Tarrawonga Coal Project

Environmental Assessment

SECTION 2 PROJECT DESCRIPTION

Resource Strategies

Tarrawonga Coal Pty Ltd

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2 PROJECT DESCRIPTION

Mining operations at the Tarrawonga Coal Mine are currently conducted in accordance with Development Consent (DA-88-4-2005) as modified by the then NSW Minister for Planning on 15 October 2010. This section presents a description of the existing operations, the history of statutory approvals within which the current mine operates and a description of the Project.

2.1 EXISTING TARRAWONGA COAL MINE OPERATIONS

The Tarrawonga Coal Mine commenced operations in 2006 and currently produces up to approximately 2 Mtpa ROM coal.

The approximate extent of the existing and approved surface development (including open cut, mine waste rock emplacement, soil stockpiles and infrastructure areas) at the Tarrawonga Coal Mine is shown on Figure 2-1.

Open cut mining and material handling at the Tarrawonga Coal Mine is currently undertaken during the following approved hours of operation:

- Monday to Friday, 7.00 am to 3.30 am the following morning (i.e. 20.5 hours per 24 hour period).
- Saturday 7.00 am to 6.00 pm.

Maintenance activities are undertaken at any time.

A summary of the existing operations undertaken at the Tarrawonga Coal Mine is provided below.

2.1.1 Mining Operations

Open Cut Mining Sequence

Conventional open cut mining methods are used at the Tarrawonga Coal Mine. The general sequence of open cut mining is as follows:

1. Vegetation clearance and removal.
2. Topsoil and subsoil stripping by scraper. Stripped topsoil and subsoil is used directly in progressive rehabilitation or is placed in stockpiles for later re-use.
3. Removal of weathered or friable overburden by scraper.
4. Drilling and blasting of competent overburden (and interburden).
5. Overburden (and interburden) removal by excavator and haul truck, with supporting dozers. Overburden and interburden placed in out-of-pit mine waste rock emplacements, or as infill in the mine void, behind the advancing open cut mining operations.
6. Mining of exposed coal seams by excavator and loading into haul trucks for transport to the ROM pad and ROM coal stockpile.
7. Progressive landform profiling and rehabilitation of mine waste rock emplacements.

Mine Fleet and Supporting Equipment/Plant

The existing/approved mine fleet at the Tarrawonga Coal Mine includes:

- four excavators;
- fourteen haul trucks;
- five dozers;
- four loaders;
- four scrapers;
- two graders;
- two drills;
- two water carts; and
- one water truck.

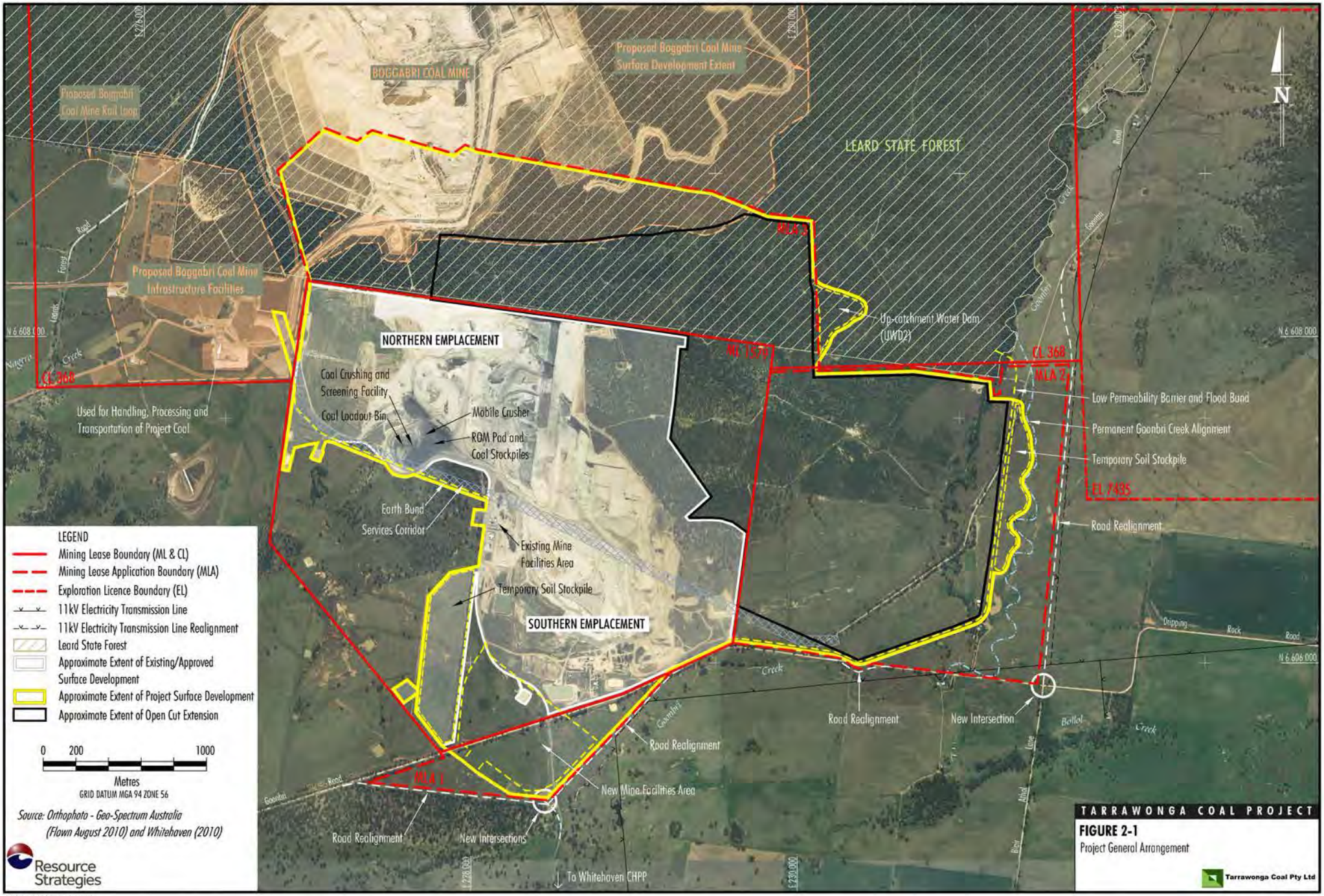
Other mining equipment and plant also used in support of the mine fleet at the Tarrawonga Coal Mine includes a mobile crusher, diesel powered generators, service trucks and lighting plant.

Coal Mining and Handling

ROM coal is loaded by excavator into haul trucks and transported to the ROM pad and ROM coal stockpile area. The capacity of the ROM coal stockpile is approximately 150,000 t.

ROM coal is delivered to the ROM pad and then transferred into a 40 t loading hopper and conveyed to the on-site coal crushing and screening facility (Figure 2-1).

The coal crushing and screening facility contains a primary and secondary crusher which produces nominal 150 and 50 millimetre (mm) sized ROM coal, respectively. Sized ROM coal is conveyed to the coal load-out bin for loading into on-highway haul trucks (Section 2.1.2).



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2.1.2 Off-site Sized ROM Coal Transport

Sized ROM coal is transported between the Tarrawonga Coal Mine and the Whitehaven CHPP by a haulage contractor using a fleet of on-highway haulage trucks (e.g. B-Doubles).

Sized ROM coal dispatch by road from the Tarrawonga Coal Mine to the Whitehaven CHPP is currently undertaken between the hours of:

- 7.00 am to 9.15 pm Monday to Friday; and
- 7.00 am to 5.15 pm Saturday.

Trucks dispatched from the Tarrawonga Coal Mine at 9.15 pm (Monday to Friday) and 5.15 pm (Saturday) arrive at the Whitehaven CHPP at approximately 10.00 pm and 6.00 pm, respectively.

The route used to transport sized ROM coal to the Whitehaven CHPP is shown on Figure 1-1. The haulage route includes sections of both private and public roads.

2.1.3 Coal Processing and Product Rail Loading at the Whitehaven CHPP

At the Whitehaven CHPP sized ROM coal received from the Tarrawonga Coal Mine is stockpiled in either ROM coal stockpiles for processing in the Coal Preparation Plant (CPP), or in product stockpiles for bypass loading at the rail loadout facility.

Tarrawonga Coal Mine product coal is loaded onto trains at the Whitehaven CHPP for dispatch to customers via the Werris Creek Mungindi Railway and comprises low ash, thermal and/or semi-soft coking products.

Further detail on the Whitehaven CHPP is provided in Attachment 3.

2.1.4 On-site Production of Domestic Coal

The Tarrawonga Coal Mine also uses an on-site mobile crusher for crushing and screening of up to 450,000 t of domestic specification (15 to 35 mm size) coal per annum. The mobile crusher operates during daytime hours only (i.e. 7.00 am to 6.00 pm).

The domestic specification coal produced at the mobile crusher is collected at the mine site by customers with the same dispatch hours as sized ROM coal (Section 2.1.2).

2.1.5 Mine Waste Rock and Coarse Reject Management

Mine Waste Rock

Mine waste rock (including overburden and interburden) generated from the open cut is either placed as infill in the mine void behind the advancing mining operations (i.e. in-pit emplacement), or placed in one of two adjoining out-of-pit mine waste rock emplacements (i.e. Northern Emplacement or Southern Emplacement).

The currently approved maximum height of the Northern and Southern Emplacements are 370 and 340 m AHD, respectively.

The approximate extent of existing and/or approved surface development which incorporates the Northern and Southern Emplacements and open cut areas is shown on Figure 2-1.

Coal Rejects

Coal that is washed at the Whitehaven CHPP is sourced from the Tarrawonga, Rocglen and Sunnyside Coal Mines. As coal is blended and processed to meet customer specifications, coal rejects produced at the CHPP can include reject material derived from coal from one or more of these mines.

The coarse rejects typically range in size from 1.4 to 50 mm, and generally constitute between 4 and 12% of the coal processed. Coarse reject is returned to the mines (i.e. backloaded in coal haulage contractor's trucks) for emplacement in approved areas of the in-pit void and covered via in-pit emplacement of overburden. Up to 2,000 t per day of coarse rejects are transported from the Whitehaven CHPP to the Tarrawonga Coal Mine for emplacement (Whitehaven, 2011a).

The coarse reject emplacement area is operated in accordance with an approval issued by DRE pursuant to Section 100 of the NSW *Coal Mine Health and Safety Act, 2002*, and the management measures described in the *Tarrawonga Coal Mine Waste Management Plan* (Whitehaven, 2011a). This includes placement of coarse reject in layers up to 15 m thick, with each layer covered with a minimum of 2 m of inert material.

Fine reject material generated at the Whitehaven CHPP generally has a particle size of less than 1.4 mm in diameter, and constitutes in the order of 6 to 10% of the coal processed. Fine rejects are pumped to a series of ponds, where they are dewatered before being transported to the former Gunnedah Colliery (approximately 6 km to the south-west of the CHPP) for emplacement.

No fine coal rejects are emplaced at the Tarrawonga Coal Mine.

2.1.6 Water Management Infrastructure

Existing and/or approved water management infrastructure at the Tarrawonga Coal Mine includes the following:

- mine water dams;
- sediment basins;
- storage dams;
- on-site drains, diversions and sumps;
- open cut dewatering and transfer pumps and pipelines; and
- a groundwater production bore located on the Thuin property.

The Tarrawonga Coal Mine currently has five NSW Office of Environment and Heritage (OEH) licensed discharge points under Environment Protection Licence (EPL) 12365 for release of excess water.

Further description of the existing water management system at the Tarrawonga Coal Mine is provided in Section 2.10.1 and Appendix B.

2.1.7 Other Infrastructure and Service Facilities

Existing infrastructure and service facilities at the Tarrawonga Coal Mine include the following:

- mine administration offices;
- toilets and shower facilities;
- crib hut;
- hardstand and laydown area;
- bunded fuel bay;
- on-site diesel power generators;
- first aid building;
- maintenance workshop;
- wash bay;
- light vehicle parking facilities;
- communication, power and water reticulation infrastructure; and
- access roads.

The electricity supply at the Tarrawonga Coal Mine is provided by on-site diesel-powered generators.

The majority of the existing infrastructure and service facilities are contained within the existing mine facilities area shown on Figure 2-1.

2.1.8 Environmental Monitoring and Management

The Tarrawonga Coal Mine environmental management system includes various environmental management strategies, plans and programmes that have been developed and implemented since operations commenced in 2006.

In October 2010 the name and content requirement of several of the strategies, plans and programmes was adjusted in the Development Consent conditions following the approval of a modification under section 75W of the EP&A Act (Section 2.2). TCPL is currently in the process of reviewing, revising, or seeking approval for the latest revisions of these strategies, plans and programmes as required by Development Consent DA-88-4-2005.

The list of strategies, plans and programmes is provided below.

- Rehabilitation Strategy.
- Rehabilitation Management Plan.
- Bushfire Management Plan.
- Water Management Plan (incorporates the Site Water Balance, Erosion and Sediment Control Plan, Surface Water Monitoring Program, Groundwater Monitoring Program, and a Surface Water and Groundwater Response Plan).
- Air Quality and Greenhouse Gas Management Plan.
- Noise Management Plan.
- Blast Management Plan.
- Aboriginal Heritage Management Plan.
- Biodiversity Offset Strategy.
- Biodiversity Management Plan.
- Waste Management Plan.
- Environmental Management Strategy.

TCPL will continue to implement the existing strategies, plans and programmes at the Tarrawonga Coal Mine, and where necessary would review and revise them (in consultation with the relevant regulatory authorities) for the Project.

Further discussion of the existing content and/or revision of these strategies, plans and programmes for the Project is provided under the relevant environmental aspect headings in Section 4 and elsewhere in this EA.

The Tarrawonga Coal Mine has an extensive environmental monitoring regime. A summary of the existing monitoring and management regime is provided in Table 2-1, and the locations of relevant monitoring sites are shown on Figure 2-2.

2.2 TARRAWONGA COAL MINE APPROVALS HISTORY

The original approval for the Tarrawonga Coal Mine (formerly called the East Boggabri Coal Mine) was granted by the NSW Minister for Planning in November 2005 under Part 4 of the EP&A Act (i.e. Development Consent DA-88-4-2005).

The potential environmental impacts associated with the original approved development of the Tarrawonga Coal Mine were assessed in the *East Boggabri Joint Venture Environmental Impact Statement* (R.W. Corkery and Co Pty Ltd [R.W. Corkery], 2005).

Development Consent DA-88-4-2005 allows for the construction and operation of an open cut coal mine, in-pit and out-of-pit mine waste rock placement, ROM coal crushing and screening on-site, and transportation of the sized ROM coal via road to the Whitehaven CHPP.

In 2010, TCPL sought approval under section 75W of the EP&A Act for a modification to Development Consent DA-88-4-2005. The modification included an extension of the open cut to the east, an increase in life-of-mine coal production by some 4 Mt and increases in mine waste rock production as well as associated alterations to the waste rock emplacements. The modification also included the provision of a mobile crusher for domestic coal production and various changes to site water management, soil stockpiles and supporting infrastructure.

The potential environmental impacts associated with the changes described above were assessed in the *Tarrawonga Coal Mine Modification Environmental Assessment* (Whitehaven Coal Limited, 2010). Approval for the modification was granted on 15 October 2010 by the NSW Minister for Planning.

Key approvals and documentation pertaining to the existing Tarrawonga Coal Mine are described in Section 6.1.

2.3 COAL RESOURCE, GEOLOGICAL FEATURES AND EXPLORATION ACTIVITIES

The Tarrawonga Coal Mine is located in the Gunnedah Basin, in the NSW Gunnedah Coalfield, which contains sedimentary rocks, including coal measures, of Permian and Triassic age.

Regionally, there are two coal-bearing sequences in the Gunnedah Basin, namely:

- Early Permian Bellata Group (comprising the Maules Creek sub-basin and Mullaley sub-basin, separated by the Boggabri Ridge); and
- Late Permian Black Jack Group.

The Project coal resource is located within the Maules Creek sub-basin of the Early Permian Bellata Group. The target coal seams are contained within the Maules Creek Formation.

Figure 2-3 presents the indicative stratigraphy of the Project area including the target coal seams within the open cut extent, as follows (Minarco-MineConsult, 2011):

- Braymont;
- Bollol Creek;
- Jeralong;
- Jeralong Lower;
- Merriown;
- Merriown Lower;
- Velyama; and
- Nagero.

Individual coal seams range up to approximately 4.5 m thick, and average 1.5 m. The coal reserve for the Project, based on the planned maximum production rate, is approximately 50.5 Mt of ROM coal[1].

Below the Maules Creek Formation are the Goonbri and Leard Formations, which are basal units of the Gunnedah Basin sedimentary sequence and unconformably overlie the Boggabri Volcanics.

Further description of the local geology and geological features in the vicinity of the Project is provided in Appendix A (Groundwater Assessment).

[1] The total Project ROM coal reserve excludes the estimated coal reserve to be mined prior to 1 January 2013 associated with the continuation of existing/approved operations at the Tarrawonga Coal Mine in accordance with the Development Consent (DA 88-4-2005).

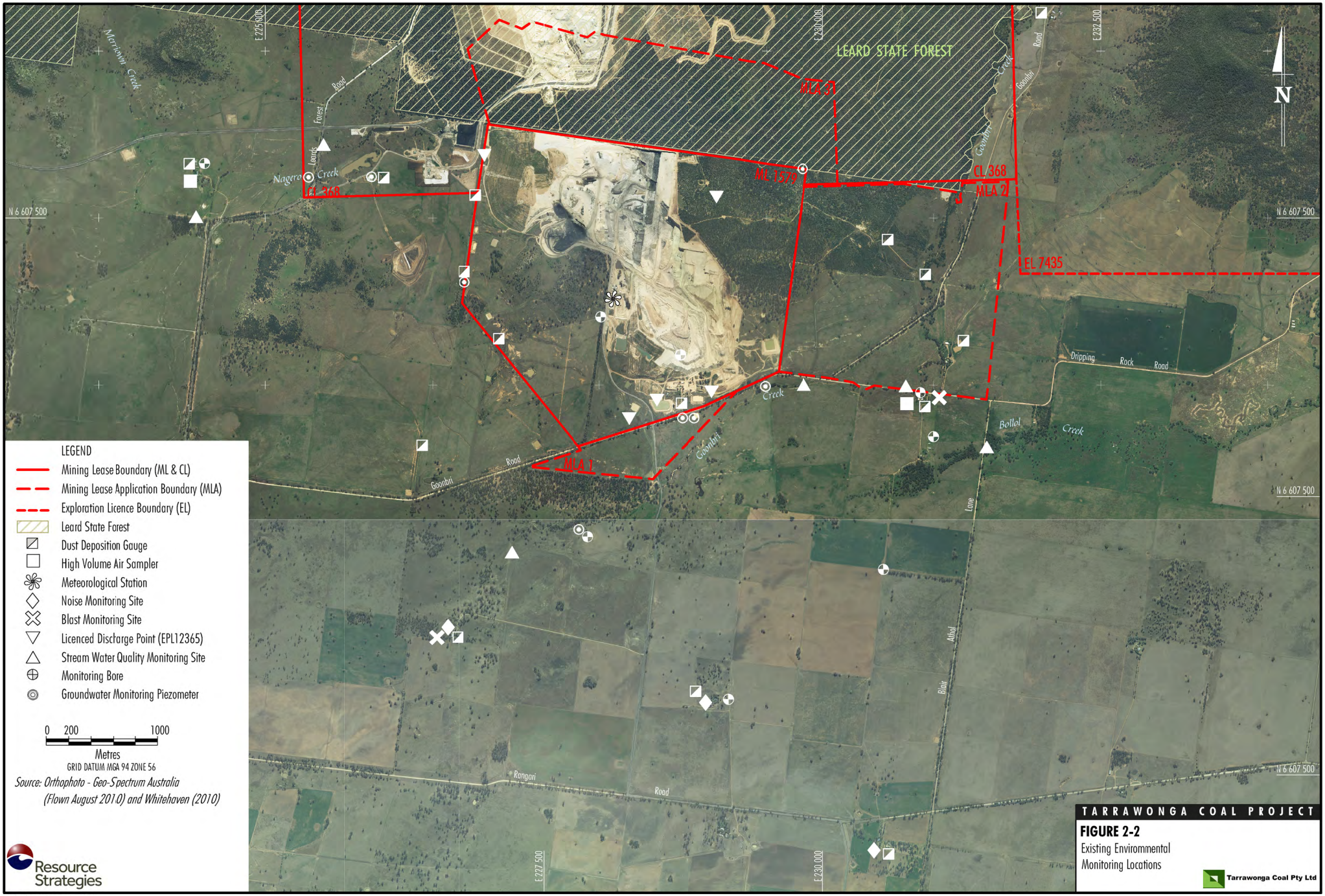
Table 2-1
Summary of the Tarrawonga Coal Mine Environmental Management and Monitoring Regime

Environmental Aspect	Environmental Management Documentation[1]	Environmental Monitoring
Land Resources	• Rehabilitation Strategy • Rehabilitation Management Plan • Bushfire Management Plan	• *Meteorology* – Meteorological Station adjacent to mine administration facilities building. • *Weeds* – all TCPL owned land.
Surface Water	• Water Management Plan[2]	• *Surface water quality* - SD17 (LDP1), SD9 (LDP2), SB14 (LDP3), SD20 (LDP4), SD16 (LDP24), BC-U, BC-D, NC-U, NC-D, GCR1 and GCR2. • *Structural integrity of dams* – all sediment dams, basins and mine water dams.
Groundwater	• Water Management Plan[2]	• *Groundwater quality* - MW1-MW8, GW044997, GW031856, GW052266, and GW020432. • *Groundwater levels* - MW1-MW8, GW044997, GW031856, GW052266, GW020432, Templemore A and Templemore B. • *Groundwater extraction* – sumps within the open cut and at the Thuin production bore.
Air Quality	• Air Quality and Greenhouse Gas Management Plan	• *Dust deposition* - D2, D3, D4, D7, D15, EB-4, EB-5, EB-6, EB-7, EB-8, EB-9, EB-10, EB-11, EB-14 and EB-15. • *PM_{10}* - Tarrawonga HVAS (EB-4) and Merriown HVAS (D7). • *Real-time PM_{10}* – monitoring and recording at neighbouring residences and other locations as required.
Noise and Blasting	• Noise Management Plan • Blast Management Plan	• *Attended mine operations noise* – Tarrawonga, Bollol Creek Station and Ambardo residences. • *Attended road noise* – Ambardo, Pine Grove and Brooklyn[3] residences. • *Blasting* - Tarrawonga and Templemore (Whitehaven-owned) residences. • *Real-time* – monitoring and recording at neighbouring private residences and other locations as required.
Aboriginal Cultural Heritage	• Aboriginal Heritage Management Plan	• Monitoring and recording undertaken as required.
Flora and Fauna	• Biodiversity Offset Strategy • Biodiversity Management Plan • Rehabilitation Strategy • Rehabilitation Management Plan	• *Rehabilitation Monitoring* – rehabilitation areas.
Waste	• Waste Management Plan	• Weekly inspections undertaken across the mine site.

[1] As required by the conditions of the Development Consent (DA-88-4-2005), as modified by the NSW Minister for Planning in October 2010.

[2] Incorporating the Site Water Balance; Erosion and Sediment Control Plan; Surface Water Monitoring Program; Groundwater Monitoring Program; and Surface Water and Groundwater Response Plan.

[3] The Brooklyn residence is not shown on Figure 2-2. It is located approximately 4 km north of the Whitehaven CHPP.



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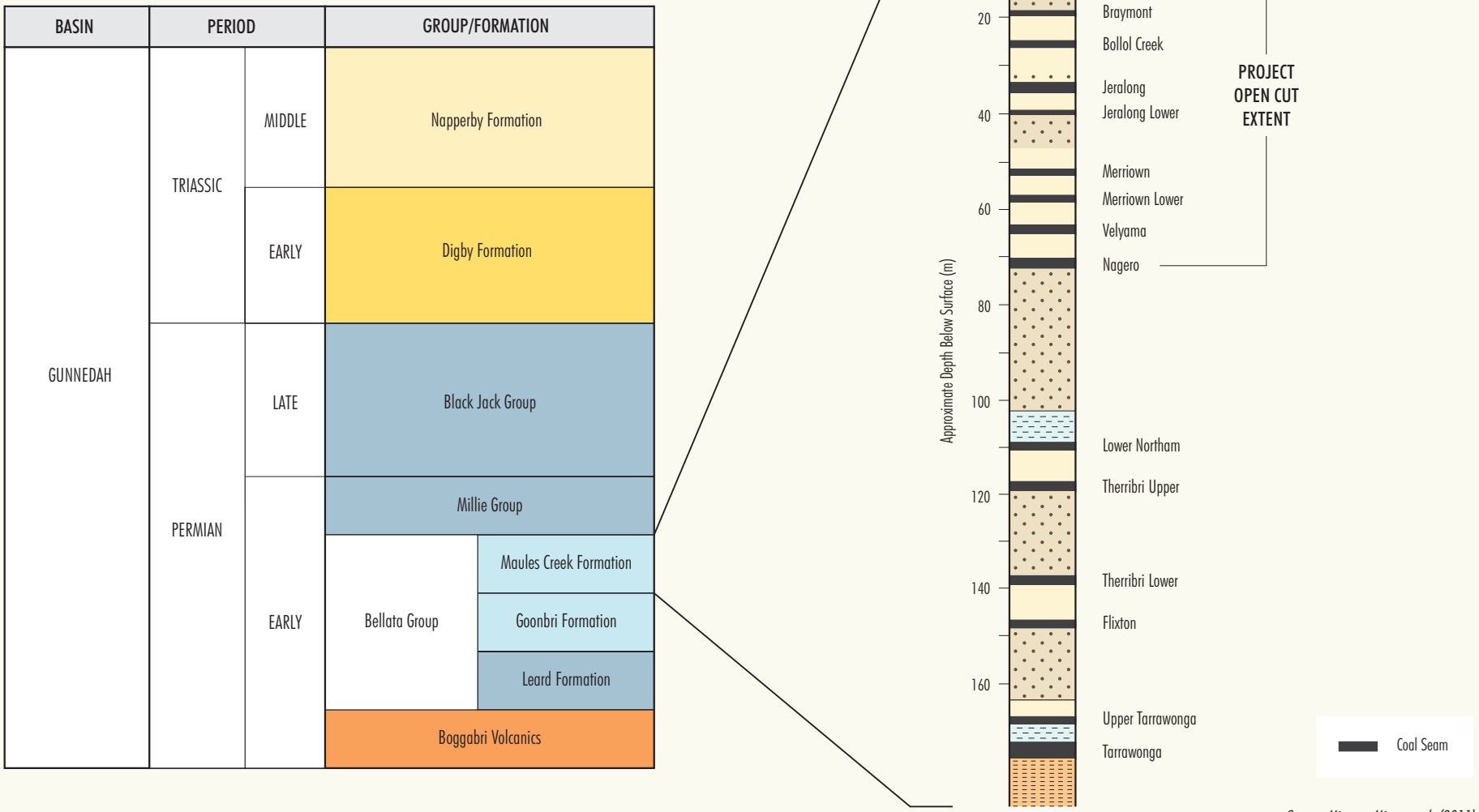

Source: Minarco-Mineconsult (2011) and NSW Industry and Investment (2011)

TARRAWONGA COAL PROJECT

FIGURE 2-3

Indicative Stratigraphy of the Project Area

Resource Strategies

Tarrawonga Coal Pty Ltd

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During the life of the Project, mine exploration activities would continue to be undertaken in the Project Application area. These activities would occur within, and external to, the open cut footprint and would be used to investigate aspects such as geological features, seam structure and coal/overburden characteristics as input to detailed mine planning and feasibility studies.

2.4 PROJECT GENERAL ARRANGEMENT

The general arrangement of the Project uses the existing infrastructure and service facilities at the Tarrawonga Coal Mine and integrates with the neighbouring Boggabri Coal Mine.

The main activities associated with the development of the Project would include (Figure 2-1):

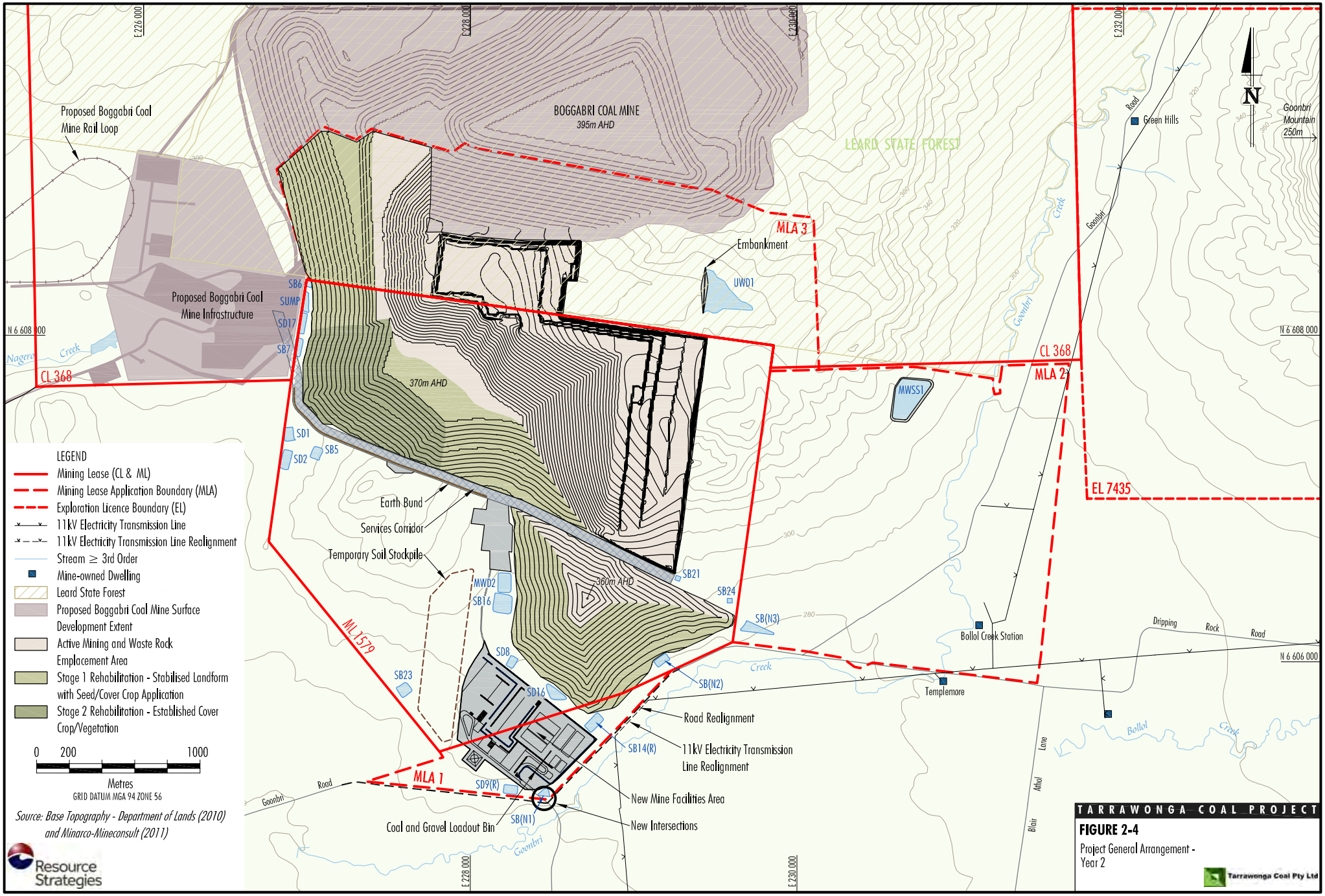
- continued development of mining operations in the Maules Creek Formation to facilitate a Project ROM coal production rate of up to 3 Mtpa, including open cut extensions:
  - to the east within ML 1579 and MLA 2; and
  - to the north within CL 368 (MLA 3) which adjoins ML 1579;
- ongoing exploration activities;
- construction and use of a services corridor (including haul road link) directly from the Project open cut mining operation to the upgraded Boggabri Coal Mine Infrastructure Facilities[2];
- use of upgraded Boggabri Coal Mine Infrastructure Facilities for the handling and processing of Project coal and the loading of Project product coal to trains for transport on the Boggabri Coal Mine private rail spur to the Werris Creek Mungindi Railway[2];
- construction and use of a new mine facilities area including relocation of existing mine facilities infrastructure and service facilities;
- use of an existing on-site mobile crusher for coal crushing and screening of up to 150,000 t of domestic specification coal per annum for direct collection by customers at the mine site;
- use an existing on-site mobile crusher to produce up to approximately 90,000 m^3 of gravel materials per annum for direct collection by customers at the mine site;
- progressive backfilling of the mine void behind the advancing open cut mining operation with waste rock and minor quantities of coarse reject material;
- continued and expanded placement of waste rock in the Northern Emplacement (including integration with the Boggabri Coal Mine emplacement) and Southern Emplacement, as mining develops;
- progressive development of new haul roads and internal roads, as mining develops;
- realignment of sections of Goonbri Road and construction of new intersections;
- construction of an engineered low permeability barrier to the east and south-east of the open cut to reduce the potential for local drainage of alluvial groundwater into the open cut;
- removal of a section of Goonbri Creek within the Project open cut and the establishment of a permanent Goonbri Creek alignment and associated flood bund to the east and south-east of the open cut;
- progressive development of sediment basins and storage dams, pumps, pipelines and other water management equipment and structures;
- continued development of soil stockpiles, laydown areas and gravel/borrow areas;
- ongoing monitoring and rehabilitation; and
- other associated minor infrastructure, plant, equipment and activities.

The proposed life of the Project is 17 years, commencing 1 January 2013.

In Project Year 1 only, or until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (Section 2.5.1), the Project would make continued use of the existing on-site ROM coal handling areas, coal crushing, screening and loadout facilities. Road transport of sized ROM coal to the Whitehaven CHPP would also continue in this initial period (with no increase in the currently approved maximum off-site coal trucking rate).

Project general arrangements for Year 2, Year 4, Year 6, Year 12 and Year 16 are shown on Figures 2-4 to 2-8. These general arrangements are based on planned maximum production and mine progression. The mining layout and sequence shown on Figures 2-4 to 2-8 may vary to take account of localised geological features, coal market volume and quality requirements, mining economics and Project detailed engineering design.

[2] Subject to approvals and upgrades being in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (Section 2.5.1).



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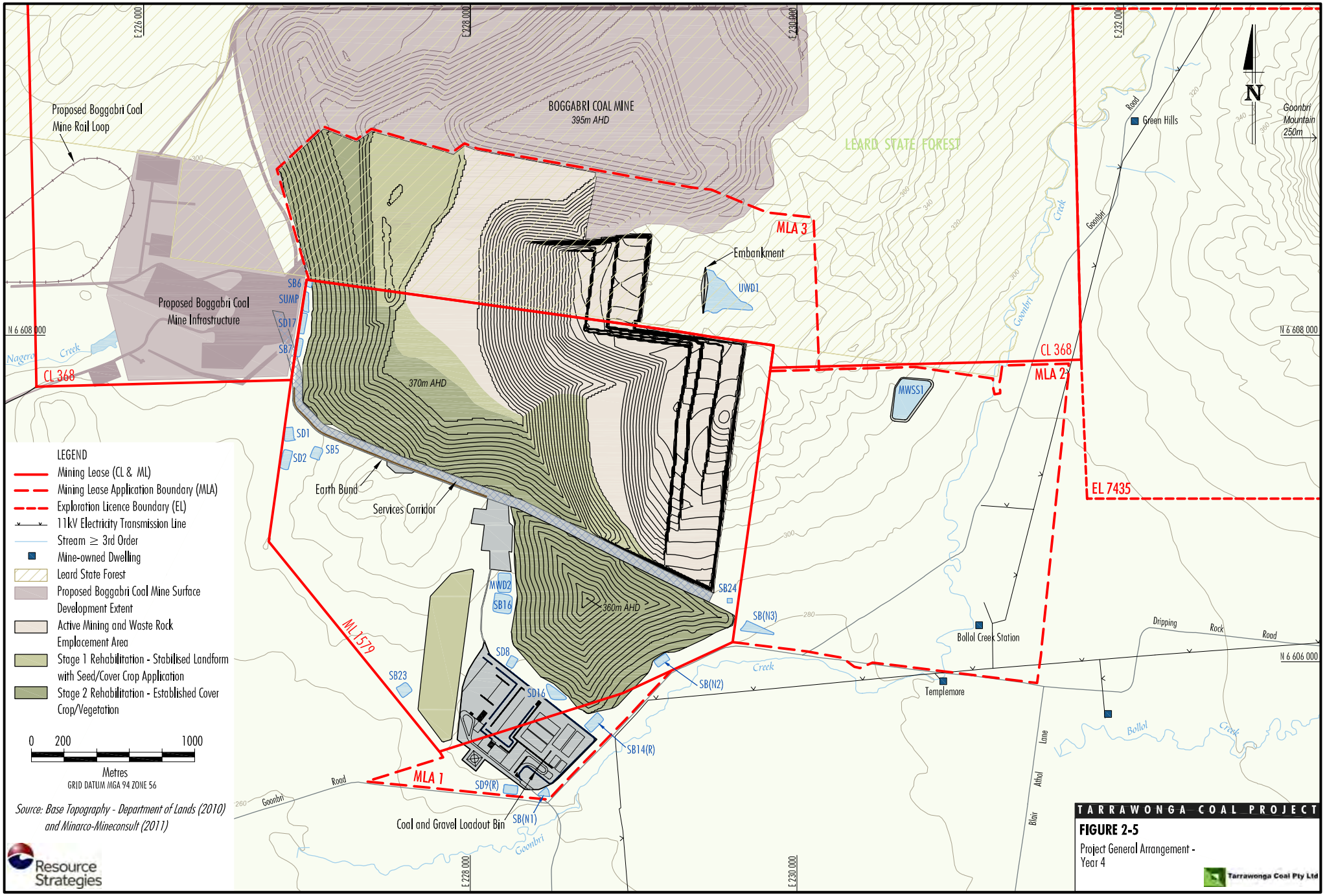

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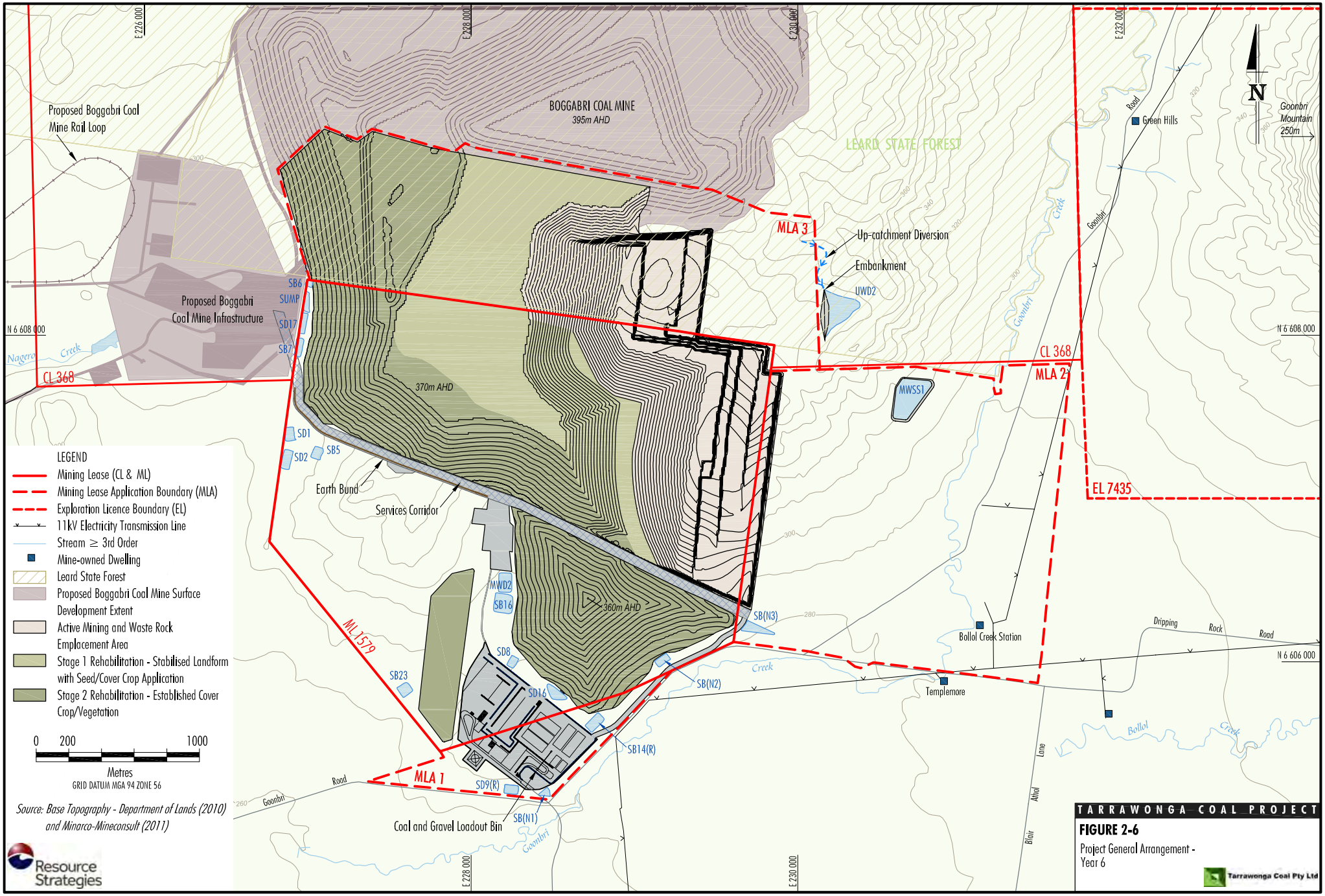

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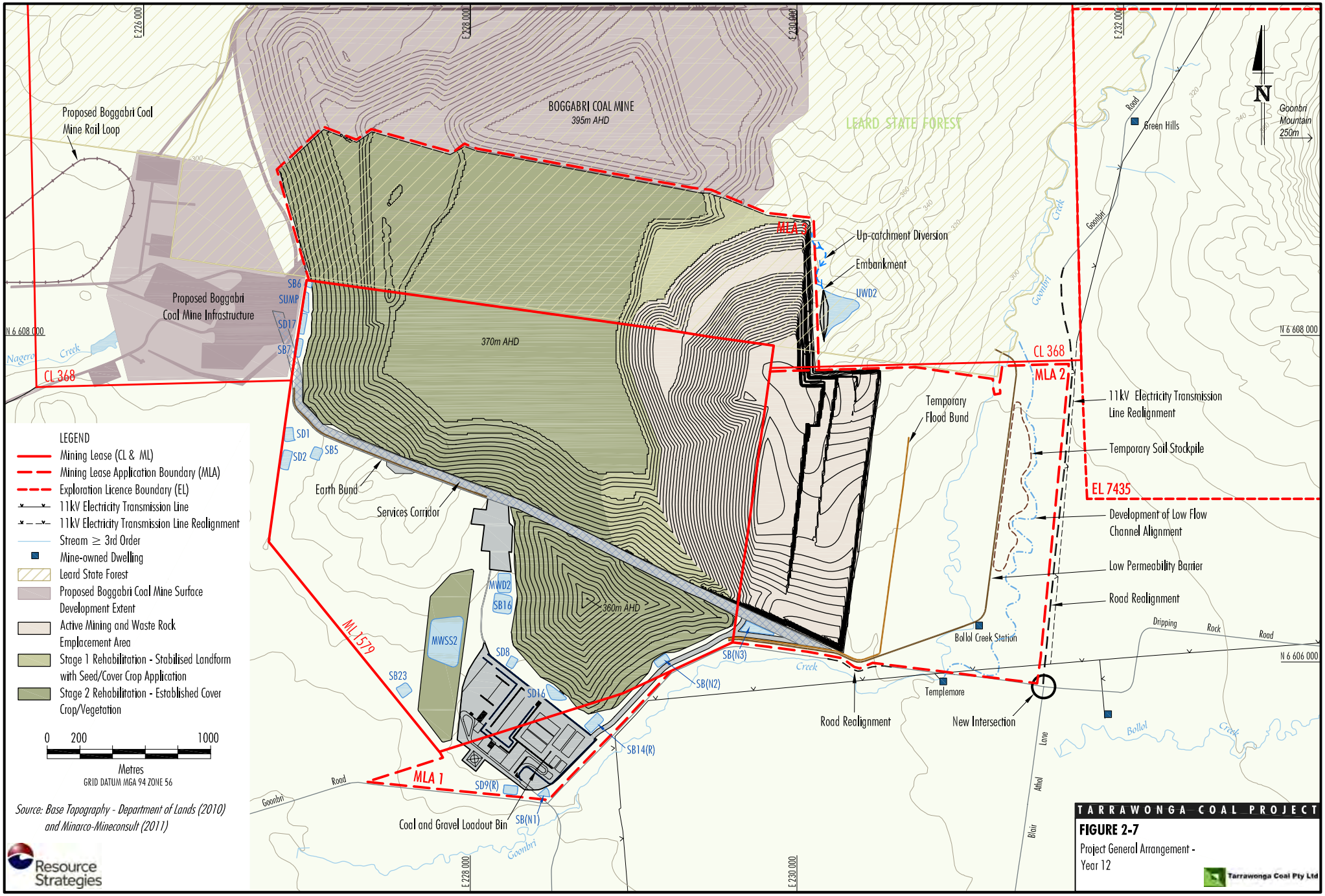

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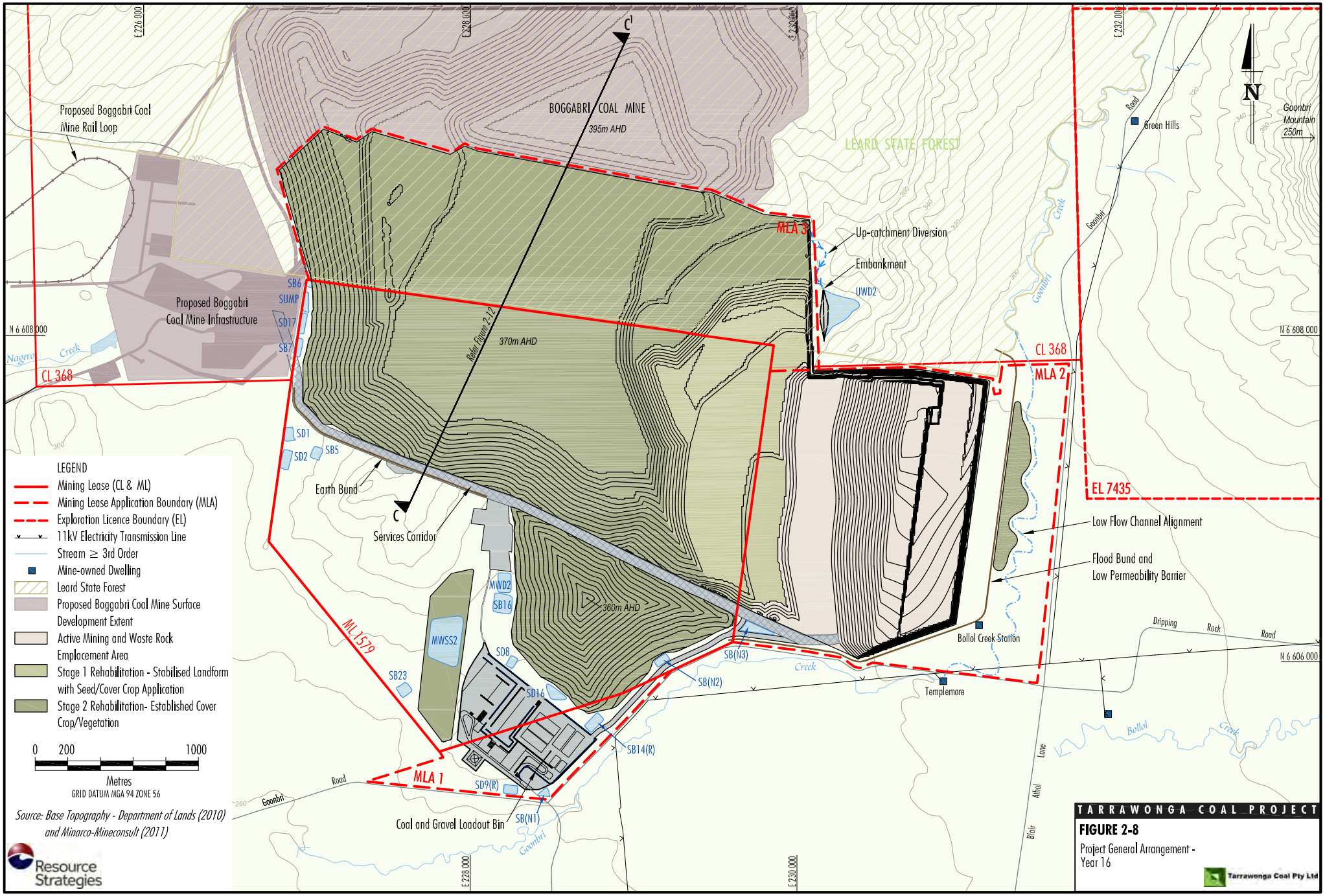

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The detailed mining sequence over any given period would be documented in the relevant Rehabilitation and Environmental Management Plan (REMP) or Mining Operations Plan (MOP) as required by the DRE.

At the completion of Project mining activities, infrastructure would be decommissioned and final landform earthworks and revegetation would be undertaken over a period of approximately one year. The final landform and rehabilitation concept for the end of the Project life and progressive rehabilitation is presented in Section 5.

2.5 KEY MINING OPERATIONS OF POTENTIAL RELEVANCE TO INTERACTIONS WITH THE PROJECT

A description of potential interactions between the Project and other regional mining/coal seam gas developments is provided in Attachment 3. Where relevant, potential cumulative impacts associated with these developments have been considered in this EA (Section 4).

A summary of the Project key interactions with the Boggabri Coal Mine and Whitehaven CHPP is provided below.

2.5.1 Boggabri Coal Mine

BCPL owns the existing Boggabri Coal Mine, which is an open cut coal mine located immediately to the north of the Tarrawonga Coal Mine in CL 368 (Figures 1-1 and 2-1).

ROM coal is currently crushed on-site and transported by truck via a 17 km private haul road to the rail loadout facility at the Boggabri Coal Terminal, located to the south-west of the Boggabri Coal Mine on the Werris Creek Mungindi Railway.

The Boggabri Coal Mine is approved to produce up to 3.5 Mtpa of ROM coal until the end of December 2013 under its Development Consent (DA 36/88), as modified in October 2011.

Proposed Continuation of Boggabri Coal Mine

In October 2009, BCPL submitted a Project Application for the Continuation of Boggabri Coal Mine to the DP&I (refer Attachment 3).

The Continuation of Boggabri Coal Mine would involve open cut mining for a further 21 years at a production rate of up 7 Mtpa product coal (BCPL, 2010).

BCPL is also seeking approval for modified and additional site infrastructure facilities, including (BCPL, 2010):

- upgrades to the existing ROM pad;
- construction of a CHPP and bypass crusher;
- upgrades to the product stockpile area and product reclaim system; and
- construction of a 17 km private rail spur, rail loop and rail loadout facility which would connect to the Werris Creek Mungindi Railway and enable the transport of product coal directly from the mine.

Project Interaction with the Boggabri Coal Mine

Whitehaven and BCPL have entered into an agreement that enables the handling, processing and transportation of Project coal at the upgraded Boggabri Coal Mine Infrastructure Facilities and private rail spur.

Under this agreement BCPL would handle and process Project ROM coal at the upgraded Boggabri Coal Mine Infrastructure Facilities and associated CHPP on a campaign basis.

Project product coal would also be separately loaded to trains for transportation to the Port of Newcastle via the Boggabri Coal Mine private rail spur and Werris Creek Mungindi Railway.

Generally, the upgraded Boggabri Coal Mine Infrastructure Facilities, as described in the *Continuation of Boggabri Coal Mine Environmental Assessment* (BCPL, 2010), would have sufficient capacity to accommodate 3 Mtpa of Project ROM coal (and processing up to 1.5 Mtpa of this coal in the CHPP).

However, some minor changes, including an additional product coal stockpile and modification to some material handling systems would be required.

The Project Northern Emplacement would also be extended to the north and east within MLA 3 to integrate with the southern extent of the Boggabri Coal Mine waste rock emplacement (Section 2.9.1). Section 2.10 and Appendix B provide a summary description of water management measures for the integrated waste rock emplacement landform and Section 5 describes the integration of the rehabilitated landforms.

It should be noted that this EA does not seek approval for any modification to the approved Boggabri Coal Mine. Further discussion on environmental approval requirements is provided in Attachment 3.

Figure 2-9 provides a schematic diagram showing the integration of the Project and the Continuation of Boggabri Coal Mine materials handling.

2.5.2 Whitehaven CHPP

The Whitehaven CHPP currently receives sized ROM coal from the Tarrawonga, Rocglen and Sunnyside Coal Mines (Section 2.1.5).

Once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (Attachment 3), Project sized ROM coal would no longer be trucked to the Whitehaven CHPP (Figure 2-9).

Further discussion on the current operation of the Whitehaven CHPP and potential interactions with the Project are provided in Section 2.9.2 and Attachment 3.

2.5.3 Other Mining Operations

Additional discussion of potential interactions between the Project and other mining operations in the vicinity of the Project and in the wider Gunnedah region (including various Whitehaven-owned coal mines and the Maules Creek Coal Project), is provided in Attachment 3.

2.6 PROJECT DEVELOPMENT ACTIVITIES

Additional infrastructure and the relocation of existing Tarrawonga Coal Mine infrastructure would be required to support the Project, including:

- relocation of the mine facilities area;
- construction of a services corridor to the upgraded Boggabri Coal Mine Infrastructure Facilities;
- realignment of sections of Goonbri Road and construction of new intersections; and
- permanent Goonbri Creek alignment and associated flood bund and low permeability barrier.

Development activities would generally be undertaken during daytime hours (i.e. 7.00 am to 6.00 pm) up to seven days a week.

Additional mobile equipment would be required for short periods during the Project development activities including mobile cranes, excavators, loaders, scrapers and delivery trucks. The number and type of equipment would be expected to vary depending on the activity being undertaken.

Consideration of development activities and their potential for noise generation is provided in the Noise and Blasting Impact Assessment (Appendix C).

2.6.1 Relocation of the Mine Facilities Area

The existing mine facilities area would be relocated to a new mine facilities area (Figures 2-1 and 2-4).

The relocation of infrastructure to the mine facilities area would involve replacement, upgrade or addition of existing infrastructure components for the Project. In addition, existing ROM coal handling equipment that is no longer required would be decommissioned. The mobile crusher used for domestic specification coal production and to be used for gravel production (Section 2.7.7) would be relocated at the new mine facilities area.

Based on the mine schedule and planned progression of the open cut, the mine facilities area relocation activities would be undertaken during Year 1 of the Project.

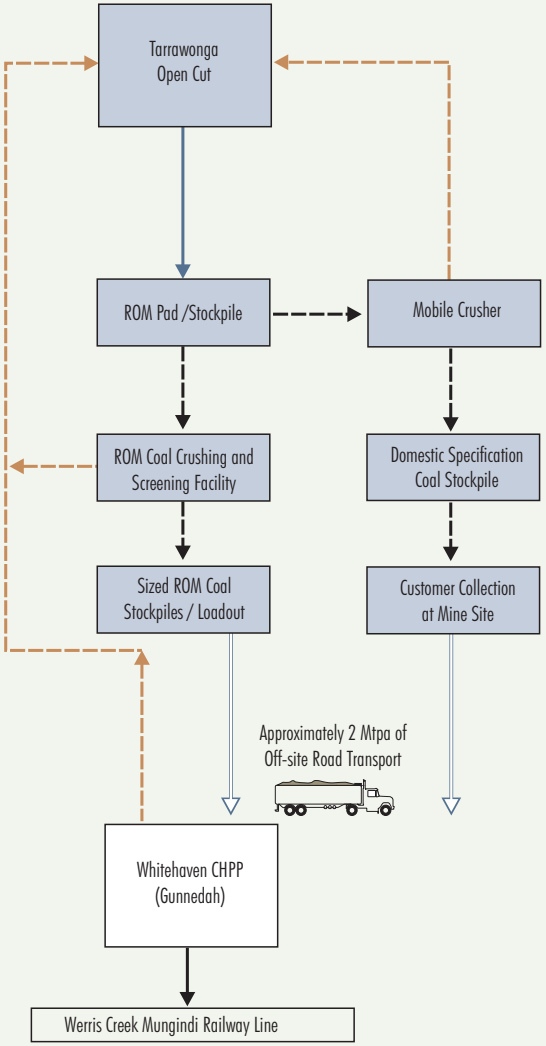
2.6.2 Services Corridor to Boggabri Coal Mine Infrastructure Facilities

A services corridor would be developed from the Project open cut mining operation directly to the upgraded Boggabri Coal Mine Infrastructure Facilities (Figure 2-10). The services corridor would be approximately 60 m wide and would comprise:

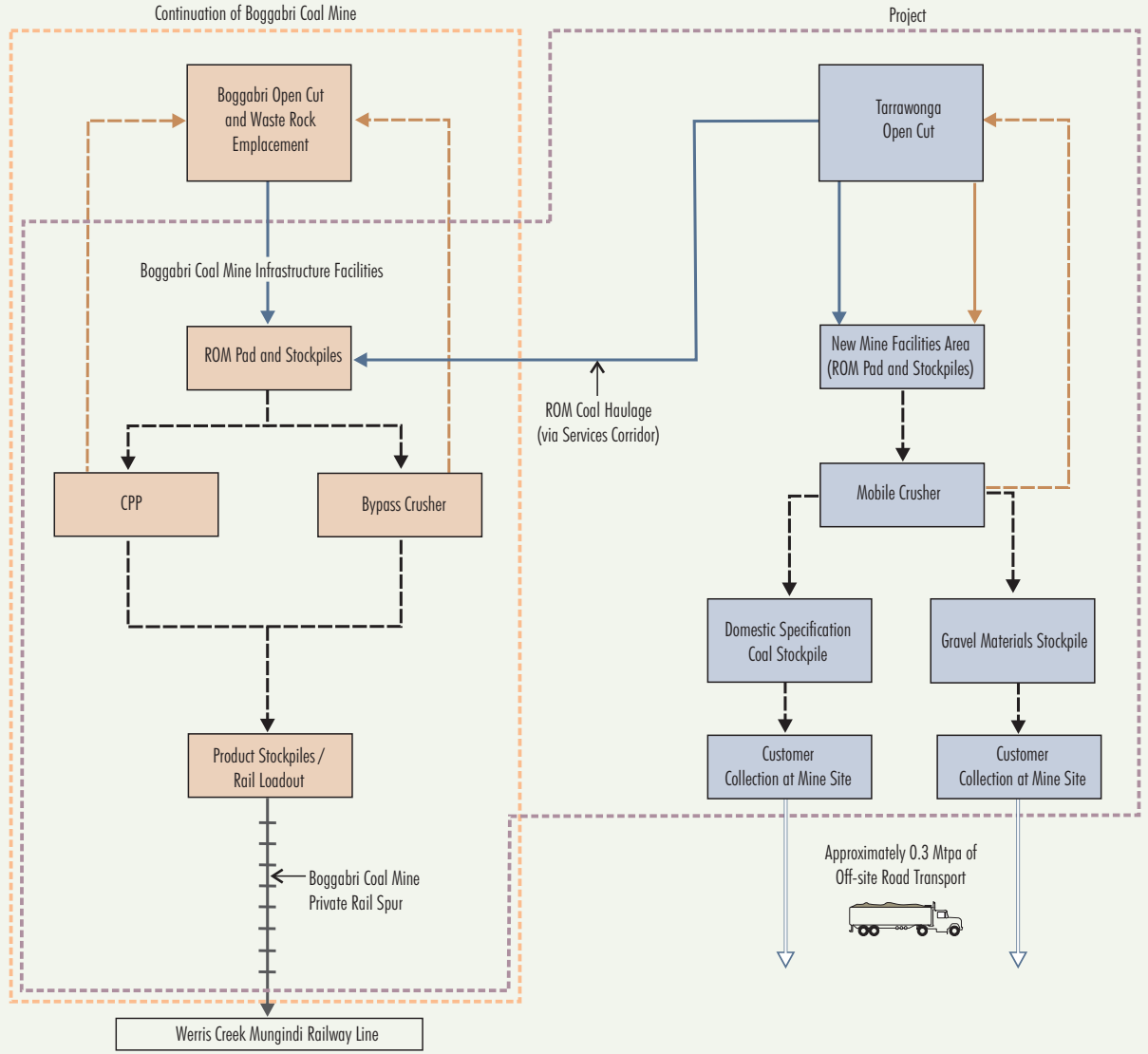
- an internal haul road link (for two-way haulage);
- a 6 m high noise control earth bund on the external side of the haul road for exposed sections of the haul road to the east and west of the Southern Emplacement (Figure 2-8); and
- water management structures (including drainage channels and erosion and sediment controls).

The services corridor would be developed during Year 1 of the Project and subsequently extended as the mine progresses (Figures 2-4 to 2-8).

Existing Tarrawonga Coal Mine - Materials Handling



Proposed Integration of the Project and Continuation of Boggabri Coal Mine - Materials Handling*



LEGEND

- ROM Coal Haulage (Internal)
- Select Waste Rock Haulage
- Direct Transfer / Conveyor
- Offsite Road Transport
- Coarse Reject Material (Backloaded into Empty Trucks)

* *Subject to approvals and upgrades being in place for the transfer of Project ROM Coal to the Boggabri Coal Mine Infrastructure Facilities (Section 2.5.1)*

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TARRAWONGA COAL PROJECT

FIGURE 2-9
Materials Handling Schematic for the Tarrawonga Coal Mine and the Project

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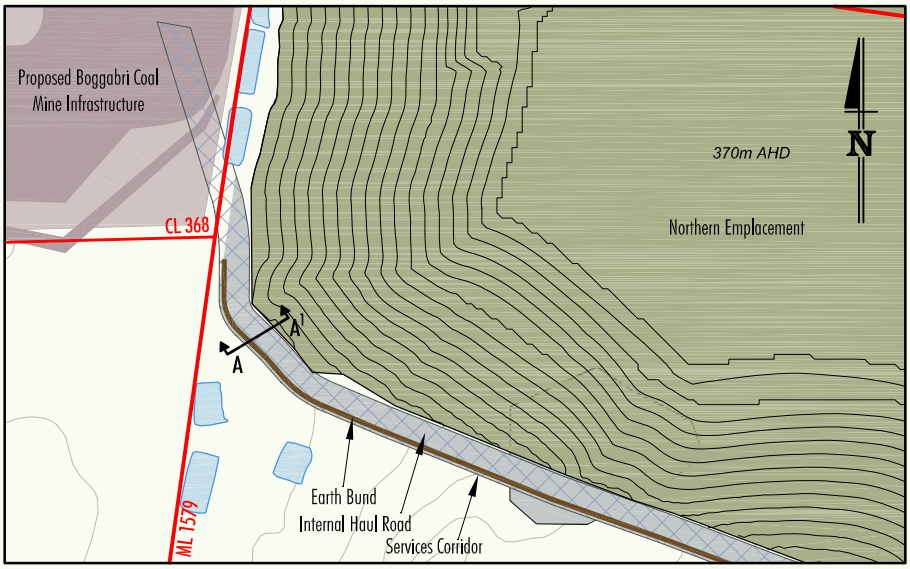
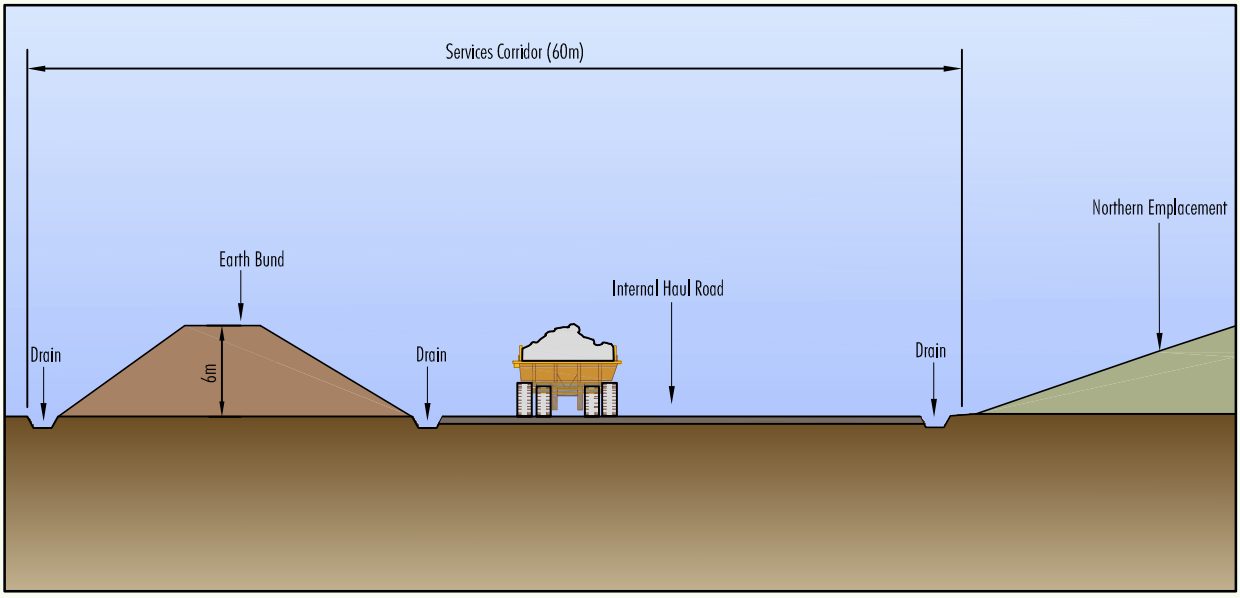


PLAN



SECTION A - A^1

Not to Scale

Source: TCPL (2011)

TARRAWONGA COAL PROJECT

FIGURE 2-10

Services Corridor to Boggabri Coal Mine Infrastructure Facilities

Resource Strategies

Tarrawonga Coal Pty Ltd

2.6.3 Realignments of Goonbri Road and New Intersections

The extent of the Project open cut and mine waste rock emplacements would require the realignment of sections of Goonbri Road and establishment of a new intersection with Dripping Rock Road to provide for continued public road accessibility around the southern and eastern extents of the Project (Figure 2-1).

The road realignments would be undertaken progressively over the life of the Project (Figures 2-4 and 2-7) and involve the construction of:

- a 1.4 km unsealed two-lane road to the south-west of the Project to facilitate construction of the new mine facilities area including a new intersection (from the west) with the sized ROM coal road transport route;
- a 1.2 km unsealed two-lane road to the south of the Southern Emplacement to facilitate construction of a new internal haul road and water management infrastructure including a new intersection with the sized ROM coal road transport route (from the east);
- a 400 m unsealed two-lane road realignment around the southern extent of the open cut; and
- a 2.8 km unsealed two-lane road from a new intersection with Dripping Rock Road and Blair Athol Lane, extending to the north and connecting with Goonbri Road to the north-east of the Project.

The road re-alignments would also require realignment of sections of the existing 11 kilovolt (kV) electricity transmission line (Figures 2-4 and 2-7).

The re-alignment of the 11 kV electricity transmission line would be subject to separate environmental assessment and approval.

2.6.4 Permanent Goonbri Creek Alignment and Associated Flood Bund and Low Permeability Barrier

Construction of the permanent Goonbri Creek alignment and associated permanent flood bund and low permeability barrier would be completed in approximately Year 12 of the Project.

These activities would be undertaken in the following general construction sequence:

- low permeability barrier;
- permanent flood bund; and
- permanent Goonbri Creek alignment.

The period of major construction earthworks is expected to be approximately 15 months, with revegetation works being completed progressively (Section 5).

The section of the permanent flood bund that crosses the existing alignment of Goonbri Creek would not be constructed until the permanent Goonbri Creek alignment is commissioned (Section 2.10.3).

The major earthworks fleet for these construction activities would consist of approximately 18 items, including excavators, scrapers, dozers, loaders and delivery trucks (Appendix C).

During the construction of the low permeability barrier approximately one to two bentonite truck deliveries would also be required per day over a period of some three months.

Further discussion of these Project water management components and associated schematic diagrams are provided in Section 2.10.

2.7 MINING OPERATIONS

Project mining operations would be conducted 24 hours per day, seven days per week.

2.7.1 Open Cut Extent

The Project includes extension of the existing approved open cut in coal seams within the Maules Creek Formation to the east in ML 1579 and MLA 2 and to the north in MLA 3. The Southern Emplacement and new mine facilities area would also extend into MLA 1 (Figure 2-4).

Constraints to the open cut extent include:

- the existing/previously mined areas (i.e. Tarrawonga Coal Mine), the occurrence of the Boggabri Volcanics and the orientation of the seams in the west;
- the neighbouring Boggabri Coal Mine operation (i.e. proposed mine waste rock emplacement) in the north;
- the target coal seams subcrop to the south; and
- uneconomic open cut ratio limits in the east.

The floor of the Nagero coal seam has been used as the depth design constraint for the Project, as there is a relatively thick layer of interburden beneath it, which currently precludes open cut mining of the deeper coal seams (e.g. Lower Northam) at the Tarrawonga Coal Mine.

Conceptual cross-sections of the open cut extent including key design constraints are shown on Figure 2-11.

2.7.2 Indicative Mine Schedule

The staging of the open cut mining operations would be determined by the requirements of the coal market, product specification and/or blending requirements. As these requirements are likely to vary over the life of the Project, the development sequence of the open cut and coal extraction rates may also vary.

An indicative mine schedule for the Project is provided in Table 2-2.

Table 2-2
Indicative Mine Schedule

Project Year	Waste Rock (Mbcm)	ROM Coal (Mtpa)
1*	25.0	2.5
2	29.5	3.0
3	27.5	3.0
4	28.0	3.0
5	29.0	3.0
6	33.0	3.0
7	32.0	3.0
8	32.0	3.0
9	27.0	3.0
10	29.0	3.0
11	30.0	3.0
12	28.0	3.0
13	31.0	3.0
14	31.0	3.0
15	31.0	3.0
16	31.0	3.0
17	23.0	3.0
Total	497.0	50.5

* Assumed Project commencement date is 1 January 2013.
Mbcm = million bank cubic metres.

2.7.3 Vegetation Clearing and Soil Stripping

Progressive vegetation clearing would be undertaken ahead of the advancing open cut mining operation. Specific vegetation clearance procedures (generally consistent with the Tarrawonga Coal Mine's existing procedures) are described in Section 4.9.

Soil stripping would be undertaken progressively and stockpiling procedures would aim to minimise soil degradation prior to its use for progressive rehabilitation. Specific soil management, stockpiling and re-application procedures (generally consistent with Tarrawonga Coal Mine's existing procedures) are described in Section 5.6.2.

A fleet of dozers, scrapers and a water cart would typically be used for vegetation clearing and soil stripping activities.

Supporting infrastructure such as soil stockpiles, hardstands and water management structures would continue to be developed progressively and used as the open cut and waste rock emplacements advance.

A temporary soil stockpile would be located to the east of the open cut extent as shown on Figures 2-1 and 2-7. This stockpile would be removed and the area rehabilitated before the permanent Goonbri Creek alignment is commissioned in approximately Year 15.

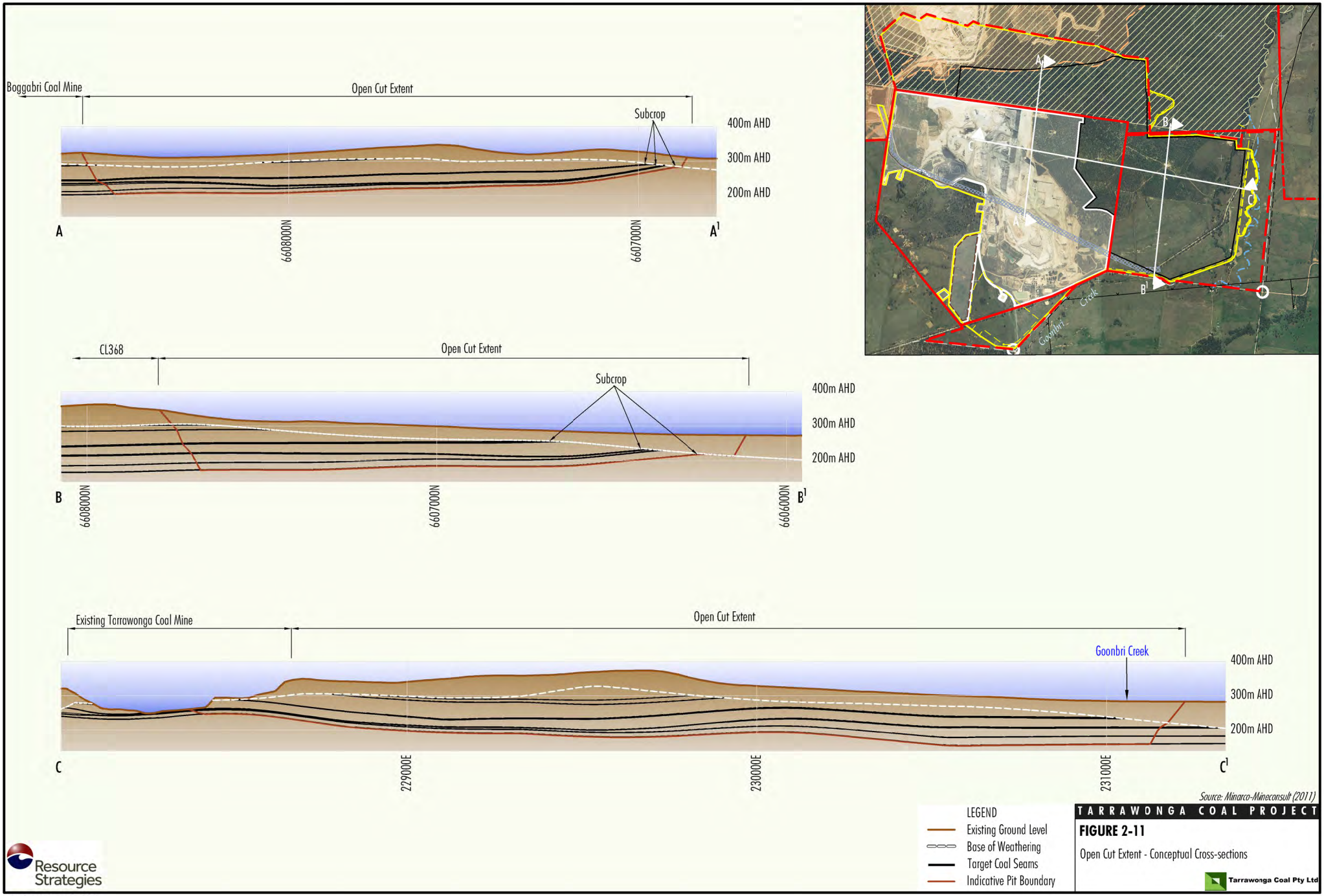
2.7.4 Overburden/Interburden Drill, Blast and Removal by Excavator

Drill and blast techniques are used for the removal of competent overburden and interburden material at the Tarrawonga Coal Mine and would continue for the Project.

A mixture of ammonium nitrate and fuel oil (ANFO) (dry holes) and emulsion blend (wet holes) explosives would continue to be used.

Blast sizes would typically range from:

- intermediate interburden blasts with a maximum instantaneous charge (MIC) of approximately 1,365 kilograms (kg); and
- deep overburden/interburden blasts with a MIC of approximately 2,275 kg.



Source: Minarco-Mineconsult (2011)

Resource Strategies

TARRAWONGA COAL PROJECT

FIGURE 2-11

Open Cut Extent - Conceptual Cross-sections

Tarrawonga Coal Pty Ltd

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The number of blasts per day would typically be one, however, two blasts per day may occur on some occasions (e.g. in the early Project life when the northern extension of the open cut is being developed, and when it is required by mine scheduling). The total number of blasts per week would not exceed nine.

TCPL would continue to co-ordinate Project blasting days and times with blasting activities at the Boggabri Coal Mine in order to minimise disruptions and impacts on neighbouring landholders.

Blast designs and sizes would vary over the life of the Project and would depend on factors such as the depth of coal seams and the design of benches.

As the open cut mining operations advance to the south-east later in the Project life, some sections of Goonbri Road would be temporarily closed during blast events that are within 500 m of the public road.

Following blasting, overburden and interburden would be removed by excavator and haul truck for placement in out-of-pit mine waste rock emplacements, or as infill in the mine void.

Further information regarding waste rock management is provided in Section 2.9.1.

2.7.5 Coal Mining and ROM Coal Handling

Approximately 50.5 Mt of ROM coal would be mined from the open cut extent during the life of the Project (Table 2-2).

Coal mining would continue to involve excavators loading ROM coal into haul trucks for haulage to either the Project or the Boggabri Coal Mine ROM coal handling areas.

Until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (Section 2.5.1), ROM coal would continue to be hauled to the existing ROM pad via internal haul roads. Processing and transport of this ROM coal would be as per the existing operations (Section 2.1).

Once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (Attachment 3), ROM coal would be transported via the services corridor haul road directly from the Project open cut (Figure 2-1).

A materials handling schematic for the Tarrawonga Coal Mine and the Project showing key Project interactions with the Continuation of Boggabri Coal Mine is shown on Figure 2-9.

2.7.6 On-site Production of Domestic Coal

Up to 150,000 t of ROM coal per annum would be selectively hauled to the on-site mobile crusher for crushing and screening to produce domestic specification (15 to 35 mm) coal. The mobile crusher would be operated during daytime hours only (i.e. 7.00 am to 6.00 pm).

Until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (Section 2.5.1) the maximum extraction of ROM coal at the Project would be capped at the existing approved rate of 2 Mtpa (Table 1-1). This would limit total off-site road haulage movements of coal materials (i.e. both sized ROM coal and domestic coal) to current maximum levels.

2.7.7 On-site Production of Gravel Materials

Up to 90,000 m^3 per annum of gravel material would be produced by crushing and screening of select overburden (excavated from within the open cut extent) in the on-site mobile crusher.

On-site gravel crushing and screening operations would be conducted during daytime hours only (i.e. 7.00 am to 6.00 pm).

2.7.8 Mine Fleet

The mine fleet for the Project would vary according to the equipment requirements associated with the advancing open cut mining operations.

The existing/approved mine fleet (Section 2.1.1) at the Tarrawonga Coal Mine would continue to be used, with some replacement and additional fleet items (in line with ROM coal production rates) including:

- one additional excavator;
- nine additional haul trucks;
- one additional drill; and
- two additional water carts.

An indicative Project mine fleet is provided in the Noise and Blasting Impact Assessment (Appendix C).

2.7.9 Final Void

At the cessation of mining, a final void would remain at the eastern extent of the open cut (Section 5).

The surface catchment of the final void would be designed to a suitable minimum by the use of upslope diversions/bunds and contour drains around the perimeter.

A low permeability barrier would be constructed to minimise the rate of potential alluvial groundwater inflows reporting to the final void in the long-term (Section 2.10.3).

The final open cut highwall would also be designed to have long-term geotechnical stability, with partial backfilling and/or adjustment to the wall batter angles to achieve suitable stability. The open cut may also be partially backfilled to achieve a suitable post-mining pit-lake equilibrium level (Section 5).

A final void water balance has been prepared for the end of the Project life and is summarised in Section 5 and presented in the Surface Water Assessment (Appendix B).

2.8 PROCESSING, PRODUCT LOADING AND TRANSPORT

2.8.1 Whitehaven CHPP

Until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (Section 2.5.1), sized ROM coal would continue to be loaded into haulage contractor trucks and transported via the approved transport route to the Whitehaven CHPP (Figure 1-1).

In this period there would be no increase in the trucking rates for sized ROM coal transport to the Whitehaven CHPP, as Project ROM coal production would be capped at 2 Mtpa.

Sized ROM coal dispatch by road would continue as per the current approved hours (Section 2.1.2).

At the Whitehaven CHPP, the sized ROM coal would continue to be either directly loaded onto trains (i.e. bypass) or crushed, screened and washed before being loaded onto trains for rail transport to Newcastle and export markets. No change to existing Whitehaven CHPP rail movements would be required for the Project.

2.8.2 Boggabri Coal Mine Infrastructure Facilities

The Continuation of Boggabri Coal Mine includes upgrades to the existing ROM pad, construction of a CHPP, upgrades to product handling and a 17 km private rail spur, rail loop and rail loadout facility (Section 2.5.1).

Once approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (Attachment 3), subsequent campaign handling and crushing of up to 3 Mtpa, processing of up to 1.5 Mtpa and train loading of up to approximately 2.8 Mtpa of Project coal would be undertaken at Boggabri.

With a typical coal train capacity of 5,400 t to 6,000 t, up to ten Project coal trains would be dispatched per week on the Boggabri Coal Mine private rail spur and Werris Creek Mungindi Railway to the Port of Newcastle.

It is expected that approximately 80% of Project product coal produced in each year would be sold as semi-soft coking coal and the remainder would be sold as thermal coal.

2.8.3 Access to Suitable Rail Capacity

Whitehaven has entered into long-term arrangements with the Australian Rail Track Corporation (ARTC) for rail track access from Whitehaven's operations to the Port of Newcastle. These arrangements provide Whitehaven with the rail capacity required for its long-term coal production, including approximately 47.5 Mt of Project coal products.

2.8.4 Domestic Coal and Gravel Materials Transport

Up to 150,000 t of domestic specification coal and 90,000 m^3 of gravel would be directly collected at the mine facilities area by customers[3].

Collection hours would be limited to the current sized ROM coal truck dispatch hours (Section 2.1.2).

[3] Until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (Section 2.5.1), total sized ROM coal, domestic coal and gravel materials transport would be limited to the current maximum off-site coal trucking rate.

2.9 WASTE ROCK AND COAL REJECT MANAGEMENT

2.9.1 Waste Rock

Quantities and Emplacement Strategy

Approximately 497 Mbcm of waste rock would be mined over the life of the Project (Table 2-2).

Waste rock (including overburden and interburden) mined during the development of the Project would continue to be used to in-fill the mine void behind the advancing open cut, as well as being placed in the two adjoining out-of-pit mine waste rock emplacements (Northern Emplacement and Southern Emplacement).

In the first one to two years of the Project, the open cut would extend north into MLA 3 (Figure 2-4). This would temporarily reduce the area within the open cut available for in-filling. As a result, the existing Southern Emplacement would be extended to the south and east (Figures 2-1 and 2-4) and increased to a maximum height of approximately 360 m AHD.

Once the open cut extension in MLA 3 begins to advance to the east, the mined-out section behind the working area would become available for in-filling. This would allow the existing Northern Emplacement to be extended to the north and east, forming an integrated landform with the southern part of the Boggabri Coal Mine waste rock emplacement (Figures 2-4 to 2-7).

The currently approved maximum height of the Northern Emplacement would remain unchanged at 370 m AHD, and its top surface would be lower than the proposed maximum height of the Continuation of Boggabri Coal Mine waste rock emplacement (i.e. 395 m AHD).

A conceptual cross-section of the Northern Emplacement illustrating its integration with the Boggabri Coal Mine waste rock emplacement is shown on Figure 2-12.

The waste rock emplacements would be progressively shaped by dozers for rehabilitation activities (i.e. final re-contouring, topsoiling and revegetation) (Section 5).

Geochemistry

An assessment of the geochemical characteristics of the waste rock material associated with the development of the Project is provided in the Geochemistry Assessment (Appendix N) prepared by Geo-Environmental Management. A summary of the findings of the assessment is provided below.

Geochemical tests were conducted on 119 overburden and interburden samples from six boreholes distributed across the proposed open cut extension areas. The test work included pH and electrical conductivity (EC), acid base accounting, net acid generation tests, a sodicity assessment, and element enrichment and solubility testwork.

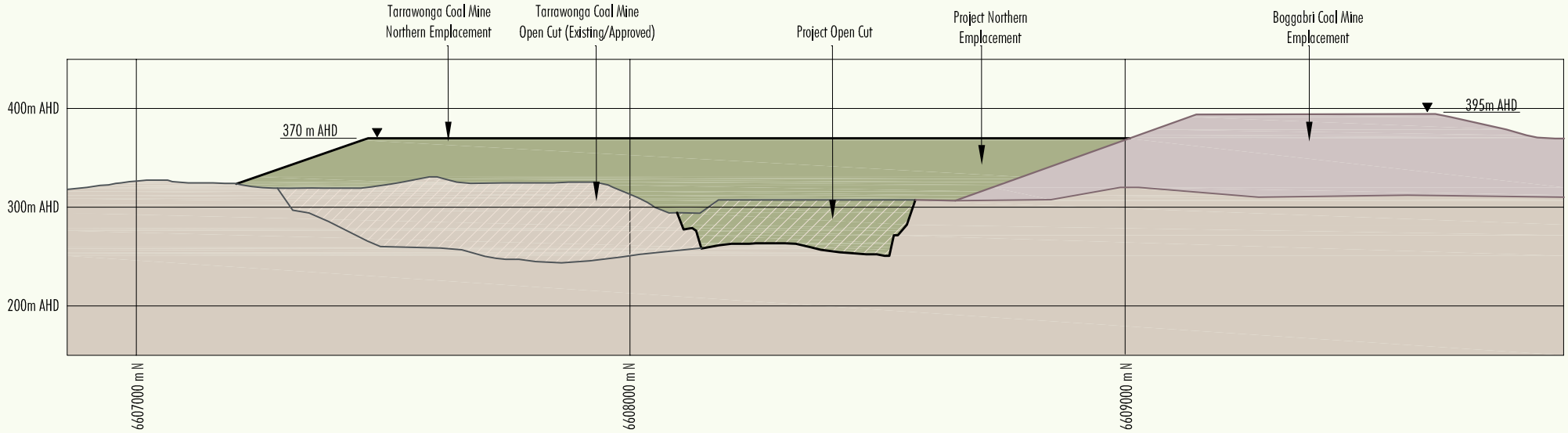
The Geochemistry Assessment (Appendix N) concluded that the overburden and interburden generated from the proposed northern and eastern open cut extensions would generally be expected to be non-acid forming (NAF). As a result, the current Tarrawonga Coal Mine practice of ROM blending of the overburden and interburden was considered by Geo-Environmental Management (2011) to be suitable for the Project.

A small quantity of overburden, including some strata immediately adjacent to some of the coal seams, was identified as containing slightly increased sulphur concentrations with low or no acid neutralising capacity. These materials were classified as potentially acid forming – low capacity (PAF-LC). In order to manage these materials, TCPL would identify and emplace them so that they are covered with at least 15 m of NAF material.

The testwork results also showed that the overburden and interburden materials are typically alkaline and are expected to be generally non-saline (Appendix N).

A sub-set of samples was also selected for exchangeable cation analysis and determination of exchangeable sodium percent in order to assess the potential sodicity risk (i.e. risk of being dispersive) presented by the different overburden and interburden materials.

The sodicity test results indicated that a relatively high proportion of the overburden and interburden from the Project open cut extension areas is likely to be moderately to highly sodic, and if these materials are left exposed on the dump surfaces or final pit walls they may become dispersive (Appendix N).



SECTION C-C[1]

(Refer Figure 2-8)

Source: Minarco-Mineconsult (2011)

TARRAWONGA COAL PROJECT

FIGURE 2-12

Integrated Waste Rock Emplacement Design - Conceptual Cross-section

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In order to manage sodic materials, the final outer surfaces of the overburden emplacements would be constructed with suitable non-sodic or low sodicity material and/or would be treated with gypsum (Section 5). Any identified occurrence of sodic material in the final void walls would be covered with backfill and/or treated with gypsum if considered material to final void management under the Mine Closure Plan (Section 5).

Multi-element analyses were also conducted on 25 samples and compared to average crustal abundance values. Results of this testwork indicated enrichment of arsenic (As), antimony and Se. The analysis of water extracts from selected overburden and interburden samples indicated As, molybdenum (Mo) and Se are likely to be slightly soluble under the prevailing near-neutral pH conditions (Appendix N).

A discussion of existing water quality including analysis of these parameters in mine water storages and local groundwater/streams, and potential impacts of these solutes, is provided in Appendix B and Section 4.5.

2.9.2 Coal Rejects

Until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (Section 2.5.1), minor quantities of coarse rejects (i.e. less than 0.2 Mtpa) would continue to be produced at the Whitehaven CHPP from the processing of Project coal.

As is the current practice (Section 2.1.5), some of the coarse rejects generated at the Whitehaven CHPP would be returned via truck to the Project for emplacement within an in-pit emplacement area in accordance with existing management and approval requirements.

Once Project ROM coal is being handled and processed at Boggabri Coal Mine (Section 2.5.1), coarse and fine reject materials generated from the these activities would be disposed of in the Boggabri open cut in accordance with relevant Boggabri Coal Mine approvals and environmental management practices (Attachment 3).

Minor volumes of coarse rejects that are generated on-site at the Project from domestic coal (and gravel material) crushing and screening would also continue to be emplaced on-site in accordance with existing management and approval requirements.

2.10 WATER MANAGEMENT

The existing water management system at the Tarrawonga Coal Mine would be progressively augmented as water management requirements change over the life of the Project.

A detailed description of the existing Tarrawonga Coal Mine and Project water management systems is provided in the Surface Water Assessment (Appendix B).

Designs for the low permeability barrier and permanent Goonbri Creek alignment have been developed by Allan Watson Associates (2011) (Appendix R).

2.10.1 Existing Water Management System

The existing water management system at the Tarrawonga Coal Mine comprises a series of mine water dams, storage dams, sediment basins and drains that are used to manage runoff and provide erosion and sediment control (Appendix B).

Key features of the existing water management system comprise:

- optimising the diversion of surface water runoff from undisturbed or rehabilitated areas around or away from disturbed mine areas;
- collection of runoff from disturbed mine areas (e.g. active waste rock emplacement areas and infrastructure areas) in sediment basins, to allow suspended sediments to settle out of the collected water; and
- transfer of mine-affected water (e.g. runoff and infiltration from waste rock emplacements, and groundwater inflows) collected in a sump in the base of the open cut to a mine water dam for storage and use on-site for dust suppression.

Operational water requirements are sourced from water storages containing runoff from disturbed mine areas or mine-affected water. Additional make-up water is sourced from water storages containing runoff from undisturbed/rehabilitated areas or from licensed bores.

Water is used for dust suppression on internal haul roads, at the coal crushing and screening facility, washdown of mobile equipment and other minor uses.

During extended wet periods controlled discharge occurs from five licensed discharge points in accordance with the conditions in the Tarrawonga Coal Mine EPL 12365. The locations of the existing licensed discharge points are shown in Appendix B.

2.10.2 Project Water Management System

The objectives of the Project water management system would be generally consistent with the existing water management system, specifically:

- to protect the integrity of local and regional water resources;
- to operate such that there are no releases of mine-affected water off-site; and
- to provide a reliable source of water for the Project's operational water requirements (e.g. dust suppression).

To meet these objectives, the Project water management system would be designed to maintain separation between surface water runoff from undisturbed, rehabilitated and active mining areas, in order to:

- minimise the capture of surface water runoff from undisturbed areas, by optimising the diversion of up-catchment water to downstream receiving waters;
- provide controlled release for surface water runoff from rehabilitated mine areas through licensed discharge points in accordance with EPL conditions;
- capture, store and manage surface water runoff from partially rehabilitated mine areas and infrastructure areas, and provide controlled release of these waters through licensed discharge points in accordance with EPL conditions; and
- capture and store surface water runoff from active mining areas and mine-affected water, with no release off-site.

The Project would involve the use of parts of the existing Tarrawonga Coal Mine water management system as well as the progressive development of additional water storages and drainage systems.

A predictive assessment of the performance of the Project water management system (including supply and containment) over a range of climatic scenarios is presented in Appendix B and the results summarised in Section 2.10.5.

The progressive development of water storages for the Project is described in Appendix B and shown on Figures 2-4 to 2-8. Figure 2-13 provides a schematic of the integration of the existing and Project water management systems.

Water captured and stored on-site would also (when available) be used to irrigate emplacement areas for revegetation establishment (Appendix B and Section 5).

The post-mining water management would incorporate some aspects of the operational Project water management system (i.e. some storages and water management structures would be retained as permanent features) (Section 5.3.4).

Up-catchment Runoff Control

Temporary and permanent up-catchment diversion bunds/drains would be constructed over the life of the Project to divert runoff from undisturbed areas around the open cut and waste rock emplacements.

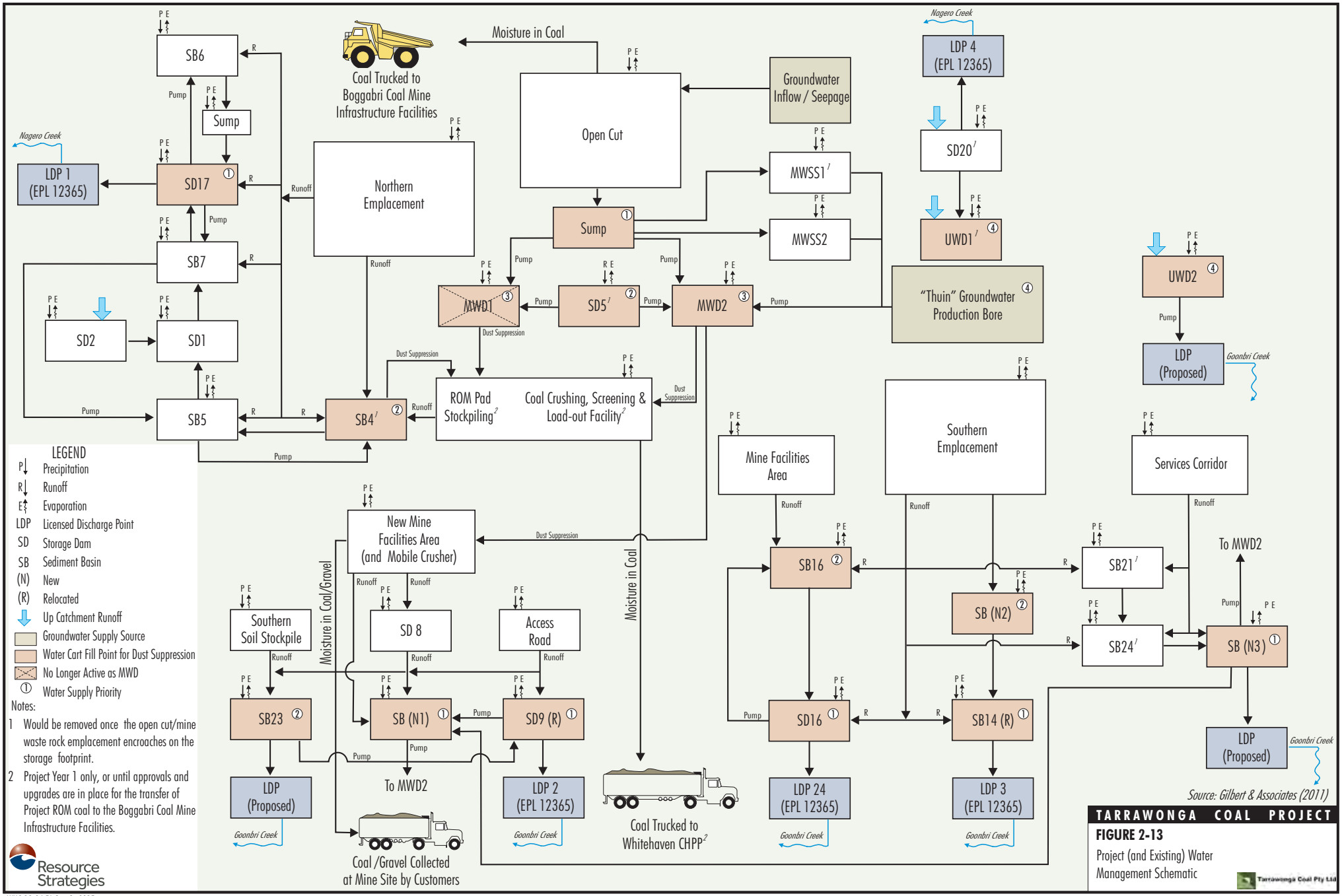
The design capacity of up-catchment diversion works would depend on the size of the catchment, the design life of the up-catchment diversion and the potential consequences of a breach. On this basis, the design capacities would range from the peak flow generated by the 1 in 2 year average recurrence interval (ARI) event through to that generated by the 1 in 100 year ARI event.

Up-catchment diversions would be designed to be stable (non-eroding) at the design flows. Stabilisation of the upslope diversion works would be achieved by design of appropriate channel cross-sections and gradients and the use of channel lining with grass or rock fill.

Two up-catchment water dams (UWDs) would be required in CL 368 to prevent up-catchment runoff from entering the advancing open cut (Appendix B).

UWD1 would be constructed during the early stages of the Project, and would be replaced by UWD2 in approximately Year 6 (Figures 2-4 and 2-6). Water captured in UWD2 would be pumped to Goonbri Creek via a proposed licensed discharge point (Appendix B).

The permanent Goonbri Creek alignment would be constructed to divert flows in this stream around the open cut (Section 2.10.3).



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Surface Water Runoff Collection

Surface water runoff from the waste rock emplacements would be separated through the use of contour banks and collection drains.

Runoff from active waste rock emplacement areas would be directed towards the open cut, where practicable.

Prior to Year 4, runoff from rehabilitated and partially rehabilitated areas on the Northern Emplacement would be directed to SB6, SB7 and SD17 (Figure 2-4) via batter drains and drop structures, and would only be discharged via the licensed discharge point from SD17 at times when stored water exceeded dust suppression requirements (and in compliance with the release conditions in EPL 12365).

Runoff from the Southern Emplacement would be captured in sediment basins via batter drains and drop structures, and similarly, would only be discharged via the licensed discharge points from SB14(R) and SD16 (Figure 2-4) at times when stored water exceeded dust suppression requirements.

From Year 4 onwards, runoff reporting to SB6, SB7 and SD17 would be from fully rehabilitated areas on the Northern Emplacement (Figure 2-5), and would spill via the licensed discharge point from SD17. The Southern Emplacement would also be fully rehabilitated by this time (Figure 2-5), and runoff would be released via the licensed discharge point from SB14(R).

From Year 4 to Year 6 only, runoff from a partially rehabilitated area on the western side of the Northern Emplacement (Figure 2-5) would be directed to the abutting Boggabri Coal Mine waste rock emplacement via a batter drain, and would be incorporated into the Boggabri Coal Mine's water management system (Attachment 3 and Appendix B).

Runoff from infrastructure areas (including the services corridor, new mine facilities area and mine access road) would be captured in sediment basins and storage dams. This runoff would be discharged from existing and proposed licensed discharge points in compliance with the release conditions in EPL 12365.

The western portion of the services corridor would drain westwards to the Boggabri Coal Mine Infrastructure Facilities Area, where it would be managed in the Boggabri Coal Mine water management system (Appendix B and Attachment 3).

Open Cut Water Storage and Dewatering

Mine-affected water captured in the open cut, comprising runoff and infiltration from active mining and emplacement areas and groundwater inflows, would be allowed to settle in an in-pit collection sump.

Where the potential for higher open cut groundwater inflows is identified during the life of the Project, advance dewatering may also be conducted using appropriately licensed temporary bores ahead of the open cut mining operation. The design of the low permeability barrier, which would minimise alluvial groundwater inflows into the open cut, is described in Section 2.10.3.

Water collected in-pit would be transferred to MWD2 (Figure 2-4). During extended wet weather periods, mine-affected water collected in the open cut would be transferred to a mine water surge storage (MWSS) to allow continued open cut dewatering.

MWSS1 would be constructed to the east of the advancing open cut (Figure 2-4). Once the advancing open cut approaches the footprint of MWSS1, MWSS2 would be constructed as a turkey's nest dam within the footprint of the western temporary soil stockpile (Figure 2-7), as the soil resource in this area would have been removed for rehabilitation work.

MWSS1 and MWSS2 would be constructed in the event that periodic Project water balance analysis indicates that they are required to minimise the volume of water stored in-pit (i.e. to minimise potential interruptions to open cut operations).

Flood Bunds

Prior to the development of the permanent Goonbri Creek alignment and associated permanent flood bund (Section 2.10.3), a temporary flood bund would be constructed (Figure 2-7). The temporary flood bund would protect the advancing open cut against inundation in the event of flooding on the western bank of Goonbri Creek.

The temporary flood bund would be designed to protect the advancing open cut for the peak flow resulting from a 1 in 100 year ARI rainfall event. The bund would be constructed to a nominal height of 1.5 m above the natural surface level (Appendix B).

The construction of the permanent flood bund as a component of the permanent Goonbri Creek alignment is described in Section 2.10.3.

2.10.3 Permanent Goonbri Creek Alignment and Associated Flood Bund and Low Permeability Barrier

The design and construction of the permanent Goonbri Creek alignment, permanent flood bund and low permeability barrier would be integrated (Section 2.6.4). Further detail on each of these key Project water management features is provided below.

Low Permeability Barrier

A low permeability barrier would be constructed in the alluvium to the east and south-east of the open cut extent (Figure 2-1). Construction of the low permeability barrier would be completed before the open cut intersects the alluvium (approximately Year 12).

The depth of the alluvium adjacent to the open cut extent has been determined with reference to local borehole logs (Figure 2-14) and a transient electromagnetic (TEM) groundwater investigation conducted in the Project area (Appendix A).

Further geotechnical evaluation of the required excavation depths to the basement rock on the final barrier alignment would be undertaken as part of its detailed engineering design.

The low permeability barrier would be constructed using a soil-bentonite mixture to meet the following design objectives:

- minimise the potential for local drainage of alluvial groundwater into the open cut during operations and post-mining;
- minimise the potential for future instability of the open cut batters formed in the alluvium (achieved by reducing the groundwater hydrostatic head in the alluvium immediately adjacent to the open cut/final void);
- maintain the hydraulic character of Goonbri Creek by minimising the potential loss of baseflow; and
- maintain the value of alluvial groundwater, by minimising potential interactions with the mine final void, post-mining.

It is expected that the low permeability barrier would reduce groundwater seepage from the alluvium to the open cut from approximately 3.3 megalitres per day (ML/day) to 0.1 ML/day (across a length of some 2 km) (Appendix A).

The alignment of the low permeability barrier would be located 50 to 100 m from the final open cut. An indicative construction sequence is shown in Figure 2-15 and comprises:

- excavation of the trench using a long reach excavator and/or a clamshell digger (bentonite slurry would maintain trench stability during excavation); and
- blending select spoil from excavation (supplemented by imported clay if required) with bentonite adjacent to the trench before being dozer pushed directly into the trench.

Construction of the section of the low permeability barrier that crosses the existing alignment of Goonbri Creek would be timed to avoid periods when surface water flow in the creek is occurring. A temporary means of channelling flows around the in-creek construction activities (e.g. cutting and/or dam and pumping system) would be installed as a contingency measure if a rainfall event was to occur.

Until such time that the permanent flood bund is completed and the permanent Goonbri Creek alignment is commissioned, this portion of the low permeability barrier would be protected from erosion scouring at the surface by rock armouring or equivalent.

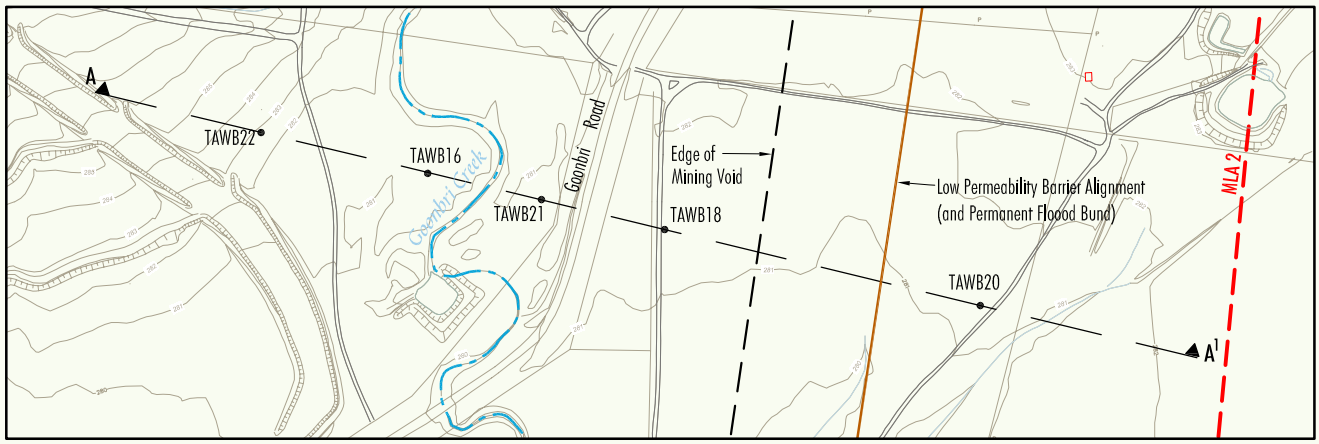
The final design of the low permeability barrier would also consider the potential impacts of blasting on the consolidation of the soil-bentonite mixture and the subsequent differential settlement to the adjacent geological sequences/interfaces and keying-in of the cut-off barrier.

Further details regarding the design considerations, construction methodology and predicted performance of the low permeability barrier are provided in Appendix R and Section 4.4.

Permanent Flood Bund

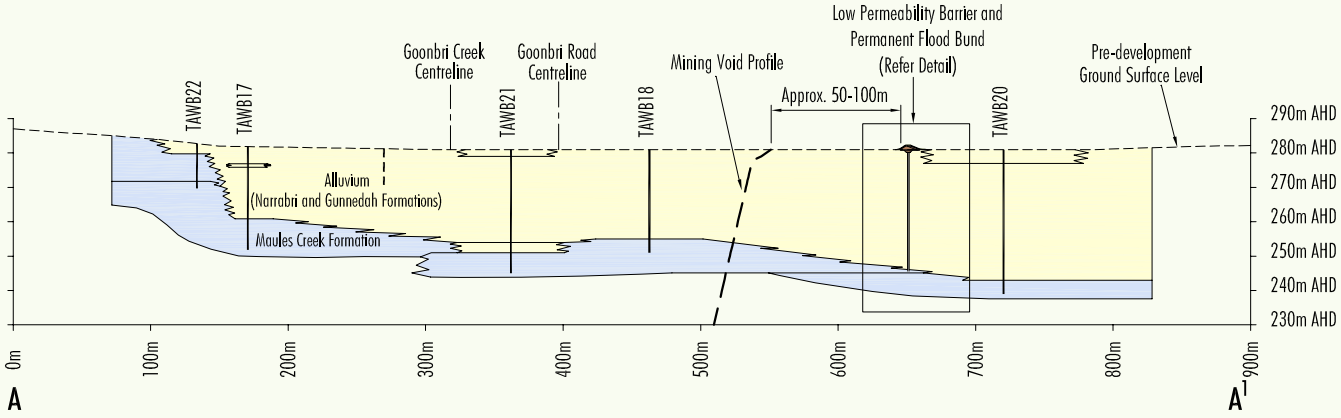
A permanent flood bund would be constructed to prevent inundation of the open cut during operations and post-mining. The permanent flood bund would generally coincide with the alignment of the low permeability barrier (Figures 2-1 and 2-16).

The permanent flood bund would be designed to a height that would provide protection against the peak flood height associated with a Probable Maximum Precipitation rainfall event. The width and geometry of the permanent flood bund would be such that it is stable under these extreme flow conditions (Appendix B).

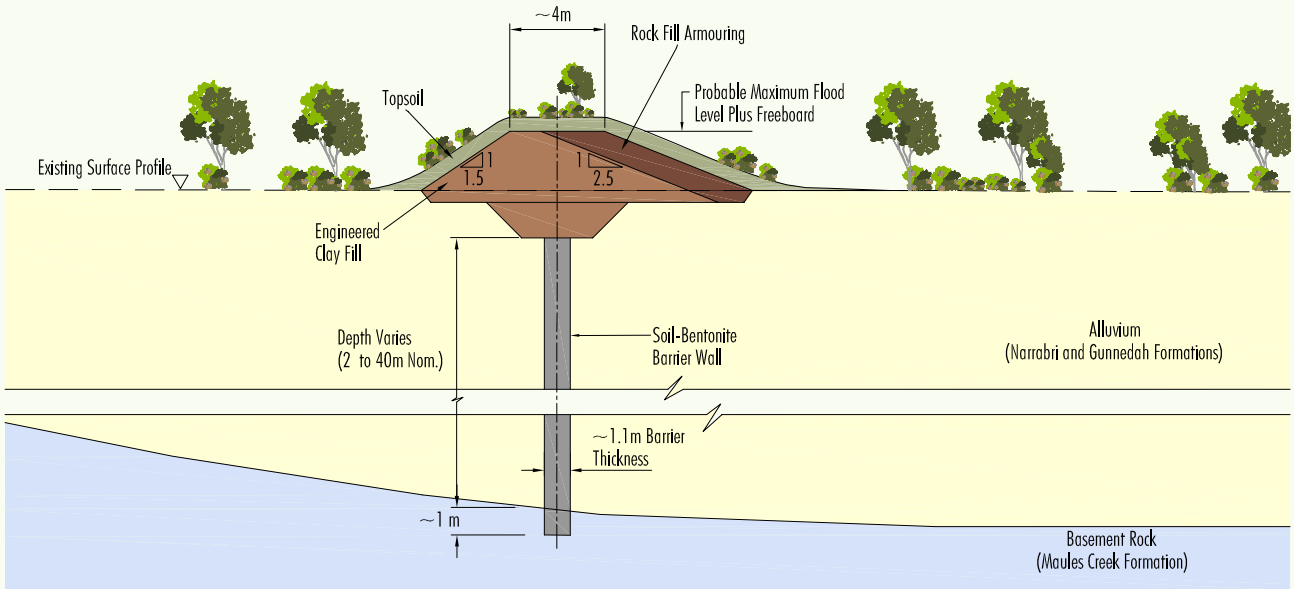


PLAN SHOWING GEOLOGICAL SECTION LOCATION

SCALE 1:6000



SECTION A-A[1]
IDEALISED GEOLOGICAL SECTION



Note: Refer to Appendix R for detailed design of Low Permeability Barrier and Permanent Flood Bund

LOW PERMEABILITY BARRIER AND PERMANENT FLOOD BUND

Source: Allan Watson Associates (2011)

TARRAWONGA COAL PROJECT

FIGURE 2-14

Conceptual Design of the Low Permeability Barrier and Permanent Flood Bund

Resource Strategies

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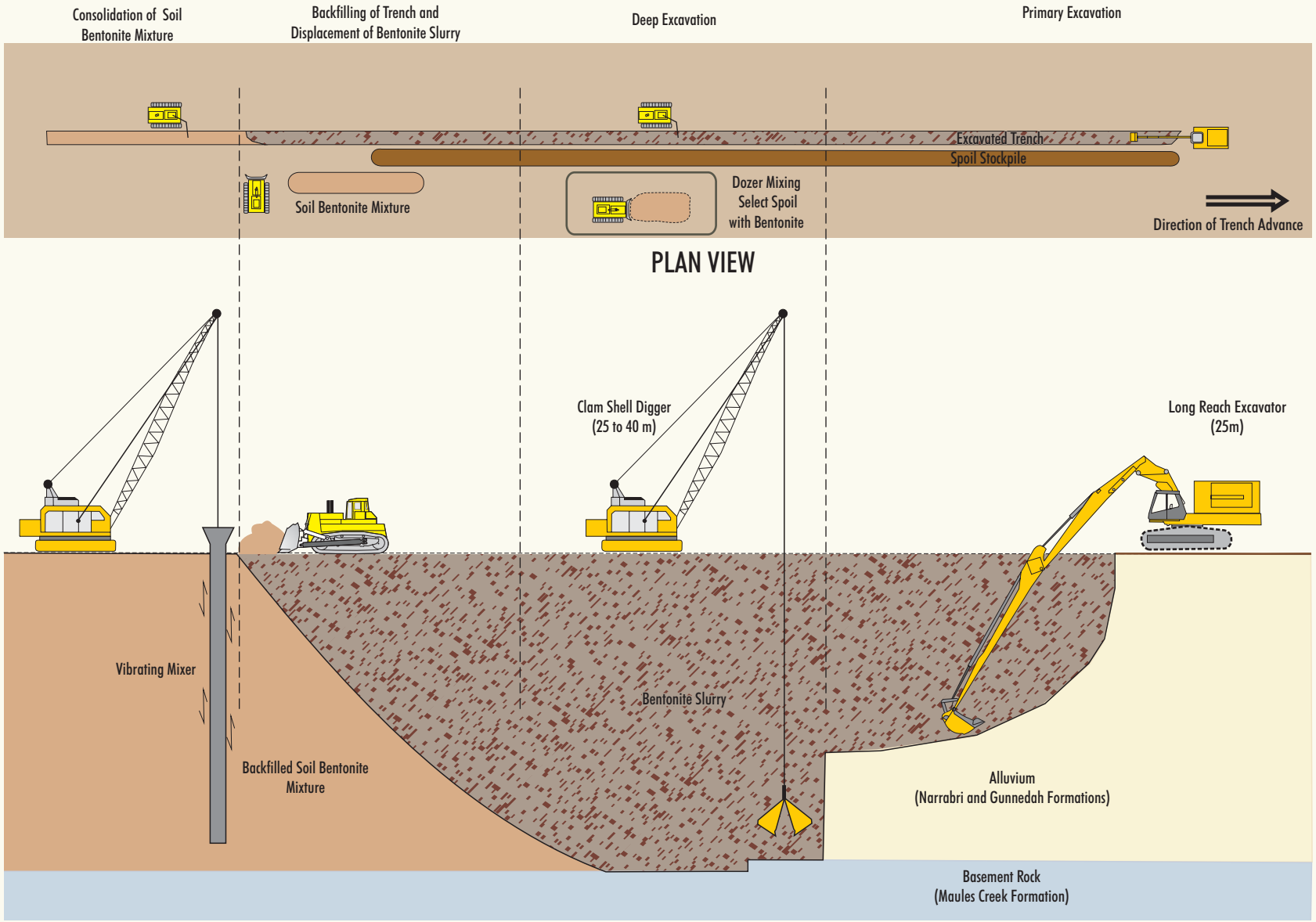


Source: After Allan Watson Associates (2011)

TARRAWONGA COAL PROJECT

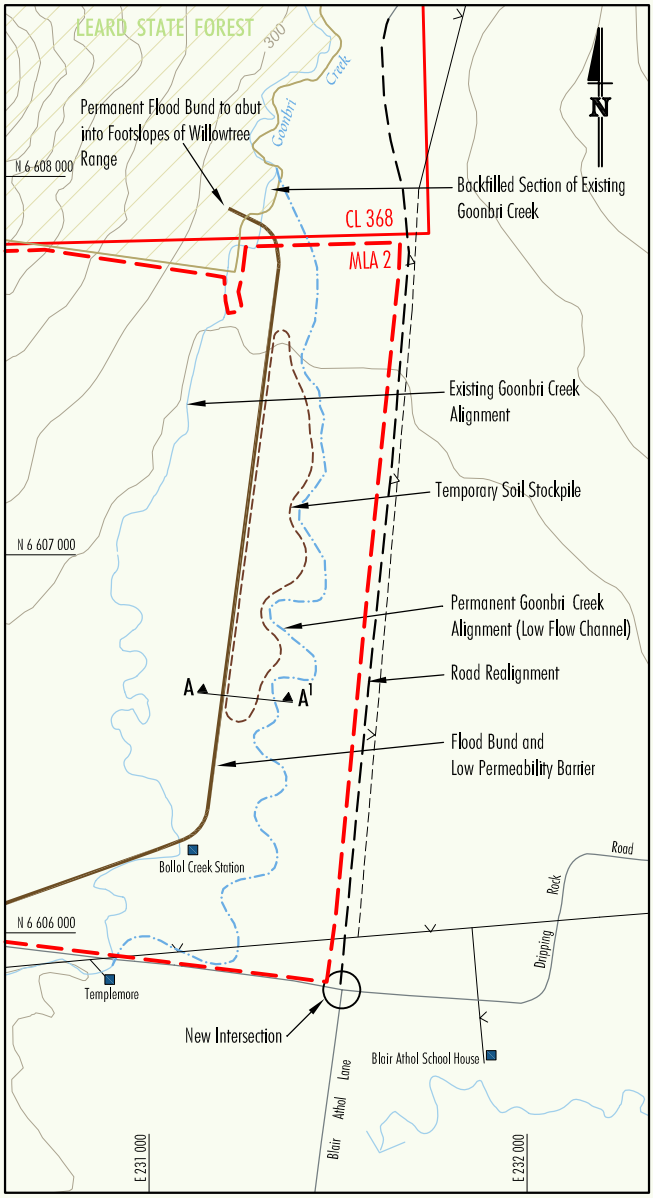
FIGURE 2-15

Low Permeability Barrier Construction Schematic

Resource Strategies

Tarrawonga Coal Pty Ltd

WHC-10-04 EA Sect 2_005C



LEGEND

- Mining Lease (CL & ML)
- Mining Lease Application Boundary (MLA)
- 11kV Electricity Transmission Line
- 11kV Electricity Transmission Line Realignment
- Leard State Forest
- Stream ≥ 3rd Order
- Mine-owned Dwelling

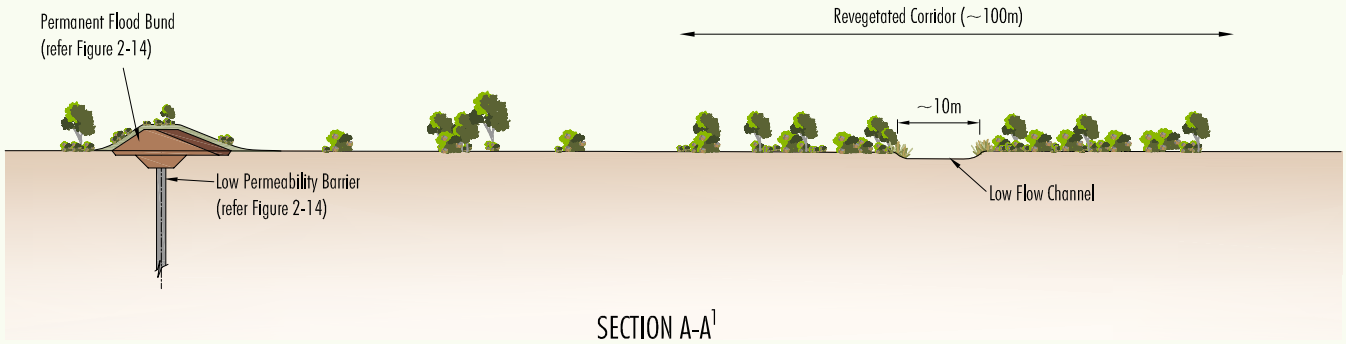
0 500

Metres

GRID DATUM MGA 94 ZONE 56

Source: Department of Lands (2010); Gilbert & Associates (2011) and Allan Watson Associates (2011)

PLAN
PERMANENT GOONBRI CREEK ALIGNMENT



SECTION A-A1

Not to Scale

TARRAWONGA COAL PROJECT

FIGURE 2-16

Permanent Goonbri Creek Alignment and Associated Flood Bund

Resource Strategies

Tarrawonga Coal Pty Ltd

The permanent flood bund would consist of an engineered clay fill core, which would be sub-excavated into the natural surface. Rock fill armouring would be placed on the eastern side of the clay fill core. The bund would then be topsoiled for revegetation.

For sections of the permanent flood bund running approximately east-west and parallel to internal haul roads, the height of the bund would be increased to 6 m as a noise mitigation measure (Section 4.6).

Further details regarding the design, function and construction of the permanent flood bund are provided in Appendices B and R.

Permanent Goonbri Creek Alignment

In approximately Year 15, open cut mining would progress through a 3 km section of Goonbri Creek. Prior to the open cut advancing into this section of the creek, the permanent Goonbri Creek alignment would be established to the east of the open cut, low permeability barrier and permanent flood bund (Figure 2-1).

The permanent Goonbri Creek alignment would be constructed to meet the following design objectives:

- construct a low flow channel that approximates the existing section of Goonbri Creek upstream of the Project in terms of stream geometry, hydrology and geomorphology;
- mimic the meandering path of the existing alignment of Goonbri Creek, such that the length of the permanent Goonbri Creek alignment is approximately the same length as the section of Goonbri Creek being removed;
- minimise the disturbance to the reaches of Goonbri Creek upstream of the permanent Goonbri Creek alignment; and
- provide a stable transition back to the existing Goonbri Creek alignment which results in no detectable change to the hydraulic conditions in the reaches of Goonbri Creek or the Bollol Creek floodplain area downstream.

Stages of construction would include:

- excavation to form the low flow channel in the upper (i.e. northern) portion of the permanent Goonbri Creek alignment;
- use of spoil from this excavation to form swales in the lower portion of the permanent Goonbri Creek alignment;
- placement of rock fill armouring and topsoil on the eastern embankment of the permanent flood bund;
- rock fill and woody debris placement to create a pool-riffle system within the low flow channel alignment;
- revegetation of the low flow channel and its banks; and
- revegetation of the surface of the permanent flood bund.

Once construction of the permanent Goonbri Creek alignment is completed and the revegetation has had time to become established, the northern end of the permanent flood bund would be constructed across the existing Goonbri Creek alignment. This would direct upstream surface water flows into the constructed low flow channel, thereby commissioning the permanent Goonbri Creek alignment. A small section of the existing Goonbri Creek alignment upstream of the permanent flood bund would also be backfilled (Figure 2-16).

Further details regarding the design, establishment and predicted performance (including environmental, hydrological and geomorphic considerations) of the permanent Goonbri Creek alignment are provided in Appendix B.

2.10.4 Water Consumption

The primary water use at the Tarrawonga Coal Mine is dust suppression on internal haul roads and at the coal crushing and screening facility. The existing water demand for dust suppression is estimated to be approximately 118 megalitres per annum (ML/annum), which is equivalent to approximately 0.3 ML/day on average.

In addition, water is required for washdown of mobile equipment and other minor non-potable uses, such as fire fighting.

The sources of water used at the Project would continue as per the existing Tarrawonga Coal Mine, and where practicable, would be supplied according to the following priority (excluding potable water supplies) (Appendix B):

1. Groundwater inflows to the open cut and associated dewatering.
2. Water storages containing runoff from active areas.
3. Water storages containing runoff from up-catchment areas.

4. Licensed groundwater extractions (i.e. Thuin production bore).

On-site water demand for dust suppression associated with coal crushing and screening would decrease once the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities commences (Section 2.5.1), as only the mobile crusher would continue to operate.

However, water demand for dust suppression on internal haul roads would increase for the Project, due to a commitment to increase watering rates to reduce air quality impacts (Appendix D) and increased haul road distances. Project average water demand for dust suppression is estimated to be 394 ML/annum (Appendix B).

Should sufficient water supply not be available for dust suppression on internal haul roads during extended dry periods, haul road watering would be supplemented with the use of chemical dust suppressants.

The water consumption requirements and water balance of the system would fluctuate with climatic conditions and as the extent of the mining operation changes over time.

2.10.5 Simulated Performance of Project Water Management System

A predictive assessment of the performance of the Project water management system (including supply and containment) is presented in Appendix B. The key findings of the assessment are summarised in Tables 2-3 and 2-4 including the predicted make-up requirements for the Project maximum production rates, water supply sources and storages for containment of mine water for a range of different climatic scenarios.

Table 2-3
Project Water Supply System Performance

	25%-ile Dry 17-Year Period	Average 17-Year Period	75%-ile Wet 17-Year Period
Inflows (ML/annum)			
Rainfall Runoff	325	402	480
Groundwater Inflow to Pit	255	255	255
Groundwater Production Bore (Thuin)	0	0	0
Outflows (ML/annum)			
Evaporation	118	130	141
Crusher Supply	8	8	8
Dust Suppression	389	394	399
Irrigation	64	125	193
Mine Water Spill to Environment	0	0	0

Source: Appendix B

^ Demand based on multiplying the total haul road length by width by evaporation rate (less rainfall) by a pan factor of 1.2 (to allow for higher evaporation). This demand takes priority over irrigation.

* Demand based on multiplying the partially rehabilitated catchment area by pan evaporation (less rainfall) multiplied by a factor of 0.5 (for crop factor and irrigation efficiency). However, if there is insufficient stored water available, the model preserves stored water for on-going haul road dust suppression and crusher use.

Table 2-4
Project Mine Water Containment System Performance

	50%-ile Median 17-Year Period	75%ile Wet 17-Year Period	95%-ile Wet 17-Year Period
Containment Storage (ML)			
Mine Water Dam	4.3 – 6.4	4.3 – 7.0	4.3 – 9.6
Mine Water Surge Dam	35 – 442	86 – 543	100 – 869
Mine Pit	0 – 2.2	0 – 2.4	0 – 168.3

Source: Appendix B

The results presented in Table 2-3 are based on the 25th, average and 75th percentile statistics over all 122, 17-year model simulated 'realisations'. Realisation 1 uses climatic data from 1889 to 1905; realisation 2 uses data from 1890 to 1906; and so on. The model records results on each day of each realisation and then ranks these to calculate 25th and 75th percentiles as well as averages.

2.11 INFRASTRUCTURE AND SERVICES

The existing infrastructure and services at the Tarrawonga Coal mine would continue to be used during the life of the Project, with upgrades and additions being undertaken progressively during the life of the Project.

2.11.1 Mine Facilities Area

The relocation of the mine facilities area to the south is described in Section 2.6.1.

2.11.2 Access Roads and Internal Roads

The primary access to the Project would continue to be via the section of the sized ROM coal road transport route north of Goonbri Road.

Wherever possible, existing internal roads would be used to service the Project facilities. New internal roads would be constructed progressively as required. The use of internal roads would generally be restricted to mine personnel.

2.11.3 Electricity Supply and Distribution

Electricity at the Project would continue to be supplied by on-site diesel-powered generators. The estimated diesel consumption to meet the maximum Project electricity supply requirements would be up to approximately 542 kilolitres (kL) per annum.

The existing electricity distribution system at the Tarrawonga Coal Mine would continue to supply power to the Project with minor upgrades and additions undertaken progressively during the life of the Project (i.e. during relocation of infrastructure and service facilities).

Power would be transferred either by overhead or underground cable where necessary. Standard electrical safety laws and practices would continue to apply.

2.11.4 Potable Water

Potable water for the Project would continue to be supplied and transported by a local contractor. The existing potable water supply system would continue to be used with upgrades and additions undertaken progressively during the life of the Project (i.e. during relocation of infrastructure and service facilities).

2.11.5 Communications

The existing communication systems at the Tarrawonga Coal Mine would be retained for the Project. The communications systems may be upgraded if improved services are made available in the region.

2.12 WASTE MANAGEMENT

The Project would generate waste streams that would be similar in nature to the existing operations at the Tarrawonga Coal Mine. The key waste streams would continue to comprise:

- waste rock and coarse rejects (as described in Sections 2.1.5 and 2.9);
- recyclable and non-recyclable general wastes;
- sewage and wastewater; and
- other wastes from mining and workshop related activities (e.g. used tyres and waste hydrocarbons).

General waste minimisation principles (i.e. reduce, re-use and recycle) would continue to be applied at the Project to minimise the quantity of wastes that require off-site disposal.

All general domestic waste (e.g. general solid [putrescibles] waste and general solid [non-putrescible] waste as defined in *Waste Classification Guidelines Part 1: Classifying Waste* [NSW Department of Environment and Climate Change (DECC), 2008]) and general recyclable products would continue to be collected by an appropriately licensed contractor. TCPL would maintain a register of waste collected by the licensed waste contractor.

Sewage and wastewater from on-site ablution facilities would continue to be collected and treated in the existing biocycle sewage treatment system (approved by Narrabri Shire Council) and serviced by a licensed waste disposal contractor on an as-needs basis. Treated effluent would continue to be irrigated at the existing small wastewater utilisation area.

Used tyres from mining equipment would continue to be stockpiled prior to being safely disposed of in the backfilled mine void as the open cut advances.

Waste hydrocarbons are currently collected, stored and removed by licensed contractors. The current collection and storage methods would be continued for the Project, and removal or waste hydrocarbons by licensed contractors would continue on a periodic (i.e. 3 month) basis.

2.13 MANAGEMENT OF DANGEROUS GOODS

The transportation, handling and storage of all dangerous goods at the Tarrawonga Coal Mine is conducted in accordance with the requirements of the *Storage and Handling of Dangerous Goods – Code of Practice 2005* (WorkCover, 2005) and this practice would continue for the Project.

Transport

Consistent with existing Tarrawonga Coal Mine operations, dangerous goods required for the Project would be transported in accordance with the appropriate State legislation.

Hydrocarbon Storage

Hydrocarbons used at the Tarrawonga Coal Mine include fuels (diesel and petrol), oils, greases, degreaser and kerosene.

Existing hydrocarbon storage facilities (including one 68,000 litre [L] capacity diesel storage tank and one 105,000 L capacity diesel storage tank located adjacent to the workshop at the mine facilities area) would continue to be operated in accordance with the requirements of Australian Standard (AS) 1940: *The Storage and Handling of Flammable and Combustible Liquids*. New/relocated Project hydrocarbon storage tanks would also comply with Australian standards.

Procedures have been developed at the Tarrawonga Coal Mine for the handling, storage, containment and disposal of workshop hydrocarbons (i.e. oils, greases, degreaser and kerosene) and would continue for the Project. Workshop hydrocarbon spills and leaks are also contained by a purpose-built oil/water separator which is inspected and maintained on a regular basis. Spill kits are, and would continue to be, maintained on the Project site.

Explosives Storage

No explosive materials are stored on-site at the Tarrawonga Coal Mine. Detonators, bulk explosives and explosive products (e.g. emulsion, prill and diesel) used for the Project would continue to be stored at the blasting contractor's compound, located off-site along the sized ROM coal road transport route.

Explosives required for the Project would include initiating products and detonators, ANFO and emulsion explosives. Explosives would be transported and used in accordance with the existing safety and operational procedures at the Tarrawonga Coal Mine.

Chemical Storages and Material Safety Data Sheets

The management and storage of chemicals at the Project would continue to be conducted in accordance with TCPL's prescribed management procedures, Australian Standards and codes.

No chemicals or hazardous material would be permitted on-site unless a copy of the appropriate Material Safety Data Sheet (MSDS) is available on-site or, in the case of a new product, it is accompanied by an MSDS.

2.14 WORKFORCE

Approximately 86 full-time on-site personnel (including TCPL employees and contractors) are employed at the Tarrawonga Coal Mine.

At full development, the proposed Project operational workforce would be in the order of 120 on-site personnel, including a mixture of direct TCPL employees and contractors.

The operational hours at the Project would generally be 24 hours a day, seven days a week.

Nominal Project start and finish shift times at full development would be as follows:

- Administration Personnel – 7.00 am to 5.00 pm weekdays.
- Mining Operations (Day) Personnel – 6.30 am to 7.00 pm.
- Mining Operations (Night) Personnel – 6.30 pm to 7.00 am.

The current shift arrangements for sized ROM coal transport by haulage contractors to the Whitehaven CHPP would be retained[4].

Construction/development activities (e.g. relocation of infrastructure areas and service facilities) would require an additional construction workforce of up to approximately 20 people for short periods. It is expected that construction/development activities would peak during Year 1 of the Project, but may be required throughout the life of the Project.

Construction/development activities would generally be restricted to daylight hours (i.e. 7.00 am to 6.00 pm).

[4] Project Year 1 only, or until approvals and upgrades are in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities (Section 2.5.1).