

Three bat species were recorded by Niche (Appendix 1 of Appendix D) during the current surveys within the Modification area, namely the Eastern False Pipistrelle, Eastern Bentwing-bat and Eastern Cave Bat. These records are shown on Figure 4-7. The Eastern Bentwing-bat has also been recorded on several occasions surrounding the Modification area (Umwelt, 2003, 2005, 2006a, 2006b, 2007b, 2007c; Cumberland Ecology, 2010a, 2010b; Dames and Moore, 2000b) (Figure 4-7). The Eastern Bentwing-bat has been recorded within the Thomas Mitchell Drive offset area, Saddlers Creek Conservation area and Edderton Road Revegetation area (Figure 4-7), while the Eastern Cave Bat has also been recorded within the Saddlers Creek Conservation area and Edderton Road Revegetation area and within the Modification area surrounds (Umwelt, 2006b, 2007b, 2007c) (Figure 4-7).

Migratory Species

Database results indicate that 14 migratory species have been recorded within or surrounding the Modification area or have the potential to occur within or surrounding the Modification area (Appendix D). Three of the 14 migratory species (the White-bellied Sea-Eagle [*Haliaeetus leucogaster*], White-throated Needletail [*Hirundapus caudacutus*] and Rainbow Bee-eater [*Merops ornatus*]) have been previously recorded within or surrounding the Modification area. No migratory species were recorded during recent surveys conducted by Niche (Appendix 1 of Appendix D). One migratory species, the White-bellied Sea-eagle, was recorded near the proposed rail loop duplication area during recent flora surveys (Appendix D).

Critical Habitat

No critical habitat occurs within the vicinity of the Modification area as designated by the Register of Critical Habitat held by the SEWPaC (2012c), Register of Critical Habitat held by the Director-General of the OEH (OEH, 2012), the Register of Critical Habitat held by the Director-General of the DPI (Fishing and Aquaculture) (DPI [Fishing and Aquaculture], 2012) or the *Muswellbrook Local Environmental Plan 2009* (Muswellbrook LEP). Therefore, the Modification would not affect any critical habitat.

4.6.2 Potential Impacts

Potential impacts of the Modification on flora and fauna are assessed below.

Direct Impacts

Vegetation Clearance

The Modification would require the removal of 228.9 ha of native vegetation as outlined in Table 4-6. This comprises mostly derived grasslands (173 ha) and woodland (44.5 ha). The total land clearance area is slightly larger (259.9 ha) as it includes some introduced or cleared map units.

The Modification area is mostly comprised of Vegetation Community 1 – Derived Native Grassland (136.8 ha). Only small areas of Vegetation community 12 (Weeping Myall Woodland) and vegetation community 14 (Dominated by Sharp Rush) would be cleared for the Modification (approximately 0.1 ha to be cleared for each vegetation community) (Appendix D).

Regionally Significant Vegetation

Six of the vegetation communities identified in the Modification area represent five TECs listed under the TSC Act and one TEC listed under the EPBC Act (Table 4-9). The Modification would require the removal of approximately 90.3 ha of TECs as outlined in Table 4-9.

No regionally significant vegetation corridors are located within the Modification area and none would be impacted by the Modification.

Clearance of Fauna Habitat

Clearing of vegetation results in the loss of habitat for species that utilise the vegetation, and may also result in the loss of habitat resources which may negatively impact on the lifecycle and survival of fauna species that use these resources in the short and long-term (Appendix D). Habitat resources lost may be comprised of hollow bearing trees; dead wood and dead trees; rocks and fallen timber; and food trees (Appendix D).

As previously described, approximately 228.9 ha of native vegetation would be cleared for the Modification. The total land clearance area is slightly larger (259.9 ha) as it includes some introduced or cleared map units. The type of fauna habitat that would be removed and the location is described in Table 4-10 and in Appendix D.

Table 4-9
Vegetation Clearance of TECs within the Modification Area

Ecological Communities	Status ¹		Area (ha)
	TSC Act	EPBC Act	
Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion	E	-	0.1 ha of Vegetation Community 12.
White Box Yellow Box Blakely's Red Gum Woodland ²	E	CE	58.4 ha, comprising: <ul style="list-style-type: none"> • 35.2 ha of Vegetation Community 3; • 23.0 ha of Vegetation Community 4a; and • 0.2 ha of Vegetation Community 6.
Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions	E	-	23 ha of Vegetation Community 4a.
Central Hunter Ironbark-Spotted Gum-Grey Box Woodland in the NSW North Coast and Sydney Basin Bioregions	E	-	7.1 ha of Vegetation Community 9.
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions	E	-	1.7 ha of Vegetation Community 8.
Total			90.3

Source: Appendix D.

¹ TEC status under the TSC Act and/or EPBC Act (current at 24 January 2013).

E = Endangered, CE = Critically Endangered.

² Listed as the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the EPBC Act.

Table 4-10
Loss of Each Habitat Type within the Modification Area

Fauna Habitat Type	Approximate Area to be cleared (ha)	Location and Description
Forest	9.0	This habitat type occurs as Spotted Gum - Grey Box forest within the proposed Southern Open Cut area. It comprises a moderate-sized patch of mixed age forest with Spotted Gum reaching up to 1 m in diameter and 25 m height. This habitat type has a mid-storey of regenerating Eucalyptus with a good pulse of flowering and a patchy understorey with multiple shrub species present. Mistletoe is also abundant. Hollows are common in a range of sizes with occasional large fallen logs. This habitat type is also present in small patches in the proposed Rail Loop Duplication area. This habitat type is generally good condition with good habitat complexity with some apparent disturbance (extent unknown) due to previous clearing.
Disturbed Forest	3.3	This habitat type occurs as lowland forest within the proposed Overburden Emplacement Extension area. It comprises a moderately dense cover of large older growth trees up to 25 m in height with recent patchy regrowth of mid-storey and understorey vegetation with native and exotic grasses. Small and medium-sized hollows are frequent in older trees, with at least two large Spotted Gum and Ironbarks with large hollows (i.e. >30 centimetres [cm]). Occasional logs are present below larger trees and some weed infestations in some patches of previous disturbance are present. This habitat type is in moderate condition with some recovery of understorey and mid-storey components occurring.
Grassy Woodland	23.2	This habitat type occurs within the proposed Northern Open Cut area, proposed Southern Open Cut area (western flank) and proposed Rail Loop Duplication area. It comprises a few very old trees with limited hollows. There is some regeneration of canopy species with lower strata components having limited cover and diversity. This habitat type has limited floristic diversity or feeding resources as it is predominantly native grass cover. This habitat type is in moderate condition with good recovery potential.

Table 4-10 (Continued)
Loss of Each Habitat Type within the Modification Area

Fauna Habitat Type	Approximate Area to be cleared (ha)	Location and Description
Disturbed Grassy Woodland	17.9	This habitat type occurs as disturbed grassy woodland within the proposed Northern Open Cut Disturbance area. It comprises large scattered trees up to 20 m in height over mixed native/exotic ground cover with limited structural complexity/diversity of vegetation with understorey and mid-storey components largely absent except for some patches of regenerating Bulloak. Hollows are present in most large mature trees ranging from small to large and logs are present beneath larger trees. This habitat type is in generally poor/moderate condition with some apparent resilience with patches of regenerating shrubs.
Grassland	173	This is the most prominent habitat type located in the Modification area. It comprises native species and has limited fauna habitat due to a lack of trees.
Reeds and Rushes	2.6	This habitat type occurs as thick <i>Typha</i> along a drainage line within the proposed Conveyor Corridor Overburden Emplacement Extension area. Small patches are also present within the proposed Rail Loop Duplication area. This habitat type is a potential watering point for a range of terrestrial fauna species and has limited aquatic habitat complexity/features. The drainage line component of this habitat type is generally disturbed, while the surrounding vegetation has moderate recovery potential in most areas.
Disturbed	25.1	Limited fauna habitat.
Plantation	5.8	Limited fauna habitat.
Total	259.9	

Source: After Appendix 1 of Appendix D.

Loss of Hollow-bearing Trees, Removal of Dead Wood and Dead Trees

A total of 127 hollow-bearing trees were recorded by Hunter Eco (Appendix D) as occurring within the Modification area and may be removed as part of the Modification. In addition, the Modification would remove dead wood and dead trees on the ground as part of clearance activities (Appendix D). The removal of these habitat components could result in impacts to a number of threatened fauna species as well as birds, hollow-dwelling bat species and some ground dwelling mammals and birds (Appendix D). However, Hunter Eco (Appendix D) assessed that the lack of threatened species records from within and surrounding the Modification indicate that it is unlikely that the removal of these habitat components would impact threatened species.

Removal of Bushrock

No major rock formations or continuous rock formations are present in the Modification area (Appendix D). While bushrock generally provides a fauna habitat resource, they are unlikely to be critical to threatened species recorded within the Modification area or those which possibly occur (Appendix D). Any bushrock in the proposed clearance areas would be removed, and potential impacts on fauna species within or surrounding the Modification are considered minor (Appendix D).

Loss of Individual Animals

Mortality of individual animals may result from land clearance activities as a result of direct encounters with construction works/vehicles or through the removal of habitat during clearing (Appendix D). HVEC currently implements a pre-clearance survey programme to minimise harm to fauna species during clearance works. The pre-clearance survey programme would continue for the Modification, and mitigation measures are described in Section 4.6.3.

Impacts on Habitat Connectivity

The Modification is not likely to significantly increase the fragmentation of habitats above that already approved, due to the already highly fragmented nature of the landscape (Appendix D). The Modification is also unlikely to lead to an increase in edge habitat due to the already fragmented landscape (Appendix D).

Changes to Hydrology - Ecological Value of Watercourses

The Modification would involve the removal of a drainage line that leads into Saddlers Creek (Figure 1-3). The drainage line that leads to Saddlers Creek would be removed for the proposed Overburden Emplacement Extension area.

Toe drains would be constructed around the perimeter of the proposed Overburden Emplacement Extension area to divert rainwater runoff from Saddlers Creek to minimise the chances of contamination from the proposed Overburden Emplacement Extension area that may negatively impact flora and fauna species (Appendix D). Diversion drains would also be established to direct uncontaminated surface water away from the mine area, and into existing creeks, rivers, or other forms of drainage.

Aquatic habitat features within the Modification area are limited to small ephemeral creeks, drainage lines and a soak/stream that is a dominant feature within the proposed Overburden Emplacement area (Appendix 1 of Appendix D). The ephemeral drainage lines consists of irregular, limited flow regimes as they are situated at the top of the Saddlers Creek catchment area (Appendix 1 of Appendix D). The low flow regime limits potential aquatic habitat features along the watercourses, although creekbed condition is moderate to good (Appendix 1 of Appendix D).

SEPP 44 Koala Habitat

Some potential habitat for Koalas would be cleared by the Modification. However, the potential habitat is not likely to be used by Koalas given the isolated nature of the habitat in the Modification area and lack of any evidence of Koala inhabitation during surveys undertaken within the Modification area (Appendix D).

Indirect Impacts

Various indirect impacts on flora and fauna species have been identified and are as follows (Appendix D):

- weeds and pests;
- runoff water quality;
- noise;
- artificial lighting;
- dust; and
- infection of native plants by *Phytophthora cinnamomi*.

Hunter Eco (Appendix D) concluded that it is unlikely that any flora species or vertebrate species would be adversely impacted either directly or indirectly by the above-mentioned impacts due to the current and proposed mitigation measures in place (Section 4.6.3).

Cumulative Impacts

Cumulative impacts on biodiversity consist of the net effect of all activities that have occurred across a landscape since European settlement (Appendix D). Clearing of habitat in the Hunter Valley commenced in the early 1800s, primarily for agricultural purposes (Appendix D).

The Mt Arthur Coal Mine was originally established in a widely cleared landscape, other than for Mount Arthur itself, and cumulative impacts by the mine on biodiversity cannot be considered in isolation from earlier impacts. This can be illustrated by habitat loss data included in Peake's (2006) HRVP. Considering the two dominant woodland communities reported for the Mt Arthur Coal Mine area, Vegetation Community 4a: Central Hunter Box - Ironbark Grassy Woodland is estimated as 68.4 percent cleared, and Vegetation Community 9: Central Hunter Ironbark - Spotted Gum - Grey Box Forest as 60.9 percent cleared (Appendix D). In the context of the overall mine, the Modification would result in the loss of 259.9 ha of mixed habitat, approximately 4 percent of the already active and approved mine operation area. However, the proposed offset comprises approximately 427 ha of mostly cleared grassland with the net result being a cumulative gain in potential habitat as natural regeneration and active management proceeds. The offset includes conservation of a comparatively large area of *Acacia pendula*, part of the *Acacia pendula* endangered population in the Hunter catchment and the Weeping Myall Woodland EEC (approximately 0.4 ha) (Appendix D).

Threatened Aquatic Species

No aquatic threatened species have been recorded within the Modification area during the current surveys conducted by Niche (Appendix 1 of Appendix D) or previous surveys undertaken at the existing Mt Arthur Coal Mine (Appendix D). As previously described, aquatic habitat features within the Modification area are limited to small ephemeral streams and are unlikely to support threatened aquatic species (Appendix D).

4.6.3 Mitigation Measures, Management and Monitoring

Existing Impact Avoidance and Mitigation Measures at the Mt Arthur Coal Mine

A *Biodiversity and Rehabilitation Management Plan* (BRMP) (BHP Billiton, 2012h) has been developed to facilitate the management of biodiversity at the existing approved Mt Arthur Coal Mine. Several impact avoidance and mitigation measures currently implemented at the existing Mt Arthur Coal Mine are outlined in the BRMP (BHP Billiton, 2012h). Table 4-11 outlines the existing impact avoidance and mitigation measures that are currently implemented (after BHP Billiton, 2012h).

Proposed Impact Avoidance and Mitigation Measures at the Mt Arthur Coal Mine

Table 4-12 outlines the proposed impact avoidance and mitigation measures that would be implemented for the Modification.

Koala Monitoring

A Koala has been sighted in the Thomas Mitchell Drive Off-site Offset area (OEH, 2013) and within the approved Mt Arthur Coal Mine to the south-west of the Thomas Mitchell Drive Offset area (HVEC, pers. comm., 2012) (Figure 4-6).

The Koala would continue to be monitored through the existing annual ecological monitoring surveys and pre-clearance surveys.

Revegetation of the Post-mine Landforms

Refinements to the revegetation of the post-mine landforms would include (Appendix D):

- limiting the location of the 'rehabilitation areas' to approved disturbance areas;
- increasing the width of the 'rehabilitation areas' corridors to a minimum of 500 m; and
- consideration of the landform and location of final voids.

**Table 4-11
Existing Impact Avoidance and Mitigation Measures at the Mt Arthur Coal Mine**

Measure	Description
Rehabilitation	
Revegetation of the post-mine landforms	<p>The rehabilitation strategy provides for areas for biodiversity outcomes (e.g. woodland corridors) and areas of pasture (the predominant previous site land use). However, the strategy aims for a net increase in native vegetated areas at the end of mine life.</p> <p>Surface development areas associated with the Mt Arthur Coal Mine are progressively rehabilitated and revegetated with species characteristic of native species endemic to the local area.</p> <p>Annual ecological monitoring has taken place at the Mt Arthur Coal Mine from 2003 (Umwelt, 2003, 2005, 2006a, 2007b; Cumberland Ecology, 2009a, 2010a, 2010b; Wildthing Environmental Consultants, 2008). Permanent monitoring plots within remnant and rehabilitation areas have been established throughout the Mt Arthur Coal Mine site and are monitored annually.</p> <p>The BRMP (BHP Billiton, 2012h) describes the use of artificial roosting/nesting boxes, nesting structures (mammal and avian), fallen timber and creation of drainage depressions for frogs.</p>
Rehabilitation of creeks and drainage lines on the site	The drainage pattern of the final landform would be designed to integrate with the surrounding catchments and revegetated to achieve long-term stability and erosion control.
Management of salinity	Salinity levels in topsoil and subsoil are monitored to prevent salinity impacting on vegetation establishment and landform stability.
Conservation and re-use of topsoil	Topsoil is currently conserved so that it can be respread onto the surface during rehabilitation. Respread topsoil may contain native seed and beneficial micro-organisms which have been shown to be advantageous to the more rapid development of a sustainable and productive ecosystem.

Table 4-11 (Continued)
Existing Impact Avoidance and Mitigation Measures at the Mt Arthur Coal Mine

Measure	Description
Vegetation Clearance	
Protection of vegetation and soil outside of the disturbance areas	Conservation and Offset areas have been created to protect vegetation and soil outside of the disturbance area.
Pre-clearance surveys	Pre-clearance surveys are conducted within all patches of forest and woodland to be cleared and threatened flora and fauna species detected are translocated into protected habitat. Planned disturbance areas are delineated prior to clearing activities, with restriction of clearing to the minimum area necessary to undertake the approved activities.
Collecting and propagating seed	Seed present during land clearance activities would be collected for use in plant propagation programmes to provide tube stock for revegetation activities. The Mt Arthur Coal Mine has an existing Consent Condition requiring re-establishment of <i>Acacia pendula</i> . This has involved collection of seed from <i>Acacia pendula</i> to be used in a propagation programme.
Salvaging and reusing material from the site for habitat enhancement	Large woody debris deemed suitable for habitat enhancement is identified as part of pre-clearance and post-clearance and are salvaged and re-used for habitat enhancement.
General Management	
Nest Box Programme	A nest box monitoring programme is currently undertaken at the Mt Arthur Coal Mine. A total of 48 nest boxes have been established at two remnant sites (one site is within the Thomas Mitchell Drive Offset area). These boxes are visually examined annually for the presence of scats, nesting material, chewing or scratching marks, discarded bones, etc.). Box types include: Squirrel Glider boxes, microbat boxes and bird boxes.
Controlling weeds	In 2010, Mt Arthur Coal developed a weed action plan to improve the management of noxious and environmental weeds, which identifies priority areas as well as individual species requiring management.
Controlling feral pests	Measures to control exotic animals are implemented by an appropriately qualified person(s) and include: the destruction of pest habitat; trapping; targeted shooting programmes and baiting. Follow-up inspections would be undertaken to assess the effectiveness of control measures implemented and the requirement for any additional control measures.
Managing grazing and agriculture on-site	Several measures are currently undertaken to manage grazing including managing stock, grazing and fertiliser use.
Controlling access	Access is controlled by restricting vehicle access, preventing access to open pits or other hazardous locations, and constructing a safety berm and/or security fence at the void crest (highwalls and endwalls) to provide an engineered barrier between the pit and the surrounding area.
Bushfire management	Several measures are currently undertaken to manage bushfire including monitoring fuel loads, fire bans, restriction of potential ignition sources, emergency preparedness training for mine-site personnel and the establishment of firebreaks.

Source: Appendix D.

**Table 4-12
Proposed Additional Impact Avoidance and Mitigation Measures for the Modification**

Proposed Impact Avoidance and Mitigation Measure	Description of Measure
Pine Donkey Orchid (<i>Diuris tricolor</i>) Translocation	If any <i>Diuris tricolor</i> are identified in the Modification area during the pre-clearance surveys an evaluation of whether or not the plants should be translocated would be made by an appropriately qualified person. For example, if only one plant was found then it may not be worth translocating due to the presence of known populations in the Thomas Mitchell Drive Offset area.
Weeping Myall (<i>Acacia pendula</i>) Propagation	The Mt Arthur Coal Mine has an existing Project Approval (Condition 38(b) of Schedule 3) requiring re-establishment of <i>Acacia pendula</i> . To date this has involved collection of seed from <i>Acacia pendula</i> to be used in a propagation programme. However, it is believed that the seed is being collected from local planted <i>Acacia pendula</i> not the <i>Acacia pendula</i> which is 'native' to the Hunter Catchment. Re-establishment of <i>Acacia pendula</i> would focus on trials of growing the plants from cuttings because the <i>Acacia pendula</i> which is 'native' to the Hunter Catchment is not known to produce seed.
Weeping Myall (<i>Acacia pendula</i>) Translocation	If the trials to re-establishment of <i>Acacia pendula</i> via cuttings is not successful, the possibility of translocating <i>Acacia pendula</i> plants would be investigated. An evaluation of whether or not the plants should be translocated would be made by an appropriately qualified person.
Threatened Species Database	Threatened species sightings at the Mt Arthur Coal Mine would be reported to the environmental officer and maintained on a database.

Source: Appendix D.

4.6.4 Offsets

Proposed Modification to the Approved Offset Strategy

Conditions 36, 37 and 38 under Schedule 3 of the existing Development Consent require the provision of a biodiversity offset strategy for the approved Mt Arthur Coal Mine. The approved offset strategy aims to provide linkages between post-mining landforms and existing remnant patches, thereby improving the habitat opportunities for local fauna which would be impacted by the Mt Arthur Coal Mine.

Key components of the existing Offset areas are (Appendix D):

- re-establishment of vegetation within the offset areas with some strategic grazing;
- management and monitoring of the offset areas against performance and completion criteria (including monitoring of the *Diuris tricolor* in the Thomas Mitchell Drive Offset area);
- nest Box Program in Thomas Mitchell Drive Offset area;
- long-term security of the offset areas;
- provision of a conservation bond to the NSW Government; and
- reporting to NSW and Commonwealth Governments.

A modified offset strategy is proposed as part of the modified Mt Arthur Coal Mine. The revised Biodiversity Offset Strategy is shown on Figure 4-8 and detailed in Table 4-13.

Rehabilitation

The Modification would require refinement of the location of the 'rehabilitation areas'. The existing NSW and Commonwealth Environmental Approvals specify 'rehabilitation areas' in the existing biodiversity offset strategy (Table 4-13). This includes 1,915 ha of vegetation (including 500 ha of Box-Gum Woodland) to be established in corridors as shown on Figure 4-8. This is greater than 30 percent of the disturbance area for open cut operations at the Mt Arthur Coal Mine.

Refinements would include (Appendix D):

- limiting the location of the 'rehabilitation areas' to approved disturbance areas;
- increasing the width of the 'rehabilitation areas' corridors to a minimum of 500 m;
- post-mining land use compatible with surrounding land uses to provide environmental and community benefits; and
- consideration of the landform and location of final voids.

Table 4-13
Revised Biodiversity Offset Strategy

Area	Offset Type	Existing Minimum Size (ha)	Proposed Minimum Size (ha)
Development Consent Condition 36			
Mt Arthur Conservation Area	Existing vegetation	105	105 (no change)
Saddlers Creek Conservation Area	Existing vegetation and vegetation to be established	295	426
Thomas Mitchell Drive Off-site Offset Area	Existing vegetation and vegetation to be established	495	495 (no change)
Thomas Mitchell Drive On-site Offset Area	Vegetation to be established	222	222 (no change)
Roxburgh Road 'Constable' Offset Area	Existing vegetation and vegetation to be established	110	110 (no change)
Additional Off-site Offset Area	Existing vegetation and vegetation to be established	165	250.1*
Edderton Road Revegetation Area	Existing vegetation and vegetation to be established	154	154 (no change)
Rehabilitation Areas	Vegetation to be established	1,761**** (including 500 ha of Box-Gum Woodland)	2,642** (including 500 ha of Box-Gum Woodland)
Middle Deep Creek Offset Area (HVEC-owned land)	Existing vegetation and vegetation to be established	632*** (including 493 ha of Box-Gum Woodland)	1,042 (including 596 ha of Box-Gum Woodland)
Total		3,939	5,446.1

Source: Appendix D.

Highlighted rows have been updated.

* HVEC would provide an additional 21.3 ha offset for Central Hunter Ironbark - Spotted Gum - Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC and an additional 63.8 ha offset for Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC in a location to be determined. It is envisaged that this would be facilitated by a change to Condition 37, Schedule 3 of PA 09_0062, which describes the existing requirement for an additional 165 ha of offset area.

** This value is 34 percent of the total mine disturbance footprint.

*** Umwelt (2011) – requirement of EPBC Act Approval (EPBC 2011/5866).

**** This number excludes the Edderton Road Revegetation Area.

Offset Area

A modification to the existing Offset areas is proposed as part of the Modification (Figure 4-8). Two additional Offset areas would be required to account for additional clearance. This would include (Appendix D):

- expanding the existing Saddlers Creek Conservation area by 131 ha; and
- expanding the existing Middle Deep Creek Offset area by 410 ha.

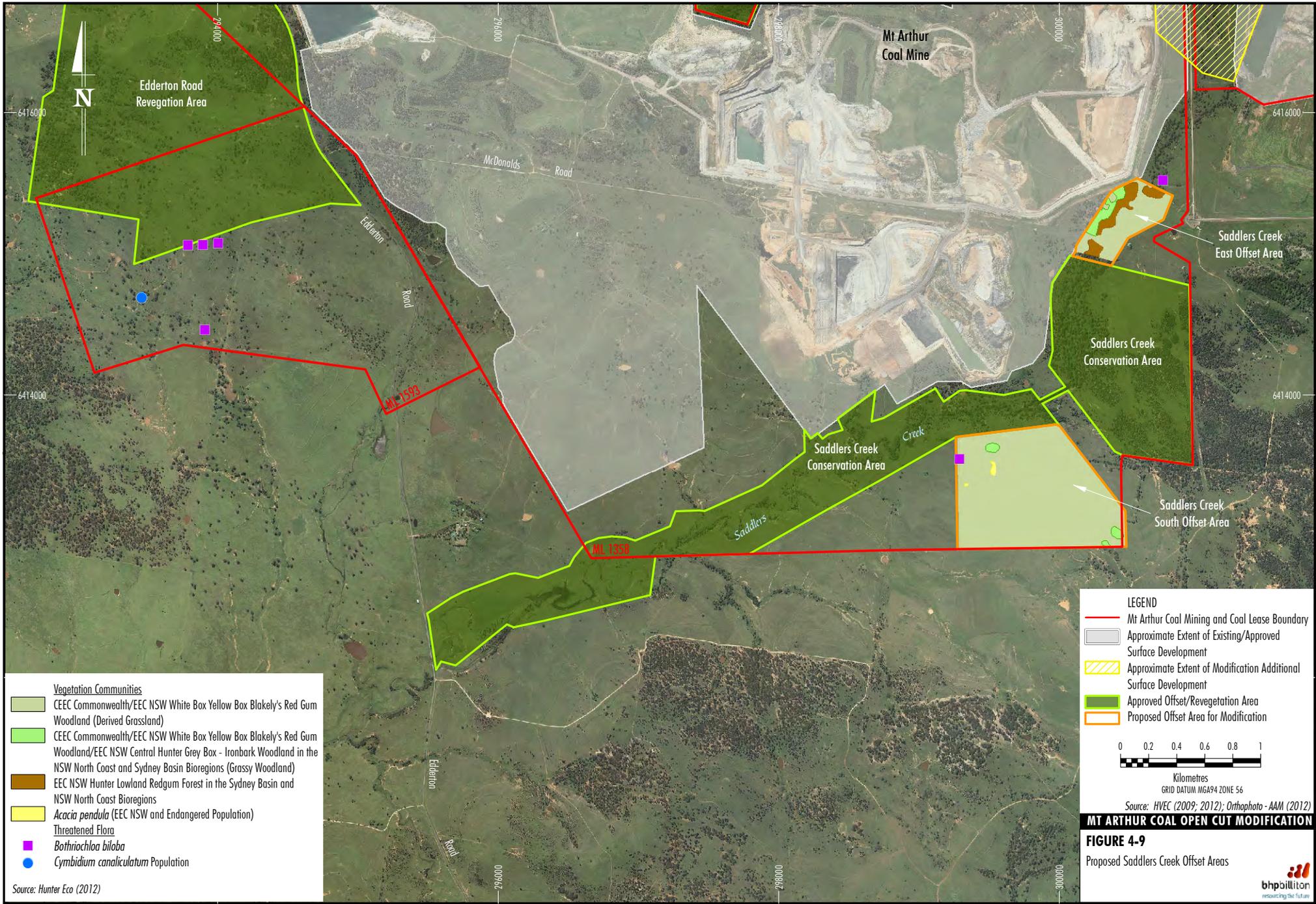
The additional Offset areas are described further below. Appendix D describes the proposed ecological benefits of the proposed offset areas and demonstrates how OEH offset principles are addressed.

Additional Saddlers Creek Conservation Area

Key benefits of the proposed additional Saddlers Creek Conservation area (Figure 4-9) are (Appendix D):

- Presence of the endangered population, *Acacia pendula* (a tree) in the Hunter catchment and the EEC Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion EEC.
- Presence of the Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregion EEC.
- Presence of the White Box Yellow Box Blakely's Red Gum Woodland EEC listed under the TSC Act and White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the EPBC Act.





- Vegetation Communities**
- CEEC Commonwealth/EEC NSW White Box Yellow Box Blakely's Red Gum Woodland (Derived Grassland)
 - CEEC Commonwealth/EEC NSW White Box Yellow Box Blakely's Red Gum Woodland/EEC NSW Central Hunter Grey Box - Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions (Grassy Woodland)
 - EEC NSW Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions
 - Acacia pendula* (EEC NSW and Endangered Population) Threatened Flora
 - Bothriochloa biloba*
 - Cymbidium canaliculatum* Population

Source: Hunter Eco (2012)

LEGEND

- Mt Arthur Coal Mining and Coal Lease Boundary
- Approximate Extent of Existing/Approved Surface Development
- Approximate Extent of Modification Additional Surface Development
- Approved Offset/Revegetation Area
- Proposed Offset Area for Modification

0 0.2 0.4 0.6 0.8 1
Kilometres
GRID DATUM MGA94 ZONE 56

Source: HVEC (2009; 2012); Orthophoto - AAM (2012)

MT ARTHUR COAL OPEN CUT MODIFICATION

FIGURE 4-9

Proposed Saddlers Creek Offset Areas



- Presence of the Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC.
- Scattered patches of Lobed Blue-grass (*Bothriochloa biloba*) across the open grassland.
- Inclusion of approximately 930 m of Saddlers Creek.
- Potential to benefit local fauna populations (and threatened fauna) impacted by the Modification.
- A large number of trees with habitat hollows.
- Potential habitat for the threatened Swift Parrot (*Lathamus discolor*), Regent Honeyeater (*Anthochaera phrygia*), Little Eagle (*Hieraetus morphnoides*), Scarlet Robin (*Petroica boodang*), Flame Robin (*Petroica phoenicea*), Brush-tailed Phascogale (*Phascogale tapoatafa*), Spotted-tailed Quoll (*Dasyurus maculata*), Yellow-bellied Glider (*Petaurus australis*), and perhaps the Common Planigale (*Planigale maculata*).
- A large number of trees with habitat hollows.

Additional Middle Deep Creek Offset Area

The Middle Deep Creek Offset area is located approximately 70 km north of the Mt Arthur Coal Mine (Figure 1-1) and is shown on Figure 4-10.

Key benefits of the proposed additional Middle Deep Creek Offset area (which comprise some 410 ha) are (Appendix D):

- Presence of the White Box Yellow Box Blakely's Red Gum Woodland EEC listed under the TSC Act and White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the EPBC Act.
- Twelve Tiger Orchid (*Cymbidium canaliculatum*) plants were recorded being part of the NSW listed endangered population *Cymbidium canaliculatum* Population in the Hunter Catchment.
- Presence of a number of threatened woodland birds, including the: Diamond Firetail (*Stagonopleura guttata*), Speckled Warbler (*Chthonicola sagittata*), Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*), Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*), Varied Sittella (*Daphoenositta chrysoptera*), Little Lorikeet (*Glossopsitta pusilla*) and Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*).
- Presence of the Squirrel Glider (*Petaurus norfolcensis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*).

The additional proposed offset areas would be managed, secured, monitored in the same way as the existing offset areas in accordance with the Project Approval for the existing Mt Arthur Coal Mine. This includes control of weeds and feral animals, management of grazing, fire management and control of vehicular access.

The BRMP (BHP Billiton, 2012h) would be revised to include the additional proposed Offset areas.

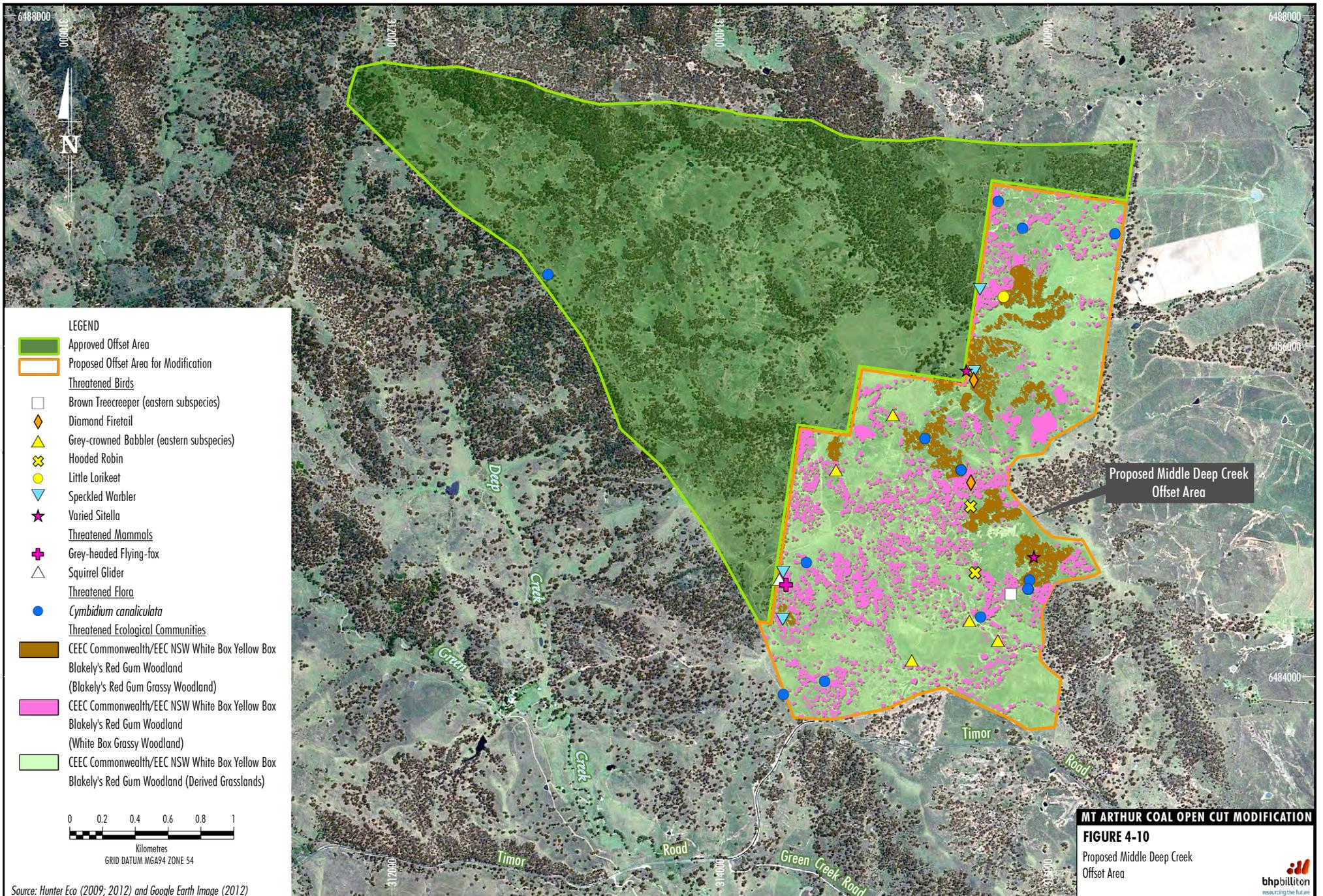
Habitat features (e.g. large hollows and some suitable logs) would continue to be salvaged during vegetation clearance activities and relocated to rehabilitation areas and the Offset area.

4.7 ABORIGINAL AND NON-INDIGENOUS CULTURAL HERITAGE ASSESSMENT

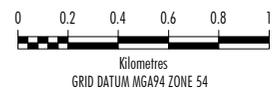
An Aboriginal and Non-Indigenous Cultural Heritage Assessment was prepared for the Modification by RPS Australia (2012) (Appendix E).

The Modification's Aboriginal and Non-Indigenous Cultural Heritage Assessment has been undertaken in consideration of the following guidelines:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011);
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (NSW Department of Environment, Climate Change and Water [DECCW], 2010a);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b);
- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005a);



- LEGEND**
- Approved Offset Area
 - Proposed Offset Area for Modification
 - Threatened Birds**
 - Brown Treecreeper (eastern subspecies)
 - Diamond Firetail
 - Grey-crowned Babbler (eastern subspecies)
 - Hooded Robin
 - Little Lorikeet
 - Speckled Warbler
 - Varied Sitella
 - Threatened Mammals**
 - Grey-headed Flying-fox
 - Squirrel Glider
 - Threatened Flora**
 - Cymbidium canaliculata*
 - Threatened Ecological Communities**
 - CEEC Commonwealth/EEC NSW White Box Yellow Box Blakely's Red Gum Woodland (Blakely's Red Gum Grassy Woodland)
 - CEEC Commonwealth/EEC NSW White Box Yellow Box Blakely's Red Gum Woodland (White Box Grassy Woodland)
 - CEEC Commonwealth/EEC NSW White Box Yellow Box Blakely's Red Gum Woodland (Derived Grasslands)



Proposed Middle Deep Creek Offset Area

MT ARTHUR COAL OPEN CUT MODIFICATION

FIGURE 4-10

Proposed Middle Deep Creek Offset Area



Source: Hunter Eco (2009; 2012) and Google Earth Image (2012)
 HVE-11-01_OCM EA_Section 4_20SE

- The Australia International Council on Monuments and Sites (ICOMOS) *The Burra Charter* (Australia ICOMOS, 1999);
- *Aboriginal Cultural Heritage: Standards and Guidelines Kit* (NSW National Parks and Wildlife Service, 1997);
- *Ask First: A Guide to Respecting Indigenous Heritage Places and Values* (Australian Heritage Commission, 2002);
- *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects* (NSW Minerals Council, 2010); and
- *NSW Heritage Manual* (NSW Heritage Office and NSW Department of Urban Affairs and Planning [DUAP], 1996).

A description of Aboriginal cultural heritage in the vicinity of the Mt Arthur Coal Mine is provided in Section 4.7.1. Section 4.7.2 describes the potential impacts of the Modification on Aboriginal cultural heritage and Section 4.7.3 outlines mitigation, management and monitoring measures.

4.7.1 Existing Environment

Previous Archaeological Investigations

A number of Aboriginal heritage surveys and assessments have previously been undertaken in the Modification area and surrounds, including:

- AECOM (2009) *Aboriginal Archaeology and Cultural Heritage Impact Assessment, Mt Arthur Coal, Muswellbrook, NSW*;
- Umwelt (2008d) *Mt Arthur Underground Project Aboriginal Archaeological Assessment*;
- Umwelt (2007d) *Aboriginal Archaeology Assessment – South Pit Extension Project Mt Arthur Coal*;
- South East Archaeology (1999) *An Aboriginal Archaeological Assessment of the Proposed Mt Arthur North Coal Mine, near Muswellbrook, Hunter Valley NSW*;
- Dyall (1980) *Report on Aboriginal Relics from the Mt Arthur North Coal Lease*; and
- Dyall (1981) *Report on Aboriginal Relics from the Mt Arthur South Coal Lease*.

In addition to the archaeological investigations described above, a number of investigations have been undertaken in the wider region. A summary of these investigations are provided in Appendix E.

A search of the Aboriginal Heritage Information Management System (AHIMS) database identified 27 previously recorded Aboriginal heritage sites within or nearby the Modification area. These included 25 artefact sites, one potential archaeological deposit (PAD) and a grinding groove site.

RPS Australia also completed historical and archival research and review of heritage registers for items of non-indigenous heritage of the Modification area.

This body of existing information assisted with providing a regional context for the Modification area and in developing a model of the likely archaeological and cultural significance of the Modification area.

Aboriginal Heritage Management

Management of Aboriginal heritage at the Mt Arthur Coal Mine is conducted in accordance with the approved *Aboriginal Cultural Heritage Management Plan*.

In order to offset impacts to cultural heritage at the Mt Arthur Coal Mine as part of the 2009 Mt Arthur Coal Consolidation Project, an offset area was designated to the north of Thomas Mitchell Drive (the Thomas Mitchell Drive Offset Area). This area is also a biodiversity offset. As identified in the Consolidation Project EA, should Muswellbrook Shire Council (MSC) require access to a small portion (approximately 11 ha) of this area for critical infrastructure in the future, Mt Arthur Coal will work with registered Aboriginal stakeholders to identify and formalise a substitute/additional offset for the portion required by MSC. Initial discussions regarding possible options for the additional offset were held with the Aboriginal community and the Board of the Wannaurah Local Aboriginal Land Council on 30 August 2012 and 12 July 2012, respectively.

Cultural Heritage Assessment

Assessment Programme

The Aboriginal and Non-Indigenous Cultural Heritage Assessment (Appendix E) used the findings of the previous archaeological investigations, search results from the AHIMS database and the results of the Aboriginal cultural heritage survey conducted by archaeologists and representatives of the Aboriginal community in April 2012.

The aim of the survey was to conduct a site-specific survey in the Modification disturbance areas and to provide the Aboriginal community with the opportunity to inspect the areas in order to provide more informed comment on cultural significance and heritage management and mitigation recommendations.

Table 4-14 summarises the main stages of the Aboriginal heritage consultation/survey programme undertaken as part of the Project.

The 41 stakeholders (or stakeholder groups) who registered an interest in being consulted in relation to the Aboriginal Cultural Heritage Assessment process were:

- Aboriginal Native Title Consultants;
- Alieria French Trading;
- Bawurra;
- Breeza Plains Cultural Heritage Consultancy;
- Bunda Consultants;
- Cacatua Culture Consultants;
- Carrawonga Consultants;
- Cheryl Moodie Consultants;
- Culturally Aware;
- Deslee Talbott Consultants;
- DFTV Enterprises;
- Gidawaa Walang Cultural Heritage Consultancy;
- Gomery Cultural Consultants;
- Hunter Traditional Owners Environmental and Management Services;
- Hunter Valley Aboriginal Corporation;
- Indigenous Outcomes;
- Jarban & Mugrebea;
- Kawul Cultural Services;
- Kayaway Eco Cultural & Heritage Services;

**Table 4-14
Summary of Modification Aboriginal Heritage Consultation/Survey Program**

Date	Consultation/Survey Conducted
Project Consultation/Survey	
20 January 2012	Letters requesting the names of Aboriginal parties or groups that may have been interested in registering in the consultation process were sent to the Wanaruah Local Aboriginal Land Council, Office of the Registrar, NTSCorp, OEH Environmental Protection and Regulation Group, the National Native Title Tribunal, Hunter Central Rivers CMA and Muswellbrook Shire Council to identify Aboriginal parties.
1 February 2012	Public advertisement published in the Hunter Valley News inviting interested Aboriginal parties or groups to register.
3 February 2012	Public advertisement published in the Singleton Argus and Muswellbrook Chronicle inviting interested Aboriginal parties or groups to register.
6 February 2012	Letters seeking registrations of interest were sent to Aboriginal parties or groups identified by the above step.
23 February 2012	Provision of a proposed methodology for undertaking the Aboriginal Cultural Heritage Assessment distributed to registered stakeholders.
February/March 2012	Feedback from the registered stakeholders in regard to the proposed methodology received. Consideration given to all comments received on the proposed methodology.
12 March 2012	Invitation to registered stakeholders to attend the Aboriginal cultural heritage survey.
14 March 2012	Record of names of registered stakeholders provided to OEH and the Wanaruah Local Aboriginal Land Council, in accordance with DECCW (2010a).
10 - 24 April 2012	Aboriginal and cultural heritage survey and inspection conducted over a period of seven days. Cultural significance of the area and Aboriginal heritage sites discussed with the Aboriginal participants.
9 August 2012	Draft Aboriginal and Non-Indigenous Cultural Heritage Assessment issued to the registered stakeholders for review, including survey results, archaeological and cultural significance assessment (based on feedback received during consultation and fieldwork), potential impacts and proposed management and mitigation measures.
30 August 2012	All registered stakeholders invited to attend a meeting to discuss the Draft Aboriginal and Non-Indigenous Cultural Heritage Assessment and to inspect the Modification area.
August/September 2012	Written feedback and advice received from registered stakeholders (including comments on the consultation, survey, assessment and proposed management and mitigation measures).
September 2012	Comments received from registered stakeholders on the draft Aboriginal and Non-Indigenous Cultural Heritage Assessment (in relation to cultural heritage) were considered and/or addressed in the Aboriginal Cultural Heritage Assessment.

Source: After Appendix E.

- Lower Hunter Wonnarua Council Inc.;
- Mingga Consultants;
- Mooki Plains Management;
- Muswellbrook Cultural Consultants;
- Myland Cultural and Heritage Group;
- Ngarramang-Kuri Aboriginal Culture and Heritage;
- Roger Noel Matthews;
- Scott Smith;
- T&G Culture Consultants;
- Tocomwall;
- Ungooroo Aboriginal Corporation;
- Upper Hunter Heritage Consultants;
- Upper Hunter Wonnarua Council Inc.;
- Valley Culture;
- Wattaka Wonnarua Cultural Consultants;
- Wanaruah Local Aboriginal Land Council;
- Warrigagil Cultural Services;
- Widescope Indigenous Group Pty Ltd;
- Wonn 1 Contracting;
- Wonnarua Nation Aboriginal Corporation;
- Wonnarua Culture Heritage; and
- Yinaar Cultural Services.

Archaeological Findings

Previous archaeological investigations identified 29 Aboriginal heritage sites within the Modification area and immediate surrounds. These included artefact scatters, PAD and a grinding groove site.

During subsequent field surveys undertaken for the Modification, an additional 25 sites were identified. A number of new “loci” (artefacts associated with previously recorded sites) were also recorded during the field surveys. All sites consisted of stone artefact scatters or isolated stone artefacts. One PAD was recorded in association with a stone artefact scatter. Further detailed description of these sites is presented in Appendix E.

The locations of known Aboriginal heritage sites within the Modification area are shown on Figures 4-11 and 4-12.

Non-Indigenous Heritage Findings

The remains of a stockyard and post and rail fence were reported in the Mt Arthur Consolidation Project Heritage Assessment (AECOM, 2009). These items are located within the Modification area and were inspected as part of the Aboriginal and Non-Indigenous Cultural Heritage Assessment (Appendix E). Due to their poor condition, these items were assessed as having no heritage or conservation significance (Appendix E). No other items of non-indigenous heritage were identified during the field survey of the Modification area.

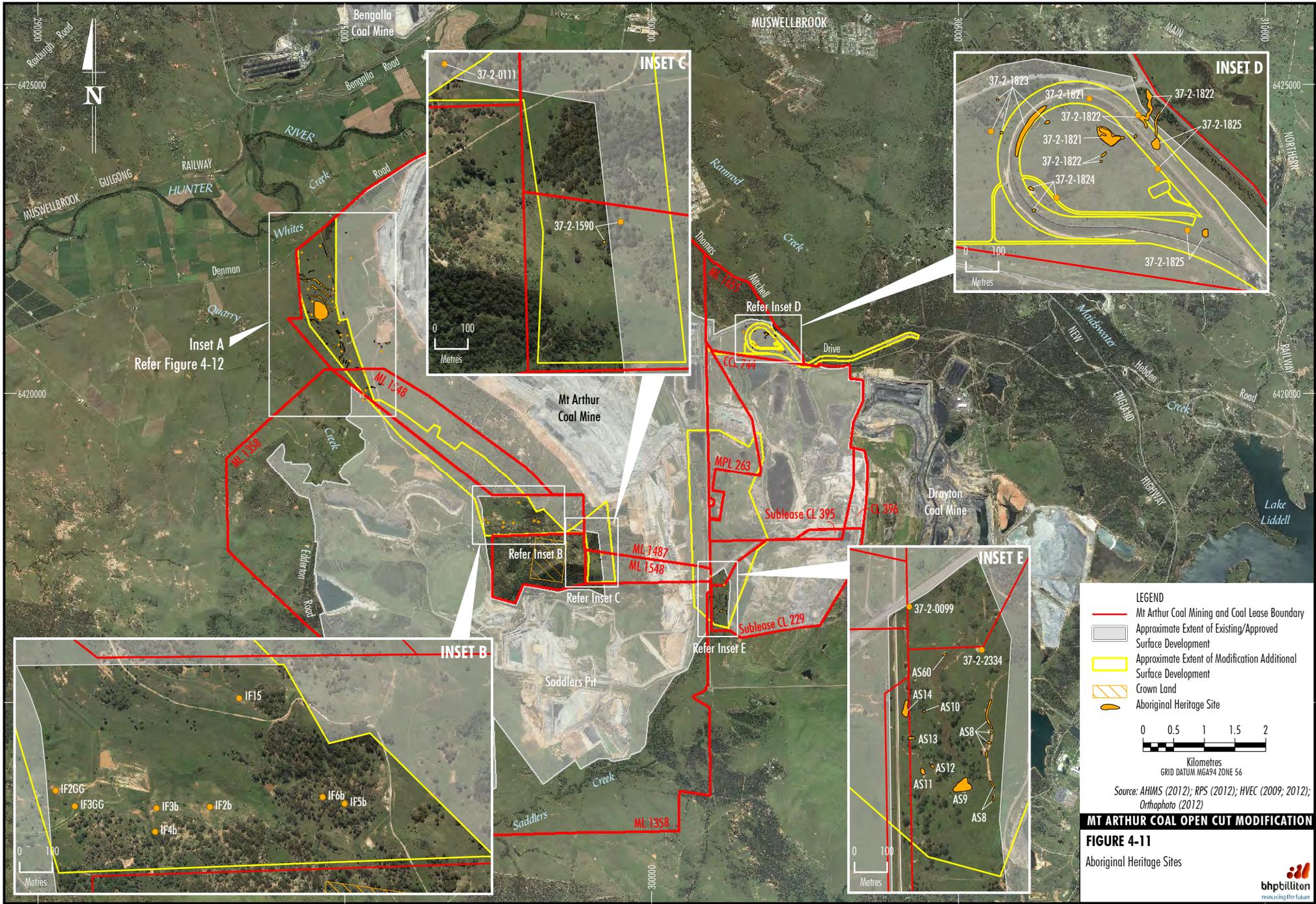
Archaeological and Cultural Heritage Values

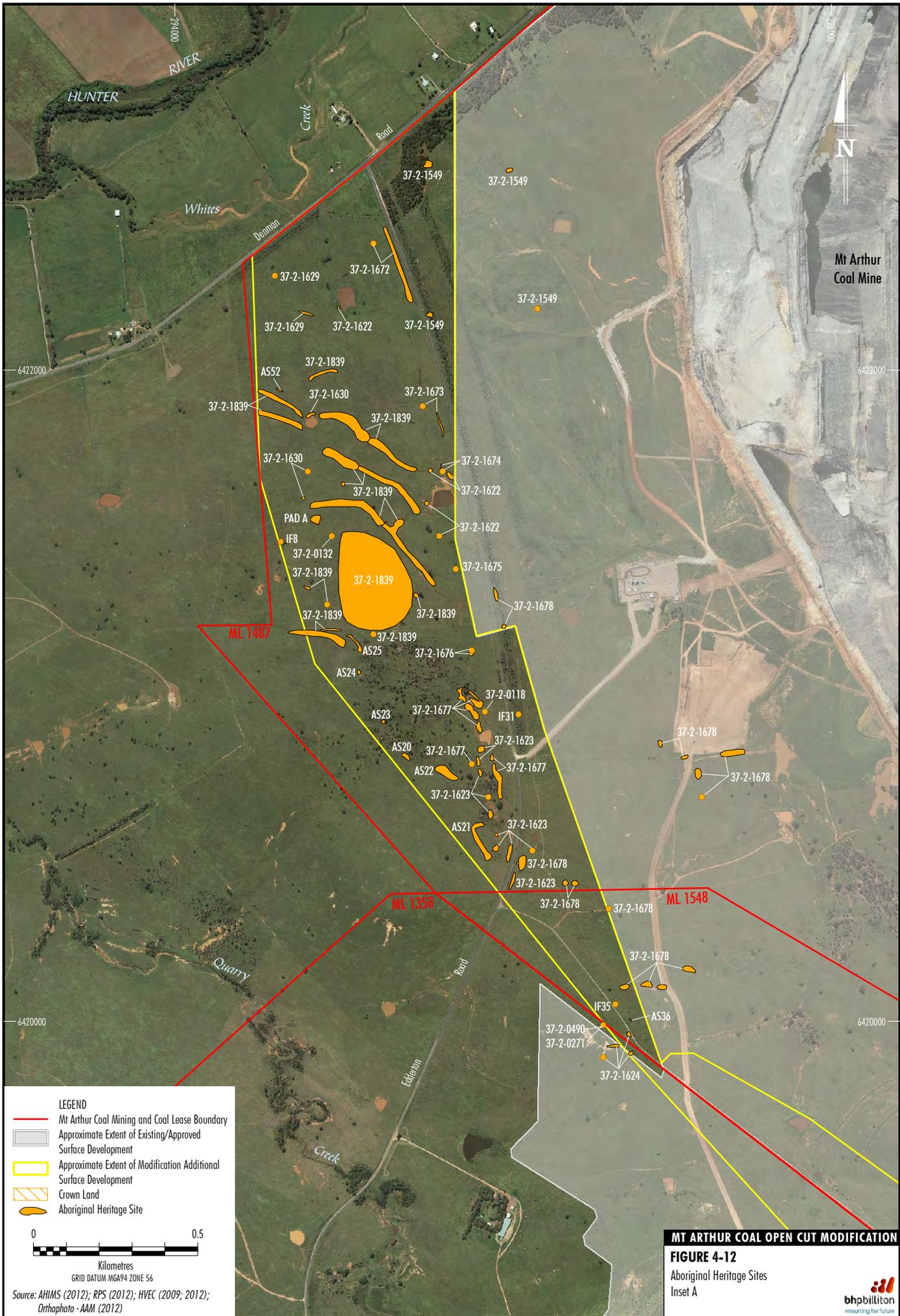
The local archaeological significance rankings for each of the sites within the Modification area are provided in Table 4-15. One site of high local archaeological significance was recorded (Table 4-15) (Appendix E). A total of nine sites of moderate local archaeological significance and 44 sites of low archaeological significance were also recorded (Table 4-15) (Appendix E).

The Aboriginal Cultural Heritage Assessment (including a specific assessment of cultural significance via consultation with the Aboriginal community) was undertaken in accordance with the relevant requirements of the various advisory documents and guidelines, as listed above.

Table 4-14 summarises the main stages of the Aboriginal heritage consultation/survey programme undertaken as part of the Modification, with further detail provided in Appendix E. The registered Aboriginal parties were asked to contribute their cultural knowledge on the Modification area, and the sites within it, at all stages during the consultation process (i.e. during the initial information session, as part of the review of the proposed methodology, during the field surveys and as part of reviewing the Aboriginal Cultural Heritage Assessment including a specific meeting held with all registered stakeholders during the review period).

The registered Aboriginal stakeholders identified the Modification area as a place where Aboriginal people would have occupied in the past. Comments received from the registered Aboriginal stakeholders in relation to the cultural significance are detailed in Appendix E.





In summary, the Aboriginal stakeholders identified that:

- All sites/artefacts have some cultural significance to Aboriginal people.
- Artefacts found in the subject area were of a similar cultural value to other artefacts known from the region.
- The Modification area and surrounds would have contained an abundance of resources that would have made it suitable for Aboriginal occupation.
- The area may have been a crossroads for travelling routes between the Sydney Basin, Western Plains and Northern Tablelands.

4.7.2 Potential Impacts

The Project would result in direct disturbance of all known Aboriginal heritage sites within the Modification area. The sites are located within or partially within the footprint of the proposed open cut extension, overburden emplacement and rail loop duplication and would therefore be subject to direct disturbance by the Modification (Figure 4-11).

The Modification would also result in the direct disturbance of the grinding groove site (37-2-0111). The grinding groove site is located within the approved open cut disturbance area however mining was not proposed for that portion in the Consolidation Project EA (Appendix E). The extension of the open cut for the Modification would result in disturbance to this site.

4.7.3 Mitigation Measures and Management

The mitigation, management and monitoring measures detailed below have been developed in consultation with the registered Aboriginal stakeholders and in consideration of the cultural and archaeological significance of the Aboriginal heritage sites to be impacted. The consultation process with the registered Aboriginal stakeholders is described in Appendix E.

The existing *Aboriginal Heritage Management Plan* would be updated in consultation with the Aboriginal community and the OEH to specify management and mitigation measures relevant to the Modification area.

These management and mitigation measures would include the following (Appendix E):

- Where practicable, known Aboriginal heritage sites would be avoided during Modification construction and operation works.
- Where avoidance of known Aboriginal heritage sites is not practicable, site(s) would be subject to baseline recording in consultation with the registered Aboriginal stakeholders prior to disturbance and artefacts would be salvaged for safekeeping in accordance with the stakeholder's wishes.
- Salvaged Aboriginal objects would be transferred to a keeping place in the Thomas Mitchell Drive Offset Area (or other location determined in consultation with the registered Aboriginal stakeholders).
- An attempt would be made to salvage and relocate the sandstone block on which grinding groove site (37-2-0111) to the Mount Arthur Conservation Area (or other location determined in consultation with the registered Aboriginal stakeholders).

Table 4-15
Local Archaeological Significance of Aboriginal Heritage Sites¹

Local Archaeological Significance Rating	Aboriginal Heritage Site	Number of Sites
High	PAD A	1
Medium	37-2-0111, AS11, AS12, AS20, AS21, AS22, AS23, AS24, AS25	9
Low	37-2-0099, 37-2-0132, 37-2-0271, 37-2-0490, 37-2-0118, 37-2-1549, 37-2-1590, 37-2-1622, 37-2-1629, 37-2-1672, 37-2-1673, 37-2-1674, 37-2-1675, 37-2-1676, 37-2-1677, 37-2-1822, 37-2-2334, 37-2-1821, 37-2-1823, 37-2-1824, 37-2-1825, 37-2-1839*, 37-2-1678, 37-2-1624, 37-2-1623*, 37-2-1630, IF2GG, IF3GG, IF2b, IF3b, IF4b, IF5b, IF6b, IF8, AS8, AS9, AS10, AS13, AS14, IF15, IF31, IF-35, AS36, AS52, AS60	45

Source: After Appendix E.

¹ Includes sites recorded by the Modification surveys and sites previously recorded in the Modification area.

* Site also contains locus classified as moderate local significance (Appendix E).

- Any additional Aboriginal heritage sites which may be identified during the development of the Modification would be recorded and registered with the OEH in consultation with Aboriginal stakeholders. Should additional Aboriginal heritage sites be identified, they would be managed in accordance with the measures described in the Aboriginal Heritage Management Plan.
- Sample test pitting would be undertaken prior to salvage at sites PAD A and AS20 to AS25 to determine the need for subsurface salvage.
- HVEC would maintain a record of known Aboriginal heritage sites (including on-site plans and in relevant Project documentation) and make employees and contractors aware of their location.
- using cover crops, increased surface roughness, or other temporary revegetation measures to form temporary seals on the surface of overburden emplacement areas that remain unused and exposed for over six months;
- maintaining unsealed coal handling areas in a moist condition using water carts or alternative means;
- prompt cleaning up of any coal spillage;
- automatic sprays on plant feed and clean coal stockpiles; and
- predictive models to forecast dust impacts would be evaluated through an assessment and trial period as a potential planning and management tool.

4.8 AIR QUALITY

An Air Quality and Greenhouse Gas Assessment for the Project was undertaken by PAEHolmes (2013) and is presented as Appendix F. The assessment was conducted in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (Approved Methods)* (DEC, 2005b).

4.8.1 Existing Environment

Air Quality Management Regime

The *Air Quality and Greenhouse Gas Management Plan (AQGGMP)* (BHP Billiton, 2012i) includes management and mitigation measures, air quality monitoring requirements currently undertaken at Mt Arthur Coal Mine and a complaints response protocol.

Existing air quality management and mitigation measures for windblown dust sources include (Appendix F):

- disturbing only the minimum area necessary for mining;
- removing topsoil from a maximum of one mining strip width ahead of the active pit at any time;
- reshaping, topsoiling and rehabilitating completed overburden emplacement areas as soon as practicable after the completion of overburden placement;
- all haul roads have clearly defined edges, with marker posts or equivalent to control their locations;
- obsolete roads will be ripped and re-vegetated, as soon as practicable;
- applying road sealant or dust suppressant product on all haul roads and, where practicable, on minor roads, hardstand and industrial areas;
- enforcing speed limits;
- tracks used by topsoil stripping scrapers during their loading and unloading cycle are watered;
- stripping occurs preferably in damp conditions where practical and during favourable wind conditions;
- long-term topsoil stockpiles, that are not planned to be used for over six months, are sown with cover crops;
- automatic sprays and/or wind shields are used when tipping raw coal that has the potential to contribute to unacceptable dust generation.
- air pollution control equipment is operated and maintained on all drilling rigs to prevent fines generated during drilling being discharged to the atmosphere;
- water drill patterns post-drilling to minimise dust generation from the fine material collected during drilling;

Existing air quality management and mitigation measures for activity generated dust sources include:

- blasting only occurs following an assessment of weather conditions to ensure that wind speed and direction will not result in excess dust emission from the site;
- when SMS wind alarms are received the current dumping strategy is assessed and alternate, less exposed dumps, are utilised;
- the mine planning dump strategy considers prevailing wind speed and direction;
- conveyors are shielded on top and at least one side, and automatic sprays are fitted at transfer points; and
- street sweeps are used on sealed hard stand areas, as required.

Existing air quality management and mitigation measures for excessive dust events include:

- strategic deployment of water carts to control haul road dust to focused locations/activities;
- relocation of haul truck routes in response to wind direction and speed;
- relocation or modification of exposed operations such as topsoil removal or overburden dumping;
- should visibility on Denman Road, Edderton Road or Thomas Mitchell Drive affect the safety of drivers, altering or ceasing mining operations until such time that visibility improves; and
- where relocation is not possible, assessing the option to temporarily halt activities and implementing this where required.

In the last ten years of complaint records (January 2002 to December 2011), 117 air quality related complaints have been received by HVEC for the Mt Arthur Coal Mine (Figure 2-3).

In 2011, Mt Arthur Coal received 14 dust complaints, an increase on previous years. In each case, real-time air quality monitoring results were within statutory limits and appropriate control measures were in place (BHP Billiton, 2011a).

Air Quality Criteria

The Mt Arthur Coal Mine mining activities described in Section 2 have the potential to generate particulate matter (i.e. dust) emissions in the form of:

- Total Suspended Particles (TSP);

- particulate matter with an equivalent PM₁₀ (a subset of TSP); and
- particulate matter with an equivalent aerodynamic diameter of 2.5 µm or less (PM_{2.5}) (a subset of TSP and PM₁₀).

Relevant health based air quality criteria (i.e. they are set at levels to reduce the risk of adverse health effects) for PM₁₀ and TSP concentrations, as specified by the OEH in the Approved Methods (DEC, 2005b), are provided in Table 4-16.

**Table 4-16
Criteria/Standards/Goals for Particulate Matter Concentrations**

Pollutant	Averaging Period	Criteria/Standards/Goals (µg/m ³)
TSP	Annual mean	90
PM ₁₀	24-hour average	50
	Annual mean	30
PM _{2.5}	24-hour average	25
	Annual mean	8

Source: After Appendix F.

µg/m³ = micrograms per cubic metre.

¹ The 50 µg/m³ 24-hour maximum PM₁₀ criteria are cumulative (i.e. include background concentrations but exclude extraordinary events such as bushfires) in the existing Mt Arthur Open Cut PA 09_0062, however the 50 µg/m³ property acquisition criteria applies specifically Project-only. A 150 µg/m³ cumulative acquisition criterion applies in Mt Arthur Open Cut PA 09_0062.

The EPA does not have specific criteria for PM_{2.5}. In the absence of EPA criteria, Table 4-16 also contains PM_{2.5} criteria that are based on the Ambient Air National Environmental Protection Measure (National Environment Protection Council, 2003) reporting standard.

Dust Deposition

Particulate matter has the potential to cause nuisance (amenity) effects when it is deposited on surfaces.

The amenity criteria for the maximum increase in dust deposition and maximum total dust deposition, as specified by the OEH in the Approved Methods (DEC, 2005b) is 2 grams per square metre per month (g/m²/month) and total dust deposition (i.e. including background air quality) is 4 g/m²/month.

Existing Air Quality

Dust deposition and dust concentration (PM₁₀) is monitored in the vicinity of Mt Arthur Coal Mine. The locations of the monitoring sites are shown in Figure 2-2. There are eight HVAS measuring 24-hour average concentrations of PM₁₀ every sixth day, and 21 dust deposition gauges measuring the monthly average of deposited dust.

The annual average PM₁₀ concentrations recorded at the Mt Arthur Coal Mine are provided in Table 4-17.

There are also six Tapered Element Oscillating Microbalance analysers (TEOMs) continuously monitoring PM₁₀ concentrations since 2008. The EPA has also operated a TEOM monitoring PM₁₀ and a Beta Attenuation Mass monitoring PM_{2.5} in Muswellbrook since December 2010.

The monthly data are presented in Appendix F, with the annual averages of dust deposition data summarised in Table 4-18. As shown in Table 4-18 the EPA criteria of 4 µg/m³ has been exceeded 12 times in the period 2003 to 2011.

Previous Assessments

PAEHolmes (2009) prepared an *Air Quality Impact Assessment for the Mt Arthur Coal Consolidation Project*, which assessed PM₁₀, TSP and dust deposition emissions from the Mt Arthur Coal Mine. This assessment predicted that approximately 20 private receivers would be impacted by dust levels exceeding the 24-hour average PM₁₀ assessment criterion of 50 µg/m³. Six private residences and one recreational facility were predicted to be impacted by dust levels exceeding the annual average PM₁₀ assessment criterion of 30 µg/m³ for the Project and other sources.

No private residences were predicted to be impacted by dust levels exceeding the TSP assessment criterion of 90 µg/m³ for the Project and other sources. Five private residences, owned by three landowners, were predicted to be impacted by dust levels exceeding the annual average 2 g/m²/month (insoluble solids) deposition level assessment criteria from the Project alone.

One private residence was predicted to be impacted by dust levels exceeding the annual average 4 g/m²/month (insoluble solids) deposition level assessment criteria from the Project and other sources.

**Table 4-17
Annual Average PM₁₀ Concentrations (µg/m³)**

Station ID	Monitoring Location	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
		Criterion										
		30	30	30	30	30	30	30	30	30	30	
DF01	Roxburgh South	9.2	16.8	17.3	15.8	16.9	17.7	18.4	23.9	15.8	20.6	17.2
DF02	Windmill	20.2	19	18.7	16.5	15.8	16	13.5	20.2	14.8	15.4	17.0
DF03	Edderton	19.8	17.1	14.6	13.5	16.9	16.7	14.5	17.7	14.1	13.9	15.9
DF04	Wire Lane	24.9	23.7	23.1	19.7	18.2	22	20.3	27.4	19.3	20.6	21.9
DF05	Constable	23.6	21.3	19	16.6	17.5	17.4	16.3	22.8	16.3	16.6	18.7
DF06	Sheppard Ave	ND	*	27.6	21.8	27.3	27.4	21.4	29.8	21.3	21.1	24.7
DF07	South Muswellbrook	*	25.3	28.4	22.4	22.3	23.2	21	28.3	19.9	21.1	23.5
DF08	Denman Road West	20.9	19.4	18	19.2	18.3	19.7	20.5	26.4	19.2	21.4	20.3

Source: Appendix F.

ND – no data.

* Less than six months of valid data available

Table 4-18
Annual Average Dust Deposition Data (Insoluble Solids) – 2003 to 2011 (g/m²/month)

Gauge	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
	Criterion = 4 g/m ² /month									
DD1	3.4	2.2	2.2	2.8	2.0	2.1	2.8	3.4	3.4	2.7
DD2	4.3	3.7	2.8	4.3	3.4	*	4.3	5.8	3.5	4.0
DD3	3.7	2.6	3.2	3.6	4.0	3.0	4.1	5.9	3.4	3.7
DD4	1.8	1.7	1.7	1.9	1.8	1.8	2.8	2.3	1.9	2.0
DD5	2.7	3.1	3.0	2.2	2.6	2.2	3.3	2.8	3.1	2.8
DD6	2.1	1.2	1.8	1.6	1.9	1.9	*	1.9	*	1.8
DD7	3.1	*	1.8	2.2	1.2	1.3	1.5	1.3	1.1	1.7
DD8	1.0	1.2	1.3	1.2	1.1	1.8	1.4	1.0	1.0	1.2
DD9	1.6	1.3	1.1	1.0	1.1	1.1	1.3	1.1	1.2	1.2
DD10	1.8	1.9	1.9	2.1	2.0	1.9	2.5	1.9	2.3	2.0
DD11	3.1	*	3.0	3.5	2.4	2.2	2.5	2.9	2.7	2.8
DD12	2.8	1.9	2.1	2.7	1.7	1.9	1.8	1.9	2.2	2.1
DD13	1.7	1.8	1.4	1.6	1.3	1.4	2.6	*	2.8	1.8
DD14	1.4	1.2	1.0	1.1	0.8	1.1	1.3	2.3	1.1	1.2
DD15	1.9	1.9	2.4	2.4	2.5	1.8	2.1	1.9	1.8	2.1
DD16	4.2	3.7	3.3	4.3	3.1	3.3	5.0	3.7	4.7	3.9
DD17	3.5	4.1	2.3	2.3	2.2	2.1	3.4	2.6	2.3	2.8
DD18	2.7	2.6	2.1	3.0	2.5	2.0	3.6	2.6	2.4	2.6
DD19	2.7	2.4	2.3	2.7	2.4	2.2	3.4	3.0	2.5	2.6
DD20	2.9	2.3	3.4	3.6	2.9	3.0	4.6	3.0	2.9	3.2
DD21	2.1	2.2	2.1	2.8	1.8	1.9	2.6	1.9	1.6	2.1

Source: Appendix F.

* Less than six months of valid data available.

Note: Figures in bold indicate concentrations above criteria.

4.8.2 Potential Impacts

The Air Quality Assessment prepared by PAEHolmes (Appendix F) deals with air quality issues that would arise from this Modification and focuses on the following:

- the potential impacts from emissions of dust from the Modification;
- the potential cumulative impacts from emissions of dust from the Modification considered in combination with emissions from nearby mining; and
- an assessment of the greenhouse gas emissions potentially arising from the Modification.

Dust emissions inventories were developed for three stages of operations of the Modification. These stages have been selected to represent the potential worst-case air quality impacts that the Modification would have on nearby receivers and enable a direct comparison with the predictions of the Consolidation Project EA.

The computer dispersion model ISCMOD is used in this assessment in order to allow a comparison with the Consolidation Project EA. The emissions inventories developed for each of the stages have been used with local meteorological data and to predict the maximum 24-hour average PM₁₀, annual average PM₁₀, maximum 24-hour average PM_{2.5}, annual average PM_{2.5}, annual average TSP and annual average dust deposition (insoluble solids). The modelling has been undertaken to show both the effects of the Modification only and the cumulative effects of the Modification with neighbouring mines and other sources of dust.

The assessment generally follows the conventional procedures outlined by the EPA Approved Methods (DEC, 2005b) and contemporary standards adopted by the DP&I.

The modelling predictions show that annual and maximum 24-hour PM₁₀ average concentrations are marginally lower at the majority of the residences compared to the Consolidation Project EA. In particular, eight residences are below the 24-hour average PM₁₀ criterion of 50 µg/m³ for the modelling predictions for the Modification compared to the Consolidation Project EA. This is partly a result of continual efforts by Mt Arthur Coal Mine to implement controls to reduce dust emissions since 2009 (Appendix F).

In summary, no privately-owned residences are anticipated to be impacted by dust levels exceeding the annual average PM₁₀ criterion, that are not already within the HVEC or Mt Pleasant Zone of Acquisition (Appendix F).

An indicative air quality emission contour for 24 hour PM₁₀ for 2016 is provided on Figure 4-13, with additional contours provided in Appendix F.

Cumulative air quality modelling was undertaken for Years 2016, 2022 and 2026 of the Modification. Dust emissions from Bengalla Coal Mine, Drayton Coal Mine, Mount Pleasant Coal Mine and Mangoola Coal Mine were considered in the cumulative assessment. The cumulative modelling predicts no additional exceedances of the EPA's annual average PM₁₀, PM_{2.5} TSP on dust deposition criteria. The cumulative 24-hour average PM₁₀ concentrations are heavily influenced by the prevailing wind speed and direction on a given day. An assessment of cumulative 24-hour PM₁₀ is provided in the Air Quality and Greenhouse Gas Assessment (Appendix F).

4.8.3 Mitigation Measures and Management

As discussed in Section 4.8.1, HVEC currently employs air quality mitigation and management measures at the Mt Arthur Coal Mine which are generally considered best practice. These measures are described in the AQGGMP. In particular, HVEC operates a proactive dust management system which uses real-time air quality monitoring. This system involves alarms which, when triggered, involve additional dust management controls.

HVEC would continue implement these mitigation measures for the Modification.

4.9 GREENHOUSE GAS

4.9.1 Modified Mt Arthur Coal Mine Greenhouse Gas Emissions

Greenhouse gas emissions associated with the Modification have been assessed in Appendix F in accordance with relevant *National Greenhouse Accounts Factors* (Commonwealth Department of Climate Change [DCC], 2009). The greenhouse gas emissions associated with the Modification have been assessed in terms of direct (Scope 1) emission potential, indirect (Scope 2) emission potential and significant upstream/downstream (Scope 3) emission potential (Appendix F).

Direct emissions include diesel usage and the liberation of methane associated with mining of the coal seam, whilst indirect emissions are associated with the transportation and end-use of coal.

The total direct (Scope 1) emissions from the Modification are estimated to be approximately 2 million tonnes of carbon dioxide-equivalent (Mt CO₂-e) emissions per annum. The total indirect emissions (Scope 3) are estimated to be 68.4 Mt CO₂-e per annum (Appendix F).

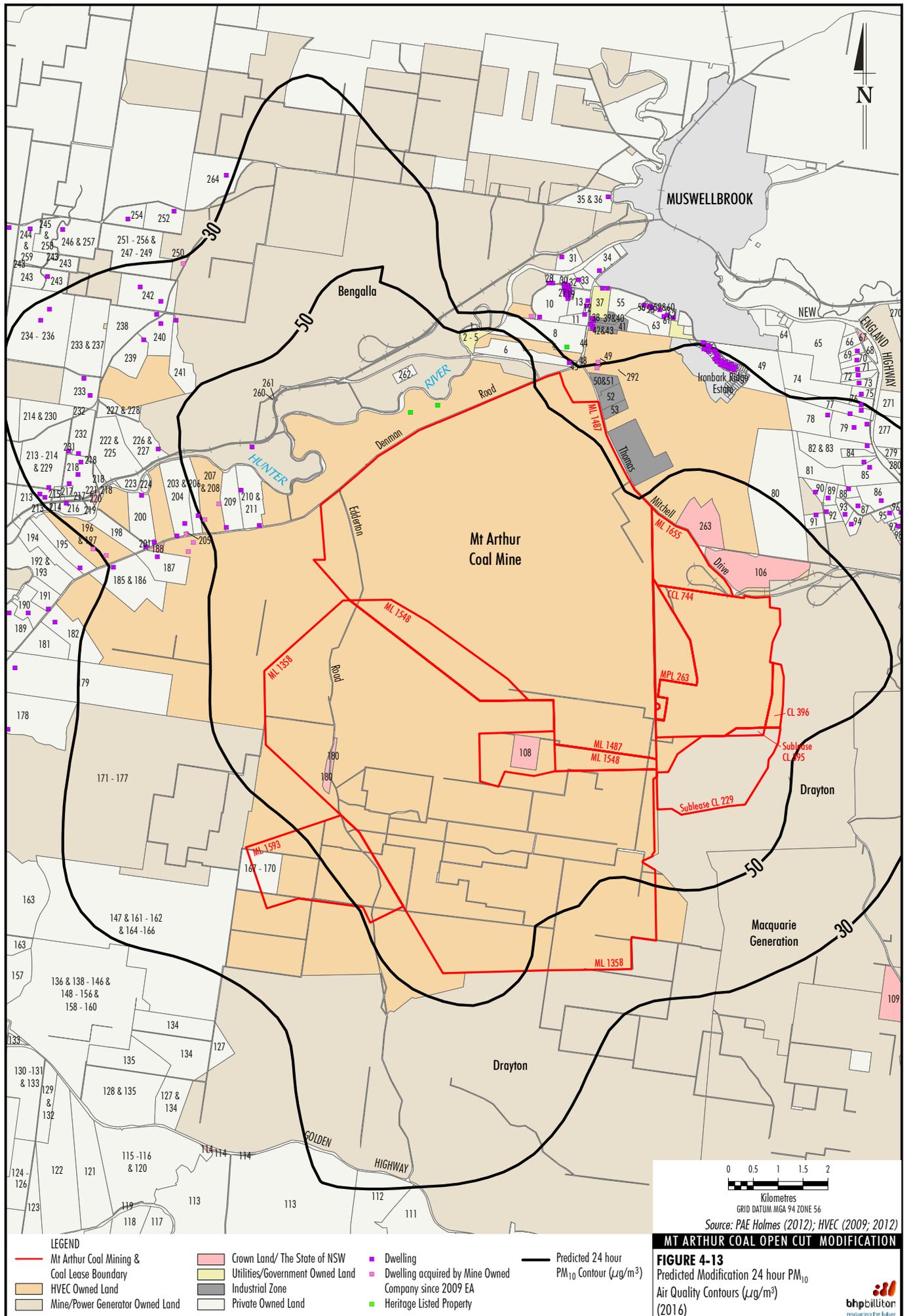
Average annual Scope 1 emissions from the Modification (2 Mt CO₂-e) would represent 0.3 percent of Australia's Kyoto commitment (591.5 Mt CO₂-e) and a very small portion of global greenhouse emissions.

4.9.2 Mitigation Measures, Management and Reporting

HVEC is committed to implementing reasonable and feasible greenhouse gas mitigation measures. In order to facilitate the control of greenhouse gas emissions, HVEC has developed an Energy Excellence Working Group. The working group has held workshops across the site to identify potential energy efficiency opportunities.

Ongoing review includes:

- reviewing equipment purchases with a view to keeping fuel efficiency levels high;
- maintaining equipment to ensure that diesel and electrically powered equipment are operated efficiently;
- reviewing mining practices to minimise double handling of materials and ensuring that coal and overburden haulage is undertaken using the most efficient routes;



LEGEND

- Mt Arthur Coal Mining & Coal Lease Boundary
- HVEC Owned Land
- Mine/Power Generator Owned Land
- Crown Land/ The State of NSW
- Utilities/Government Owned Land
- Industrial Zone
- Private Owned Land
- Dwelling
- Dwelling acquired by Mine Owned Company since 2009 EA
- Heritage Listed Property
- Predicted 24 hour PM₁₀ Contour (μg/m³)



GRID DATUM MGA 94 ZONE 56
Source: PAE Holmes (2012); HVEC (2009; 2012)

MT ARTHUR COAL OPEN CUT MODIFICATION

FIGURE 4-13
Predicted Modification 24 hour PM₁₀
Air Quality Contours (μg/m³)
(2016)



- ensuring that lighting and heating are only used when required;
- increasing the use of alternative fuels where feasible;
- improving blasting practices to minimise diesel use and emissions; and
- managing spontaneous combustion to minimise emissions of all gases including greenhouse gas.

Key focus areas for greenhouse gas management on-site include (BHP Billiton, 2012i):

- establishing a National Greenhouse and Energy Report (NGER) Method 3 assessment of fugitive coal seam gas emissions;
- improving blasting practices to minimise diesel use and emissions;
- generating and maintaining best practice management for synthetic and refrigeration gases; and
- exploring the increase of the percentage of biodiesel used across site.

Ongoing monitoring and management of greenhouse gas emissions and energy consumption at Mt Arthur Coal Mine would be achieved through HVEC's participation in the Commonwealth Government's NGER system. Under NGER requirements, relevant sources of greenhouse gas emissions and energy consumption must be measured and reported on an annual basis, allowing major sources and trends in emissions/energy consumption to be identified.

BHP Billiton participates in the Commonwealth Government's EEO Programme. Several EEO projects have been identified and implemented by BHP Billiton and details are reported in the AEMR.

BHP Billiton is also a participant in the Cooperative Research Centre for Greenhouse Gas Technologies programme that actively researches emission reductions from the use of coal. BHP Billiton also contributes to the COAL21 fund which supports the pre-commercial demonstration of low emissions technologies in the power generation sector.

Additionally, a drilling programme commenced during 2010 investigating coal seam gas levels to enable better understanding of fugitive emissions at the Mt Arthur Coal Mine.

Greenhouse gas mitigation measures would continue to be investigated and reported through the AEMR.

4.10 NOISE AND BLASTING

A Noise and Blasting Assessment for the Project was undertaken by Wilkinson Murray (2013) and is presented in Appendix G. The assessment was conducted in accordance with the NSW *Industrial Noise Policy* (INP) (EPA, 2000), *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (Australian and New Zealand Environment Council, 1990), *Environmental Assessment Requirements for Rail Traffic - Generating Developments* (EPA, 2012) and *Interim Construction Noise Guideline* (DECC, 2009).

4.10.1 Existing Environment

Background

The noise emissions of the original Mt Arthur North Project were assessed by Wilkinson Murray (2000). The assessment was conducted in accordance with the requirements of the INP.

Subsequent to Wilkinson Murray's (2000) report, a number of modifications have been assessed that involved re-assessment of predicted noise levels from the Mt Arthur Coal Mine, as follows:

- As a component of the South Pit Extension, Wilkinson Murray (2007a) conducted the *Mt Arthur Coal South Pit Extension Noise and Blasting Assessment*.
- As a component of the Underground Project, Wilkinson Murray (2007b) conducted the *Mt Arthur Underground Project Noise and Vibration Assessment*.
- As a component of the Open Cut Expansion, Wilkinson Murray (2009) completed the *Mt Arthur Coal – Consolidation Project Noise and Blasting Impact Assessment*.

Compliance and Complaints

Noise monitoring is undertaken at locations surrounding the Mt Arthur Coal Mine (Figure 2-2). A review of Mt Arthur Coal Mine routine noise monitoring results by Wilkinson Murray (2012) was conducted (Appendix G).

Review of the 2007 to 2011 noise monitoring data by Wilkinson Murray indicates that noise levels were consistent with the relevant Project Approval requirements and were compliant with the relevant noise limits with the exception of two exceedances at site NP9 in the August 2008 survey and in the September 2011 survey (Appendix G).

During the 2007 to 2011 period, one exceedance of the 120 linear decibels (dB(L)) airblast pressure was recorded at site BP7 on 24 February 2009 which recorded an airblast pressure of 124.6 dB(L). In the 2007 to 2011 period, the 115 dB(L) airblast pressure limit was not exceeded for any 12 month period, with the exception of the BP7 exceedance above (Appendix G).

All vibration results were less than 10 millimetres per second (mm/s) with the exception of two blasts on 17 February and 23 March 2011, both of which were attributed to equipment malfunction. During the 2007 to 2011 period, the 5 mm/s vibration limit was not exceeded for any 12 month period, with the exception of the two equipment malfunctions above (Appendix G).

HVEC manages complaints in accordance with the Noise Management Plan. A summary of noise and blasting-related complaints is provided in Appendix G.

During the 2007 to 2011 period, 192 complaints were received in relation to on-site noise. Of these, 39 complaints specifically referred to operational noise, 153 related to blasting and eight related to rail noise (Appendix G).

Recent complaints in the Antiene area have been in regard to stationary trains on the Antiene Rail Spur travelling to Mt Arthur Coal Mine and the Drayton Coal mine. HVEC has recently improved driver education and also monitors the position of stationary trains. This has led to fewer trains idling in acoustically exposed locations and, recently, fewer complaints.

4.10.2 Potential Impacts

The Noise and Blasting Impact Assessment (Appendix G) included assessment of the following potential impacts:

- on-site operational noise (including the potential for sleep disturbance);
- off-site rail noise;
- off-site road noise;
- construction noise associated with the duplication of the rail loop; and
- on-site blasting.

These aspects are discussed further below and in Appendix G.

Background Noise and Intrusive Noise Criteria

Operational noise criteria are based on the rating background level (RBL), which is determined by the existing background noise. Wilkinson Murray began noise surveys as part of the Mt Arthur North EIS (Sinclair Knight & Partners Pty Ltd, 2000) in 1999, and the existing operational noise criteria for Mt Arthur Coal are based largely on the results of those surveys.

In the Mt Arthur Consolidation Project Noise and Blasting Impact Assessment (Wilkinson Murray, 2009), the history of monitoring between 1999 and 2009 was discussed. Over the 10 years since those surveys, there has been considerable development in the area surrounding the Mt Arthur Coal Mine.

The Consolidation Project EA Noise and Blasting Assessment discussed the changing background noise level based on the results of noise monitoring for various HVEC projects and the results from the permanently installed BarnOwl noise monitors surrounding the site.

The results of that study are considered the best information available for setting intrusive noise criteria for the Modification (Appendix G). The RBL for the assessment zones and the resulting intrusive noise levels results are summarised in Table 4-19. This is consistent with Condition 2, Schedule 3 of the Mt Arthur Consolidation Project Approval (09_0062).

Operational Noise Modelling

Predicted Noise Emissions

Detailed noise modelling was undertaken for the Modification. Noise impacts of the Modification were compared to the Consolidation Project EA and Project-specific noise criteria. Changes in noise predicted exceedances relative to the Consolidation Project EA are detailed below:

- one new noise marginal management zone exceedance (less than 5 A-weighted decibels [dBA] above the criteria);
- two existing noise management zone exceedances have moved into the noise affectation zone (greater than 5 dBA above the criteria); and
- one existing noise affectation exceedance moves into the noise management zone.

**Table 4-19
Background and Intrusive Noise Criteria**

Receiver Zone	Location	Assessed RBL (Day/Evening/Night) (dBA)	Intrusive Criteria (Day/Evening/Night) (L _{Aeq,15min} dBA)
A	Antiene Estate	32/35/33	37/40/38
B	Skelletar Stock Route Thomas Mitchell Drive Denman Road	34/33/32	39/38/37
C	Racecourse Road	36/35/34	41/40/39
D	Denman Road (north-west) Roxburgh Vineyard (north-east) and Roxburgh Road	32/31/30	37/36/35
E	South Muswellbrook (including the South Muswellbrook Development Area and Ironbark Ridge Estate)	34/34/34	39/39/39
F	Denman Road West and Roxburgh Vineyard (west)	32/31/30	37/36/35
G	East Antiene	36/35/34	41/40/39
H	South of Mine	30/30/30	35/35/35

Source: Appendix G.

L_{Aeq} = equivalent continuous noise level.

Table 4-20 presents a summary of potential exceedances of intrusive operational noise criteria at private receivers during daytime, evening and night-time. Indicative worst-case (i.e. the maximum envelope of all three modelled years) noise contours for night-time operations under adverse meteorological conditions for Years 2016, 2022 and 2026 are presented in Figure 4-14.

Detailed results are provided in Appendix G.

Vacant Land Assessment

Wilkinson Murray (Appendix G) also reviewed potential intrusive noise impacts on private vacant land and concluded that no properties are predicted to exceed intrusiveness criteria by greater than 25 percent of vacant land.

Other Land Uses

Other (non-residential) land uses were assessed by Wilkinson Murray in accordance with the INP. This included the following receivers:

- South Muswellbrook Industrial Estate;
- Muswellbrook Race Club Ltd;
- Highbrook Park Muswellbrook; and
- Lake Liddell Recreational Park.

No exceedance of the amenity criterion was predicted at any of the above receivers.

**Table 4-20
Summary of Predicted Exceedances under Night-time Inversion Conditions**

Receiver ID	Noise Management Zone		Noise Affection Zone
	1 to 2 dBA Exceedance	3 to 5 dBA Exceedance	> 5 dBA Exceedance
	87 ⁺ , 93 ⁺ , 6 ^a , 8 ^a , 11 [^] , 40 ^{^#} , 41 ^{^#} , 43 [#] , 200 ^b , 203 ^a , 187 ^b , 95 ⁺ , 97 [^] , 98 [^] , 99(1) [^] , 99(2) [^]	94 ^{^b} , 204 ^a , 206 ^a , 209 ^a , 226 ^a , 100 [^] , 101 ⁺	210 ^a , 102 ⁺ , 211 ^a

Source: Appendix G.

⁺ Existing Noise Acquisition Upon Request as per Project Approval (09_0062).

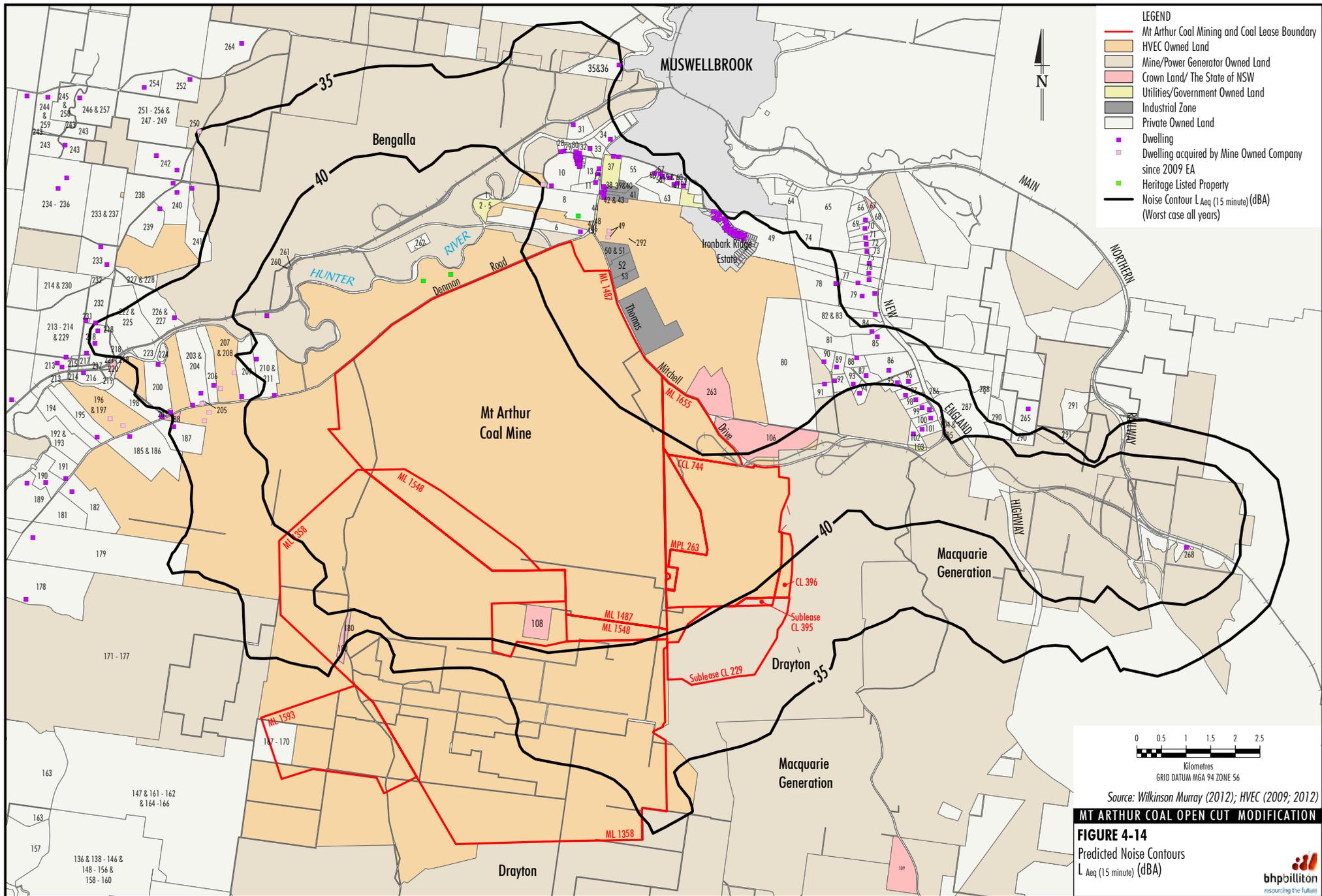
[^] Existing Noise Management Zone as per Project Approval (09_0062).

[#] Receivers within Industrial Zone as per the Muswellbrook LEP.

^a Existing Air Quality Acquisition Upon Request as per Project Approval (09_0062).

^b Existing Air Quality Management Zone as per Project Approval (09_0062).

⁺ Noise exceedances by 1 to 2 dBA in the Consolidation Project, however, not included in the Noise Management Zone of Project Approval (PA 09_0062).



Cumulative Noise Emissions

Existing and proposed coal mining and processing operations in the vicinity of the Mt Arthur Coal Mine that may potentially be sources of cumulative noise emissions include:

- Bengalla Mine;
- Drayton Mine (including the proposed Drayton South Project);
- Mangoola Mine; and
- Mount Pleasant Mine.

Cumulative noise impacts resulting from the concurrent operation of the Modification and developments listed above were assessed against the INP amenity criteria.

The cumulative noise level was estimated for 2016 as it is the year with the potential for the highest noise impact as a result of the Modification. For the other coal mines the year presented in the Noise Assessment closest to 2016 was used for the cumulative assessment. It should be noted that this is a conservative worst-case assessment as it assumes that all mines simultaneously emit their maximum noise levels to a common receiver locality.

No exceedance of the recommended acceptable amenity criterion (40 dBA) was predicted during the night-time period (Appendix G).

Construction Noise

Assessment of the potential for noise impacts from construction associated with the duplication of the rail loop and spur for receivers in Zones A and G indicates that no receiver would exceed the construction noise criteria (Appendix G).

Rail Noise

As there is no change in the maximum coal production rate, the average number of rail movements would remain the same for the Modification. However, an increase in maximum daily train movements from 24 to 38 per day is required for the Modification.

There would be a negligible increase in noise along the Main Northern Railway, with an increase in L_{Aeq} rail noise predicted to be 0.4 dBA (which is lower than the relevant threshold in the OEH rail noise assessment requirements for Project-related rail noise increases). The predicted $L_{Aeq,max}$ would remain unchanged for the Modification. The buffer distance from the rail line at which the relevant ARTC and OEH criteria would be met would increase (extend away from the rail line) by 2 m during the day and 3 m during the night due to the Modification. In addition, predicted L_{Amax} passby noise levels would not change due to the Modification (Appendix G).

Road Noise

The Modification does not involve a change to the currently approved number of employees and would not increase road deliveries of consumables. However, some changes in traffic distribution would occur due to the proposed access to the explosives facility and magazine off Edderton Road. However, given that land in the vicinity of Edderton Road is owned by mining proponents (HVEC and Anglo Coal), it follows that potential road noise impacts would be negligible (Appendix G).

4.10.3 Mitigation Measures and Management

Noise would continue to be managed in accordance with the Mt Arthur Coal EMS, and the Noise Management Plan (including commitments in this EA). These plans would be revised to incorporate the changing requirements of the Modification.

HVEC would review the existing Noise Management Plan for the site to incorporate the following additional practical management measures which may be implemented as required to ensure predictions at private receivers are met:

- procurement of noise attenuated vehicles for critical haul routes;
- modified alignment of haul routes for day and night scenarios;
- dumping of overburden in less noise-sensitive locations during night-time, then using daytime overburden placement to increase barrier heights in the vicinity of the night-time dumping locations; and
- use of bulldozers on overburden emplacements in less noise-sensitive locations during the night-time.

Where feasible and reasonable, mitigation measures have been introduced into the proposal to reduce potential noise emissions from the Modification. The iterative steps undertaken are described below:

1. Preliminary noise modelling of scenarios representative of the maximum noise emissions from the Modification to identify the potential for noise exceedances.
2. Evaluation of various combinations of noise management and mitigation measures to assess their relative effectiveness.
3. Review of the effectiveness of these measures and assessment of their feasibility by HVEC.
4. Adoption by HVEC of management and mitigation measures to appreciably reduce noise emissions associated with the Modification, including:
 - procurement of noise-attenuated vehicles for critical haul routes; modified alignment of haul routes for day and night scenarios dumping of overburden in less noise-sensitive locations during night-time, then using daytime dumping to increase barrier heights in the vicinity of the night-time dumping locations; and
 - use of bulldozers on overburden in less noise-sensitive locations during night-time.

The existing Mt Arthur Coal Mine Project Approval (Attachment 1) provides a mechanism for landholders (outside of the existing acquisition and mitigation zones) to request an independent investigation of noise levels at their residence. If an exceedance is demonstrated by such an investigation, the Project Approval provides a mechanism for acquisition of the property, if a noise management solution or negotiated agreement cannot be reached and subsequent monitoring indicates the exceedance is continuing. This process is also outlined in the Noise Management Plan.

In addition, the existing Mt Arthur Coal Mine Project Approval also provides for receivers experiencing 38 dBA L_{Aeq} noise levels to be entitled to 'feasible and reasonable' mitigation measures at the receiver (such as such as double glazing, insulation and/or air conditioning).

4.11 VISUAL

A Landscape and Visual Impact Assessment for the Modification was undertaken by Urbis (2013) (Appendix H).

The methodology employed by Urbis for the Visual Assessment was based on methodology developed by the United States Department of Agriculture, Forest Service (1974). Visual simulations prepared for key sensitive viewpoints in the vicinity of the Mt Arthur Coal Mine are presented in Appendix H.

4.11.1 Existing Environment

The area surrounding the Mt Arthur Coal Mine is comprised of a number of distinct land use types and landscape units of varying levels of landscape quality, including open cut coal mining, power generation and industrial activities, agriculture, rural and residential (town) areas. As with most of the Hunter Valley (other than for ruggedly steep areas), the natural vegetation in and around these areas had been predominantly cleared for a variety of agricultural purposes prior to mining (Appendix D).

The existing mine landforms at the Mt Arthur Coal Mine have modified the topography within the mining tenements.

The Consolidation Project EA (HVEC, 2009) included a Visual Impact Assessment (Integral, 2009) (herein referred to as the 2009 VIA). The assessment concluded that the Consolidation Project would create visual impacts beyond those experienced by the previously approved mine plans, however, these impacts would be reduced over the life of the Consolidation Project and would occur within the same timeframe as the previous approvals.

Notwithstanding, the 2009 VIA described that additional crests would be built into the final overburden emplacement area landform as a visual mitigation measure *viz. The OEA [overburden emplacement area] at Mt Arthur North will be increased to an average height of RL 360 m. Additional crests on the OEAs have been incorporated to a maximum height of RL 375 m in two locations as a result of design workshops with mine planners and visual impact specialists in order to improve visual amenity and result in a less engineered appearance of the final landform.*

The Statement of Commitments of the Mt Arthur Coal Consolidation Project Approval includes a commitment that *Mt Arthur Coal will minimise views from the Woodlands Property within the Primary View Zone to active overburden faces on the out of pit emplacement areas of the Project to ensure the extent of any primary view is less than 2.5%, as described in Appendix 1 of the EA Report.*

4.11.2 Potential Impacts

The potential visual impact was assessed by evaluating the level of visual modification of the development in the context of the visual sensitivity of relevant surrounding land use areas (i.e. those areas from which the proposed development may be visible) (EDAW Australia, 2006). The extent to which the viewer may have become accustomed to the existing approved Mt Arthur Coal Mine was also considered. Levels of visual impact resulting from visual modification and sensitivity are illustrated in Table 4-21.

**Table 4-21
Visual Impact Matrix**

		Viewer Sensitivity			
		H	M	L	
Visual Modification	H	H	H	M	VL = Very Low
	M	H	M	L	L = Low
	L	M	L	L	M = Moderate
	VL	L	VL	VL	H = High

Source: EDAW Australia (2006).

The major aspects of the Modification considered to have the potential to impact on the visual landscape include:

- modification of topographic features, including:
 - extension of the Northern Open Cut to the west by approximately 400 m in the area adjacent to Denman Road and up to approximately 1 km in the vicinity of Mount Arthur;
 - increase in the western extent of Northern Open Cut overburden emplacement (to an average height of 360 m AHD) in-line with an increase in the open cut footprint;
 - use of the conveyor corridor for overburden emplacement;

- duplication of the existing rail loop;
- additional vegetation clearance;
- relocation of the explosives magazine and facilities; and
- extension of lighting associated with extended landforms.

Six viewpoints located within the sub-regional and regional settings, and previously identified in the 2009 VIA, were chosen for detailed assessment based on their higher levels of viewer sensitivity and/or their representativeness of a range of aspects (Figure 4-15):

- Northern Sector – Roxburgh Road, Racecourse, South Muswellbrook;
- Western Sector – Denman Road, Roxburgh Vineyard; and
- Southern Sector – Golden Highway/Saddlers Creek.

Potential visual impacts were determined in accordance with the matrix presented in Table 4-21.

Overall, the potential visibility of the elevated topographic features (e.g. the conveyor corridor overburden emplacement) would be limited by the existing and/or future approved landforms at the Mt Arthur Coal Mine, specifically for viewpoints in the southern sector. For the northern and western sectors, the conveyor corridor overburden emplacement would appear as an extension to the existing Northern Open Cut overburden emplacement only at locations where it is currently visible.

A summary of the visual assessment locations analysed below is provided in Table 4-22.

Visual simulations were prepared to show the existing views as well as simulations of the Modification landforms during Year 2026 of operations, when the landforms would be at their maximum heights and the open cut pit at its greatest extent, representing the greatest potential for visual impact. A post-mining simulation was also developed to illustrate the conceptual landform following completion of mining and rehabilitation activities. The post-mining simulations take into account the rehabilitation strategy described in Section 5.

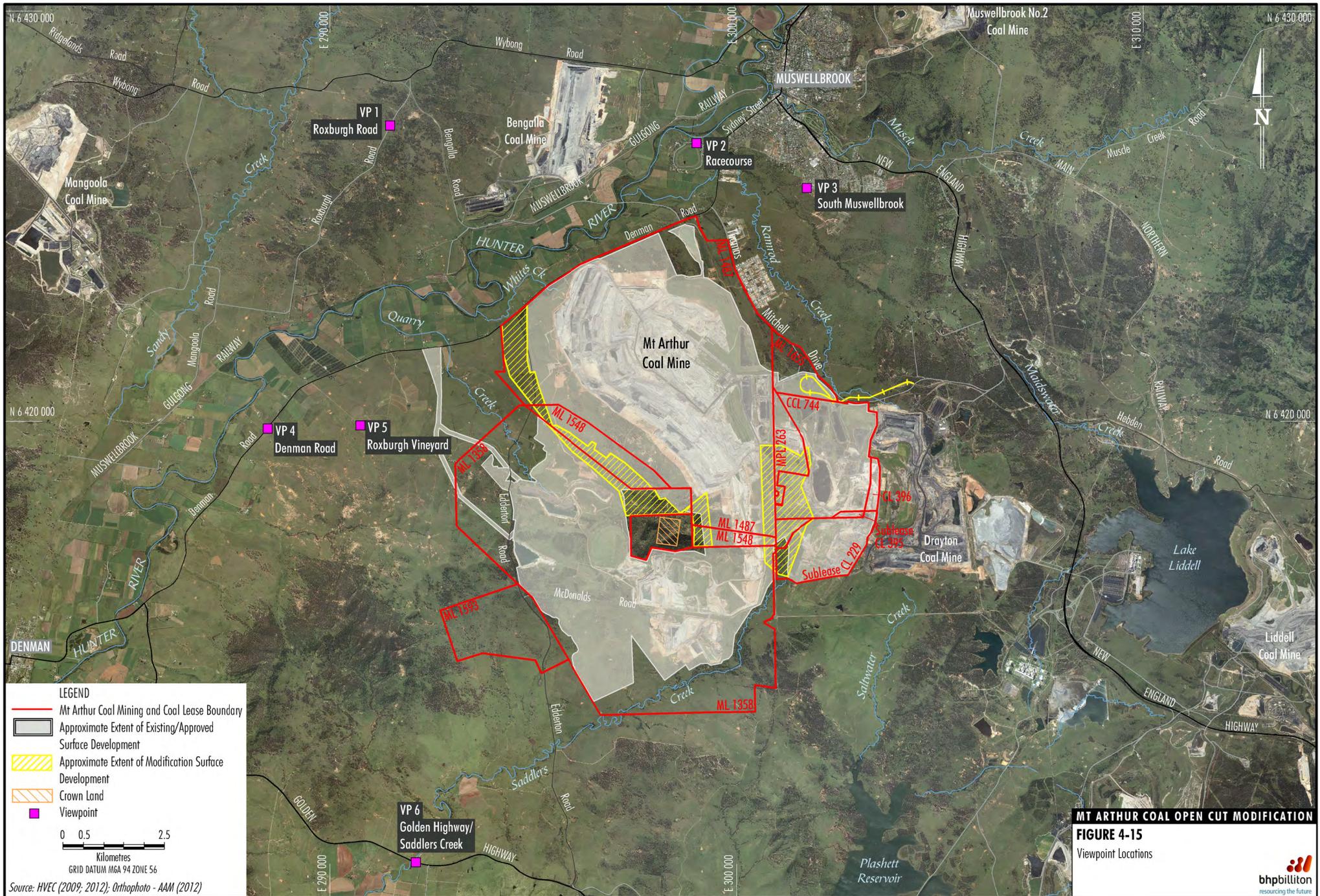


Table 4-22
Summary of Modification Visual Assessment

	Viewing Location	Sensitivity	Visual Modification Level	Visual Impact	Visual Impact (After Amelioration)
Regional Setting (Greater than 5 km from the Modification)	Roxburgh Road – Residence (VP1)	L	L -M	L	VL
	Racecourse (VP2)	L	L	L	VL
	South Muswellbrook (VP3)	L	M	L	VL
	Denman Road (VP4)	L	VL - No Impact	VL - No Impact	No Impact
	Golden Highway/Saddlers Creek (VP6)	L	VL - No Impact	VL - No Impact	No Impact
Sub-Regional Setting (1 – 5 km from the Modification)	Roxburgh Vineyard (VP5)	VL	L	VL	VL

Source: Appendix H.

H = High, M = Moderate, L = Low, VL = Very Low

Regional Setting

Roxburgh Road – Residence (VP1)

The viewpoint location on Roxburgh Road is located adjacent to a residence, approximately 5.6 km from the approved mine landform components (Figure 4-15). The residence was privately-owned at the time of the 2009 VIA and is now owned by Coal and Allied. However, the viewpoint is still considered to be representative of receivers on Roxburgh Road (Appendix H).

The residence has numerous trees and shrubs within the 'house paddock' surrounding it, which heavily screen views to the existing Mt Arthur Coal Mine. From Roxburgh Road, and away from the screening vegetation of the residence, the existing operations and the Modification would be potentially visible.

The Modification open cut would not be located any closer to the viewpoint than the existing open cut. The proposed activities would appear as a slight westward extension of the approved open cut and would be consistent with its appearance in terms of colour and pattern. Views towards the conveyor corridor overburden emplacement would be obscured by the Northern Open Cut overburden emplacement. As a result, the visual modification level would be low to moderate.

The low visual sensitivity (due to distance from the Modification) combined with a low to moderate visual modification level would result in a low level of visual impact. This would reduce to very low as landform rehabilitation measures are established (Appendix H).

Racecourse (VP2)

The Muswellbrook Racecourse is located approximately 3.2 km from the approved mine landform components (Figure 4-15) and is located on a low-lying flood plain adjacent to the Hunter River. Views to the site are depressed and existing vegetation located between the Modification area and the viewpoint screen views to the lower portion of the existing Northern Open Cut overburden emplacement and the area of the proposed open pit extension. The upper portion of the existing Northern Open Cut overburden emplacement is currently visible above the band of existing vegetation which obscures the view. The visible component of the Modification, the conveyor corridor overburden emplacement, would be located an additional 4.6 km away from the viewpoint than the closest point of the approved Northern Open Cut overburden emplacement.

The conveyor corridor emplacement area would appear as a slight eastward extension of the approved Northern Open Cut overburden emplacement and be consistent with its appearance in terms of colour and pattern. Therefore, the visual modification level would be low (Appendix H).

The low visual sensitivity (due to distance from the Modification) combined with a low visual modification level would result in a low level of visual impact. This would reduce to very low as landform rehabilitation measures are established (Appendix H).

South Muswellbrook (VP3)

The Ironbark Ridge Estate (South Muswellbrook) is located approximately 3.2 km from the approved mine landform components (Figure 4-15). Views towards the Modification area would be afforded over an intervening, and less elevated, rolling agricultural landscape of pasture grass with scattered stands of trees. The approved Northern Open Cut overburden emplacement is currently visible between breaks in the existing vegetation. The only component of the Modification visible from this location would be the conveyor corridor overburden emplacement, which would be located an additional 3 km away than the closest point of the approved Northern Open Cut overburden emplacement. The conveyor corridor overburden emplacement would appear as a southerly extension of the approved Northern Open Cut overburden emplacement and would be consistent with its appearance in terms of colour and pattern. As a result, the level of visual modification would be moderate (Appendix H).

The low visual sensitivity (due to distance from the Modification) combined with a moderate visual modification level would result in a low level of visual impact. This would reduce to very low as landform rehabilitation measures are established (Appendix H).

Denman Road (VP4)

The viewing location on Denman Road is located approximately 6.4 km from the approved mine landform components (Figure 4-15).

Due to rising intervening topography between the viewpoint and the Modification, any views of the proposed mine extension area and conveyor corridor overburden emplacement would be obscured. Therefore, the visual modification level would be very low to non-apparent for this location. The very low sensitivity (due to distance from the Modification) combined with a very low to non-apparent level of visual modification would result in a very low to negligible level of visual impact (Appendix H).

Golden Highway/Saddlers Creek (VP6)

The viewing location on the Golden Highway is located adjacent to Saddlers Creek, approximately 5.9 km from the approved mine landform components (Figure 4-15).

This viewing location has direct views to the Modification area and Mt Arthur along the Saddlers Creek valley. The currently approved emplacement would result in a partial loss of these views. Notwithstanding, the Modification would not change this impact.

The approved out-of-pit south west overburden emplacement (located between the viewpoint and the Modification) would obscure views of the proposed mine extension areas as well as of the conveyor corridor overburden emplacement.

The two additional crests (maximum height of 375 m AHD) incorporated for visual amenity on the approved Northern Open Cut overburden emplacement are of particular relevance to views from this location, as they mitigate views to the overburden emplacement which, from this location, would be viewed in profile in the distance.

The level of visual modification would therefore be very low to non-apparent for this location. The low sensitivity (due to distance from the Modification) combined with a very low to non-apparent level of visual modification would result in a very low to negligible level of visual impact (Appendix H).

In reference to the existing Consolidation Project EA commitment for this location (described in Section 4.11.1), the visible face of the Modification (Year 2026) would total 0.028 percent of the 30 degree primary view cone, which is *less than 2.5%*, as described in Appendix 1 of the Consolidation Project EA Report (Appendix H).

Sub-Regional Setting*Roxburgh Vineyard (VP5)*

The vineyard property (owned by HVEC) is located approximately 4.3 km from the approved mine landform components (Figure 4-15).

Due to rising intervening topography between the viewpoint and the Modification, any views of the proposed mine extension area would be obscured. The conveyor corridor overburden emplacement would only be marginally visible as a thin line on the horizon extending from the approved Northern Open Cut overburden emplacement to behind Mount Arthur itself and would be consistent in its appearance in terms of colour and pattern. As a result, the level of visual modification would be low (Appendix H).

The very low sensitivity (due to distance from the Modification) combined with a low visual modification level would result in a very low level of visual impact (Appendix H).

Night-Lighting

Over the life of the Modification, the effects of night-lighting would vary from the approved Mt Arthur Coal Mine. The nature of the night-lighting for the Modification would be of a similar intensity when compared to the currently approved operations. However, there is the potential for fixed and mobile lights to be visible from a wider area surrounding the Modification as a result of an increase in the extent of emplacements, primarily the conveyor corridor overburden emplacement, and the increase in the footprint of the open cut (Appendix H).

Cumulative Impacts

The assessment above has considered the existing landforms of nearby mining operations as they relate to visual sensitivity and visual impact.

The assessment of cumulative visual impacts has also considered the combined effects of the Modification with the effects of the proposed Drayton South Coal Project.

The proposed Drayton South Coal Project is located immediately south and adjacent to the Mt Arthur Coal Mining and Coal Lease boundary. The *Drayton South Coal Project Environmental Assessment* (Hansen Bailey, 2012) indicates the following potential visual impacts:

- The operational areas of the Drayton South Coal Project have been designed to remain behind existing topography in order to conceal them from views at the most sensitive locations to the south.
- A visual bund would be constructed to screen views to the operational areas. Receivers located to the south of the Drayton South Coal Project including residences within Jerrys Plains, parts of Coolmore Stud and motorists on the Golden Highway would experience views of the visual bund during construction. During this time (estimated 16 months) the visual impacts for these areas would be high, reducing to moderate and then low for the remainder of the Drayton South Coal Project.

- Since the dominant sources of light are located at the existing Drayton Mine, mobile equipment operating within the Drayton South Coal Project area would not significantly increase the overall diffuse light effect. Lighting impacts within the Drayton South Coal Project area would predominantly be caused by lights fitted to mobile equipment operating outside of active mining areas and in most cases, would be limited as a result of existing topography and vegetation.

The potential for cumulative visual impacts on sensitive viewpoints in the southern sector (including motorists on the Golden Highway) would be limited given the visual impacts assessed for viewpoints in these areas are low for both the Modification (Section 4.11.2) and proposed Drayton South Coal Project (following amelioration) (Hansen Bailey, 2012).

Based on review of the above, no significant cumulative visual impacts are anticipated to arise from the coincident development of the Modification and the proposed Drayton South Coal Project, should it be approved.

As described in Section 4.11.2, the nature of night-lighting for the Modification is expected to be of a similar intensity when compared to the existing night-lighting at the Mt Arthur Coal Mine, although there is the potential for fixed and mobile lights to be visible from a wider area. If approved, the Drayton South Coal Project would result in limited night-lighting impacts (caused by lights fitted to mobile equipment operating outside of active mining areas) that may result in limited cumulative night-lighting impacts. For example, there may be increased night-time lighting effects on motorists using the Golden Highway.

4.11.3 Mitigation Measures and Management

Potential visual impacts are currently managed through the use of progressive rehabilitation, mine planning, and night-lighting management, which would continue to be implemented for the Modification.

Progressive Rehabilitation

The rehabilitation of mine overburden emplacements would be undertaken on a progressive basis in order to improve integration of the Modification landforms with the surrounding environment and mitigate potential visual impacts. This would include progressive rehabilitation with selected grass, shrub and tree species. The final void would be generally screened from public view by the other mine landforms and surrounding visual bunding and screen planting. Further details are provided in Section 5.

Night-Lighting

Measures that would be employed to mitigate potential impacts from night-lighting would include one or more of the following, where practicable:

- restriction of night-lighting to the minimum required for operations and safety requirements;
- use of directional lighting techniques to direct light away from sensitive viewpoints; and
- use of light shields to limit the spill of lighting. Additional mitigation measures at affected residences such as vegetation screening, may be developed in consultation with individual landholders.

4.12 GEOCHEMISTRY

A Geochemistry Assessment of Overburden and Interburden was undertaken by Geo-Environmental Management (GEM) (Appendix I).

4.12.1 Existing Environment

Two major previous geochemical investigations have been conducted for the Mt Arthur Coal Mine:

- Dames and Moore (2000c) as part of the Mt Arthur North EIS (Sinclair Knight Pty Ltd, 2000); and
- confirmatory geochemical testing conducted by GEM (2013) (August, 2012) for the approved open cut mining operations at Mt Arthur Coal Mine.

These investigations indicated that the bulk of the overburden and interburden was likely to be non-acid forming (NAF) and non-saline (Appendix I). Due to the relatively inert nature of the overburden, it was recommended that no specific constraints relating to the handling and storage of the general overburden and interburden would be required for geochemically secure disposal of this material (Appendix I).

However, some sporadic occurrence of potentially acid forming (PAF) materials associated with some of the coal seams was detected. Consequently, it was recommended by Dames and Moore (2000c) that the uneconomic coal seams, partings, and roof and floor strata, estimated to comprise approximately 5 percent of the overburden and interburden, be selectively mined and buried at a depth of greater than 5 m within the overburden emplacements in order to reduce the risk of developing acid condition and acid rock drainage. This strategy was considered feasible by Dames and Moore (2000c), given that the total volume of coal-associated overburden was approximately 5 percent of the total annual overburden produced, and that coal-associated overburden is readily identifiable in the field.

Additionally, due to the occurrence of moderately sodic materials within the overburden and interburden it was recommended that any sodic materials exposed within the final surfaces of the emplacements be treated with the direct application of gypsum or lime prior topdressing (Appendix I).

Dames and Moore (2000c) also included investigation of bulk coal rejects. This study found that the coal rejects will be PAF. The proposed storage strategy involved compaction and burial of the co-disposed tailings and coarse rejects within the overburden emplacements with a minimum cover thickness of 5 m material (Dames and Moore, 2000c).

4.12.2 Potential Impacts

GEM conducted an extensive overburden and interburden sampling and geochemical analysis programme of overburden for the Modification. A total of 137 samples were collected from two drill-holes located within the proposed pit extension area by HVEC personnel for inclusion in the geochemical testing programme (Appendix I). Concurrently an additional 60 samples were collected from two drill-holes located within an area to the west of the current pit which is part of the existing/approved operations (GEM, 2013).

GEM concurred with previous studies and found that the overburden and interburden from the Modification area (Appendix I):

- is generally expected to be NAF with a low salinity risk;
- includes a relatively small quantity of the overburden and interburden occurring in close proximity to the coal seams (i.e. partings, and roof and floor rock) has a risk of being PAF or PAF/low capacity;
- includes a significant quantity of the overburden and interburden from the Modification area is likely to be moderately or highly sodic; and
- contains significantly enriched concentrations of arsenic, antimony and selenium and some of these materials may also contain slightly enriched concentrations of mercury compared to the average crustal abundance.

Although no specific testwork of tailings or coarse rejects was undertaken for the Modification, based on Dames and Moore (2000c) and the geochemical characteristics of the strata associated with the coal seams from the current investigations, GEM expects that tailings and coarse rejects associated with the Modification would be PAF (Appendix I).

4.12.3 Mitigation Measures and Management

Because of the similarity of the findings of Appendix I with previous studies, existing mitigation and management measures would remain for the Modification. In particular:

- the selective mining and burial of overburden and interburden associated with the coal seams (uneconomic coal seams, partings, and roof and floor rock) within the overburden emplacements such that the outer 5 m of the final surfaces comprises only NAF material (consistent with Dames and Moore, 2000c);
- final emplacement surfaces (top and batter slopes) would be treated with gypsum and/or constructed of material that is known to be non-sodic or to only have low sodicity (consistent with Dames and Moore, 2000c); and

- because of the predicted elemental enrichment found in some of the overburden, pH, EC, total suspended solids, total alkalinity/acidity, sulphate, arsenic, mercury, antimony, selenium, and molybdenum would be included in the suite of water quality parameters monitored in dams containing runoff from overburden areas.

Additional geochemical investigations would be conducted on overburden and interburden in the future if the mining operations expand or move into new areas not covered by the previous or current investigations.

Existing tailings and coarse rejects management measures would remain for the Modification (i.e. compaction and burial of the co-disposed tailings and coarse rejects within the overburden emplacements with a minimum cover thickness of 5 m material) (Appendix I). A detailed geochemical testing programme would be conducted on representative samples of the tailing and coarse rejects as part of future engineering investigations into coal rejects disposal in order to confirm the geochemical characteristics of these materials.

4.13 ROAD TRANSPORT ASSESSMENT

A Road Transport Assessment has been undertaken by GTA Consultants (NSW) Pty Ltd (Appendix K).

4.13.1 Existing Environment

The Mt Arthur Coal Mine is located approximately 5 km south-west of Muswellbrook and 130 km north-west of Newcastle in the Upper Hunter Valley of NSW. The site is accessed from Thomas Mitchell Drive (Figure 1-3). The site is bounded to the east by the New England Highway, to the south by the Golden Highway, to the north by Denman and Edderton Roads and to the west by Edderton Road, which also runs partly within HVEC's tenements.

HVEC employs a total of approximately 2,600 full time equivalent employees during peak production, and 240 full time equivalent employees during peak construction phases. These employees access the site from Thomas Mitchell Drive. Vehicular access to Mt Arthur Coal Mine via Edderton Road also occurs intermittently for access to equipment shutdown or construction activities (Appendix K). In addition, access is also provided to the summit of Mount Arthur for emergency services and legitimate users in accordance with Condition 47(e) of Project Approval (09_0062).

The Consolidation Project EA included an assessment of Road Transport implications (HVEC, 2009). The assessment, which included cumulative consideration of nearby mining activities, found that the Level of Service at the intersection of Thomas Mitchell Drive and Denman Road will be unacceptable in the evening peak with the additional traffic.

In accordance with condition 47(b), Schedule 3 of the Consolidation Project Approval (09_0062), HVEC is required to fund the upgrade of this intersection by the end of 2019.

In addition, similar requirements to fund an upgrade of Thomas Mitchell Drive (in accordance with the terms of a planning agreement with MSC) and the intersection of Thomas Mitchell Drive and the New England Highway were outcomes of the Consolidation Project Approval (09_0062). At the time of writing, the required upgrades to intersection of Thomas Mitchell Drive and the New England Highway were underway.

The Consolidation Project EA also included the realignment of the northern portion of Edderton Road to allow the continuation of mining operations. Two conceptual alignments were considered (Figure 2-1). Edderton Road must be realigned prior to mining operations occurring within 200 m of the road.

4.13.2 Potential Impacts

As the Modification would not change the currently approved operational or construction workforce, the key potential change to the local road network would be associated with the proposed new site access to the relocated explosives magazine and facilities to be located off Edderton Road.

Approximately 60 permanent employees would work at the explosives magazine and facility. In addition, approximately 5,000 heavy vehicle movements per year would access the facility for the delivery of materials and consumables. These movements currently take place at the existing facility, which is accessed from the Mt Arthur Coal Mine Access Road off Thomas Mitchell Drive.

GTA Consultants (NSW) Pty Ltd (Appendix K) assessed the potential impact of the Modification on the safety and efficiency of local roads (measured by the Levels of Service). Appendix K also considers cumulative road movements associated with nearby approved mining operations (Mt Pleasant Coal Mine and Mangoola Coal Mine Modification) and background traffic movement increases with time.

Appendix K concludes that, with the proposed mitigation measures from the Consolidation Project EA in place, the Levels of Service of key intersections or roadways would not change due to the Modification. In addition, no specific safety implications were identified.

4.13.3 Mitigation Measures and Management

HVEC would continue to implement the key mitigation measures identified in the Consolidation Project EA, namely fund the upgrade to:

- the intersection of Edderton Road and Denman Road;
- Thomas Mitchell Drive (in accordance with the terms of a planning agreement with MSC); and
- the intersection of Thomas Mitchell Drive and the New England Highway.

The existing Road Management Plan would be reviewed and revised to incorporate the Modification.

4.14 RAIL TRANSPORT

4.14.1 Existing Environment

All coal produced by the Mt Arthur Coal Mine is railed to the Port of Newcastle using the Antiene Rail Spur and Main Northern Railway (with the exception of coal conveyed to Macquarie Generation via conveyor). No coal is hauled on public roads except in the case of an emergency.

The Modification would not change average daily coal train movements. However, due to congestion on the Main Northern Railway and reduced cargo assembly times at the Port of Newcastle, additional train movements are required to meet loading times and reduce delays in loading at the Port of Newcastle. This would only occur when there is both sufficient capacity on the rail network and high shipping demand at the Port of Newcastle.

As part of the Modification, HVEC seeks an increase in maximum rail movements from 24 to 38 train movements. The ARTC is undertaking a series of expansion projects at strategic locations across the Hunter Valley aimed at increasing the capacity of the rail network and reducing the congestion that is currently being experienced. As these projects roll out, the peaking requirement (i.e. maximum number of trains per day) will progressively reduce meaning there will be fewer days where this peaking capacity will be required.

Antiene Railway Station Road is an unsealed road coming off Hebden Road and crosses the Antiene Rail Spur at a level crossing near where the rail spur joins the Main Northern Railway Line. The road was primarily used as an access route to Antiene Station, which was closed in 1975 (NSW Rail, 2007). It is noted that whilst most of the land surrounding Antiene Rail Station Road is owned by Macquarie Generation, the road does service a number of local residents.

Notwithstanding, in accordance with Condition 48 of Schedule 3 of Project Approval (09_0062), the following measures have been implemented by HVEC and its rail contractor QR National:

- Trains entering the spur must not stop until clear of Antiene Railway Station Road level crossing.

Trains exiting the spur will continue directly onto the main line under clear (green signals), however will stop at a signal before the Antiene Railway Station Road level crossing under stop or caution (red or amber) signals.

As part of its EMS, Mt Arthur Coal has a procedure for receiving, investigating, responding and reporting complaints received from the community. The 2011 AEMR identified zero complaints related to delays at level crossings (BHP Billiton, 2011a).

4.14.2 Potential Impacts

A key issue for efficiency at the Port of Newcastle is the need for the dump stations to receive a continuous flow of trains (ARTC, 2012). When the flow of trains at the dump station is interrupted, this creates a direct unrecoverable loss of coal chain capacity, except to the extent that maintenance downtime of the terminal infrastructure can be aligned to the rail side disruption. A critical consideration for the coal chain as a whole is therefore maximising the continuity of trains rather than simply total track capacity (ARTC, 2012).

The Modification would actually increase the continuity of train flow as HVEC would be able to supplement the flow on the network with additional train movements whenever there is a low-flow period.

According to the Hunter Valley Corridor 2012-2021 Capacity Strategy (HVCCS) (ARTC, 2012) the three main issues affecting the line between Muswellbrook and Hexham are:

- headways;
- junctions; and
- continuous flow of trains.

The increase in maximum rail movements from 24 trains per day to 38 trains per day would not exacerbate the problems with headways and junctions as the maximum rail movements would only be scheduled when there is both sufficient capacity on the rail network and high shipping demand at the Port of Newcastle.

An example of this high shipping demand is when two or three Cape Class vessels are scheduled to be loaded at Port Waratah Coal Services. This scenario requires a continuous flow of trains to load efficiently, to avoid an unrecoverable loss of (short term) capacity.

Under this type of scenario, with the proposed increase in maximum rail movements from 24 trains per day to 38 trains per day, HVEC would be able to supplement the flow on the network with additional train movements whenever there is a low-flow period.

The Modification has the potential to increase the frequency in which trains would restrict access across the level crossing at Antiene Railway Station Road on some high volumes days. However, with the continued implementation of the mitigation measures described above, additional restricted access to traffic on Antiene Railway Station Road would be minimised.

4.14.3 Mitigation Measures and Management

Given that the additional trains would only be scheduled when capacity exists on the Main Northern Railway, any potential impacts the Modification may have on line have already been considered, with ARTC accounting for increases in contracted volumes from the Mt Arthur Coal Mine in the HVCCS. This expected increase is reflected in the numerous upgrade projects being undertaken on the main line between Muswellbrook and Hexham. These upgrades are outlined in the Table 4-23.

4.15 HAZARD AND RISK

The assessment concludes:

4.15.1 Existing Environment

An assessment of potential hazards associated with the Mt Arthur Coal Mine is presented in the Consolidation Project EA (HVEC, 2009). This assessment was undertaken in accordance with SEPP 33 – Hazardous and Offensive Development Application Guidelines 1994 (DUAP, 1994), and the Hazardous Industry Planning Advisory Paper No 6 – Guidelines for Hazard Analysis 1997 (Planning NSW, 1997).

A review of the relevant components of the Project has confirmed that the Project is not considered to be Potentially Hazardous or Offensive. As such, a detailed preliminary hazardous analysis is not required. Further, as SEPP 33 applies only to proposals that are potentially hazardous or offensive, and the proposed development does not constitute a potentially hazardous or offensive industry under Clause 3, SEPP 33 does not apply to this development.

It is relevant to note that these guidelines have recently been updated and the relevant guidelines are now:

- *Hazardous and Offensive Development Application Guidelines Applying SEPP 33* (Department of Planning, 2011a).
- *Assessment Guideline Multi-level Risk Assessment* (Department of Planning, 2011b).

4.15.2 Potential Impacts

The Modification has the potential to result in additional hazards/risks due to the relocation of the explosives magazine and facility. HVEC (2009) assessed the existing facility as follows:

The assessment provided in HVEC (2009) considered a variety of potential hazards, including:

Mt Arthur Coal will continue to utilise a variety of explosive products (including initiating products, detonators, and emulsion explosives) for blasting activities to facilitate open cut coal mining. These commonly used forms of explosives have successfully been managed in accordance with existing OH&S procedures and legislative requirements.

- storage and use of hazardous materials, including chemicals;
- storage and use of explosives; and
- storage and use of flammable liquids, such as diesel.

Mt Arthur Coal currently has a fully bonded onsite explosives magazine (managed by site personnel) for the storage of detonators and other materials. An independent, licensed contractor is currently utilised to supply emulsion explosives and other initiating products to the site on an as required basis.

**Table 4-23
Muswellbrook to Hexham Rail Upgrades**

Junction/Section	Upgrade	Supporting Quotes
Drayton	Improve existing turnouts	During 2010 work was undertaken to improve the condition of the existing turnouts, which also allowed the speed for trains exiting the branch to be increased to 40 kilometres per hour. This allowed the turnout upgrades to be deferred. ARTC will continue to advance the full renewal of the junction with completion proposed by Q2 2013.
Nundah Bank	Additional Track	Provision of a third track will allow alternate trains to be directed to opposite tracks, effectively doubling the capacity. Completion is expected by Q1 2013.
Minimbah—Maitland Third Road	Additional Track	To provide a better solution, a third track between Minimbah and Maitland, connecting to the Minimbah bank third track, was proposed. Though this track is technically not required for capacity purposes, it provides the least cost method of providing incremental capacity to the network from a holistic perspective. The Project is being opened in stages with the forecast completion date for Minimbah – Branxton by Q4 2012 and Greta – Farley by Q1 2013.

Source: ARTC (2012).

The relocated explosives magazine and facility would be constructed in accordance with relevant standards and guidelines and existing site standards, and operation procedures would continue to apply. Consequently, HVEC considers that the Modification would not alter existing hazards/risks associated with the Mt Arthur Coal Mine. As such, consistent with the findings of HVEC (2009), the Modification is not considered to be Potentially Hazardous or Offensive. Therefore, a Preliminary Hazard Analysis is not required for the Modification.

4.15.3 Mitigation Measures and Management

The relocated explosives magazine and facilities would be bundled in accordance with relevant standards and guidelines. Existing site operational practices and protocols would continue to apply.

4.16 EMPLOYMENT, POPULATION AND COMMUNITY INFRASTRUCTURE

A Socio-Economic Assessment was undertaken for the Modification by Gillespie Economics and is presented as Appendix J.

As discussed in Section 1.5, HVEC is an active community participant and maintains a number of community programmes in the local area. The subsections below describe the results of HVEC's community engagement initiatives and the findings of Appendix J, where relevant.

4.16.1 Existing Environment

Mt Arthur Coal commenced the *Sustainable Communities Project* (BHP Billiton, 2011b) in October 2010 to understand the cumulative impacts of coal mining on the community, economy and environment and address these impacts through collaboration between the mining industry and other stakeholders. This report, and the Consolidation Project EA (HVEC, 2009) has been used to describe the local community in the sub-sections below.

Population Profile

Population growth in the Muswellbrook LGA was 3.3 percent between the 2001 and 2006 census periods. Muswellbrook Shire's population growth at June 2010 was 1.8 percent (MSC, 2010).

Demographic Profile

The population increase over the 2001–2006 Census periods was complemented by growth in key industrial sectors such as Education and Training, as well as Mining, which increased its employment rates by 3.2 percent from 2001–2006. This growth in the mining sector was significant given that the mining sector was the primary employer in the Muswellbrook LGA employing up to 17 percent of Muswellbrook's total workforce (HVEC, 2009).

In addition, the population of the Muswellbrook LGA recorded significantly higher income levels relative to that of the Hunter Statistical Division during the 2006 Census, with income levels increasing by a substantially greater proportion between the Census periods of 2001–2006 relative to the period of 1996–2001 (HVEC, 2009).

HVEC (2009) notes substantially high dwelling occupancy rates in the Muswellbrook LGA. This finding is generally consistent with (BHP Billiton, 2011b), which reports data showing that housing stress (where households spend more than a third of their income on housing) was more than two times higher amongst renters than home owners in the Upper Hunter region. Muswellbrook had the highest overall level of housing stress compared with Upper Hunter and Singleton shires. Rental housing stress was highest in Muswellbrook and home purchaser housing stress was highest in the Upper Hunter Shire (BHP Billiton, 2011b).

Data Review in the Sustainable Communities Project

Subsequent to the Consolidation Project EA, BHP Billiton (2011b) collected data to describe the baseline social and economic conditions in the Upper Hunter region.

These data are summarised as follows, from BHP Billiton (2011b).

Community Involvement and Community Life

The research findings confirmed that the mining industry makes a positive contribution to jobs, community infrastructure and education. However, community trust in the mining industry is low, coupled with a declining confidence by the community in its ability to influence mining outcomes.

Level of Social Disadvantage

The research findings confirmed that Muswellbrook had the highest level of reported domestic violence compared to Singleton and Upper Hunter, and which is also higher than NSW, although the rate has dropped since 2005.

There is also evidence of significant localised disadvantage.

Population Health

Muswellbrook and the Upper Hunter region have consistently poorer health outcomes than NSW, Sydney and regional NSW. While existing data indicates higher levels of respiratory illness to varying degrees of significance in the Upper Hunter region, further monitoring and investigation is required to address community concerns in relation to possible health impacts from air quality.

Housing Affordability

Australian Bureau of Statistic 2006 Census data (Figure 8) shows that housing stress – where households spend more than a third of their income on housing – was more than two times higher amongst renters than home owners in the Upper Hunter region. Muswellbrook had the highest overall level of housing stress compared with Upper Hunter and Singleton shires.

Homelessness

Fewer people in Muswellbrook and Singleton live in boarding houses and government-supported accommodation, with the majority staying with friends and relatives and living in improvised dwellings. Increasing housing costs driven by low vacancy rates and high demand from an incoming workforce makes finding appropriate housing very difficult.

The Hunter Regional Homelessness Action Plan, an initiative of the NSW and Australian governments, identifies a number of strategies and actions aimed at preventing homelessness and supporting homeless people back into long-term housing. However, this plan has only a limited focus on the Upper Hunter region.

Wealth Distribution

Compared with regional NSW, the Upper Hunter region has a higher proportion of people earning more than \$1,400 per week, and a lower proportion of people earning less than \$500 per week. There was no disproportionately high clustering of households in the lower income brackets.

Educational Attainment

As shown in Figure 11 [of the Sustainable Communities Project], a greater proportion of residents in both Singleton and Muswellbrook have attained a certificate qualification as their highest qualification. In Singleton, a greater proportion of residents have attained a diploma, bachelor, graduate diploma or postgraduate degree in comparison to other shires in the Upper Hunter region. A smaller proportion of residents in the Upper Hunter region have attained a diploma qualification or higher, with attainment recorded at lower levels than in regional NSW.

Employment Access

In 2009, employment levels in all three shires in the Upper Hunter region were well above that of regional NSW. However, the low rate of unemployment suggests that there are labour shortages in the region.

Business Growth

Between 2006 and 2010 there was a steady decline in the registration of new businesses in the Upper Hunter region, in particular small businesses, indicating a decline in the appeal of small business in the region. The trend of declining number of new business registrations is similar for the state of NSW. In particular, state wide the number of businesses with between 1 and 19 employees declined steadily between June 2006 and June 2009.

Industry Diversification

The mining industry is the predominant industry in the Upper Hunter region. The project's findings suggest that the distribution of industry in the Upper Hunter region is substantially less diverse than in the Lower Hunter region. All three shires in the Upper Hunter are substantially less diverse in industry type than their Lower Hunter counterparts.

Community Perceptions

A key component of the Sustainable Communities Project (BHP Billiton, 2011b) was data collection of community perceptions. A snapshot of key perceptions is provided in Table 4-24.

Table 4-24
Snapshot of Community Perceptions from Sustainable Communities Project

Aspect	Community Perception
Community involvement and community life	The community told us that more people living in Muswellbrook bring a range of benefits, but that some newcomers have difficulty integrating. Shiftwork impacts on many aspects of community life, for example volunteering, and there is a lack of things for young people to do. The community also reported a low level of town pride.
Population health	The community told us they are concerned about the impacts of dust on health, the long wait for a doctor's appointment, limited access to mental health services and increased drug and alcohol abuse. There was also concern about the increased stress on families associated with the 12-hour shifts typically employed by the mining industry.
Community perceptions of environmental impact	The community told us that they were particularly concerned about environmental impacts on their quality of life. Community concerns included increased dust and reduced air quality, reduced water quality and aquifers being breached by mining, loss of native vegetation, loss of good agricultural land, impact of rail movements through the centre of town, land and water salinity, water retention and visual amenity.
Housing affordability	The community told us that workers on low to middle incomes, such as teachers, local government and non-government organisation workers, are finding it difficult to afford housing. Some disadvantaged people can also no longer access housing that is secure and affordable.
Homelessness	Through the Sustainable Communities Project, local services told us about the high demand from homeless people, including being unable to provide direct services due to the demand for available beds. Much of the homelessness in the area is said to be 'hidden', meaning that homeless people are staying with others, for example 'couch surfing', until a place to stay becomes available.
Wealth distribution	The community told us that they have a concern about the perceived level of income difference reducing social cohesion, as well as the increased cost of living driven by high mining incomes.
Educational attainment	<p>The community told us that the mobility of the population in Muswellbrook contributes to transience in local primary and secondary schools, and that there is a need for early intervention programmes to enhance student retention rates. They also said that it is difficult to attract teaching staff to the area, in part because of housing costs.</p> <p>There is also a need for more work experience programmes, sponsorship of technical and further education (TAFE) scholarships for local residents and increased opportunities for mining-based traineeships to increase local community access to jobs. There are also concerns about limited opportunities for education for young people who have limited access to transport.</p>
Employment access	The community told us that the mining industry brought benefits to the local community by generating jobs for local people. However, local businesses are unable to compete with mining wages and face difficulties attracting staff.
Business growth	The community told us that many small business people have found it more beneficial to work for the mines than continue working in their own business.
Industry diversification	The community told us that uncertainty about the future location of mining activities is holding back investment in agricultural industries. Tourism has also declined because short-term accommodation, such as hotels, motels and caravan parks, is largely occupied by mining industry workers.

Source: BHP Billiton (2011b).

Potential Impacts Associated with the Consolidation Project

The potential impacts reported in HVEC (2009) included:

- *potential strains on health services in the Muswellbrook LGA;*
- *potential constraints on existing and long term residential land availability, unless effective planning processes are in place to assist the MSC in progressively phasing in new residential land applications in accordance with the influx of new production personnel for the Project;*
- *the variety of different primary schools in Muswellbrook, including large capacity intakes and flexibility for some of these schools suggests that there is likely to be sufficient capacity in existing primary education services to accommodate the minimum influx case addition of 71 primary school-aged children;*
- *current capacity of the Muswellbrook High School (840/Flexible) and the St Joseph's High School (650/Flexible) suggests sufficient capacity to accommodate a minimum influx of an additional 47 secondary school aged students into the Muswellbrook LGA; and*
- *potential strains on existing childcare services across the Muswellbrook LGA, given that most current childcare services are already running at, or close to, capacity and are therefore unlikely to be able to accommodate an additional 48 young children (0–4 years) in the Shire.*

4.16.2 Potential Impacts

The main construction phase of the Modification would occur in 2015 with the relocation of the Macquarie Generation Conveyor load point and the explosive magazine as well as the duplication of the existing rail loop. It is anticipated that during this development phase of the Modification, a workforce of up to 240 people would be required in the short-term (12 months). This is consistent with the construction workforce described in HVEC (2009).

It is envisaged that most of the required short-term construction workforce would be contractor labour from existing contractor firms located within the region (Appendix J). Any construction workforce unable to be sourced locally would most likely be able to be sourced from Newcastle and commute to the region daily. Consequently, little, if any, population change as a result of the construction workforce is envisaged (Appendix J).

Therefore no community infrastructure impacts would occur as a result of the construction component of the Modification (Appendix J).

The Modification would therefore result in continued employment of the existing workforce at the Mt Arthur Coal Mine, up to 2,600 full-time equivalent jobs for a period of four years. Consequently, no population changes are envisaged as a result of the operation workforce. Therefore increase in community infrastructure impacts would occur as a result of the operation phase of the Modification (Appendix J), rather, these impacts would continue for a further 4 years to 2026.

4.16.3 Mitigation Measures and Management

HVEC would continue to develop and run programmes that help in the recruitment of local labour and would work in partnership with Councils and the local community so that the benefits of the economic activity in the region are maximised and impacts minimised, as far as possible. In this respect, a range of impact mitigation and management measures are proposed including:

- continuation of the Community Development Fund to help benefit a wide range of community needs such as education and training, community capacity building, environment, health, infrastructure projects, arts, sports and recreation;
- employment of local residents preferentially where they have the required skills and experience and demonstrate a cultural fit with the organisation; and
- purchase of local non-labour inputs to production preferentially where local producers can be cost and quality competitive.

HVEC has worked to respond to community feedback received on the priorities identified by preparing a Community Development Management Plan aimed at guiding its investment program over the next five years (BHP Billiton, 2011b).

Through this program HVEC would work alongside the community to help strengthen overall capacity to respond to local issues.

4.17 REGIONAL ECONOMY

A Socio-Economic Assessment was undertaken for the Modification by Gillespie Economics and is presented as Appendix J.

4.17.1 Existing Environment

The regional economic assessment was based on 2005-2006 input-output analysis for the Muswellbrook, Upper Hunter Shire and Singleton LGAs referred to as the regional economy.

Gross regional product (value-added) for the regional economy is estimated at \$4,229 million (M), comprising \$1,694M to households as wages and salaries (including payments to self employed persons and employers) and \$2,535M in other value added contributions (Appendix J).

From analysis of the gross regional output, value-added, income, employment, imports and exports; it is evident that coal mining is the most significant sector of the regional economy (Appendix J). The next most significant sectors for output and value-added are the utilities sector and business services sector. For income and employment the next most significant sectors are business services and retail trade. The food manufacturing sectors and utilities sectors are the next most important sectors in the region for imports and exports.

4.17.2 Potential Impacts

The Modification is estimated to make up to the following total annual contribution to the regional economy for four years (Appendix J):

- \$2,691M in annual direct and indirect regional output or business turnover;
- \$1,654M in annual direct and indirect regional value added;
- \$326M in annual direct and indirect household income; and
- 2,715 direct and indirect jobs.

Appendix J indicates that direct, production-induced and consumption-induced employment impacts of the Modification on the regional economy are likely to have different distributions across sectors. Production-induced flow-on employment would occur mainly in services sectors, mining, manufacturing, wholesale/retail and services sectors while consumption-induced flow-on employment would be mainly in wholesale/retail, accommodation/cafes/ restaurants and services sectors.

Businesses that can provide the inputs to the production process required by the Modification and/or the products and services required by employees would directly benefit from the Modification by way of an increased economic activity. However, because of the inter-linkages between sectors, many indirect businesses also benefit.

Closure of the Mt Arthur Coal Mine

The Modification approval would extend the life of the Mt Arthur Coal Mine open cut by four years and extend the period of time that the Mt Arthur Coal Mine provides economic activity in the regional and NSW economy. Ultimately, cessation of the mining operations would result in a contraction in regional economic activity (Appendix J).

The magnitude of the regional economic impacts of cessation of the Modification would depend on a number of interrelated factors at the time, including (Appendix J):

- the movements of workers and their families;
- alternative development opportunities; and
- economic structure and trends in the regional economy at the time.

The region is a prospective location with a range of coal resources. New mining resource developments in the region would help broaden the region's economic base and buffer against impacts of the cessation of individual projects.

Ultimately, the significance of the economic impacts of cessation of the Modification would depend on the economic structure and trends in the regional economy at the time (Appendix J). For example, if Modification cessation takes place in a declining economy, the impacts might be more significant. Alternatively, if Modification cessation takes place in a growing diversified economy where there are other development opportunities, the ultimate cessation of the Modification may be less significant (Appendix J).