	647	TBC[1]	TBC[3]
Species Credits Regent Honeyeater			
Total credits required	**1,923**	**10,326**	**6,683**
Credits supplied through land-based offsets	454	TBC[1]	3,759
Will supplementary measures be provided?	No	No	No
Remaining credits to be retired by the rules of the UHSA	1,469	TBC[1]	TBC[3]
Species credits Large-eared Pied Bat (breeding habitat)			

Table 12.7 Summary of the offset outcomes for each component

Element	WSW/WSG vegetation for the proposal (Component 1)	Non-WSW/WSG vegetation for the proposal (Component 2)	Non-WSW/WSG vegetation for the 2003 extension (Component 3)
Total credits required	n/a	n/a	139
Credits supplied through land-based offsets	n/a	n/a	0
Will supplementary measures be provided?	n/a	n/a	No
Remaining credits to be retired by the rules of the UHSA	n/a	n/a	TBC[3]
Species credits Southern Myotis (breeding habitat)			
Total credits required	**875**	**11,810**	**5,538**
Credits supplied through land-based offsets	61	TBC[1]	912
Will supplementary measures be provided?	No	No	No
Remaining credits to be retired by the rules of the UHSA	814	TBC[1]	4,626
Total residual credit requirement to be retired under the rules of the UHSA	**2,930**	**31,569**	TBC[3]

Note: 1. To be confirmed as land-based offsets may be identified.

2. The total ecosystem credits only includes 'like for like' outcomes.

3. Remaining credits would be either provided through further land-based offsets or purchased on the open market.

12.4.2 Component 1: WSW/WSG vegetation impacted by the proposal

The offsetting requirements for Component 1 would be met through the provision of land-based offsets, supplementary measures and retirement of credits under the UHSA. The WSW EEC would be protected and WSG would be re-established to WSW in the SBA and NBA, resulting in an increase in the total area of WSW under long-term conservation. Additional supplementary measures would be implemented to provide a comprehensive package of offsets that would contribute to the long-term viability of WSW. These are outlined in Section 12.5.3.

i Establish offset sites

A total of 75.5ha of WSW (approximately 19.5ha of existing WSW in the NBA and 56ha of WSW in the SBA) is available to offset the impacts of the proposal. An additional 159ha of WSG is available for re-establishment of WSW.

The WSW/WSG offsets add to existing protected areas containing WSW and other extant vegetation in the locality. Together, these would form the largest known area of WSW under long-term conservation in the region. The proposed land-based offsets generate a total of 2,818 credits (2,303 ecosystem credits and 515 species credits) (Table 12.8).

Table 12.8 Credits generated by the land-based offsets for Component 1

Component	SBA		NBA		Total
	Area (ha)[1]	Credits	Area (ha)[1]	Credits	
Ecosystem credits					
Warkworth Sands Woodland	56	382	19.5	191	573
Warkworth Sands Grassland (to be re-established to WSW)	2.5	24	156.5	1,706	1,730
Total ecosystem credits		*406*		*1,897*	*2,303*
Species credits					
Southern Myotis (breeding habitat)	56	337	19.5	117	454
Regent Honeyeater	10	61	0	0	61
Total species credits		*398*		*117*	*515*
Total credits		**804**		**2,014**	**2,818**

Notes: 1. Rounded to the nearest 0.5ha.

ii Mine rehabilitation

No mine rehabilitation is proposed to be used to compensate for the impacts on WSW.

iii Supplementary measures

A range of supplementary measures would be provided to compensate for the credit deficit for WSW. These include:

- re-establishment of WSG in the NBA to WSW;
- the preparation of an Integrated Management Plan for WSW;
- development of completion criteria for the WSW re-establishment; and
- protection and conservation of WSG to be re-established as part of the current development consent.

Further supplementary measures may be developed in consultation with the OEH.

a. Integrated Management Plan

An Integrated Management Plan for WSW would be prepared in consultation with OEH and neighbouring mines. It would establish an effective mechanism to provide improved conservation outcomes for WSW in the locality, through coordinated management activities, exchange of knowledge and consistency in monitoring programmes to increase the knowledge of management and re-establishment.

b. Re-establishment of WSG

The WSG refers to grassland with a native species component occurring on Aeolian Warkworth Sands derived from the clearing of the original WSW canopy and mid-storey from previous land use. It does not conform to the TSC Act listing for the EEC, but may be re-established to WSW through appropriate management.

Coal & Allied is committed to the successful re-establishment of WSW in the areas mapped as WSG in the SBA and NBA. The areas of WSG to be re-established would once have contained WSW, occur on the same geology, contain many of the same understorey species, but just lack the trees. Re-establishment would provide a large, fully functioning example of the EEC through the enhancement of areas that are currently in reasonable ecological condition, and by re-establishing the community in areas where it is currently degraded.

Historical aerial photography has revealed that much of the vegetation at the Site is regrowth (Figure 12.9). This includes some areas of WSW that were reduced to sparse paddock trees in the late 1960s, that have been mapped as medium and high quality WSW by Bower (2004) (Figure 12.9). This demonstrates the ability of the WSW community in the area to re-establish post-disturbance.

Knowledge of the EEC is growing from research completed by the UNE as part of the approval granted for the development consent in 2003. As part of the Warkworth Extension 2010, $500,000 was made available to contribute to WSW research. Despite the disapproval by the L&E Court in 2012, these funds have been allocated and distributed for research. The UNE researched a variety of aspects of the EEC which would provide leading-practice advice on the enhancement, re-establishment and management of the WSW in the SBA and NBA. A WSW Restoration Manual has also been prepared (Niche 2013) to provide a sound basis for guiding best management practices to restore WSW, and set out a process for tracking the recovery of WSW sites toward a reference state as a result of appropriate applied land management restoration interventions.

As part of the supplementary offsets, completion criteria would be developed for the re-establishment of WSW. These would consist of criteria that need to be achieved in order for successful re-establishment to have occurred.

c. Conservation of WSG re-established under the current development consent

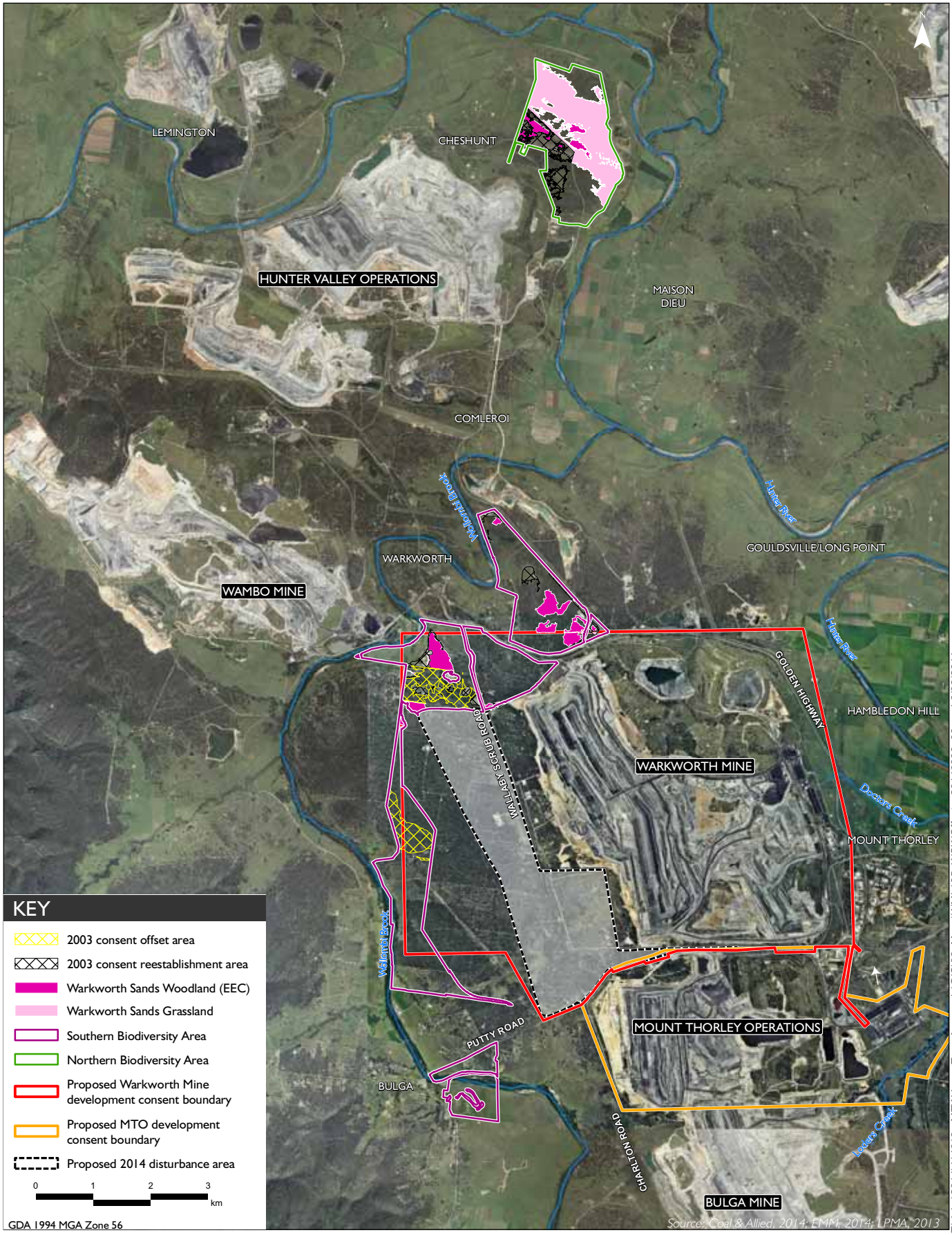
Areas of WSG in the SBA and NBA identified for re-establishment under the current development consent, but not protected as part of the offset, would now be protected and conserved as part of the Biodiversity Offset Strategy in the long-term.

iv Retirement of credits under the UHSA

The residual credits required to compensate for the proposal's disturbance of WSW (2,927 total credits) would be retired by contribution to the UHSA and/or the use of supplementary measures as it is recognised that areas for offsetting WSW/WSG may not be available.

12.4.3 Component 2: Non-WSW/WSG vegetation impacted by the proposal

The impacts of the proposal on Component 2 non-WSW/WSG vegetation would be compensated through the retirement of credits under the rules of the UHSA. This may include the provision of land-based offsets or retirement of credits under the UHSA. In addition, large areas of ironbark woodland would be established through the rehabilitation of mined areas.



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Warkworth Sands Woodlands offsets

Warkworth Continuation 2014
Environmental Impact Statement

Figure 12.9

i Establish offset sites

No land-based offsets have been established for Component 2.

The proposal has been included in Coal & Allied's future planning through the UHSA. Accordingly, the BCAM credits may be retired through the provision of either land-based offsets, or provision of rehabilitation and/or funding contributions through the arrangements and provisions of the UHSA. This would result in a 'maintain or improve' outcome for the values being lost due to the proposal.

ii Mine rehabilitation

Up to 25 per cent of the credit requirements for the proposal can be met through the provision of mine rehabilitation, in accordance with the UHSA. A total of 6,650 ecosystem credits for non-WSW/WSG vegetation would be met through supplying 1,227.5ha of mine rehabilitation.

iii Supplementary measures

No supplementary measures would be required or provided for non-WSW vegetation for the proposal.

iv Retirement of credits under the UHSA

Should land-based offset sites be utilised, any residual offsetting requirements for Component 2 may be met through the provision a contribution to the Upper Hunter Offset Fund as part of the UHSA.

12.4.4 Component 3: Non-WSW/WSG vegetation impacted by the 2003 extension

The offsetting requirements for Component 3 would be met through the provision of land-based offsets, mine rehabilitation and may include the purchase of credits on the open market. The non-WSW/WSG vegetation in the SBA and NBA would be protected, resulting in an increase in the total area of non-WSW/WSG vegetation in proximity to the Site under long-term conservation. In addition, large areas of ironbark woodland would be established through the rehabilitation of mined areas. This would create a large area of treed vegetation in the landscape subject to long-term conservation.

i Establish offset sites

Some of the BBAM credits calculated for Component 3 would be retired using land based offsets in the SBA and NBA. The non-WSW vegetation in the SBA and NBA generate approximately 6,921 ecosystem credits using the BBAM, of a required 11,575 credits required to offset the 2003 extension (Table 12.9). A total of 4,436 species credits have been generated by the offsets to compensate for the impacts on Southern Myotis breeding habitat, Large-eared Pied Bat breeding habitat and habitat for the Regent Honeyeater.

Table 12.9 Credits generated by the land-based offsets for Component 3

	SBA		NBA		Total	
Vegetation community	**Area (ha)[1]**	**Credits**	**Area (ha)[1]**	**Credits**	**Area (ha)[1]**	**Credits**
Like for like ecosystem credits						
Central Hunter Grey Box - Ironbark Woodland	380.0	3,318	104.0	1,201	484.0	4,519
Regenerating Central Hunter Grey Box - Ironbark Woodland	18.5	161	0	0	18.5	161
Central Hunter Grey Box – Ironbark Derived Grassland	144.0	1,240	23.0	251	167.0	1,491
White Box Woodland	28.0	265	0	0	28.0	265
Yellow Box Woodland	7.0	77	0	0	7.0	77
Hunter Valley Vine Thicket	0.5	6	0	0	0.5	6
Hunter Lowlands Redgum Forest	32.5	319	0	0	32.5	319
River Red Gum Floodplain Woodland	9.5	83	0	0	9.5	83
Sub-total like for like ecosystem credits		*5,469*		*1,452*		*6,921*
Non-like for like ecosystem credits						
Hunter Valley River Oak Forest	25.5	238	0	0	25.5	238
Regenerating Hunter Valley River Oak Forest	1.0	11	0	0	1.0	11
Sub-total non-like for like ecosystem credits		*249*		*0*		*249*
Species credits						
Regent Honeyeater	502	3,012	104	623	606	3,635
Southern Myotis (breeding habitat)	150	901	0	0	150	901
Sub-total species credits		*12,360*		*-7,924*		*4,536*
Total credits generated		**18,078**		**-6,472**		**11,706**

Notes: 1. Rounded to the nearest 0.5ha.

ii Mine rehabilitation

A total of 4,654 of the credits requirements for Component 3 non-WSW/WSG vegetation for the 2003 extension would be met through mine rehabilitation. This equates to 872.5ha of mine rehabilitation would be included in the offset reallocation for the 2003 extension.

iii Supplementary measures

No supplementary measures would be required or provided for non-WSW vegetation for the 2003 extension.

iv Purchase of credits on the open market

The residual species credit requirements for Component 3 may be offset through purchase of credits on the open market.

12.5 Conclusions

The ecology study for the proposal has been undertaken in accordance with the Secretary's requirements and the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a). It incorporates the use of quantitative tools (BCAM and BBAM) to develop an appropriate biodiversity offset strategy to compensate for the impacts of the proposal on biodiversity values.

The proposed 2014 disturbance area is encompassed within the BAA for Warkworth Mine, which would be included as part of the UHSA.

In accordance with the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a) and the accompanying FBA, the ecology study follows three stages depicted in Figure 12.2; Stage 1 biodiversity assessment requirements, Stage 2 impact assessment and Stage 3 biodiversity offset strategy. The outcomes from the assessment are provided in the following sections according to these.

12.5.1 Stage 1: Biodiversity assessment requirements

A range of field surveys have been conducted in the proposed 2014 disturbance area has been extensively studied since the 1990s. The ecology study relies on this existing data as results are considered directly applicable to the current assessment, are contemporary, and the ecological values of the study area are unlikely to have changed significantly in the intervening period.

The vegetation in the study area primarily consists of dry sclerophyll woodland, regrowth woodland and grassland. Approximately 400 flora species have been recorded in the study area; with over 75 per cent of the species being native. A suite of fauna species have been recorded, using a variety of available habitat types, including 21 threatened fauna species.

12.5.2 Stage 2: Impact assessment

The proposal would require the progressive clearing of an additional 611ha of native vegetation, including approximately 72ha of WSW EEC, 372ha of Central Hunter Grey Box – Ironbark Woodland EEC and 15ha of Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC (including regenerating vegetation). The vegetation to be removed comprises a suite of woodland and open forest communities, which provide habitat for several threatened fauna species.

No listed threatened flora species have been recorded within the disturbance boundary although two species and one population are known to occur nearby. The vegetation to be removed comprises a suite of woodland and open forest communities, which provide habitat for several threatened fauna species.

Avoidance and minimisation measures have been implemented through the design of the proposal to reduce the proposal's impacts, including the decision to close rather than relocate Wallaby Scrub Road to reduce impacts on EECs that would occur if the road was relocated. Measures to mitigate and compensate for the loss of biodiversity features, including EECs and associated woodland habitat, have also been identified. Mitigation would be implemented under Rio Tinto Coal Australia's biodiversity commitments, which include a rigorous management regime to achieve a net positive impact on biodiversity.

The BCAM analysis provided an objective, numeric determination of the offsets required to compensate for the impacts of the proposal. The BCAM baseline calculations are subject to review and certification by OEH, either under the UHSA or in accordance with *Draft NSW Biodiversity Policy for Major Projects* (OEH 2014a).

12.5.3 Stage 3: Biodiversity offset strategy

A key feature of the proposal is the development of a biodiversity offset strategy for WSW/WSG, non-WSW/WSG vegetation impacted by the 2003 extension (reallocating the existing non-WSW/WSG vegetation offsets that would be disturbed under the 2014 proposal) and non-WSW vegetation impacted by the proposal.

The Biodiversity Offset Strategy comprises establishment of substantial land-based offset sites (the SBA and NBA), mine rehabilitation, supplementary measures and retirement of credits under the rules of the UHSA. A total of 1,008ha of native vegetation would be protected within the SBA and NBA and an additional 2,100ha would be rehabilitated within mined areas of the MTW operations, with the majority at Warkworth Mine.

i Component 1: WSW/WSG vegetation impacted by the proposal

The offsetting requirements for Component 1 would be met through the provision of land-based offsets, supplementary measures and retirement of credits under the UHSA. WSW would be protected and WSG would be re-established to WSW in the SBA and NBA, resulting in an increase in the total area of WSW under long-term conservation.

Opportunities for land-based offsets to compensate for impacts on WSW are limited, given its restricted distribution. Therefore additional supplementary measures would be implemented to provide a comprehensive package of offsets that would contribute to the long-term viability of WSW, including:

- re-establishment of WSG in the NBA to WSW;
- the preparation of an Integrated Management Plan for WSW;
- development of completion criteria for the WSW re-establishment; and
- protection and conservation of WSG to be re-established as part of the current development consent.

ii Component 2: Non-WSW/WSG vegetation impacted by the proposal

The impacts of the proposal on Component 2 non-WSW/WSG vegetation, would be compensated through the retirement of credits under the rules of the UHSA. The UHSA provides the options of land-based offsets or to contribute to the Upper Hunter Offset Fund that would be used to secure offset lands and fund ongoing management of such lands. In addition, large areas of ironbark woodland would be established through the rehabilitation of mined areas. Should land-based offsets be used any residual credits would be retired through the UHSA, as calculated by the rules set out by the UHSA.

iii Component 3: Non-WSW/WSG vegetation impacted by the 2003 extension

The offsetting requirements for Component 3 would be met through the provision of land-based offsets, mine rehabilitation and may also include purchase of credits on the open market.

The non-WSW/WSG vegetation in the SBA and NBA would be protected as a land-based offset, resulting in an increase in the total area of non-WSW/WSG vegetation under long-term conservation. In addition, large areas of ironbark woodland would be established through the rehabilitation of mined areas. This would create a large area of treed vegetation in the landscape subject to long-term conservation.

12.5.4 Summary of outcomes

Avoidance and mitigation measures have been implemented through the design of the proposal to reduce the ecological impacts. In accordance with the UHSA, BCAM and BBAM metrics have been used to objectively quantify the impacts and offsetting of the Proposal.

The Biodiversity Offset Strategy would meet the requirements of the UHSA and be consistent with the principles of the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a). Through the use of the UHSA, the proposal commits to providing suitable offsets, thereby ensuring that the offsets for the remaining vegetation communities would result in a 'maintain or improve' outcome for these communities.

The proposed mitigation and offset measures presented for the proposal would minimise the impacts on threatened species, populations and ecological communities and compensate for the loss of biodiversity as it would:

- adequately reallocate the offsets for the 2003 extension for non-WSW vegetation, providing a 'maintain or improve' outcome in accordance with the BBAM;
- provide suitable offsets for the WSW through both land-based and supplementary measures to maximise the long-term viability of the community;
- adequately compensate for the impacts of the proposal on non-WSW vegetation through the UHSA;
- provide a net increase in the area of EECs proximate to the Site to compensate for the predicted loss as a result of the proposal;
- provide a net increase in protected habitat available for threatened fauna species such as threatened woodland birds, microchiropteran bats and the Squirrel Glider;
- provide a connecting corridor of woodland vegetation and fauna habitat across the rehabilitated Warkworth Mine, linking to other rehabilitation areas and remnant vegetation, providing large contiguous patches of habitat into the future in the locality; and
- meet the requirements of the seven offset principles in the *Draft NSW Biodiversity Offsets Policy for Major Projects*.

Chapter 13

Final landform and rehabilitation

Chapter 13 — Final landform and rehabilitation

13 Final landform and rehabilitation

13.1 Introduction

This chapter describes the objectives of rehabilitation at the Site, which are aligned with those of biodiversity (see Chapter 12), and presents the desired rehabilitation domain types. It includes discussion on the final landform and rehabilitation and measures to promote the achievement of rehabilitation objectives for the life of the development consent.

13.2 Final landform

13.2.1 Objectives

The primary objective of final landform at the Warkworth Mine is to create a safe, stable, free draining, non-polluting feature that is able to maintain viable land uses where the post-mining rehabilitated areas have been integrated with the surrounding landscape.

13.2.2 Conceptual framework and design

The existing Warkworth Mine has already altered the local landform and includes overburden emplacements, a void, TSFs, roads and infrastructure. Some of the existing overburden emplacement areas, mostly on the eastern and northern parts of the Site, have been rehabilitated to pasture and trees.

The proposal requires revision of previously planned and approved final landforms described in past development applications and MOPs. The development of the proposal's conceptual final landform considered previous landform designs and surrounding land use, external and internal planning requirements, existing management measures and rehabilitated landforms and desired ecological and sustainability values inclusive of consideration of the local and regional surface and groundwater systems.

The post-mining land capability across Warkworth Mine is planned to provide biodiversity values in native habitat and support agricultural land predominately for cattle grazing in areas of rehabilitated grassland.

By using an integrated approach through the MOP process including regular review of mine plans, progressive rehabilitation and monitoring; potential environmental or community impacts may be reduced, hence improving outcomes for the final landform.

The final landform at Warkworth Mine would be developed with the intent of blending with the surrounding landscape features of both the Warkworth Mine and MTO. The landform would be undulating, with slopes of generally 10 degrees for overburden emplacements and up to 18 degrees for internally draining areas such as low walls and ramps consistent with the approved landform design and extensive performance/completion criteria in the current MTW MOP (see Appendix Q). This would be achieved by creating gradients for the overburden emplacements similar to the adjoining natural slopes and cognisant of existing rehabilitation.

The existing overburden emplacement areas would be extended to the west as both West Pit and North Pit progress. The haul roads, water storage and TSFs would be covered or capped and rehabilitated. The grading on the overburden emplacement area batters would reduce surface water runoff and erosion and encourage vegetation establishment.

The overburden emplacement area would be constructed to enable the post-mined landscape to have some vertical relief created into these areas. Visually, this would enable the rehabilitated land to have a lower contrast and higher integration levels with that of the surrounding landscape (see Chapter 15). With the final void being largely hidden from view due to the surrounding topography and landscape, the post-mining environment would be difficult to determine from non-mined environments once the vegetation has established.

As discussed further in Section 23.2.2, a number of alternatives were considered in relation to the final void; however, all were assessed as unviable and, accordingly, discounted. One of these alternatives was backfilling the final void, this is addressed below.

Backfilling the final void to a similar level as the highwall crest would require over 800 million bank cubic metres (Mbcm) of material. As under the proposal Warkworth Mine would have completed mining in 2035, this material would need to be sourced from an alternative location. One option would be to excavate the previously rehabilitated emplacements at Warkworth Mine. This process would take many years and use a large fleet of excavating equipment and trucks. This would initially increase the disturbance footprint of Warkworth Mine, as well as prolong its environmental impacts particularly those related to dust and noise, and would be prohibitively expensive.

Alternatively, material could be transported from elsewhere in the Hunter Valley. Similar to the above, this option is not considered desirable from a social, environmental or economic perspective and, accordingly, was also discounted.

The final void would be in the west of the proposed 2014 disturbance area (see Figure 2.16). The void would fill with water as groundwater, localised surface runoff and rainfall inflows slowly fill the rehabilitated mining void until, over time, an equilibrium between inflows and outflows is reached. The speed with which this equilibrium is reached would depend on the climatic variability (see Chapter 16). However, the final landform has been designed to achieve the objective of a safe, stable, free draining, non-polluting feature able to maintain viable land uses where the post-mining rehabilitated areas have been integrated with the surrounding landscape.

13.3 Final landuse

The applicant acknowledges that final landuses need to integrate with the rehabilitation undertaken by the surrounding mining operations, existing agricultural land and areas containing remnant vegetation, ultimately providing sustainable land uses agreed by a range of stakeholders. The conceptual final landuse is shown in Figure 2.15.

The consultation and communications programmes to be undertaken in the development of the Closure Strategy would explore options and alternatives for post-mining landuses. The importance of the local agricultural industry is recognised and the applicant seeks to integrate biodiversity enhancement with sustainable agricultural practices, where practical. The final landuse under the proposal aims to provide agricultural benefits whilst creating complementary areas of biodiversity.

The term ‘ecoagriculture’ can be used to describe this concept of ecosystem management, which also includes enhancing wildlife habitat within agricultural landscapes, and improving the habitat quality of productive farmlands.

This would contribute to local agricultural practices, increase habitat and biodiversity values and establish vegetation cover that creates corridors to link surrounding native vegetation and enhance local and regional ecological linkages to provide for a sustainable final landuse (see Chapter 12).

13.4 Rehabilitation

13.4.1 Objectives

Rehabilitation would continue to be undertaken progressively across the mined area under the proposal in accordance with extensive performance/completion criteria (see Appendix Q). The requirements for rehabilitation would be determined in consultation with relevant government agencies and stakeholders. Rehabilitation of the mined area would be undertaken in accordance with the MOP as required by the Mining Act. The objectives of the rehabilitation domains of mined areas at Warkworth Mine are to:

- re-create approximately 1,617ha of EEC woodland communities to a standard comparable to similar reference EECs (analogue site);
- create approximately 222ha of trees over grass not conforming to any particular community, creating treed corridors to ensure connectivity of woodland community areas;
- recreate some 848ha of grassland;
- establish some productive grazing;
- provide additional habitat for threatened species; and
- create an additional north/south wildlife corridor providing connectivity to other habitat.

The progressive rehabilitation is currently, and would continue to be, overseen by an onsite specialist who, along with mine planners, through detailed planning ensures that future rehabilitation resource requirements are available to enable the objectives of rehabilitation domains to be met.

13.4.2 Rehabilitation trials and research activities

Rehabilitation trials and applied research activities are currently undertaken at Warkworth Mine in an effort to continually improve the effectiveness and efficiency of rehabilitation of mined lands.

i Compost application and incorporation

A compost application and incorporation trial is underway with the objective of improving the nutritional and physical properties of the growth medium. Two agricultural implements are used to incorporate the compost through the top layer of growth medium: a rock windrower (which removes rocks from the soil surface), and an aerator (which incorporates the compost while minimising the breakdown of soil structure usually caused by traditional cultivation equipment).

ii Sowing of native seed

Warkworth Mine is trialling the use of a direct drill seeding machine instead of the conventional broadcast seeding equipment. The following advantages were identified from 2013 trial results:

- better placement of seed to enhance germination with lower seeding rates;
- minimal soil disturbance during sowing and resulting in weed seeds being depleted from the top soil layer; and
- maintenance of mulch layer during seeding as seed is planted through surface stubble.

iii Native seed collection

Given the rehabilitation objectives of Warkworth Mine include the re-establishment of an ironbark EEC community, diversity targets have been set for the various functional groups to ensure sufficient levels of species diversity are included in the native vegetation seed mixes to cover the progression of rehabilitation. Suitable areas of seed collection have been identified and seed collected from Site, other Coal & Allied land and nearby privately-owned properties. The 2014 harvest has already yielded approximately 4 tonnes of seed from native understorey species. This amount would cover the bulk of the annual requirement for native understorey seed in the rehabilitation programmes across MTW (and Hunter Valley Operations). Supplementary seed would be purchased from seed suppliers to improve the diversity of understorey species in the seed mixes. Seed from 17 tree and shrub species would also be collected to develop the over and middle storey vegetative stratum while an additional nine species have been collected for use in establishing seed production areas. Seed is stored at a Coal & Allied-owned property near Muswellbrook and is transported to Warkworth Mine when required.

13.4.3 Rehabilitation domains

Detailed baseline data from analogue sites would be used to develop and monitor a number of rehabilitation performance measures/criteria for specific rehabilitation domains. Rehabilitation of Warkworth Mine and MTO is planned collectively to facilitate an integrated landform and provide for enhanced rehabilitation objectives. This is reflected in the MTW MOP.

The applicant has committed to progressively establishing approximately 2,100ha of EEC woodland (an ironbark community) within the rehabilitated MTW, predominantly at Warkworth Mine with the residual at MTO to a standard comparable to similar reference EECs (analogue site).

The areas of the other vegetation types that are proposed to be established within the post-mined rehabilitation areas are provided in Table 13.1.

Table 13.1 Rehabilitated domain types

Vegetation type	Warkworth Mine (ha[1])	MTO (ha[1])	Total (ha[1])
Woodland	1,617	483	2,100
Trees over grass	222	97	319
Grassland	848	575	1,423

Notes: 1. Areas of domain have been estimated and are approximate.

The final landuse, landform and rehabilitation domain types for Warkworth Mine at closure and completion of rehabilitation are shown in Figure 2.16. The figure outlines the areas proposed for woodland community re-establishment, treed grasslands and grasslands.

Mining infrastructure within the identified disturbance area would be removed and the affected lands rehabilitated if it is determined that the infrastructure is no longer required. However, should other potential uses for the mining infrastructure be considered viable then these options would be examined further.

13.4.4 Rehabilitation performance/completion criteria

Performance/completion criteria for the proposed rehabilitation of mined lands would be the same as currently approved for the operation which is defined in the current MTW MOP. These criteria were developed in accordance with industry best practice such as the *ESG3: Mining Operations (MOP) Guidelines* (NSW Trade & Investment 2013) and the *Warkworth Extension 2010 Environmental Assessment* (EMM 2010a). Consideration was given to the full available range of reasonable and feasible mitigation and their effectiveness in determining the measures to be implemented at the Site.

Performance measures/criteria are measurable benchmarks which provide a greater level of detail about how the applicant would achieve the desired rehabilitation objectives for the proposal. Specific performance indicators would be established and measured to demonstrate and guide the implementation and track the progress of rehabilitation with monitoring of performance reported annually.

The performance measures quantify the rehabilitation and land management programme in terms of efficiency or effectiveness and establish the indicative timeframes for completion. The performance indicators are used to define and evaluate the programme, typically in terms of making progress towards the development of sustainable ecosystems whilst also providing a framework for the implementation of key activities. These indicators provide the basis for the procedural context of the site work practices. The performance indicators are attributes of the biophysical environment, for example pH and slope, that can be used to approximate the progression of a biophysical process and can be measured to demonstrate and track the progress of an aspect of rehabilitation towards desired completion criteria.

Similar to the existing MOP, performance measures and indicators for the proposal would be designed to form the basis of the performance criteria and provide the ability to track the development of sustainable ecosystems through a series of conceptual stages for each of the domain types. These stages are:

- Stage 1 – Decommissioning: removal of hard stand areas, buildings, contaminated materials, hazardous materials;
- Stage 2 – Landform establishment: incorporates gradient, slope, aspect, drainage, substrate material characterisation and morphology;
- Stage 3 – Growing media development: incorporates physical, chemical and biological components of the growing media and ameliorants that are being used to optimise the potential of the media in terms of the preferred vegetative cover;
- Stage 4 – Ecosystem and landuse establishment: incorporates revegetated lands and habitat augmentation, species selection, species presence and growth together with weed and pest animal control/management and establishment of flora;
- Stage 5 – Ecosystem and landuse sustainability: incorporates components of floristic structure, nutrient cycling recruitment and recovery, community structure and function which are the key elements of a sustainable landscape; and
- Stage 6 – rehabilitation complete: landuse and landscape is deemed as suitable to be relinquished from the mining leases.

Rehabilitation performance/completion criteria are established in the MTW MOP (see Section 13.4.6) and these are provided in Appendix Q.

13.4.5 Rehabilitation outcomes

The progressive rehabilitation of ironbark EEC woodland on mined land would be guided by leading-practice knowledge of rehabilitation and revegetation professionals. Investigations into the communities present within the region have been undertaken and a sound understanding of the structure and functioning of these communities has been gained. The knowledge acquired from these investigations would be incorporated into the rehabilitation techniques utilised to re-establish a diversity of native species within each stratum.

Replanting of mine rehabilitation areas (with the exception of improved pasture) would re-establish local native plant species through seed collection programmes that have been designed to ensure adequate seed is collected from the relevant species to enable a suitable species diversity to be maintained.

Where practical, topsoil would be translocated from proposed 2014 disturbance area, with minimal stockpiling, in an attempt to maximise the viability of the native seed bank of local ecological communities. With time, the rehabilitated areas would provide additional suitable habitat for native flora and fauna including threatened species such as the Regent Honeyeater and Swift Parrot (see Chapter 12). Current rehabilitation programmes being undertaken at Warkworth Mine would provide suitable foraging habitat for these species to utilise as the vegetation matures. Further information regarding soils stripping and topsoil dressing is provided in Chapter 14.

The woodland and trees over grassland components of the rehabilitation would form a north/south connecting corridor of vegetation. As previously described, the corridor extends from the Wollemi National Park, across the Wollombi Brook and its riparian vegetation, through the proposed Warkworth Mine rehabilitation and nearby biodiversity offset areas to connect with the planned rehabilitation within MTO and adjacent Bulga Coal Complex, the Singleton Military Training Area, Pokolbin State Forest and the Yengo National Park further to the south. This is shown in Figure 2.16.

13.4.6 Mining Operations Plan

A MOP is intended to fulfil the function of both a rehabilitation plan and a mine closure plan (see Section 13.5). It is a public document that outlines the processes and procedures that would enable the Site to progress towards the final rehabilitation and ultimately relinquishment. The MOP is required to be consistent with the development consent requirements, but, as the MOP may be more readily modified, the processes, procedures and the techniques utilised to enable the Site to minimise its environmental impact are further refined and are often more detailed than that presented in the EIS. As a result, additional detail and improvements on performance indicators, completion/relinquishment criteria and rehabilitation methods or technologies utilised can often be found outlined in the approved MOP. The existing MTW MOP contains detailed rehabilitation performance/completion criteria which would be updated to incorporate the proposal. These criteria for the current domain types have been extracted from the MOP and are provided in Appendix Q.

13.5 Mine closure

13.5.1 Rio Tinto Closure Standard

As the development of the final landform progresses to completion through the life of the development consent, and it is determined that Warkworth Mine is to move toward closure (rather than prepare and lodge a further modification or new development application to extend the operations), detailed planning and preparation for closure of the mine would commence. Rio Tinto maintains a number of standards applicable to all Rio Tinto managed activities, such as Warkworth Mine. This includes the current Rio Tinto Closure Standard (Rio Tinto 2013), which was developed with the intent:

> to ensure that Rio Tinto managed activities are left in a condition which minimises adverse impacts on the human and natural environment, and that a legacy remains which makes a positive contribution to sustainable development.

Upon determination of the closure of Warkworth Mine, a Closure Strategy would be prepared in accordance with the contemporary Closure Standard. The Closure Strategy is a thorough process whereby desired closure and post closure options are evaluated and documented, with a preferred option chosen. The Closure Strategy would build on the rehabilitation domains committed to under the proposal and documented in this EIS.

It is generally consistent with the principles of the *Strategic Framework for Mine Closure* (ANZMEC & Minerals Council of Australia 2000).

As part of the Closure Strategy preparation and implementation, a comprehensive consultation process of both employees and relevant external stakeholders would be developed and maintained and supported by a thorough communication programme.

A Closure Management Plan based on the current preferred option or options for closure as determined through the Closure Strategy process would then be prepared. The current plan would:

- develop and document a description of specific technical solutions related to infrastructure and facilities for the preferred closure option or options;
- develop and maintain full auditable details of closure cost;
- develop a detailed communication plan that is executed in a timely, consistent and transparent manner. This must target all internal and external stakeholders; and
- develop and maintain a socio-economic mitigation programme which addresses, as a minimum, the following (if relevant to the specific proposal):
    - socio-economic impacts, land owner considerations and community dependencies throughout the life of the operation;
    - details of a hand over plan for all infrastructure projects and social services developed by the company. This must include putting in place management and operational systems, ensuring there are adequate resources for the projects to continue delivering, and establishing sufficient lead-time for phase out;
    - all post closure institutional arrangements that clearly outline the governance, financing, staffing and monitoring of these institutions; and

- the development of programmes to manage the issues associated with artisanal miners or other community activities, which have potential to adversely impact mine closure solutions.

In addition to the above processes, a full decommissioning plan would be prepared following the decision to close the mine. The decommissioning plan would be prepared five years prior to the estimated date of ceasing production, would contain specific details of how closure would be achieved and would be linked to the Closure Management Plan.

13.5.2 Post-mining management

Similar to the decommissioning plan referenced in Section 13.5.1 required by Rio Tinto's internal procedures, a final void management plan (to be incorporated into the MTW MOP) would be prepared for Warkworth Mine at least five years prior to completion of mining and would include:

- identification of possible beneficial uses for the void;
- review of modelling and predictions of long-term hydrological behaviour and water quality responses, including final void water quality and level. Should any water take continue beyond completion of mining, these licences would be retired in accordance with the rules of the relevant WSP;
- long-term integrity of void slopes;
- waste characterisation and containment as pertains to runoff into final voids;
- coal seam capping; and
- long-term management, monitoring and mitigation measures.

The key management requirements would be to ensure the ongoing stability of the void and safety for the community.

Due to their location and design, rehabilitation of highwall and end walls may be difficult but the area would be seeded with an appropriate seed mix for grassland. Measures that are designed to restrict fauna, pedestrian and vehicle access from the highwall and final void would be implemented to ensure their safety.

These measures would be developed following consultation with stakeholders during the mine closure planning as referenced in Section 13.5.1.

13.6 Conclusions

The final landform at Warkworth Mine would be developed with recognition of the pre-mining landform features and would incorporate the existing rehabilitated landforms to ultimately blend with the surrounding landscape features of both the Warkworth Mine and MTO.

Approximately 2,100ha of EEC woodland is proposed to be rehabilitated within Warkworth Mine (around 1,617ha) and MTO (around 483ha). Woodland and trees over grassland components of the rehabilitation would form a north/south connection corridor of vegetation connecting the planned rehabilitation of the Warkworth Mine, the MTO and Bulga Coal Complex with the Singleton Military Training Area, the Pokolbin State Forest and the Yengo National Park.

Rehabilitation of the mined areas under the proposal would continue to be undertaken progressively to create a stable, free draining landform able to maintain viable land uses where mining areas are integrated with the surrounding landscape. Upon determination of the closure of Warkworth Mine, detailed investigations and consultation and communications programmes in accordance with Rio Tinto's global standards would be undertaken regarding viable, practical and sustainable land uses. The importance of the local agricultural industry is recognised and the applicant seeks to integrate biodiversity enhancement with sustainable agricultural practices, where practical.

Chapter 14

Land and soils capability

Chapter 14 — Land and soils capability

14 Land and soils capability

14.1 Introduction

This chapter provides a summary of the soils study for the previous Warkworth Extension 2010 prepared by GSS Environmental Pty Ltd (GSSE), which is presented in full in Appendix I. The previous study covers the footprint of the proposal and remains current with the exception of an incorrectly identified soil type verified during the site verification certificate process undertaken prior to lodging the EIS (EMM 2014b).

The chapter describes the existing soils environment, including updated soil type and landscape at Warkworth Mine, and presents potential impacts from the proposal. It includes an analysis of pre and post-mining land capability and suitability as well as management and monitoring measures that would be implemented to prevent or minimise adverse impacts.

14.2 Existing environment

14.2.1 Soils

i Soil types

Two major soil landscape units underpin the disturbance area, namely the Jerrys Plains unit and the Branxton unit. These soil landscape units typically exhibit soloth soils for the former and podzolic soils for the latter. Six soil types were identified within these greater soil landscape units, and these are shown in Figure 14.1. A description of each soil type is provided in Table 14.1 below.

The potential for acid generation from the topsoil and subsoil (regolith) within these landscape units is low and well buffered. This is supported by the experience with these soils during the extensive mining undertaken at Warkworth Mine. Acid sulphate soil (ASS), which is the main cause of acid generation within the soil mantle, is commonly found less than 5m above sea level. There has been little history of acid generation from regolith material from the Singleton area (which is approximately 100km from the coast). As discussed in Section 2.4.4.iii, results from testing at Warkworth Mine are consistent with this trend.

Table 14.1 Description of soil types[1]

Soil type	Area (%)	Description
Brown kurosol	44.3	Brown kurosol is the dominant soil type in the proposed 2014 disturbance area and associated with undulating hillslopes, particularly mid-low sloping land and creek flats. It is characterised by an abrupt texture change between the dark brown silty/loam surface soil and the brown sandy clay loam and yellowish-brown medium/heavy clay subsurface layers.
Red sodosol	17.9	Red sodosol is the second most dominant soil type in the proposed 2014 disturbance area and is largely associated with the central ridge area in the south-eastern part of the proposed 2014 disturbance area. This soil type is characterised by an abrupt texture change between the dark brown loamy surface soil and the reddish-brown medium clay subsurface soil.
Yellow sodosol	14.5	Yellow sodosol is associated with the Arenic rudosol. This soil type is characterised by an abrupt texture change between the sandy surface soil and the medium-heavy clayey subsurface soil. Subsurface soils may be greyish, brownish or yellowish in colour.

Table 14.1 Description of soil types[1]

Soil type	Area (%)	Description
Grey sodosol	15.4	Grey sodosol occurs mainly in and around Wallaby Scrub Road extending towards Wollombi Brook. It is a minor soil type of the proposed 2014 disturbance area and generally associated with lower slopes. This soil type is associated with subsoil saturation and can be observed on higher slopes where local saturation zones occur. It is characterised by an abrupt texture change between the grey-brown sandy-loam surface soil and the underlying grey-pink clayey subsurface soil.
Arenic rudosol	7.0	This minor soil type occurs in the northern part of the Site, predominately to the north-western boundary. This deep sand is associated with the WSW vegetation community and has developed from Aeolian sand deposits.
Grey kandosol	0.9	This soil type occurs on top of the central ridge to the south-east of the Site, ie Saddleback Ridge. The soil unit is characterised by a gradual texture change between the brownish-black surface loam and the underlying greyish-brown sandy clay loam and sandy clay.

Notes: 1. Soil types names have been updated based on BSAL site verification certificate soil sampling (EMM 2014b).

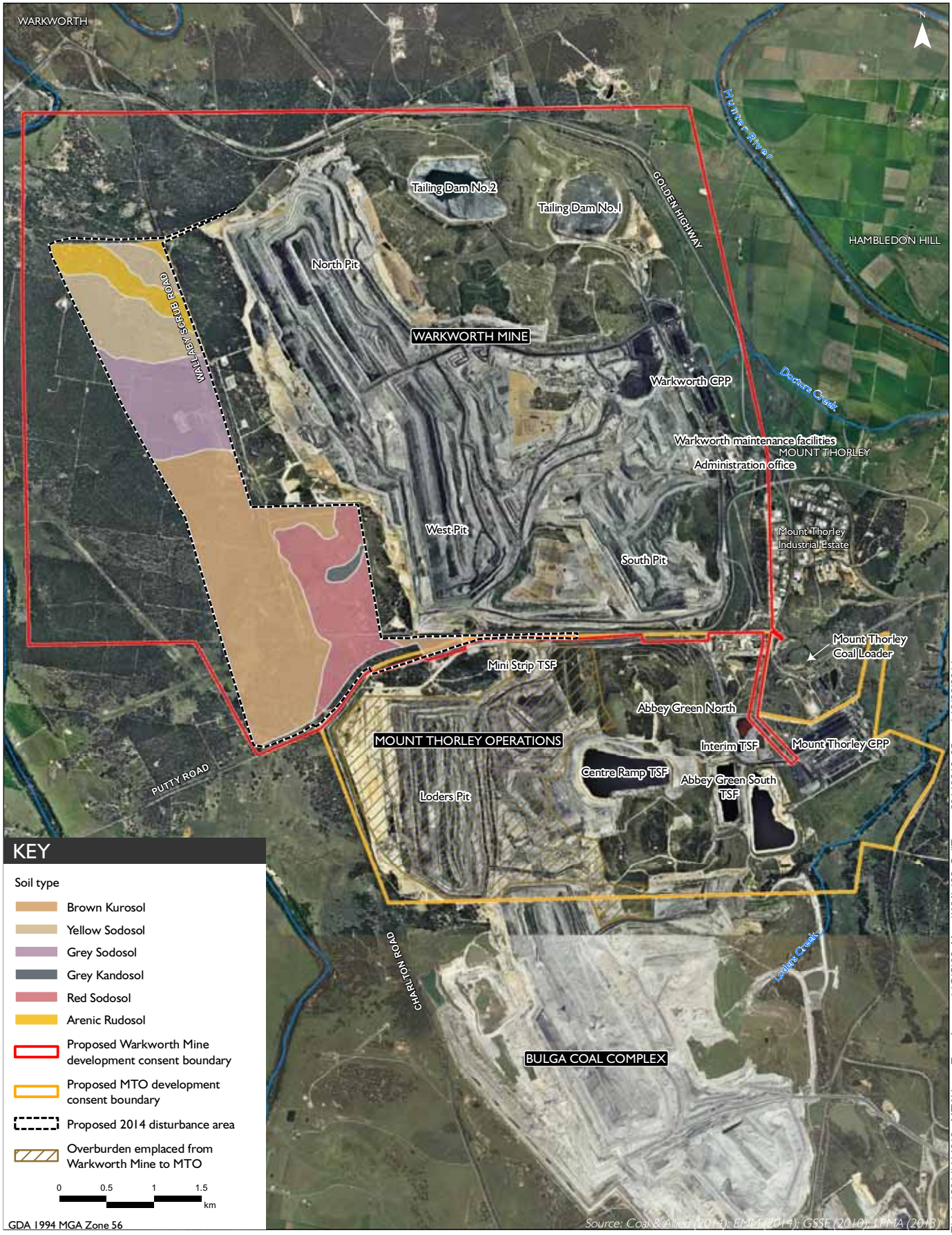
ii Topdressing suitability

The soils within the proposed 2014 disturbance area were assessed to determine their suitability as topdressing media in post-mining rehabilitation works.

The areas of mining infrastructure, such as access tracks, underpass or bridge crossing of Putty Road and contour drains would be stripped of topsoil in accordance with the topdressing suitability. The topdressing suitability for each soil unit in the proposed 2014 disturbance area is provided in Table 14.2.

Table 14.2 Topdressing suitability of soil types

Soil type	Description
Brown kurosol	The surface 10cm of topsoil is suitable for stripping and reuse as a topdressing medium in rehabilitation works. Some topsoil profiles exhibited high sodicity values. However, soil aggregate stability was reasonable due to significant organic carbon content. The subsoil is unsuitable for rehabilitation works as it is highly sodic and dispersive.
Red sodosol	The surface 10cm of this soil is marginally suitable for stripping and reuse as a topdressing medium in rehabilitation works. This soil material is classified as marginal due to its inherent characteristics of weak structure combined with variable amounts of sodicity. However, its loamy texture combined with moderate aggregate stability identifies its application as a topdressing material particularly if mixed with other suitable media. The subsoil is not recommended for reuse in rehabilitation due to the limiting factors of apedal structure and high sodicity.
Yellow sodosol	The surface 30cm of topsoil is suitable to marginally suitable for stripping and reuse as topdressing in rehabilitation works. The top 5cm of this soil is of suitable nature and the subsequent 25cm is of marginal nature. The downgrading to marginal with depth is due to an increase in single grain structure. It is recommended that the full 30cm of topsoil be utilised. However, additional measures to treat the 5-30cm stratum are recommended. The subsoil is not recommended for reuse in rehabilitation activities due to the limiting factors of texture, high sodicity and dispersion.
Grey sodosol	The surface 30cm of this soil is suitable for stripping and reuse as a topdressing medium in rehabilitation works. The subsoil is not recommended for reuse in rehabilitation due to the limiting factors of poor structural grade and high sodicity.
Arenic rudosol	This soil type is not suitable for stripping and reuse as a topdressing medium in mine rehabilitation works due to its' single grain sandy structure.
Grey kandosol	The surface 8cm of this soil type is suitable for stripping and reuse as a topdressing medium in rehabilitation works. The subsoil is not recommended for reuse in rehabilitation due to the limiting factors of high stone content and apedal structure.



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Soil units

Warkworth Continuation 2014
Environmental Impact Statement
Figure 14.1

iii Topdressing availability

The availability of topsoil for each soil type in the proposed 2014 disturbance area was assessed. The recommended stripping depth for each soil unit, together with area of land and calculated soil volumes are provided in Table 14.3.

Table 14.3 Recommended stripping depths for rehabilitated landforms

Soil type	Recommended stripping depth (m)	Stripping area (ha)	Volume (m^3)
Brown kurosol	0.1	294.9	294,900
Red sodosol	0.1	119.3	119,300
Yellow sodosol	0.3[1]	96.4	289,200
Grey sodosol	0.3	102.7	308,100
Arenic rudosol	nil[2]	nil	nil
Grey kandosol	0.08	6.1	4,880
Total volume			**1,016,380**
Total volume with 10% handling loss allowance			**914,742**

Notes: 1. Stripping to 1m for vegetation restoration activities in Biodiversity offset areas may be viable.

2. Stripping recommended up to 2m for vegetation restoration activities in Biodiversity offset areas may be viable.

The total volume of topsoil available is 914,742m^3 when a handling loss of 10 per cent is allowed. The Grey sodosol would generate the largest volume of topsoil followed by the Brown kurosol. The total volume provides for an approximate average respread depth of 13cm. At other Hunter Valley mines a topdressing depth of 10cm has been found to be adequate for healthy pasture establishment on rehabilitated overburden. The depth of re-spreading topdressing material is not critical for tree establishment.

a. Topdressing suitability for biodiversity offset areas

Two of the six soil types were identified as being suitable for offsite ecological restoration works for WSW (see Chapter 12). Descriptions of these soil types are provided in Table 14.4.

Table 14.4 Topdressing biodiversity offset areas

Soil types	Description
Arenic rudosol	The Arenic rudosol support WSW and the use of this soil for restoration/re-creation works in the biodiversity offset areas is appropriate. This soil does not present any physical or chemical constraints that would prevent its reuse in this context. However, due to its single grain structural characteristics, preventing wind erosion during stripping, haulage and re-spreading is required. The recommended stripping depth is 1-2m.
Yellow sodosol	This soil type is closely related to the Arenic rudosol which supports WSW. Therefore, this soil may contain a viable seed-bank for this community and utilisation of all sandy topsoil to aid restoration efforts in the biodiversity offset areas is feasible. Stripping depth may be in places as deep as 1m for this purpose.

14.2.2 Biophysical strategic agricultural land

As described in Chapter 7, since the Warkworth Extension 2010 application was lodged, the NSW Government has released the SLRUP. This policy seeks to balance the growth of extractive industries with the need to protect, among other things, BSAL (ie land which is naturally capable of sustaining high levels of productivity with minimal management).

As part of the SRLUP and the Upper Hunter Strategic Regional Land Use Plan, soils in the vicinity of the Site have been mapped using desktop information (such as historical regional-scale soil landscape maps) identifying BSAL. A review of this mapping indicates no BSAL occurs within at least 3km of the proposed 2014 disturbance area.

As previously stated, the proposal constitutes a mining development, as defined in the Mining SEPP. Clause 50A of the EP&A Regulation requires a mining development to obtain a site verification certificate to certify the land where the proposed development is to be carried out is not BSAL. The footprint of the proposal is within a mining lease 20m below ground level and, therefore, requires a mining lease from the surface to 20m below ground level. The results of the BSAL verification are provided in Section 14.3.

14.2.3 Critical industry clusters

The nearest Critical Industry Cluster (CIC) as defined by the SRLUP is approximately 5km to the south, outside of the 2km barrier nominated by the SRLUP Guidelines for CICs and, accordingly, no further assessment is required.

14.3 Impact assessment

Potential impacts on soils and land capability from the proposal would result from the continuation of the mining footprint to the west and to a lesser degree from the underpass of Putty Road. These potential impacts are discussed in this section.

A BSAL verification was undertaken in accordance with the Interim Protocol (OEH 2013) and lodged with DP&E.

The BSAL verification found the proposal to have a low risk of agricultural impact due to the absence of agricultural resources within the proposed 2014 disturbance area. All soil units failed the BSAL verification assessment on the basis of having fertility less than moderately high.

No soil units within the BSAL verification application area are classified as BSAL.

It should also be noted that:

- the Arenic rudosol /Tenosol (HMA104 from GSEE (2010) and USC1 to USC3 from EMM (2014b)) would have also likely failed on the basis of rooting depth.
- the Yellow sodosol (HMA204, HMA103, HMA101, NDA101 and NDA102 from GSSE 2010 and DS1 to DS5, DSC1 and DSC4 from EMM (2014b)) would have likely failed on the basis of poor drainage.

Accordingly, a site verification certificate was issued by DP&E in June 2014 enabling lodgement of the development application. The site verification certificate is provided in Appendix D.

14.3.1 Mining

The area of pre and post-mining land and soil capability classes have been calculated based on the disturbance area of the proposal, the contours of the final landform and *The land and soil capability assessment scheme* (OEH 2012). A comparison of the pre and post-mining rural land capability classification is provided below in Table 14.5.

Figures 14.2 and 14.3 illustrate the classification boundaries for pre and post-mining land and soil capability classes.

A comparison of the areas of pre and post-mining land and soil capability classes is provided in Table 14.5.

Table 14.5 Comparison of pre and post-mining land and soil capability classes

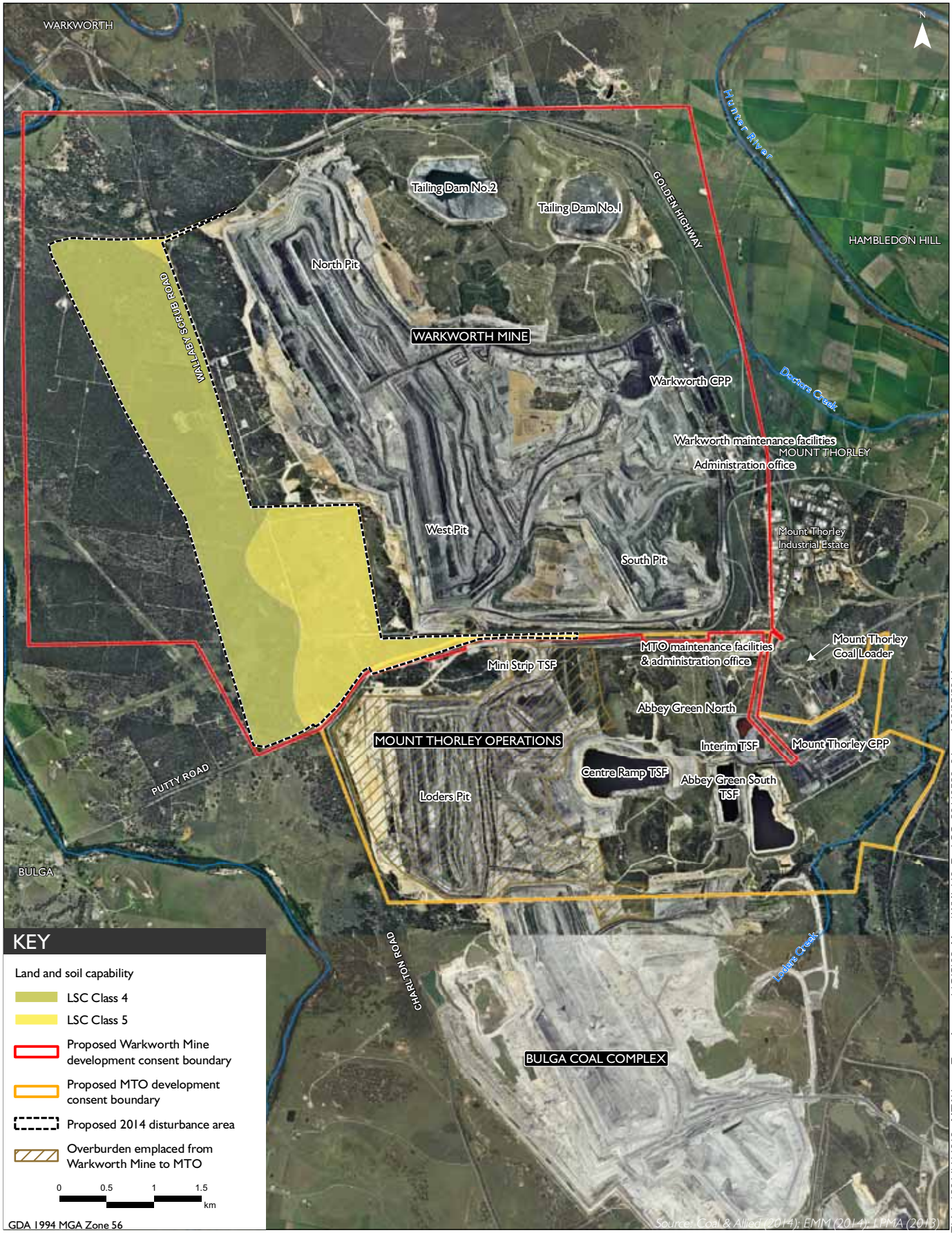
Classes	Pre mining		Post-mining		Change per class
	Area (ha)	%	Area (ha)	%	%
4	457	66	-	-	-66
5	240	34	-	-	-34
7	-	-	314	45	+45
8	-	-	374[#]	55	+55

Notes: # 340ha of this area comprises the final void that would fill with water and become a permanent water body.

The pre-mining classification of the disturbance area contains approximately 66 per cent Class 4 land and 34 per cent Class 5 land. Class 4 lands have limitations that restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology. Class 5 lands have limitations that restrict land use to mainly grazing, some horticulture; for example, orchards, forestry and nature conservation. The limitations need to be carefully managed when utilising the land for agricultural activities to prevent long-term degradation.

The post-mining disturbance area is dominated by Class 8 land (55 per cent) which correlates with the location of the final void highwalls and the final voids. About 340ha of the Class 8 land or 49 per cent of the proposed 2014 disturbance area would be voids and would fill with water and become a permanent water body. The rehabilitated landforms are classified Class 7 land (45 per cent) and have severe limitations for most land uses. They may be suitable for wood production, passive tourism, nature conservation or apiary. This capability and the restrictions that it poses are consistent with the post-mining capability classes approved under the current development consent.

It should also be noted that the post-mining capability classes are consistent with the proposed final land use which seeks to integrate biodiversity enhancement with sustainable agricultural practices, where practical, as well as the planned rehabilitation on adjacent lands (ie MTO and Bulga Coal Complex) as presented in Chapter 13.



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Pre-mining land and soil capability

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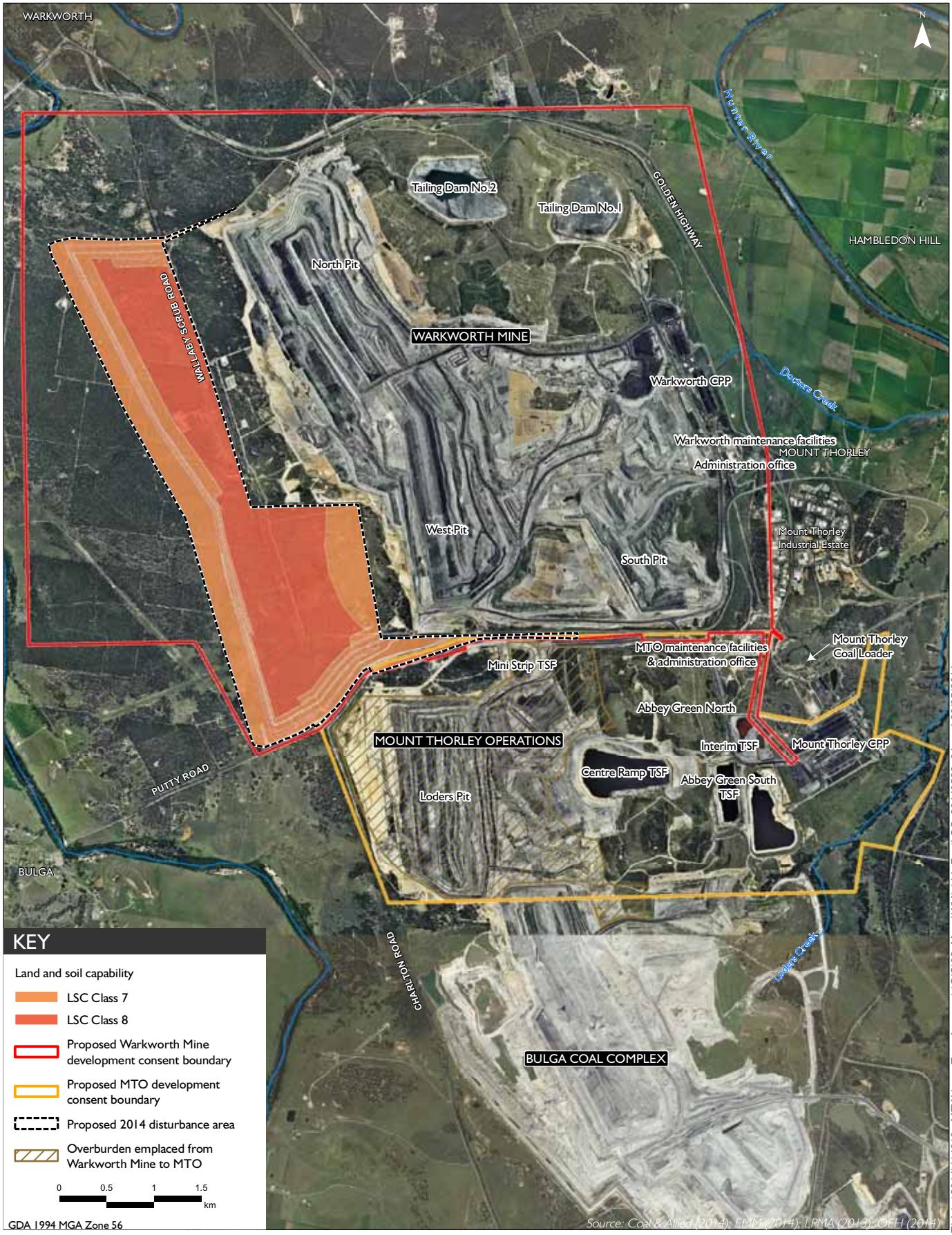
Figure 14.2



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Post-mining land and soil capability

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Figure 14.3

14.3.2 Underpass of Putty Road

The existing development consent for the Warkworth Mine has approved the construction of a bridge over Putty Road. The option to construct an underpass beneath Putty Road to facilitate the transfer of overburden from Warkworth Mine to MTO instead of the bridge construction is requested with this proposal. If approved, the decision on whether the bridge or underpass would be the preferred option would be determined based on the outcomes of further investigations that are currently being undertaken.

The underpass of Putty Road would be within the approved bridge envelope and extended further west. The underpass would involve clearing vegetation and topsoil stripping. However, the extent of these activities would be no greater than the approved bridge crossing. Topsoil from the underpass' surface footprint would be stripped to recommended topsoil stripping depths and used as topdressing media in rehabilitation works.

14.4 Management and monitoring

Management of land and soils capability at the Warkworth Mine is undertaken in accordance with the MTW MOP (see Section 2.4.4.i) and the erosion and sediment control section of the MTW WMP. These documents were developed in accordance with industry best practice with consideration given to the full available range of reasonable and feasible mitigation and their effectiveness, inclusive of contingency plans to manage any residual risks, for implementation at the Site.

These plans include the following management and monitoring strategies which would continue to be implemented under the proposal to achieve the desired post-mining land capability and agricultural suitability outcomes.

Measures for topsoil stripping and handling are as follows:

- topsoil stripping would be appropriately managed and depths limited to those stated in Table 14.3. Stripped topsoil would be maintained in a slightly moist condition during stripping. Material would not be stripped in either an excessively dry or wet condition;
- where practicable, stripped material would be placed directly onto reshaped overburden and spread immediately;
- soil stockpiles would be stored appropriately and stockpiles planned for storage greater than 12 months would be seeded and fertilised to maintain soil structure and minimise weed growth; and
- an inventory of available soil would be maintained to ensure adequate topsoil materials are available for planned rehabilitation activities.

Measures for topsoil re-spreading and seeding are as follows:

- where possible suitable topsoil would be re-spread directly onto reshaped landforms;
- where soil stockpiling has occurred, a weed assessment would be undertaken prior to re-spreading to determine if herbicide application and or 'scalping' of weed species is required;

- thorough seedbed preparation would be undertaken to ensure optimum establishment and growth of vegetation. The respread topsoil surface would be cultivated prior to, or during seeding, to reduce run-off and increase infiltration. Best results would be obtained by ripping when soil is moist and when undertaken immediately prior to sowing; and

- spreading of topsoil, addition of soil ameliorants and application of seed would be carried out in consecutive operations to reduce the potential for topsoil loss to wind and water erosion.

Measures for landform design, erosion and sediment control are as follows:

- regrading would be undertaken where required to produce slope angles, lengths and shapes compatible with the proposed final land use and not prone to an unacceptable rate of erosion;

- the drainage features on the landforms would be capable of conveying runoff from the newly created catchments whilst minimising the risk of erosion and sedimentation;

- engineered waterways would be constructed for the transfer of runoff downslope and the collection of sediment laden runoff prior to offsite release. These may include erosion blankets, ground-cover vegetation and/or rip rap; and

- spillways and sediment-control dams would be constructed for the purpose of capturing sediment laden runoff prior to offsite release. They would be designed and implemented such that maximum predicted runoff and sediment loads are safely captured and transferred.

14.5 Conclusions

The total volume of topsoil available for rehabilitation provides for an approximate average respread depth of 13cm. This depth is considered adequate for healthy pasture establishment on rehabilitated overburden. The depth of re-spreading topdressing material is not critical for tree establishment and is supported by the experience with rehabilitation undertaken at Warkworth Mine.

A review of regional BSAL mapping has indicated that no BSAL is present within the proposed 2014 disturbance area. A BSAL site verification study has prepared and submitted to DP&E and a site verification certificate issued confirming that no BSAL is present. Subsequently, the SRLUP does not apply to the proposal.

The post-mining land use is dominated by areas designated for ecosystem development and the final void. Smaller areas of grazing land to the east of the mining lease have been provided in the proposed final landuse, many of which are currently being constructed under the existing approval. The final voids and highwall slopes account for nearly 55 per cent of the proposed 2014 disturbance area. Of the proposed 2014 disturbance area, 49 per cent would be voids which would fill with water and become permanent water bodies. The areas designated for ecosystem development would enable a wildlife corridor across the rehabilitated lease as described in Chapter 13.

The option of the underpass of Putty Road would not result in additional surface disturbance to that which is already approved for the bridge crossing.

The proposed management and monitoring measures would reduce the potential for degradation within the proposed 2014 disturbance area and adjoining lands and would assist to achieve the desired post-mining land capability and agricultural suitability outcomes.

Chapter 15

Visual amenity

Chapter 15 — Visual amenity

15 Visual amenity

15.1 Introduction

This chapter provides a summary of the visual amenity study for the proposal prepared by Integrated Design Solutions Pty Ltd, which is presented in full in Appendix J.

The chapter describes the existing visual landscape, the changes that are predicted as a result of the proposal and the potential visual amenity impacts associated with these, and the proposed mitigation measures to address these impacts.

15.2 Existing environment

As described in Section 2.1, the land to the north, east and south of Warkworth Mine comprises predominantly mines and supporting infrastructure. A number of rural residential properties are also located to the north and east of the Site. To the west of the Site is predominantly wooded vegetation to Wollombi Brook. Beyond the Brook are a number of rural and rural residential properties in Bulga village. The existing visual character of the Site includes views of mining operations, grazing and cropping.

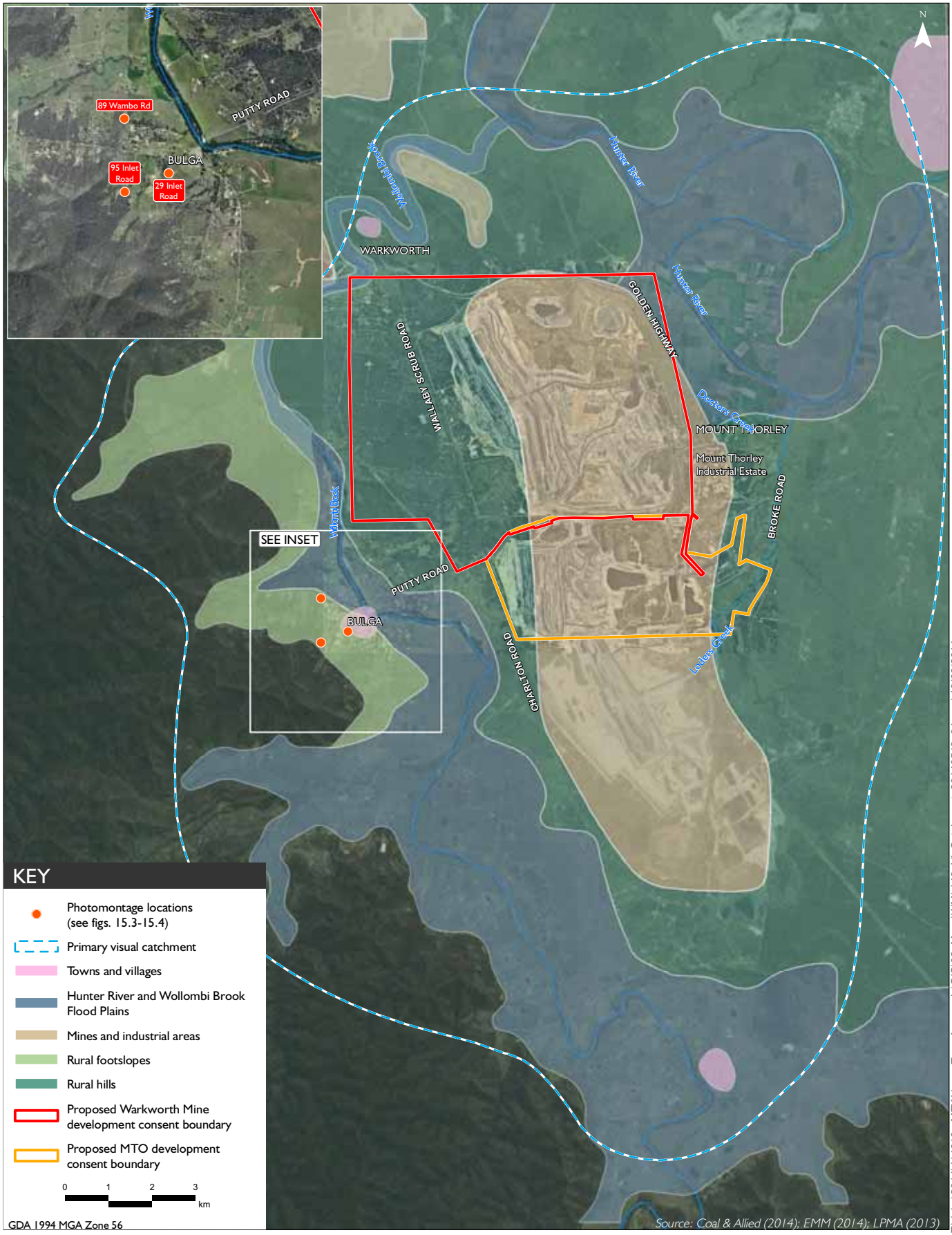
The landscape character of the local area is dominated by moderate to gently sloping hills with several locally dominant ridges. The highest natural points in the area lie west of Bulga village with ridgelines running in an east-west direction and range between 340 and 440m in height. A smaller ridgeline lies east of Bulga village and west of the Site which includes Charlton Ridge and Saddleback Ridge and in the range of approximately 150 to 165m. The highest natural point within the Site is Saddleback Ridge from where the land slopes down to the undulating land along the Hunter River and Wollombi Brook with open views along and across the floodplains and cleared rural lands. Rehabilitated overburden emplacement areas are a feature of the existing landscape including areas within Warkworth Mine, MTO, Bulga Coal Complex and Wambo Mine.

The primary visual catchment of the Site is the area containing the majority of views of the proposal and is defined predominantly by the surrounding topography. The visual catchment units (VCUs) of the Site are areas of visual uniformity which make up the overall landscape setting.

The VCUs within the primary visual catchment are shown in Figure 15.1, and are as follows:

- Hunter River and Wollombi Brook floodplains;
- rural hills;
- rural footslopes;
- town and village areas;
- surrounding ranges; and
- mine and industrial areas.

The VCUs are described in detail in Appendix J.



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Primary visual catchment and visual character units

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Figure 15.1

15.3 Impact assessment

15.3.1 Visibility of the proposal

The currently approved Warkworth Mine forms part of the existing landscape. As described in Chapter 2, the operations commenced in 1981 with the current approval due to expire in 2021. As noted in ERM (2002b), overburden emplacement at the Site would continue to be visible to some viewers in Bulga for the duration of the current approval.

The proposal has potential to alter the visual amenity of the environment in the context of the current approved operations at Warkworth Mine.

The activities under the proposal which have potential visual effects are:

- advancement of the open cut mining in North and West pits westward to within approximately 2.6km of Wambo Road;
- advancement of mining through Saddleback Ridge;
- continuation of existing overburden emplacements westward;
- establishment of a third crossing of Putty Road between Warkworth Mine and MTO (nominally an underpass as an alternative to the currently approved bridge);
- construction of a visual bund adjacent to the northern side of Putty Road; and
- continuation of night lighting on overburden emplacement areas and on mining equipment.

15.3.2 Method

To determine the potential visual impacts of the proposal, the assessment considered the visual effect and visual sensitivity in the context of the existing environment.

Visual effect is a measure of the level of contrast a development would have within its landscape setting. The magnitude of a development's visual effect is determined by considering the level of contrast or integration with its surroundings and the proportion of the view that includes the proposed development for the given level of contrast or integration. The proportion of the view is determined by measuring the occupied percentage of the Primary View Zone (PVZ), the area occupied by an arc created by sight lines radiating vertically and horizontally at angles of 30 degrees around the centre view line from the eye.

A viewshed analysis was undertaken using GIS modelling software to determine the aspects of the proposal visible from within the primary visual catchment and was used in the assessment of visual effect. Inputs into the GIS model included the proposed mine plan, topographical contours, and vegetation height of the surrounding area. The viewshed analysis for Bulga village is shown in Figure 15.2.

Vegetation was estimated at a height of 12m, which is considered to be conservative as vegetation to the west of Warkworth Mine varies between 10 and 20m. This analysis determined that from the north, south and east there is likely to be limited change in the visual effects due to the proposal in comparison to approved operations. The potential impacts from the west, however, could be high in some locations, including residential properties in and around Bulga.

Visual sensitivity is a measure of how critically a change to the existing landscape would be viewed by people from different land use areas in the vicinity of a development. For private dwellings, visual sensitivity would be high for visible mine elements less than 2.5km away, high to moderate for elements 2.5 to 7.5km away, moderate for elements 7.5 to 12.5km away, and low for elements more than 12.5km away.

Visual impacts are determined through the consideration of visual effect and visual sensitivity in conjunction, as shown in Table 15.1.

Table 15.1 Visual impact

Visual effect	Visual sensitivity		
	High	**Moderate**	**Low**
High	High visual impact	High/moderate visual impact	Moderate/low visual impact
Moderate	High/moderate visual impact	Moderate visual impact	Moderate/low visual impact
Low	Moderate/low visual impact	Moderate/low visual impact	Low visual impact

Visual impacts of the proposal are described in the following sections.

15.3.3 Visual sensitivity

Residences within the proposal's primary visual catchment are within a range of up to 7.5km and, therefore, the visual sensitivity of these residences where the proposal is viewed would be high or high/moderate.

15.3.4 Potential visual impacts

Photomontages were prepared as part of the study for three locations considered to represent high and high/moderate visual impacts of the proposal. These photomontages, shown in Figures 15.3 and 15.4, illustrate the existing view (that is, where Warkworth Mine is operating now under its development consent), the view of the proposal without mitigation measures applied, and the view with an example of mitigation measures described in Section 15.4 applied.

The visual impact of the proposal would generally be low/moderate for a majority of the primary visual catchment, with more prominent views and greater impacts on residences in elevated locations in and around Bulga village. Impacts on areas within the primary visual catchment are described in the sections below.

i Views from the north

The VCUs in the primary visual catchment north of the proposal are towns and villages, rural hills, mines and industrial areas, and Hunter River and Wollombi Brook floodplains.

The intervening topography and vegetation means there are limited views from Warkworth village, the Golden Highway, or near to medium field locations in the rural foothills to Warkworth Mine. The eastern overburden emplacement areas may be visible during the initial period of the proposal. Some areas already exist under the current operations; however, these views would be distant and have a low visual impact in a wider context.

The area to the north-east includes rural residences and the Apex Lookout at Gowrie. The visual sensitivity of these locations is potentially high. Generally, the change in visual effect would be low given the exposure to existing overburden emplacement areas.

ii Views from the east

The VCUs in the primary visual catchment to the east of the proposal are rural hills and Hunter River floodplains.

Views from the east are more direct and currently include the expanding areas of revegetated final landform. The existing visual effects vary from high at closer assessment locations, such as the Golden Highway and Putty Road which have open and immediate views of the overburden emplacement areas and the CPP, to low for more distant locations. The visual impacts of the proposal at these locations would generally be low as the existing views will not be significantly varied. The expansion of revegetation as the final landform is completed, would continue to decrease the impacts on views from the east. Localised mitigation could be considered to reduce the impact of newly disturbed areas although the elevated roadway and existing low topography are a significant constraint in this regard.

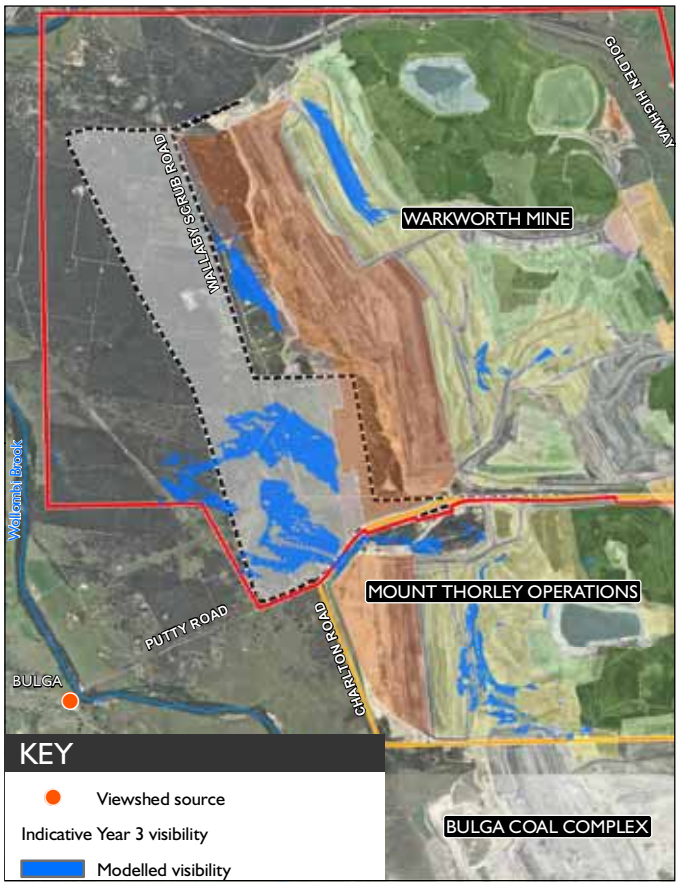
Residences to the east along Putty Road, Golden Highway, and nearby rural roads such as Hambledon Hill Road and Idano Road, would have views to the eastern face of the active Warkworth Mine overburden emplacement areas. Whilst the sensitivity of these residences is potentially moderate to high and the visual effect would vary depending on any changes to the extent of exposed overburden at any given time, it should be noted the final landform and rehabilitation of this overburden emplacement area is currently being established.

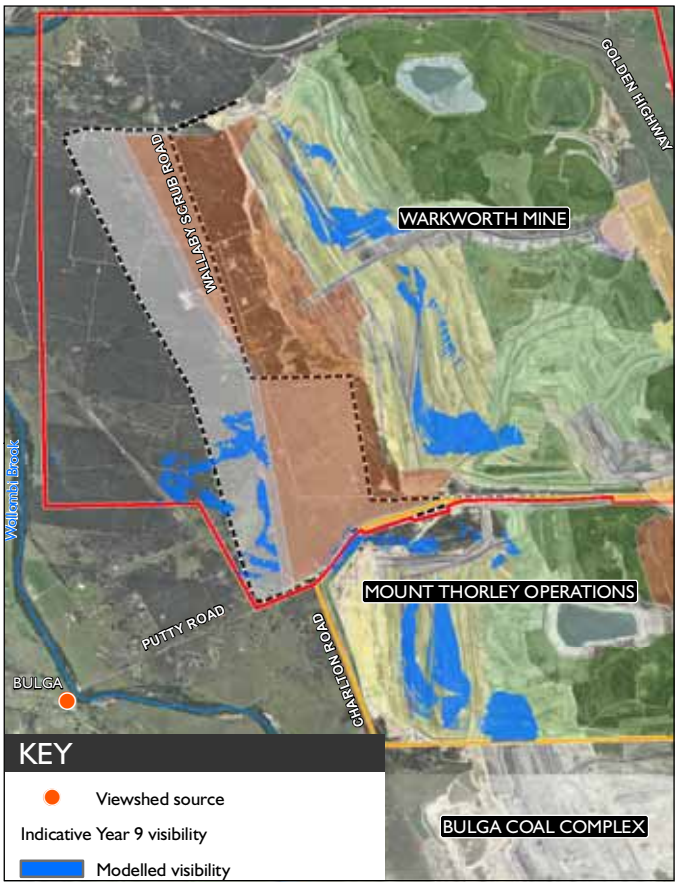
iii Views from the south

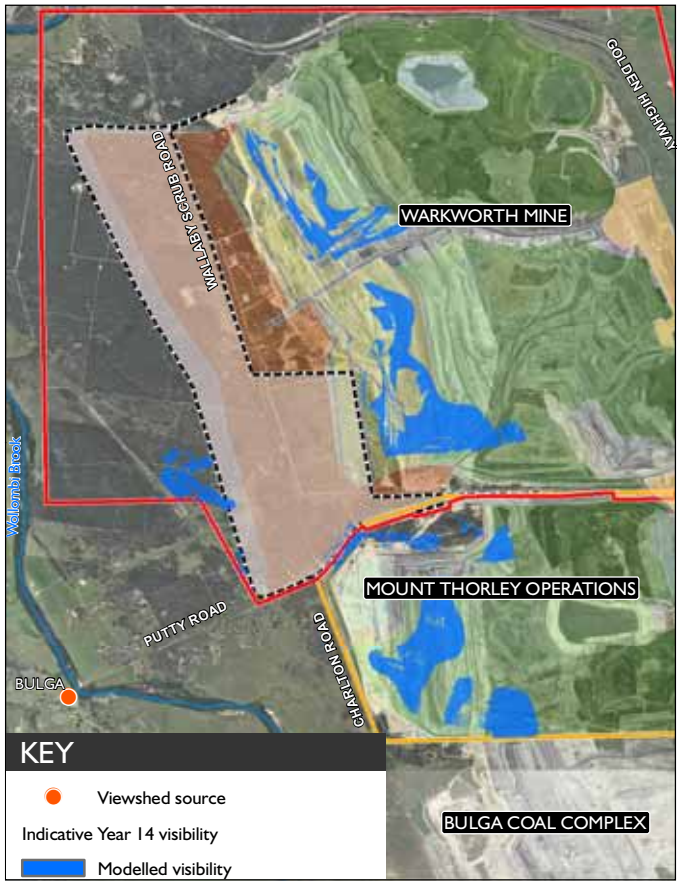
The VCUs in the primary visual catchment to the south of the proposal are rural hills, towns and villages, and Hunter River floodplains.

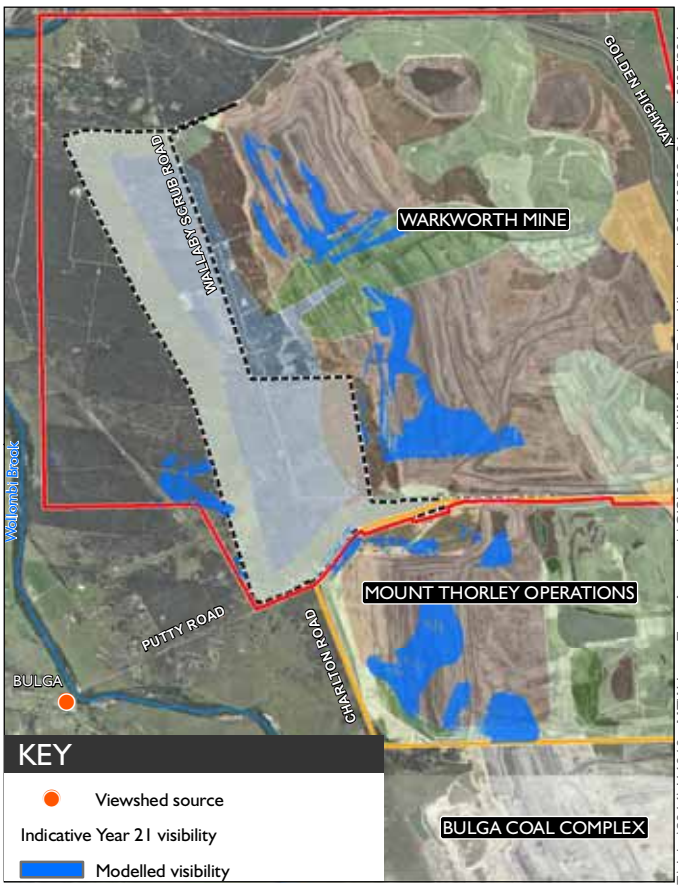
Topography, vegetation and other mining operations generally conceal the current operation and the proposal from the south. While a small number of exposed viewpoints exist to the south-west, Mount Leonard generally screens Warkworth Mine from much of the area. Views from this area would mostly see the western face of MTO and Bulga Coal Complex. Parts of the overburden emplacement areas may be seen where they become raised above the existing levels and would have moderate visual effects despite the distance at which they are seen (3 to 5km). The views in this area would generate a high to moderate visual impact for the floodplains VCU due to the high sensitivity and moderate visual effects. The overburden emplacement areas would be progressively rehabilitated and the impacts of the proposal would reduce to moderate and low as a result.

Putty Road forms the southern boundary to the operations and the proposal. Due to its proximity, it has a high sensitivity and high to moderate visual impact as mining extends west beyond the existing approved limits. The exposed areas during the construction of a proposed bund along the northern boundary to Putty Road would itself have a moderate impact prior to its revegetation; however, the impacts would significantly reduce once vegetation cover is established. The proposed underpass beneath Putty Road would have a low visual impact in comparison to the currently approved bridge.









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Bulga viewshed analysis - all years
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Figure 15.2

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95 Inlet Road, Bulga

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Figure 15.3

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29 Inlet Road, Bulga

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Figure 15.4

iv Views from the west

The VCUs in the primary visual catchment to the west of the proposal are towns and villages, rural hills, rural footslopes, and Hunter River and Wollombi Brook floodplains.

The removal of Saddleback Ridge and progression of mining westward would generally be concealed to most viewers to a varying extent by the intervening vegetation and topography, particularly in lower lying areas where views are mostly of trees along Wollombi Brook.

The extent of views of the proposal would be dependent on the position of the viewing location. Views from some south-westerly view points along Putty Road, as well as from some parts of Bulga village, would exist above and through the existing foreground trees; however, the visual effects would be low.

The proposed overburden emplacement is largely screened from Wambo Road as it is at a lower elevation and benefits from screening by trees along Wollombi Brook. This area is not considered likely to experience any noticeable change in visual impact.

Road users from Putty Road to the south of Bulga village and along Inlet Road would have moderate to low sensitivity and visual impacts due to the exposure of overburden emplacements once Saddleback Ridge is removed. Initially, the colour and form visual contrasts would cause moderate visual effects, which would reduce to low as rehabilitation progresses.

Most residential properties to the west would have a high level of sensitivity, with some properties in elevated locations throughout Bulga potentially experiencing high visual impacts depending on the orientation of the property and intervening screening provided by vegetation. Appropriate mitigations would be implemented, where requested (see Section 15.4).

15.4 Management and monitoring

As part of the Warkworth Extension 2010, a MTW Visual Impact Management Plan (VIMP) was developed to the draft stage in accordance with industry best practice with consideration given to the full available range of reasonable and feasible mitigation and their effectiveness, inclusive of contingency plans to manage any residual risks, for implementation at the Site. It detailed the management of MTW's visual impacts. Mitigation currently implemented at the Site, together with elements of the VIMP as it applies to the proposal, are described below. The draft VIMP would be revised and adapted to the proposal, should it be approved. Mitigation strategies specific to the proposal are also detailed below.

15.4.1 Current mitigation measures

Onsite mitigation measures currently in place for the approved operations at Warkworth Mine include:

- structure design to minimise visual impacts, consistent with engineering principles and practice, and any site constraints;
- direction of lighting away from offsite areas to the greatest degree possible, and the use of sensor lighting where permanent lighting unnecessary; and
- construction of small bunds, vegetated and built screens at appropriate locations along the Site boundary.

15.4.2 Visual Impact Management Plan

Elements of the draft VIMP that apply to the proposal include:

- examination, in detail, of any high sensitivity viewing points and determination of the opportunities for relevant screening treatments including onsite boundary treatments or mitigation measures to individual residences;
- minimisation of the amount of pre-rehabilitation areas exposed to view by establishing grass cover to remove colour contrast; and
- establishment of planting patterns of trees and grasses in rehabilitation areas to create a high level of visual integration with the surrounding landscape.

15.4.3 Proposal specific mitigation

In order to determine mitigation for any viewpoint with high sensitivity, a SSVA would be undertaken on request for properties in Bulga village. As a site visit to each individual property to assess potential visual impacts from the proposal is not feasible, the VIMP would outline a process to undertake these assessments. A landowner affected by visual impacts from the proposal may request a SSVA, which may result in the application of appropriate screening treatments at the affected property or between the property and the source for impacts assessed as high.

For the small number of individual residences within the primary visual catchment, which may have high visual impacts at some stage of the proposal, suitable mitigation measures would be implemented, subject to agreement with the landowner. This is likely to constitute vegetation screening; however, all mitigation measures would be guided by an SSVA and associated consultation with the affected property owners.

15.5 Conclusions

The existing environment in the vicinity of the proposal includes Warkworth Mine. Operations at Warkworth Mine are approved to 2021. As noted in ERM (2002b), overburden emplacement at the Site will continue to be visible to some viewers in Bulga for the duration of the current approval.

The proposal seeks an extension of mining operations westward across Wallaby Scrub Road, the transfer of overburden material to MTO to assist in the development of the final landform and a 21 year development consent period.

Potential visual impacts of the proposal would generally be moderate to low, as the impact on visual amenity would be limited and localised. The existing topography and vegetation would continue to provide screening to the mine to varying extents depending on view location and elevation. Some residences west of the Site, such as elevated residences around Bulga village, may potentially experience high visual impacts. The proposal would extend exposure to views of the Site, and decrease the distance between sensitive viewers and mine and rehabilitated landform, in the long-term.

Visual impact mitigation measures would be put in place to mitigate the potential impacts on the overall surrounding landscape including vegetation and bund screening to the boundaries of the Site. In addition, SSVAs would be available to individual landowners for properties affected, which would prescribe specific mitigation measures, if determined to have high visual impacts. The progressive rehabilitation of the Site would reduce the level of contrast in the viewing landscape and ultimately result in a higher level of visual integration.

Chapter 16

Groundwater

Chapter 16 — Groundwater

16 Groundwater

16.1 Introduction

This chapter provides a summary of the groundwater study for the proposal prepared by Australasian Groundwater and Environmental Consultants Pty Ltd (AGE), which is presented in full in Appendix K.

This chapter includes a description of the existing groundwater environment, including the current status of the regional and local groundwater systems. The study considered existing mining areas and the proposed extension area. To adequately assess the potential impacts resulting from the proposal, the assessment methodology incorporated all of the existing and approved Warkworth Mine operations. The assessment results thus represent the potential impacts resulting from Warkworth Mine including the changes resulting from the proposal. Consequently, it must be recognised that some of the predicted effects are due to the activities from already approved operations that would occur irrespective of the proposal.

An independent peer review of the groundwater model was completed as required by the AIP by Dr Frans Kalf from Kalf & Associates Pty Limited. The review interrogated the hydrogeological modelling, assumptions, descriptions and their clarity and validity. In addition, the review also took into consideration all relevant aspects as set out in the requirements of the *Australian Groundwater Modelling Guidelines* (Barnett *et al.* 2012) and the AIP. The outcomes of the peer review are reflected in the groundwater study.

The management and monitoring measures that would be implemented to prevent or minimise the potential impacts are also discussed in this chapter.

16.2 Existing environment

16.2.1 Climate and surface water

Climate and rainfall data relevant to the study area (defined as the model domain adopted for the groundwater study) was obtained from BoM's Jerrys Plains Station and local data recorded at MTW and Bulga Coal Complex. The monthly rainfall records were used to calculate the Cumulative Rainfall Departure (CRD – also known as rainfall residual mass) which shows trends in rainfall relative to the long-term average and provides a historical record of relatively wet and dry periods. The CRD for the Jerrys Plains Station indicates that the district experienced above average rainfall between 2007 and 2012, followed by a general decline in rainfall.

The most prominent watercourse in relation to groundwater for the proposal is Wollombi Brook west of the Site. Stream flow data from NOW gauging stations on Wollombi Brook at Warkworth (No. 210004) and Bulga (No. 210028) shows that peaks in stream flow are in response to rainfall events. Between peak rainfall events the stream flow shows a steady recession. Stream flow in the Wollombi Brook at Warkworth has been continuous since 2010. Prior to early 2010, Wollombi Brook at both Bulga and Warkworth had extended periods of no flow. In addition, flow volumes during flood events were higher downstream of the Site (Warkworth) than upstream (Bulga). This indicates that there is surface and/or groundwater input to Wollombi Brook between these stations. An analysis of flow data, however, also indicates that a loss of flow is sometimes observed along the reach of Wollombi Brook adjacent to the Site. Due to the large number of potential locations for extraction of flow (from significant surface and groundwater entitlements in the area), it was not possible to accurately determine where the flow loss is occurring.

The Hunter River is in the north and north-east sections of the study area. The Hunter River characteristics are described in Chapter 17 together with other aspects of the existing surface water environment. The majority of the Hunter River and associated alluvium is hydraulically separated from MTW by the sub-crop of Permian coal measures being mined.

16.2.2 Geology and hydrogeology

The geologic strata at Warkworth can be categorised into the following hydrogeological units:

- alluvium along Wollombi Brook and the Hunter River that can form a productive aquifer system, although salinity can limit use of the water;
- aeolian sands associated with the WSW to the north-west of North Pit that forms a thin perched groundwater system of limited extent;
- shallow weathered bedrock (regolith) near the ground surface that is mainly present in the more elevated mining areas and is largely dry;
- very low yielding sandstone, siltstone and conglomerate that comprise the majority of the Permian interburden/overburden and is considered a low permeability aquitard (an aquitard is defined as a low permeability units that retards groundwater movement vertically between strata); and
- low to moderately permeable coal seams that range in thickness from 1 to 6m and are the prime water bearing strata within the Permian sequence, containing brackish to saline water.

The geology and a hydrogeological cross-section of the Site are shown in Figures 16.1 and 16.2, respectively.

The alluvium along Wollombi Brook is considered an important groundwater resource, mainly used for agriculture and industrial purposes. This alluvial aquifer is largely restricted to the main channel of Wollombi Brook and only extends a short distance up the associated tributaries.

The Permian deposits occur as a regular layered westerly dipping sedimentary sequence. The coal seams currently mined at Warkworth Mine and at surrounding mines including MTO, Bulga Coal Complex and Wambo Mine are within these deposits. As shown in Figure 16.1, the coal seams outcrop west of the Hunter River alluvium and are more than 200m below the ground surface to the west where the Wollombi Brook alluvium occurs. Groundwater usage from the coal seams is limited by the generally brackish to saline nature of the groundwater and the low and variable yields. The main users of this resource are the underground mines in the area.

Aeolian sands overlie areas of the Permian coal measures to the north-west of Warkworth Mine and have the ability to store and release water. Vertical flow of groundwater below these sands is impeded by a layer of clay at their base forming a thin perched water table known as the Warkworth Sands groundwater system. This groundwater system supports the protected WSW community discussed in Chapter 12, but is not directly connected to the regional water table.

16.2.3 Recharge and discharge

Recharge is a natural process whereby water moves downward from the surface to the water table. Recharge to the alluvium occurs via rainfall infiltration, hill slope runoff and leakage from rivers and streams when and where the surface water levels are above the water table in the alluvium. Recharge to the Permian coal measures occurs where coal seams outcrop or sub-crop close to the surface such as within and to the east of Warkworth Mine.

In the Hunter Valley, recharge to the Permian coal measures is low, typically below 1 per cent of annual rainfall, and recharge to alluvium is between 5 and 10 per cent of rainfall, dependant on alluvial composition.

Natural discharge processes in the system are through groundwater flow into water courses as base flow when the water table in adjacent aquifers is higher than either the stream bed or the water levels in the surface water body.

Dewatering associated with mining (Permian) and groundwater use by private landholders, is the other main discharge process. Evapotranspiration occurring where the water table is within the root zone is another component.

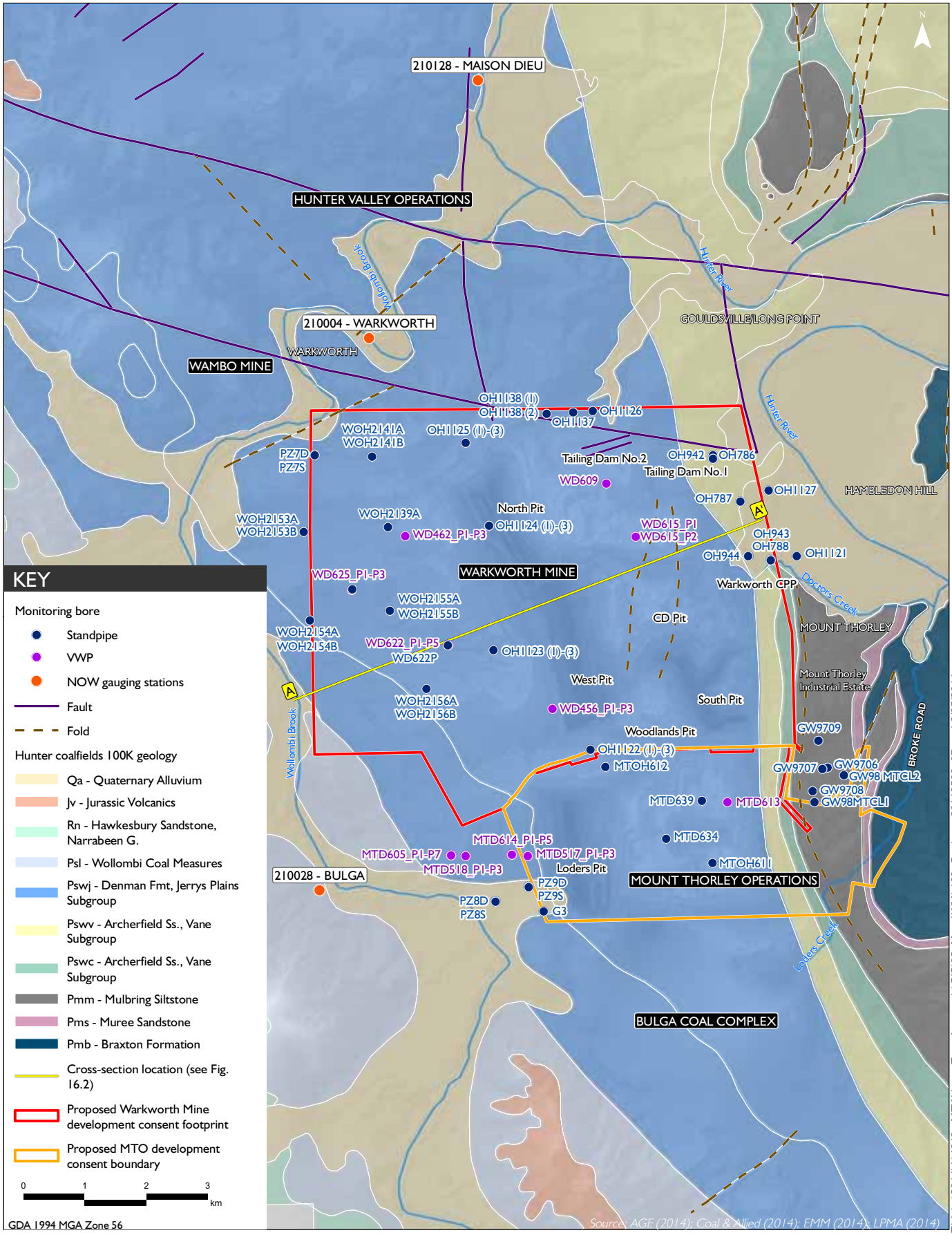
Comparison of Wollombi Brook water levels to rainfall and groundwater levels, indicates there is connectivity (ie recharge and discharge) between Wollombi Brook and the alluvial system.

16.2.4 Water quality

Groundwater quality monitoring has been undertaken at MTW since 1993 recording pH, electrical conductivity (EC) and concentrations of selected major ions. Monitoring results indicate both the Hunter River alluvium and Wollombi Brook alluvium have relatively saline water quality, while the underlying coal seams have moderately saline to saline water quality. Better water quality occurs in the alluvium in the northern area of the mining lease where seepage from the Warkworth Sands appears to enter the alluvium. Concentrations of ions are lowest in Wollombi Brook and highest in the deeper Permian coal seams.

16.2.5 Groundwater users

Groundwater users within the predicted zone of depressurisation were identified in 2010 through a search of the NOW groundwater database (PINEENA) and a bore census. Ten privately-owned groundwater bores were identified west of the Site, north of Bulga village, as shown in Figure 16.3. Of the bores identified, seven were relatively shallow, at less than 25m in depth, indicating that these bores are likely to be constructed in the alluvial sediments. The remaining three groundwater bores had a depth greater than 60m and are expected to be constructed in the underlying bedrock. An updated search of the PINEENA groundwater database in 2013 identified no new bores within the predicted zone of depressurisation since 2010.



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Geology and monitoring bores

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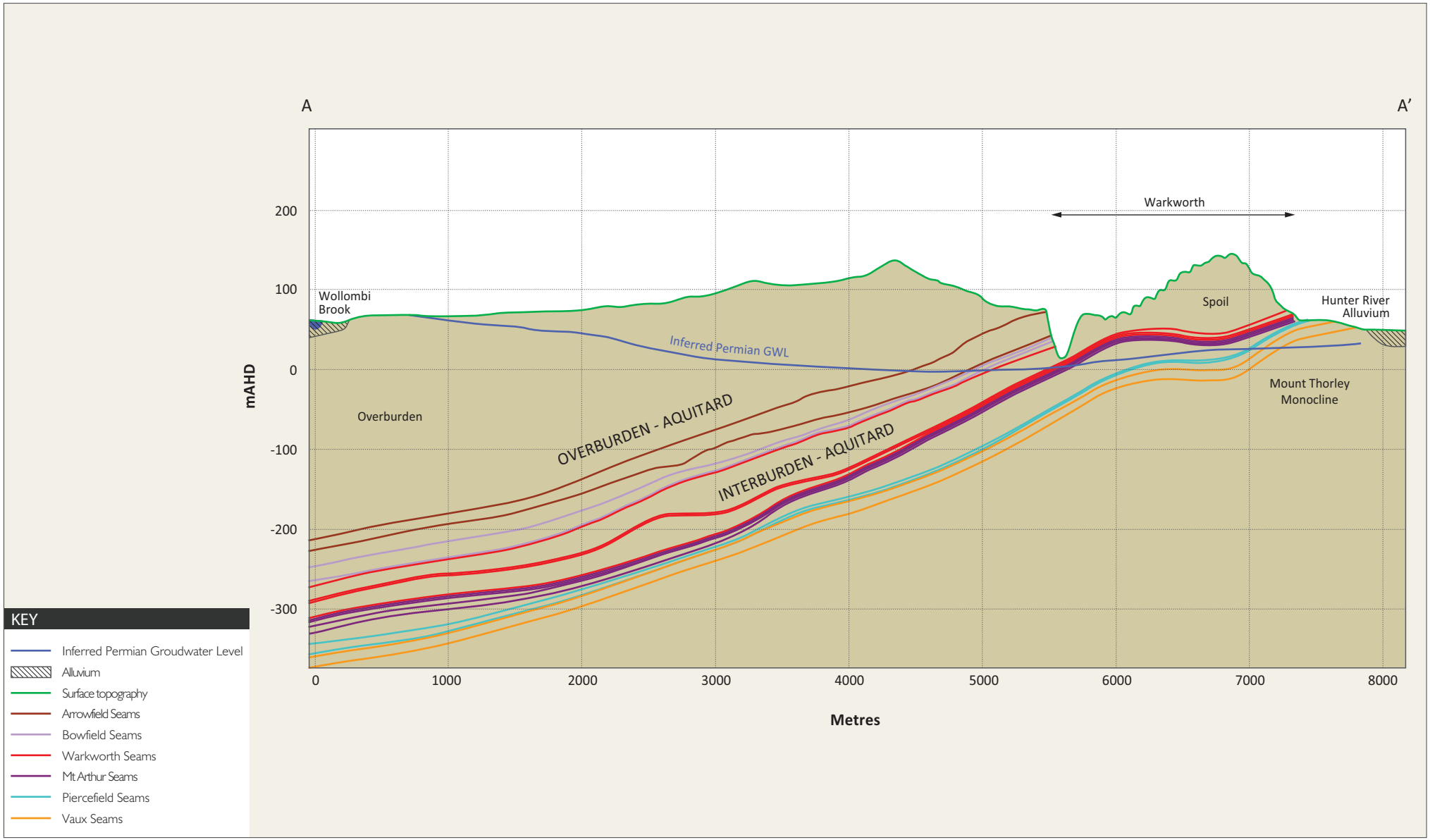
Figure 16.1



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Hydrogeological cross-section

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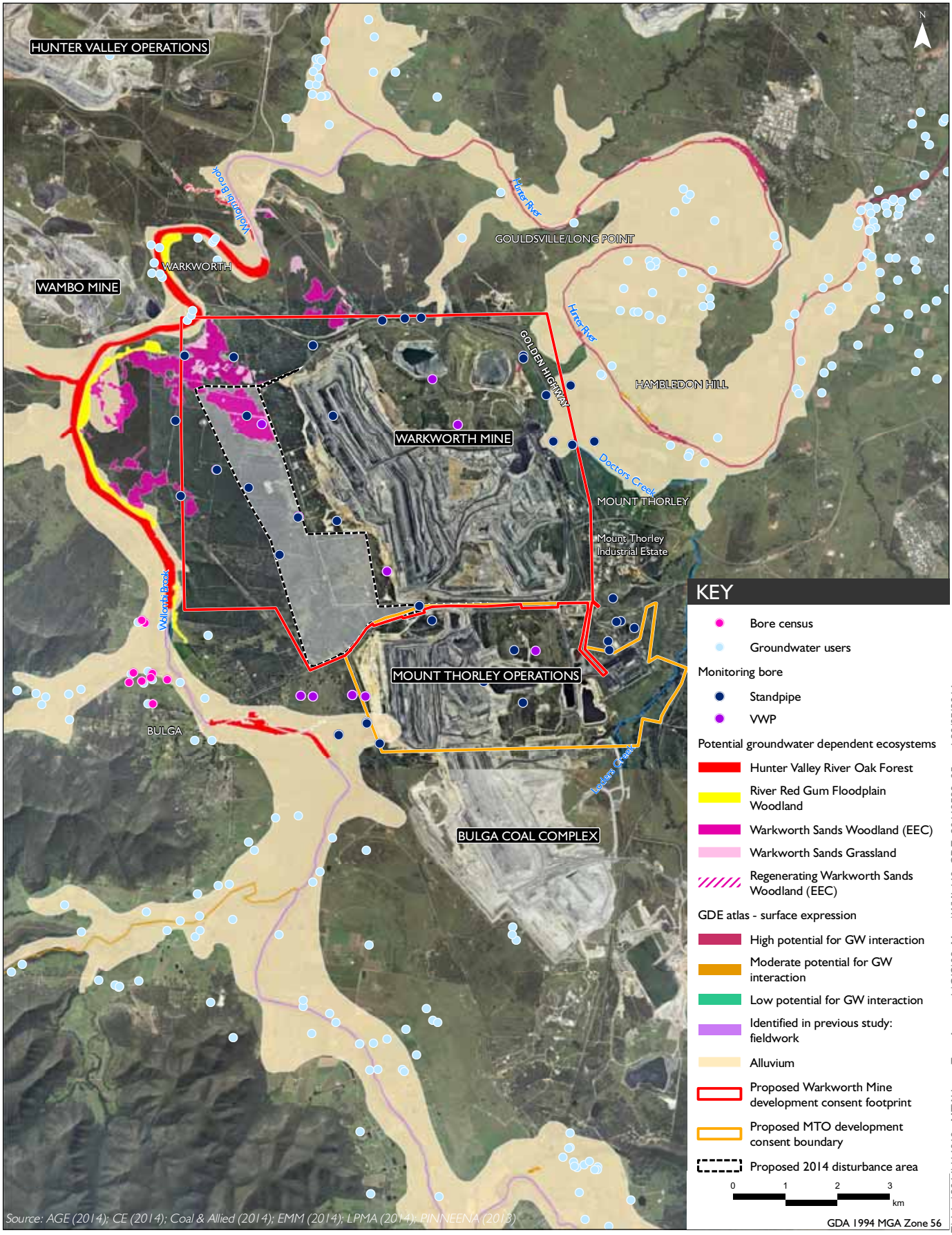
Figure 16.2



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Groundwater users and GDEs

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Figure 16.3

16.2.6 Groundwater dependent ecosystems

There are potentially two GDEs found along Wollombi Brook as shown in Figure 16.3. These are the Hunter Valley River Oak Forest and the River Red Gum Floodplain Woodland. These potential GDEs occur in a thin riparian zone along Wollombi Brook.

The WSW community also has the potential to be a GDE, particularly in swales between dunes. Although, as described in Chapter 12, this formation is not connected to the regional groundwater system and the water table is expected to fluctuate with rainfall and from evapotranspiration, not as a result of mining induced drawdown.

16.2.7 Existing groundwater interactions

Mining removes overburden and interburden material to access and remove the Permian coal seams. The coal seams store water, although typically saline and of poor quality. The overburden and interburden units typically have low ability to transmit groundwater. The removal of overburden and coal seams draws groundwater into the pit and reduces groundwater pressures, referred to as depressurisation, leading to a zone of lower groundwater levels (or drawdown) around a mine.

A long history of mining has depressurised the coal seams west of Warkworth Mine and lowered the groundwater levels, which are more pronounced near the active highwall. Drawdown to the north appears to be relatively limited with some recovery of water levels within and adjacent to the spoil piles. No measureable drawdown has been recorded in the Wollombi alluvium. The outcropping of the Permian strata west of the Hunter River prevents drawdown in the Hunter River alluvium.

Adjacent mines including MTO, Bulga Coal Complex and Wambo Mine, extract similar coal seams as the Warkworth Mine. These mining operations have caused cumulative impacts on groundwater pressures in the coal seams within the proposed extension area. The groundwater study investigated the contribution of Warkworth Mine to the cumulative impacts.

Figure 16.4 shows the contours and generalised flow direction for existing Permian groundwaters, which generally flow towards the Site as a result of current and historical mining.

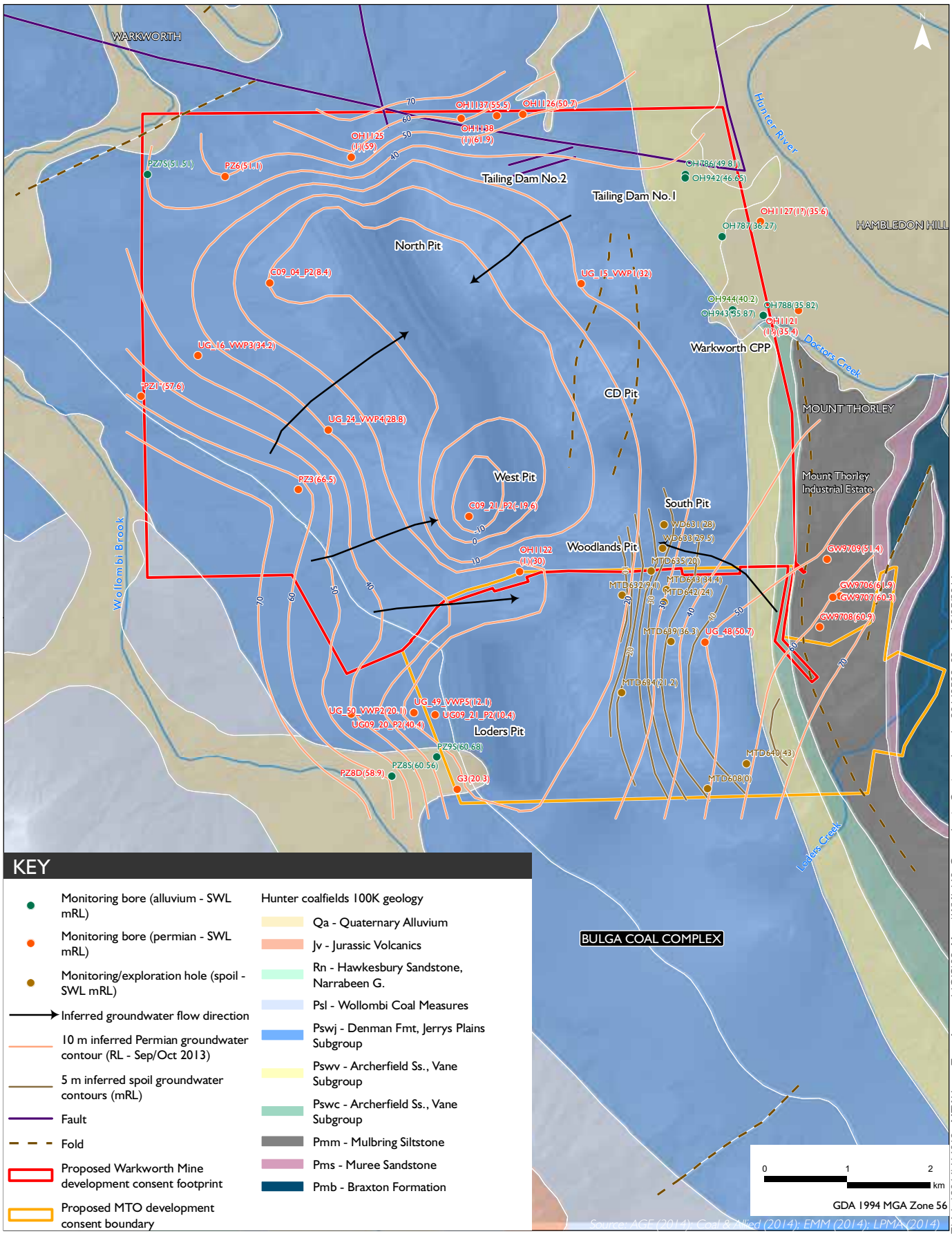
16.2.8 Water licensing

As described in Section 7.3.6 the two key pieces of legislation for the management of water in NSW are the WM Act and the Water Act. Operations at MTW have the potential to interact with water sources that require licensing under these Acts, namely:

- the Permian groundwater described in Section 16.2.2, which is not yet covered by a water sharing plan and is therefore still under the Water Act; and
- Wollombi Brook and its associated alluvium and the alluvium associated with the Hunter River, which is covered by the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009 (WSPHUAWS).

The Water Sharing Plan for the Hunter Regulated River Water Source 2003 (WSPHRRWS) is not relevant to the proposal as there would be no take from the Hunter River or other Hunter regulated water sources.

Water licenses currently held by Warkworth Mine are detailed in Table 16.1.



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Groundwater contours

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Figure 16.4

Table 16.1 Warkworth Mine water licences

Licence No.	Reference	Approved extraction (ML/year)	Security	Type
20BL170012	Water Act	570	-	Groundwater (Part 5)
WAL 18558	WM Act	50	General	Wollombi Brook (WSPHUAWS)
WAL 10543[1]	WM Act	1,012	High	Hunter River (WSPHRRWS)
20AL201237[2] (WAL 962)	WM Act	1,070	High	Hunter River – 2012/2013 temporary transfer (WSPHRRWS)
20AL201242 (WAL 963)	WM Act	243	General	WML Hunter River Pump (WSPHRRWS)
20AL201254 (WAL 969)	WM Act	39	General	Glennies Creek Pump (WSPHRRWS)

Notes *1: Singleton Council holds a high security water licence (WAL 10543), of which MTW has an entitlement to 1,012ML/yr of water in Zone 1 B of the Hunter River.*

2: Hunter Valley Operations has a temporary transfer of 1,070 ML to MTW for the 2012/2013 financial year, giving MTW an available allocation of 2,082ML/year to offset groundwater draw from the Hunter River.

A comparison of the predicted water take from groundwater interactions under the proposal (both during operation and post-closure) versus held entitlements is presented in Section 16.3.3.iii.

16.3 Impact assessment

16.3.1 Groundwater modelling

A numerical groundwater flow model was used to assess the potential changes from the proposal on the groundwater regime and address the requirements of the AIP. The consistency of the proposal with the AIP is considered in Section 16.3.3.

The MER (2002) model simulated the impact of mining from 1981 until 2020 as part of the groundwater impact assessment that supported the DA for the current development consent. A review of the MER (2002) model indicated it was relatively conservative and the magnitude and extent of depressurisation in the Permian coal measures was less than predicted at most monitoring sites. The new groundwater model was developed for the Warkworth Extension 2010 (AGE 2010), and has been refined since this time, and rigorously calibrated with data from the extensive MTW monitoring network. The model has successfully predicted the impacts from existing operations at Warkworth Mine as verified by monitoring results providing further confidence in the predictions presented in the EIS.

In summary, the impact of the proposal on groundwater resources was assessed by:

- developing a numerical model (MODFLOW SURFACT) using the available hydrogeological data and information;
- calibrating the model using available historical mine stresses at MTW, Bulga Coal Complex and Wambo Mine (1981 to 2013), groundwater levels and stream flows recorded in the area;
- assessing the uncertainty and variability in the calibration by running multiple models with randomly generated parameters held within measured and realistic bounds;
- simulating the impacts of the proposed mining from 2015 to 2035;

- assessing the uncertainty and variance in the predictions; and
- simulating impacts on the groundwater regime post-closure for a further 1,000 years following the completion of mining.

Two scenarios were modelled, namely:

1. All mining associated with both the proposal and surrounding mining activities (MTO, Bulga Coal Complex and Wambo Mine).
2. The surrounding mining activities only.

The results of these modelled scenarios are presented in the following sections.

As outlined in Section 16.1, Dr Frans Kalf reviewed the modelling undertaken during key stages of the investigation. Recommendations made by Dr Kalf were incorporated in to the modelling during the study. The groundwater study, Appendix K, contains a copy of the peer review report.

16.3.2 Predicted impacts

i Approved water take

The current development consent approves the take of 1,825ML of water per annum from all groundwater sources including both the alluvium and Permian sources. Further refinement of the groundwater model for this proposal predicts a decrease in water take from the approved and proposed areas of impact.

ii Alluvium

Drawdown within the Wollombi Brook alluvium is predicted to be less than 1m at the end of mining (see Figure 16.5). Modelling indicates water leaking through the Wollombi Brook river bed does not buffer drawdown predictions in the alluvium. The maximum water take under the proposal from the Wollombi Brook alluvium (during mining) is conservatively estimated at 124ML/year.

Within the Hunter River alluvium, a narrow area close to Warkworth Mine is predicted to record about 5m drawdown. However, as the Hunter River alluvium thickens to the east and crosses the coal measure outcrop area the drawdown reduces to less than 1m. Maximum take from the Hunter River alluvium during mining is estimated at 68ML/year. This estimated take from the Hunter River alluvium is very conservative due to the modelling methods used for calculations.

Permian strata potential impacts on the alluvium water quality are discussed in Section 16.3.2.vii below.

Drawdown in the Permian coal measures is predicted to be up to 150m in proximity to the Warkworth Mine pits, gradually decreasing to the west towards Wollombi Brook.

The maximum water take for the Warkworth Mine under the proposal from the Permian strata during mining is estimated at 736ML/yr (see Section 16.3.2 vi).

iii Groundwater users

The AIP stipulates that for any bores where the maximum cumulative decline in groundwater levels is predicted to exceed 2m due to mining a make good agreement between the landholder and the applicant should be in place.

The modelling predicts water levels at all privately-owned water supply bores in the alluvium would reduce by less than 2m due to the proposal (see Figure 16.5). The predicted reduction in groundwater levels in these alluvial bores is relatively small compared with the available drawdown in each bore, and is considered unlikely to noticeably reduce the pumping yield from any bore.

Modelling also predicts no drawdown greater than 2m in any privately-owned bores within Permian units.

iv Wollombi Brook base flow

As discussed above, the modelling indicates that current and historical mining has depressurised the Permian strata reducing the rate of flow of groundwater from the Permian to the alluvium. This reduction in groundwater discharge to the Wollombi Brook alluvium reduces the base flow to the Wollombi Brook.

Modelling shows that the majority of the loss in Wollombi Brook base flow is predicted to be in the upper reach above the stream gauge at Bulga and the mid reach to the stream gauge north of Warkworth Mine, with only negligible loss in the lower reach to the confluence with the Hunter River. Base flow reduction from historical and, current operations and proposed mining for Wollombi Brook (all reaches) is predicted to be a maximum of 100ML/year (273m^3/day) at the end of mining in 2035.

Hunter River base flow would not be impacted.

v Groundwater dependent ecosystems

The Hunter Valley Oak Forest and River Red Gum Floodplain Woodland communities are on the eastern bank of Wollombi Brook about 2.5km from the Site and within the alluvial aquifer. These vegetation communities are likely to be extracting groundwater from the shallow alluvial aquifer, which would not be impacted by water table drawdown in this location.

The groundwater model does not predict a significant change in the water table in the Wollombi Brook alluvium or Hunter River alluvium and, therefore, any associated or aquatic and riparian ecosystems would not be impacted by the proposal.

The water table formed at the base of the Warkworth Sands is perched and is not directly connected with the underlying Permian. Further, the Warkworth Sands does not occur as one large sand sheet, but many smaller isolated sheets, separated by areas where sand is not present. In between these sand sheets, clay based bedrock derived soils occur at the surface. The topography of the area also means that these separate sand sheets can be considered different and not interconnected hydrogeologic units. The northern boundary of the proposed 2014 disturbance area largely follows a natural division between the sand sheets (AGE 2011). Groundwater flow in the area to be disturbed by mining is predominantly to the west, whereas groundwater in the sand sheets outside the proposed 2014 disturbance area flows to north. This is shown in Figure 16.6.

Therefore, the proposal is not expected to impact on the Warkworth Sands ephemeral groundwater system or the associated vegetation community outside the proposed 2014 disturbance area. Nevertheless, as previously described in Chapter 2, the proposal includes the commitment to install monitoring bores in the western extent of the shallow sands west of the approved mining activities. These monitoring bores would assist in the monitoring of shallow groundwater of the Warkworth Sands and the WSW during mining activities.

vi Pit inflows

Groundwater inflows to the pit are a combination of leakage through spoil and seepage through the Permian coal measures.

The majority of inflows are from rainfall seepage through the spoils and leakage through the base of the TSFs. These inflows are not groundwater, are not required to be licensed and, therefore, are not discussed further in this section.

Modelling results indicate inflows from the Permian to the pit are initially 566ML/year (1,550m^3/day) in 2015, peaking at 736ML/year (2,014m^3/day) in 2023. Simulated inflow from the Permian decreases after 2020 to 296ML/year (812m^3/day) in 2035. The simulated inflows include water lost through evaporation at the pit face and water that remains bound in coal.

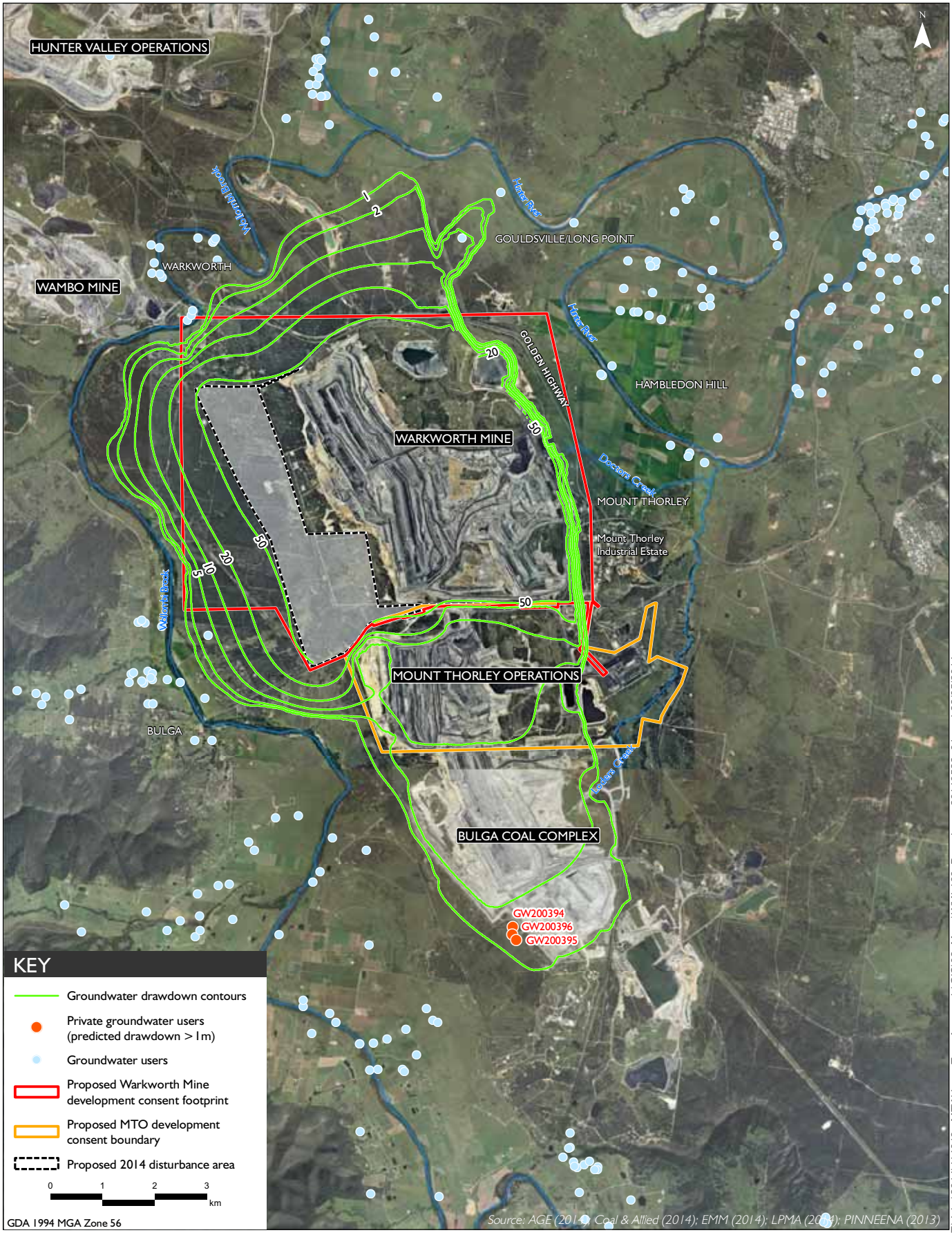
vii Water quality

The AIP requires that any increase of the long-term average salinity in a highly connected surface water source at the nearest point to the activity cannot exceed one per cent. As indicated in 16.3.2.iii, modelling predicted a reduction in Permian groundwater discharge to the Wollombi Brook alluvium as mining progresses. The reduction in saline Permian groundwater discharge to the Wollombi Brook alluvium is predicted to reduce the salinity of the alluvium during the life of the proposal. The reduction in baseflow of more saline groundwater to Wollombi Brook means there is limited potential for surface water salinity to increase in the Wollombi Brook during the life of the proposal and thus the proposed mining complies with the AIP requirement.

viii Post-mining recovery

The final void for the combined North and West Pit void would be approximately 445ha in area and up to 250m to 300m deep. The void would develop to be a local ‘sink’ with groundwater, surface runoff and rainfall inflows slowly filling the void forming a water body. The level of the water body would be, influenced by the balance of groundwater seepage, surface water runoff and infiltration from the rehabilitated landform with losses from evaporation.

As the water body begins to form in the void, the rate of groundwater inflow would slow and eventually a state of equilibrium would occur where inputs are balanced by outputs, the water level in the voids would stabilise and the groundwater levels in the aquifers would begin to recover. The rate of recovery would depend on rainfall, for example, several wet years would reduce the time for groundwater aquifers to recover.



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Groundwater drawdown in the alluvium

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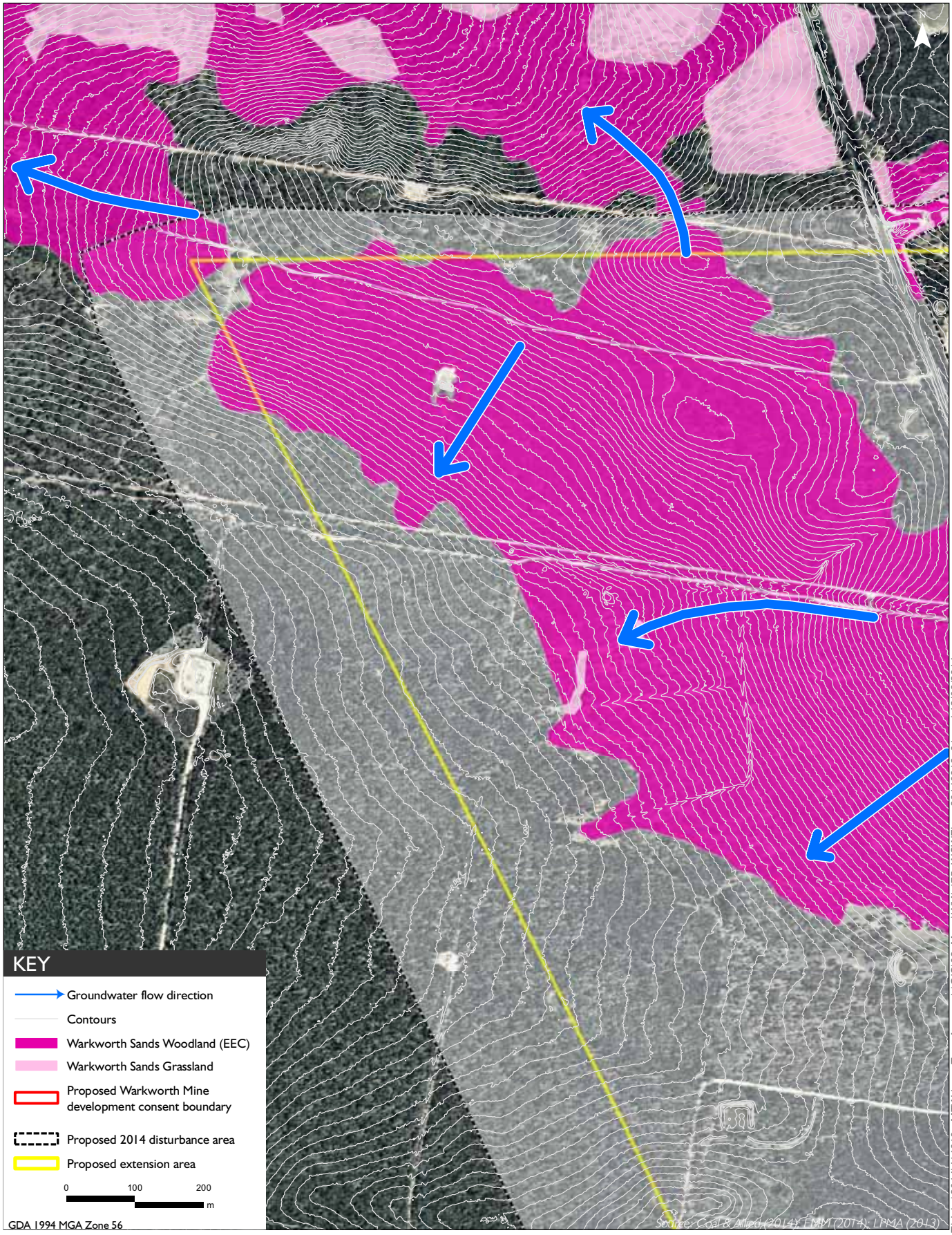
Figure 16.5



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Warkworth Sands Woodland and the proposed 2014 disturbance area

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Figure 16.6

The long-term post closure average inflow from the Permian coal measures to the final voids is predicted to be 496ML/year (1,365m^3/day) with a maximum of 551ML/year (1,507m^3/day). The maximum inflow is predicted to be the worst case long-term inflow from the Permian and is less than the 736ML/year peaks during mining.

Modelling shows the final void would become a sink in the local groundwater environment. Therefore, the salinity of water in the final void is not considered to be a risk to salinity increases in the surrounding aquifer systems.

During the proposal and into the post closure period a recovery can be seen in flow from the Permian to the Wollombi Brook alluvium. This recovery in net flow can be attributed to cessation of mining at MTO and Bulga Coal Complex and increased recharge to spoil.

16.3.3 Aquifer Interference Policy

i Overview

The AIP covers the water licensing and assessment processes for aquifer interference activities within NSW.

The AIP was designed to address the 'incidental' take of groundwater from significant developments (ie mines) which was not accounted for in the Water Act or the WM Act. The AIP ensures that all groundwaters are accounted for, in order for a water sharing plan to be implemented and function effectively. A water sharing plan is used to set out the rules for the sharing of water in a particular water source between water users and the environment and outline rules for the trading of water in a particular water source.

The AIP forms the basis for assessment of aquifer interference activities under the EP&A Act. It clarifies the need to hold water licences under the WM Act and Water Act and establishes whether 'minimal impact' occurs.

The AIP outlines highly productive and less productive groundwater sources, as well as high and minimal impact interference activities. The alluvial aquifers associated with Wollombi Brook and the Hunter River are both potentially highly productive aquifers, while low permeability units and saline groundwater within the Permian coal measures are classed as a less productive groundwater source.

ii Assessment against policy

A full assessment of against the AIP is given in Appendix K, including:

- accounting for, or preventing the take of water;
- determining water predictions in accordance with the AIP; and
- other requirements to be reported in accordance with the AIP.

An overview of the outcomes against the Policy is given below. The proposal is generally consistent with the objectives of the AIP.

The predicted total amount of water (peak) that would be taken from each connected groundwater or surface water source on an annual basis as a result of the proposal during operations and post-mining are detailed in Table 16.2.

Risks to groundwater systems are considered to be negligible and manageable subject to the applicant holding appropriate licences to account for predicted water take.

An uncertainty analysis undertaken of modelling results indicated that the predicted impacts on the alluvium and Permian groundwater units have a relatively high degree of certainty with limited error bands around the predictive results. The uncertainty analysis is fully described in Appendix D of the groundwater study (see Appendix K).

There are no predicted impacts of over 2m on water supply bores in alluvium or Permian. However, predicted draw downs associated with the proposal of over 2m were recorded at three mine-owned bores intersecting the Permian groundwater units.

iii Water licensing

As described in Section 16.2.8, water licensing to account for take from the proposal is required under the Water Act and WSPHUAWS. Table 16.2 summarises the predicted water take from these water sources due to the proposal, and water licenses held by the applicant for these sources and the WSPHRRWS.

Table 16.2 Predicted take

Water source	Approved 2003 water take[2]	Share component required for proposal (units)		Share component held by applicant (units)	Total share component in system (units)	Licenses held by applicant
		Peak during mining (ML/Year)	Peak post-mining (ML/Year)			
Water Act 1912	-	736	551	750	Note 3	20BL170012
Wollombi Brook Alluvium (WSPHUAWS)	-	124	<124	Nil	5,071	Nil
Hunter River Alluvium (WSPHUAWS)	-	68	<68	Nil (CN 1012 ML WAL10543)	Source 1: 8,714 Source 2: 20,341	Nil
Wollombi Brook (WSPHUAWS)	-	Nil[1]	Nil[1]	50	6,663	WAL 18558
All water sources	**1,825**	**928**	**<743**	**800**	**40,789**	**-**

Notes: *1. Accounted for in predicted take from Wollombi Brook.*

2. Mackie Environmental Research (2002).

3. WML is currently in discussions with NOW regarding the disaggregation of this licence.

As shown in Table 16.2, licenses are required to account for up to 124ML/year during mining and less than 124ML/year post-mining from the Wollombi Brook alluvium and up to 68ML/year, and less than 68ML/year post-mining from the Hunter River alluvium.

A reduction in baseflow into the Wollombi Brook is predicted to reach up to 100ML/year at the end of mining. However, this is already accounted for by the take from the Wollombi Brook alluvium, and therefore no additional licensing is required for the Wollombi Brook.

There are no predicted impacts on base flow for the Hunter River.

It is the applicant's responsibility to ensure that the necessary licences are held with sufficient share component and water allocation to account for all water taken from a groundwater or surface water source as a result of an aquifer interference activity, both for the life of the activity and after the activity has ceased.

As required by the AIP, sufficient water licences would be held by the applicant to account for any water take during mining. Additional modelling may be undertaken improve the model in areas where clarification may be required. Should the modelling results alter the predicted take then the licencing requirements would also be adjusted.

If required upon mine closure, licences held for water take would be surrendered in perpetuity. Accordingly, there would be no net loss and no effect on water security.

16.4 Management and monitoring

Groundwater at MTW is currently managed in accordance with the MTW WMP, prepared in consultation with NOW and the EPA. The MTW WMP was developed in accordance with industry best practice with consideration given to the full available range of reasonable and feasible mitigation and their effectiveness, inclusive of contingency plans to manage any residual risks, for implementation at the Site.

The MTW WMP is available on Rio Tinto Coal Australia's website:

(http://www.riotintocoalaustralia.com.au/documents/MTW_Water_Management_Plan_(Approved_31Jan2013).pdf).

While many of these procedures are already undertaken in accordance with the protocols outlined in the approved WMP, management and monitoring measures that would be implemented under the proposal are presented below.

16.4.1 Updates to current groundwater monitoring programme

Groundwater management is currently undertaken based on the existing MTW groundwater monitoring programme, which is included in the WMP. The WMP includes scheduled monitoring of 30 groundwater monitoring bores within and around MTW. Review of the MTW groundwater database indicates that groundwater level data is currently collected at 50 monitoring locations.

The groundwater monitoring programme details that the monitoring bores would be monitored for field parameters of pH, EC and water level on a quarterly basis, and a comprehensive water quality analysis conducted annually. Review of the MTW groundwater database indicates that the groundwater samples are being collected on an annual basis for all bores.

The following updates would be undertaken to the existing monitoring programme, to assist ongoing assessment and quantification of any potential surface water and groundwater impacts:

- installation of nested monitoring bores along the Wollombi Brook (PZ10, PZ11, PZ12); and
- installation of monitors bores with the Warkworth Sands system as part of an update to the existing Warkworth Sands Ephemeral Perched Aquifer Management Plan within the MTW WMP.

Yearly audits of the performance of the monitoring network would also be included as part of the annual groundwater review, and optimisation of the monitoring sites and frequency would be undertaken where required.

16.4.2 Mine water seepage monitoring

Monitoring of in-pit mine water seepage would be undertaken to identify seepage rates and water quality.

The seepage monitoring programme would include:

- recording of the time, location and estimated volume of any unexpected increased groundwater outflow from the highwall and endwall;
- measurement of water pumped from the void, preferably using flow meters or other suitable gauging apparatus;
- correlation of rainfall records with mine seepage records so groundwater and surface water can be separated; and
- monitoring of coal moisture content.

16.4.3 Trigger values

Trigger values provide a quantifiable measure for identifying adverse changes in groundwater levels and quality, including those to GDEs.

The MTW WMP specifies trigger values for important parameters such as pH, EC and TSS. In the absence of licence or applicable ANZECC (2000) criteria, the approach to trigger level monitoring and reporting would continue under the proposal (ie water quality trigger levels would be based on the 95th and 5th percentile of baseline data and compared to monitoring results on a monthly basis).

A site-specific investigation into trigger level exceedance would be undertaken if:

- professional judgement determines that the single deviation or a developing trend could result in environmental harm; or
- three consecutive measurements exceed trigger values.

16.4.4 Data management and reporting

Data management and reporting would include:

- establishment of trigger levels;
- quarterly review of groundwater levels and field water quality against trigger levels, with site-specific investigations initiated, as detailed in Section 16.4.2;
- annual reporting (including all water level and water quality data); and
- all groundwater data being stored in a database customised for MTW with suitable QA/QC controls.

16.4.5 Future model iterations

Every three years the validity of the model predictions would be assessed. If substantial differences (previously unrecognised information) to those interpreted are identified, the validity data would be incorporated into the model and revised predictions made and reported.

16.5 Conclusions

As a result of the long history of mining at Warkworth Mine and associated groundwater monitoring, the groundwater systems within and surrounding the Site are well understood.

The main water bearing units are the Permian strata and the Wollombi Brook and Hunter River alluvium. Groundwater levels within the Permian strata are highly influenced by existing mining and flow towards the active pits. Groundwater within the Wollombi Brook alluvium appears to be relatively unaffected by current mining.

A detailed assessment of the proposal was completed using a calibrated groundwater model. The groundwater modelling was independently peer reviewed with outcomes reflected in the groundwater study. Results of the numerical groundwater model indicate risks to groundwater systems are considered to be negligible and manageable subject to the obtainment of the necessary water entitlements.

The proposal is generally consistent with the objectives of the AIP.

Groundwater would continue to be managed under the existing groundwater management system and in accordance with the MTW WMP. A number of management and monitoring measures specific to the proposal would be implemented and incorporated into the MTW WMP.

Chapter 17

Surface water

Chapter 17 — Surface water

17 Surface water

17.1 Introduction

This chapter provides a summary of the surface water study for the proposal prepared by WRM Water and Environment Pty Ltd (WRM), which is presented in full in Appendix L.

The chapter describes the existing surface water environment, including water management at Warkworth Mine, and presents potential impacts from the proposal. It includes a site water balance and management and monitoring measures that would be implemented to prevent or minimise adverse impacts.

The water management systems at Warkworth Mine and MTO are integrated and referred to in this chapter as the MTW WMS. The surface water study has been prepared based on the combined impacts of the proposal and the Mount Thorley Operations 2014. Unless a discussion on MTO is required to understand the management processes, the studies relevant to Warkworth Mine have been the focus of this chapter.

17.2 Existing environment

17.2.1 Rainfall and evaporation

Rainfall and evaporation data were taken from BoM rainfall stations at Bulga (Down Town) and Jerrys Plains. A synthetic rainfall dataset was also obtained for the Site using the Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA) Data Drill rainfall.

The mean annual rainfall over the long-term (1884 to 2013) at the Jerrys Plains BoM station is 645mm. The mean annual rainfall over the coincident period (1960 to 2013) is 668mm and 695mm at Jerrys Plains and Bulga, respectively. This indicates that rainfalls are around 4 per cent higher at Bulga than Jerrys Plains. The annual average rainfall from Data Drill is 658mm for the period 1889 to 2012 and 650mm for the period 1960 to 2012.

The mean annual pan evaporation at Jerrys Plains for the period 1957 to 1972 was 1,641mm. The mean annual lake evaporation from Data Drill for the period 1889 to 2012 was 1,390mm. This indicates that annual average lake evaporation is more than double the annual average rainfall for the Site.

17.2.2 Regional drainage network

The Site is on the southern side of the Hunter River, and the eastern side of Wollombi Brook.

The Hunter River has a catchment area of approximately 16,400km^2 to Singleton and includes the Glennies Creek Dam and Glenbawn Dam upstream of the Site. The combined catchment area of these dams is about 9 per cent of the Hunter River catchment to Singleton (ie about 1,533km^2).

17.2.3 Local drainage network

Wollombi Brook drains in a north-easterly direction and joins the Hunter River approximately 3.5km north of the Site. Natural landforms surrounding the Site slope inwards towards the active mining areas, however in the proposed extension area the natural landform generally slopes westwards towards Wollombi Brook. Clean water diversions have been constructed to divert clean water away from the active pits. The catchment areas and the diversion structures are progressively changing with the westward advancing highwall.

Other drainage lines in the Site mostly drain westward or north-westward to Wollombi Brook. All are ephemeral and first or second order watercourses. No major tributaries are within the Site. The local drainage network is shown in Figure 17.1. Doctors Creek to the east is utilised by Warkworth Mine as a discharge location under the Site's EPL. This is further discussed in Section 17.2.5.ii(b).

There are no surface water bodies in the disturbance area of the proposal.

17.2.4 Streamflow

Streamflow data used in the study was obtained from three NOW stream gauging stations in the vicinity of the Site, comprising:

- Station No. 210001 – Hunter River at Singleton (approximately 28km downstream of Wollombi Brook confluence). The catchment area of the river to the gauge is approximately 16,400km^2;
- Station No. 210004 – Wollombi Brook at Warkworth (approximately 7km upstream of the Hunter River confluence). The catchment area of the brook to the gauge is approximately 1,848km^2; and
- Station No. 210028 – Wollombi Brook at Bulga (20km upstream of the Hunter River confluence). The catchment area of the brook to the gauge is approximately 1,672km^2.

The locations of these, and other NOW stations referenced in this chapter, are shown in Figure 17.1. Recorded flow information from these stations is discussed below.

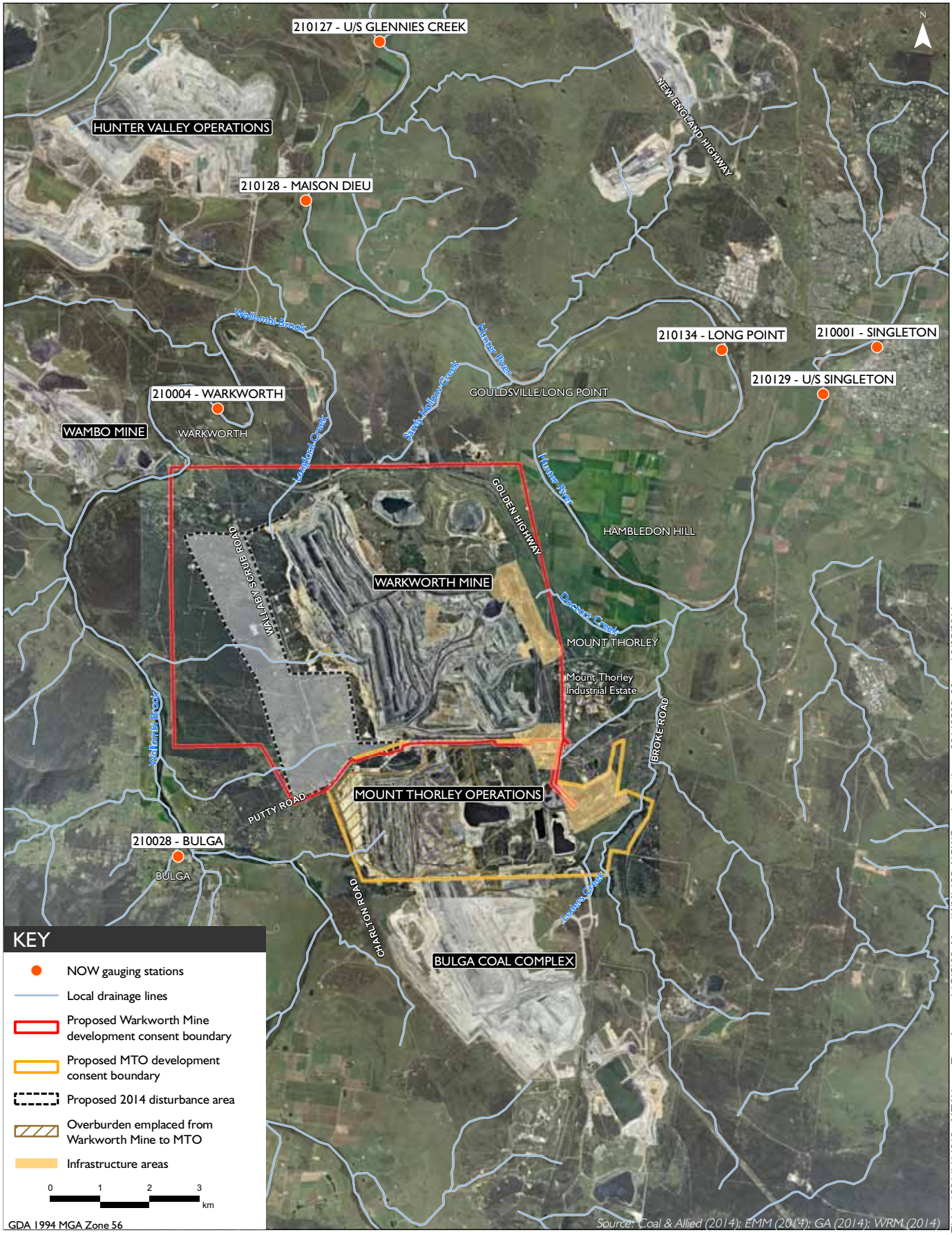
i Hunter River

The data from Station No. 210001 indicates that, under current catchment conditions, the Hunter River is perennial with a minimum flow rate of 10ML/day. The median flow rate is about 300ML/day and the flow rate is greater than 100ML/day for 95 per cent of the time. The data also indicates that the raising of Glenbawn Dam in 1988 has increased the frequency of low flows and moderately reduced the frequency of high flows.

ii Wollombi Brook

The data from Stations No. 210004 and No. 210028 indicates the Wollombi Brook is ephemeral, with a flow rate of 2ML/day at Warkworth and 0.2ML/day at Bulga for 80 per cent of the time. The median flow rate is about 40ML/day at Warkworth and 30ML/day at Bulga. The data also indicates that, during flood events, water levels at Warkworth may be affected by backwater from the Hunter River.

An analysis of annual runoff versus rainfall for Wollombi Brook at Station No. 210028 found that there is very little runoff when annual rainfall is less than 400mm. However, when annual rainfall exceeds this value, the volume of surface runoff increases substantially. There are no large water storages on Wollombi Brook.



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Local drainage network and NOW stream gauging locations

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Figure 17.1

An analysis of flow data at Stations No. 210004 and No. 210028 indicates that a loss of flow (potentially in the order of 10 to 50ML per month) is sometimes observed along the reach of Wollombi Brook adjacent to the Site, despite an additional catchment area of 176km^2 between the two stations. Given the significant surface and groundwater entitlements in the area, some loss of flow along this reach is not unexpected. However, due to the large number of potential locations for extraction of flow, it was not possible to accurately determine where the flow loss is occurring.

17.2.5 Surface water quality

i NSW Office of Water monitoring

Hunter River water quality data has been collected by NOW since the 1970s, including from the Hunter River (Station No. 210001) and Wollombi Brook (Station No. 210004). Additionally, EC has been monitored continuously from Wollombi Brook since 1992 and from the Hunter River upstream of Singleton (Station No. 210129) since 1993.

The Australia and New Zealand Environment Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand have prepared a guideline for water quality management for use throughout Australia and New Zealand based on the philosophy of ecological sustainable development. These guidelines are referred to as the ANZECC (2000) water quality guidelines.

The NOW water quality data at Stations No. 210001, No. 210004 and No. 210129 were compared against the ANZECC (2000) water quality guidelines for different environmental values of receiving waters including aquatic ecosystem protection, irrigation water supply, livestock water supply and recreation. A summary of results for the Hunter River and Wollombi Brook is provided in Table 17.1. The comparison shows water quality in the Hunter River generally meets the ANZECC water quality guidelines for ecosystem protection while water quality in Wollombi Brook generally meets the ANZECC water quality guidelines for irrigation.

Table 17.1 Comparison against ANZECC (2000) water quality guidelines

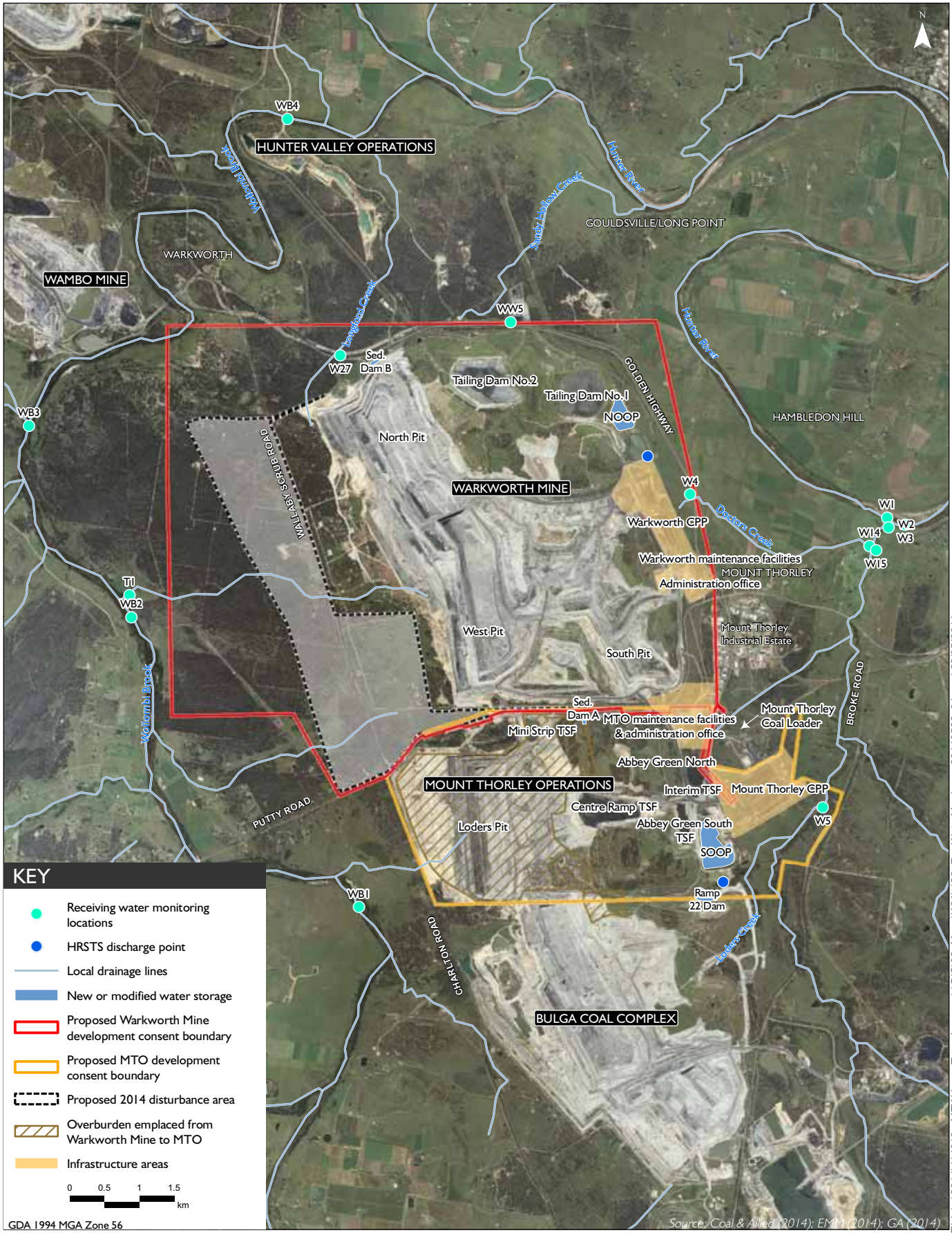
Hunter River[1]	Wollombi Brook[2]
Moderately alkaline, with a median pH of 8.24.	Slightly alkaline, with a median pH of 7.56.
Fresh, with a median EC of 621µS/cm.	Fresh, with a median EC of 595µS/cm.
Has a median value greater than the ANZECC guideline trigger value for pH (ecosystem protection), total nitrogen (ecosystem protection) and total phosphorus (ecosystem protection).	Has a median value greater than the ANZECC guideline trigger values for chloride (irrigation) and sodium (irrigation).
Has a median value lower than the ANZECC guideline trigger value for all other monitored parameters.	Has a median value lower than the ANZECC guideline trigger value for all other monitored parameters.

Notes: 1. Based on NOW water quality data from Station No. 210001 and Station No. 210129.

2. Based on NOW water quality data from Station No. 210004.

ii Coal & Allied monitoring

Coal & Allied undertakes surface water quality monitoring of receiving waters and site dams at the locations shown in Figure 17.2. A summary of the monitoring results for receiving waters and site dams is provided in the subsequent sections.



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Coal & Allied surface water quality monitoring locations

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Figure 17.2

a. Site dams

The primary saline water storages in the existing MTW WMS (ie Dam 6S, Dam 1N and Dam 9S) are routinely monitored for EC, pH and turbidity. Additionally, a comprehensive analysis of water quality in a number of saline and sediment dams is undertaken on a quarterly basis.

Review of Coal & Allied's water quality monitoring results for the site dams indicates that:

- Dams 1N, 6S and 9S are characterised as brackish and strongly alkaline, with median ECs of approximately 7,000µS/cm and median pH values of 8.7 to 9.0; and
- water quality of sediment dams varies considerably in salinity from fresh to brackish, with median ECs of between 300µS/cm and 8,400µS/cm, and in pH from moderately alkaline to very strongly alkaline, with median pH values between 7.9 and 9.8.

b. Receiving waters

Controlled discharges from Dam 1N and Dam 9S are directed to Doctors Creek (for Warkworth Mine) and Loders Creek (for MTO) respectively, which are tributaries of the Hunter River. These discharges are regulated by conditions contained in Warkworth Mine's EPL and the HRSTS. Runoff from undisturbed areas and small areas of disturbed catchment is treated via sediment dams onsite. Overflows from these sediment dams discharge to Wollombi Brook and Longford Creek (a tributary of Wollombi Brook), as well as Sandy Hollow Creek, Loders Creek and Doctors Creek.

Review of the Coal & Allied water quality monitoring results for Warkworth Mine receiving waters indicates that:

- Hunter River upstream of the Loders Creek confluence has a median EC of 645µS/cm and a median pH of 8.0;
- Hunter River downstream of the Loders Creek confluence has a median EC of 630µS/cm and a median pH of 8.1;
- Loders Creek has a median EC of 4,200µS/cm and a median pH of 8.1;
- Longford Creek has a median EC of 288µS/cm and a median pH of 7.4;
- Sandy Hollow Creek has a median EC of 270µS/cm and a median pH of 7.7; and
- Wollombi Brook north of Bulga village has a median EC of 680µS/cm and a median pH of 7.5.

It is difficult to determine the Doctors Creek catchment runoff water quality characteristics, as the water quality monitoring results are potentially impacted by controlled discharges under the HRSTS. The water quality monitoring results indicate a median EC of 4,695µS/cm and a median pH of 8.2.

Water quality monitoring results for Loders Creek are influenced by controlled discharges under the HRSTS. Pre-mining water quality data (BHP Ltd, 1980) at Loders Creek indicated ECs varying between 2,000 µS/cm and 14,200µS/cm, with an average of 7,100µS/cm. The salinity was attributed to seepage from the Saltwater Creek coal measures which subcrop in areas of Loders Creek (MER, 2013).

iii Analysis of water quality

An analysis of data for EC and TSS as measured in the Hunter River from both NOW and Coal & Allied monitoring locations indicates a slight decrease in EC downstream of the Loders Creek confluence. Additionally, the median EC downstream of Loders Creek is lower than upstream of Glennies Creek, indicating the controlled releases from the existing MTW WMS do not appear to be adversely affecting salinity in the Hunter River. The TSS levels increase slightly across the Loders Creek confluence.

17.2.6 Existing water management system

The MTW WMS is a network of infrastructure (ie dams, pipelines and contour drains) which controls the movement of water around MTW and prevents the unscheduled release of water offsite. Water is managed according to its type which is determined by catchment area, quality and use. The main types of water managed in the study area include mine water, sediment water and clean water.

The main elements of the existing MTW WMS and a schematic diagram of the conceptual configuration are presented in Figures 2.8 and 2.9 of Appendix L. The existing MTW WMS is described in detail in the MTW WMP.

17.3 Site water balance

17.3.1 Methodology

The computer based OPSIM model was used to simulate the site water balance for the proposal. The model simulates the operation of all major components of the proposed MTW WMS, including:

- climatic variability – rainfall and evaporation;
- catchment runoff;
- controlled discharges (under the HRSTS) and uncontrolled overflows;
- groundwater inflows; and
- site water usage (CPP, haul road dust suppression and stockpile dust suppression, vehicle wash).

The simulation method used and water balance model calibration is fully described in the surface water study in Appendix L.

17.3.2 Proposed water management system

The proposed MTW WMS has been developed in conjunction with the mine planning and operational teams to develop a surface water management system that has minimal impacts on surface water resources. The proposed MTW WMS is a continuation of the current system described above in Section 17.2.6.

i Proposed mine water storages

The proposal includes a number of new or modified storages are proposed at Warkworth Mine as described below.

- NOOP Dam: saline water storage directly to the north of Dam 1N at Warkworth Mine. The NOOP Dam has a proposed capacity of 740ML.

- Sediment Dam B: sediment dam location at Warkworth Mine to capture runoff from future spoil and rehabilitation areas. The exact location is yet to be confirmed.

It is noted that the Mount Thorley Operations 2014 proposal also seeks approval for a minor upgrade to an existing mine water storage, as well as new minor storages associated with sediment and erosion control. These have been included here for information purposes only as the MTW WMP transfers water between the two sites as needed. The locations of these storages can be seen in Figure 17.2. The proposed upgrades to the MTO water storages comprise:

- SOOP Dam: primary water storage for MTO, also referred to as Dam 6S. Increase in the storage capacity to 2.2GL within the same footprint.

- Ramp 22 Dam: sediment dam situated at the current Dam 10S and Dam 11S location at MTO. Joint sediment dam with Bulga Coal Complex to the south. Runoff from both MTW and Bulga would be directed to this dam; and

- Sediment Dam A: sediment dam at MTO to capture runoff from future spoil and rehabilitated areas. The exact location is yet to be confirmed.

ii Layout and operation

The changes to the approved mining operations would result in a number of potential changes to the MTW WMS layout. These changes are described below for each of the mine stages used in the assessment.

- Indicative Year 3 mine plan: tailings are directed to both the CRTSF and AGS. Construction of the NOOP Dam is complete. Construction of Ramp 22 Dam is complete, replacing Dam 10S and 11S. Dam 32N (Tailings Dam No.1) has been capped and rehabilitated. Dam 6N and Dam 12S have been mined out.

- Indicative Year 9 mine plan: tailings are directed to the CRTSF and AGN TSF. Mining has been completed in Loders Pit, which has been partially backfilled. Mini-strip TSF has been rehabilitated. Sediment Dam A has been constructed. The AGS is covered and rehabilitated.

- Indicative Year 14 mine plan: tailings are directed to the partially backfilled Loders Pit. The CRTSF has been capped and rehabilitated. Sediment Dam B has been constructed. The AGN is covered and rehabilitated.

- Indicative Year 21 mine plan: no changes to the MTW WMS layout. Considerable areas of MTW have now been rehabilitated.

A schematic of the existing MTW WMS, with proposed changes highlighted, is shown in Figure 17.3. The proposed changes to the MTW WMS have been designed to avoid discharge (for example, an uncontrolled release) and to minimise environmental impacts when discharge (for example, under the rules of the HRSTS) is necessary. Further detail on the proposed changes to the MTW WMS and the proposed operating rules used in the model are detailed in Appendix L.

iii Groundwater inflows, catchments, and water quality

The groundwater inflow rates to MTW were predicted in the groundwater study (see Appendix K). No Permian groundwater inflows to Warkworth Mine are predicted for the life of the proposal, consistent with the existing operations which have very little groundwater inflow. This is due to the minor seepage rate, evaporative losses from the pit face and moisture retained in extracted ROM coal.

The catchment areas used in the site water balance reflected the proposed changes to the mining operations and were separated by land use types. Coal & Allied water quality monitoring data was then used to determine salinity generation rates for each land use type.

iv Water demands

A summary of the water demands over the life of the proposal is presented in Table 17.2.

Table 17.2 Water demand summary (ML/year)

Demand	2014	2017	2023	2028	2035
CPP gross (net)[1]	6,591 (2,466)	7,168 (2,731)	7,168 (2,731)	7,168 (2,731)	7,168 (2,731)
Haul road dust suppression[2]	1,623	1,510	1,423	1,144	1,107
Misc. industrial use and vehicle washdown – gross (net)[1]	135 (126)	146 (136)	146 (136)	146 (136)	146 (136)
Total – gross (net) [1]	**8,349 (4,215)**	**8,824 (4,377)**	**8,737 (4,290)**	**8,458 (4,011)**	**8,421 (3,974)**

Notes *1. Net rates include return.*

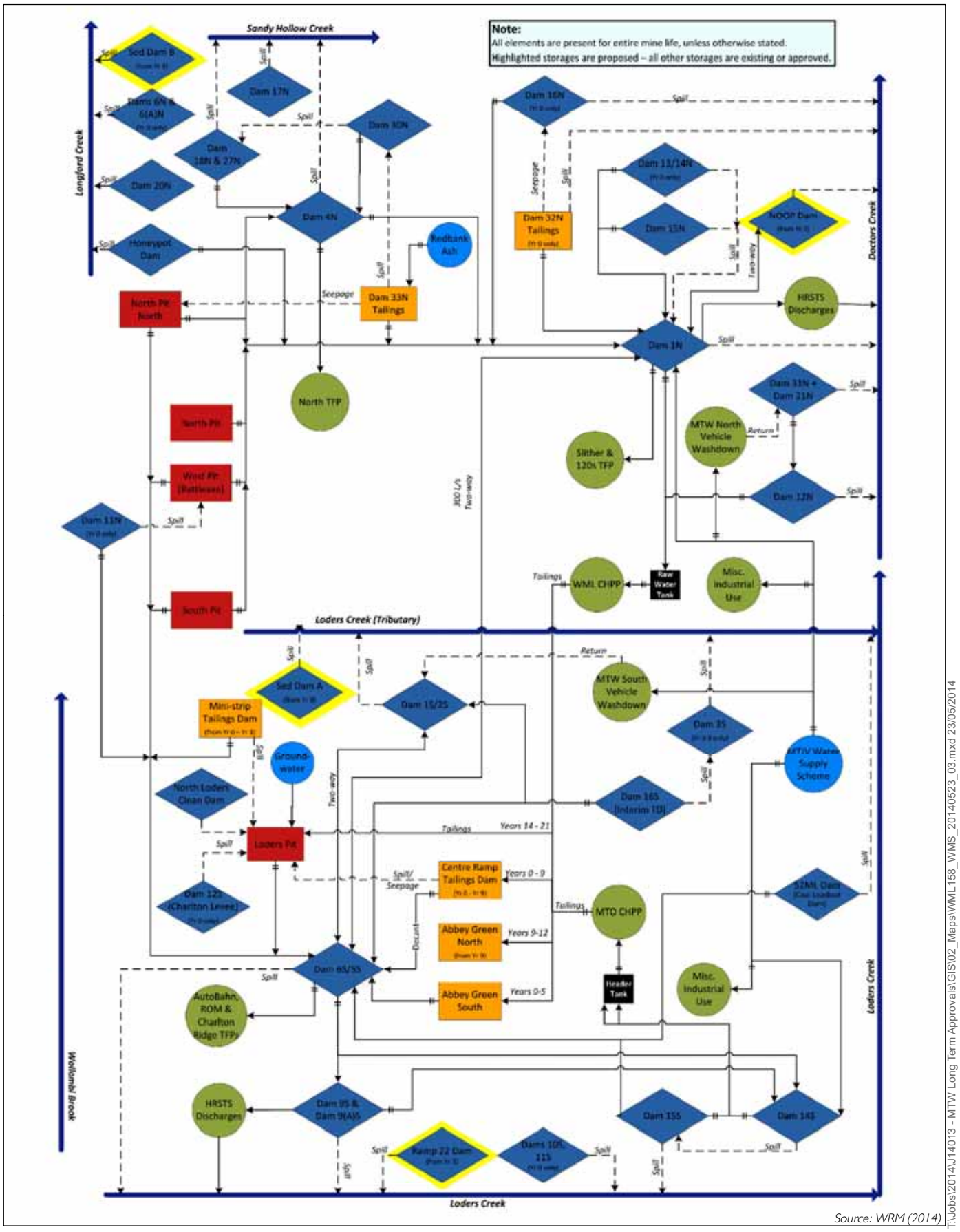
2. Long-term average (dependent on rainfall), based on haul road lengths of 92.6km, 87.2km, 70.1km and 68.1km for 2017, 2023, 2028 and 2035 year indicative mine plans, respectively.

v Proposed sediment dams

Conceptual sediment dam locations have been proposed based on the indicative mine plans and are shown in Figures 6.4 to 6.11 in Appendix L. The locations and sizes of the sediment dams are conceptual for inclusion in the water balance modelling and would be refined and confirmed through detailed design and incorporated into the MTW WMP.

Sizing of the proposed sediment basins has been undertaken in accordance with the Blue Book (DECC 2008) requirements for Type D basins in consideration of the following parameters:

- Sediment Dam A – catchment area of 238ha with a five day management period volume of 105ML; and
- Sediment Dam B – catchment area of 102ha with a five day management period volume of 45ML.



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Proposed water management system
Warkworth Continuation 2014
Environmental Impact Statement
Figure 17.3

vi Hunter River Salinity Trading Scheme

The Warkworth Mine currently has approval to discharge under the rules of the HRSTS. The proposal's modelling rules for HRSTS discharges were based on Hunter River stream flow and salinity, and discharge dam volumes and salinity. Historically, there have been sufficient credits available for trade and, therefore, it was assumed that the number of salt credits held by MTW is not a limitation to releases.

17.3.3 Summary of water balance results

Water balance results have been analysed in two ways:

- by mine stage – the results for each climatic realisation are averaged over the duration of each mine stage (summarised in Section 17.3.3i); and
- annual statistical results - a statistical analysis is performed on an annual basis and reported as a percentile (summarised in Section 17.3.3ii).

i Overall site water balance by mine stage

A summary of the MTW water balance, averaged over each stage of the modelled mine life, is provided in Table 17.3.

Table 17.3 MTW water balance results summary

Process (Modelled stage duration)	Volume (ML/year)				
	Year 0 (2 years)	Year 3 (4 years)	Year 9 (7 years)	Year 14 (5 years)	Year 21 (4 years)
Inflows					
Rainfall runoff	3,524	3,846	4,111	4,210	4,278
Groundwater	187	10	0	0	0
External raw water requirements	1,251	1,807	1,720	1,519	1,803
ROM moisture	877	978	978	978	978
Redbank power station	25	25	25	25	25
Total inflows	**5,873**	**6,665**	**6,833**	**7,016**	**7,084**
Outflows					
Evaporation	495	656	751	607	817
Fine tailings moisture retention	1,774	1,965	1,965	1,965	1,965
Haul road dust suppression[1]	1,627	1,511	1,420	1,138	1,108
Misc. industrial demand and vehicle wash	126	136	136	136	136
Product coal moisture	1,008	1,110	1,110	1,110	1,110
Coarse rejects moisture	572	633	633	633	633
HRSTS discharges	561	453	548	369	366
Offsite sediment dam releases	91	214	240	316	315
Offsite saline dam releases	0	0	0	0	0
Total outflows	**6,253**	**6,679**	**6,803**	**6,274**	**6,450**
Change in site water inventory	***-380***	***-14***	***+30***	***+742***	***+634***

Note: Haul road dust suppression requirements reduce over time as rehabilitation progresses following mining (particularly at MTO).

ii Annual statistical results

In interpreting the results of the water balance study, it should be noted that the results provide a statistical analysis of the performance of the MTW WMS over the 21 years of mine life, based on a number of realisations with different climatic sequences. The 50th percentile probability represents the median results, the 10th percentile represent 10 per cent exceedance and the 90th percentile results represent 90 per cent exceedance. There is an 80 per cent chance that the result would fall within the 10th and 90th percentiles and a 98 per cent chance the result would fall between the 1st and 99th percentiles. The results show the percentile chance of a particular value on each day, and do not represent continuous results from a single model realisation; for example, the 50th percentile trace does not represent the model time series for median climatic conditions.

The results of the water balance modelling show that external water may be required to meet all site demands. Total external water requirements are characterised as:

- a minimum of 140ML/year of external raw water from the Hunter River would be required for the life of the proposal. This is consistent with site demands of industrial use and vehicle wash of around 140ML/year which are supplied from raw water sources only;
- there is a 90 per cent chance that at least 450ML of external water would be required in any year of project life;
- a step change in external raw water requirement occurs in around Year 2 which is consistent with the modelled decrease in pit inflows at MTO and an increase in production at Warkworth Mine. From Year 3 onwards the external water requirements are generally consistent with:
    - a 50 per cent chance that between 1,500 to 2,000ML/year of external water would be required; and
    - a 10 per cent chance that between 3,000 to 3,700ML/year of external water would be required.

The current MTJV allocation is 1,012ML/year (at 100 per cent Available Water Determination (AWD)).

The results of the water balance modelling indicate a low probability of pit inundation, and no offsite uncontrolled release (overflows) from saline storages.

Discharges under the HRSTS would continue to be required for site water management, with the following discharge characteristics:

- overall, much greater volumes are discharged from MTO than Warkworth Mine, which is consistent with the capacity of the discharges structures and dam volumes;
- there is a 50 per cent chance that small volumes of controlled discharges (100ML) would be required from Warkworth Mine in any year of the proposal life; and
- there is a 10 per cent chance of controlled releases of around 400ML from Warkworth Mine would be required in any year of the proposal life.

The model results presented above represent the application of the adopted MTW WMS rules over the mine life, regardless of climatic conditions. In reality, there are numerous options for adaptive management of the proposed MTW WMS to accommodate climatic conditions. For example, temporary adjustments to pumping arrangements could be made to accommodate very wet or dry periods. These alternative management approaches would be used to reduce the risks to the operations associated with climatic variability.

17.4 Impact assessment

17.4.1 Mine site water requirements

Likely mine site water requirements were determined from the water balance modelling as described above. A significant proportion of mine site water requirements would be sourced from water collected onsite, including rainfall runoff and groundwater inflows to the open cut pits (ie Year 0 and Year 3), which would be transferred to the MTW WMS for recycling.

Possible sources of additional water for the proposal, which would be negotiated on an as-needed basis when mutually beneficial, include the following:

- water sharing with Hunter Valley Operations, with this strategy successfully adopted in the past;
- water sharing with Bulga Coal Complex; and
- water sharing with Wambo Mine.

If required, additional water licences would be sought and purchased by Coal & Allied over the life of the proposal to meet external raw water demands. As all offsite water supplies for the proposal would be obtained from licensed sources, there would be no adverse impact on other licensed users who would still have access to their entitlement (subject to climatic conditions and the operation of the water supply scheme).

17.4.2 Loss of catchment

During active mining operations, the MTW WMS would capture runoff from areas that would have previously flowed to Wollombi Brook or the Hunter River.

The maximum total catchment area captured within the MTW WMS during the proposal is 10.5km^2 or 0.56 per cent of the Wollombi Brook catchment to the confluence of the Hunter River. Following completion of progressive rehabilitation, the Hunter River catchment area (excluding the Wollombi Brook catchment) influenced by the combined proposal and Mount Thorley Operations 2014 would be restored to 99.96 per cent of its pre-mining area. The final landform would capture 8.6km^2 or 0.44 per cent of the Wollombi Brook catchment to the confluence of the Hunter River.

17.4.3 Surface water quality

The results of the water balance modelling indicate that, under the current model assumptions and configuration, no uncontrolled release of saline water would occur over the life of the proposal. Excess saline water would continue to be released in accordance with the existing rules of the HRSTS. There would be no downstream impacts on surface water quality as salinity would be in accordance with the acceptable limits under the HRSTS discussed in Section 17.4.5. Given that discharges to Doctors Creek under the rules of the HRSTS are currently approved to be undertaken by the Site and would continue under the proposal, no tributary impact assessment was considered necessary.

Potential impacts on surface water quality in the receiving waters would be managed through compliance with HRSTS discharge limits and implementation of the management measures described in Section 17.5.1.

17.4.4 Uncontrolled offsite releases

The results of the water balance modelling indicate that, under the current model assumptions and configuration, there is a low risk of the proposed MTW WMS accumulating water over the 21 year life of the proposal. The results show that the system recovers well after each wet season.

Overflows of water from sediment dams would occur during wet periods that exceed the design standard of the sediment control system (as per the design intent). Monitoring water quality in sediment dams would continue, as described in Section 17.2.5.ii.

17.4.5 Controlled releases under the Hunter River Salinity Trading Scheme

Controlled releases of saline water under the HRSTS may have the following impacts:

- impacts on the total flow volume in the Hunter River;
- impacts on stream condition, including bank erosion; and
- water quality impacts.

These potential impacts are discussed in the following sections.

i Hunter River flow volumes

Table 17.4 shows the net impact of the MTW WMS on Hunter River flow volumes over the life of the proposal. The results show that the median annual reduction in flows to the Hunter River varies between 16 and 75ML/year during the life of the proposal. Post-mining the median annual reduction is 104ML/year (approximately 0.02 per cent of the median annual Hunter River discharge to Singleton) due to a reduction in catchment areas and cessation of discharges and sediment dam overflows.

Table 17.4 Impact of water management system on flow volumes

Mine stage	Median runoff captured (ML/year)	Median discharge to Hunter River (ML/year)	Median sedimentation dam overflows (offsite)	Median net runoff reduction (ML/year)
Year 0 (existing)	225	181	25	19
Year 3	215	81	118	16
Year 9	231	40	116	75
Year 14	246	66	151	29
Year 21	243	48	154	41
Post-mining	104	0	0	104

An analysis of the impact of MTW HRSTS discharges on the Hunter River flow was undertaken based on simulated flow in the Hunter River over the life of the proposal. The results showed that the impacts of HRSTS discharges on the Hunter River flow characteristics are negligible during both wet periods and dry periods.

ii Stream condition

The proposed flow rate of the controlled discharge would be less than 300ML/day (3,500L/s) from Dam 9S to Loders Creek (increased rate of discharge from current approval), and less than 100ML/day (1,160L/s) from Dam 1N to Doctors Creek (no change to approved rate of discharge). It is possible that controlled discharges may occur at times when there is no natural flow in Doctors Creek. It is noted that current MTW operations have discharged flows of this magnitude to Doctors Creek in the past when required and it is not expected that discharges under the proposal would have an additional impact on the stream condition of Doctors Creek to that already experienced under the current operations.

As specified under the rules of the HRSTS, controlled discharges may only occur when the 'high' or 'flood' flow block is passing MTW. Therefore, controlled releases from the proposal would only occur when the Hunter River is in an increased state of flow (at least 2,000ML/day). Based on the comparatively low controlled discharge rate, it is not expected that controlled discharges would result in adverse hydraulic impacts on the Hunter River, such as increased bed and bank erosion.

iii Water quality

Discharges under the HRSTS are controlled so that the salt concentration in the Hunter River Lower Sector (downstream of Glennies Creek confluence) does not exceed 900µS/cm. An important component of meeting the salinity goal is to discharge the salt load evenly throughout the discharge period to avoid short periods of elevated salinity in the Hunter River.

Controlled discharges under the proposal would continue to be released in accordance with HRSTS and EPL 1376 and EPL 1976 requirements for Warkworth Mine and MTO, respectively.

A comparison was undertaken of the Coal & Allied and NOW water quality monitoring data in the Hunter River in the vicinity of MTW, with the ANZECC (2000) water guideline trigger values and site water quality monitoring at the discharge dams. The comparison showed that discharge dam water quality (median) is:

- better than Hunter River water quality and the lowest recommended ANZECC guidelines trigger value for manganese, selenium, phosphorus (total) and zinc;
- better than the lowest recommended ANZECC trigger value, but worse than the Hunter River water quality for arsenic, boron, barium, calcium, calcium carbonate, iron (filtered), potassium, lithium, magnesium, rubidium, and strontium;
- poorer than the lowest recommended ANZECC trigger value but better than the Hunter River water quality for aluminium; and
- poorer than the lowest recommended ANZECC trigger value and the Hunter River water quality for chloride, sodium and sulphate.

It is likely that the elevated sodium and chloride concentrations are the main component of salts generated onsite, discharges of which are controlled by the HRSTS. The ANZECC (2000) water guideline trigger value of 115mg/L for sodium and 175mg/L for chloride applies to irrigation of sensitive crops. A trigger value of 300mg/L for sodium and 400mg/L for chloride applies for recreational use. There are no sodium or chloride trigger values for livestock drinking or ecosystem protection.

The median sulphate levels in the discharge dams exceed the ANZECC (2000) water guideline trigger value for recreational use (400mg/L), and are equal to the ANZECC (2000) water guideline trigger value for livestock drinking use (1,000mg/L).

As controlled discharges occur during high flow events in the Hunter River, significant dilution of discharges is expected. The 'worst case' dilution ratio for MTW discharges to Hunter River flows is 1:5 (400ML/day discharge rate to 2,000ML/day minimum flow required in the Hunter River flow for discharge under HRSTS). In the immediate vicinity of the Loders Creek confluence with the Hunter River, inside a mixing zone, contaminant concentration would be elevated compared to adjacent areas. However, secondary velocity currents induced by the nearby channel bends and turbulence induced by the riparian vegetation would promote mixing of the discharge water with the Hunter River flow. It is therefore likely that complete mixing of the discharge water with the river flow would occur within a few hundred metres of the outlet.

17.4.6 Flooding and stream geomorphology

There are no major tributaries within the proposed 2014 disturbance area and the proposal would continue to discharge via Doctors Creek under the rules of the HRSTS and in accordance with the MTW WMS. Given this, no significant impacts are expected to result from the proposal. Therefore, no geomorphic assessment has been provided.

The potential interactions between the proposed operations and the 100 year ARI design flood event for the Hunter River to the east and Wollombi Brook to the west has been investigated. The results of this examination are presented below.

i Hunter River flooding

A desktop assessment was undertaken to assess flood levels along the Hunter River adjacent to the Site.

Water level data for the Hunter River is available adjacent to the study area at Maison Dieu (Station No. 210128), Long Point (Station No. 210134), Upstream Singleton (Station No. 210129) and Singleton (Station No. 210001) (see Figure 17.1). Of these stations, only gauge levels from Long Point and Singleton can be translated into Australian Height Datum (AHD) levels. The peak levels at these stations and Station No. 210004 and Station No. 210028 on Wollombi Brook are shown in Table 17.5 for the June 2007 flood which is the largest flood event since 1955 and the third largest event on record.

Table 17.5 June 2007 peak flood levels

Station Number	River	Station name	Peak water level (m AHD)
210134	Hunter River	Long Point	48.98
210001	Hunter River	Singleton	41.67
210028	Wollombi Brook	Bulga	63.48
210004	Wollombi Brook	Warkworth	56.30

The minimum ground level along the eastern boundary of MTW is approximately 50m AHD, which is about 1m higher than the maximum June 2007 flood level recorded at Long Point, about 5km to the north-east. Therefore, the proposal would not result in any additional flood risk to infrastructure adjacent to the Hunter River.

ii Wollombi Brook flooding

The HEC-RAS steady state hydraulic model was used to estimate the 100 year average recurrence interval (ARI) design flood levels in Wollombi Brook adjacent to the Site. The model was calibrated to recorded flood levels and discharges for the June 2007 event. Estimated flood levels for the 100 year ARI design event vary from 59.4m AHD to 65.7m AHD at the villages of Warkworth and Bulga, respectively. Figure 17.4 shows the 100 year ARI design flood extent.

The results of a flood study for Wollombi Brook indicate that the proposal is outside the 100 year ARI flood extent. The 100 year ARI design flood level is about 11m below the top of the proposal pit highwall. Therefore, the proposal would not impact on flooding behaviour in Wollombi Brook and would not have any measurable effect on the geomorphology of Wollombi Brook.

17.4.7 Water allocations

The proposed MTW WMS has been designed to minimise the capture of clean runoff wherever possible.

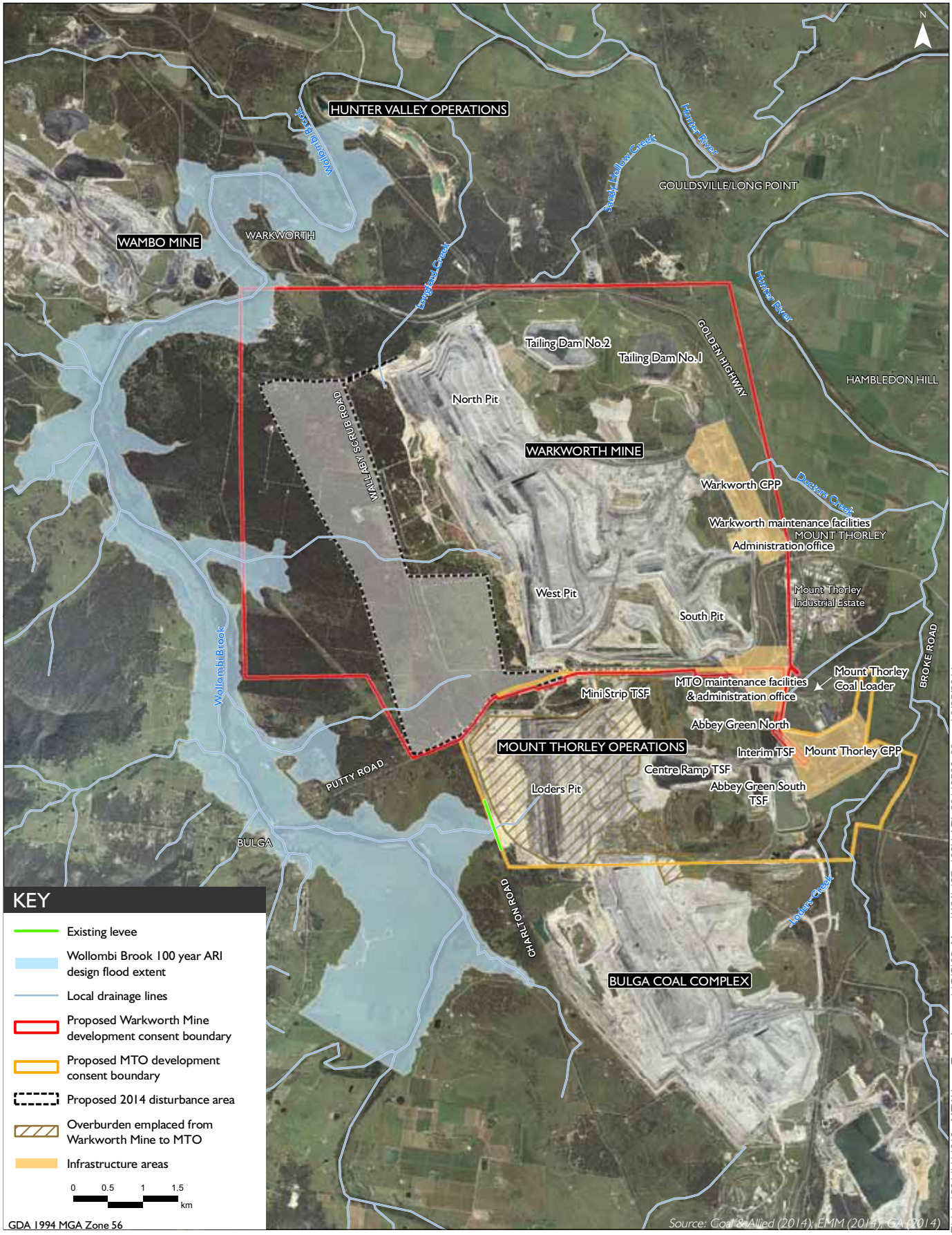
Dams solely for the capture, containment and recirculation of mine affected water to prevent the contamination of a water source are excluded works and are exempt from the requirement for water supply works approvals and a Water Access Licence under the WM Act. On this basis, water captured in the site water management structures, with the exception of rainfall runoff from undisturbed natural catchments, is not subject to licensing.

The capture of runoff from undisturbed natural catchment draining to any of MTW's water management dams and mining areas may require a Water Access Licence. Table 17.6 shows the estimated average volume of water captured within the MTW WMS over the life of the proposal.

Table 17.6 Surface water allocations

Water type		**Surface water**		
Water sharing plan		**Hunter unregulated and alluvial water sources**		**Hunter regulated river**
Water source		**Lower Wollombi Brook**	**Singleton**	**Hunter regulated river**
Predicted annual take (ML/year)	**Average**	10	73	1,876
	Maximum	18	135	4,410
Predicted annual impact on water source (%)	**Average**	0.1	8	3.3
	Maximum	0.3	14	7.7
MTW current licences		187 units*	280 units*	1,012 units
Additional water potentially required for the integrated operation (ML/year)	**Average**	0	0	864
	Maximum	0	0	3,398

*Note: * These values are not Water Access Licenses held by MTW, they have been calculated as harvestable rights.*



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Wollombi Brook 100 year ARI design flood extent

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Figure 17.4

The total unregulated river access entitlement for the Hunter Unregulated and Alluvial Water Sources is 80,619 units (ML/year). The Site is on the boundary of the Singleton Water Source and the Lower Wollombi Brook Water Source, which have unregulated river access component shares of 960 units (ML/year) and 6,663 units (ML/year), respectively.

As can be seen in Table 17.6, the predicted average annual impacts of the proposal on the share components for the Singleton Water Source and for the Lower Wollombi Brook Water Source under the Hunter Unregulated and Alluvial Water Sources Water Sharing Plan are 73ML/year and 10ML/year, respectively. These levels represent approximately 8 per cent and 0.1 per cent, respectively.

The total surface water entitlement (general and high security access licences) for the Hunter Regulated River water source is 151,792 units (ML/year). The Site is in Management Zone 2, which has an entitlement of 57,094 units (ML/year). The existing MTW WMS holds approximately 1,012ML/year of high security units of Hunter River water shares under the MTJV Supply Scheme.

Water demands for the operation are reviewed regularly as a requirement of the MTW WMS. In the event that a shortfall for MTW is identified, then operations would be adjusted to ensure that its water requirements are satisfied.

17.5 Management and monitoring

Surface water at MTW is currently managed in accordance with the MTW WMP, prepared in consultation with NOW and the EPA. The MTW WMP was developed in accordance with industry best practice with consideration given to the full available range of reasonable and feasible mitigation and their effectiveness, inclusive of contingency plans to manage any residual risks, for implementation at the Site.

The impacts of the proposal on surface water resources would be mitigated through the implementation of the following measures to be documented in a revision of the MTW WMP:

- control the flow and storage of water of different qualities across the Site through the proposed MTW WMS;
- a sediment control plan to reduce sediment loads from disturbed area runoff;
- drainage of the final landform; and
- a surface water monitoring programme to continually assess environmental impacts and ensure that the MTW WMS is meeting its objectives of managing impacts on receiving waters.

An overview of each of these management measures is provided in the following sections.

17.5.1 Water management system

A key objective of the proposed MTW WMS is to minimise the risk of uncontrolled releases from mine site storages. To achieve this objective, operation of the proposed MTW WMS would be based on the following principles:

- diversion of clean surface water runoff away from areas disturbed by mining activities;
- operation of the MTW WMS to ensure no uncontrolled releases of water from the Site;

- collection of potentially sediment-affected runoff in sediment dams for treatment prior to release from Site;
- transfer of groundwater and seepage inflows to the open cut pits to the water system for reuse;
- collection of contaminated water from industrial areas for treatment in an oil and grease separator prior to recycling in the MTW WMS; and
- minimisation of fresh water usage by recycling water from the water system before taking additional water from external sources.

The MTW WMS includes specific triggers for water quality and flow requiring action. These would continue to be in place under the proposal. In addition, an important component of the MTW WMS would be to ensure that contingency measures are in place to accommodate either a surplus or deficit of water onsite.

Appropriate water licences or third party external water sources would be obtained to meet the potential shortfall in water during dry conditions. Mine operations would also be planned to ensure that mining can continue during extended wet periods when water may accumulate in the open cut mining areas.

The revised MTW WMP would detail reporting and action procedures to identify any lack of compliance with objectives and a process for implementing corrective actions.

17.5.2 Erosion and sediment control

The design of sediment control measures for the proposal would be based on the principle of ensuring that runoff from disturbed areas is separated from clean area runoff and collected in sediment dams for treatment. Design of proposed erosion and sediment control measures would be based on the recommended design standards in the following guidelines:

- *Managing Urban Stormwater, Soils and Construction* (Landcom 2004); and
- *Managing Urban Stormwater, Soils and Construction, Volume 2E Mines and Quarries* (DECC 2008).

17.5.3 Drainage of final landform

The rehabilitated overburden east of mining operations would be drained using the approach currently adopted at MTW which is based on:

- topsoiling and revegetation of the finished landform;
- construction of contour drains across the batter slope to minimise the potential for rilling and gullying of the finished landform;
- collection of inflows from contour drains in rock chutes which flow downslope; and
- flows from rock chutes are directed to sediment basins prior to release from Site.

17.5.4 Surface water monitoring programme

The existing MTW surface water monitoring programme is described above in Section 17.2.5.ii. The existing surface water monitoring locations and frequencies of the receiving waterways are considered appropriate to identify any changes in water quality associated with the proposal.

The site dam watering monitoring programme would be updated to include additional locations as new dams are constructed, with EC, pH and TSS monitored on a monthly basis and a comprehensive analysis undertaken annually.

17.6 Conclusions

The proposed MTW WMS has been developed in conjunction with the mine planning and operational teams to develop a WMS that has minimal impacts on surface water resources. The proposed MTW WMS is a continuation of the current MTW WMS, and the results of the surface water study indicate that the impacts of the proposal on surface water resources are unlikely to be significantly different to the existing approved operations and would not have a significant impact on surface water quality of the adjacent water features.

Chapter 18

Aboriginal cultural heritage

Chapter 18 — Aboriginal cultural heritage

18 Aboriginal cultural heritage

18.1 Introduction

This chapter provides a summary of the Aboriginal cultural heritage study for the proposal prepared by Central Queensland Cultural Heritage Management Pty Limited, which is presented in full in Appendix M.

The chapter describes the current Aboriginal cultural heritage management systems in place which apply to operations at both Warkworth Mine and MTO. It summarises the potential impacts of the proposal on Aboriginal cultural heritage items identified within the Site, and the management measures proposed to address impacts on Aboriginal cultural heritage values.

18.2 Existing environment

The management of Aboriginal cultural heritage is integrated across MTW. A suite of policies, protocols and processes in the areas of community engagement, heritage management and relationships with Aboriginal communities, have been developed and implemented by Coal & Allied in its approach to Aboriginal cultural heritage management at MTW. Current Aboriginal cultural heritage management consists of:

- implementation of the Cultural Heritage Management System (CHMS);
- ongoing consultation through the CHWG; and
- preparation and implementation of management plans required under relevant development consents.

Further detail on these is provided in the following sections.

18.2.1 Cultural Heritage Management System

The CHMS is comprised of a series of comprehensive cultural heritage management policies and protocols, or work standards, that apply across all of Rio Tinto Coal Australia's operations, including MTW. The overarching objective of the CHMS is to efficiently manage and mitigate the risks on cultural heritage in order to provide timely and authorised access to land for mining and associated development activities. The CHMS has been developed in accordance with industry best practice to ensure that all activities and ground disturbances associated with mining operations comply with Rio Tinto Coal Australia's internal policies as well as with State and Commonwealth legislation, and other statutory regulations, governing the management of Aboriginal cultural heritage. The CHMS has given consideration to the full available range of reasonable and feasible mitigation and their effectiveness, inclusive of contingency plans to manage any residual risks, for implementation.

18.2.2 Cultural Heritage Working Group

Coal & Allied is committed to active, meaningful and transparent engagement with the Aboriginal community as the basis for successful management of cultural heritage issues for all projects and operations. The CHWG was established in September 2005 so that Rio Tinto Coal Australia, Coal & Allied and the Aboriginal community could jointly develop and implement an integrated cultural heritage consultation and management process in the Upper Hunter Valley.

The CHWG is currently comprised of representatives from Coal & Allied, Upper Hunter Valley Aboriginal community groups, corporations and 82 Registered Aboriginal Parties (RAPs) and other stakeholders, including the Wanaruah Local Aboriginal Land Council. The CHWG provides a regular forum for discussions, often meeting several times each year, and oversees all matters pertaining to cultural heritage associated with Coal & Allied owned and operated lands, projects and operations in the Upper Hunter Valley.

The CHWG regularly reviews the progress and outcomes of Rio Tinto Coal Australia's cultural heritage processes and management programmes, revising and refining elements of the process by consensus. The CHWG is recognised by both DP&E and OEH as an appropriate consultative forum. The procedures adopted in running the CHWG conform to published OEH consultation requirements by way of establishment, composition, and timeframes for consultation.

18.2.3 Management plan

Condition 41 of the existing development consent requires the development of an Archaeology and Cultural Heritage Management Plan (ACHMP) for the Warkworth Mine. The ACHMP sets out the protocols for managing Aboriginal cultural heritage affected by mining activities at Warkworth Mine, and key matters of concern to the Aboriginal community. Aboriginal cultural heritage outside of the present development consent boundary, including the proposed 2014 disturbance area, are also subject to interim protective management measures developed in consultation with the CHWG and in accordance with the CHMS.

18.2.4 Warkworth Extension 2010 Aboriginal cultural heritage assessment studies

Aboriginal cultural heritage investigations associated with the Warkworth Mine commenced in the late 1970s, with the frequency and types of work undertaken notably increasing from the late 1990s onwards. Since the granting of the development consent in 2003, a range of Aboriginal cultural heritage investigation and management programmes have been undertaken within the mining leases associated with the proposal. This has included five detailed Aboriginal cultural heritage surveys, five cultural heritage salvage operations, and two comprehensive investigations, one of which included a large scale multi-disciplinary archaeological and geomorphological investigation, into areas of the Warkworth Sands land system (AMBS 2002; AECOM 2009; Scarp Archaeology 2009a; Scarp Archaeology 2009b; Central Queensland Cultural Heritage Management 2010). All Aboriginal cultural heritage investigations were undertaken in consultation with the active participation of Aboriginal community members and, from 2005, under the auspices of the CHWG.

The locations of Aboriginal cultural heritage areas or objects identified as a result of these studies are shown in Figure 18.1 and discussed in Section 18.3.3. These have been registered on the Aboriginal Heritage Information Management System (AHIMS) maintained by OEH, as well as included into the MTW Cultural Heritage Management Database (CHMD) established by Coal & Allied. The information held within the CHMD is regularly updated as a result of ongoing site inspections, monitoring, and implementation of agreed management measures. The CHMD is a key element within the preparation and operation of management plan and associated management arrangements.

18.3 Impact assessment

18.3.1 Methodology

Aboriginal cultural heritage assessments must be prepared in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (ACHCRP) (OEH 2010). Extensive consultation has been undertaken for activities at MTW as well as specifically for the proposal. Consultation has occurred under the auspices of the CHWG and the relevant requirements of the ACHCRP or the former *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation Guidelines* (DECCW 2005).

The Aboriginal cultural heritage assessment for the proposal has relied on the findings of previous studies undertaken at MTW, including surveys of the proposed 2014 disturbance area. While OEH generally requires that data used in preparing impact assessments, management plans and strategies should be derived from surveys undertaken no more than five years prior, the studies relied upon for the proposal are considered to be more than adequate for the purpose of informing this impact assessment. They were undertaken using a systematic and comprehensive strategy consistent with current best practice, additional studies have not identified a fundamental change in the scale or nature of the items requiring management, and the technology used for site recording remains state-of-the-art. Further, there have not been any significant changes in landform condition due to land use or erosion and sedimentation that would have significantly altered the patterns of distribution, site form or condition identified in the course of the fieldwork studies conducted previously.

18.3.2 Consultation

Aboriginal community consultation relevant to the proposal undertaken to date includes:

- the extensive consultation process undertaken as part of the Aboriginal Cultural Heritage Assessment for the Warkworth Extension 2010 (Central Queensland Cultural Heritage Management 2010);
- consultation undertaken as part of the fulfilment of the conditions of the now disapproved Warkworth Extension 2010; and
- consultation undertaken recently as part of the Bulga Ramp 22 Sedimentation Dam project, and subsequent approval of an Aboriginal heritage impact permit for this area by OEH in April 2014.

Since 2008 there have been 30 Aboriginal community consultation meetings conducted under the auspices of the CHWG with regard to the Warkworth Extension 2010 and/or the ACHMP. Matters pertaining to the identification, significance assessment and management of Aboriginal cultural heritage associated with proposed mining west of the existing operations have been discussed at 28 CHWG meetings held between August 2008 and December 2013.

Further detail is provided in Appendix M.

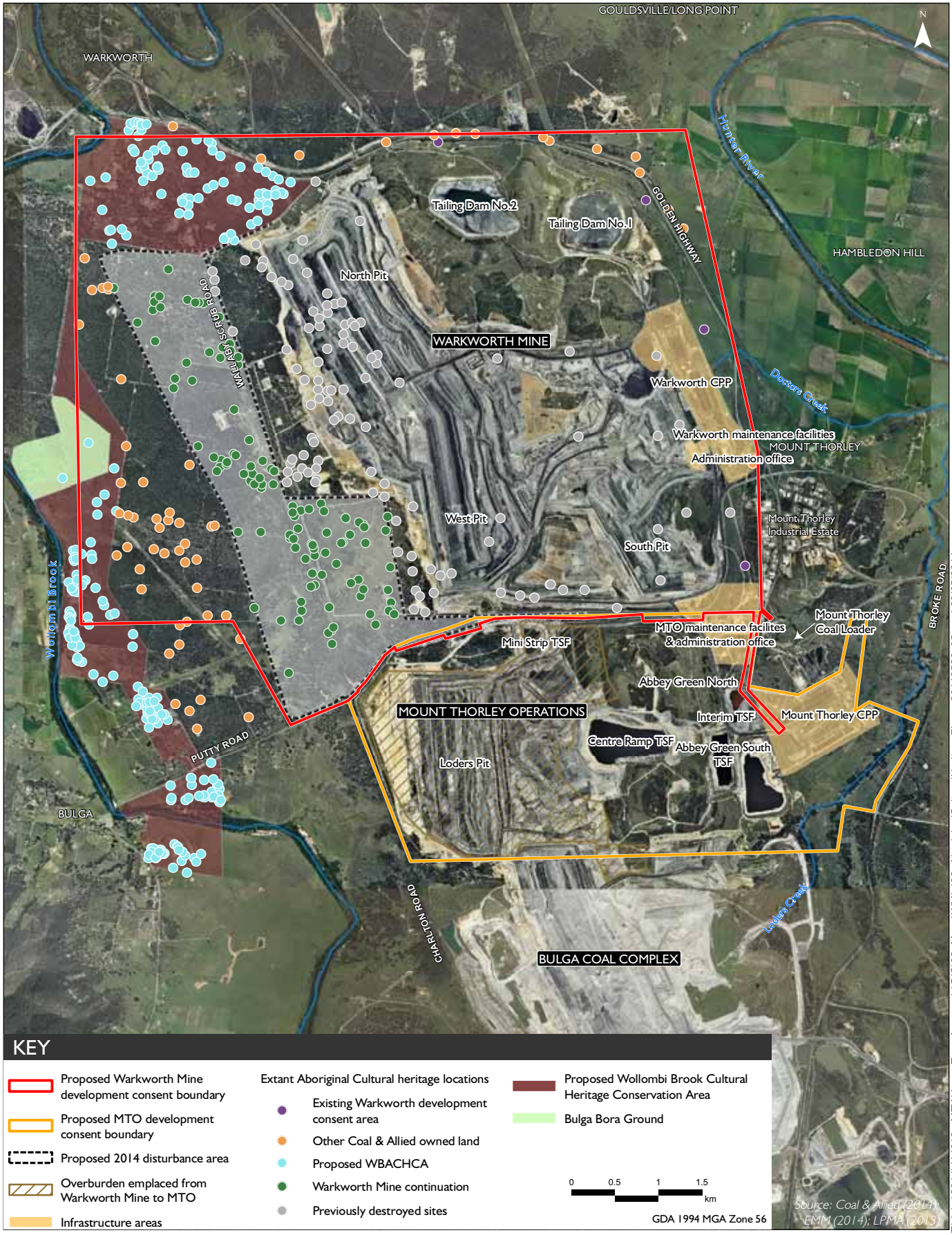

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Figure 18.1

Consultation specific to the proposal was also undertaken at CHWG meetings held on 3 April and 7 May 2014. An inspection of the proposed 2014 disturbance area by the RAPs was undertaken on 29 April 2014. Copies of the Aboriginal cultural heritage assessment as supplied in Appendix M of this EIS were provided to the RAPs for their feedback on 19 May 2014.

The outcomes of the above consultation were that, while the RAPs and stakeholders would prefer that no additional disturbance to Aboriginal cultural heritage occur as a general principle, the proposed management measures (summarised in Section 18.4 and detailed in Appendix M) are appropriate for managing Aboriginal cultural heritage impacts associated with the proposal. To date, Coal & Allied has not received correspondence from any CHWG participants that is inconsistent with this. The CHWG has also expressed continued support for the establishment of the WBACHCA, shown in Figure 18.1, originally proposed as part of the Warkworth Extension 2010.

18.3.3 Results

A considerable number of places containing Aboriginal cultural heritage have been identified and recorded at MTW and in adjacent Coal & Allied owned lands. Those relevant to Warkworth Mine and the proposal are shown in Figure 18.1.

It should be noted that the discussions below do not specifically include those Aboriginal cultural heritage places which have been identified and recorded within the neighbouring MTO.

A total of 111 places (either wholly or in part) containing Aboriginal cultural heritage objects have been identified and recorded within the proposed 2014 disturbance area as shown in Figure 18.1. Of these, one (37-6-1250; W23) has previously been destroyed and two (37-6-1234; W12 and 37-6-1235; W13) partially destroyed under a consent (AHIP #C0000201) granted under the NP&W Act.

The 110 extant places (including the two partially destroyed places) primarily consist of stone artefacts with a smaller number of culturally modified (scarred) trees, areas of potential archaeological deposit (PAD), and an area containing grinding grooves. These are summarised in Table 18.1.

Table 18.1 Extant Aboriginal cultural heritage places within the proposed 2014 disturbance area

Place type	Number	Per cent (%)
Stone artefacts	103	93.7
Stone artefacts / PAD	3	2.7
Scarred trees	2	1.8
Scarred tree / Isolated stone artefact(s)	1	0.9
Grinding grooves	1	0.9
Total	**110**	**100**

Given the nature of the activities to be undertaken within the proposed 2014 disturbance area, it is likely that all of the 110 extant Aboriginal cultural heritage places would be impacted as a result of the proposal. Impact management measures for these places are outlined in Section 18.4.2. Prior to disturbance, these places would continue to be managed consistent with the provisions of the ACHMP and the CHMS.

18.3.4 Potential impacts

As is clear from the above discussion, there is Aboriginal cultural heritage presence within the MTW mining leases. For the Aboriginal people of the Upper Hunter Valley, such places are of cultural significance. There are two distinct categories of cultural place that attract Aboriginal cultural significance:

1. places of cultural significance through their association with creator beings, spirit beings, culture heroes, traditional activities, historical events or contemporary values where there may not be any physical material – sometimes referred to as intangible cultural heritage although very tangible to enculturated Aboriginal people.

2. places where there is material cultural heritage (either organic or inorganic) that derives from cultural activities of Aboriginal people, commonly called archaeological material and constitutes the objects protected under the NP&W Act.

Examples of the former have been identified and recorded within the MTW mining leases. The Bulga Bora Ground (37-6-0056, 37-6-0055) is the most notable in this regard but there are also other features such an arrangement of three stone mounds (37-6-2315), and an earthen mound with the potential to contain burials (37-6-2555). All of these places and values are within the proposed WBACHCA.

Only the latter category of place (ie material cultural heritage) has been identified within the proposed 2014 disturbance area. None of the extant Aboriginal cultural heritage places identified in the proposed 2014 disturbance area are the subject of any specific requirements to address issues of cultural sensitivity. Further, it is considered that there are no Aboriginal cultural heritage places with scientific values that constitute a constraint on the proposal.

i Scientific significance

The majority of Aboriginal cultural heritage places identified within the MTW mining leases are typical of the regional archaeology of the Upper Hunter Valley. The places are concentrated along drainage lines with a particular focus around permanent sources of water. These areas also have generally been subjected to a long history of disturbance through a range of land uses including vegetation removal, grazing, farming and the development of formal and informal access tracks.

In general, the majority of the Aboriginal cultural heritage places identified and recorded to date are unlikely to yield significant additional information with regard to patterns of land and resource use either locally or regionally. Further, it is difficult to date the majority of these cultural heritage places, given sample sizes both within individual places and across place types, together with factors (such as landuse) that affect the preservation of objects and sites over time and therefore, affect, their scientific value. Therefore, further archaeological research into the scientific values of a majority of the identified Aboriginal cultural heritage places is not considered warranted.

Despite this, recommendations for each identified Aboriginal cultural heritage place from the investigations and assessments undertaken have been reviewed by Coal & Allied and the Aboriginal community (through the CHWG), and reporting finalised consistent with comments received from those parties. The decisions of the CHWG and Coal & Allied, informed by the recommendations, have been accepted by OEH, and the ACHMP has been developed to capture those decisions, with each recorded place managed consistent with the scientific significance assessment. The only situation in which scientific assessments of significance have not been accepted in their entirety has been where such assessments impose a lesser management requirement than those specified in the ACHMP, which set a minimum standard for compliance with Aboriginal cultural significance.

Within the proposed 2014 disturbance area, the vast majority of the identified and recorded cultural heritage places consist of isolated stone artefact(s) in disturbed contexts. While several modified (scarred) trees have been identified, they represent a relatively small proportion of the total numbers which would remain extant, and in the case of those within the WBACHCA, they would be protected in the long-term. The most significant place from a scientific perspective that would be impacted is the grinding grooves (37-6-0163) generally referred to as 'Site M'. Although all categories of Aboriginal cultural heritage places have separate and agreed management measures within the ACHMP, specific additional management measures have been settled for this place (as discussed further in Section 18.4).

Notwithstanding any statement of scientific significance relating to any particular site, Rio Tinto Coal Australia has committed to providing for the management of all cultural heritage objects and areas identified during surveys through the ACHMP.

ii Significance to the Aboriginal community

In general, the cultural heritage places for which the Aboriginal community has shown the strongest concerns are those that have been identified as having a higher scientific significance. A number of places within the MTW mining leases have been identified on that basis, as outlined above.

During participation in the design and conduct of the cultural heritage survey and assessments, Aboriginal community representatives have expressed strong views about their concern for particular places and cultural locations as well as their preferred mitigation methods. In the course of the extensive consultation conducted by Coal & Allied, the Aboriginal community have continually endorsed an Aboriginal cultural heritage management approach based on the limits of acceptable change to heritage at a landscape scale. They have also expressed the desirability of achieving long-term and secure management of a range of significant places and areas, such as the Bulga Bora Ground and Wollombi Brook in general, which have significance to them at a broader regional level.

The Bulga Bora Ground, for example, is of very high cultural significance to the Aboriginal community of the Upper Hunter Valley region because it is a location of important traditional ceremonial activity. The place is also of great significance to non-Aboriginal science and history.

The early recognition of the significance of the Bulga Bora Ground directly led to the proposal for the establishment of the WBACHCA as a permanent conservation area, including considerable areas within the Warkworth Mine mining lease to protect such Aboriginal cultural heritage places and areas. The WBACHCA proposal has been jointly developed by Coal & Allied and the Aboriginal community through the CHWG over an extended period and all parties remain committed to its enactment.

A key ongoing objective in the development of the WBACHCA would be the establishment of a co-management regime in partnership with the Aboriginal community through the development of a comprehensive and well considered management strategy supported by an appropriate community-based governance structure. Discussions, positions and mechanisms for the delivery of both are well advanced.

18.4 Management and monitoring

18.4.1 Wollombi Brook Aboriginal Cultural Heritage Conservation Area

The WBACHCA is proposed to offset impacts on Aboriginal cultural heritage across MTW. The WBACHCA has been developed through discussions with the CHWG and was originally proposed under the Warkworth Extension 2010.

A total of 265 Aboriginal cultural heritage places have been identified and recorded within the areas that have been the subject of survey. On the advice of the CHWG and owing to the sensitivity of its location (which is in the area of the Bulga Bora Ground), a small portion (some 69ha) of the WBACHCA has not been the subject of comprehensive and systematic cultural heritage investigation and assessment to date.

Although heavily dominated by places containing stone artefacts, there is considerably more diversity in Aboriginal cultural heritage place types identified than elsewhere at MTW (see Table 18.2). Of particular note is the identification of spiritual and ceremonial places (notably the Bulga Bora Ground) and a mound feature, which may potentially contain burials. Examples of grinding grooves and scarred trees noted elsewhere within Warkworth Mine are also present within the WBACHCA albeit in greater numbers. For scarred trees it is likely that this is a direct function of the general lack of all forms of development activity which have taken place in this area.

Table 18.2 Aboriginal cultural heritage places within the proposed WBACHCA area

Place type	Number	Percentage (%)
Stone Artefacts	244	92.1
Scarred Trees	11	4.1
Grinding Grooves	4	1.4
Spiritual Place	1	0.4
Spiritual Place / Scarred Trees	1	0.4
Stone Arrangement	1	0.4
Mound Feature (potential burials)	1	0.4
Stone Source	1	0.4
Isolated Stone Artefact(s) – Stone Source	1	0.4
Total	**265**	

Although not specifically identified in Table 18.2 above, a total of 112 places have been identified as PADs. Geographically, PADs have tended to cluster throughout the central and southern portions of the conservation area and particularly adjacent to Wollombi Brook. As with elsewhere at MTW, these are predominantly associated with areas containing stone artefacts, but they were also associated with three of the grinding groove places, two of the scarred trees and the mound feature. In addition, and although not identified formally as a PAD during cultural heritage investigations, portions of an extensive linear Warkworth Sands dune (portions of which have previously been quarried) also lie within the WBACHCA. This latter feature was previously identified as one of the locations suitable for further research as part of the Hunter Valley Sand Bodies Research Study required under the disapproved Warkworth Extension 2010. Consistent with these conditions, a research design and action plan for its implementation was developed by an expert panel in conjunction with DP&E and OEH which has subsequently been approved.

All Aboriginal cultural heritage places within the proposed WBACHCA are managed in accordance with the provisions of the CHMS and management principles developed in consultation with the CHWG. Under the auspices of the CHWG, a WBACHCA Steering Committee (comprised from the CHWG membership) has been established and in operation for several years. This group has, and would continue to, develop specific management arrangements for this area. The WBACHCA would be managed under its own stand-alone and formalised Aboriginal cultural heritage management plan. A draft management plan was developed during CHWG consultation for the Warkworth Extension 2010 and is in the process of further consultation and revision.

The following commitments would be undertaken by Coal & Allied in relation to the WBACHCA.

- The WBACHCA would be established for the long-term conservation and management of Aboriginal cultural heritage places and values. It is noted that the WBACHCA falls within the SBA. While biodiversity values of this area would be conserved and protected through legislative mechanisms, the WBACHCA would provide for the protective management and cultural maintenance of the Bulga Bora Ground and associated cultural landscape and other places.

- The WBACHCA would be protected in the long-term from mining, exploration drilling and associated development disturbance.

- The WBACHCA would be managed in accordance with a customised management plan developed in consultation with the CHWG and other stakeholders including DP&E and OEH. This plan would include the following matters:

    - the establishment of strictly controlled non-access zones and protocols around culturally sensitive areas as determined in consultation with the CHWG;

    - the establishment of areas for use by the Aboriginal community for cultural and community purposes;

    - the establishment of areas for active Aboriginal cultural heritage and landscape management, including vegetation rehabilitation;

    - the processes and protocols by which ongoing Aboriginal community access to the WBACHCA can be facilitated; and

    - the Aboriginal community, through a WBACHCA management committee, would oversee the implementation of the management plan.

- Continue to ensure an active Aboriginal community role in both Aboriginal cultural heritage and environmental management activities for the WBACHCA, including training and employment development opportunities.

- Continue to engage with Wambo Coal Pty Ltd with a view to developing a collaborative management protocol for highly significant areas associated with and immediately adjacent the Bulga Bora Ground (which has been identified as containing portions of the extended Bulga Bora Ground precinct and associated places) on the lands which they own.

18.4.2 Onsite management and monitoring

The Aboriginal cultural heritage impact management measures which have been developed for the proposal, beyond the WBACHCA, fall into a series of categories as follows:

- the finalisation of a MTW integrated Heritage Management Plan (HMP);

- management of Aboriginal cultural heritage within the proposed 2014 disturbance area; and

- implementation of a research programme to be known as Hunter Valley Sand Bodies Research Study focusing on possible Pleistocene occupation.

The proposed management measures within each of these areas are outlined separately below. The measures would be an extension of existing management arrangements and processes developed in consultation with the CHWG.

i Integrated heritage management plan

Considerable work has been done developing an integrated HMP for MTW. A completed consultation draft which captured existing agreed principles, protocols and processes for Aboriginal cultural heritage management has been provided to the RAPs and stakeholders. Should this proposal and the Mount Thorley Operations 2014 proposal be approved, the MTW HMP would be finalised and implemented.

ii Proposed 2014 disturbance area

A total of 110 extant places (or remnant portions thereof) containing Aboriginal cultural heritage are within the proposed 2014 disturbance area. It is likely that all of these would be impacted by the proposal. Coal & Allied commits:

- to only implement the agreed impact management measures for those places for which development impacts are unavoidable, with avoidance through design planning being the preferred option;
- to implement the agreed impact management measures with these staged over time based on a minimum three year and maximum five year mine operation plan requirements;
- that until such time as the agreed impact management measures need to be implemented, all Aboriginal cultural heritage within the area would continue to be managed in accordance with the provisions of the CHMS and ACHMP (or HMP). Avoidance and physical protection would comprise the key management strategy in this period;
- that if and when mitigation becomes necessary, the following measures would be implemented:
    - areas containing stone artefacts (as per Table 18.1) would be managed in accordance with the specific provisions for such objects within the ACHMP (or HMP). This would include standard salvage collection measures which, in the case of the four stone artefact scatters (37-6-2359,2360, 2374 and 2376), would include controlled collections with the assistance of established grids;
    - the three areas (37-6-2349, 2359 and 2364) noted as having the potential to contain archaeological deposits (ie PADs) would be investigated and managed in accordance with the specific provisions for such features within the ACHMP (or HMP). This would involve sub-surface testing to confirm or otherwise this potential. The results would be submitted to DP&E and OEH; and
    - the three scarred trees (37-6-2307, 2369 and 2379) would be managed in accordance with the specific provisions for such objects within the ACHMP (or HMP) and Rio Tinto Coal Australia's *Scarred Tree Management Procedure*. This may include removal and relocation; and
    - consistent with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010), an Aboriginal Site Impact Recording Form would be completed and submitted to the AHIMS Registrar, for each AHIMS site subject to salvage mitigation.

- to continue investigations into the feasibility of moving the Site M grinding grooves (37-6-0163) although considerable review of the matter has already taken place. The final management and salvage measures for this place would be agreed in consultation with the CHWG, DP&E and OEH. Specific impact mitigation activities that would be undertaken include:

    - further geotechnical assessment and testing of the suitability for the removal and relocation of all or parts of this place;

    - the removal of soils which surround and cover portions of the place to gain the fullest appreciation of its constituents;

    - the completion of high definition laser scanning (including photography) of the site and its immediate surrounds; and

    - ahead of the completion of the final management and salvage measures for this place, the establishment of a blast monitoring regime to ensure that ongoing mining activities are not having deleterious effects upon the place.

- to the management of other currently unidentified Aboriginal cultural heritage places or place-type, which may come to light as part of the implementation of impact management measures, in accordance with the relevant specific provisions for such places within the ACHMP (or HMP). Any unidentified places would be reported to DP&E and OEH prior to implementation of the agreed impact management measures;

- to involving the Aboriginal community in the implementation of all impact management measures consistent with the existing CHWG processes and protocols with such being formalised and conducted under a terms of reference; and

- to all Aboriginal cultural heritage objects collected being curated and stored in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010). Until such time as an adequate facility is in place within the WBACHCA, objects would be stored in the secure facility at Coal & Allied's Hunter Valley Services office.

iii Hunter Valley Sand Bodies Research Study

As noted previously, a condition of the now disapproved Warkworth Extension 2010 required the preparation of the Hunter Valley Sand Bodies Research Study. Coal & Allied remains committed to the implementation of this research programme, for which the research design and implementation action plan has been developed and approved.

18.5 Conclusions

Extensive studies and community consultation have been undertaken in relation to the identification and management of Aboriginal cultural heritage within the MTW mining leases. In 2005, Rio Tinto Coal Australia established the CHWG to integrate consultation and management for its operations in the Upper Hunter Valley. Aboriginal cultural heritage places identified within the MTW mining leases are currently managed under the auspices of the CHWG and the ACHMP.

A considerable number of places containing Aboriginal cultural heritage have been identified and recorded at MTW and in adjacent Coal & Allied managed lands. A total of 110 extant places, primarily consisting of stone artefacts, identified within the proposed 2014 disturbance area would be disturbed or destroyed as a result of the proposal.

A number of management measures are proposed for the places that would be disturbed under the proposal. Aboriginal cultural heritage at Warkworth Mine would continue to be managed through the CHWG and under the ACHMP (or HMP). In particular, the WBACHCA would be established for the long-term conservation and management of Aboriginal cultural heritage places and values.

Chapter 19

Historic heritage

Chapter 19 — Historic heritage

19 Historic heritage

19.1 Introduction

This chapter provides a summary of the historic heritage study for the proposal prepared by ERM Australia Pty Limited (ERM), which is presented in full in Appendix N.

The chapter describes the existing historic heritage environment and potential impacts from the proposal. It includes management and monitoring measures that would be implemented to avoid or minimise impacts.

19.2 Existing environment

19.2.1 Historical context

The earliest European presence in the Hunter region dates back to the 1790s, when coal was discovered by a party of escaped convicts. The resource was exploited at a low level and shipped to Sydney, but difficult terrain hampered attempts to explore the region (Weir Phillips 2012). More in-depth survey of the coastlines east and north of the Hunter region were undertaken by John Oxley in 1818, and the following year the countryside was explored by John Howe, Chief Constable of Windsor (ERM 2012; Weir Phillips 2012). Government plans for the establishment of free settlements in the Hunter Region followed, and soon after towns became established around the higher population areas, such as Jerry's Plains in the 1830s and Bulga in the 1840s.

Plans for the construction of the Great North Road were developed in the early 1820s to accommodate the influx of settlers moving into the Hunter Valley. Between 1829 and 1830 the road was extended by convict gangs from Wollombi to Broke, and branch lines to Patrick's Plains (Whittingham/Singleton) and Cockfighter's Creek (Warkworth) were added (Nexus Archaeology and Heritage 2006; Bill Jordan and Associates 2006; Karskens 1982).

The land became used for a variety of purposes, with pastoral grazing and wheat growing being the primary industries. At Warkworth, originally known as Cockfighter's Creek, the land remained primarily used for grazing and little development occurred, apart from a few hotels constructed along the road alignment in the 1840s for people travelling between the Hunter Valley and Sydney (RPS 2012).

From the early 1900s until World War II, dairying was the primary industry in the Hunter Valley (RPS 2012). In the lands around Bulga and Warkworth, lucerne growing was popular and to a lesser extent viticulture supported by timber felling, fruit production and grazing.

In 1942, during World War II, a Royal Australian Air Force (RAAF) base with a landing strip was established in Warkworth as a satellite to its parent base in Bulga. The base included hideouts to conceal bomber aircraft and a number of buildings including mess facilities and ablutions blocks, and petrol storage tanks. As the threat of attack dissolved with end of the war, the base was eventually decommissioned and the majority of assets were auctioned and removed by 1949.

Acquisition of coal mining leases in the Hunter began in the 1970s to 1980s. The mining lease for Warkworth was granted in 1976, and mining operations began in 1981. Coal & Allied purchased an interest in the Warkworth Mine in 2001, and the land was subsequently acquired.

19.2.2 Methodology

The historic heritage study presents a combined impact assessment of the subject proposal and Mount Thorley Operations 2014 proposal. The study area for the historic heritage study is the development consent boundaries for both the proposed Warkworth Mine and MTO development consent boundaries. For the purposes of this chapter, the study area is defined as the proposed Warkworth Mine development consent boundary only (see Figure 19.1).

The study was prepared in accordance with the Heritage Act and the Australia ICOMOS Charter for Places of Cultural Significance – the Burra Charter. It included:

- a five day field survey of the study area and surrounds;
- a search of relevant statutory and non-statutory heritage registers;
- a review of existing historic heritage studies undertaken within and adjacent to the study area;
- contextual background research including a review of primary and secondary archival records; and
- consultation with the Cultural Heritage Advisory Committee (CHAC).

19.2.3 Results

i Registered items or places

A search of heritage items on the relevant statutory and non-statutory heritage registers found:

- no registered heritage item or places within the proposed 2014 disturbance area;
- one registered heritage item or place on the boundary of the study area – the Brick Farm House which is listed as a local item under Singleton LEP 2013; and
- six registered heritage items and places outside of the study area but within a 7.5km radius from the centre of the proposed 2014 disturbance area.

Details of the registered items are described in Table 19.1 and their locations are shown in Figure 19.1.

Table 19.1 Registered heritage items and places

Location on Figure 19.1	Register ID	Name	Location	Distance from centre of proposed 2014 disturbance area (km)
1	LEP#I40	Brick Farm House	Golden Highway, Mount Thorley	4.5
2	LEP#I8; SHR 01459	Bulga Bridge	213 Main Road, Bulga	6
3	LEP#I10; TNSW#R1330	Mount Leonard Public School	2099 Putty Road, Bulga	6.5
4	LEP#I9; NTNSW#R1331	Mount Leonard	2201 Putty Road Bulga	7
5	LEP#I143;NTNSW#R5782	St Phillips Church	Off High Road, Warkworth	7

Table 19.1 Registered heritage items and places

Location on Figure 19.1	Register ID	Name	Location	Distance from centre of proposed 2014 disturbance area (km)
6	LEP#A6	Former Queen Victoria Inn Ruins	Jerrys Plains Road	7
7	LEP#I11	War Memorial Gates	19 The Inlet Road, Bulga	7.5

Notes: LEP = Singleton LEP 2013, NTNSW = National Trust of New South Wales. and SHR = State Heritage Register.

ii Field survey

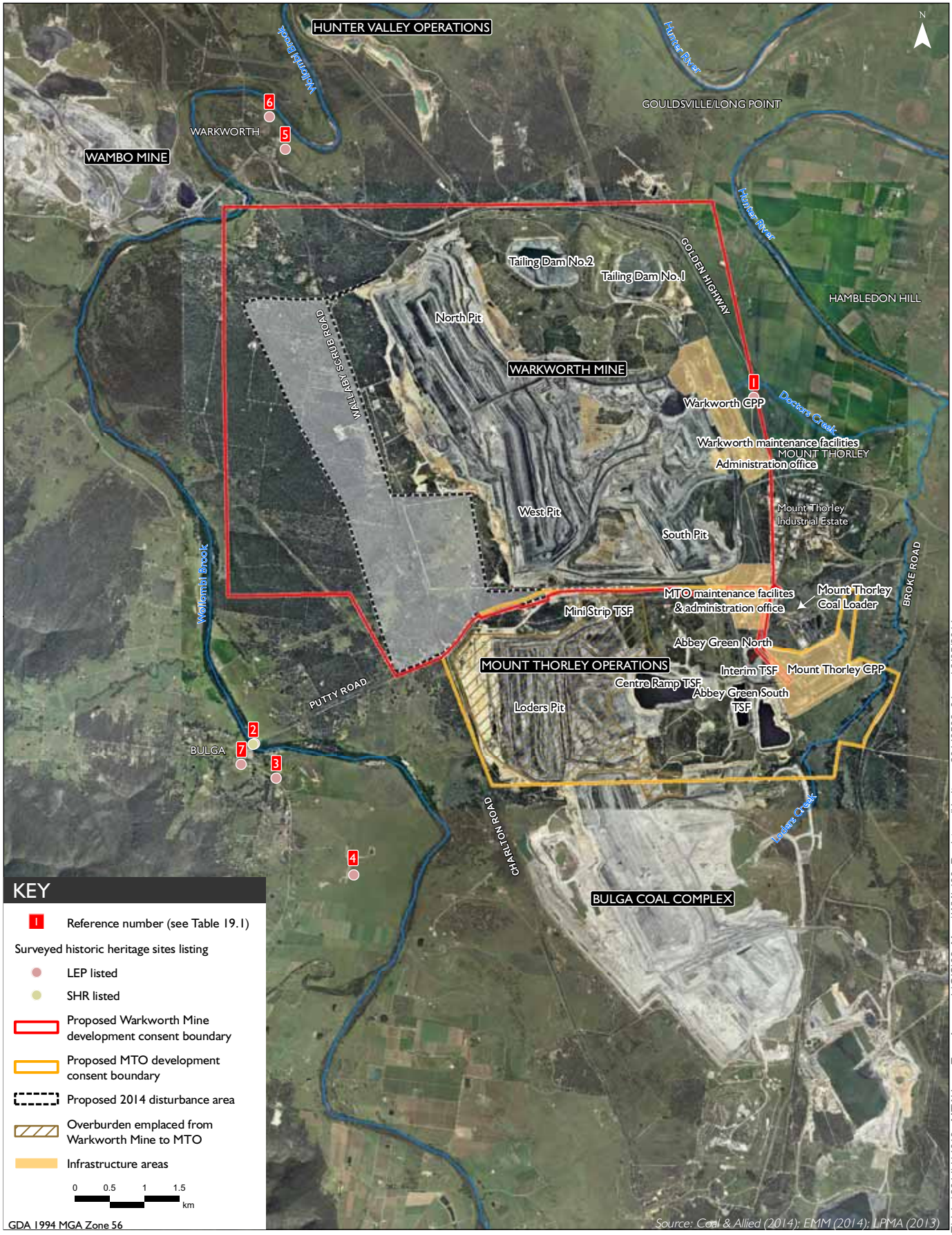
Field survey was undertaken from 3 to 7 March 2014 and comprised pedestrian survey of the former RAAF Base Bulga Complex and a targeted survey of identified potential historic features. A total of 50 historic features were recorded during the field survey (see Figure 19.2). This comprised the seven registered heritage items (as shown in Table 19.1), seven heritages features identified from a review of local historic heritage studies, contextual background research and community consultation, and 43 historic features solely identified during field survey.

Registered heritage items were re-surveyed to provide an up to date assessment of their condition. All buildings along Putty Road (from the mining area at MTO and Warkworth Mine to the Wollombi Brook) and Wallaby Scrub Road were recorded during the survey. Descriptions of historic features that fulfil local or state significance criteria are included in Tables 19.2 to 19.4. Descriptions of all the recorded historic features, including those that do not meet local or state significance criteria, are presented in Tables 4.3 to 4.6 of Appendix N.

19.2.4 Assessment of significance

All historic features recorded during the field survey (including registered items that were re-surveyed), were assessed against the following criteria established by the Heritage Office (NSW Heritage Office 2006) to determine whether they are of local or State significance:

- an item is important in the course, or pattern, of NSW's cultural or natural history;
- an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history;
- an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW;
- an item has strong or special association with a particular community or cultural group in NSW for social, cultural or spiritual reasons;
- an item has potential to yield information that would contribute to an understanding of NSW's cultural or natural history;
- an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history; and
- an item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places or cultural or natural environments.



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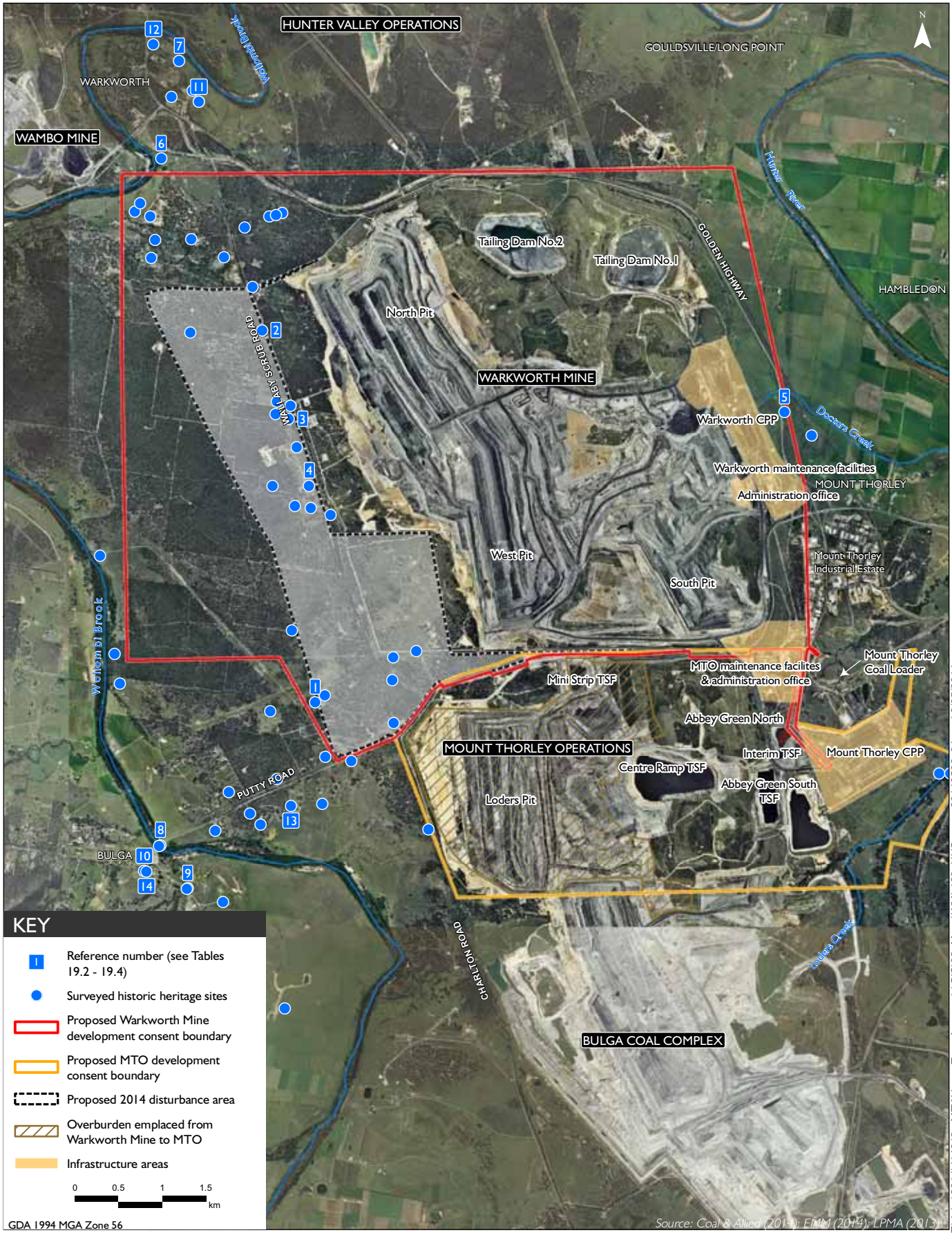
COAL & ALLIED

Registered heritage places
Warkworth Continuation 2014
Environmental Impact Statement
Figure 19.1



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Field Survey Results
Warkworth Continuation 2014
Environmental Impact Statement
Figure 19.2

Table 19.2 Assessment of heritage significance and impact assessment of all heritage features recorded during field survey within the proposed 2014 disturbance area

Heritage feature					Assessment of significance			Impact assessment	
Location on Figure 19.2	ID	Name	Location	Description	Significance		Summary of significance	Type of impact	Heritage impact significance
					Local	State			
1	RBHH-001	Former RAAF Base Bulga Complex	North-west of the Putty Road and Wallaby Scrub Road intersection. Very small portion of the eastern part of east-west runway falls within proposed 2014 disturbance area. No structures or structural remains associated with the former RAAF base are within the proposed extension area.	Remains of 1940s RAAF Base including runways, hideouts, Mess building and other associated infrastructure. The kitchen and mess was originally irregular in plan comprising a central kitchen area measuring 13.4 x 8.8m, with long rectangular mess halls to the east and west, connected by a servery on either side. The remnant structure today comprises the kitchen building and the foundation of one of the serveries. It is 'L' shaped in plan with brick and concrete footings. Overall the building is in poor condition with trees physically impacting on the building fabric, and some minor settlement issues resulting in cracking and failing brickwork. The western section of the building is the most intact part and retains the original timber frame, corrugated asbestos cement roof sheeting and walls clad with corrugated iron sheeting.	X	X	The former RAAF Base Bulga demonstrates the response to threat of attack from the Japanese during World War Two and has local historical significance for its establishment as an operational airfield for general reconnaissance for the Upper Hunter Valley region. The NSW Heritage Office thematic study furthermore recommends that all parent air bases be considered for inclusion on the state heritage register.	Partial direct impact (mining)	Minor
2	GNR-001	Great North Road Complex	Wallaby Scrub Road from the intersection with the Golden Highway in the north, across Putty Road and onto Charlton Road in the south. Alignment of road falls within proposed 2014 disturbance area.	General alignment and physical remnants of early road system. The existing road was observed to have been constructed with more recent road construction techniques, with a large extent of the study area undergoing major road and earth works over the last 40 years. These more recent road works appear to have been built on top of the original road alignment along most of the proposed 2014 disturbance area, potentially resulting in the demolition of the original road in a number of locations. Where the alignment and grading of the more recent road construction works have been	X	X	The Great North Road was the first of the 'Great Roads' to be established in Australia and was important in connecting Sydney and the Hunter Valley. The road was modelled on the 'Great Roads' of England and is significant in demonstrating an early convict road that resulted in opening up the Hunter Valley to trade and settlement. While not retaining as much physical evidence as other sections of the Great North Road, this section retains much of the original alignment and is historically significant at State level. The road has a special association with	Partial direct impact (mining)	Minor

Table 19.2 Assessment of heritage significance and impact assessment of all heritage features recorded during field survey within the proposed 2014 disturbance area

Heritage feature					Assessment of significance			Impact assessment	
Location on Figure 19.2	ID	Name	Location	Description	Significance		Summary of significance	Type of impact	Heritage impact significance
					Local	State			
				significantly elevated to create a more level and consistent road gradient, there is potential for original road pavement in the form of stone cobbles to remain in place underneath the newer sub grade.			Governor Darling who was responsible for the 'Great Roads' concept in Australia and assistant surveyor, Heneage Finch and Sir Thomas Mitchell who were responsible for surveying this section of road. While not much original fabric is thought to survive, much of the original road alignment has been retained in the modern Wallaby Scrub Road, therefore meeting threshold requirements for this criterion. A number of areas along the road have a degree of archaeological potential, and information yielded has the potential to contribute to knowledge of NSW history.		
3	MTW-020	P1 Huts #1	377 Wallaby Scrub Road.	Two P1 huts joined to form an 'L shaped' floorplan - 16m along main elevation, and 11m along southern elevation and 5.7m in width. Corrugated galvanised iron roof. Original timber windows have been replaced with aluminium and boarded up. Vents below each gable. Interior has been re-lined with plasterboard and forms a modern three bedroom, one bathroom house.	X		P style buildings in general are becoming increasingly rare, with less than 500 examples of P1 huts remaining in 2007 (Miller 2007), and many more anticipated to have been demolished as part of recent redevelopment projects across the Defence Estate. A number of examples appear to remain within the Singleton LGA. The building has some historical significance due to its association with the WWII era of the local area.	Direct (mining)	Moderate
4	MTW-023	P1 Huts #2	297 Wallaby Scrub Road.	Two P1 huts joined to form an 'L shaped' floorplan, and used as a residential property. Windows have been replaced with aluminium.	X		As per heritage feature 3.	Direct (mining)	Moderate

Table 19.3 Assessment of heritage significance and impact assessment of all heritage features recorded during field survey within study area but outside proposed 2014 disturbance area

Heritage feature					Assessment of significance			Impact assessment	
Location of Figure 19.2	ID	Name	Location	Description	Significance		Summary of Significance	Type of impact	Heritage impact
					Local	State			
5	I40	Brick Farm House	Golden Highway, Mount Thorley.	Single storey square in plan. Brick laid in Flemish bond. Hipped corrugated iron roof and bull nosed verandah to north, east and west elevations. Outbuildings to rear.	X		Local historical significance.	Potential impact through lack of maintenance.	Minor

Table 19.4 Assessment of heritage significance and impact assessment of all heritage features recorded during field survey outside study area

Heritage feature					Assessment of significance			Impact assessment	
Location of Figure 19.2	ID	Name	Location	Description	Significance		Summary of Significance	Type of impact	Heritage impact
					Local	State			
6	MTW-005	Springwood	South of Golden Highway, west of Wallaby Scrub Road and adjacent to Wollombi Brook.	Building located on rise on top of Wollombi Brook with outbuilding and yard remains to north of building towards Golden Highway. Dam is100m south-east. Slab construction, four roomed cottage with central hallway. Has a verandah to three sides and enclosed along eastern and western elevations. Weatherboards to front over slabs. Corrugated iron roof over timber shingles. Sandstone chimney in centre of house. Overall in good condition for age of building, but trees are physically impacting on structure, some damp in stone and stones dropping from fireplace.	X		Established south of Warkworth village in the mid nineteenth century, Springwood Estate was a well-known orchard associated with early pioneers, William Watts. The remnant homestead is representative of the types of dwellings constructed in regional areas during the nineteenth century, and remains in good condition, with slab construction, timber shingle roof and sandstone chimney remaining intact. The house and surrounding property has some research potential, which could contribute knowledge to the history of the local area.	Potential indirect impacts by blasting, lack of maintenance, and alteration of setting.	Minor

Table 19.4 Assessment of heritage significance and impact assessment of all heritage features recorded during field survey outside study area

Heritage feature					Assessment of significance			Impact assessment	
Location of Figure 19.2	ID	Name	Location	Description	Significance		Summary of Significance	Type of impact	Heritage impact
					Local	State			
7	A6	Former Queen Victoria Inn/Three Brothers Inn Ruins	High Street, Warkworth Village.	Site of the former Queen Victoria Inn/Three Brothers Inn. Brick and stone chimney with hard concrete mortar marks location of former inn. Timber lean-to is to the west.	X		Local historical and archaeological significance.	No impacts anticipated	Negligible
8	I8 SHR 01459	Bulga Bridge	Putty Road, Bulga.	The Bulga bridge is a Dare type timber truss bridge. It was constructed in 1912 and has had some recent strengthening works.	X	X	State historical, aesthetic and social significance, representativeness, rarity and research potential.	No impacts anticipated	Negligible
9	I10 R1330	Mount Leonard Public School	2099 Putty Road.	Single storey brick with verandah to front elevation. Galvanised iron roof with three chimneys. Number of alterations and additions including the front verandah, fibrous cement sheeting extension to the rear with aluminium windows.	X		Local historical significance.	No impacts anticipated	Negligible
10	I11	War Memorial Gates	19 The Inlet Road Bulga.	Two concrete and stone memorial posts, painted steel gates.	X		Local historical significance.	No impacts anticipated	Negligible
11	I143	St Phillips Church	Off High Street, Warkworth.	Early Victorian style stone and brick construction. Brick and render to three elevations and new corrugated metal roof. A number of cemeteries to the rear.	X		Local historical significance.	No impacts anticipated	Negligible
12	MTW-002	Warkworth Public School	High Street, Warkworth.	Single storey Victorian Gothic architectural style. Brick amenities block to rear of building. Sign at front reads 'Warkworth Public School 1859'.	X		Warkworth Public School was constructed c1859, and has historical significance and special association with the community for its continued use as a school for over a century.	No impacts anticipated	Negligible

Table 19.4 Assessment of heritage significance and impact assessment of all heritage features recorded during field survey outside study area

Heritage feature					Assessment of significance			Impact assessment	
Location of Figure 19.2	ID	Name	Location	Description	Significance		Summary of Significance	Type of impact	Heritage impact
					Local	State			
13	MTW-037	P1 Huts #3	1855 Putty Road.	Three P1 huts including one used for residence, one with original features to rear, and a portion of one used as a shed to the east.	X		P style buildings in general are becoming increasingly rare, with less than 500 examples of P1 huts remaining in 2007 (Miller 2007), and many more anticipated to have been demolished as part of recent redevelopment projects across the Defence Estate. A number of examples appear to remain within the Singleton LGA. The building has some historical significance due to its association with the WWII era of the local area.	No impacts anticipated	Negligible
14	MTW-047	Post Rail Fence	Inlet Road, Bulga.	Remnant two rail post and rail fence, provenanced to the former Police Station Paddock at Bulga.	X		The post and rail fence has local historical significance for its association with the Bulga Police Station. Its retention and commemoration with a plaque shows its importance within the local community.	No impacts anticipated	Negligible

Tables 19.2 to 19.4 show that, within the study area, there are three historic features with local heritage significance and two historic features with State heritage significance. Of these five features, four are within the proposed 2014 disturbance area: two of local significance, and two of State significance.

The significance of all historic features, including those that do not meet local or state significance criteria, are presented in Tables 5.1 to 5.4 of Appendix N.

19.3 Impact assessment

Four historic features identified within the proposed 2014 disturbance area would be directly (or partially) impacted by mining activities. Other historic features within and in close proximity to the study area may experience indirect impacts associated with activities such as exploration and blasting.

The potential impacts on the identified historic features were assessed with reference to their level of significance evaluated against the magnitude of the potential impacts on the item. Impacts were then described as negligible, minor, moderate or major. The evaluation matrix is in Table 6.1 of the historic heritage study (see Appendix N). The results of the assessment of impact on each identified historic feature can be seen in Tables 19.2 to 19.4.

The results show that within the proposed 2014 disturbance, there are two non-registered state significant heritage features; the Former RAAF Base Bulga Complex and Great North Road Complex, and two non-registered local significant features; P1 Huts #1 and P1 Huts #2.

The study found that while small portions of the Former RAAF Base Bulga Complex and Great North Road Complex would be impacted by the proposal, heritage impacts are likely to be minor. Impacts on the P1 Huts are likely to be moderate as these style huts are becoming rare with less than 500 examples remaining in 2007 (Miller 2007).

Within the study area (but outside the proposed 2014 disturbance area) there is one local significant feature, the Brick Farm House. The Brick Farm House is listed as a registered heritage item or place. The study found that impacts on the Brick Farm House are likely to be minor, but generally only due to a lack of maintenance, and unrelated to the proposal.

Impacts on historic features outside of the study area were considered to be negligible for all features except one feature, Springwood, where the impact is likely to be minor. Impacts on Springwood are also only due to a lack of maintenance, and unrelated to the proposal.

19.4 Management and monitoring

Where impacts on historic heritage sites and places are unavoidable, mitigation measures would be undertaken in accordance with their heritage value. Accordingly, a range of mitigation measures would be implemented for the heritage features identified during background review, research, consultation and field survey based on their heritage value. These mitigation measures are detailed in Tables 7.1 to 7.5 of the historic heritage study (see Appendix N) and summarised below.

19.4.1 Conservation management plans

Preparation of CMPs has been undertaken for a portion of the Great North Road Complex, former RAAF Base Bulga Complex and the Brick Farm House. These documents were developed in accordance with industry best practice with consideration given to the full available range of reasonable and feasible mitigation and their effectiveness, inclusive of contingency plans to manage any residual risks, for implementation. Recommendations within these plans would be implemented to ensure the heritage values of these places are maintained and conserved.

Due to its level of significance, Coal & Allied would also prepare a CMP for Springwood Homestead.

19.4.2 Archaeological investigations

Archaeological excavations would be undertaken at the following locations to assist in contributing to the historical record and aiding in interpretation of the place:

- test pitting along locations of Wallaby Scrub Road where there is potential for subsurface remains associated with the early road system; and
- mechanical excavation and recording of Well #2.

19.4.3 Salvage of moveable heritage items

The Singleton Local Historical Society and Museum would be approached to determine their interest in any items of moveable heritage within the study area. The clean-up of dumps would be monitored by an archaeologist and any items of heritage interest including machinery, bottles or other moveable heritage considered appropriate for a museum collection would be salvaged and provided to the Museum, or another interested community group.

19.4.4 Chance procedure

While the study area has been comprehensively surveyed for potential historic heritage features, sites of potential historic heritage value may be encountered or uncovered unexpectedly during clean-up or construction activities. These finds may include (but are not limited to) structural ruins, wells, bottle dumps or grave sites.

A Chance Finds Procedure would be implemented to assist in the process for identifying and reporting such places.

19.4.5 Heritage interpretation

The history of the former RAAF Base Bulga Complex and the Great North Road Complex in the Upper Hunter region is not widely published or known. Coal & Allied, in collaboration with local community groups, would implement an interpretation programme to ensure the historic heritage values of the study area are adequately captured.

19.4.6 Community participation

Coal & Allied would conduct ongoing community engagement and consultation on historic heritage through the CHAG which is comprised of community representatives with particular knowledge and interests in historic heritage of the region, including representatives from historical groups, individuals and local government.

In response to community engagement and consultation through the CHAG, Coal & Allied proposes to implement a Local Community Historic Heritage Conservation Initiative the key element of which is to establish two historic heritage funds – the Mount Thorley Warkworth Historic Heritage Conservation Fund and the Great Northern Road Conservation Fund.

19.5 Conclusions

The historic heritage study identified a total of 14 sites within the study area, through methods including database searches, research, consultation and field surveys. There are no registered heritage items in the proposed 2014 disturbance area.

The field survey within and adjacent to the study area recorded 50 historic features. This is included seven listed heritage sites that were re-surveyed to provide an up to date assessment of their condition.

The study has identified four non-registered historic features within the proposed 2014 disturbance area, two with state significant heritage features (the Former RAAF Base Bulga Complex and Great North Road Complex) and two with local significant features (P1 Huts #1 and P1 Huts #2). While small portions of the Former RAAF Base Bulga Complex and Great North Road Complex would be impacted by the proposal, heritage impacts are likely to be minor. The former RAAF Base Bulga Complex and the Great North Road Complex have been subject to comprehensive assessment, and CMPs have been prepared for both. The former RAAF Base Bulga Complex has also been subject to archival recording in accordance with NSW Heritage Office guidelines.

The study found that impacts on the P1 Huts are likely to be moderate, as these style huts are becoming rare, with less than 500 examples remaining in 2007 (Miller 2007).

Within the study area, but outside of the proposed 2014 disturbance area, there are no state significant heritage features and one local significant feature; the Brick Farm House that would not be directly impacted by the proposal.

The study found that subject to the implementation of the mitigation measures, potential heritage impacts within the study area are likely to be low.

Chapter 20

Traffic and transport

Chapter 20 — Traffic and transport

20 Traffic and transport

20.1 Introduction

This chapter provides a summary of the traffic and transport study for the proposal prepared by EMM, which is presented in full in Appendix O.

The chapter describes the existing transport network and summarises the potential impacts of the predicted traffic generation associated with the proposal on the capacity and performance of the road and rail networks. It also includes a summary of the impacts of the proposed closure of Wallaby Scrub Road and management measures to address these impacts.

The Warkworth Mine and MTO workforces and coal transport are integrated across MTW. Therefore, the study considered the traffic and transport impacts due to the subject proposal and the Mount Thorley Operations 2014 proposal. The structure of the study is based on the *Guide to Traffic Generating Development* (RTA 2002), which is the standard template for the preparation of traffic impact studies for major projects in NSW.

20.2 Existing environment

20.2.1 Local road network and site access

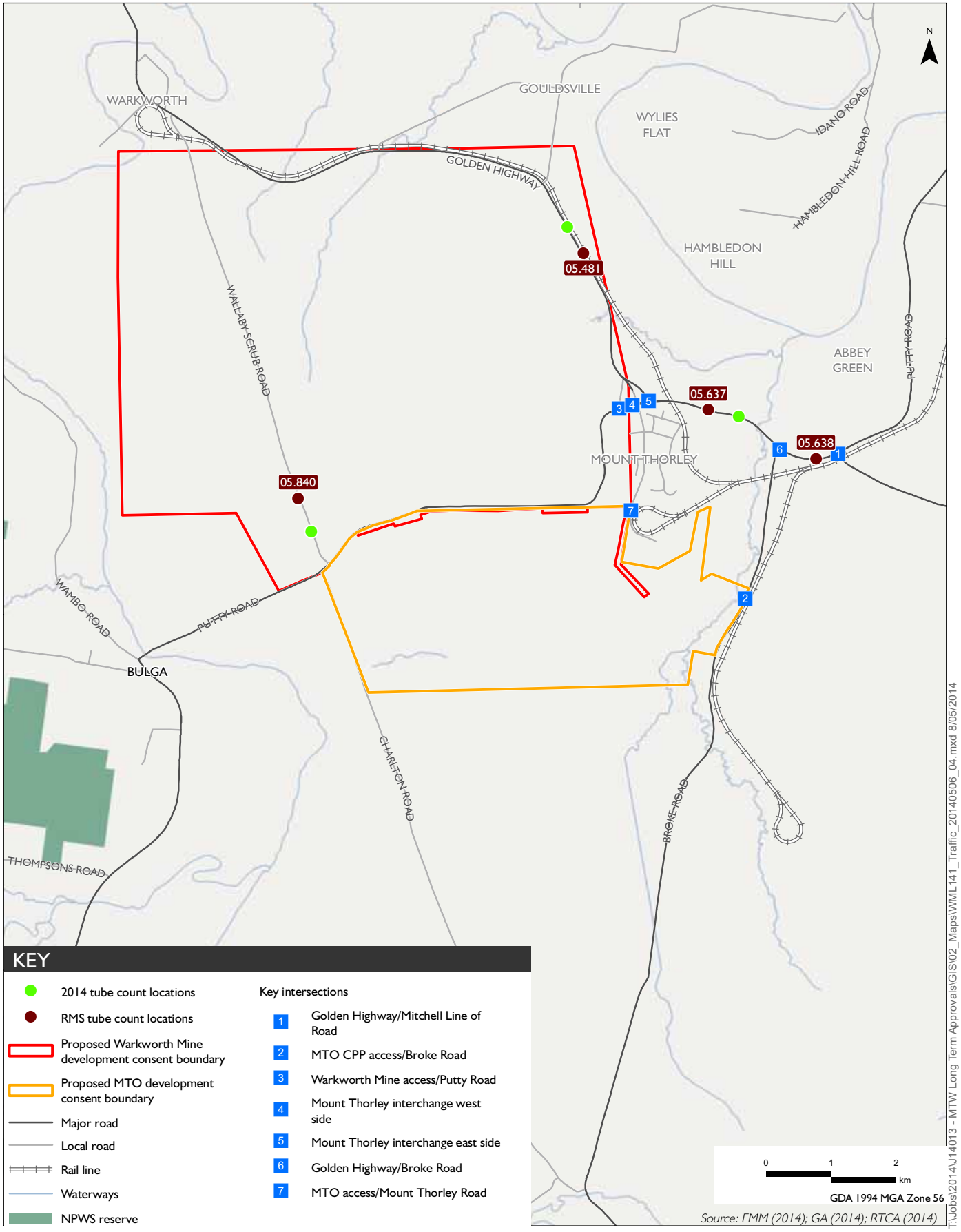
The study considered impacts on the regional and local road network, including the Golden Highway, Putty Road, Wallaby Scrub Road, Charlton Road and Broke Road. The road network in the vicinity of the Site is shown in Figure 20.1.

The Golden Highway, east of Mount Thorley, is the primary route for most MTW generated traffic. Approximately 80 per cent of the existing MTW workforce resides east of the Site and travel via the Golden Highway and Putty Road or Mitchell Line of Road routes which connect to Singleton and other Hunter Valley townships. The remainder of the existing MTW workforce travels from either the west via Putty Road, the north via the Golden Highway, or the south via Broke Road with proportions of approximately 7 per cent, 8 per cent and 5 per cent, respectively.

The main vehicular access to the mine facilities are via three intersections, namely:

- Warkworth Mine access/Putty Road at Lydes Lane, approximately 200m west of the Mount Thorley Interchange (west side);
- MTO CPP access/Broke Road, approximately 2km south of the Golden Highway; and
- MTO access/Mount Thorley Road, at the southern end near the location of the MTCL rail loop.

These intersections are shown in Figure 20.1 as Intersections 3, 2 and 7, respectively.



COAL & ALLIED

Local road network and survey locations

Warkworth Continuation 2014
Environmental Impact Statement

Figure 20.1

20.2.2 Current traffic volumes

i Daily traffic volumes

Daily traffic volume surveys for the study were undertaken by EMM in March 2014 at the locations shown in Figure 20.1 (see 2014 tube count locations). Other daily traffic volume surveys include Roads and Traffic Authority (RTA), now RMS, surveys between the years 1980 and 2004 and recent surveys undertaken in 2009 for the Warkworth Extension 2010 (Parsons Brinckerhoff 2010) and in 2011 for the Bulga Optimisation Project (ARC *et al*. 2013).

The historic growth trends and future growth projections for the daily traffic volumes on the local road network to the year 2017 have been determined from these surveys, as summarised in Table 20.1.

It is noted that the Hunter Expressway was opened on 22 March 2014. Over time, the Expressway will likely generate changes to regional traffic patterns. Though these cannot be definitively quantified at this time, it is noted that the Expressway provides a more direct, faster and safer option than has existed to this point, to link the Upper Hunter and the M1 Motorway, and that this option will be available to drivers currently using Wallaby Scrub Road and Charlton Road.

ii Peak hour traffic volumes

Peak hour intersection traffic counts were undertaken by EMM on Tuesday 4 March 2014 at three intersections:

- Golden Highway/Mitchell Line of Road (Intersection 1 in Figure 20.1);
- MTO CPP access/Broke Road (Intersection 2 in Figure 20.1); and
- Warkworth Mine access/Putty Road (Intersection 3 in Figure 20.1).

The results of the intersection traffic counts, including peak hourly traffic volumes and the proportions of heavy vehicles, are summarised in Tables 20.2 to 20.4 for the three intersections surveyed.

Table 20.1 Summary of base daily traffic volumes from surveys on the regional road network

RTA-RMS location ref[1]	Route and nearest cross street	Year 1984	Year 1998	Year 2001	Year 2002	Year 2004	Year 2009	Year 2011	Year 2014	Per cent annual traffic growth between the 1984 or 1998 and 2004 RTA surveys	Future trend volume in Year 2017[2]
05.481	Golden Highway (north of Putty Road at Mount Thorley)	4,200	6,256	7,059	-	5,572	-	-	3,314	-	3,512[3]
05.637	Golden Highway (between Broke Road and Mount Thorley)	5,180	-	-	-	-	-	-	8,346	+1.2%	8,847
05.638	Golden Highway (between Broke Road and Mitchell Line of Road)	5,160	7,164	7,966	-	8,143	-	9,355	9,860[4]	+1.7%	10,452
05.840	Wallaby Scrub Road (between Golden Highway and Putty Road	-	-	-	660	-	777	-	875	+2.0%	928

Note: 1. RTA-RMS locations shown in Figure 20.1.

2. The traffic growth projection is calculated from the current base year 2014 to the year 2017, using a linear traffic growth projection at +2 per cent annually (the highest rate observed from the traffic surveys in previous years).

3. The +2 per cent per annum future traffic growth projection is still assumed to apply to this route despite negative actual growth in recent years (since 2001).

4. The year 2014 daily traffic volume has been estimated from comparison of the Golden Highway peak hourly traffic flows east and west of the Broke Road intersection.

Sources: RMS, PB (2010), ARC (2013) and EMM (2014).

Table 20.2 Summary of peak hourly traffic at Golden Highway/Mitchell Line of Road intersection

Road	Direction	Morning peak hour			Afternoon peak hour		
		All traffic	Heavy vehicles	Percentage heavy*	All traffic	Heavy vehicles	Percentage heavy*
Mitchell Line of Road (south of Golden Highway)	N'bound	537	28	5%	73	14	8%
	S'bound	172	10		338	20	
Golden Highway (west of Mitchell Line of Road)	E'bound	328	17	5%	704	31	7%
	W'bound	944	42		212	32	
Golden Highway (east of Mitchell Line of Road)	E'bound	172	7	4%	384	11	5%
	W'bound	423	14		157	18	

*Note: * Percentage heavy vehicle traffic is the average proportion based on the traffic flow in both directions.*

Table 20.3 Summary of peak hourly traffic at MTO CPP access/Broke Road intersection

Road	Direction	Morning peak hour			Afternoon peak hour		
		All traffic	Heavy vehicles	Percentage heavy*	All traffic	Heavy vehicles	Percentage heavy*
MTO CPP access (west of Broke Road)	E'bound	2	0	0%	22	0	0%
	W'bound	12	0		0	0	
Broke Road (south of MTO CPP access)	N'bound	123	5	4%	140	5	5%
	S'bound	246	11		100	6	
Broke Road (north of MTO CPP access)	N'bound	123	5	4%	159	5	4%
	S'bound	256	11		97	6	

*Note: * Percentage heavy vehicle traffic is the average proportion based on the traffic flow in both directions.*

Table 20.4 Summary of peak hourly traffic at Warkworth Mine access/Putty Road intersection

Road	Direction	Morning peak hour			Afternoon peak hour		
		All traffic	Heavy vehicles	Percentage heavy*	All traffic	Heavy vehicles	Percentage heavy*
Warkworth Mine access (north of Putty Road)	N'bound	101	4	2%	8	0	4%
	S'bound	111	0		73	3	
Putty Road (west of Warkworth Mine access)	E'bound	38	2	4%	31	1	8%
	W'bound	12	0		48	5	
Putty Road (east of Warkworth Mine access)	E'bound	139	1	2%	102	4	6%
	W'bound	103	3		54	5	

*Note: * Percentage heavy vehicle traffic is the average proportion based on the traffic flow in both directions.*

20.2.3 Intersection performance

The performance of a road network is generally reflected in the performance of key intersections. The Signalised (and Unsignalised) Intersection Design Research Aid (SIDRA) traffic analysis programme was used to assess the existing and future traffic capacity at the following intersections with the potential to be impacted by the proposal:

- Warkworth Mine access/Putty Road;
- MTO CPP access/Broke Road;
- Golden Highway/Broke Road; and
- Golden Highway/Mitchell Line of Road.

The peak hour traffic performance of intersections is quantified in terms of 'level of service' and 'degree of saturation'. Level of service is an index of the operation of traffic at an intersection and is based on the average delay per vehicle. The current RMS intersection operation standards for level of service are summarised in Table 20.5.

Table 20.5 Intersection level of service standards

Level of service	Average delay (seconds per vehicle)	Traffic signals, roundabout	Priority intersection ('Stop' and 'Give Way')
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity At signals, incidents will cause excessive delays. Roundabouts require other control mode	At capacity; requires other control mode
F	Greater than 71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; requires other control mode

Source: Guide to Traffic Generating Development (RTA 2002).

Degree of saturation provides an overall measure of the capability of the intersection to accommodate the traffic levels. A degree of saturation of 1.0 indicates that an intersection is operating at capacity. A satisfactory degree of saturation is considered to be 0.90 or lower at traffic signal controlled intersections and 0.80 or lower at other intersections.

The SIDRA analysis results for the current intersection performance during the morning and afternoon peak hour periods are summarised in Table 20.6.

Table 20.6 Peak hour SIDRA performance at key intersections (including current mine traffic)

Intersection	Peak hour period	Degree of saturation	Average delay (seconds/vehicle)	Level of service
Golden Highway/Mitchell Line of Road	Morning	0.700	20.6	B
	Afternoon	0.270	19.0	B
Golden Highway/Broke Road*	Morning	0.386	31.6	C
	Afternoon	0.369	16.5	B
MTO CPP access/Broke Road	Morning	0.138	12.5	A
	Afternoon	0.074	12.5	A
Warkworth Mine access/Putty Road	Morning	0.093	12.9	A
	Afternoon	0.063	13.0	A

Note ** The current peak hour intersection traffic volumes have been determined from volumes at the two adjoining intersections.*

The intersections assessed are currently operating at acceptable conditions, with minimal traffic delays at most locations. The Golden Highway/Broke Road intersection is operating at satisfactory conditions (level of service C) during the morning peak hour. The highest degree of saturation occurs at the Golden Highway/Mitchell Line of Road intersection and is associated with the westbound left turn movement from Mitchell Line of Road during the morning peak hour. At the Golden Highway/Broke Road intersection, although the degree of saturation is lower, the right turn traffic delays are higher at over 30 seconds per vehicle.

20.2.4 Mine traffic generation

i Car and other light vehicle traffic

The workforce at MTW is approximately 1,300 persons of whom approximately 25 per cent are office/business employees, 65 per cent are day or night shift operations workforce and 10 per cent are contractors.

The majority of the workforce is based at Warkworth Mine where 80 per cent of the combined mining workforce facilities and car parking activity is located. Workforce numbers are greatest during the daytime when day shift and office/business staff are present.

The combined estimated maximum number of employees and contractors travelling to and from work at MTW on any given day (or 24 hour period) is 878 persons (comprised of 423 day/night shift operations staff, 50 office/business staff and 30 contractors). The potential daily car traffic movements generated by this workforce is a maximum of 1,756.

ii Heavy vehicle traffic

The external road transport of mining supplies and other consumables for the mine operations and maintenance activities, generally represent approximately 40 truck and other service vehicle deliveries (80 movements) each weekday, mainly using delivery routes between the mines and either Singleton, Maitland or Newcastle.

20.2.5 Road safety

Intersection traffic safety and sight distances were observed by EMM on 20 March 2014. The intersection traffic safety and sight distances are considered good at all the intersections potentially affected by the proposal.

The high design standard of the Golden Highway in the vicinity of Mount Thorley (with marked centre lines and sealed shoulders on all sections) provides a comparatively higher standard of travel safety for traffic using this route in comparison to other roads in the area; for example, Wallaby Scrub Road, Charlton Road, Broke Road and Putty Road.

20.2.6 Internal road network

Extensive internal coal haulage is undertaken using the internal private roads within MTW which transport ROM coal to CPP facilities and also transfer overburden material within and between Warkworth Mine and MTO.

Two private road crossings of Putty Road already exist for these movements and the proposal provides for an optional underpass beneath Putty Road, in place of a third approved, but yet to be constructed, bridge crossing.

20.2.7 Existing rail conditions

The product coal transport operations for the proposal utilise rail transport for export via the Port of Newcastle using the MTW (Whittingham) branch line. The location of the Whittingham branch line in relation to the overall Hunter Valley rail network used for coal transport is shown in Figure 20.2.

On the Whittingham branch line there are three coal loading loops which serve MTW, Bulga Coal Complex, and Wambo Mine. At MTW there are two coal loading points (MTCL 1 and MTCL 2) which serve the Warkworth CPP and MTO CPP conveyor loading systems. An additional coal loading loop on the Whittingham branch line at Hunter Valley Operations South has also been approved but is not yet constructed.

The capacity of the existing Whittingham branch line (which is single track) is generally adequate for the current usage (ARTC 2013). The primary future constraint to this rail line capacity is generally the availability of coal train paths where the Whittingham branch junction meets with the Hunter Valley main line, to the south of Singleton. The railway junction capacity has recently been improved by the completion of the third track at Minimbah Bank.

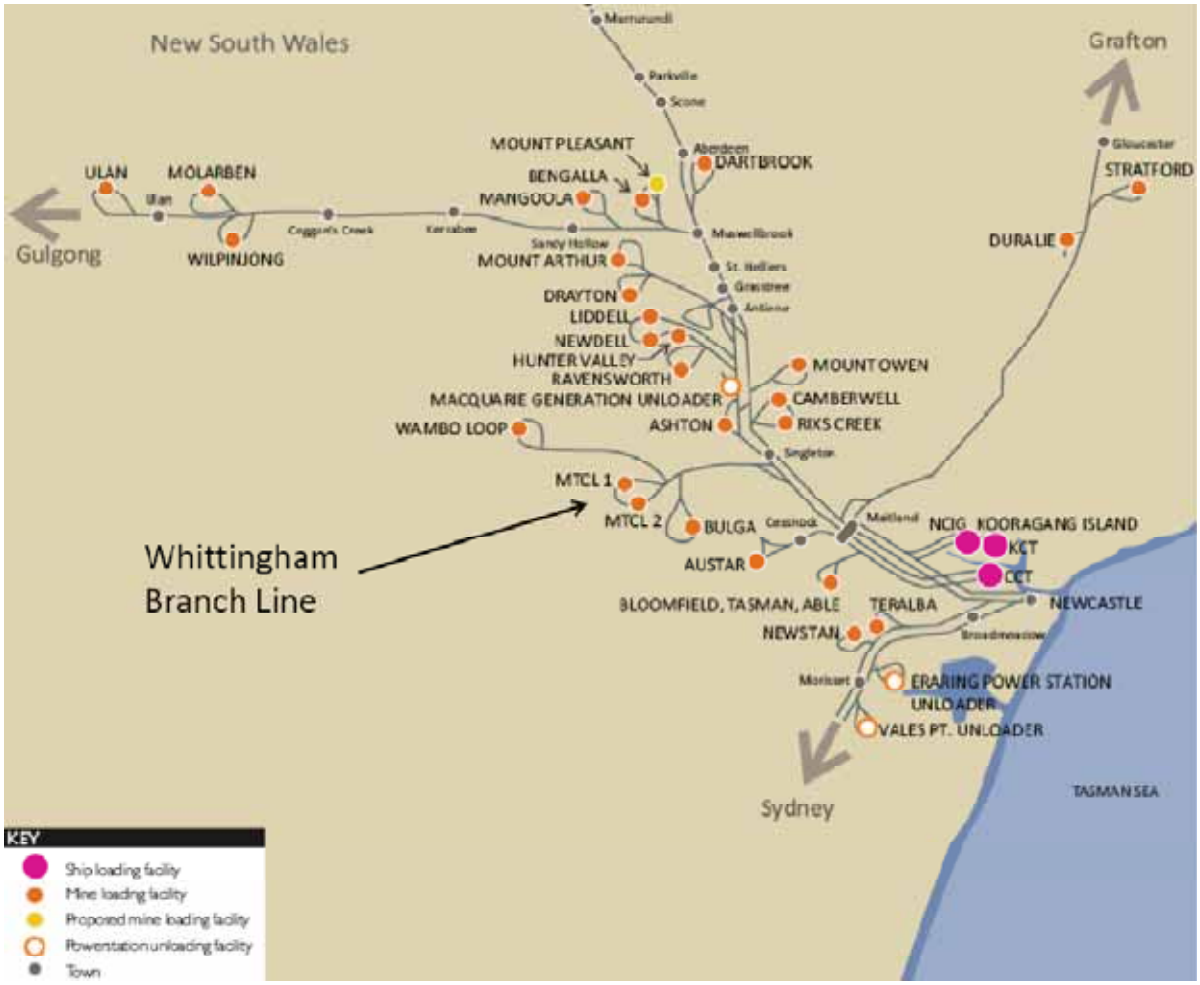


Figure 20.2 Hunter Valley rail network

20.3 Impact assessment

20.3.1 Proposal related traffic and transport

Average employee traffic generated by Warkworth Mine and MTO on external public roads would not change under the proposal as there would be no changes to the combined project workforces. With the substantial shift workforce numbers, the typical maximum number of persons travelling to and from MTW each weekday is approximately 878.

Approximately 80 daily truck movements are currently generated on public roads by MTW operations (40 truck deliveries each day for maintenance and other activities). This truck traffic would also remain at generally similar levels in future years.

The volumes and methods of product coal transported from the mines by rail would remain as per the current operations.

Traffic generation associated with construction activities, including contractor vehicles and truck traffic, are considered part of MTW's normal operational traffic movements, similar to those which are occurring currently.

20.3.2 Road network impacts

i Methodology

The background information review included the previous traffic impact assessments and road safety investigations undertaken by Parsons Brinkerhoff in 2010 for the Warkworth Extension 2010, and the Bulga Optimisation Project (ARC *et al*. 2013). This background information was supplemented with the data obtained from surveys undertaken within the local road network described in Section 20.2. To enable a thorough and detailed assessment analyses were undertaken for three future traffic scenarios.

- Scenario 1 – Year 2017 traffic situation including base network traffic growth at +2 per cent per annum.
- Scenario 2 – Year 2017 traffic situation including base network traffic growth at +2 per cent per annum and the detoured traffic from the proposed closure of Wallaby Scrub Road at relevant intersections (for example this traffic does not affect the Golden Highway/Mitchell Line of Road intersection).
- Scenario 3 – Year 2017 traffic situation including base network traffic growth at +2 per cent per annum, the detoured traffic from the proposed closure of Wallaby Scrub Road, and the Bulga Optimisation Project year 2017 construction traffic movements from a workforce of 25 persons at relevant intersections (for example this traffic does not affect the Warkworth Mine access/Putty Road intersection).

The year 2017 traffic conditions were assessed as this year represents the first full year of operations, following the proposed closure of Wallaby Scrub Road. The predicted future background traffic growth to the year 2017 is assessed at +2 per cent per annum, which corresponds to the higher end of the range of recent recorded traffic growth rates on the major road network shown in Table 20.1. Beyond the year 2017, the future traffic growth rates for Wallaby Scrub Road and other traffic routes are not able to be reliably forecast as a result of future regional traffic changes from the opening of the Hunter Expressway.

ii External traffic movements

a. Traffic impacts on road networks

The road network traffic impacts of the proposal are quantified in Table 20.7 in terms of the typical percentage contribution of MTW generated traffic towards the current (2014) total daily vehicle traffic movements, at locations on the external roads potentially affected by the proposal.

Table 20.7 Proportional impact of MTW generated traffic on external roads

Road location	Current daily traffic volume (2014)	Daily traffic movements generated by MTW	Proportion of current daily traffic volume generated by MTW
Golden Highway (north of Putty Road at Mount Thorley)	3,314	128	3.8%
Golden Highway (between Broke Road and Mount Thorley)	8,346	1,561	18.7%
Golden Highway (between Broke Road and Mitchell Line of Road)	9,860*	1,469	14.9%
Mitchell Line of Road (south of the Golden Highway and Putty Road)	5,958*	698	11.7%

Table 20.7 Proportional impact of MTW generated traffic on external roads

Road location	Current daily traffic volume (2014)	Daily traffic movements generated by MTW	Proportion of current daily traffic volume generated by MTW
Broke Road (south of the MTO CPP access intersection)	3,240*	9w	2.8%
Putty Road (west of the Warkworth Mine access towards Bulga Village)	686*	147	21.4%

Notes: **2014 daily traffic volumes estimated from comparisons of peak hourly intersection traffic volumes with the EMM 2014 surveyed peak hourly and daily traffic volumes.*

On most major roads in the locality, the current MTW daily traffic movements shown in Table 20.7 represent between 11 to 22 per cent of the total daily traffic movements. On other roads, such as Broke Road and the Golden Highway route north of Mount Thorley, MTW has a lesser effect on existing traffic flows, representing only 3 to 4 per cent of the total daily traffic movements currently.

The effects of heavy vehicle traffic movements represent between 4 and 5 per cent of the total MTW generated daily traffic, which is not disproportionate with other current traffic sources.

It is noted that the road and intersection traffic surveys for the study were undertaken shortly before the Hunter Expressway opened on 22 March 2014. The Expressway may reduce the future regional through traffic usage of routes such as Wallaby Scrub Road and Charlton Road, by providing a faster and safer route for the longer distance traffic travelling between Sydney and some Upper Hunter locations.

b. Traffic impact at intersections

The future (year 2017) peak hour traffic operations at the intersections potentially affected by the proposal have been analysed using the SIDRA intersection model for the three future traffic scenarios described above. The results for the future traffic scenarios are summarised in comparison to the current year 2014 intersection analysis results in Table 20.8.

Table 20.8 Summary of year 2017 peak hour performance at intersections

Intersection	Peak hour period	SIDRA parameter	Base year (2014)	Future traffic scenario 1	Future traffic scenario 2	Future traffic scenario 3
Golden Highway/ Mitchell Line of Road	Morning	Dos	0.700	0.766	0.766	0.781
		Delay	20.6	22.5	22.5	23.1
		Los	B	B	B	B
	Afternoon	Dos	0.270	0.289	0.289	0.296
		Delay	19.0	19.5	19.5	19.7
		Los	B	B	B	B
Golden Highway/Broke Road	Morning	Dos	0.386	0.409	0.409	0.409
		Delay	31.6	34.1	34.6	34.9
		Los	C	C	C	C
	Afternoon	Dos	0.369	0.397	0.412	0.448
		Delay	16.5	17.1	18.2	18.5
		Los	B	B	B	B

Table 20.8 Summary of year 2017 peak hour performance at intersections

Intersection	Peak hour period	SIDRA parameter	Base year (2014)	Future traffic scenario 1	Future traffic scenario 2	Future traffic scenario 3
MTO CPP access/Broke Road	Morning	Dos	0.138	0.145	0.150	0.156
		Delay	12.5	13.4	13.6	13.6
		Los	A	A	A	A
	Afternoon	Dos	0.074	0.078	0.086	0.093
		Delay	12.5	13.2	13.3	13.3
		Los	A	A	A	A
Warkworth Mine access/Putty Road	Morning	Dos	0.093	0.093	0095	0.095
		Delay	12.9	12.9	12.9	12.9
		Los	A	A	A	A
	Afternoon	Dos	0.063	0.063	0.063	0.063
		Delay	13.0	13.0	13.0	13.0
		Los	A	A	A	A

Notes: *Dos = degree of saturation*
Delay = average delay (seconds per vehicle)
Los = level of service

At the Warkworth Mine access/Putty Road and MTO CPP access/Broke Road intersections there would be no change to the level of service with the future (year 2017) intersection operations. The peak hour traffic delays at these intersections would increase marginally under the future traffic scenarios considered.

At the Golden Highway/Mitchell Line of Road intersection, the level of service and the future intersection traffic delays are also not generally affected under the scenarios considered with only a marginal increase in the average intersection traffic delays during the morning peak period. However, the degree of saturation for the left turn movements from Mitchell Line of Road would increase from 0.7 to a maximum of 0.781. This degree of saturation is indicative of a developing traffic capacity constraint at this intersection in the longer term beyond 2017, but still within acceptable standards.

At the Golden Highway/Broke Road intersection, the level of service and intersection traffic delays are not generally affected under the scenarios considered though, in the afternoon peak period, there would be a minor increase in the average intersection delays. There would continue to be spare traffic capacity for the right turn movements from Broke Road at this intersection, which would accommodate any additional future traffic growth in the longer term, beyond 2017.

iii Impacts of the Wallaby Scrub Road traffic detour

The proposed closure of Wallaby Scrub Road would divert its existing traffic to use alternative routes via either the Golden Highway and Putty Road or the Golden Highway and Broke Road (see Figure 20.3). These routes are the Golden Highway and Broke Road for vehicles travelling north/south using both Charlton Road and Wallaby Scrub Road, and Putty Road and the Golden Highway for vehicles travelling east/west using Wallaby Scrub Road.

The existing traffic movements, which are primarily from the Charlton Road direction travelling to and from the south, were identified in previous traffic studies (Parsons Brinckerhoff 2010) as approximately 557 vehicle movements during a 12 hour period and 777 vehicle movements daily, by means of an origin-destination (OD) traffic survey and tube traffic count.

These surveys were repeated for the study to update and further investigate the local and regional characteristics of traffic using Wallaby Scrub Road.

A detailed comparison of the traffic distribution results from this traffic survey, compared to the previous OD traffic survey (Parsons Brinckerhoff 2010), is provided in Table 20.9.

Table 20.9 Comparison of Wallaby Scrub Road 2010 and 2014 OD traffic survey results

Direction	Route	2010 Survey traffic		2014 Survey traffic	
		vehicles	%	vehicles	%
Southbound	To Charlton Road	223	76.6	168	63.2
	To Wallaby Scrub Road (local)	0	0	36	13.5
	To Putty Road (east)	14	4.8	8[1]	3[1]
	To Putty Road (Bulga)	16	5.5	54[2]	20.3[2]
	To Putty Road (south of Bulga)	38	13.1		
	Total vehicles	*291*	*100*	*266*	*100*
Northbound	From Charlton Road	202	75.9	215	67.6
	From Wallaby Scrub Road (local)	0	0	5	1.6
	From Putty Road (east)	0	0	17[1]	5.3[1]
	To Putty Road (Bulga)	29	10.9	81[2]	25.5[2]
	To Putty Road (south of Bulga)	35	13.2		
	Total vehicles	*266*	*100*	*318*	*100*
Combined	Charlton Road	425	76.3	383	65.6
to/from	Wallaby Scrub Road (local)	0	0	41	7
	Putty Road (east)	14	2.5	25[1]	4.3[1]
	Putty Road (Bulga)	45	8.1	135[2]	23.1[2]
	Putty Road (south of Bulga)	73	13.1		
	Total vehicles	*557*	*100*	*584*	*100*

Notes: 1. Also includes traffic travelling on Charlton Road which does not continue to the southern end.

2. Includes traffic travelling from Bulga village and from other locations further to the south.

As some of the traffic survey locations were different for the two surveys, the results are not directly comparable at all locations. Notwithstanding this, the most recent (2014) survey results generally confirmed the key findings of the earlier OD survey from 2010, which identified the major traffic proportions using Wallaby Scrub Road were approximately 60 to 70 per cent from Charlton Road (south end) and 20 to 25 per cent from Putty Road (west, for Bulga village and areas to its south).

The actual traffic volumes using Wallaby Scrub Road from the Charlton Road direction decreased between the 2010 and 2014 surveys, which has increased slightly the proportional significance of the traffic from Bulga village and the south. It is considered that the future traffic proportions travelling from Charlton Road would continue to decline with increasing use of the Hunter Expressway route. However, the actual extent of this traffic reduction is not able to be forecast currently.

a. Traffic impacts on the road network

The daily traffic increases which would occur on the alternative traffic detour routes following the closure of Wallaby Scrub Road are summarised in Table 20.10. There would be proportional traffic increases of up to 20 to 30 per cent on some of these roads. However, the increases would be small in comparison to the actual capacity of the affected roads, which would continue to have considerable spare capacity.

The closure of Wallaby Scrub Road is projected to affect approximately 863 daily vehicle movements in 2017. The affected traffic volume could potentially increase at approximately +2 per cent annually from 2017 onwards. However, the future effect of the Hunter Expressway route opening on this traffic flow has yet to be determined.

Table 20.10 Proportional impact of the Wallaby Scrub Road closure on alternative routes

Road location	Projected daily traffic volume (year 2017)[1]	Route daily traffic capacity (vehicles)	Daily traffic detoured by Wallaby Scrub Road closure	Detoured traffic proportion compared to projected 2017 daily traffic movements	Detoured traffic proportion compared to route daily traffic capacity
Golden Highway (north of Putty Road at Mount Thorley)	3,512	20,000	863	24.6%	4.3%
Golden Highway (between Broke Road and Mount Thorley)	8,847	20,000	609	6.9%	3%
Broke Road (south of the MTO CPP access intersection)	3,434	18,000	609	17.7%	3.4%
Putty Road (west of Warkworth Mine access intersection)	727	18,000	254	34.9%	1.4%

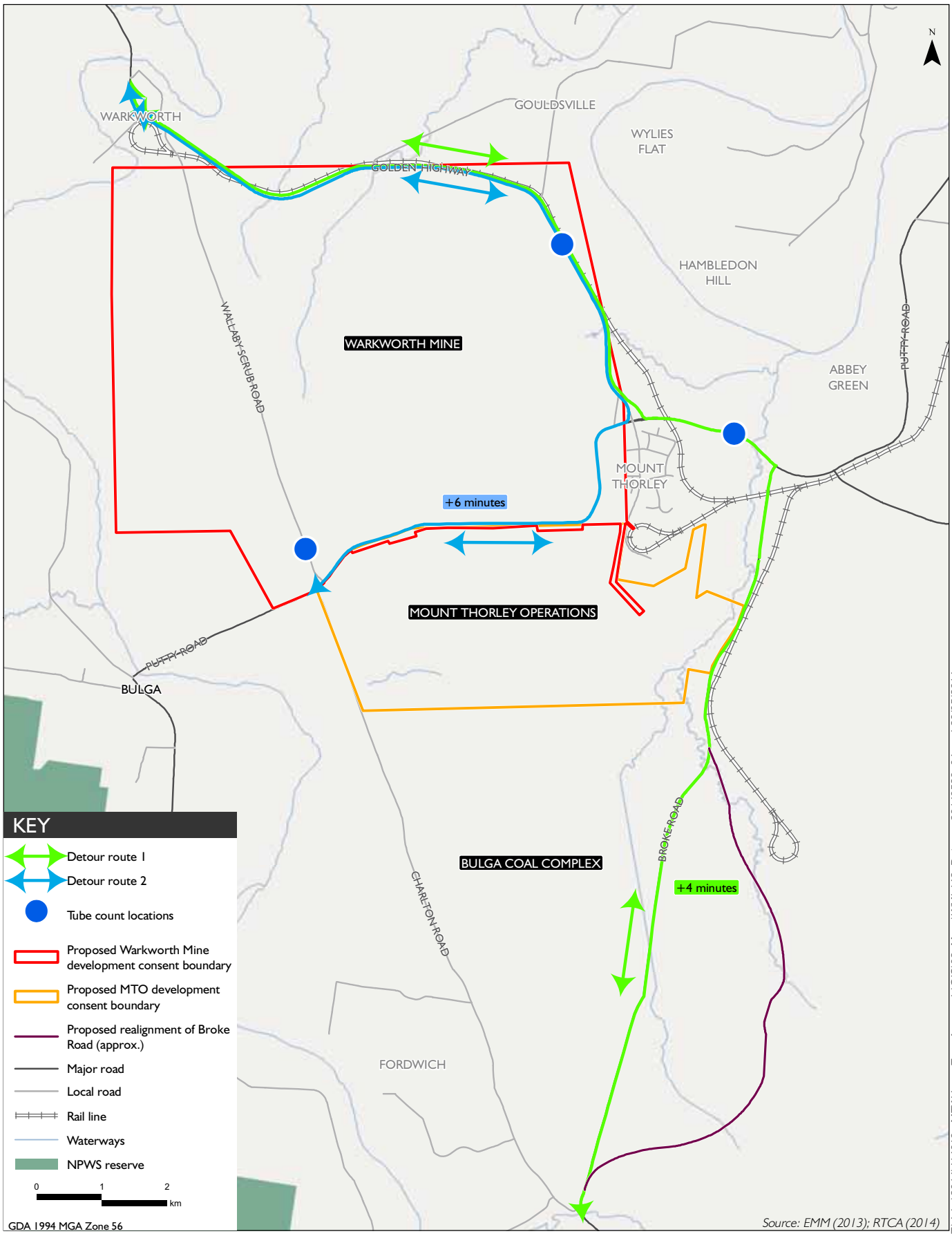
Notes: 1. 2017 daily traffic volumes estimated from applying a uniform annual traffic growth factor of 2 per cent to all routes to the 2014 daily traffic volumes estimated from comparisons of peak hourly intersection traffic volumes with the EMM 2014 surveyed peak hourly and daily traffic volumes.

b. Traffic detour impacts at intersections

The Wallaby Scrub Road closure would affect approximately 77 to 80 peak hourly vehicle movements in 2017, increasing at approximately +2 per cent annually onwards, assuming no reduction from traffic using the Hunter Expressway.

There would be minimal intersection traffic impacts on the alternative traffic detour routes for Wallaby Scrub Road as the relevant intersections have sufficient spare capacity to accommodate this traffic with minimal intersection capacity or delay impacts as shown in Table 20.8.

At the four existing intersections at the northern and southern ends of Wallaby Scrub Road and Charlton Road with the Golden Highway, Putty Road and Broke Road, the detoured traffic would be travelling straight through rather than turning at these intersections. This would generally reduce the turning traffic conflicts and generally improve the traffic safety and traffic delays at these intersections.



COAL & ALLIED

Wallaby Scrub Road detours

Warkworth Continuation 2014
Environmental Impact Statement

Figure 20.3

Following the recent road improvement works at the Golden Highway/Broke Road intersection, the peak hour traffic delays and level of service at this intersection have substantially improved. No further capacity improvements to the local road network would be required as a result of the generally minor intersection traffic impacts of the proposal, including the traffic detours from the closure of Wallaby Scrub Road.

c. Increased travel times and distances for detoured traffic

The Wallaby Scrub Road closure would potentially affect approximately 863 vehicle movements daily from the year 2017 onwards, increasing at approximately +2 per cent annually.

The Putty Road and Charlton Road originating vehicle movements would be subject to increased travel distances of approximately 8.8km and 6.2km and additional travel times of 6 and 4 minutes per trip, respectively. For the residents of the village of Bulga, the perceived impacts of these traffic detours are likely to be greater than for other road users as they would be occurring in combination with other locality impacts from mining in the area.

For the Charlton Road originating traffic, it is also likely that with the Bulga Optimisation Project (which is proposed but not yet approved) an additional traffic detour would be implemented to Broke Road (not shown on Figure 20.3) which would generally increase the overall travel detour distances and travel times for this traffic to similar levels as for the Putty Road traffic, ie approximately 9km and 6 minutes per trip.

The current local property access functions for traffic using Wallaby Scrub Road have also been reviewed in the study. All the properties affected on Wallaby Scrub Road, to the south of the railway bridge, are owned by MTW. Emergency vehicle access would be maintained by the construction of an emergency access road/fire trail between Putty Road and the Golden Highway, prior to the closure of Wallaby Scrub Road. The road would be constructed in accordance with the NSW Rural Fire Service's access standards prescribed in *Planning for Bush Fire Protection* (RFS 2006) and the NSW Bushfire Coordinating Committee Policy No. 2/2007. However, the fire trail route would be slower and less direct than the existing Wallaby Scrub Road route which would increase emergency response times in the area.

The economic impact of closing Wallaby Scrub Road is discussed and assessed in more detail in Chapter 9. There would be some maintenance cost savings each year for Singleton Council as a result of the road closure as the current annual road maintenance expenditure for the route would no longer be required.

d. Road safety

Generally, there would be safer travelling conditions for detoured traffic (and lower accident rates per kilometre travelled) when travelling via the Golden Highway, due to the improved intersection sight distances and higher road construction standards which are present along this route. These improved traffic safety conditions should generally compensate for the greater travel distances which are likely to be travelled by the detoured traffic.

A road closure implementation plan for Wallaby Scrub Road would be prepared in conjunction with relevant stakeholders in the local community, RFS, RMS and Singleton Council, which would include strategies to minimise the potential traffic and road safety impacts of the closure. This would include a review of the requirement for speed advisory and additional curve warning signs at all curves on the roads which are likely to be used by detoured traffic (ie Putty Road, Broke Road and Golden Highway). This review would be undertaken prior to the detour being implemented.

iv Construction of underpass of Putty Road

The optional new underpass for internal mine truck traffic at Putty Road would be constructed in two stages.

Initially, the current alignment of Putty Road at the location of the proposed underpass would be deviated to the south (on the MTO side) to allow for the construction of the new 'cut and cover' underpass (inclusive of the new bridge over the underpass). The existing design travel speed of Putty Road in the locality (in the vicinity of the curves west of the Golden Highway intersection) which is 80 km/hr, would be retained for the temporary traffic detour.

When the construction works are complete, including the approach to the underpass from the Warkworth side, the Putty Road traffic would be diverted back to its original route and the remaining section of the underpass approach road would be constructed from MTO.

The additional 'traffic detour distance' to be travelled by Putty Road traffic would be minimal as the detour route would likely be offset by around 100m from the existing alignment of Putty Road. Free-flowing road connections would be provided to permit 80km/hr travel speeds to be maintained by traffic when switching from the existing Putty Road alignment to the traffic detour route. Accordingly, impacts are considered negligible.

v Car parking and alternate site access

There are no proposed changes to the MTW car parking areas. The capacity of the existing car parking areas is adequate for the workforce and visitor car parking requirements under the proposal.

Given the current patterns of predominantly industrial development in the Mount Thorley area (ie the MTIE), and distance from residential areas, the local and major roads would continue to have only minimal pedestrian and cyclist usage.

vi Cumulative impacts

The potential cumulative traffic impacts from the proposal and the construction work phases for the Bulga Optimisation Project have also been considered for 2017 which is the first year in which cumulative traffic impacts would potentially occur. Although the proposed construction stage workforce for the Bulga Optimisation Project would be up to 300 persons during the early years of construction in 2014 and 2015 (ARC *et al*. 2013), this workforce would be greatly reduced (to approximately 25 persons) by the year 2017, such that minimal cumulative traffic impacts are anticipated from the two proposals in that and subsequent years. The MTW workforce and other traffic related contributions to cumulative road traffic impacts (with other mining projects) would remain unchanged under the proposal.

There would be minimal cumulative intersection traffic impacts when the proposal, including the effects of the Wallaby Scrub Road closure, is considered in combination with the Bulga Optimisation Project. The relevant intersection traffic impacts detailed in Table 20.8 show all the potentially affected intersections would have sufficient spare capacity to accommodate the predicted cumulative traffic increases, with minimal intersection capacity impacts.

There would be some additional road detour delay impacts from the proposal on Broke Road, in conjunction with the Bulga Optimisation Project as that project also proposes a deviation with an additional travel detour distance of 3km (two additional minutes travel time) on Broke Road which would also affect the Wallaby Scrub Road detoured traffic from the Charlton Road direction.

The recent RMS intersection improvement works at the Golden Highway/Broke Road intersection have substantially improved the peak hour traffic delays and level of service such that this intersection no longer represents a capacity constraint on the local road network.

20.3.3 Rail impacts

i Rail line capacity

The daily train movements for coal transport from MTW would be consistent with those loaded previously at MTCL and are not anticipated to increase above levels seen historically. As there is no projected increase in annual train movements, the MTW coal transport operations are not expected to cause any increase in delays to other users of the Whittingham branch line.

The current ARTC strategy includes a planned increase in the total processed export coal transported from existing and proposed mining operations using the Whittingham branch between the years 2013 and 2022 from 25 to 40Mtpa. This would increase the annual average daily number of loaded trains using the Whittingham branch from approximately 8.5 in 2013 to approximately 13.6 in 2022. While this is within the current operating capacity of a single track branch line, which can generally accommodate approximately one train movement hourly in each direction, it is believed that the limiting factor for the branch line capacity is the number of available train paths at the junction with the main line at Whittingham. This capacity would ultimately determine the capacity of the Whittingham branch line to accommodate the projected daily train loads beyond 2022.

ii Rail safety

The ARTC network expansion plans include significant expenditure to construct facilities that separate road vehicles from the high volume public level crossings to eliminate interaction. Notable crossings already completed include Range Road (Singleton), Golden Highway (adjacent to New England Highway intersection) and Hermitage Road (Belford). As there would not be an increase in daily train movements beyond those seen historically for MTW under the proposal, the number of MTW train interactions with users of existing public and private level crossings would not change.

Train movements under the proposal would continue to transport coal in a manner consistent with historical operations. Coal would be loaded onto trains provided by approved rail haulage companies who are licensed and approved to operate on the ARTC network. These companies must comply with the requirements of the Independent Transport Safety Regulator whose principal objective is to facilitate the safe operation of railways in NSW. Therefore, the proposal is not expected to impact rail safety.

20.4 Management and monitoring

Measures to manage and monitor potential traffic and transport impacts from the proposal comprise:

- preparation of a road closure implementation plan for Wallaby Scrub Road, in conjunction with emergency services, RMS and Singleton Council, which would include strategies to minimise the potential traffic and road safety impacts of the closure;
- construction of an emergency access road between Putty Road and the Golden Highway prior to the closure of Wallaby Scrub Road in accordance with the relevant NSW Rural Fire Service's access standards; and

- review the existing speed advisory and curve warning signs for all the curves on the roads which are likely to be used by detoured traffic (ie Putty Road, Broke Road, and Golden Highway) prior to the closure of Wallaby Scrub Road.

No specific rail transport impact mitigation measures are required for the proposal.

20.5 Conclusions

Employee traffic generated by Warkworth Mine and MTO on external public roads would not change under the proposal as there would be no changes to the average combined project workforces. Truck traffic generated would also generally remain at similar levels.

The proposal would result in only minimal traffic impacts on the wider local road network with the primary traffic impacts related to the closure of Wallaby Scrub Road.

There would generally be minimal traffic impacts on the traffic detour routes for the Wallaby Scrub Road closure as these roads (and the relevant intersections) have sufficient spare capacity to accommodate this traffic with minimal intersection capacity impacts or delays.

Traffic detoured by the Wallaby Scrub Road closure would be subject to some increases in daily travel distances, as well as increases in travel times. However, given the improved road construction standard and travelling conditions on the Golden Highway, the closure of Wallaby Scrub Road should not result in an increase in the travel safety risk for the detoured traffic. There would also be some future savings in road maintenance costs for the Singleton Council as a result of the road closure.

Emergency vehicle access to areas west of Wallaby Scrub Road would be maintained by the construction of an emergency access road/fire trail between Putty Road and the Golden Highway. However, the fire trail route would be slower and less direct than the existing Wallaby Scrub Road route which would increase emergency response times.

As there is no projected increase in annual train movements, the proposal is not expected to cause any rail transport impacts.

Management measures proposed include preparation of a road closure implementation plan for Wallaby Scrub Road, construction of an emergency access road between Putty Road and the Golden Highway, and a review of existing speed advisory and curve warning signs.

Chapter 21

Social assessment

Chapter 21 — Social assessment

21 Social assessment

21.1 Introduction

This chapter presents the social impact assessment (SIA) prepared by EMM which is presented in full in Appendix P.

The SIA was prepared based on the combined impacts of the proposal and the Mount Thorley Operations 2014. Except where discussion of MTO is required to understand the SIA interactions, the findings relevant to Warkworth Mine are the focus of this chapter.

The chapter describes the existing social environment and considers the key changes that are likely to result, either directly or indirectly, from the proposal. As the proposal is to continue operations in 2015 and beyond, enabling the combined operations at MTW to maintain as far as possible 1,300 jobs over the longer term, the greater impacts on the socio-economic environment and community services are projected to occur if the proposal does not proceed.

The stakeholder perceived impacts and opportunities of the proposal have been determined through consultation and were assessed with the economic and environmental technical studies prepared as part of the EIS or considering external literature. The combined assessment of perceived and technical impacts address the L&E Court judgement (par. 430) that states that the assessment of impacts should include consideration of the "subjective fear or concern" of stakeholders and the "concrete likely effects of the proposed development".

This is the last technical study chapter presented in the EIS as it draws from the outcomes of the preceding economic and environmental studies.

21.2 Methodology

Social impacts include any intended or unintended changes to one or more of the following as a result of a proposal (Vanclay 2003):

- people's way of life (for example, how they live, work and play);
- their culture (for example, shared beliefs and values);
- their community (for example, cohesion, stability and character);
- political systems (for example, democratisation and participation);
- the environment (for example, impacts on amenity from dust and noise);
- people's health and well-being (for example, physical, mental, social, spiritual health and well-being);
- personal and property rights (for example, economic affects, disadvantage and civil liberties); and
- people's fears and aspirations (for example, fears about the future of the community and their children).

These changes are inter-related and the impacts have been considered in this chapter in three groups:

- socio-economic impacts;
- impacts on community services; and
- stakeholder perceptions and assessment outcomes.

People's perception of social impacts often varies depending on their location and experience with the proposal. For instance, those that live in close proximity tend to focus on matters relating to amenity and property values. Whereas those further from the proposal tend to focus on potential impacts associated with social infrastructure (for example, housing, schools, transport etc) and socio-economic benefits either direct or indirectly. Therefore, scale is an important consideration in a social impact assessment. For the purposes of this assessment, the following scales are used:

- Local community: The local community refers to those areas with close linkages to or in close proximity to the operation:
  - 'Near neighbours' defined as stakeholders who reside in the neighbouring villages of Bulga, Warkworth, Long Point and Gouldsville and those stakeholders who reside on properties in close proximity to the MTW operation. A particular focus on Bulga village is given in accordance with the Secretary's requirements.
  - In the context of the community profile (21.2.1) this includes 'State suburbs' (SSCs) defined using available ABS census data and where there is a significant resident population. SSCs used in the SIA include the Bulga SSC, Broke SSC and Singleton SSC.
- Assessment area LGAs: Singleton LGA is the main area considered as part of the assessment as this is where the proposal is located. Maitland, Cessnock, Muswellbrook, and Upper Hunter Shire LGAs are also included given the socio-economic linkages between MTW and these LGAs.
- NSW is used given the resource is owned by the State and exploitation of the resource is a State decision.

The SIA also refers to the Hunter Region as the broader context area of the assessment. The methodologies employed as part of this assessment are detailed in the sections below.

21.2.1 Community profile

A community profile was developed for each geographic scale using the latest ABS census data (2011) together with a range of other data sources. The 2011 census forms the best available basis for the community profile. However, changes to the community profile over the last three years, including those resulting from the mining industry slowdown, are reflected in this chapter.

21.2.2 Employee and supplier surveys

Employees and suppliers of MTW were surveyed in March 2014. The surveys provide an insight into the ways in which MTW employees and suppliers contribute to, and participate in, the Hunter community.

i Employee survey

An invitation to complete the employee survey was sent by email to more than 400 MTW employees. Of this sample, 228 completed the survey online. Employees who do not have regular access to computers at work were invited to complete a paper-based survey at pre-shift meetings; resulting in the completion of 145 paper-based surveys. In total, 373 employees completed the survey.

The employee survey consisted of 18 questions related to place and status of residence, employment status and remuneration, and various questions on contribution and participation to the communities in the LGAs and the Hunter Region more broadly.

ii Supplier survey

An invitation to complete the online supplier survey was sent by email to over 450 suppliers and 256 valid survey responses were received.

The supplier survey consisted of 16 questions related to industry type, location, workforce size, supplier relationship with MTW, and the contribution and participation to LGAs and the Hunter Region more broadly.

21.2.3 Identification of stakeholders and perceived issues

i Rationale

In assessing social impact, consideration must be given to the foundation or rationale for concerns held and expressed in relation to a proposed development. The L&E Court has found that community concerns are required to be considered in assessing social impacts, and those concerns require support in objectively assessing evidence before a decision can be made of adverse impact. In *New Century Developments Pty Ltd v Baulkham Hills Shire Council* [2003] L&E Court 154, Lloyd J heard a merit appeal against the refusal by the Council of a DA for a Muslim prayer house. Lloyd J held that:

> 62A fear or concern without rational or justified foundation is not a matter, by itself, that can be considered as an amenity or social impact pursuant to s 79C(1) of the EP&A Act (*Newton v Wyong Shire Council*, NSWLEC, McClellan J, 6 September 1983, unreported, *Jarasius v Forestry Commission of New South Wales* (1990) 71 LGRA 79 at 93 per Hemmings J; *Perry Properties Pty Ltd v Ashfield Municipal Council*(2000) 110 LGERA 345 at 350 per Cowdroy J). Where there is no evidence to support a rational fear it will be irrelevant that members of a community may have modified their behaviour arising from such an unjustified fear (*Dixon* at [71]).
>
> 63 It follows that in forming an opinion on the probable impact of a proposed development on the amenity of an area, tangible or otherwise, a court would prefer views from residents which are based upon specific, concrete, likely effects of the proposed development. That is consistent with the statement of Mason P in *Fairfield City Council v Liu* at [2] that "... the demonstrable social effect of a particular ... use is relevant under s 90(1)(d) [now s 79C]" (see also *Dixon* at [48]).

In *Telstra Corporation Ltd v Hornsby Shire Council* [2006] L&E Court 133, Preston CJ heard a merit appeal against the refusal by the Council of a DA for a mobile phone base station. Preston CJ held:

> 195 A fear or concern without rational or justified foundation is not a matter which, by itself, can be considered as an amenity or social impact pursuant to s 79C(1) of the EPA Act: *Newton v Wyong Shire Council*, unreported, LEC No. 40135 of 1982, 6 September 1983, McClellan J, pp 110, 11; *Jarasius v Forestry Commission of New South Wales* (1988) 71 LGRA 79 at 92; *Perry Properties Pty Ltd v Ashfield Municipal Council* (2000) 110 LGERA 345 at 350 [22]; *New Century Developments Pty Ltd v Baulkham Hills Shire Council* (2003) LGERA 301 at 316[62]. 'Mere local prejudice' or 'the resistance of uninformed opinion to innovation' is not a basis for rejecting a proposal: *Cecec (No. 8) Pty Ltd v Mosman Municipal Council* (1960) 5 LGRA 251 at 263; *Foreman v Sutherland Shire Council* (1964) 10 LGRA 261 at 269.

In *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Limited* [2013] L&E Court 408, Preston CJ held that:

> 408 ... consideration of both the objective data for the broader community, and the experiential evidence from residents of the impacts at the local level, is required to have a complete picture of the likely social impacts of the Project.

As described below, a range of stakeholders were consulted to determine their perceptions of the proposal and its potential impacts and these are assessed with the technical assessment of the impacts.

ii Stakeholder identification

A plan was developed to identify key stakeholders and detail a programme for stakeholder consultation. This built upon regular and ongoing consultation with local and regional stakeholders undertaken by Coal & Allied throughout the life of the operation, and in particular since 2009 with regards future plans for the operation. A total of 151 stakeholders participated in the consultation process.

Approximately 44 per cent of participants in the SIA consultation process were near neighbours. Near neighbours included residents from the neighbouring communities of Bulga, Warkworth, Long Point and Gouldsville. Fifteen per cent of the participants were MTW employees and suppliers. Further details regarding the stakeholders groups and portion of stakeholders in each group is described in Chapter 8.

iii Determining stakeholder perceptions

The perceived impacts and opportunities of a proposal can be determined by a number of methods. One method is to randomly select and survey individuals across a community. This allows the proportion of a community that has particular perception of a development to be objectively quantified (within the statistical limitations of the sample size). This method often provides a large number of responses from stakeholders who have not actively considered the development proposal prior to the survey. Further, as participants are randomly selected, many stakeholders who would like their views considered are not surveyed.

Another method to determine the perceived impacts and opportunities is to select and survey stakeholders who have an active interest in the development. This generally provides more in-depth responses and also provides an opportunity for those stakeholders who wish to express an opinion on the development to do so.

A combination of random and selected community participation was adopted for the assessment of stakeholder's perceptions of the proposal. Firstly, stakeholder identification and mapping was undertaken using the information sourced as part of the profiling activities, together with the existing stakeholder database developed by Coal & Allied's Communities Team as a part of their ongoing stakeholder consultation activities. Secondly open community forums were held in Bulga and Singleton for those interested in the project to attend and share their views. This combined approach ensured an appropriate range of views was canvassed.

Stakeholder consultation for the proposal was undertaken from March to May 2014 to determine the perceived impacts and opportunities associated with the proposal.

As noted in the section above, a large proportion of participants in the consultation process for the proposal were near neighbours (44 per cent of participants). Some of the near neighbours' comments on the proposals either fully, or mostly related mostly to the proposal (not Mount Thorley Operations 2014), given its proposal to extend mining operations westwards.

The key results of this consultation are therefore the qualitative stakeholder perceptions of a range of matters. These are provided in Section 21.4.2i alongside the technical assessment of each matter.

21.3 Existing environment

21.3.1 Community profile

The proposal is situated in the Singleton LGA, approximately 200km north-west of Sydney and 80km west of Newcastle (the largest city in the region) (See Figures 2.1 and 2.2). The Singleton LGA covers an area of approximately 4,893km^2 and includes the town of Singleton, the villages of Broke, Bulga, Milbrodale and smaller surrounding communities. A summary of the assessment findings is presented in Table 21.1.

Table 21.1 Demographic indicators

	Assessment area suburbs			Assessment area LGAs					State
	Bulga SSC*	**Broke SSC***	**Singleton SSC***	**Singleton LGA**	**Maitland LGA**	**Cessnock LGA**	**Muswellbrook LGA**	**Upper Hunter Shire LGA***	**NSW**
Population 2011 (count of persons and per cent population change 2001-11)									
2001	N/A	N/A	N/A	20,384	53,718	45,071	14,746	N/A	6,311,168
2006	321	540	5,783	21,937	61,880	46,206	15,236	12,976	6,549,177
2011	358	636	5,510	22,694	67,478	50,841	15,791	13,753	6,917,660
% population change 2001-06	N/A	N/A	N/A	7.6%	15.2%	2%	3.3%	N/A	3.7%
% population change 2006-11	11.5%	17.7%	-4.7%	3.5%	9%	10%	3.7%	6%	5.6%
Demographic characteristics 2011 (% of total population)									
Male	183 (51%)	328 (51.6%)	2,741 (49.7%)	11,648 (51%)	33,005 (49%)	25,257 (50%)	8,163 (51.7%)	6,865 (49.9%)	3,408,878 (49%)
Female	175 (49%)	308 (48.4%)	2,769 (50.3%)	11,046 (49%)	34,473 (51%)	25,583 (50%)	7,628 (48.3%)	6,889 (50.1%)	3,508,780 (51%)
Indigenous	30 (8.3%)	11 (1.7%)	246 (4.5%)	845 (3.7%)	2,355 (3.5%)	2,456 (4.8%)	847 (5.4%)	537 (3.9%)	172,621 (2.5%)
Age groups 2011 (% of total population)									
0-4 years	18 (5%)	55 (8.6%)	338 (6.1%)	1,651 (8%)	5,043 (7%)	3,801 (7%)	1,246 (7.9%)	984 (7.2%)	458,736 (7%)
5-14 years	58 (16%)	78 (12.2%)	707 (12.8%)	3,381 (16%)	9,778 (14%)	7,064 (14%)	2,358 (14.9%)	1,922 (13.9%)	873,776 (13%)
15-24 years	48 (13%)	69 (10.8%)	798 (14.5%)	3,292 (16%)	9,036 (13%)	6,520 (13%)	2,195 (13.9%)	1,578 (11.5%)	893,101 (13%)
25-54 years	139 (39%)	256 (40.2%)	2,196 (39.9%)	9,564 (45%)	27,351 (41%)	19,732 (39%)	6,639 (42%)	5,257 (38.2%)	2,863,574 (41%)
55-64 years	58 (16%)	113 (17.7%)	571 (10.4%)	2,452 (12%)	7,710 (11%)	6,570 (13%)	1,680 (10.6%)	1,753 (12.7%)	810,290 (12%)
65+ years	39 (11%)	67 (10.5%)	900 (16.2%)	2,354 (11%)	8,561 (13%)	7,153 (14%)	1,676 (10.7%)	2,257 (16.3%)	1,018,180(15%)
Same usual address 5 years ago 2011 (% of people aged 5 years and over with same address 5 years ago)									
% of persons	71%	59%	58%	57%	58%	60%	51%	58%	57%

Notes: ** due to changes in geographical boundaries between the 2001 and 2011 Census, comparisons between these years are misleading and subsequently are not included in this assessment for Bulga, Broke and Singleton SSCs, and Upper Hunter Shire LGA. Therefore, comparisons are limited to the 2006 and 2011 Census for these areas.*

Due to rounding, not all totals add to 100%.

i Population size, growth and future change

Singleton SSC has the largest population of the SSCs with 5,510 residents in 2011. Bulga and Broke had populations of 358 and 636 residents respectively in 2011. Maitland LGA had the largest population of the assessment area LGAs (67,474) followed by Cessnock LGA (50,841), Singleton LGA (22,694), Muswellbrook LGA (15,791) and the Upper Hunter Shire LGA (13,753). NSW had a population of 6,917,660.

The population profile in the assessment area has changed significantly over the last five years, although changes are at different rates between the LGAs and SSCs. Population growth in the region centred on the junction of Cessnock, Maitland and Singleton LGAs, and also in the areas around Aberdeen and Scone.

Between 2006 and 2011, the population in the key regional centres of Maitland and Cessnock grew at 9.1 per cent and 10.0 per cent, respectively. Singleton grew at 3.5 per cent and NSW at 5.6 per cent. The population growth in these areas was slightly faster than in the previous five year period. Growth was higher in Maitland and Cessnock as these centres are the focus of Greenfield house development and regional development planning initiatives. Bulga SSC and Broke SSC grew between 2006 and 2011, with a population growth of 11.5 per cent and 17.7 per cent (an increase of 37 and 96 persons respectively). The population in the Singleton SSC declined by 4.7 per cent.

The rates of population growth in the assessment area LGAs were slightly higher than in the previous five-year period between 2001 and 2006, excluding Maitland and Singleton which decreased.

The impact of the growth of the mining industry is evident in patterns of migration to the area, which contributed significantly to population growth between 2006 and 2011, with around 20 per cent of current residents having lived outside the area in 2006.

It is estimated that the Hunter Region population will grow from 622,000 in 2012 to about 762,000 in 2036 (Deloitte Access Economics 2013). By this time, the population of the lower Hunter Region (Newcastle, Lake Macquarie, Port Stephens, Maitland and Cessnock LGAs) is projected to reach approximately 640,000 people (growing from 520,000 in 2012). Population growth in the upper Hunter Region (Upper Hunter, Gloucester, Muswellbrook, Singleton, Dungong and Great Lake LGAs) of which this assessment area is a part is likely be more variable as a result of the cyclical nature of the dominant mining and agriculture sectors, which heavily influence the size and demographic composition of smaller LGAs.

ii Population structure

There are a slightly higher proportion of males in Singleton LGA (51 per cent) and Muswellbrook LGA (51.7 per cent) when compared with Maitland LGA, Cessnock LGA and the Upper Hunter Shire LGA (49 to 50 per cent) and NSW (49 per cent).

There is a higher proportion of Indigenous persons in the region than in NSW (2.5 per cent), particularly in the suburb of Bulga (8.3 per cent), and the LGAs of Muswellbrook (5.4 per cent) and Cessnock (4.8 per cent).

There are more young people aged 5 to 14 years, 15 to 24 years, and working adults aged 25 to 54 years residing in the Singleton LGA relative to the NSW average (see Table 21.1).

In addition to the information presented in Table 21.1 since 2006, Singleton LGA has experienced a 20 per cent decline in the 5 to 15 year age group and increases in the 20 to 29 year age group. This is likely through in-migration associated with the mining workforce.

With the exception of in the Singleton LGA, the 55-64 and 65+ age groups generally had the biggest contributor to population growth in the region. Bulga SSC and Broke SSC in particular had a substantially older population, with relatively low numbers of young children aged 0 to 4 years and a significant reduction in the primary family-formation age groups between 25 and 35 years old.

iii Income and employment

Personal and business incomes increased across the region between 2006 and 2011. Increases were greater than for NSW as a whole with individual incomes rising substantially in Singleton and Muswellbrook LGAs in conjunction with mining investment. The other LGAs in the area were closer to the NSW average, except for Cessnock LGA where incomes remained substantially lower than the average, despite a growth in both personal and family incomes between 2006 and 2011. Incomes in the SSCs in the assessment area were also generally similar or higher than NSW averages.

The Hunter Region is currently underpinned by the key industries of coal mining; agriculture (particularly dairy, beef cattle, vegetable growing and pasture production) and associated service industries; horse breeding; power generation; tourism; viticulture and wine making; and defence.

Mining is the dominant industry of employment across the assessment area, representing up to 22 per cent of the workforce in Singleton LGA, and up to 21 per cent in Bulga, well above the proportion of mining employment in NSW of 1.6 per cent of the total workforce. While not evident in these 2011 figures, the slowing of the coal mining sector is starting to impact the regional economy and the labour market. Recent job losses have also occurred in the wider industry, with approximately 1,500 direct mining jobs lost in the Hunter Valley over the last 18 months (NSW Minerals Council 2014) not including layoffs that occurred in May 2014. These job losses and their respective flow-on effects are representative of the indicators described above (refer to Section 3.2.1).

iv Education

Education attainment levels in the assessment area, particularly in Muswellbrook and Cessnock LGAs, are generally below the NSW average.

Data from the 2011 Census shows that Year 12 completion rates increased across the area but remained well below the state average, so much so that that the gap between the area and the state actually widened between 2006 and 2011. Year 12 completion rates among younger residents (aged 18 to 24) declined slightly across most of the area and most noticeably in Muswellbrook LGA, related to the availability of work and other training options in the mining industry.

Education continues to be identified by HVRF (2013) as a critical area for the future sustainability of the area, particularly given the growth in knowledge-based employment nationally and the likelihood of declining mining industry employment over the long-term.

v Housing

There is a predominance of separate houses, as opposed to semi-detached and unit housing within the assessment areas. There was also a higher proportion of dwellings being purchased and a lower proportion being rented in the assessment area compared to NSW as a whole.

The proportion of occupied private dwellings generally reflects the NSW average in all LGAs except the Upper Hunter Shire.

Median mortgage repayments in Singleton LGA and Bulga SSC were higher than the NSW average. Between 2006 and 2011, mortgage repayments also increased more rapidly in these LGAs than across NSW. Over the last five years, the regional residential housing market has outperformed NSW benchmarks and those for comparable regions in Sydney and Wollongong.

Rental price growth for three-bedroom houses slowed markedly over the year to June 2013. At the same time, indications are that vacancy rates have increased to 2.9 per cent for the Hunter Region as a whole in June 2013. Anecdotally, this trend has accelerated with the slowing of the mining industry and, as of June 2014, a large number of dwellings are for sale or are available for rent.

vi Infrastructure

There has been substantial infrastructure investment across the assessment area LGAs, with most major projects associated with mining and related rail and port infrastructure, particularly the Hunter Valley Coal Chain (HVRF 2013b). Major resources and energy projects completed by mid-2013 within the region had a total estimated value of $674million (BREE 2013). While the bulk of this expenditure flows out the region, the stimulatory effect on local employment and business is evident, reflecting a robust regional economy to 2013. The $1.7billion 40km long Hunter Expressway between Newcastle and the Upper Hunter is now open.

vii Community perception of changes in the region

Just over 60 per cent of stakeholders consulted identified a positive change in the region compared with five years ago, including: more/better shops (most frequently nominated in Singleton and Maitland); better services and/or facilities (most frequently nominated in Muswellbrook); the Hunter Expressway (most frequently nominated in Cessnock); improvements related to housing (most frequently nominated in Maitland and Muswellbrook).

21.3.2 Workforce profile

MTW's existing workforce profile was reviewed to understand the potential impacts of the proposal on the workforce and social infrastructure and services.

i Employees

The average workforce currently employed at MTW is approximately 1,300 employees and contractors.

MTW workforce demographics are characterised by:

- the employee workforce is predominantly male (about 90 per cent of all employees), as is the contractor workforce (about 75 per cent of all contractors);
- Indigenous employees represent about two per cent of the total MTW workforce, with a similar representation within the contractor workforce; and
- the dominant age group across both employees and contractors is 35-39 years (16 per cent of employees and 21 per cent of contractors).

ii Employees residential locations

The employee survey showed that the majority of MTW employees and long-term contractors are from the region or have settled in the region and intend to stay:

- almost three quarters of MTW employees and long-term contractors live in the Mid and Upper Hunter region: Singleton LGA (35 per cent), Cessnock (19 per cent) and Maitland LGA (17 per cent);
- the majority of the workforce have lived in their current suburb for less than 10 years; and
- the majority of the workforce (61 per cent) have a mortgage, 16 per cent own their property outright while 20 per cent rent, and 3 per cent live with friends or family.

iii Household income and expenditure

The employee survey showed that the average pre-tax income (gross) earned from work at MTW is $124,514.

A third of employees estimated that they spend between 70 per cent and 90 per cent of their income in the LGA in which they live. The remainder estimate that they spend between 30 per cent and 80 per cent of their income in the LGA in which they live.

iv Charitable contributions and community participation

More than 30 per cent of employee survey respondents stated that they currently undertake some form of voluntary work in the community. Of these respondents, the majority carried out this work for sporting or community recreation organisations. Respondents also carried out voluntary work for emergency services; children, youth or parenting organisations; education or training organisations; and community or welfare organisations.

21.3.3 Supplier profile

i Overview

In 2013, MTW spent:

- $188million on 228 local suppliers from Upper Hunter, Muswellbrook, Singleton, Maitland and Cessnock LGAs;
- $147million on 377 suppliers from the rest of NSW; and
- $238million on 198 supplier from the rest of Australia.

Supplier organisations were mainly mining (32 per cent), manufacturing (29 per cent), wholesale trade (7 per cent) and construction (7 per cent) industries (MTW Supplier Contribution and Participation survey 2014).

The regional offices of supplier organisations were mainly in Singleton (26 per cent), Newcastle (19 per cent) and Maitland (12 per cent) LGAs, with 'Other LGAs' (23 per cent) typically being LGAs in Sydney, Brisbane and the Central Coast.

Two-thirds of suppliers indicated that they employed 20 people or less (66 per cent) while 18 per cent indicated that they employed 21 to 30 employees (MTW Supplier Contribution and Participation survey 2014).

ii Value of relationship with MTW

The average value of the supplier relationship with MTW in the last financial year (total amount spent by MTW on their goods and/or services in 2012/13) was estimated by supplier survey respondents to be approximately $2million, with the aggregate value for the 214 respondents of approximately $256million (MTW Supplier Contribution and Participation survey 2014).

The majority of respondents derive 30 percent or less of their revenues directly from MTW with some 7 per cent relying on more than 40 per cent of their revenues directly from MTW.

21.3.4 MTW community engagement and investment

The Coal & Allied Community Relations programme manages and supports relationships with a range of stakeholder groups across its MTW and Hunter Valley Operations, including: community groups; near neighbours; Aboriginal community and groups; government (particularly local government); education sector; industry and business associations; non-government organisations including research institutions, strategic community partners; and, to some extent, media and local suppliers.

Current community activities and programs include:

- Consultation and engagement: near neighbour engagement programme (including one-on-one and group events); council engagement; business community and industry forum engagement; schools engagement; community events; Aboriginal community engagement; MTW Community Consultative Committee.

- Community development: investment across three funds – Community Development Fund (CDF) and Aboriginal Community Development Fund (ACDF); and, Site Donations Committee. The CDF was initiated in 1999. In 2011, Coal & Allied announced the continuation of the Community Development Fund and committed $4.5million to distribute to eligible projects between January 2012 and December 2014. The aim of the fund is to support projects and programmes that would create opportunities that would provide a lasting benefit to the wider community. The ACDF was initiated in 2006 and is a 20 year commitment to the Aboriginal Community of the Hunter Valley. Since its inception, the fund has spent over $3million on projects that would deliver long-term, sustainable outcomes for the Upper Hunter Valley Aboriginal community in areas such as business development, education and training and health. The fund currently contributes approximately $600,000 annually and has an additional $900,000 in a Future Fund. The MTW Site Donation Committee commits annual funding for community projects in accordance with the funding guidelines of the Committee. This includes projects which contribute to near neighbour communities, including the Bulga community.

- Communications: key communications are undertaken and maintained through the Singleton shopfront; Coal & Allied Information Line; website and email; quarterly newsletters, factsheets and media; site tours/open days; internal communication, input into external monitoring and compliance activities, community involvement in monitoring; regular CCC meetings and other forums/groups (refer to Section 8.2).

Community awareness of the company's community engagement and investment activities is high, with 60 per cent of residents surveyed in the Hunter Region indicating they are aware or very aware of the CDFs. Of those who were aware, six in ten either agreed (45 per cent) or strongly agreed (15 per cent) that the Coal & Allied Community Development Fund was benefiting the local community by providing support for appropriate and effective programs (HVRF 2013).

21.4 Impact assessment

This section describes the proposal's potential social impacts based on the existing social and economic conditions, social infrastructure capacity, and stakeholder perceptions determined through consultation.

21.4.1 Socio-economic impacts

i Perceived socio-economic impacts

As part of the stakeholder consultation process, stakeholders were asked to consider the socio-economic impacts if the proposal did not proceed.

Some stakeholders, particularly near neighbours, felt that there would be minimal negative impacts if Warkworth Continuation 2014 (and Mount Thorley Operations 2014) did not proceed, suggesting that most employees would continue at MTW in the short-term or move to other mining operations.

Other stakeholders identified job losses as an immediate and critical impact if the proposal did not go ahead. These stakeholders commonly described the loss of 1,300 jobs at MTW operations and the negative impacts this would have on the local economy and community. The commonly identified impacts of these job losses included:

- workers and their families moving away from the area;
- workers and their families faced with unemployment and financial difficulties;
- reduced local spending;
- decreased local businesses;
- population decline; and
- reduced community life and participation.

These stakeholders also commonly identified the flow-on negative impacts on local suppliers, other businesses and on the local economy and community generally. These matters are discussed below.

ii Continuation of employment and net benefits

The economic study (refer to Chapter 9) considers the net economic benefits and the regional and state impacts of the proposal (the proposal scenario) relative to a no development case (referred to as the reference scenario). In the reference scenario, it assumed that the development application for the Warkworth Continuation 2014 (and MTO 2014) is refused.

The reference case is provided as a basis for conservatively evaluating the incremental value of the proposal. However, as described in Section 2.4.15, the reference case is not likely to eventuate as mining under this scenario would not be economically viable due to extraction constraints when mining in West Pit at Warkworth Mine is forecast to reach consent limits in 2015. The SIA adopts the same conservative assumption as the economic study.

The two scenarios differ in terms of their production and employment (and associated costs) profiles. In the proposal scenario, current average employment and production levels would continue until 2030 and decline toward the end of the open cut life with production complete by the end of 2035. In the reference scenario, coal production and employment would begin to decline from 2016 onwards and would cease by 2021.

The economic study prepared by BAEconomics (Appendix E) states that while mining activity has been historically very high, a number of indicators suggest that significant declines in Australian thermal coal prices, amongst other factors, over the past two years have had a negative impact on economic activity. Capital investment in new tangible assets in the mining sector has fallen by more than half between December 2012 and December 2013. These trends are consistent with the expectation by the HVRF that few additional mining investment proposals will progress in the medium term, excepting those required to maintain economic production that require minimal upfront capital.

In addition, HVRF's Upper Hunter Region Economic Indicators (HVRF 2014), states that "business conditions in the Upper Hunter through calendar year 2013 were the most difficult, and affected the greatest number of businesses, since the HVRF's Business Survey began in 2001".

The effects of the mining slowdown are also being observed in the labour market. In a reversal of trends of the more recent past, there is now an excess of qualified mining engineers in NSW (Australian Journal of Mining 2014), as well as a shortage of positions for mining apprentices and trainees in the Hunter Valley (Australian Mining 2013). HVRF note that the unemployment rate in the Hunter Valley region has increased notably since 2011.

HVRF's measure of employment intentions suggest that further weakness in the Hunter region labour market can be anticipated. Employment intentions have declined since December 2011. HVRF's most recent measures are lower than during the Global Financial Crisis. Similar trends are also evident in the HVRF's Household Survey, which suggests that consumer confidence and purchasing intentions in the Hunter Valley region remains negative.

It has been assumed in the economics study that, in the event that the proposal application is refused and MTW closes by 2021, 30 percent of employees made redundant would be re-employed in the same year, and that 40 per cent of employees made redundant would be re-employed in the subsequent year. The remaining 30 per cent of people are assumed to either leave the workforce altogether or to move interstate. Based on the declining economic conditions described above and the significant recent loss of jobs at other mines in the Hunter Valley, these are considered to be conservative assumptions.

The economic study considers both direct economic benefits and flow-on effects (or benefits) of the proposal scenario in net present value terms. These are detailed in Chapter 9. As noted, almost three quarters of MTW employees and long-term contractors live in the Mid and Upper Hunter region and around $464million in additional disposable income would flow to that region.

Significant positive flow-on effects are also expected for the Mid and Upper Hunter region and the Singleton LGA including around $227million in additional income and additional annual employment of around 214 full-time equivalent workers. The flow-on effects for the Singleton LGA are around $84million in additional income and additional annual employment of around 61 full-time equivalent workers. As discussed in Section 9.1, the majority of these would be attributable to the proposal should it be approved.

These benefits would not be realised should the proposal be refused.

iii Direct employee contribution to the regional economy

The employee survey estimated the percentage income that is spent by participants in their LGA. Over two-thirds of employees estimated that they spent between 30 per cent and 80 per cent of their incomes in their LGA. Almost a third of all employees estimated their local spend in the 70 per cent to 90 per cent band (Figure 21.1). A much higher percentage was spent in the entire Hunter Region.

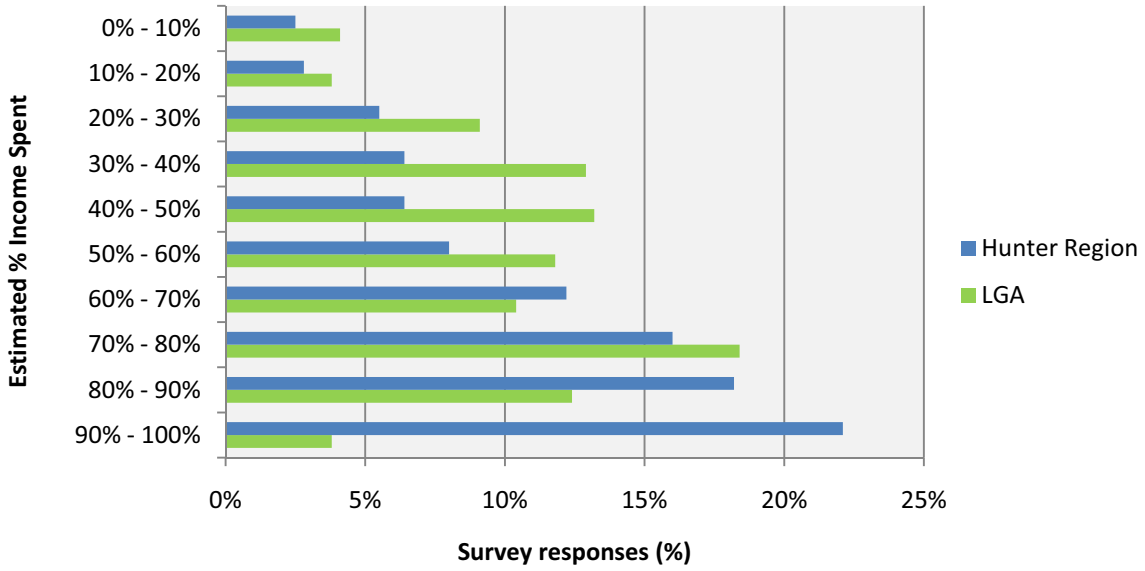


Figure 21.1 Estimated income spent in LGAs and the Hunter Region

The MTW employee contribution to the regional economy would be substantially reduced should job losses occur and current employees either left the region to find employment, stayed in the region but were unable to find employment or their income was reduced in an alternative place or work in the region.

iv Population decline

The stakeholder consultation process identified a common concern that workers and their families would move away from the area if the proposal was not to proceed. The potential impacts of these concerns can be assessed by comparing the proposal scenario discussed in the economic study.

As described in Section 21.4.1ii, the economic assessment reference scenario (Appendix E) conservatively assumed that of the employees made redundant, 70 per cent (910 people) of would be re-employed in the same year or the subsequent year. The remaining 30 per cent (390 people) were assumed to either leave the workforce altogether or to move interstate. If it is assumed that of those who are not re-employed, 50 per cent move from the region, 195 former employees would leave the region.

Assuming the impacts on the workforce in the reference scenario are equal across all regions, the impacts within the different LGAs are presented in Table 21.2.

Table 21.2 Employee residential location and impacts of reference scenario

LGAs	Percentage of workforce	Employees	Not re-employed Remain in the region (15%)	Not re-employed Leave the region (15%)
Upper Hunter and Muswellbrook	3.0	39	27	6
Singleton	34.9	454	318	68
Maitland	17.1	222	155	33
Cessnock	19.4	252	176	38
Great Lakes	1.5	20	14	3
Dungog	0.8	10	7	2
Port Stephens	8.1	105	74	16
Newcastle	6.9	90	63	14
Lake Macquarie	6.1	79	55	12
Other	2.2	29	20	4
Total	**100**	**1300**	**910**	**195**

Notes: Totals may differ due to rounding.

Based on an average number of people in each household of 2.7 (2011 census data for Singleton LGA) and assuming that 195 former employees leave the region as a household unit, a total of 527 people would leave the region in the reference case. The approximate distribution of these departures is provided in Table 21.3.

Table 21.3 Population decline

Area	Not re-employed Leave the region (15%)	Population decline (employees + family members)*
Upper Hunter and Muswellbrook	6	16
Singleton	68	184
Maitland	33	89
Cessnock	38	103
Great Lakes	3	8
Dungog	2	5
Port Stephens	16	43
Newcastle	14	38
Lake Macquarie	12	32
Other	4	11
Total	**195**	**527**

Notes: ** Based on an average household size of 2.7.*
Totals may differ due to rounding.

Flow-on benefits (jobs) from direct employment provide additional jobs in the community. Reducing direct employment therefore also reduces these flow-on jobs in the community. Therefore, the total number of people leaving the region would be expected to be greater than the 527 former employees and their families.

v Impact on housing market

Consultation with stakeholders (including Singleton residents, businesses and real estate agents) suggested that the recent contraction of the coal industry had contributed to the weakening of the property market through decreased demand. Local business stakeholders (Singleton-based real estate agents) suggested that the market was 'over-heated' during the coal mining boom, and that current soft property market figures may reflect a recalibration of the market towards a more realistic and stable trend.

This is demonstrated in recent property market data for the Singleton LGA (Housing NSW 2014) which shows a decline in sales results and a dramatic fall in rental returns for Singleton LGA. Median sales prices fell consistently in 2013 (almost 9 per cent annual decline for all properties) and rental returns fell by approximately 25 per cent on average in the 12 months to December 2013.

A population decline due to workers made redundant by the closure of the Warkworth Mine moving out of the region or a decline in the financial resources of previous employees would be likely to contribute to reduced property sales, sale prices and rental property demand.

vi Reduced local spending and decline in businesses

MTW spends a significant amount of money in the local area on local and regional suppliers, supporting a variety of businesses. In 2013, MTW spending on suppliers (based upon the postcode from which the good or service was invoiced) included:

- $188million with 228 local suppliers from Upper Hunter, Muswellbrook, Singleton, Maitland and Cessnock LGAs;

- $147million with 377 suppliers from the rest of NSW; and
- $238million with 198 suppliers from the rest of Australia.

The above figures correlate with the results of an online survey of suppliers to MTW in March 2014.

Under the reference scenario, the majority of spend by MTW on suppliers within the local area, as well as significant amount of spend by employees within the local area would cease by 2021, if not beforehand. This results in a significant reduction of spend per year (hundreds of millions of dollars) in the local area which would significantly impact local businesses, particularly those that demonstrated a degree of reliance on MTW for their business.

21.4.2 Community services and participation

i Education

Participants of the employee survey were asked to indicate the number of children they had in educational facilities in the Hunter Region. Of the 337 employees who responded to the employee survey, 209 had families. These employees had a total of 184 children attending educational facilities in the Hunter Valley. Based on the survey data, there is an average of 0.55 children per employee or 715 in total. Based on the assumptions detailed earlier, the departure of 15 percent of the workforce would include a reduction in the number of children in the region by a similar proportion and, therefore, may lead to a reduction of 107 children attending an education facility in the region (Table 21.4).

Table 21.4 Educational attendance by MTW employees

Facility	Estimated number of children of MTW employees	Number leaving the region (assumed 15%)
Childcare facility	186	28
Primary school	279	42
High school	186	28
Newcastle University	36	5
Technical college	29	4
Total	**715**	**107**

While the reduction in population would lower demand for school places and health services it is likely that this could place stress on future funding for these services particularly for smaller local community schools such as Milbrodale, Broke and Jerrys Plains Public Schools that had 11, 59 and 21 enrolments in 2013, respectively.

ii Employee contributions to community organisations

During the survey of suppliers and employees in March 2014, employees and suppliers were asked a series of questions relating to their direct contribution to, and participation in, community organisations and activities.

In the employee survey, 123 employees (33 per cent of responses) stated that they currently undertake some form of voluntary work, which is higher than the proportion of residents in Singleton LGA that volunteers (HVRF 2013b and ABS 2011). Of those that indicated current voluntary work activities, the majority carried out this work for sporting or physical recreation organisations (50 per cent of responses) followed by emergency services (21 per cent), children and youth (20 per cent), education and training (13 per cent) and community/ welfare (12 per cent) (see Figure 21.2).

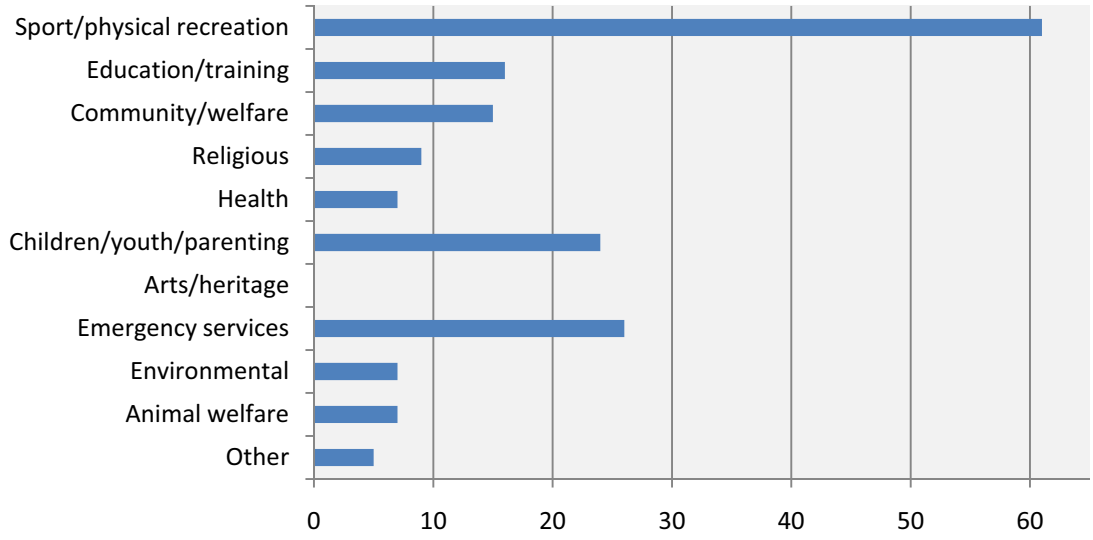


Figure 21.2 Organisation type for voluntary work

The majority of employees (73 per cent) estimated that they dedicate between 1 and 10 hours per month to voluntary work in the Hunter Region. About 22 per cent dedicated 10 to 20 hours per month to voluntary work (see Figure 21.3). Of those that indicated current voluntary work activities, the majority carried out this work for sporting or physical recreation organisations (49.6 per cent of responses) followed by emergency services (21.1 per cent), children/ youth (19.5 per cent), education/ training (13.0 per cent) and community/ welfare (12.2 per cent).

MTW employees contribute to community life and participate in community organisations. This would be substantially reduced if previous employees leave the region to seek work. The flow on effect for organisations which require volunteers may be a loss of capacity to carry out community activities through the loss of MTW employees and their voluntary contributions.

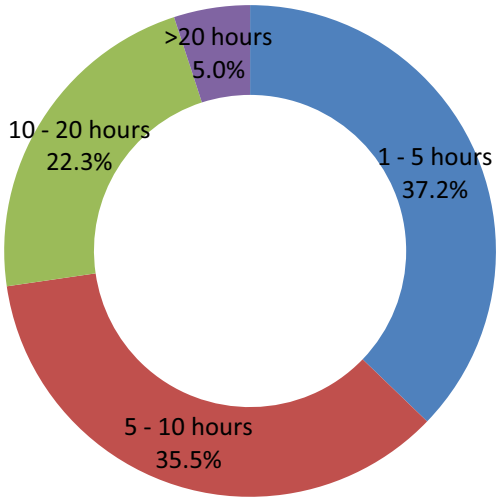


Figure 21.3 Hours per month dedicated to voluntary work

iii Supplier contributions to community organisations

About 75 per cent of suppliers surveyed indicated that they make direct financial contributions to community organisations (for example, charities, community services and health care) in the Hunter Region. The organisations supported included sporting (84 responses), welfare (65 responses), emergency services (55 responses), education (42 responses) and health (41 responses) organisations. The financial contribution on these community organisations for the past 12 months is shown in Figure 21.4.

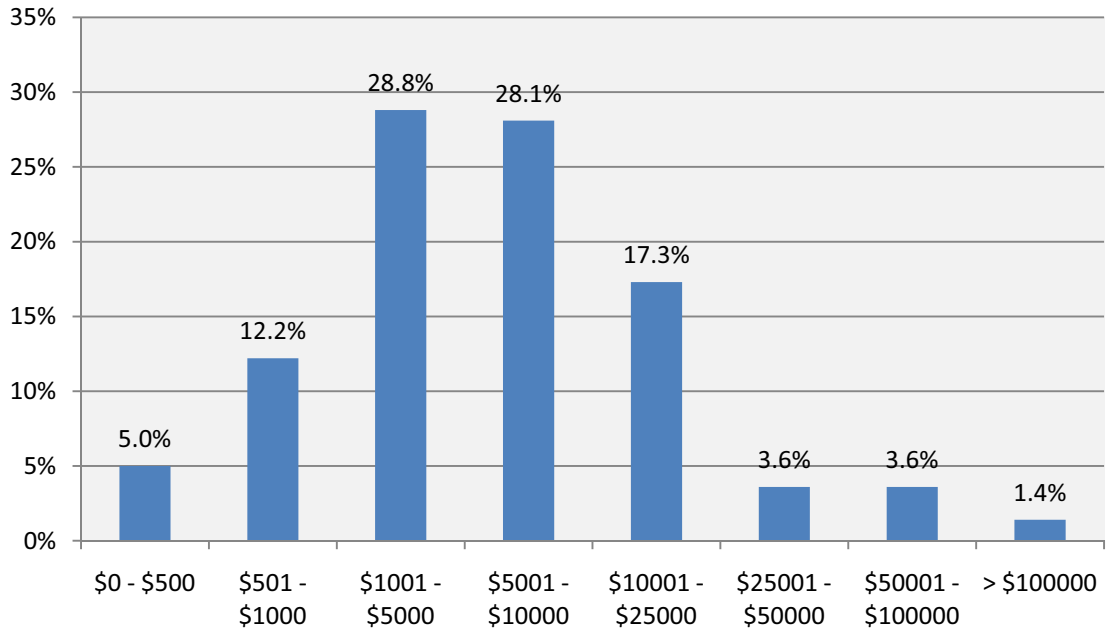


Figure 21.4 Total financial contributions of suppliers to community organisations in the past 12 months

Suppliers also made any non-financial contributions (for example, donating equipment, company resources and use of facilities) to community organisations in the Hunter Region. The number of non-financial contributions in each sector is shown in Figure 21.5. It is noted that totals add to 101 per cent due to rounding.

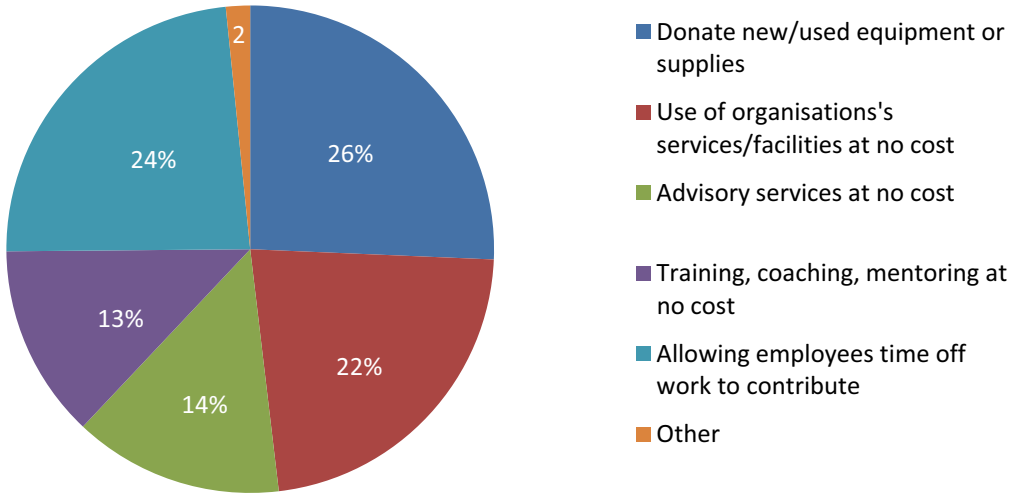


Figure 21.5 Type of non-financial contributions made by supplier to community organisations

Suppliers are also actively engaged in and contribute to community organisations, particularly through volunteer work.

The continued use of suppliers by MTW contributes to the financial success of these suppliers and allows them and their employees to contribute to and participate in community organisations in the region. In the absence of the proposal, the financial viability and the contributions of some of these suppliers would, at the least, be reduced.

21.4.3 Stakeholder perceptions and study outcomes

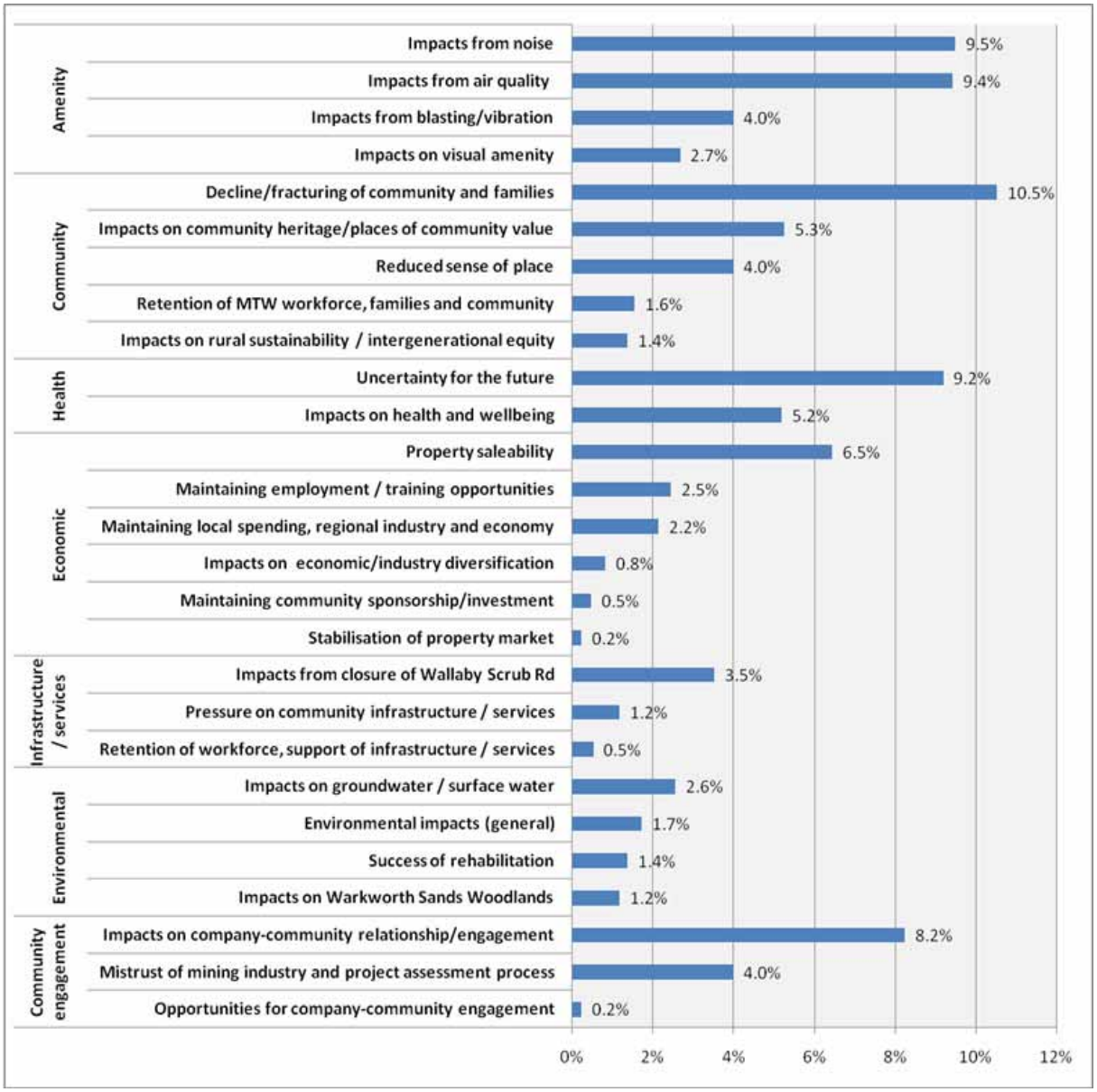
The technical studies are central in understanding and addressing impacts but it is important to understand stakeholder perceptions of impacts and opportunities so they can be considered in designing appropriate social management, mitigation or enhancement strategies. This section provides an assessment of the perceived impacts and opportunities associated with the proposal. It also provides a technical assessment of each of these perceived impacts and opportunities sourced from relevant technical studies and literature.

The perceived impacts and opportunities are categorised into seven groups:

- amenity;
- environmental;
- community;
- health and well-being;

- economic;
- infrastructure and services; and
- community engagement, relationships and governance.

The frequency that participating stakeholders identified specific impacts and opportunities is shown in Figure 21.6 providing an indication of key areas of focus for assessment. Table 21.5 provides a summary of perceived impacts and opportunities and the technical studies of the impacts and opportunities. They provide particular attention on Bulga village which contributed to approximately 20 per cent of the survey completed for the SIA.



Notes: Percentages are based on the total number of responses (1,673) from the 151 participants.
Data does not include results of the employee and supplier surveys

Figure 21.6 Perceived impacts and opportunities of the proposal

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Amenity		
Noise	**Noise levels and impacts on amenity, health and well-being** Noise was the most frequently identified perceived impact. Near neighbours (that is, residents living in proximity to the mine with potential noise exposure) perceive that the proposal is very likely to contribute to noise (including low frequency noise), impacting on the amenity, health and well-being of residents in Bulga, Long Point and Gouldsville.	**Noise management** The applicant has committed to implementing best practice sound suppression on all major plant. Further, the applicant is in final stages of developing a pre-emptive real time noise modelling interface (a first in the NSW mining industry) and is using best practice real time noise monitoring and management techniques. This constitutes all reasonable and feasible mitigation that has and would be adopted under the proposal. **Assessment criteria** The Mining SEPP's non-discretionary standard for cumulative amenity noise levels at privately-owned residential dwellings is met for Bulga village, and noise impacts are predicted to be below the acceptable noise levels and amenity of the village as a rural area would be maintained. Further, the Mining SEPP's non-discretionary standard for cumulative amenity noise levels is also met at other surrounding localities such as Gouldsville and Long Point. The L&E Court judgement (par. 64), notes that experience of noise levels from current mine operations is more than an expression of subjective fear or concern. However, while noise levels may be perceived differently by different stakeholders, the noise assessment used objective INP noise criteria designed to protect at least 90 per cent of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90 per cent of the time. **Project specific noise levels** The determining factor for the project specific noise levels (PSNLs) for all residences is the intrusiveness criteria. Background levels have been set at appropriate levels to determine these. Significant exceedances (>5dB(A)) of the PSNLs are predicted to occur at four assessment locations, three at Warkworth village (77, 102 and 264) and one to the north of Bulga village (34). Assessment location 77 is currently afforded acquisition rights from an adjacent mining operation. Assessment location 264 is inferred to have acquisition rights from an adjacent mine but is not currently included in its approval. Assessment location 102 is Warkworth Hall, which is a non-residence. Significant exceedances (>5dB(A)) of the PSNLs are not predicted at any other surrounding localities including Long Point and Gouldsville. Noise levels would be within 1 or 2dB(A) of the PSNLs for the majority of the residences at Bulga. As noted in Section 10.2.2, changes of 1 to 2dB are imperceptible. **Low frequency noise** Noise levels are predicted to meet relevant Broner criteria for low frequency noise and INP criteria for sleep disturbance at representative assessment locations.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

Impact/opportunities	
Perceived	**Technical assessment**
	Cumulative noise Cumulative noise levels would satisfy the INP (and Mining SEPP) night time criterion at all but one representative assessment location in Warkworth village (77). As this is a representative location, the criterion is also likely to be exceeded at two neighbouring locations in Warkworth village (102 and 264). It should be noted that these assessment locations are currently afforded acquisition rights from an adjacent mining operation. The status of assessment location 264 is referenced above. **Traffic noise** The closure of Wallaby Scrub Road and resulting increased traffic on detoured roads would not result in an exceedance of relevant noise criteria; and All reasonable and feasible measures have been applied to control noise from Warkworth Mine. Overall, one additional privately-owned residence that is not within either Warkworth Mine's or a neighbouring mine's existing acquisition zone (as per existing development consents), would be afforded acquisition rights under the proposal. Furthermore, given that the cumulative noise levels have been met at the majority of assessment locations, and it is unlikely there would be additional noise sources nearby in the future, the residences at Bulga generally have a rural level of amenity as defined in the NSW Industrial Noise Policy. Coal & Allied would implement operational, noise and blasting management strategies and monitoring as detailed in Chapter 10. Specifically for Bulga, this includes measures such as a trigger action response process (TARP), whereby noise level triggers from the MTW real time noise monitoring network initiate a series of management measures to reduce offsite noise levels.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Air quality	**Air quality impacts** Near neighbours expressed concern that the proposal is likely to contribute to air quality impacts from dust, diesel emissions and blast fumes. It is perceived that air quality would deteriorate due to increasing proximity of the mine to Bulga, the proposed disturbance of approximately 698ha of land, and air quality impacts experienced from current operations. **Impacts of air quality on health and well-being** Some stakeholders perceive that air quality impacts on amenity, health and well-being of affected residents are likely. Some stakeholders feel that they have little capacity of these affected residents to cope with air quality impacts.	**Air quality management** Air quality goals are benchmarks set to protect the general health and amenity of the community in relation to air quality. Air quality impacts are currently managed at Warkworth Mine through an existing integrated management system which involves the implementation of a monitoring network, best practice mitigation measures, and operational control strategies and measures with the objective of continuous improvement (see Section 11.5). Recent air quality monitoring results for 2012 and 2013 have shown that the Warkworth Mine is complying with the relevant air quality criteria. **Assessment criteria** The Mining SEPP's non-discretionary standard for cumulative air quality is met at all but two privately-owned residential dwellings (assessment locations 77 and 264) which are in Warkworth village. These assessment locations, and one non-residence (102 – Warkworth Hall), may experience concentrations above the relevant air quality goals for 24-hour average and annual average PM_{10} (particulate matter with a diameter of 10µm or less). Assessment location 77 is currently afforded acquisition rights from a neighbouring mine. Assessment location 264 is inferred to have acquisition rights from neighbouring mines but is not currently included in its approval. The Mining SEPP's non-discretionary standard for cumulative air quality at privately-owned residential dwellings is met for Bulga village and air quality impacts are predicted to be below the acceptable air quality concentrations and amenity of the village would be maintained. **Particulate matter** Twenty four mine-owned assessment locations are predicted to experience concentrations above the relevant air quality goals for 24-hour average and annual average PM_{10}. A subset of these assessment locations may also experience concentrations above the relevant air quality goals for annual average total suspended particulate matter (TSP) and incremental and total annual average dust deposition. Dust from mining is generally coarse in fraction (> $PM_{2.5}$) whereas the fine fraction dust (< $PM_{2.5}$) of concern to human health typically originates from combustion sources. Cumulative $PM_{2.5}$ (particulate matter with a diameter of 2.5µm or less) concentrations would be below the National Environment Protection Measure (NEPC 2003) advisory reporting standards at all of the assessment locations where the concentrations of other pollutants are below the relevant air quality goals. **Diesel emissions and blast fume emissions** No air quality impacts are predicted to result from diesel emissions (NO_2 and CO) and blast fume emissions.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Blasting and vibrations	**Blasting and vibration impacts** Near neighbours perceive that the proposal is likely to contribute to vibration impacts from blasting on the amenity and properties of residents in Bulga, Milbrodale, areas of Broke, Long Point and Gouldsville. Stakeholders perceive that vibration impacts from the proposal on the amenity and properties of affected residents are likely as mining operations and blasting activities come closer to Bulga.	**Blasting and vibration impacts** Blast noise overpressure and ground vibration limits would be met with the implementation of appropriate blast management (see more detail in Chapter 10). The blasting impact assessment focused on Bulga Bridge and St Phillip's Church in Warkworth Village as the most sensitive local structures. As the minimum separation distance between these structures and blast areas would be at least 2.5km, it is highly unlikely that these structures would be impacted. Subject to the implementation of the protocols outlined in the MTW Blast Management Plan no impacts are predicted to result from blast fume emissions. As described in Chapter 11 MTW is currently implementing a predictive management system to aid with management of blasting operations. Such a system uses actual conditions for each blast to predict the potential impact which may occur. The prediction is made on the basis of forecast weather data, allowing operators to schedule a blast to the time of least impact over the course of the upcoming day. In effect the system updates the blasting restrictions for each individual blast on the basis of predicted impact. The system thus deals with the spatially and time varying weather and terrain influences and is generally more reliable than relying on a fixed set of wind speed and wind direction restrictions.
Visual amenity	**Visual amenity impacts** Near neighbours expressed concern that the proposal is very likely to contribute to visual amenity impacts on residents of Bulga, Milbrodale, areas of Broke, Long Point and Gouldsville. It is perceived that visual amenity would deteriorate due to the increasing proximity of the mine to Bulga and given the surrounding landforms. Some stakeholders expressed concern that that this would particularly be experienced at properties in Bulga on the western side of Inlet Road and nearby roads/streets, the western side of Putty Road and nearby roads/streets, and the elevated sections of the western side of Wambo Road.	**Visual amenity impacts** As described in Section 15.1, open cut coal mines, including Warkworth Mine, and supporting infrastructure are a prominent landscape feature the landscape. The proposal would extend exposure to views from the west of the Site, and decrease the distance between sensitive viewers and mine and rehabilitated landform, in the long-term. The active mining face would advance away from sensitive viewers in the east under the proposal. Overburden emplacement at the Site would continue to be visible to some viewers in Bulga. Some residences west of the Site, such as elevated residences around Bulga village, may experience high visual impacts. However in the broader area, overall visual impacts of the proposal would generally be moderate to low, as the impact on visual amenity would be limited, localised and consistent with existing views. The existing topography and vegetation would continue to provide screening to the mine to varying extents depending on view location and elevation. **Visual impact mitigation measures** Visual impact mitigation measures would be put in place to mitigate the potential impacts on the overall surrounding landscape. This would include vegetation and bund screening to the boundaries of the Site. In addition, site-specific visual assessments (SSVAs) would be available to individual landowners of potentially impacted properties. These SSVAs would prescribe specific mitigation measures, if the proposal is determined to have high or high/moderate visual impact at the property. The L&E Court judgement (par. 434) found that being able to see overburden emplacements are a constant reminder of the mine and that lights from the mine are intrusive and annoying. Implementation of the mitigation measures prescribed in SSVAs at impacted properties would be important to substantially reduce these amenity impacts. Progressive rehabilitation of the Site would further reduce the level of contrast in the viewing landscape and, ultimately, result in a higher level of visual integration.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Environmental		
Groundwater and surface water	**Groundwater impacts** Stakeholders raised concern about impacts on groundwater from the proposal, including: • well and bore water decline at privately-owned properties; • impacts on the general hydrogeological system of the Bulga, Milbrodale and Broke areas; and • subsidence caused by aquifer changes. These were acknowledged as a broader cumulative matter by some near neighbours. These impacts were considered to be contributing factors in reducing water supply to properties, damaging properties and impacting way of life through reducing environmental quality in the area. **Surface water impacts** Stakeholders perceived that there would be impacts on surface water from the proposal, particularly the potential continued deterioration of the Wollombi Brook which is considered to be an important environmental, social and community attribute, with several stakeholders citing its long-standing importance to Bulga for agricultural production and recreational activities.	**Groundwater** Groundwater modelling predicts there would be no groundwater drawdown at any privately-owned bore greater than 2m. Government policy stipulates that for any bores where the maximum cumulative decline in groundwater levels is predicted to exceed 2m due to mining a make good agreement between the landholder and the applicant should be in place. A reduction of less than 2m is unlikely to noticeably reduce the pumping yield from any bore. Groundwater modelling indicates that risks to groundwater systems are negligible and manageable subject to the obtainment of the necessary water entitlements. The applicant is committed to ensuring the necessary licences are held with sufficient share component and water allocation to account for all water taken from a groundwater or surface water source as a result of an aquifer interference activity, both for the life of the activity and after the activity has ceased. Potential groundwater impacts from the proposal would not result in subsidence and, as such, would not impact on property. Coal & Allied would implement groundwater management strategies and monitoring as detailed in Chapter 16. **Surface water** Impacts of the proposal are unlikely to be significantly different to those from the existing approved operations. Groundwater modelling predicts a reduction in saline Permian groundwater discharge to the Wollombi Brook as mining progresses, reduce the salinity of the alluvium (and subsequently in the brook) during the life of the proposal. Surface water modelling predicts that no uncontrolled release of saline water would occur over the life of the proposal. Excess saline water would continue to be released in accordance with the existing rules of the Hunter River salinity trading scheme. The MTW water management system would continue to operate and prevent sedimentation. As all offsite water supply requirements (if required) and water take under the would be obtained from licensed sources, there would be no adverse impact on other licensed users (subject to climatic conditions and the operation of the water supply scheme). Therefore, agricultural production and recreational activities would not be impacted. Coal & Allied would implement surface water management strategies and monitoring as detailed in Chapter 17.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Warkworth Sands Woodland	**Loss of Warkworth Sands Woodland (WSW)** Near neighbours expressed concern about a loss of the 'unique ecology' of WSW. It was perceived that this would impact fauna (particularly birdlife) and groundwater systems, removing opportunities for educational and recreational activities such as school visits, bird watching and nature walks. **Biodiversity offsets** Stakeholders were generally sceptical about the effectiveness of biodiversity offsets in areas far-removed from WSW and questioned the achievements of other offsetting projects undertaken in the Hunter Valley.	**Impacts to vegetation including WSW** WSW would be disturbed under the proposal. This would be managed through provision of biodiversity offsets and supplementary measures, such as the re-establishment of Warkworth Sands Grassland to Warkworth Sands Woodland and provision of funds for the development of an Integrated Management Plan for WSW. A thin perched groundwater system of limited extent, recharged by rainfall, is present in the aeolian Warkworth sands that support the WSW ecological community. This system is not in direct hydraulic connection with the underlying Permian fractured rock (AGE, 2014). Therefore, the proposal is not expected to impact on the groundwater system or the associated vegetation community. Open cut mining projects cannot readily avoid impacts where mineral resources are beneath flora and fauna habitats. Listed species and communities, including WSW, were avoided to the greatest possible extent during mine and infrastructure design. The proposal's remaining impacts on WSW and other vegetation were assessed in accordance with contemporary government policy. Coal & Allied would implement the measures to avoid, minimise, mitigate and compensate for the loss of WSW and other native vegetation as described in Chapter 12. **Biodiversity offsets** Offsets for WSW are proposed within the Southern and Northern Biodiversity Offset Areas including existing vegetation and re-establishment. The re-establishment of WSW in areas mapped as WSG which would establish large, fully functioning examples of the EEC through enhancement of areas. In the long-term, this would result in a larger area of WSW than currently exists and would be managed and protected, which is not the case currently. The offsets would also provide habitat into the future for threatened fauna species associated with this vegetation community. In addition, supplementary measures are proposed, including: • development of rehabilitation completion criteria based on the UNE research over the last five years; and • provision of funds for the development of an Integrated Management Plan. The assessment of groundwater dependent ecosystems concluded that no direct impacts to this groundwater system resulting from the proposal would occur. In combination, these measures would result in a larger area of WSW than currently exists that would be managed and protected, which is not the case currently.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Rehabilitation and future land use planning	**Ineffective rehabilitation** Near neighbours and interested stakeholders perceived that past and present rehabilitation practices at MTW and at other mining sites throughout the Hunter Valley have been ineffective/unsuccessful and that little change in these practices is included as part of the proposal. Several stakeholders suggested that evidence is yet to emerge of open-cut coal mine rehabilitation leading to positive environmental and land use outcomes.	**Rehabilitation achieved and proposed** Rehabilitation at MTW is undertaken in a series of stages as mining progresses. Much of the rehabilitation to date has been in the north of the site predominately away from the public views and is consistent with the progression of mining. The 2013 Annual Environmental Review for MTW illustrates that the rehabilitation completed in 2013 exceeded the commitment outlined in the Mining Operations Plan (MOP). The cumulative rehabilitation undertaken during the MOP period of 126.2ha has also exceeded that committed to in the MOP (121.9ha) at this point in the mine life. The proposal includes commitments (see Chapter 13) to leading practice rehabilitation and future innovations in rehabilitation to achieve improved outcomes. Given this is the case, it is unlikely that ineffective rehabilitation would lead to social impacts.
Community		
Community and family cohesion	**Loss of population, community members and leaders** The residents of Bulga, Long Point and Gouldsville perceive there may be loss of population, community members and leaders as a result of acquisition and relocation, leading to the gradual decline of community (both facilities/services and existing community connections and village life) and loss of connections between and within communities and families.	**Population** The proposal is required to enable continuation of operations at Warkworth Mine in 2015 and beyond, and so maintaining the current and the regional population in the medium-term. The decline of smaller rural communities is a broad concern across Australia including in parts of the middle and upper Hunter region that are experiencing decline. A wide range of factors are contributing to this such as improved communications which is encouraging migration to cities and centralisation of services, restructuring of rural industries and reduced employment opportunities, and population aging and non-replacement leading to towns falling below the critical threshold needed to maintain essential services (Productivity Commission 2009). In contrast, Bulga has a number of significant attributes including retail and community facilities (service station, general store, tavern, community hall, sports ground and fire brigade) and it is well located to service the tourist trade being proximal to attractions like wineries and is on the Putty Road tourist route. Consequently, Bulga has experienced both a growth in population and housing prices, has a relatively robust age structure and relatively low rates of population turnover. Predicted impacts from the proposal would not necessitate property acquisitions in Bulga village. It is also important to note that in contrast to perceptions any property acquisition rights included in an approval are upon the request of the landowner and are not compulsory. If a landowner does not wish to take up their acquisition rights they do not have to. Any landowner with acquisition rights under an approval can also choose when they might like to have their property acquired, if at all, during the life of the development. For example, if the landowner is happy at the start of the project to stay but 10 years later choose to take up their acquisition rights, the rights would still exist and can be validly processed under the approval. The Bulga population has increased 11.5 per cent or 37 persons between the 2006 and 2011 census. However, it is acknowledged that local stakeholders reflect on gradual population decline in nearby villages such as Warkworth, Camberwell and Ravensworth. Even with the replacement of population that may occur with leasing any acquired properties, or with the

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
		new owners living or leasing properties sold by owners voluntarily relocating, concern remains regarding the loss of existing community connections, activity and village life. ABS data shows that Bulga SSC's population increased by 11.5 per cent from 321 to 358 persons between 2006 and 2011, which is double the NSW rate of 5.6 per cent for the same period. In this period, Singleton's population declined by 4.7 per cent. While the proposal would contribute to maintaining the current and the regional population, individual community members would continue to make decisions based on individual circumstances about whether to stay in the area. ABS data has shown that Bulga has a lower population turnover rate than the NSW average: in 2011, 71 per cent of people in the Bulga SSC were recorded at the same address they were five years earlier (compared to 57 per cent for both Singleton and NSW). This suggests that community connections would be relatively strong. It also suggests that the majority of residents consider Bulga to be an attractive place to live and, assuming an acceptable level of amenity can be maintained by the proposal, would continue to be so.
Places of community value and sense of place	**Loss of sense of place** Near neighbours are worried by the loss of the places of community value and uncertainty regarding the future of the Bulga community. Loss of sense of place has been associated with 'solastalgia', which is defined as the distress that is produced by environmental change impacting on people while they are directly connected to their home environment. Some stakeholders had a sense of distress, loss, depression and abandonment when discussing their connections to home, community, family and the rural environment, and that these connections may be lost as a result of the proposal. **Loss of historic and Aboriginal cultural heritage** Stakeholders also expressed concern that the proposal would impact on places of community value due to impacts on the Former RAAF Base Bulga Complex, sections of the Great North Road, places of Aboriginal cultural heritage significance and Saddleback Ridge. They also associated indirect impacts of the proposal on places of heritage and community value in Bulga through	**Loss of sense of place** A 'loss of sense of place' is a concern of some Bulga residents. Bulga experiences low population turnover and residents have relatively positive health, employment, crime rate and property ownership characteristics that are illustrative of a stable and cohesive community. The reference case (if the proposals were not to proceed) would have a subsequent 'loss of sense of place' for a different set of stakeholders if viable mining could not be maintained. These would include employees, particularly those that reside in the Singleton LGA (35 per cent of the workforce) and others where the present level of social services could not be maintained (for example student numbers and school closure). **Loss of historic heritage** Small portions of the former RAAF Base Bulga Complex and Great North Road would be impacted by the proposal, and heritage impacts are considered minor. The former RAAF Base Bulga Complex and the Great North Road have been subject to comprehensive assessment, and Conservation Management Plans have been prepared for both. The former RAAF Base Bulga Complex has also been subject to archival recording in accordance with NSW Heritage Office guidelines. No direct or indirect impacts are predicted on heritage items located in and surrounding Bulga village. The study found that with the implementation of the mitigation measures (see Chapter 19), potential heritage impacts within the study area are likely to be low. Coal & Allied would implement the following additional management measures: • establish the MTW Historic Heritage Conservation Fund – the purpose of the fund is to provide resources for local historical research and heritage conservation projects proposed by the local community; and • establish the Great North Road Conservation Fund – the purpose of the fund is to provide resources for heritage conservation works on significant surviving elements of the convict built Great North Road located within Singleton LGA (and potentially other areas including the Great North Road World Heritage Area).

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
	potential impacts of population decline on the management and maintenance of those places.	**Loss of Aboriginal cultural heritage** Places of material Aboriginal cultural heritage have been identified within the proposed 2014 disturbance area. There are 110 places of material cultural heritage within the proposed 2014 disturbance area that would be disturbed or destroyed as a result of the proposal. However, there are no Aboriginal cultural heritage places with scientific values that constitute a constraint on the proposal. Aboriginal cultural heritage at MTW would continue to be managed under the auspices of the CHWG and the ACHMP. In particular, the WBACHCA would be established for the long-term conservation and management of Aboriginal cultural heritage places and values (see Chapter 19).
MTW workforce and their families	**Retention of MTW workforce and their families** A range of stakeholders identified positive opportunities for the community from the proposal. These opportunities were largely identified for the broader Singleton LGA as a result of the retention of the MTW workforce and their families as a result of the proposal. It was described that the workforce and their families contribute to the community, not only economically (through local spending and support for local business), but also through community participation (attendance at local schools, participation in sporting and other community events and community volunteering).	**Indirect contributions of the proposal on the community** The local community is experiencing impacts from the recent downturn in the coal industry including a decline in population and the loss of mine workers and their families. Approximately 35 per cent of the MTW workforce lives in Singleton LGA, 56 per cent of the workforce have children who attend educational facilities in their local LGA and approximately 33 per cent participate in volunteering in their local LGA. The MTW workforce and their families contribute to the local and regional economy and community through high levels of local spend and through the continuing use of community facilities and participation in the community, such as through volunteering. The employee and supplier survey results indicate that there would be benefits to small to medium sized enterprises (SMEs) from the retention of the workforce. The proposal would ameliorate some of uncertainty in the community resulting from the recent downturn in the coal industry.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Intergenerational and intra-generational equity	**Rural sustainability and intergenerational equity** Some stakeholders perceived that there would be impacts on rural sustainability and intergenerational equity as a result of loss of family and community heritage and the loss of rural villages, environment, community and other associated livelihoods (for example, local business and agriculture). These impacts were perceived as potentially permanent and significant due to the perceived inability to replace the heritage, community and land values of the area post-mining.	**Final landform and land uses** Following the completion of mining and rehabilitation, a final landform would remain that is safe, stable, free draining, and non-polluting. This would be integrated with the surrounding landscape. The final landform would support final land uses including for the conservation of native vegetation and for agriculture for existing and future generations. The impacts the proposal on heritage and land-values are described above and below, respectively. **Direct and indirect employment** The proposal contributes to social equity by providing direct and indirect employment. It would result in the transformation of a geological resource into physical and human capital through investment in infrastructure and workforce training, and, indirectly, through contributions to governments which would enable greater investments in public infrastructure and services.
Health and well-being		
Health and well-being – community uncertainty	**Health impacts** Stakeholders, particularly near neighbours, raised concerns regarding health impacts from the proposal. Perceived health impacts related to stress as a result of uncertainty for the future; and concerns about the health impacts of poor air/water quality. **Stress and uncertainty** Some stakeholders were concerned about health impacts from stress and uncertainty – for themselves, their family and the community. This uncertainty was most often related to: the acquisition process; the future of Bulga and its community; potential decline of community and fracturing of families; a mistrust of the proposal assessment process; uncertainty regarding ability to sell properties, property values, and related impacts on investments/assets and their future.	**Stress-related health impacts** Health and well-being impacts need to be considered at a community level. In a study of the health of Hunter Valley communities in proximity to coal mining and power generation, Merrit *et al*. (2013) found that: > There were no significant differences in management rates of mental health conditions in the Hunter Valley region compared with the rest of rural NSW. Management rates of depression and anxiety were not higher, nor were prescription rates of antidepressants. This indicates that similar levels of anxiety are experienced in Hunter Valley region compared to rural NSW as a whole although the causes of anxiety may vary between regions. **Health impacts of dust** The air quality and greenhouse gas study was completed in accordance with the applicable NSW and Commonwealth guidelines, standards and impact assessment criteria which take into account the known health effects of particulates on sufferers of asthma, lung conditions and heart disease. Air quality assessment criteria are designed to protect urban communities. Compared to the urban environment, there are less fine particulates in dust from mining and these particulates do not contain combustion products. Therefore, the assessment criteria provide a high level of conservatism when used to determine the acceptable levels of dust from mining projects in rural settings. The assessment results based on these criteria are described in above in 'Impacts on air quality'. **Health impacts of blast fumes** The impacts of blast fumes have been assessed based on guidelines, standards and impact assessment criteria. With the implementation of blast restrictions when required, blasts would not result in assessment criteria being exceeded. The

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

Impact/opportunities	
Perceived	**Technical assessment**
	assessment results based on these criteria are described in above in 'Impacts from blasting/vibration'. **Impacts on rainwater tanks** Lucas *et al*. (2009) investigated the potential for health impacts from coal dust deposited on rooftops and washed into water tanks. With the exception of two mine-owned residences, the incremental dust deposition predicted for the proposal at private and mine-owned residences is less than the 2g/m^2/month incremental criterion in all modelling years. Taking the predicted dust deposition levels, the spatial separation of residences from the mine and the findings of Lucas *et al*. (2009) into account, the potential for adverse impacts to rainwater tanks from the deposition of coal dust is low, even at the closest residences. **Impacts of mining on health** Merrit *et al*. (2013) conducted an analysis of general practice data for rural communities in close proximity to coal mining and coal-fired power generation in the Hunter Valley to identify unusual patterns of illness. The study in the NSW Public Health Bulletin concluded that: > There was no evidence of a significant difference in problems managed or medications prescribed by [general practitioners] GPs for residents of communities potentially affected by heavy industrial activity (coal mining and power generation) in the Hunter Valley region of NSW compared with residents in the remainder of rural NSW during the period 1998–2010. The diverging trend for respiratory problem management over time is worthy of further exploration. The "diverging trend" refers to a comparison of the management rates of respiratory problems (as a group) during the period 2005–2010 with those for 1998–2004. This indicated that there was no significant change in the Hunter Valley region despite a significant decrease for the remainder of rural NSW over this period. However, the statistical significance of this difference could not be determined due to the sample size. **Other** Particular areas of concern to stakeholders regarding community uncertainty are addressed elsewhere in this chapter in the following sections: • uncertainty surrounding the acquisition process; • the future of Bulga and its community; • potential decline of community and fracturing of families; • a mistrust of the proposal assessment process; and • uncertainty regarding the ability to sell properties, property values, and related impacts on investments/assets and their future.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Vulnerable groups	**Impacts to vulnerable groups** Some stakeholders expressed concern that some vulnerable groups would be exposed to impacts on: their health from the amenity impacts; their economic and asset base due to a perceived inability to sell properties/assets; and indirectly through the potential loss of community services and facilities in light of a perceived decline in community.	**Vulnerable groups** Particular areas of concern to stakeholders regarding vulnerable groups are addressed elsewhere in this Chapter: • potential amenity impacts of the proposal (from noise, dust and vibration); • health matters related to mining; • potential impacts on property values and ability to sell; and • the potential for fracturing of the community. **Mitigation measures** Notwithstanding this, it is recognised that vulnerable groups, including older members of the community, may not adapt to change and can be more susceptible to impacts, perceived or otherwise. In recognition of this concern, Coal & Allied propose to contribute to a Bulga and Near Neighbour Amenity Resource which would provide services such as property maintenance to residents surrounding the operation. Vulnerable near neighbour residents would have access to this resource.
Economic		
Properties value, saleability and investor confidence	**Negative impacts on property values and saleability** Near neighbours raised concern that the proposal would have a negative impact on property values and ability to sell in line with current and historical trends. **Positive impacts on property values and saleability** Stakeholders living in Singleton perceived favourable property market opportunities as maintenance of the current workforce would help to stabilise the property market after recent decreases in sales results and rental returns. Some stakeholders (including Singleton residents, businesses and real estate agents) suggested that the recent contraction of the coal industry had contributed to the weakening of the property market through decreased demand. Local business stakeholders (Singleton-based real estate agents) suggested that the market was 'over-heated'	**Recent property market trends** Recent property market data for the Singleton LGA show a decline in sales results and a dramatic fall in rental returns for Singleton LGA. Median sales prices fell consistently in 2013 (almost 9 per cent annual decline for all properties) and rental returns fell by approximately 25 per cent on average in the 12 months to December 2013. The issue of devaluation of properties was considered by Stubbs (2012) who examined the purchase price of properties within Bulga during the lodgement and determination of the application for the Warkworth Extension Project in 2010 and 2011 and early 2012. The application was lodged on 1 March 2010 and the EA was placed on exhibition from 30 April to 15 June 2010. The matter was considered by the PAC and an approval granted on 3 February 2012. The approval was subsequently appealed in the L&E Court. Stubbs (2012) examined the sale price of all properties sold in Bulga between 1 April 2008 and 23 May 2012. She noted that the purchase price of properties did not appear to have been affected by the lodgement and assessment of the application, with median property values in Bulga and surrounds increasingly considerably since that time ($282,500 median sale price in the two years prior to lodgement, and $450,000 median sale price since the lodgement) (Stubbs 2012). **Property market stabilisation** The proposal would aim to maintain current workforce levels across MTW operations, which should contribute to population levels in the Singleton LGA (with over 35 per cent of MTW employees residing in Singleton LGA) and, subsequently, partly assist in stabilising the property market. Coal & Allied would continue to manage residential properties via the open market. Coal & Allied utilises the services of local real estate agents to manage its properties to a high standard of maintenance and management.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
	during the coal mining boom, and that current soft property market figures may reflect a recalibration of the market towards a more realistic and stable trend.	
Property maintenance and impact management costs	**Property maintenance and impact management costs** Near neighbours perceived that the impacts of current operations, particularly dust and vibration impacts, have a direct and ongoing economic cost and that the proposals would intensify those impacts. Near neighbour communities are not generally connected to mains water supply, so properties are reliant on tank water.	**Assessment of impacts** Air quality and noise and vibration studies indicate that dust and vibration levels would be within the relevant guidelines. **Water tanks** Regardless of proximity to mining water tanks generally require routine maintenance to ensure that water quality is maintained. The impacts of the proposal on rainwater tanks are summarised in 'Health and wellbeing impacts'. While there would be no significant impacts to private residences directly attributable to the proposal, Coal & Allied propose contribution to a Bulga and Near Neighbour Amenity Resource to provide services to residents surrounding the operation.
Employment and training	**Employment and training opportunities** Stakeholders identified employment, expenditure on suppliers' services and associated opportunities for skills development and scholarships as primary benefit of the proposal. **Contribution to economic growth** Experience with the growth of the coal industry since the late 1990s gave some stakeholders confidence that the proposal would significantly contribute to employment and economic growth in the Singleton LGA. Local business stakeholders were confident that the proposal would deliver employment and skills development opportunities across the Singleton LGA. Many stated that small downturns in coal industry activity were immediately felt by local suppliers and that the proposal would stabilise supplier workforce numbers and supporting revenues.	**Ongoing workforce and suppliers** MTW currently employees a workforce of approximately 1,300 persons on average. Although Warkworth Mine and MTO are integrated operations and workforce numbers are difficult to assign to the respective development consents, an estimate of 63 per cent (819 persons on average) could be attributed to activities on the Warkworth Mine development application and 37 per cent (481 persons on average) to the MTO development application. The proposal aims to maintain current workforce levels across MTW operations, bringing with them employment and training opportunities and are expected to contribute employment and supplier revenue benefits into the medium-term, with economic opportunities for the region extending over the proposal life-cycle.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Representation of local residents, near neighbours, women, and Aboriginal and Torres Strait Islanders in the MTW workforce	**Representation of local residents, near neighbours, women, and Aboriginal and Torres Strait Islanders in the MTW workforce** Many near neighbour residents from Bulga, Milbrodale, Long Point/Gouldsville contended that few near neighbours were employed at MTW and that no new targets for lifting employment rates for near neighbour communities or local employment are included in the proposal.	**Locals in the workforce** As described in Section 21.3.2 almost three quarters of MTW employees and long-term contractors live in the Mid and Upper Hunter region: Singleton LGA (35 per cent), Cessnock (19 per cent) and Maitland LGA (17 per cent). In January 2014, MTW employed 24 people from direct near neighbour communities (for example, Bulga, Milbrodale, Warkworth and Maison Dieu) which equates to approximately 7 per cent of the labour force from those communities. Coal & Allied maintains a continued preference for employees and contractors to reside locally. **Women and Aboriginal people in the MTW workforce** About 12 per cent of the current workforce (both employees and contractors) are women. Rio Tinto Coal Australia's goal is to achieve 15 per cent female employment across it operations (RTCA 2014) which is the average proportion of female employees in the mining Australian industry (WGEA 2013). The Indigenous workforce (both employees and contractors) represent about 2 per cent of the total MTW workforce. Rio Tinto Coal Australia's goal is to achieve five per cent Indigenous employment across its operations (RTCA 2014). The proportion of Indigenous people in the Australian mining industry is four per cent. The MTW Diversity Action Plan has a focus on increasing Indigenous and female employment. Coal & Allied would continue to implement the MTW Apprenticeship and Graduate programme, drawing on local candidates, and consisting of: • five new apprenticeship positions each year; • Aboriginal scholarship programme in partnership with University of Newcastle, supporting two Aboriginal students per annum with a scholarship programme and vacation employment to complete their degrees; • two graduate positions per annum on a two year programme; and • two vacation student positions each year.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Local and regional businesses and industry	**Opportunities for local businesses** Local businesses generally speculated that the economic contribution of the proposal would be the most significant opportunity, with continuity of work and the implications that continuity has for workforce planning and maintenance being cited as the most critical benefits for suppliers.	**Hunter Valley labour market outlook** The HVRF's measure of employment intentions suggest that further weakness in the Hunter Valley labour market can be anticipated. Employment intentions have declined since December 2011 with HVRF's most recent measures lower than those during the Global Financial Crisis of 2008. Similar trends are also evident in the HVRF's (2013b) Household Survey, which suggests that consumer confidence and purchasing intentions in the Hunter Valley remain negative. Overall, HVRF (2013b) conclude that the economic outlook for the Hunter Valley reflects the end of the previous expansion phase combined with a drive to achieve efficiencies, the effects of which are now being felt by local suppliers, contractors and operational employees. Continued MTW operations would assist in maintaining a proportion of supplier revenues. Coal & Allied would continue: • to engage with Singleton Council on key areas of common interest including attraction and retention of residents and long-term planning; • the preference for employees and contractors to reside locally; and • the development of the Coal & Allied Local Procurement Strategy incorporating the MTW operation.
Corporate community investment and sponsorship	**Continued contribution to, and investment in, local communities** Stakeholders reflected on the potential for continued contribution to, and investment in, local communities through the proposals, including: Aboriginal and Torres Strait Islander employment, education and training opportunities; direct contributions to community service providers; and, contributions made to training and life-skills programmes at Singleton High School.	**Continued contribution to, and investment in, local communities** Existing direct community contributions and investment from MTW operations would continue under the proposal. Employees and suppliers make financial and non-financial contributions to the regional community and participated significantly in community activities, which in turn, contribute to community way of life. The proposal would continue to provide employment and economic benefits to suppliers, allowing employees and suppliers to continue to contribute to the community. A proportion of the MTW Site Donation Committee annual funding would be dedicated for projects which contribute to near neighbour communities, including the Bulga community, and which are in accordance with the funding guidelines of the Committee.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Other industries and diversification	**Retention of skilled employees** Local business stakeholders perceived that it was difficult to retain skilled employees given their migration to mining jobs for higher salaries. **Two-speed economy** Several stakeholders commented on the mining industry's contribution to the creation of a 'two-speed economy', where those employed by or who contract to the industry enjoy substantial financial benefits whilst others deal with the inflationary effects on cost of living generated by spending of these benefits. **Diversification** Local government stakeholders perceived that there is insufficient planning regarding structural diversification of the Singleton LGA economy.	**Requirement for skilled employees** The proposal would continue current requirements for skilled workers and would continue to be a focus of planning in the Singleton LGA, generating potential for continued skills migration from other industries in the region and potential for maintenance of the status quo when it comes to structural diversification planning. **Structural diversification required** The imperative for structural diversification has become even more apparent since the end of the mining boom, with the HVRF (2014) noting that the medium-term outlook for increased non-mining productivity in the region would depend on business capacity to invest in innovation and skills to adapt to, and develop, new products, services and markets as the resources boom fades.
Infrastructure and services		
Infrastructure, services and local community facilities	**Pressure on local infrastructure and services** Local government stakeholders perceived that maintenance of MTW workforce numbers would continue to place pressure on local infrastructure, particularly through the frequency of heavy vehicle movements on local roads. However, local government representatives also noted the positive benefits of retention of MTW workforce on community infrastructure and services. Near neighbours perceived that the medium to long-term viability of community facilities and services in Bulga, including the Bulga Hall, tavern and store, would be impacted by proposal-related acquisitions and associated relocation of Bulga residents. Near neighbour stakeholders perceived a failure to	**Demand for local infrastructure and services** There would be no increase in the use of local infrastructure and demand for health and allied services, emergency services and emergency departments under the proposal, as the intention is to retain the current level of employment. Traffic would remain similar to current levels and safety levels would be unaffected. The proposal would aim to maintain current average workforce levels across MTW operations, helping to stabilise population levels across the Singleton LGA. Subsequently, the contribution of MTW employees to council land rates would be maintained, helping to support the viability of current council services. The continued MTW workforce and their families would also help maintain the use of local businesses and services, particularly shops, services, schools and childcare facilities. A Voluntary Planning Agreement (VPA) would be negotiated with Singleton Council. The VPA presents an opportunity to ensure a proportion of the funds are dedicated to maintaining and/or improving facilities and services in Bulga, other local neighbouring communities, and the Singleton LGA as a whole. As described in the noise section of this table, no residences in Bulga village would be afforded acquisition rights under the proposal due the predicted noise levels being in exceedence of relevant regulatory criteria. It is noted that one resident, assessment location 34, which is north of the village would be afforded acquisition rights. Therefore, proposal related

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
	adequately plan for lease holdings at the tavern and store following acquisition. It was perceived that changes to these facilities would impact the way of life in the village and access to services, particularly for the elderly, ill and disabled. Local government stakeholder's identified the potential opportunity to stabilise population levels across the Singleton LGA. Subsequently, the contribution of MTW employees to council land rates would be maintained, helping to support the viability of current council services.	acquisitions would not impact the medium to long-term viability of community facilities and services in Bulga, including the Bulga Hall, tavern and store. The maintenance of the current workforce under the proposal, however, may contribute to the viability of the community facilities and services.
Closure of Wallaby Scrub Road – traffic, safety, emergency services	**Wallaby Scrub Road closure impacts** Many stakeholders, including emergency services and local council representatives, perceived that the closure of Wallaby Scrub Road is a key impact of the proposal. It is perceived that it would impact vehicle accident rates, emergency services, shift workers and local residents access to towns. Many local stakeholders perceived that there are a high number of accidents at the intersection of Putty Road and the Golden Highway. It was perceived that the proposal would increase the frequency of vehicle movements through this intersection given the closure of Wallaby Scrub Road. It was also perceived that traffic would increase on the Golden Highway between Putty Road and the existing intersection with Wallaby Scrub Road and that, in turn, this would increase vehicle movements through the intersection of Long Point Road and the Golden Highway. Near neighbours perceived increases in accidents at this location given that there are no turning bays at this intersection.	**Wallaby Scrub Road closure impacts** The traffic and transport study (see Chapter 20) found that the primary traffic impacts as a result of the closure of Wallaby Scrub Road would be as follows: • Level of service would remain unchanged at all intersections. • There would generally be minimal traffic impacts on the detour roads for the Wallaby Scrub Road closure as these roads (and the relevant intersections) have sufficient spare capacity to accommodate the resulting additional traffic with minimal intersection capacity impacts or delays. • The Putty Road and Charlton Road originating vehicle movements would be subject to increased travel distances of approximately 8.8km and 6.2km and additional travel times of 6 and 4 minutes per trip, respectively. • Travel safety and travelling conditions for the detoured traffic is expected to be improved due to improved road construction standards on the Golden Highway. • There would also be some savings in road maintenance costs for the Singleton Council as a result of the road closure. In its letter dated 19 May 2014 (see Appendix O), the RFS advises that "whilst its preferred option would be the relocation of Wallaby Scrub Road to maintain access for emergency services, an acceptable second option is the construction of a suitable fire trail on the perimeter of the proposed extension area..". The applicant has committed to the construction of an emergency access road/fire trail between Putty Road and the Golden Highway in accordance with RFS standards under the proposal. Impacts on other local roads generated by Warkworth Mine and MTO employees on external public roads would not change as there would be no change to the combined average project workforce. Truck traffic generated would remain at similar levels.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
	Voluntary emergency service stakeholders (Bulga, Warkworth and Jerrys Plains RFS stations) estimated that travel to areas along the Golden Highway west of the Wallaby Scrub Road intersection and east to Long Point Road would require additional travel time for trips to Bulga, Milbrodale and Broke from RFS stations at Warkworth and Jerrys Plains. Near neighbours perceive that the closure of Wallaby Scrub Road would inconvenience all Bulga and Milbrodale and some Broke residents in accessing areas west of the current intersection of Wallaby Scrub Road and Golden Highway.	
Community engagement/relationships and governance		
Company and community relationships	**Opportunities to improve historic community relations** Some stakeholders perceived that there were opportunities to improve historic community relations and management of the mine's current impacts. This perception has impacted community trust. **Positive community relations** Some stakeholders from local business and local government described positive interactions with individual staff at MTW but perceived a general history of relations with scope for improvement with the mine and a lack of ability to openly discuss, negotiate and engage as part of the local business and resident community.	**Opportunities to improve community relations** Since the Warkworth Extension 2010 proposal, based on feedback received from a range of stakeholders, a suite of ongoing and proposal specific strategies have been developed by Coal & Allied for communications generally and to manage/ mitigate or enhance these proposal-related impacts and opportunities. These are provided in Sections 21.5.1 and 21.5.2.

Table 21.5 Social impacts and opportunities from the proposal – perceived and technical studies

	Impact/opportunities	
	Perceived	**Technical assessment**
Understanding of community and social impacts	**Opportunity to improve understanding of relationships** Some stakeholders perceived the opportunity to improve understanding of relationships with the community through the assessment process.	**Opportunity to improve understanding of relationships** The assessment provides an opportunity to build understanding of community and social impacts and to improve company-community relations. Stakeholder feedback also suggested some satisfaction with the consultation process itself, and the ability to 'be heard'.
Government major project assessment process, regulation, monitoring and public representation	**Confidence in government assessment processes** Stakeholders, including near neighbours, local businesses and council, and other interested stakeholders, perceived that the changes encompassed in the Mining SEPP have resulted in a loss of confidence in the NSW Government to adequately assess major mining projects, including this proposal, and to provide protection to, and representation of, the public. Stakeholders pointed to current allegations before the Independent Commission Against Corruption (ICAC) (during early-mid 2014) and the demonstrated connections between some mining companies and the NSW government (for example, improper donations). Stakeholders also discussed the impact on the ability to undertake a merits-based appeal on a project as an impairment of democratic rights. This proposal is seen by stakeholders to be relevant to the Mining SEPP amendments due to the timing and history of the proposal.	**Government assessment processes** Coal & Allied conduct its operations in accordance with NSW and Commonwealth legislation and internal high standards of conduct, including The Way We Work, its statement of business practice. As described in Chapter 7, the proposal will be considered by the NSW Government under the EP&A Act and a range of other legislation, regulations, policies and guidelines. These documents are frequently updated to ensure their ongoing relevancy. This EIS was prepared in accordance with current legislation and government policy and used the most recent and accurate scientific data relevant to the proposal. Feedback received from community and government stakeholder engagement together with the Secretary's requirements and the L&E Court judgement, provided guidance to the assessment approach, ensuring that all potential matters of relevance associated with the proposal were assessed.

21.5 Management and monitoring

21.5.1 Existing socio-economic initiatives

Coal & Allied would continue to implement a range of socio-economic initiatives under the proposal. These initiatives include the below.

- Continued management of Coal & Allied residential properties via the open market. Coal & Allied utilises the services of local real estate agents to manage its properties to a high standard of maintenance and management.
- Continued support for local primary schools – i.e. Broke and Milbrodale Public Schools.
- Continued engagement with Singleton Council on key areas of common interest including attraction and retention of residents and long-term planning.
- Continued dedication of a proportion of the MTW Site Donation Committee annual funding for projects which contribute to near neighbour communities, including the Bulga community, and which are in accordance with the funding guidelines of the Committee.
- Continued development of the Coal & Allied Local Procurement Strategy incorporating the MTW operation.
- Continued preference for employees and contractors to reside locally.
- Continued implementation of the MTW Diversity Action Plan, with a key focus on increasing Indigenous and female employment relative to the local demographic context.
- Continued implementation of the MTW Apprenticeship and Graduate programme, drawing on local candidates, and consisting of:
    - five new apprenticeship positions each year;
    - Aboriginal scholarship programme in partnership with University of Newcastle, supporting two Aboriginal students per annum with a scholarship programme and vacation employment to complete their degrees;
    - two graduate positions per annum on a two year programme; and
    - two vacation student positions each year.
- Enhance two-way flow of information and feedback between the MTW operation and the community through appropriate programmes such as a 'Community Scorecard'.
- Continued development of a mechanism to provide information on operational monitoring results and responses on a regular basis.
- Continued implementation of the Near Neighbour Engagement Programme (incorporating Bulga, Long Point, Warkworth, Mt Thorley, Milbrodale, Maison Dieu and Gouldsville) as part of Coal & Allied's Multi-Year Community Relations Plan, including:
    - community events (dinners/BBQs) in Bulga each year including optional site tours;

- a “Closure 101” information session with the community to provide an overview of the Coal & Allied approach to mine closure planning, rehabilitation, future land use and management;

- specific consultation for mining related activities that require near neighbour community input and communication; and

- continued provision of a bi-annual open day to provide community stakeholders with the opportunity to visit the site and further understand the operation.

- Continued implementation of a Community Awareness Induction program for new and existing MTW site employees.

21.5.2 Proposal specific mitigation

Additional initiatives that relate specifically to the proposal and form part of the statement of commitments (see Table 22.1) are provided below. It is noted that management and monitoring measures related to social amenity and community sustainability are detailed in the relevant technical aspect chapters and are not repeated here.

Proposal specific mitigation comprises:

- the development of a Social Impact Management Plan (SIMP) to manage and monitor the implementation of strategies to reduce identified social impacts and enhance social opportunities. The SIMP would detail implementation responsibilities; timing; performance indicators and targets; and monitoring measures. The SIMP would be prepared in consultation with key stakeholders, following the EIS public exhibition and submissions process. The key aims of the SIMP would be to:

    - reflect the findings and recommendations of the SIA and provide a short summary of findings;

    - summarise for all stakeholders the potential positive and negative impacts of the proposal, proposed mitigation and management strategies, and implementation actions;

    - be developed for the life of the proposal; and

    - promote an active and ongoing role for communities, local authorities and all levels of government through construction, operation and decommissioning of a proposal.

- the negotiation of a Voluntary Planning Agreement with Singleton Council. The VPA would present an opportunity to ensure a proportion of the funds are dedicated to maintaining and/or improving facilities and services in Bulga, other local neighbouring communities, and the Singleton LGA as a whole.

- the establishment of a Bulga and Near Neighbour Amenity Resource to provide support to residents surrounding the operation.

21.6 Conclusions

Coal mining is a key industry and is the largest employer in Singleton, Cessnock, Muswellbrook LGAs, and the second largest employer in Upper Hunter Shire LGA. These LGAs have generally experienced population growth greater than the NSW average between 2006 and 2011 (with the exception of Singleton LGA). Average incomes in these areas have also increased by more than the NSW average. However, the recent slowdown in the mining industry has impacted the regional economy.

The proposal would enable operations to continue in 2015 and beyond allowing MTW to maintain 1,300 jobs over the longer term (of which approximately 1,187 would be attributed to Warkworth Mine under the proposal) and so continuing to be a major employer in the Singleton LGA. As an established operation, the greatest impacts on the socio-economic environment and community services are predicted to occur if the proposal does not proceed. These would include:

- workers and their families moving away from the area;
- workers and their families faced with unemployment and financial difficulties;
- reduced local spending;
- decreased local businesses;
- population decline;
- reduced viability of services such as local schools; and
- reduced community life and participation.

The stakeholder perceived impacts and opportunities of the proposal, paying particular attention to Bulga village, have been determined through consultation and were compared to the outcomes of the environmental aspects and economic technical studies that form part of the EIS or with external literature.

The selection of stakeholders focussed on consulting with those who were concerned regarding the proposal. The majority of the perceived impacts or matters raised by stakeholders are addressed by the corresponding technical studies of the impact. Coal & Allied would continue to address these matters of concern for stakeholders through ongoing consultation process to inform stakeholders of the impacts of the proposal and proposed mitigation, management and enhancement strategies. This EIS forms an important part of this consultation.

In addition, a suite of continuing and new social initiatives strategies have been developed by Coal & Allied to manage or mitigate perceived impacts and to enhance opportunities, based on feedback from stakeholders. These strategies include the continued investment in the community and engagement with key stakeholders including Singleton Council and near neighbours and enhancement of the two-way flow of information and feedback between the MTW operation and the community through appropriate programmes such as a 'Community Scorecard'.

A SIMP would be developed for the proposal to further develop these management and mitigation measures and detail a plan of implementation including responsibilities; timing; performance indicators and targets; and monitoring measures. The SIMP would be prepared in consultation with key stakeholders, following the EIS public exhibition and submissions process.

Chapter 22

Environmental management and commitments

Chapter 22 — Environmental management and commitments

22 Environmental management and commitments

This chapter describes the commitments made by Coal & Allied through the life of the proposal to manage potential impacts identified within the EIS. Commitments include management, mitigation and monitoring and/or compensation measures.

Environmental management at Warkworth Mine has been discussed in general in Section 6.4 and includes management under Coal & Allied's accredited ISO 14001 EMS. This forms part of Rio Tinto Coal Australia's HSEQ Management System and the basis for ongoing environmental management. The EMS is a management tool implemented by the company, rather than a consent requirement. It would continue to be implemented across Warkworth Mine. The relevant plans, procedures and monitoring programmes contained within the EMS would be reviewed and modified to incorporate the commitments outlined in this chapter and reflect the changes to operations resulting from the proposal.

The technical studies provide a number of measures to avoid or minimise the potential impacts resulting from the proposal. These measures have been considered in the context of existing operations at Warkworth Mine and the EMS. Many of these measures are already in place as part of exiting controls and would continue to be implemented under the proposal.

Commitments relating specifically to the proposal, beyond those implemented in the current EMS, are presented in Table 22.1 below.

Table 22.1 Commitments

Item	Commitments
General	Upon receipt of development consent, all management plans relevant to the proposal would be updated with requirements as specified in this EIS and any subsequent response to submissions report.
Noise	Management and monitoring of noise would continue to be undertaken in accordance with the MTW noise management plan. The noise management plan would be reviewed and updated to include the following additional management measures: • Land acquisition: - acquisition rights would be afforded to one additional privately-owned assessment location (34) predicted to experience noise levels above the relevant criteria for operational noise under prevailing meteorological conditions.
Air quality and GHG	Management and monitoring of air quality would continue to be undertaken in accordance with the MTW AQMP. The MTW AQMP would be reviewed and updated to incorporate the proposal.
Groundwater	Management and monitoring of groundwater would continue to be undertaken in accordance with the MTW WMP. The MTW WMP would be reviewed and updated to include the additional management measures prescribed below. • Updates to current groundwater monitoring programme: - installation of nested monitoring bores along the Wollombi Brook (PZ10, PZ11, PZ12); and - installation of monitors bores with the Warkworth Sands system as part of an update to the existing Warkworth Sands Ephemeral Perched Aquifer Management Plan within the MTW WMP. • Mine seepage monitoring programme: - recording of the time, location and estimated volume of any unexpected increased groundwater outflow from the highwall and endwall; - measurement of water pumped from the mine, preferably using flow meters or other suitable gauging apparatus; - correlation of rainfall records with mine seepage records so groundwater and surface water can be separated; and - monitoring of coal moisture content. • Data management and reporting: - establishment of trigger levels; - quarterly review of groundwater levels and field water quality against trigger levels, with site-specific investigations initiated; - formal review of depressurisation of coal measures and alluvium would be undertaken annually by a suitably qualified hydrogeologist; - annual reporting (including all water level and water quality data); and - all groundwater data being stored in a database customised for MTW with suitable QA/QC controls. • Future model iterations: - assess the validity of the model predictions every three years; and - incorporate into the model and revise predictions, if required.

Table 22.1 Commitments

Item	Commitments
	• Licensing: - retain and obtain appropriate water licences, as required, to account for modelled take.
Surface water	Management and monitoring of surface water would continue to be undertaken in accordance with the MTW WMP. The MTW WMP will be reviewed and updated to include the following additional management measures: • Licensing: - retain and obtain appropriate water licences, as required, to meet operational requirements. • Surface water monitoring programme: - update to include locations of new dams as they are constructed (ie NOOP and Sediment Dam B) with EC, pH and TSS monitored monthly and a comprehensive analysis six monthly.
Ecology	Management and monitoring of ecology would be undertaken through the proposed biodiversity offset strategy which would include: • establishment of two offset sites (SBA and NBA) for the conservation of WSW and non-WSW vegetation; • contribution to the UHSA and/or the use of supplementary measures to meet the outstanding credit requirements; and • proposed rehabilitation of mined areas.
Aboriginal and cultural heritage	Management and monitoring measures to be implemented for Aboriginal and cultural heritage comprise: • Preparation of an integrated HMP. • Management of Aboriginal cultural heritage at the Site, including: - implement only the agreed impact management measures for those places for which development impacts are unavoidable, with avoidance through design planning being the preferred option; - continue investigations into the feasibility of moving the Site M grinding grooves (37-6-0163); and - involve the Aboriginal community in the implementation of all impact management measures consistent with the existing CHWG processes and protocols with such being formalised and conducted under a terms of reference. • Establish and manage WBACHCA in accordance with a customised management plan developed in consultation with the CHWG and other stakeholders including DP&E and OEH. • Management of other 'onsite' Coal & Allied owned lands in accordance with such procedures and protocols as outlined within the provisions of the CHMS and ACHMP (or HMP). • Implement the outcomes of the Hunter Valley Sand Bodies Research Study.

Table 22.1 Commitments

Item	Commitments
Historic heritage	Management and monitoring to be implemented for historic heritage comprise: • Conservation Management Plans: - adopt the measures of existing CMPs for the former RAAF Base Bulga Complex and the Great North Road Complex; • Archaeological investigations: - test pit along locations of Wallaby Scrub Road where there is potential for subsurface remains associated with the early road system; - mechanical excavation and recording of Well #2; and - test excavation of the eastern runway of the former RAAF Base Bulga Complex. • Salvage of moveable heritage items: - approach Singleton Local Historical Society and Museum to offer opportunity for salvage of moveable heritage items. • Implement a Chance Finds Procedure. • Heritage interpretation: - establish an interpretation programme of the heritage values of the RAAF Base Bulga Complex and the Great North Road Complex, in collaboration with the local community groups. • Local Community Historic Heritage Conservation Initiative: - establish two historic heritage funds – the Mount Thorley Warkworth Historic Heritage Conservation Fund and the Great Northern Road Conservation Fund.
Traffic and transport	Management and monitoring measures to be implemented for traffic and transport comprise: • Wallaby Scrub Road: - prepare a road closure implementation plan for Wallaby Scrub Road, in conjunction with the relevant road authorities and emergency services, which will include strategies to minimise potential impacts of the closure. • Emergency services access road: - construct an emergency access road, in accordance with the guidelines provided in *Planning for Bush Fire Protection* (RFS 2006) and the NSW Bushfire Coordinating Committee Policy No. 2/2007, between Putty Road and the Golden Highway prior to the closure of Wallaby Scrub Road. • Road safety review: - review the existing speed advisory and curve warning signs for all the curves on the roads which are likely to be used by detoured traffic (ie Putty Road, Broke Road, and Golden Highway) prior to the closure of Wallaby Scrub Road.

Table 22.1 Commitments

Item	Commitments
Final landform and rehabilitation	Rehabilitation will continue to be undertaken in accordance with the MOP. Should the proposal and the Mount Thorley Operations 2014 be approved, the plan will be updated to include objectives for combined MTW rehabilitation as described below. • Rehabilitation domain objectives: - progressively establish approximately 2,100ha of EEC woodland (an ironbark community) across the combined MTO and Warkworth Mine; and - create an additional north/south wildlife corridor providing connectivity to other habitat. • Post-mining management: - upon determination of the closure of Warkworth Mine, prepare a Closure Strategy and subsequent Closure Management Plan, in consultation with employees and relevant external stakeholders. The Closure Management Plan would include: ▪ a description of specific technical solutions related to infrastructure and facilities for the preferred closure option or options; ▪ full auditable details of closure cost; ▪ a detailed communication plan that is executed in a timely, consistent and transparent manner. This must target all internal and external stakeholders; and ▪ a socio-economic mitigation programme. - prepare a final void management plan at least five years prior to completion of mining and include: ▪ identification of possible beneficial uses for the void; ▪ review of modelling and predictions of long-term hydrological behaviour and water quality responses, including final void water quality and level; ▪ long-term integrity of void slopes; ▪ waste characterisation and containment as pertains to runoff into final voids; ▪ coal seam capping; and ▪ long-term management, monitoring and mitigation measures.

Table 22.1 Commitments

Item	Commitments
Visual amenity	Management and monitoring of visual amenity will continue to be undertaken in accordance the draft MTW VIMP which will be updated to include the following additional measures: • SSVA: - develop a process to enable any landowner who perceives a significant visual impact from the proposal to receive a SSVA. The assessment will recommend appropriate mitigation if required for high impacts which will be implemented in consultation and agreement with the landowner. • Onsite mitigation: - examine, in detail, high sensitivity viewing points and determine opportunities for relevant screening treatments including site boundary treatments; - minimise the amount of pre-rehabilitation areas exposed to view by establishing grass cover to remove colour contrast; and - establish planting patterns of trees and grasses in rehabilitation areas to create a high level of visual integration with the surrounding landscape.
Social	Socio-economic initiatives to be implemented under the proposal comprise: • the development of a Social Impact Management Plan (SIMP) to manage and monitor the implementation of strategies to reduce identified social impacts and enhance social opportunities. The SIMP would detail implementation responsibilities; timing; performance indicators and targets; and monitoring measures. The SIMP would be prepared in consultation with key stakeholders, following the EIS public exhibition and submissions process. The key aims of the SIMP would be to: - reflect the findings and recommendations of the SIA and provide a short summary of findings; - summarise for all stakeholders the potential positive and negative impacts of the proposal, proposed mitigation and management strategies, and implementation actions; - be developed for the life of the proposal; and - promote an active and ongoing role for communities, local authorities and all levels of government through construction, operation and decommissioning of a proposal. • the negotiation of a VPA with Singleton Council. The VPA would present an opportunity to ensure a proportion of the funds are dedicated to maintaining and/or improving facilities and services in Bulga, other local neighbouring communities, and the Singleton LGA as a whole. • the establishment of a Bulga and Near Neighbour Amenity Resource to provide support to residents surrounding the operation.

Chapter 23

Design considerations and alternatives

Chapter 23 — Design considerations and alternatives

23 Design considerations and alternatives

23.1 Introduction

The applicant considered and investigated a number of different options for mining areas, overburden emplacement and other components in developing the proposal described in this EIS that would achieve the objectives stated in Section 2.2. The following sections provide an overview of this process.

23.2 Design considerations

Chapter 3 presents the need for the proposal and describes coal reserves known to be west of the current operation. As previously discussed, increases in the long-term average price of coal since 2003 have translated into these resources meeting internal Rio Tinto operational and financial thresholds regarding a continuation of the existing open cut operation. As a result, the proposal's objectives as stated in Section 2.2 (for example, maintaining economic viability of the mine and employment levels whilst, at the same time, minimising impacts on near neighbours to the greatest extent possible and satisfying government policy) were fundamental in the development of the design of the proposal.

As was the case with the Warkworth Extension 2010 and as described earlier in Section 2.4.1, development of the proposal considered different options and alternative plans to avoid or minimise impacts on sensitive features, including those on ecology and Aboriginal cultural heritage, whilst striking a balance between economic and financial viability requirements of the operation in the longer term.

In this context, the development of the proposal design has incorporated features of the Warkworth Extension 2010 but, importantly, includes some key differences and improvements. These are outlined in Chapter 4. Options considered, but not included for various reasons as part of the proposal in the design process are described in the following sections.

23.2.1 Mining areas

i Option 1 – retention of NDA1 (and Saddleback Ridge)

A mine design which included the retention of NDA1 (including Saddleback Ridge) was investigated. Some near neighbour residents have proposed that Saddleback Ridge should not be mined as it is perceived as important for noise, dust and visual protection from the mining operations. While WML acknowledges reference was made to this in the 2002 EIS, technical noise and air quality studies prepared for the proposal indicate that the Saddleback Ridge does not provide a 'protective' role in respect of noise and air quality amenity at Bulga.

Under this design, West Pit would be completed at the western extent of the current development consent boundary (as recently modified under Modification 6). South Pit would be completed as is currently proposed whereas North Pit would continue in a westerly direction towards Wallaby Scrub Road as currently approved. Under this option, the westerly continuation of North Pit would then mine through Wallaby Scrub Road, requiring its closure. The continuation of North Pit would avoid NDA1 but would mine through HMA1.

This mine plan was discounted for following important reasons as it did not satisfy the proposal's key objectives:

- substantial capital has been invested by MTW to establish extraction at 18Mtpa of ROM coal to minimise unit costs of production to position itself as economically viable in the long-term. A mine plan that does not support 18Mtpa of ROM coal does not provide long-term economic viability in the context of variable international economic conditions;

- a combined strike length of approximately 6.65km is currently operated at MTW. This will reduce to approximately 3.8km as mining is completed at Warkworth Mine's South Pit and MTO's Loders Pit. MTW is proposed to continue operating in the long-term from the strike length afforded by West Pit and North Pit. An alternative mine plan that excludes NDA1 at North Pit would see the strike length further reduced to 0.75km in North Pit at the shortest point. At this length, inadequate physical working room is available to allow production to be maintained at 18Mtpa of ROM coal;

- sterilisation of coal reserves in NDA1; and

- probable sterilisation of coal reserves in the area within MTO's mining lease, north of Putty Road as this would not be accessible from Warkworth Mine should NDA1 (and Saddleback Ridge) be retained. As described in Chapter 2, this area is approved to be mined by MTO under DA 34/95. Under this design option, the area would be mined from MTO, which would require relocation of Putty Road.

An important aspect of considering the option of retaining NDA1 (and Saddleback Ridge) is the Deed, established for biodiversity purposes that covered this area. As noted in the *Warkworth Mine Modification 6 Response to Submissions* (EMM 2013b), the Deed makes provision for mining of NDAs subject to a relevant planning approval issued under the EP&A Act. It is widely acknowledged that the original Deed was an early attempt at offsetting and one that does not reflect contemporary government policy. The Deed was considered by both the former Department of Planning and Infrastructure (DP&I) (now DP&E) and PAC prior to their recommendations for approval and positive determination of the Warkworth Extension 2010, respectively. In its assessment report for the Warkworth Extension 2010, the PAC noted the 'questionable condition and ecological value of much of the offset area' contained in the area covered by the Deed. Further, the Deed was incorporated into the PAC's assessment of Modification 6, before it determined in January 2014 that the modification should be approved.

Detailed studies undertaken by the applicant regarding the availability and suitability of land near the mine have identified potential land to be reallocated as offsets to account for the biodiversity values currently conserved in the NDAs and HMAs (see Chapter 12 and Appendix H). Should this be the case, the Deed would no longer be required. These detailed studies were undertaken in accordance with relevant contemporary government policy regarding biodiversity values. In summary, the retention of NDA1 and Saddleback Ridge would result in significant negative effects on the economic viability of the operations due to reduced production levels. However, the identification of suitable alternative offset lands to be reallocated for the NDAs and HMAs, removing the Deed as a constraint, was considered to be a more viable option for the operation to progress mining identified reserves in this area, subject to further detailed EA as part of the development application process. Impacts from the removal of Saddleback Ridge are addressed in the noise and vibration, air quality and visual chapters (see Chapters 10, 11 and 15, respectively).

ii Option 2 – mining north of North Pit

A design option which, instead of continuing West and North pits westwards, progressed North Pit to the north was considered. The most feasible method of mining in this area would be a small box-cut off North Pit's end wall due to the current advancement of North Pit and as it would be an irregularly shaped pit.

Although economic coal does exist in this area, the resource does not provide a viable economic alternative to the proposal due to its limited volume. The area has potential to provide additional coal to the proposal but the decision has been made to avoid it as it did not satisfy the proposal's key objectives, for the following reasons:

- the area is part of the SBA which is an approved offset under the EPBC Act (EPBC 2009/5081); and
- this option would result in additional disturbance to WSW, over and above the proposal.

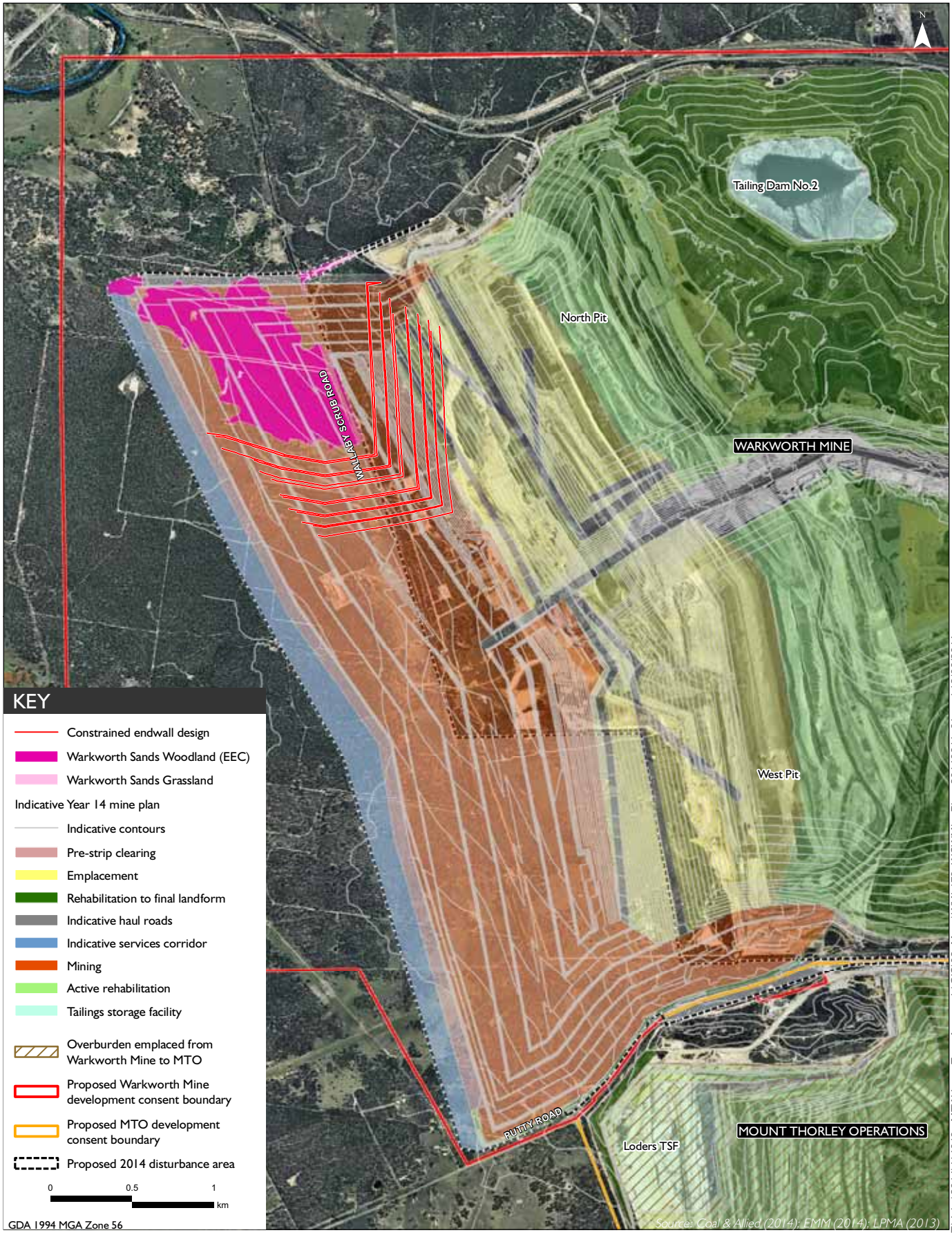
It is noted that the mining method would be less efficient compared to the proposal in this area because the constrained area would limit dragline access. The dragline fleet is a significant sunk investment at Warkworth Mine.

iii Option 3 – retention of WSW

Consistent with the Warkworth Extension 2010 design process, an option which retained approximately 72ha of WSW within the proposal's footprint was considered. However, this design option would still require the closure of Wallaby Scrub Road.

This mine plan was discounted as it did not satisfy the proposal's key objectives for the following important reasons:

- sterilisation of coal reserves in excess 30Mt of ROM coal over the proposal life and a substantial reduction in annual production levels for the operation;
- avoidance of WSW would require avoidance of the general area, rather than the specific footprint of mapped WSW. That is, avoidance would require a reduced strike length at North Pit by up to approximately 60 per cent in some places due the constraints placed on endwall design as shown conceptually in Figure 23.1 below;
- substantial capital has been invested by MTW to establish extraction at 18Mtpa of ROM coal to minimise unit costs of production to position itself as economically viable in the long-term. A mine plan that does not support 18Mtpa of ROM coal does not provide long-term economic viability in the context of variable international economic conditions;
- a combined strike length of approximately 6.65km is currently operated at MTW. This will reduce to approximately 3.8km as mining is completed at Warkworth Mine's South Pit and MTO's Loders Pit. MTW is proposed to continue operating in the long-term from the strike length afforded by West Pit and North Pit. An alternative mine plan that excludes WSW at North Pit would see the strike length further reduced to 0.75km in North Pit at the shortest point. At this length, inadequate physical working room is available to allow production to be maintained at 18Mtpa of ROM coal; and
- with the reduction in production rate and increased operational costs, this option would not enable viable production rates to be achieved west of Wallaby Scrub Road (see Chapter 9).



COAL & ALLIED

Managed by Rio Tinto Coal Australia

Constrained endwall design and reduced strike length

Warkworth Continuation 2014
Environmental Impact Statement
Figure 23.1

iv Underground mining considerations

The potential application of underground mining methods in preference to open cut mining was raised during consultation with near neighbours. The applicant has considered underground mining in response to this feedback.

Underground resources are known to occur at Warkworth Mine and MTO. These seams are deeper than the seams targeted under the proposal (see Chapter 2). Eight of the seams targeted by the proposal are not suited to underground extraction because they are either:

- too thin;
- too narrow with high risk of splitting; or
- too close to an adjacent seam sterilising the other should one be extracted.

The remaining seams would also be constrained due to the footprint and the method of extraction. These limitations would include required buffers to current highwalls of the open cut operation for stability reasons and sterilisation of reserves within any curved footprint boundaries due to the straight-lined longwall panels. As reported in the *Warkworth Extension 2010 Environmental Assessment* (EMM 2010a), investigations into underground mining the proposal's targeted seams would result in approximately 20 per cent of the available reserves extracted, a significant underutilisation of an economic resource which is a key objective of the proposal.

Consideration was given to underground mining the seams deeper than those targeted by the proposal. As stated in Chapter 2, potential underground mining is in its early stages of exploration drilling and resource definition with feasibility studies yet to be undertaken.

Therefore, much more work needs to be undertaken such as commencement of a feasibility study prior to developing a mine plan and optimising it before carrying out the requisite environmental studies in order to prepare and lodge a development application if this approach was determined as feasible.

This would rely on investment of significant capital which is unlikely to be feasible in prevailing economic conditions and would require further feasibility studies before mining could commence. The current status of the operation, as described in Chapters 1 and 2, requires a proposal design capable of being realised in the short term allowing for a continuation in the viability of the operation, particularly with current market conditions and competition for capital investment in the mining sector, thereby satisfying a key objective of the proposal.

Given the uncertainty regarding the potential for underground mining and the current viability of the operation, pursuing underground mining instead of the proposal does not satisfy the proposal's key objectives and is not an option to retain ongoing operations. A continuation of open cut operations at Warkworth Mine is the most effective and feasible option for extraction of the identified target coal seams compared to underground mining.

Notwithstanding this, the proposal recognises the potential for future underground mining at MTW with South Pit left open as a potential future access point.

Using South Pit as an overburden emplacement area and rehabilitating the area represented potential double-handling of overburden, increasing dust and noise generation, and was discounted as part of the proposal. It should be noted that if during the life of the proposal, the foreshadowed underground access at South Pit is not required, the final landform of South Pit will be considered further and updated in the MOP (see Chapter 13).

23.2.2 Overburden emplacement

i Emplacement areas

At Warkworth Mine, there are limited opportunities across the Site to emplace overburden from the proposal within the proposed footprint. As noted in the preceding section, the proposed mine plan includes a small void in South Pit as an access point for potential future underground mining at the Site. This, together with the swell of overburden material in comparison to its in-situ status, translates into a shortfall of available capacity at Warkworth Mine to emplace the overburden.

There are also limited opportunities to extend the disturbance footprint of the operations to emplace overburden. As described in Chapter 2, Warkworth Mine is bound by the Golden Highway to its north and east and Putty Road to its south, restricting the ability to extend the footprint. Areas east of the Golden Highway are also inappropriate considering the proximity to the Hunter River and its floodplain, notwithstanding the distance required transporting this material and the associated environmental impacts.

For the reasons outlined above these options were discarded as they did not satisfy the proposal's key objectives and, therefore, alternative overburden areas do not form part of the proposal.

ii Visual bund west of the proposed footprint

The construction of a large visual bund west of Warkworth Mine for the operations to be concealed and work behind was raised by several near neighbours during consultation for the proposal.

The construction of a visual bund west of the proposed footprint was investigated during the proposal design. Two options were considered, one with the visual bund established at the edge of the mining footprint and occupying some of the services corridor area and the other established further west and outside of the proposal's footprint. The visual bund options would need to be constructed using either trucked overburden material from active areas or using a dragline to establish a box-cut for the visual bund construction.

The investigations considered the potential visual bund's benefits and costs, which are summarised below:

- either location of the visual bund is unlikely to provide noticeable reduction in noise given the distance and topography between active mining and the bund;

- either location of the visual bund is unlikely to offer noticeable visual benefit given the topography of the area between active mining or overburden emplacement and the bund;

- construction of the visual bund west of the proposal's footprint closer to Bulga village would require the clearance of additional vegetation, predominantly EECs and most likely within currently conserved and protected areas (ie the SBA). As noted above, the SBA is an approved offset under the EPBC Act (EPBC 2009/5081);

- construction of the visual bund in either location would likely take between 18 months and two years, meaning rehabilitated areas are unlikely to provide a visual benefit to surrounding areas in the short to medium term; and

- construction of the visual bund in either location would require significant volumes of overburden to provide a visual benefit given the currently approved and proposed working heights of overburden emplacements within active areas.

On balance it was determined that construction of a visual bund either within the proposal's footprint or to the west does not provide justification for its inclusion as part of the proposal.

iii Emplacement methods

During the PAC assessment of Modification 6, consideration by the PAC was given to restricting overburden emplacement heights during night time due to noise generation (PAC 2014). Consultation feedback from near neighbours has also queried the potential for the operations to operate during the daytime only. In response to this feedback, the applicant investigated different scenarios for overburden emplacement at night time. It is noted that consistent with other mines in the region, the mine is required to operate a 24 hr operation to remain economically viable.

Current operational controls at the mine include management of day to day activities to real-time and predictive monitoring of prevailing meteorological conditions. Where prevailing conditions are unsuitable, emplacement at specific locations, regardless of height, are suspended (see Chapter 10).

Regardless, the applicant considered a range of different design scenarios for night time overburden emplacement with permutations of emplacement height and equipment used, with various scenarios modelled to predict dust and noise effects on the surrounding environment. The modelling results demonstrated that restricting the number and location of available emplacement locations, without regard to prevailing conditions, would be unlikely to result in material benefit to assessment locations. That is, a blanket restriction to emplacement location without regard to prevailing meteorological conditions had the effect of limiting the ability of the operation to respond to prevailing conditions in the most effect manner.

Analysis of lower level night time overburden emplacement identified additional spatial constraints as well as negative impacts on productivity (ie a key objective of the proposal), particularly as the overburden inventories reduce over the life of the proposal. To mitigate these negative operational effects, the night time overburden emplacement scenarios considered different and more efficient equipment operating at higher levels during the day whilst lower emplacement areas would be rolled over at night as the main strip progresses. Similar to other scenario modelling, these results indicated that additional dust would be generated during these activities and would increase the total dust emissions generated from the operation.

Notwithstanding that Warkworth Mine currently implements active operational control for emplacement areas in response to actual and predicted meteorological conditions to meet prescribed criteria (see Chapters 10 and 11), the option of establishing a consistent night time emplacement solution across the site was discounted for the reasons outlined above.

23.2.3 Final void

i Background

The final landform for Warkworth Mine has been designed to be constructed with minimal reshaping of the waste emplacements to achieve a long-term environmentally stable landform as described in Section 13.2.2. Minimising the amount of reshaping required (or movement of emplaced material to final landform) reduces the cost and time taken to rehabilitate the Site to final landform, as well as minimising environmental impacts (ie a key objective of the proposal) such as dust and noise emissions during the rehabilitation process.

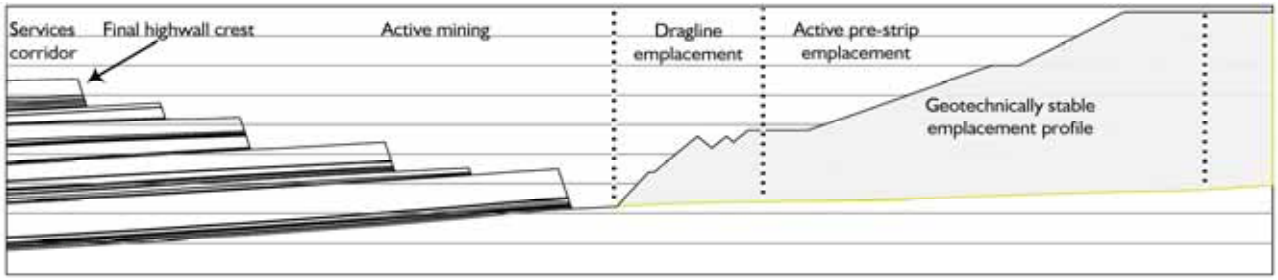
Figure 23.2 shows representative emplacement profiles over the final years of Warkworth Mine's operation. In 2028, pre-strip overburden mining would be at maximum rates and all available emplacement space would be utilised.

From 2028 to 2035 pre-strip activities would ramp down and the heights of emplacements would be lower to match the final landform as closely as possible. Draglines would remain operational up to the closure of Warkworth Mine, preventing any pre-strip waste from being emplaced in the base of the pit.

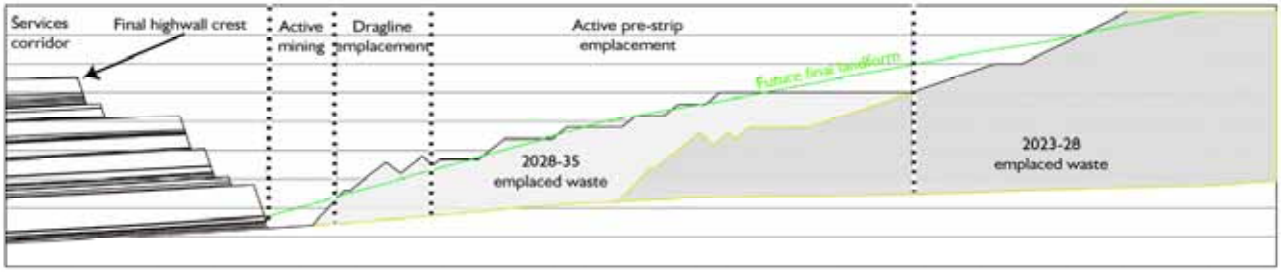
In order to shape the final landform, emplacements above the landform would be cut down and used to fill any areas where more material would be required to reach final landform height (this process is known as cut/fill). Mining equipment such as draglines, excavators and dozers are commonly used for such activities.

Approximately 50Mbcm of emplaced material would require removal to reshape to final landform under the proposal. By minimising the amount of cut/fill required, the final pit void at Warkworth Mine would only be filled to a maximum height of 30m above the coal floor. A number of alternatives were considered in relation to the form of the final void. These are discussed in the sections below.

North Pit 2028



North Pit 2035



North Pit Final Landform

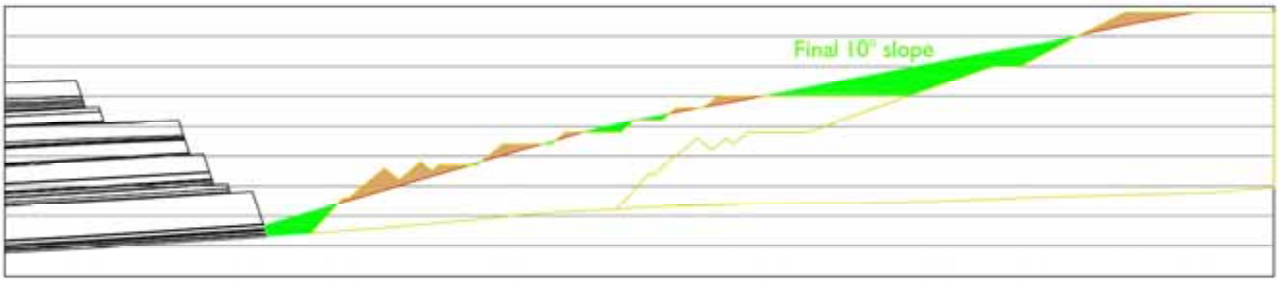


Figure 23.2 Representative cross-section of emplacement profiles in North Pit

ii Backfilling the final void

Backfilling the final void was considered during the mine planning process for the proposal. The removal of over 800Mbcm of material would be required to fill the void to a similar level as the highwall crest. As under the proposal Warkworth Mine would have completed mining in 2035, this material would need to be sourced from an alternative location.

One option would be to excavate the previously rehabilitated emplacements at Warkworth Mine. This process would take many years and use a large fleet of excavating equipment and trucks. This would initially increase the disturbance footprint of Warkworth Mine, as well as prolong its environmental impacts particularly those related to dust and noise, and would be prohibitively expensive.

Alternatively, material could be transported from elsewhere in the Hunter Valley. Similar to the above, this option is not considered desirable from a social, environmental or economic perspective (ie key objectives of the proposal) and, accordingly, was also discounted.

iii Reduction in final profile bench slope

The reduction in final profile bench slope was considered during the mine planning process for the proposal. This option comprised the blasting of the final profile benches to produce a reduced slope overall when compared to the preferred option that could be more conducive to rehabilitation. As shown in Figure 23.3, a typical final highwall profile at Warkworth Mine with an overall slope of approximately 35°, could be blasted to create a slope of approximately 30°. However, a 30° slope would be too steep to establish rehabilitated vegetation due to erosion of topsoil on such angles and does not accord with the mine's final landform objectives. The slopes would only enable aerial seeding. There would also be a risk of ongoing spontaneous combustion from coal seams disrupted by blasting.

Under the proposal the highwalls and endwalls have been left in their final mining profile to avoid further increases to the footprint of the operation being necessitated. It is noted that there is an opportunity for the final highwall and endwall benches to be revegetated as part of rehabilitation of Warkworth Mine. This vegetation would be classified as within the final void footprint due to the steep nature of the walls between benches and, therefore, has not been considered in calculations for on-site revegetation.

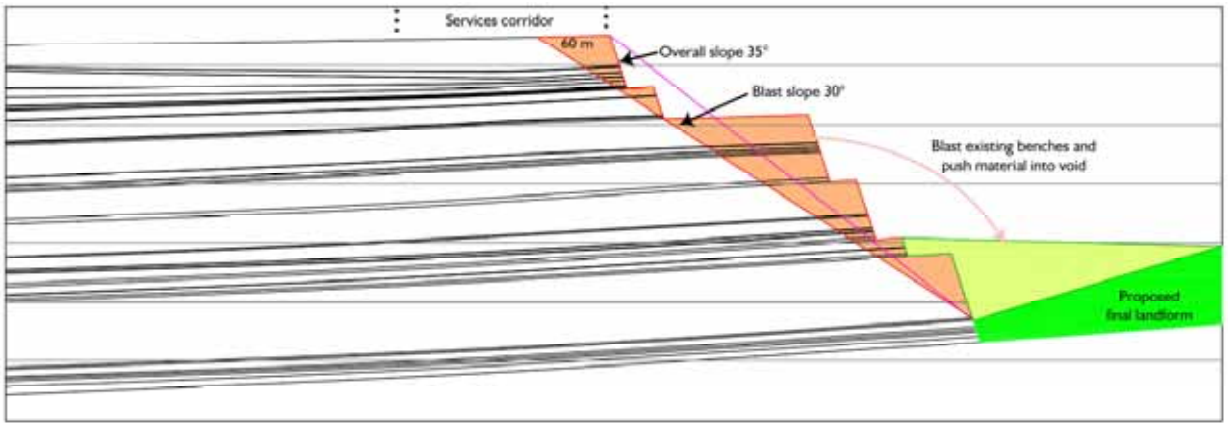


Figure 23.3 Representative cross-section of final highwall in North Pit showing minimal blasting of benches to achieve a shallower final void slope

iv Reduction in highwall and endwall slopes

Reshaping highwalls and endwalls to final landform slopes of 10° was considered during the mine planning process for the proposal. This option is shown in Figure 23.4. Under this option additional disturbance outside of the services corridor would be required. The disturbance would encroach on biodiversity offset areas to the north, various EECs to the west, and Putty Road to the south. The final landform would still contain a depression that would capture and store water. This option would prolong the rehabilitation process and, therefore, increase closure costs. For the preceding reasons, this option was discounted.

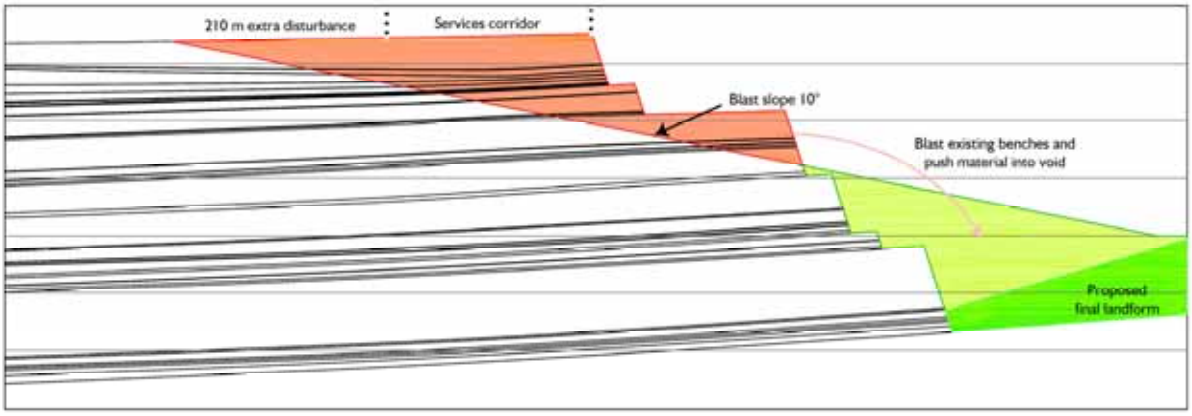


Figure 23.4 Representative cross-section of final highwall in North Pit overlaid with a final landform wall of 10^0 slope

23.2.4 Wallaby Scrub Road

i Background

An important proposal component is the closure of Wallaby Scrub Road to enable the operation to access and extract resources beneath it and to the west. An assessment of the relocation of Wallaby Scrub Road was undertaken in the *Warkworth Extension 2010 Environmental Assessment* (EMM 2010a). Various possible routes for a relocated road were considered with the primary constraints being ecology, Aboriginal cultural heritage, flooding, land tenure and minimising sterilisation of coal resources (EMM 2010a).

The sections below described considerations for the permanent relocation and temporary relocation of Wallaby Scrub Road.

ii Permanent relocation of Wallaby Scrub Road

Technical studies investigating the relocation of Wallaby Scrub Road west of the proposal identified numerous additional impacts, when considered cumulatively did not justify relocating Wallaby Scrub Road as part of the Warkworth Extension 2010.

In its assessment of the previous application, the former DP&I (now DP&E) concurred with the outcomes of these studies.

The Director-General's assessment report (DP&I 2012b) stated:

> On balance, the Department is of the opinion that the potential impacts associated with relocation of Wallaby Scrub Road cannot be justified for the following key reasons:
>
> - additional and avoidable impacts on EECs, in particular the WSW EEC, and impacts associated with fragmentation of the proposed SBA;
> - the level of road use is relatively low;
> - additional travel times associated with the closure are not significantly greater when compared to additional travel times associated with relocation;

- the costs associated with relocation (to both Warkworth, in terms of capital cost, and the community in terms of ongoing maintenance), are unlikely to outweigh the benefits which would be gained by a small proportion of road users;

- potential additional and avoidable impacts on Aboriginal cultural heritage sites and the proposed WBAHCA, and increased proximity to the highly significant Bulga Bora Ground; and

- Singleton Council, while objecting to both closure and relocation, identified that closure would decrease road maintenance costs for Council while relocation would require Council to maintain additional road for lesser convenience to road users. Council also identified that relocation may result in a lower level of use by the community and is therefore not likely to result in a positive benefit cost.

It is considered that the reasons outlined during the development and assessment of the Warkworth Extension 2010 regarding relocation of Wallaby Scrub Road remain valid for the proposal. Therefore, relocation does not form part of the proposal as it does not satisfy its key objectives.

It should also be noted that the relocation of Wallaby Scrub Road west of the proposal may require an approval under the EPBC Act as it is outside of the approved action (EPBC 2009/5081) and may affect MNES.

iii Temporary relocation option

During the assessment of the Warkworth Extension 2010, consideration was given to the temporary relocation of Wallaby Scrub Road west of its current alignment. Following the western progression of mining, under this option Wallaby Scrub Road would then be relocated to a permanent alignment east of its current position on rehabilitated mine spoils (EMM 2010a). During the conceptual design phase of the relocation options for Wallaby Scrub Road, an alignment on rehabilitated mine spoils was considered.

This option was deemed unsuitable for the following reasons:

- uncontrolled settlement;
  - the relocated road would be on a depth of approximately 325m of uncompacted overburden, with an unpredictable and irregular settlement pattern over the length of the road. This would cause localised changes in grade and crossfall creating an unsafe environment for drivers and drainage issues such as ponding creating pavement failure;
- interaction with mining;
  - as mining activities would still be occurring west of the proposed alignment, heavy and light mining plant would still need to cross the relocated road to access the mine facilities on the eastern side of Warkworth Mine. Whilst a bridge would provide a solution that separated the Wallaby Scrub Road and mine vehicle traffic, a bridge could not properly be constructed on over 300m of uncompacted fill (due to uncontrolled settlement referenced above);
- physical constraints;
  - in order for the road to be relocated to the rehabilitated mine spoil, the road would need to transition from current ground levels to the level of the top of the mine spoil, then down again. Effectively, the road would require construction of a series of switchback ramps with hairpin turns to rise to the top of the mine spoil.

It is considered that the reasons outlined during the development and assessment of the Warkworth Extension 2010 regarding relocation of Wallaby Scrub Road east of its current alignment on rehabilitated mine spoil remain valid for the proposal. Therefore, this option does not form part of the proposal as it does not satisfy its key objectives.

However, as described in Chapter 2, the proposal does include an emergency services access track west of the mining footprint and within the disturbance area. The design of this track has been undertaken in consultation with the NSW RFS during the previous Warkworth Extension 2010 and also as part of this proposal.

23.3 Alternative sources of coal

A consideration of stakeholders in relation to applications for new coal mines or extensions to coal mines is whether alternative coal resources exist elsewhere, either currently being mined or that could be mined, meaning the proposal need not proceed. This matter was considered in detail as part of the economic assessment for the Warkworth Extension 2010 (Gillespie Economics 2009).

It is important to consider this view in the context of mineral economics, in particular the difference between 'resources' and 'reserves'. Resources are the volume of a mineral present in the ground but may not be able to be mined due to certain constraints. In contrast, reserves are those mineral deposits which have proven capacity to be developed under current or forecast financial, infrastructure, regulatory and other influencing conditions. Therefore, the volume of reserves available to society is much smaller than the resources present.

In determining whether an identified and geologically suitable mineral deposit can be classified as a reserve with the potential to be mined, many factors need to be considered. These include tangible factors like the availability of physical and human infrastructure both in the locality and at the potential mine site itself. Equally important are less tangible or 'governance quality' factors which determine the investment climate for minerals within a particular jurisdiction, such as NSW, including tax rates, contractual certainty under law and property rights. In combination, these tangible and governance factors are often as important as geological ones in determining whether reserves can be developed.

Continuation of existing mines, such as the proposal, is often more beneficial than the development of new mines as it inevitably involves less significant capital investment in infrastructure. Warkworth Mine has existing infrastructure including rail lines, power lines, processing plant, mining equipment which would constitute a significant capital investment for a 415ummarized mine. Current and expected prices for coal are an obvious and significant determinant of investment decisions of mining companies. At current and expected prices for coal, applicants seeking approval for expansion of an existing mine or development of a new mine are those confident of an appropriate return on their investment. Applicants proposing to establish a new mining operation are likely to be at a cost disadvantage relative to applicants proposing continuation of an existing mine.

More expensive producers of coal, whether they be associated with expansion of an existing mine or establishment of a new mine, will also have a range of potential environmental externalities. In NSW, these producers will be subject to environmental assessment. Whether or not the environmental impacts of these mines are greater or less than cheaper coal producers currently seeking approval is not known but what is certain is that if costs of production increase, with inelastic demand, community welfare will diminish. Prices for coal will rise and this will be passed on through domestic electricity production and steel production and ultimately to consumers. There will be a reduction in returns to shareholders and payments to government. Given that NSW competes in a competitive global coal market, if the next cheapest producers of coal are overseas or interstate then there will be reduction in the State's share of the market (Gillespie Economics 2011). The economic assessment for the proposal has estimated that the proposal would contribute $1.34billion to NSW GSP in NPV terms ($1.5billion when combined with the Mount Thorley Operations 2014) which would otherwise be lost should the resource be obtained from outside of NSW.

23.4 Not proceeding with the proposal

As described in Chapters 2 and 3, the disapproval of the Warkworth Extension 2010 has resulted in substantial time and effort spent on reviewing options for Warkworth Mine and planning for its future. The approval of Modification 6 afforded Warkworth Mine a very short timeframe for the operation to maintain production levels at or as close as possible to current levels and the jobs of its 1,300 employees. The operations will be unable to avoid a further drop in production and employment levels with the reduction of available strike length, again adversely impacting the operation if the proposal is not approved.

The above factors are likely to impact the mine's economic viability. Under this scenario, coal production (and employment levels) would end by 2021; however, due to the reduced strike length, production would decline from 2016 onwards and could drop below viable levels creating uncertainty for continued operations. Therefore, foregoing the following benefits of the proposal (including Mount Thorley Operations 2014):

- net benefits of around $1.5billion to NSW in the form of:
    - the additional disposable income received by MTW employees and long-term contractors who live in NSW, around $612million in NPV terms, of which $464million would flow to the Mid and Upper Hunter regions;
    - the additional coal royalties paid to the NSW government of around $617million in NPV terms; and
    - additional payroll taxes, council rates and other payments that accrue to different levels of government, and which amount to around $259million in NPV terms.
- positive flow-on effects to the NSW economy with initial effects estimated at:
    - around $385million in additional income (in NPV terms);
    - additional annual employment of around 206 full-time equivalent workers; and
    - an increase in GSP of around $450million (in NPV terms).

- significant positive flow-on effects to the Mid and Upper Hunter region within initial effects estimated at:
    - around $227million in additional income (in NPV terms); and
    - additional annual employment of around 214 full-time equivalent workers.
- estimated flow-on effects for Singleton of:
    - around $84million in additional income (in NPV terms); and
    - additional annual employment of around 61 full-time equivalent workers.

It is also estimated that not pursuing the proposal would leave approximately 230Mt of ROM coal within the proposal footprint, or 358Mt of ROM coal in total.

Chapter 24

Justification and conclusion

Chapter 24 — Justification and conclusion

24 Justification and conclusion

24.1 Justification

24.1.1 Introduction

Warkworth Mine and MTO have high fixed costs and can only operate at a profit when production is approximately 18Mtpa of ROM coal in the current economic environment. The proposal would extend the spatial limit approved under the current development consent to allow mining in West Pit along the full strike length and, subsequently, enable the two main pits, North and West Pit, to advance down dip to the west. This would enable the mine to remain economically viable in 2015 and beyond.

While the proposal has similarities to the Warkworth Extension 2010 there are a number of important differences to its form, the mine's approach to operational management of noise and dust, and the legislative and policy environment that the proposed developed will be assessed. The latter changes clarify the considerations required by decision makers. The most significant of these are the amendments to the Mining SEPP which require the consent authority to make the significance of the resource the principal consideration under Part 3 of the Mining SEPP and the setting of non-discretionary standards.

The sections below discuss the objects of the EP&A Act and the significance of the resource proposed for extraction, and provide consideration to the non-discretionary standards under the Mining SEPP and L&E Court judgement of the Warkworth Extension 2010.

24.1.2 Objects of the Act

An assessment of the proposal against the objects of the EP&A Act was provided in Section 7.2.2. The assessment found that the proposal is consistent with these objects for the following important reasons:

- the Site contains a substantial coal resource on privately-owned land, within the footprint of existing mining leases, and that is supported by existing extensive physical and human infrastructure;
- it enables existing jobs and community services to continue without creating any significant additional demand as the long-term average workforce would be similar;
- ongoing operations would enable current socio-economic benefits to continue including community support initiatives, and payment of royalties which contribute towards State revenue to provide for community services and facilities;
- rehabilitation and conservation areas are proposed to offset ecological and heritage impacts and provide long-term protection and conservation of native animals, plants and cultural heritage; and
- community consultation was undertaken for the proposal with feedback received considered in preparation of the EIS.

The principles of ESD are discussed in following section.

24.1.3 Ecologically sustainable development

A definition of ESD is provided in Section 7.2.2. The principles of ESD are outlined in Section 6 of the POEO Act and Schedule 2 of the EP&A Regulation. The consistency of the proposal with each of these principles is discussed below.

Precautionary Principle: in practice this means that development should not cause serious or irreversible environmental impact. Such impacts can be avoided through the understanding of potential environmental impacts by undertaking a full environmental assessment, and incorporating effective mitigation or compensation measures into development proposals.

Avoidance was applied as a guiding principle for the proposal's development wherever possible. As detailed in Chapter 23, a significant number of design options were considered for the proposal, with the preferred options chosen to provide an appropriate balance between environmental, social and economic impacts and maintaining the viability of the mine.

The environmental assessment of the proposal and the supporting technical studies were based on conservative assumptions ensuring that potential worst case impacts are determined. The principles of ESD require such impacts to be balanced against humanity's needs, including for energy and material well-being.

The applicant has committed to measures to prevent or minimise potential adverse environmental impacts from the proposal. Any residual impacts will be balanced against the provision of a cost effective and efficient means of energy generation which provides for humanity's current and future needs.

For these reasons, the proposal is consistent with the precautionary principle.

Social equity including intergenerational equity: the proposal contributes to social equity by providing direct and indirect employment. It would result in the transformation of a geological resource into physical and human capital through investment in infrastructure and workforce training, and, indirectly, through contributions to governments which would enable greater investments in public infrastructure and services. For example, MTW implements an apprenticeship and graduate programme, drawing on local candidates and consisting of five new apprenticeships each year; an Aboriginal scholarship programme; intake of two new graduates per annum on a two year programme; and two vacation students each year (see Section 21.5.1).

The assessment worst case potential residual noise and air quality impacts determined that acquisition criteria will be exceeded on occasion at one privately-owned residence not within either Warkworth Mine's or a neighbouring mine's existing acquisition zone during the proposed consent period. This residence will be offered acquisition upon request.

Given the above, it is considered that the proposal will generally promote social equity including intergenerational equity.

Conservation of biological diversity and maintenance of ecological integrity: in accordance with the principles and guidelines of contemporary government policy, measures to mitigate and compensate for the loss of biodiversity features, including EECs and associated woodland habitat are proposed. These include establishing offset sites, and/or undertaking mine site rehabilitation, and/or undertaking supplementary measures (for WSW only given its restricted distribution), and/or retiring of credits under the UHSA.

The proposed offset strategy fully satisfies contemporary government policies and provides a significant ecological benefit in the long-term and, accordingly, will provide for the conservation of biological diversity and maintenance of ecological integrity.

Improved valuation and pricing of environmental resources: the economic study of the proposal included a comparison of the benefits and costs. The proposal would enable the mine to remain economically viable enabling jobs to be maintained. Monetary estimates were determined for the intangible environmental, cultural and social impacts of the proposal. This approach is consistent with contemporary internationally good practice and, therefore, it is considered that the proposal assists in the valuation and pricing of environmental resources.

The general conclusion is that the proposal is consistent with ESD and its principles.

24.1.4 Significance of the resource

The resource within the footprint of the proposal is significant. The resource can be extracted efficiently and effectively by WML because of the hundreds of millions of dollars invested in the mine since it commenced operations in 1981 and, that as an existing mine, it has established access to product transport and distribution infrastructure such as road, rail and port.

Extraction of the resource would enable Warkworth Mine, which is a major employer in the Singleton LGA, to continue.

The continued operation of MTW has significant social and economic benefits in the form of continuing employment of its current workforce, approximately $6billion in additional expenditure (including capital investment) and royalties of approximately $617million. The economic benefits attributable to the Warkworth Mine include continuing employment for a workforce of some 1,187 people, approximately $5.7billion in additional expenditure (including capital investment) and $567million in royalties to the state.

As described in Chapter 2, mineral resources are in fixed locations and, therefore, open cut projects cannot readily avoid impacts. However, avoidance was applied as a guiding principle for the proposal's development wherever possible; for example, avoidance of potential resources contained in the SBA.

Where avoidance is not possible, best practice mitigation measures (for example, in relation to noise and dust) and, where mitigation is not possible, compensation measures (for example, biodiversity offsets) are integrated into the proposal design to manage the impacts to the standards determined as acceptable by various NSW Government policies and legislative requirements.

24.1.5 Non-discretionary standards

Clause 12AB of the Mining SEPP sets out a number of non-discretionary development standards for the purposes of section 79C(2) and (3) of the EP&A Act in relation to the carrying out of development for the purposes of mining. The proposal satisfies the non-discretionary development standards. There are no additional exceedances of cumulative noise levels and airblast overpressure, ground vibration and aquifer interference meet appropriate criteria as detailed in Section 7.2.4.

24.1.6 Land & Environment Court considerations

In developing the proposal consideration has been given to the outcomes of the L&E Court judgment and Warkworth Mine's long-term mine planning requirements. While the proposal has similarities to the Warkworth Extension 2010 there are a number of important improvements and differences which are summarised below.

- Operational improvements in response to ongoing stakeholder engagement particularly regarding the proactive and reactive management of noise and dust resulting in changes to operations.
- Additional commitments, for example, the inclusion of an additional area within the WBACHCA, and establishment local historic heritage conservation initiatives.
- Design elements, such as a more undulating landform and optional underpass of Putty Road.
- Changed legislative and policy environment. Of importance, this includes the introduction of Clause 12AA of the Mining SEPP which operates to make the 'significance of the resource' the principal consideration of the matters the Minister is to consider under Part 3 of the Mining SEPP. Non-discretionary development standards for mining were also introduced through the operation of Clause 12AB.
- Key matters raised in the L&E Court have been addressed, namely:

  Noise:

  - Background noise levels in Bulga have been confirmed through further detailed studies enabling a thorough and advanced way of allocating background noise levels to each individual receiver, which has been discussed with the NSW EPA.
  - All residences in Bulga are below the Mining SEPP's cumulative noise limit from all industrial noise sources. Compliance with the Mining SEPP's cumulative noise limit is accepted as providing significant protection against noise impacts. This means that the total impact from all mines in the locality would not result in reduced amenity.

  Ecology:

  - The proposed offset strategy fully satisfies contemporary policies and provides a significant ecological benefit in the long-term.
  - An assessment of impacts on biodiversity has been undertaken in accordance with new government policies which were not in place for Warkworth Extension 2010. These include the principles and strategies in the *Draft NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014) and the *Upper Hunter Strategic Assessment* (UHSA) – Interim Policy. These new policies have been developed to encourage a transparent methodology for calculating biodiversity loss and gain and support the strategic management of biodiversity.
  - The calculation of impact credits using the BCAM.
  - WSW communities impact credits would be retired using a combination of land based offsets and supplementary measures.

- Non-WSW communities' impact credits would be retired in accordance with the provisions of the UHSA or by providing land based offsets.

Economics:

- New models have been provided to assist the consent authority in understanding the economics of the proposal. The models used rely on market-based and revealed preference techniques for valuing the external effects associated with the proposal as opposed to choice modelling as it is considered to be a more reliable indicator of people's preferences. It is noted that these are tools only, and do not replace the decision-making task of the consent authority, but are as robust as current economic modelling permits.

- The resource within the proposed 2014 disturbance area, approximately 230 million tonnes is economically significant as per the matters outlined in clause 12AA(2) of the Mining SEPP.

- It is clear that the proposal provides significant economic benefits. The benefits of MTW include annual average employment of almost 1,300 full time people, approximately $6billion in additional expenditure (including capital investment), and over $617million in royalties (see Section ES5.5). The benefits attributable solely to Warkworth Mine include annual average employment of approximately 1,187 full time people, approximately $5.7billion in additional expenditure (including capital investment), and over $567million in royalties.

Social:

- A detailed social impact analysis has been undertaken. The results of which are that, while immediate neighbours have expressed subjective concerns in respect of the proposal, the objective evidence demonstrates that the actual impacts meet the levels prescribed in various government policies. Therefore, while not wanting to minimise the subjective concerns of immediate neighbours, the impacts of the proposal need to be considered in this light.

Further, it should be noted that the decision by the L&E Court in respect of the Warkworth Extension 2010 was a merits based appeal determined on those particular facts the subject of the appeal. Accordingly, it is not a binding legal precedent that limits the discretion of future decision makers in respect of the proposal.

24.2 Conclusions

Warkworth Mine and the adjoining MTO are long standing members of the community having commenced operations in 1981. A workforce of approximately 1,300 people on average including full-time contractors is employed at MTW.

Environmental management at the Site is undertaken in accordance with a range of best practice systems, plans, procedures and licenses. The approach to environmental management is underpinned by the principle of continuous improvement which is demonstrated by recent noise, dust and rehabilitation management commitments such as fleet noise attenuation of mining fleet and real-time noise alarm system, predictive forecasting tools, advanced directional monitoring technology, accelerated rehabilitation programme of the eastern face of the mine and community response officers on shift to assist with the management of noise, air quality and lighting.

Significant constraints in the mine's main coal producing pits, North and West pits, has been materially impacting productivity and increasing costs. As a result, production is expected to drop by around 1Mt in 2014 worth approximately $100million.

The recent approval of Modification 6 has now enabled the mine to continue to operate as close as possible to current viable production and employment levels in the very short-term. Its approval has also allowed for the planning and development of the current proposal, assessment of its potential impacts, stakeholder engagement and, ultimately, its determination without job losses.

Following the timeframe afforded by the 350m mining extension afforded by Modification 6, however, MTW will be unable to avoid a further drop in production and employment levels with the mining constraints referenced above again adversely impacting the operation if the proposal is not approved. Under this scenario, the mine would not be economically viable.

Numerous design alternatives have been canvassed during the scope development of the proposal. These included consideration of, amongst other aspects, potential impacts on amenity which were identified as a higher risk during preliminary environmental risk analysis. Accordingly, noise and air quality specialists worked closely with mine planning engineers to develop mine plans that achieve the applicant's efficiency and production objectives whilst mining noise and dust emissions where possible.

The proposal incorporates a number of differences and improvements from the Warkworth Extension 2010 which was granted project approval by the PAC, as delegate of the Minister, in February 2012, and subsequently disapproved by the L&E Court in April 2013. Significant operational improvements have also been made since the 2010 application. These would be continued and enhanced under the proposal. These changes and improvements provide consideration to, amongst other matters, feedback received during stakeholder engagement for the proposal and L&E Court judgement of the previous application.

Similarly, during this time there have been a number of important and relevant key changes to legislation and Government. In the absence of any statutory indication, determining authorities (including the L&E Court, when relevant) previously determined the appropriate weight to be given to economics, social and environmental considerations, when determining a development application. A key amendment to the Mining SEPP is the directive for decision-makers in clause 12AA(4) which states:

> In determining whether to grant consent to the proposed development, the significance of the resource is to be the consent authority's principal consideration under this Part.

This EIS was prepared in accordance with current legislation and government policy and used the most recent and accurate scientific data relevant to the proposal. Feedback received from community and government stakeholder engagement together with the Secretary's requirements and the L&E Court judgement, provided guidance to the assessment approach, ensuring that all potential matters of relevance associated with the proposal were assessed.

Technical studies adopted conservative assumptions to enable the upper limit of potential environmental impacts to be determined. Noise and vibration and groundwater studies were independently peer reviewed. The proposal complies with the majority of the non-discretionary standards of the Mining SEPP, including standards relating to cumulative noise, airblast over pressures, ground vibration and aquifer interference.

The economic benefits of continuation of mining are quantified in the economic study which compared the reference case (or proposal refusal case) to the proposal approved case. Under the reference case, coal production would decline from 2016 onwards and would end in 2021. It is important to note, however, the reference case is not likely to eventuate as mining under this scenario would not be economically viable due to extraction constraints from the reduced strike length in West Pit.

Together the proposal at Warkworth Mine and MTO would deliver direct net benefits to NSW of around $1.5billion beyond the reference case. In addition to the direct average employment of approximately 1,300 people (with approximately 1,187 attributed to Warkworth Mine), the proposal is expected to have substantial positive flow-on effects to the Mid and Upper Hunter region and NSW economies including additional annual employment of around 191 and 198 full-time equivalent workers in NSW and in the Mid and Upper Hunter region, respectively. The people of Australia would also benefit through the Commonwealth Government in the form of company and income taxes.

In summary, not approving the proposal would mean:

- sterilisation of approximately 230Mt of ROM coal, preventing the continued supply of this necessary resource for energy generation and steel production;
- combined net benefits to NSW of around $1.34billion would not be realised;
- direct economic benefits for NSW of around $346million in additional income in NPV terms, additional annual employment of 191 full-time equivalent workers, and a contribution to NSW GSP of around $406million would not occur;
- direct economic benefits for the Mid and Upper Hunter region of around $204million in additional income in NPV terms, and additional annual employment of 198 full-time equivalent workers would not occur;
- direct economic benefits for the Singleton LGA, around $75million in additional income in NPV terms, and additional annual employment of 57 full-time equivalent workers would not occur; and
- failure to meet WML's obligations under the conditions of its existing mining leases that require it to maximise efficient and economic resource extraction.

The applicant has committed to proposal specific management measures where adverse impacts were assessed irrespective of the implementation of existing best practice environmental management safeguards. Residual impacts were identified to noise, dust, Aboriginal cultural heritage and ecology. Compensation measures have been developed in consultation with the relevant stakeholders to ensure residual impacts are fully offset and the proposal provides a net environmental benefit.

The stakeholder perceived impacts and opportunities of the proposal, paying particular attention to Bulga village, were determined through consultation and compared to the outcomes of technical studies that form part of the EIS or with external literature. Matters raised related predominately to amenity, the physical environment, health and well-being, the economy, infrastructure and services, and community engagement, relationships and governance.

As the proposal is to continue operations in 2015 and beyond, and combined with the MTO, enable MTW to maintain 1,300 jobs over the longer term, the greater impacts on the socio-economic environment and community services are projected to occur if the proposal does not proceed.

Since the Warkworth Extension 2010 proposal, based on feedback received from a range of stakeholders, a suite of ongoing and proposal specific strategies have been developed by Coal & Allied to improve communications generally and to manage/ mitigate or enhance these proposal-related impacts and opportunities.

In particular, a social impact management plan would be developed for the proposal to further develop these management and mitigation measures and detail a plan of implementation including responsibilities, timing, performance indicators/targets and monitoring measures. The social impact management plan would be prepared in consultation with key stakeholders, following the EIS/SIA, public exhibition and submissions process.

Overall, while the proposal has some residual social and environmental impacts some of which are experienced by near neighbours, it should be approved as:

- the resource within the footprint of the proposal is significant (long-term employment of approximately 1,187 persons, $5.7billion in expenditure and $567million in royalties);
- the majority of the Mining SEPP's non-discretionary standards are met;
- impacts on near neighbours have been minimised to the greatest extent possible using all reasonable and feasible measures while maintaining an economically viable mine plan;
- it meets all government policies;
- Warkworth Mine has a long history of minimal non-compliances with government approvals;
- it ensures maximum return on the substantial capital invested in the mine since it commenced in the 1981 and has access to existing infrastructure such as road, rail and port; and
- it provides a state significant economic benefit to the local, regional, state and national economies.

Abbreviations

Abbreviations

µm	Micrometre
µg/m^3	micrograms per cubic metre
ABS	Australian Bureau of Statistics
ACHMP	Archaeology and Cultural Heritage Management Plan
WBACHCA	Wollombi Brook Aboriginal Cultural Heritage Conservation Area
ACHCRP	Aboriginal Cultural Heritage Consultation Requirements for Proponents
AGE	Australasian Groundwater and Environmental Consultants Pty Ltd
AGN	Abbey Green North
AGS	Abbey Green South
AHD	Australian height datum
AHIMS	Aboriginal Heritage Information Management System
AIP	NSW Aquifer Interference Policy 2012
AMBS	Australian Museum Business Studies
ANZECC	Australian and New Zealand Environment and Conservation Council
AQMP	Air Quality and Greenhouse Gas Management Plan
ARC	ARC Transport & Traffic
ARI	average recurrence interval
ARTC	Australian Rail Track Corporation
ASNA	Australian System of National Accounts
ASS	acid sulphate soils
BCAM	biodiversity certification assessment methodology
BDT	beneficiated dewatered tailings
BMP	blast management plan
BoM	Bureau of Meteorology
BSAL	biophysical strategic agricultural land
CBA	cost benefit analysis
CCC	community consultative committee
CCL	consolidated coal lease
CHMD	cultural heritage management database

CHMS	cultural heritage management system
CHWG	cultural heritage working group
CIC	critical industry cluster
CMP	conservation management plans
CO	carbon monoxide
CO_2-e	carbon dioxide equivalent
CRD	cumulative rainfall departure
CPP	coal preparation plant
CRTSF	Centre Ramp Tailings Storage Facility
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cth	Commonwealth
DA	development application
dB	decibels
dB(A)	sound intensity with an 'A' contour filter
dB($L_{in\ Peak}$)	peak linear frequency response
DEC	NSW Department of Environment and Conservation
DCCEE	Commonwealth Department of Climate Change and Energy Efficiency
DECCW	NSW Department of Environment, Climate Change and Water
DIICSRTE	Commonwealth Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education
DLWC	NSW Department of Land and Water Conservation
DoE	Commonwealth Department of the Environment
DP&I	NSW Department of Planning and Infrastructure
DPC	NSW Department of Premier and Cabinet
DRE	Division of Resources and Energy
DSITIA	Queensland Department of Science, Information Technology, Innovation and the Arts
DS Act	NSW *Dams Safety Act 1978*
DSC	Dams Safety Committee
EA	environmental assessment
EC	electrical conductivity
EEC	endangered ecological community
EIS	environmental impact statement

EL	exploration lease
EMM	EMGA Mitchell McLennan Pty Limited
EMS	environment management system
ENC	environmental noise compass
ENM	environmental noise model
EPA	NSW Environment Protection Authority
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPL	environment protection licence
ERM	Environmental Resources Management Limited
EWU	early warning unit
ESD	ecologically sustainable development
FBA	Framework for Biodiversity Assessment
FeS_2	pyrite
FFMP	Flora and Fauna Management Plan
FTE	Full time equivalent
GDE	groundwater dependent ecosystem
GDP	gross domestic product
GE	general equilibrium
GHG	greenhouse gases
GOS	gross operating surplus
GSP	gross state product
GSSE	GSS Environmental Pty Limited
GWP	global warming potential
ha	hectares
HEC-RAS	Hydrologic Engineering Centres Rivers Analysis System
Heritage Act	NSW *Heritage Act 1977*
HHA	Historic Heritage Assessment
HMA	habitat management areas
HMP	heritage management plan
HRSTS	Hunter River Salinity Trading Scheme
HSEQ	health, safety, environment and quality

HSEQMS	health, safety, environment and quality management system
HVAS	high volume air samplers
HVRF	Hunter Valley Research Foundation
IHAP	Independent Hearing and Assessment Panel
INP	NSW Industrial Noise Policy
IS	iso-thermal
ISO	International Organisation for Standardisation
kg	kilograms
km	kilometres
L&E Court	NSW Land and Environment Court
$L_{1,1min}$	noise level present for 1% of 1 minute
LEP	local environmental plan
LEP 1996	Singleton Local Environmental Plan 1996
LEP 2013	Singleton Local Environmental Plan 2013
$L_{eq,15min}$	15-minute A-weighted equivalent continuous sound pressure level
L_{max}	maximum noise level
m	metre
MGJ	million gigajoules
MIC	maximum instantaneous charge
Mining Act	NSW *Mining Act 1992*
Mining SEPP	State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007
ML	mega litres
mm/s	peak particle velocity measured in millimetres per second
MNES	matters of national significance
MOP	mining operations plan
Mt	million tonnes
MTCL	Mount Thorley Coal Loader
MTJV	Mount Thorley Joint Venture
MTO	Mount Thorley Operations
Mtpa	million tonnes per annum
MTW	Mount Thorley Warkworth
NBA	Northern Biodiversity Area

NDA	non-disturbance area
NEPC	National Environment Pollution Committee
NEPM	national environment pollution measure
NES	national environmental significance
NGA	national greenhouse accounts
NMP	noise management plan
NO_2	nitrogen dioxide
NOOP Dam	North Out of Pit Dam
NOW	NSW Office of Water
NPV	net present value
NP&W Act	NSW *National Parks and Wildlife Act 1974*
OD	origin-destination
OEH	NSW Office of Environment and Heritage
PAC	NSW Planning Assessment Commission
PAD	potential archaeological deposit
PB	Parsons Brinckerhoff
$PM_{2.5}$	particulates which are 2.5 millimetres in diameter
PM_{10}	particulates which are 10 millimetres in diameter
POEO Act	NSW *Protection of the Environment Operations Act 1997*
PPV	peak particle velocity
PRP	Pollution Reduction Programme
PSNL	project specific noise levels
RAPs	registered Aboriginal parties
REIA	regional economic impact assessment/analysis
RFS	Rural Fire Service
RMS	NSW Roads and Maritime Services
Roads Act	NSW *Roads Act 1993*
ROM	run of mine
RTA	NSW Roads and Traffic Authority
SA	statistical area
SAL	strategic agricultural land
SBA	Southern Biodiversity Area

SCADA	supervisory control and data acquisition
SD	statistical division
SSDS	security sensitive dangerous substances
SEPP	State environmental planning policy
SEPP 33	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
SEPP 44	State Environmental Planning Policy No. 44 – Koala Habitat Protection
SEPP 55	State Environmental Planning Policy No. 55 – Remediation of Land
SHR	State Heritage Register
SIDRA	Signalised Intersection Design Research Aid
Singleton LEP	Singleton Council Local Environmental Plan 2013
SPCC	State Pollution Control Commission
SPL	sound power level
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2011
SRLUP	Strategic Regional Land Use Policy
SSD	State significant development
SSI	State significant infrastructure
SSVA	site-specific visual assessment
t	tonne
TARP	trigger action response plan
TEC	threatened ecological communities
TEOM	tapered element oscillating microbalance
TSC Act	NSW *Threatened Species Conservation Act 1995*
TSF	tailings storage facility
TSP	total suspended particulate matter
TSS	total suspended solids
UHSA	Upper Hunter Strategic Assessment
UNE	University of New England
US EPA	United States Environment Protection Agency
VCA	voluntary conservation agreement
VCU	visual catchment unit
VIMP	visual impact management plan
VPA	voluntary planning agreement

WAL	water access license
Water Act	NSW *Water Act 1912*
WM Act	NSW *Water Management Act 2000*
WML	Warkworth Mining Limited
WBACHCA	Wollombi Brook Aboriginal Cultural Heritage Conservation Area
WMP	water management plan
WMS	water management system
WRM	WRM Water and Environment Pty Ltd
WSG	Warkworth Sands Grassland
WSP	water sharing plan
WSW	Warkworth Sands Woodland
WTA	'willingness-to-pay'

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