Environmental Assessment

Cadia East Project

SECTION 2

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2 PROJECT DESCRIPTION

2.1 EXISTING MINING OPERATIONS

The Project includes the proposed consolidation and replacement of existing Development Consents held by CHPL under Part 4 of the EP&A Act with a single Cadia Valley Operations Project Approval under Part 3A that includes Cadia East (Section 1). This sub-section provides a description of the existing/approved Cadia Valley Operations for background purposes, and as a requirement of the EARs.

The Cadia Valley Operations currently consist of Cadia Hill, Ridgeway and the Blayney Dewatering Facility (Figure 1-1). A summary of the key components of the existing/approved mining operations is provided in Table 2-1, with further detail provided in the following sub-sections.

2.1.1 Cadia Hill Mining Operations

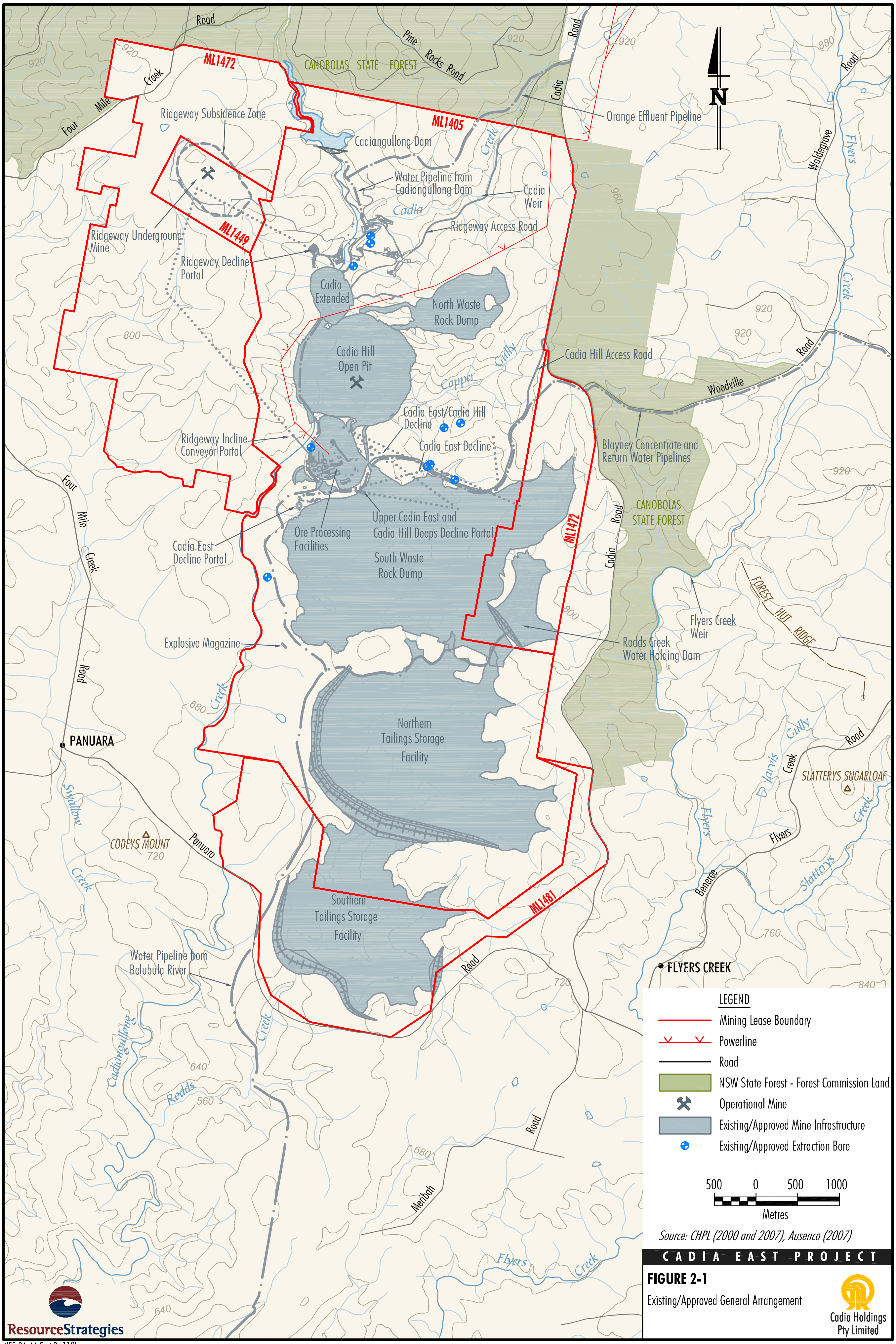
The Cadia Hill deposit is on average 400 metres (m) thick and is expected to have an average life of mine strip ratio of 1.4:1 (i.e. 1.4 t waste rock to 1 t ore). Prior to the commencement of mining, the orebody had a mining resource of approximately 273 Mt at a grade of 0.85 grams per tonne (g/t) gold and 0.18 percent (%) copper. Conventional open pit mining methods are used at Cadia Hill. An extension to the Cadia Hill open pit (Cadia Extended open pit [Cadia Extended]) was mined in 2003/2004 and has been backfilled with waste rock.

The planned maximum extent of the Cadia Hill open pit and associated infrastructure is shown on Figure 2-1. The final open pit would have dimensions of approximately 1,450 m by 1,350 m, with a surface disturbance area of approximately 150 ha. The final pit floor will be at approximately 235 m Australian Height Datum (AHD), which is approximately 480 m below the bed of Cadiangullong Creek.

Table 2-1
Summary of Currently Approved Cadia Hill and Ridgeway Operations

Project Component	Cadia Hill Gold Mine[1]	Ridgeway/Ridgeway Deeps Gold Mine[2]
Description	• Open pit gold/copper mine.	• Underground gold/copper mine.
Project Life	• Cadia Hill commenced operations in 1998 with an expected mine life of up 17 years (including Cadia Extended).	• Ridgeway commenced operation in 2003 with an expected mine life of approximately 18 years (including Ridgeway Deeps).
Tenements	• ML 1405.	• ML 1472, ML 1449, ML 1405, ML 1481 and ML 1482.
Mining Method	• Open pit mining method producing approximately 18 Mtpa of gold/copper ore.	• Underground mining operations (Ridgeway - sublevel caving, Ridgeway Deeps – block caving) producing approximately 6 Mtpa of gold/copper ore.
Waste Rock Management	• Deposition of approximately 430 Mt of waste rock in the North and South Waste Rock Dumps and Cadia Extended.	• Deposition of approximately 1.68 Mt of waste rock in North and South Waste Rock Dumps.
Ore Processing	• Cadia Hill ore processed in the low grade processing plant.	• Ridgeway ore processed in the high grade processing plant.
Tailings Storages	• Deposition of approximately 243 Mt of tailings in the NTSF.	• Deposition of approximately 96 Mt of tailings in the NTSF and STSF.
Product Handling	• Gold/copper concentrate transported from the ore processing facilities via a concentrate pipeline to the Blayney Dewatering Facility where the concentrate is dewatered and then transported by rail to the eastern seaboard.	• Product handling system as per Cadia Hill.
Water Supply	• Water supply sourced from the Cadiangullong Dam, Flyers Creek Weir, Cadia Creek Weir, Orange Sewage Treatment Plant, Blayney Sewage Treatment Plant, on-site groundwater extraction bores and site runoff.	• Existing Cadia Hill water supply supplemented by water sourced from the Belubula River and use of the Rodds Creek Water Holding Dam.

1 In accordance with Development Consent (DA 44/95) (as modified).
2 In accordance with Development Consent (DA 134-04-00) (as modified) and Development Consent (DA 257-10-2004) (as modified).



Source: CHPL (2000 and 2007), Ausenco (2007)

CADIA EAST PROJECT

FIGURE 2-1

Existing/Approved General Arrangement

Cadia Holdings Pty Limited

ResourceStrategies

NEC-06-66 Sect 2_119H

The Cadia Hill open pit fleet (2007) is shown in Table 2-2.

Table 2-2
2007 Cadia Hill Open Pit Fleet

Equipment	Number
CAT 793 Haul Trucks	19
Graders	3
Watercart	1
Shovels	2
Dozers	2
Front End Loader	1

Source: Appendix D.

Up to approximately 18 Mtpa of gold/copper ore is transported from the open pit via haul truck to the ore processing facilities (Section 2.1.6). The Cadia Hill ore is processed in the low grade processing plant. Cadia Hill surface infrastructure includes administration buildings, workshop, fuel storage facilities, ablution facilities, and crib facilities.

The existing primary crusher is used to crush ore received from Cadia Hill. Primary crushed ore is transported from the crusher via a conveyor to the low grade coarse ore stockpile. The primary crushed ore is then reclaimed and transported via another conveyor, with a portion going to the mobile secondary crusher and a portion going directly to the low grade processing plant for processing. The secondary crushed ore is stockpiled before being transported to the low grade processing plant.

Cadia Hill is approaching the end of its mine life, with mining currently scheduled to cease in 2013. Only relatively minor amounts of waste rock are anticipated to be removed from the open pit during the remainder of the mine life (i.e. less than 2 Mt).

2.1.2 Ridgeway and Ridgeway Deeps Mining Operations

The top of the Ridgeway deposit is located approximately 500 m below the surface and has approximate dimensions of 450 m east-west, 250 m north-south and extends approximately 1,000 m below the surface.

Prior to the commencement of mining the orebody had a mining resource of approximately 96 Mt of ore at a grade of 2.47 g/t gold and 0.71% copper.

Ridgeway is located approximately 2.5 km to the north-west of Cadia Hill (Figure 2-1). Ridgeway currently uses sublevel caving mining methods, however block caving mining methods would be used from 2009 as mining transitions into the deeper sections known as Ridgeway Deeps. Ridgeway and Ridgeway Deeps are herein referred to as Ridgeway.

The caving mining method has resulted in the fracture and subsidence of rock overlying the underground workings. At the end of the Ridgeway mine life, the surface subsidence area would resemble a dish-shaped depression surrounded by steep, but stepped, slopes on the margins.

The planned maximum extent of the Ridgeway subsidence zone is shown on Figure 2-1.

Relatively little waste rock is generated at Ridgeway when compared with Cadia Hill (i.e. less than 0.3 Mtpa). This material either remains underground or is placed in the South Waste Rock Dump (Figure 2-1).

Further detail of the current Cadia Valley Operations waste rock management system is provided in Section 2.1.5.

Up to approximately 6 Mtpa of Ridgeway ore is processed in the high grade processing plant. Primary crushing is undertaken underground and secondary crushing on the surface. Primary crushed ore is transported to the surface via the Ridgeway incline conveyor and stored in the high grade coarse ore stockpile. The primary crushed ore is reclaimed, transported via conveyor to the secondary crusher and crushed. The secondary crushed ore is then transported to the high grade processing plant.

Ridgeway surface infrastructure includes a decline portal, hardstand areas, contractor's area, mine workshops, general stores building, fuel storage facility, and administration and ablution facilities.

Ridgeway is currently scheduled to cease operations in 2017.

2.1.3 Underground Exploration Activities

Cadia East Exploration Decline

Development of the Cadia East exploration decline (Figure 2-1) commenced in May 2005 to allow underground drilling, bulk sampling and access to ventilation shafts. Ventilation infrastructure that has been installed includes the VR1, VR3A, VR4, VR5 and VR6 ventilation shafts.

Development of the Cadia East exploration decline and underground exploration drilling programme is ongoing and is expected to continue throughout the Project life. Activities would include:

- further horizontal development to allow drilling and bulk sampling of the southern and eastern sides of the Cadia East underground orebody;
- additional vertical development to extend the ventilation system; and
- further extension of the decline below the base of Lift 1 to enable drilling and bulk sampling of the Cadia East deposit at depth.

Upper Cadia East and Cadia Hill Deeps Exploration Decline

Underground exploration of the Upper Cadia East and Cadia Hill Deeps area commenced in late 2008. This programme is designed to improve the geological, geotechnical and metallurgical knowledge of the upper portion of the Cadia East orebody. The programme involves the construction of a second decline, drilling, bulk sampling and other works (i.e. construction of ventilation shafts).

CHPL commenced the Upper Cadia East and Cadia Hill Deeps exploration decline (Figure 2-1) in December 2008.

2.1.4 Surface Exploration Activities

CHPL periodically undertakes campaigns of surface exploration throughout its mining leases using conventional drilling techniques in order to provide additional resource definition in accordance with NSW Department of Primary Industries – Mineral Resources (DPI-MR) approvals. A resource development team is located on-site, with the aim of identifying potential economic resources on-site and providing better definition of known resources. Surface exploration activities would continue over the life of the Project.

2.1.5 Waste Rock Management

The Cadia Valley Operations Waste Rock Management strategy was developed to allow CHPL to achieve the waste rock management objectives described in the *Cadia Gold Mine Environmental Impact Statement* (Cadia Hill EIS) (Newcrest, 1995) (i.e. segregation and encapsulation of potentially acid forming [PAF] materials).

The current waste rock and low grade ore categories and the management strategies for each are as follows:

- ***Blue waste*** – managed as non-acid forming (NAF); identified by ore control as having a modelled total sulphur content that is less than 0.5%.
- ***Pink waste*** – managed as PAF; identified by ore control as having modelled total sulphur content that is greater than or equal to 0.5%.
- ***Yellow*** – stockpiled, low grade mineralised ore to be reclaimed.
- ***Green*** – stockpiled mineralised waste rock with current sub-economic gold/copper content. This material may or may not be reclaimed for processing before the end of the mine life; is mineralised and managed as PAF.

Low grade ore and mineralised waste (i.e. Yellow and Green materials) are placed in accessible parts of the South Waste Rock Dump for reclamation. Blue waste rock would be used as construction material in the future (e.g. raising of the tailings storage facilities). Pink waste is encapsulated with a combination of a low permeability layer and a cover of Blue waste material over each layer of Pink waste material. The cover system is designed to reduce oxygenation and infiltration rates.

The majority of the 430 Mt of waste rock material produced over the life of Cadia Hill is placed in mine waste rock dumps (i.e. North Waste Rock Dump and South Waste Rock Dump) (Figure 2-1), with smaller amounts placed in Cadia Extended and some benign waste rock used for construction purposes. Only minor amounts of waste rock are required to be extracted from remaining open pit operations.

The North Waste Rock Dump has a surface disturbance area of approximately 60 ha and extends to approximately 890 m AHD in height (up to approximately 30 m above the natural surface level). Deposition of waste rock into the North Waste Rock Dump has ceased and rehabilitation has commenced.

The approved South Waste Rock Dump has a surface disturbance area of approximately 450 ha and extends to approximately 880 m AHD in height (approximately 100 m above the natural surface level).

2.1.6 Ore Processing Facilities

The existing ore processing facilities have a combined maximum design capacity of up to approximately 24 Mtpa. The ore processing facilities comprise a low grade processing plant (approximately 18 Mtpa design capacity) for processing ore from Cadia Hill and a high grade processing plant for processing ore from Ridgeway (approximately 6 Mtpa design capacity).

Ore from Cadia Hill and Ridgeway is temporarily stockpiled adjacent to the ore processing facilities.

The low and high grade processing plants use flotation cells to produce a gold/copper concentrate slurry (i.e. no cyanide is used during processing). The gold/copper concentrates are then combined in a concentrate thickener and pumped via a buried concentrate pipeline to the Blayney Dewatering Facility (Figure 2-1) (Section 2.1.8).

2.1.7 Tailings Management

Tailings from the existing ore processing facilities are deposited in the NTSF and STSF (Figure 2-1).

The tailings are delivered via a pipeline and are peripherally discharged using sub-aerial tailings deposition techniques. The approved embankment crest level for the existing NTSF and the STSF are 741 m AHD (or approximately 92 m above natural ground surface) and 682 m AHD (or approximately 70 m above natural ground surface), respectively. The approximate approved surface areas are 535 ha and 300 ha for the NTSF and STSF, respectively.

Tailings are currently deposited into the NTSF and STSF at a rate of up to approximately 24 Mtpa.

2.1.8 Blayney Dewatering Facility

The Blayney Dewatering Facility is located approximately 25 km to the east of the Cadia Valley at the town of Blayney (Figure 1-1). The gold/copper concentrate slurry is pumped via a buried concentrate pipeline to the Blayney Dewatering Facility, where it is dewatered using a vertical plate pressure filter press and stockpiled within the facility.

A front-end loader is used to load the dewatered concentrate from the stockpiles into containers for rail transport. A forklift transfers the filled containers from the load-out area to hardstand areas, and then onto rail wagons for transport by rail to Port Kembla on the eastern seaboard. Approximately three trains per week are currently used for concentrate transport.

2.1.9 Water Management System

The Cadia Valley Operations water management system currently includes the following main components:

- Tailings storage facilities return water system including the Central Pumping Station;
- process water pond;
- NTSF and STSF;
- sediment dams and ponds containing site runoff;
- waste rock dump leachate ponds;
- return water from the Blayney Dewatering Facility;
- Cadia Hill open pit (dewatering);
- Ridgeway/Ridgeway Deeps underground mine (dewatering);
- Cadia East and Cadia Hill Deeps exploration declines (dewatering);
- Orange Sewage Treatment Plant treated effluent (delivered to site via a pipeline owned by Orange City Council [OCC]);
- Blayney Sewage Treatment Plant treated effluent (delivered via a pipeline from the Blayney Sewage Treatment Plant to the Blayney Dewatering Facility, which is owned by Blayney Shire Council [BSC]; and the Blayney return water pipeline, which is owned by CHPL);
- Cadiangullong Dam;
- Cadia Creek Weir (gravity fed to Cadiangullong Dam);
- on-site groundwater extraction bores (potable water, and process water under exceptional circumstances);
- Belubula River pumping system;
- Rodds Creek Water Holding Dam, which holds water pumped from the Belubula River (maximum annual licensed quantity of 7,205 megalitres [ML]) and other sources listed above as required; and
- Flyers Creek Weir.

Water management during construction and operational phases is described in the Integrated Erosion and Sediment Control Plan (IESCP) (CHPL, 2007a).

2.1.10 Water Supply

The Cadia Valley Operations water supply scheme comprises recycling of water used on-site and make-up water required to compensate for losses in the system. Mine water, excess water in the tailings storage facilities and return water from the Blayney Dewatering Facility are recycled. Make-up water sources comprise extraction from the Belubula River, Cadiangullong Dam, Flyers Creek Weir, Cadia Creek Weir, Orange Sewage Treatment Plant treated effluent, Blayney Sewage Treatment Plant treated effluent, on-site groundwater extraction bores and site runoff.

A summary of the main components of the existing scheme is provided below, with further detail contained in Appendix F.

Water Recycling

The majority of water on-site is recycled. The systems include:

- recycled water from the tailings thickeners in the low and high grade processing plants;
- recycled water from the tailings storage facilities;
- return water from the Ridgeway workings and the Cadia East and Cadia Hill Deeps exploration declines;
- treated effluent from the on-site wastewater treatment plant; and
- recycled water recovered from the filtration process at the Blayney Dewatering Facility.

During 2007-2008, of the total water demand for the Cadia Valley Operations of 41,450 ML, up to approximately 34,010 ML (approximately 82%) was recycled. The remainder (7,440 ML) was lost from the system. Major water losses across the Cadia Valley Operations generally include (CHPL, 2008a):

- tailings entrainment – moisture held within the tailings once it has consolidated;
- evaporation and rewetting – evaporation during consolidation and losses that occur when tailings are deposited on a dry tailings surface;
- evaporation from ponded water – evaporation from the tailings storage facilities decants and the Rodds Creek Water Holding Dam;
- open pit mining – water used for dust suppression on haul roads; and
- underground mining – losses from the ventilation system.

Belubula River

CHPL has 7,205 ML of licensed entitlements on the Belubula River. Of this, 4,080 ML are regulated General Security Entitlements (GSE), and 3,125 ML are held as unregulated High Security Entitlements (HSE). The GSE are subject to the NSW Department of Water and Energy's (DWE) allocation announcements, with the water being released from Carcoar Dam. The HSE is taken from unregulated "off allocation" flow that enters the Belubula River downstream of Carcoar Dam. CHPL is licensed to take this water subject to the conditions of its licence, which include minimum "end of system" flow levels at the downstream end of the Belubula River (i.e. Helensholme gauging station).

During the financial year 2007-2008, the overall extraction from the Belubula River was 806 ML of GSE, 326 ML of HSE and 418 ML of temporary transfers from other high security licence holders.

Cadiangullong Dam

Cadiangullong Dam was constructed following the approval of the Cadia Hill EIS (Newcrest, 1995) and has a capacity of approximately 4,200 ML. The dam was constructed in 1997/1998 using roller compacted concrete techniques. Cadiangullong Dam is used to harvest water from Cadiangullong Creek. Cadia Hill Development Consent (DA 44/95) conditions include provisions for the maintenance of flows in Cadiangullong Creek downstream of the dam.

Harvesting of water on-site (including Cadiangullong Creek, Flyers Creek, Cadia Creek, Rodds Creek and Copper Gully) is subject to an annual cap of 4,200 megalitres per annum (ML/annum).

Flyers Creek Weir

Flyers Creek Weir was assessed and approved in the Cadia Hill EIS (Newcrest, 1995), but was not constructed until 2004 (Figure 2-1). Water is drawn to a fixed pumping station located adjacent to the weir through a low velocity intake installed in the floor of the weir. The weir allows extraction of water from Flyers Creek when flows in the creek are above 3.5 megalitres per day (ML/day).

Cadia Weir

A small weir on Cadia Creek is also used to harvest water (Figure 2-1). This water is gravity fed to Cadiangullong Creek Dam via a pipeline.

Orange and Blayney Treated Effluent

Treated effluent is sourced from OCC and BSC via a pipeline from the Orange Sewage Treatment Plant and the Blayney return water pipeline (with a take-off from the Blayney Sewage Treatment Plant), respectively.

During the financial year 2007-2008, approximately 3,465 ML of treated effluent was sourced from Orange and 335 ML from Blayney.

On-site Groundwater Extraction Bores

Ten groundwater extraction bores have been installed within the mining leases. The locations of these bores are shown on Figure 2-1. The borefield is permitted for use as a potable water supply, and is also currently permitted for use as process make-up water under exceptional circumstances (e.g. periods of prolonged drought), as determined by the Director-General of the DoP, in accordance with the Cadia Hill Development Consent (DA 44/95).

Improvements in the Water Management System

The Central West of NSW has experienced below average rainfall for several years from the mid-2000s, which has resulted in drought conditions. At the Cadia Valley Operations the drought has meant that on-site dam levels in 2006, 2007 and 2008 have been critically low and opportunities for harvesting water from licensed sources have been limited.

In 2007, CHPL sought to augment its water supply by sourcing additional water. This included obtaining water from the Icely Road quarry and Gosling Creek reservoir near Orange, the purchase and extraction of water available for temporary transfer from the Belubula River and obtaining surplus water from Central Tablelands Water at Blayney.

CHPL has also implemented various measures to increase the efficiency of water use on-site including:

- reducing water loss by increasing the density of tailings reporting to the tailings storage facilities;
- decreasing the amount of water used for dust suppression via the use of a surfactant in water trucks;
- storage of excess water from the tailings storage facilities in Rodds Creek Water Holding Dam instead of on the tailings storage facilities themselves (resulting in reduced water loss due to evaporation);
- improving the pumping efficiency of the Flyers Creek Weir and the Belubula River extraction point (i.e. improved operational controls to take better advantage when CHPL is authorised to pump);
- trialling various of products to reduce evaporation on the tailings storage facilities and water storage dams; and
- storage of treated effluent and return water from the Blayney Dewatering Facility in the Rodds Creek Water Holding Dam.

2.1.11 Infrastructure and Services

The Cadia Valley Operations has extensive existing infrastructure to support the Cadia Hill and Ridgeway operations. A summary of the existing infrastructure is provided in Table 2-3.

2.1.12 Environmental Management and Monitoring

The Cadia Valley Operations has an extensive existing environmental management and monitoring regime. A summary of the existing environmental management and monitoring regime is provided in Table 2-4. The relevant monitoring sites are shown on Figure 2-2.

Table 2-3
Summary of Existing Cadia Valley Operations Infrastructure

Mining Lease	Infrastructure Type	Description
1405	Major Infrastructure	• Ore processing facilities (including low and high grade processing plants) and associated infrastructure. • Cadia Hill administration buildings. • Ridgeway administration buildings. • Emergency response building. • Training centre. • Carparks. • Concrete batch plant.
	General Mining	• Cadia Hill open pit. • Cadia Extended (now backfilled). • Ridgeway decline and conveyor incline boxcuts and portals. • Ventilation raises (VR1, VR3A, VR4, VR5 and VR6). • North Waste Rock Dump. • South Waste Rock Dump. • NTSF. • STSF. • Ridgeway workshop. • Ridgeway stores. • Cadia Hill workshop. • Cadia Hill crib room. • Cadia Hill store. • Cadia Hill laydown areas. • Ridgeway diesel storage and dispensing facilities. • Cadia Hill diesel storage and dispensing facilities. • Bulk emulsion plant. • Explosive magazine. • Contractor workshops. • Contractor laydown areas. • Tailings storage facilities lift office buildings.
	Water Management	• Cadiangullong Dam. • Copper Gully Dam. • Hoares Creek Dam. • Cadia Creek Weir. • Process water pond. • Site runoff pond. • Sediment ponds. • Waste rock dump leachate ponds. • Tailings drainage collection ponds. • Belubula River pipeline. • Rodds Creek Water Holding Dam pipeline. • Tailings pipeline. • Central tailings pumping station. • Tailings return pumping station.

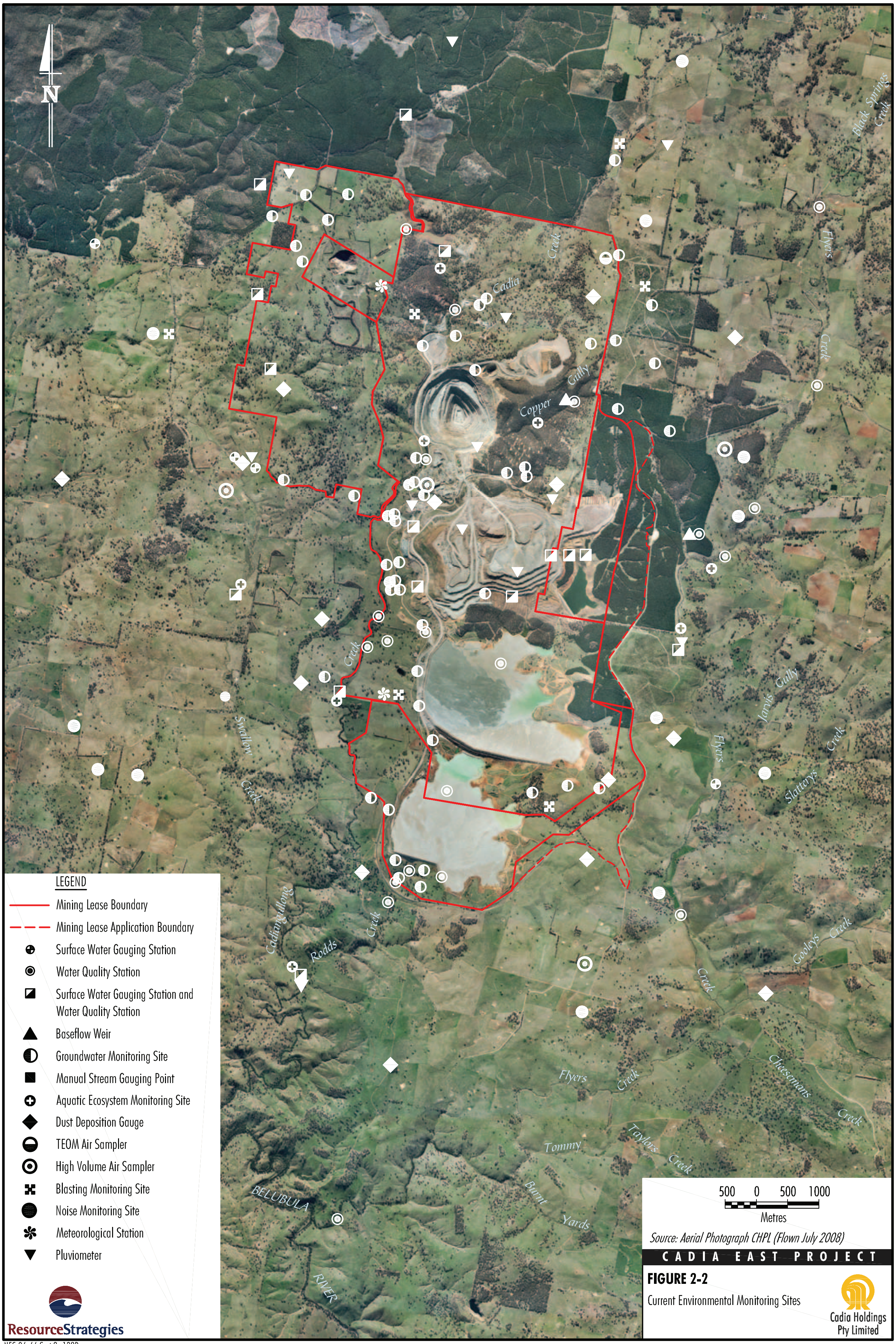
Table 2-3 (Continued)
Summary of Existing Cadia Valley Operations Infrastructure

Mining Lease	Infrastructure Type	Description
1405 (continued)	Water Management (continued)	• Orange treated effluent delivery sump (dissipation pit). • Blayney return water tank. • Fire-water tanks. • Sewage treatment plant. • Sewage ponds. • Small farm dams.
	Roads	• Cadia Hill access road. • Ridgeway access road. • Haul roads. • Tailings storage facilities access roads. • Water supply dam access roads.
	Exploration	• Cadia East exploration decline portal and boxcut. • Cadia East administration building. • Cadia East workshop. • Core farms and processing area. • Upper Cadia East and Cadia Hill Deeps decline portal and boxcut.
	Miscellaneous	• Cadia Hill gate security building. • Storage sheds. • Electricity substation. • Powerlines. • Communication towers. • Switching station.
1449	General Mining	• Ridgeway subsidence zone. • Ventilation raises (VR1 to VR4, VR6 and VR7).
	Roads	• Ventilation service roads.
	Water Management	• Fire-water tanks.
	Miscellaneous	• Helipad.
1472	General Mining	• Ridgeway subsidence zone. • South Waste Rock Dump.
	Water Management	• Rodds Creek Water Holding Dam. • Rodds Creek Water Holding Dam pipeline. • Belubula River pipeline.
	Miscellaneous	• Biosolids stockpile. • Farm quarry. • Airstrip.
1481	General Mining	• STSF. • Tailings embankment lift laydown area.
	Water Management	• Sediment control dams. • Seepage control dams and pumping station. • Rodds Creek Water Holding Dam pipeline. • Belubula River pipeline.
	Miscellaneous	• Tailings storage facilities rehabilitation trial area.

Source: After CHPL (2008b).

Table 2-4
Summary of the Cadia Valley Operations Environmental Management and Monitoring Regime

Environmental Aspect	Environmental Management Documentation	Environmental Monitoring
Land Resources	• Land Management Plan (LMP) • Farm Management Plan (FMP) • Bushfire Management Plan (BMP)	• Meteorology – Meteorological Stations (SLB and Ridgeway) and Pluviometers/Rain Gauges (PV1A, PV2A, PV3, PV5, PVCP, PVDC, PVFC, PVLO, PVRO, 412701 and 412702). • Weeds – all CHPL-owned land. • Geotechnical monitoring – vicinity of the Cadia Hill open pit and Ridgeway subsidence zone on 'Turnbridge Wells'.
Surface Water	• Water Management Plan • IESCP	• Water quality – 412144, 412147, 412161, 412167, 412168, 412702, CAWS2, CAWS10, CAWS17, CAWS18, CAWS30, CAWS31, CAWS33, CAWS34, CAWS35, CAWS36, CAWS37, CAWS41, CAWS42, CAWS43, CAWS44, CAWS45, CAWS47, CAWS48, CAWS49, CAWS50, CAWS52, PKLeach1, PKLeach4, PKLeach5, PKLeach6, DCBW1, SCBW2, SCBW3, NEC061, NEC062, POT001 to POT034 and SROP. • Surface Water Flow – 412080, 412144, 412147, 412161, 412166, 412167, 412168, 412700, 412701, 412702, DCBW1, SCBW2, SCBW3, CGBW, WBW, NLEACH, SLEACH, PKLeach1, PKLeach4, PKLeach5, PKLeach6. • Structural integrity of sediment dams – CD11, CD13 to CD15, CD18, CD20, CDHT, CDGL, SB4a, SB10, SB12 to SB15, CP2, HC, CS, R2, R3, SROP, NLD, SLD, AR1 to AR5, H19 and T6.
Groundwater	• Water Management Plan	• Groundwater quality – CB series (6A), MB series (1 – 11A, MB17, MB18, MB19A, MB20-25, MB26B, MB27, MB28-29B, MB30, MB44B, MB48 and MB49). • Groundwater level – Brown 3, RO series (RO6A, RO7, RO10A, RO11, RO12), RB Series (1-7), MB series (MB1B, MB3B, MB4B, MB5B, MB6B, MB7B, MB8B, MB9B, MB10B, MB11B, MB19B, MB26A, MB28A, MB29A, MB44A, MB45, MB46 and MB47). • Groundwater extraction – CB3, CB6, CB8, CB9, RE001, RE002, RE004 and RH641.
Air Quality	• Dust Management Plan (DMP)	• Dust deposition – DGCP1, DG4C, DG4D, DG5, DG8, DG9A, DG12A, DG15, DG16A, DG17 to DG19, DG20A, DG25, DG28 and DG29. • TSP – HVAS1, HVAS2 and HVAS3. • PM_{10} – TEOM.
Noise and Vibration	• Noise Management Plan (NMP) • Blasting and Vibration Management Plan (BVMP)	• Attended and unattended noise – 'Mayfield', 'Endsleigh Park,' 'Argyle', 'Mount Arthur', 'Triangle Flat', 'Triangle Park', 'Barton Park', 'Bonnie Glen', 'Mayburies', 'Eastburn', 'Northwest', 'Southlog', 'Warrengong' and Blayney (various locations). • Vibration and sound over-pressure – Chimney, Engine house, Southern Lease Boundary, 'Cornwall', 'Barton Park', 'Coorabin' and 'Wire Gully'.
Aboriginal Cultural Heritage	• Heritage Management Plan	• Monitoring and recording undertaken as required.
European Cultural Heritage	• Heritage Management Plan • Cadia Interpretation Plan	• Vibration and sound over-pressure – Chimney and Engine house.
Flora and Fauna	• Flora and Fauna Management Plan (FFMP) • LMP	• Rehabilitation monitoring – rehabilitation areas. • Biological monitoring – CVOCC1 to CVOCC4, CVOGC1, CVOFC1, CVOFC2 and CVOSC1.
Visual	• Lighting Management Plan	• Monitoring undertaken on a complaints basis.
Waste	• Waste Management Plan (WMP)	• Weekly inspections undertaken across site.



CADIA EAST PROJECT

FIGURE 2-2

Current Environmental Monitoring Sites

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CHPL's environmental management regime is documented in a number of plans, including:

- Site Management Plan;
- LMP;
- Water Management Plan;
- FFMP;
- Mine Closure Plan;
- NMP;
- BVMP;
- DMP;
- IESCP;
- BMP;
- Lighting Management Plan;
- Heritage Management Plan;
- Cadia Interpretation Plan; and
- WMP.

2.2 MINERAL RESOURCE

The Cadia Hill, Ridgeway and Cadia East deposits occur as mineralised zones within Ordovician-aged volcano-intrusive complexes of the eastern Lachlan Fold Belt of NSW.

The Cadia East deposit occurs immediately east of the Cadia Hill open pit. The mineralisation occurs near the surface in the western portion (i.e. near the Cadia Hill open pit), and plunges towards the east to be more than 1,000 m below the surface towards the ML 1405 boundary. The deposit is overlain by a cover sequence of up to 200 m of Silurian shale and sandstone. Various generations of faults are present throughout the deposit the most prevalent being numerous steep pyrite – sericite faults and several moderate to flatly dipping late carbonate thrusts. A major thrust (the Gibb fault) separates Cadia Hill from Cadia East.

The Cadia East mineralisation is generally defined by an upper disseminated chalcopyrite (copper-rich) section and a deeper quartz vein hosted (gold-rich) section. The majority of the mineralisation is hosted in Ordovician Forest Reefs Volcanics, with some monzonite intrusives at depth. The main sulphide mineral species are chalcopyrite, pyrite, bornite and molybdenite.

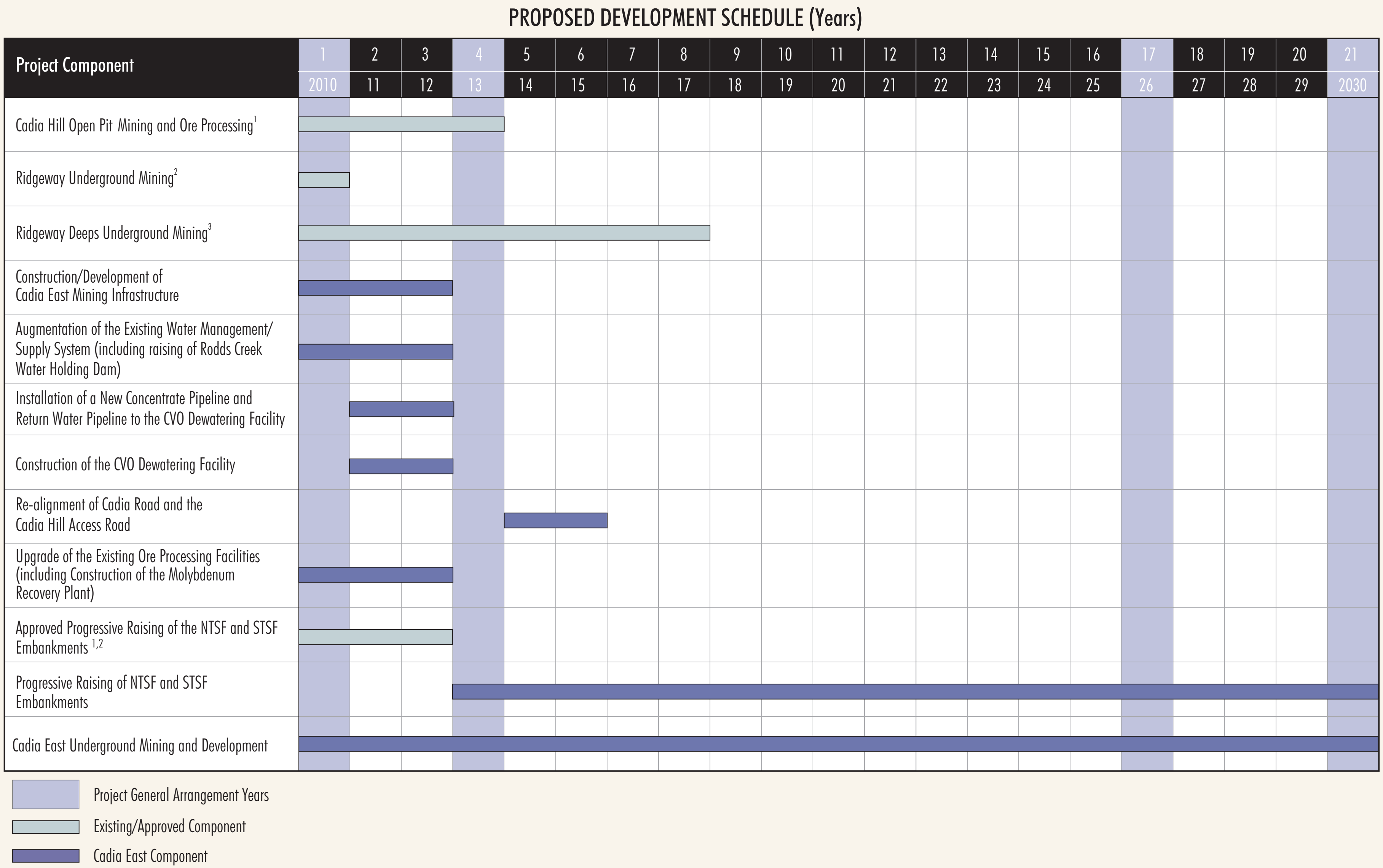
The Cadia East deposit has a mining reserve of approximately 828 Mt of ore at a grade of 0.60 g/t gold, 0.32% copper and 0.014% molybdenum, with contained metal of 15.8 million ounces of gold and 2.68 Mt of copper.

2.3 PROJECT GENERAL ARRANGEMENT

Figure 2-3 shows the proposed development schedule for the Project and integration with the approved Cadia Valley Operations. The layout (general arrangement) of the Project has been designed to use the existing Cadia Valley Operations infrastructure (Section 2.1) where practicable. Project general arrangements for Years 1, 4, 17, and the end of mine life are shown on Figures 2-4a to 2-4d, respectively. Year 1 corresponds to 2010, Year 4 to 2013 and Year 17 to 2026. These general arrangements show the progressive development of the Project over time.

The key Project extensions to the approved Cadia Valley Operations would include:

- underground mining of the Cadia East deposit using a panel caving mining method at a rate of up to 27 Mtpa and the development of an associated 255 ha subsidence zone above the underground mining area;
- development of underground crushing, handling and incline conveyor systems to transfer ore and waste rock mined from the Cadia East orebody to the Cadia Valley Operations ore processing facilities;
- development of supporting infrastructure for the underground mine including multiple ventilation shafts, personnel and equipment access systems;
- upgrade of the existing Cadia Valley Operations ore processing facilities and associated stockpiles and materials handling equipment to accommodate the harder ore from Cadia East and enable a total Cadia Valley Operations ore processing rate of up to approximately 27 Mtpa;



[1] In accordance with Development Consent (DA 44/95) (as modified).
[2] In accordance with Development Consent (DA 134-04-00) (as modified).
[3] In accordance with Development Consent (DA 257-10-2004) (as modified).

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Source: CHPL (2008)

CADIA EAST PROJECT

FIGURE 2-3
Proposed Development Schedule

Cadia Holdings Pty Limited

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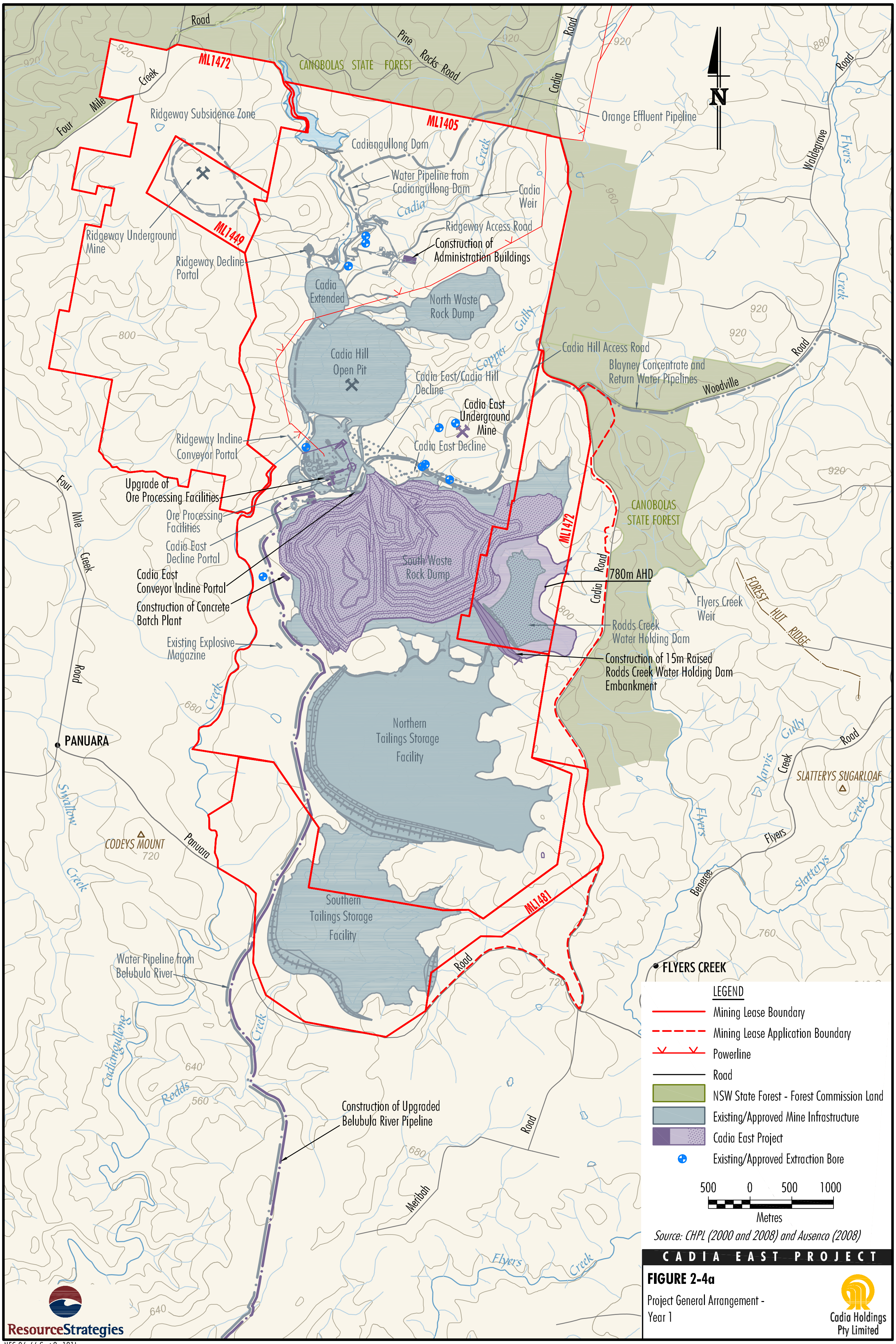

FIGURE 2-4a
Project General Arrangement - Year 1

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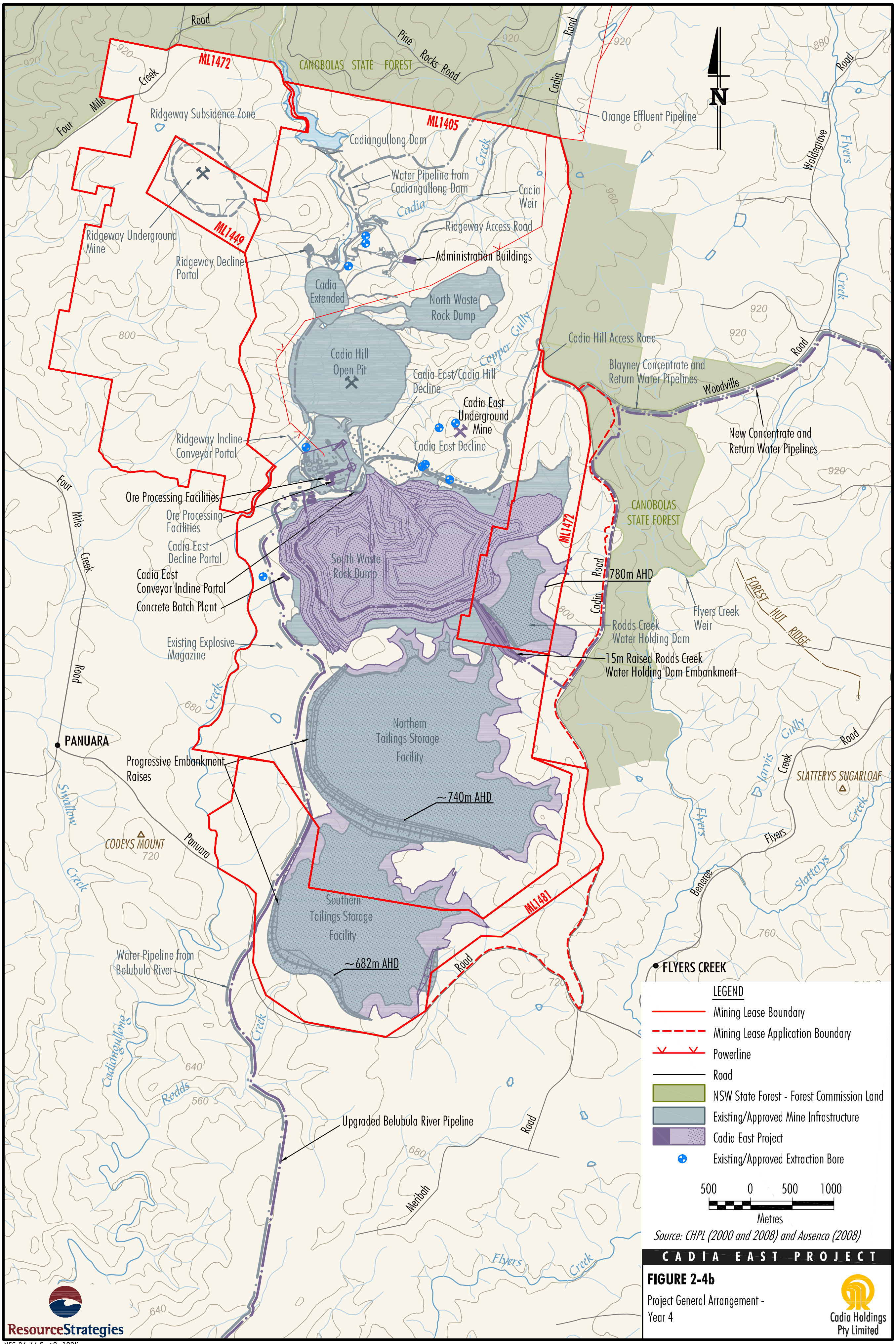
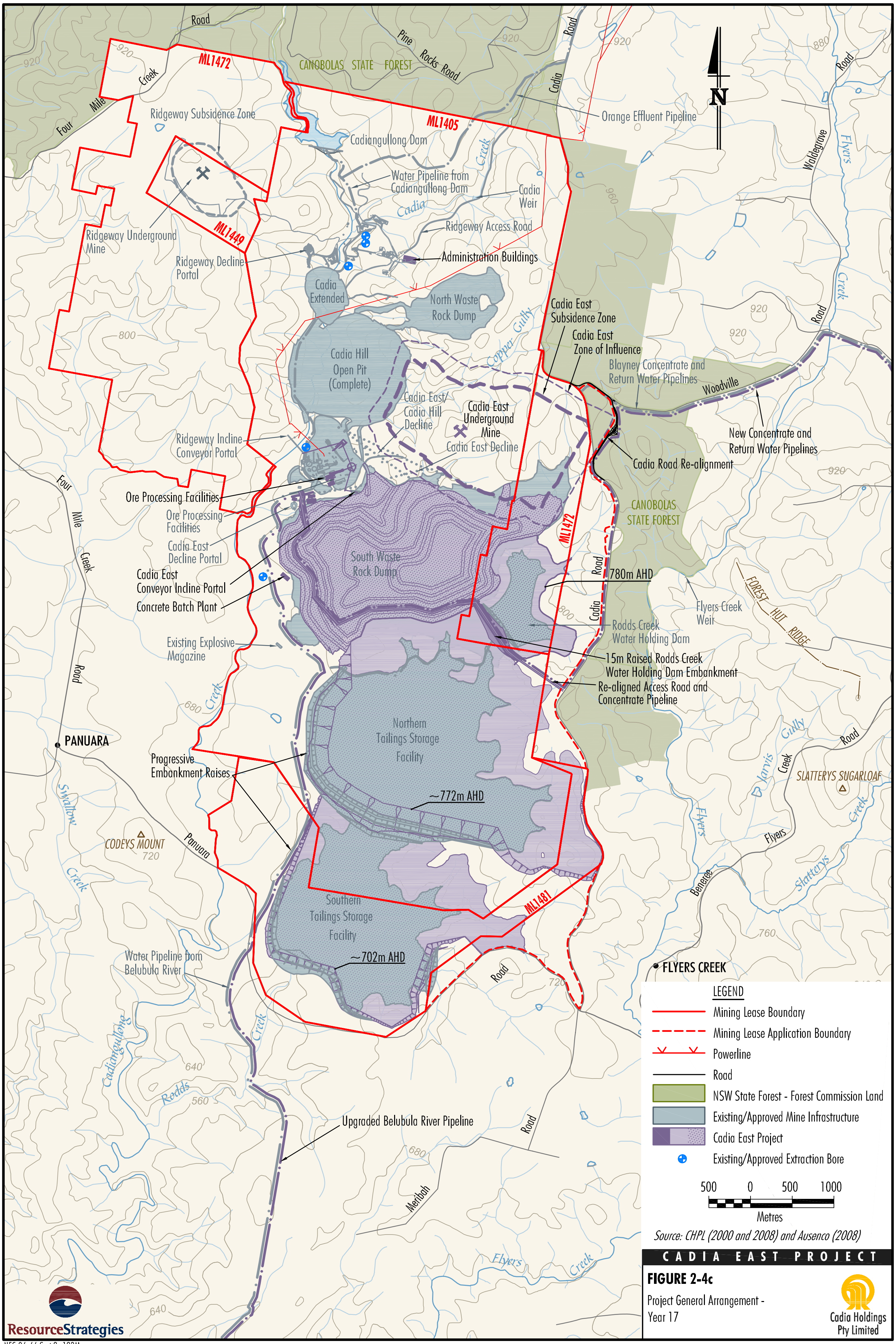


FIGURE 2-4b

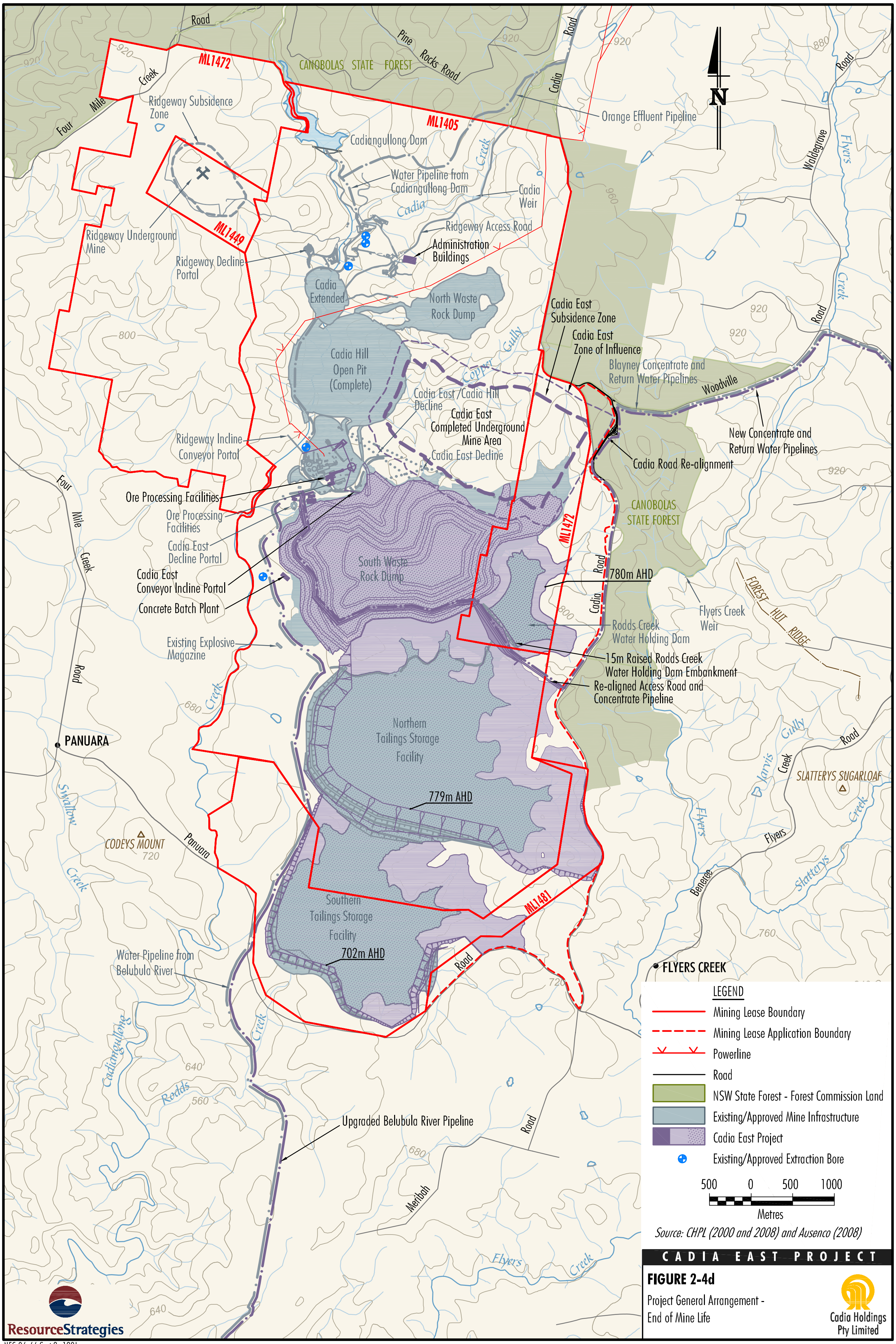
Project General Arrangement - Year 4



CADIA EAST PROJECT

FIGURE 2-4c

Project General Arrangement - Year 17



CADIA EAST PROJECT

FIGURE 2-4d

Project General Arrangement - End of Mine Life

Cadia Holdings Pty Limited

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NEC-06-66 Sect 2_120J

- construction and operation of a molybdenum recovery plant with a capacity of up to 460,000 tpa and trucking of molybdenum products off-site;
- placement of additional waste rock produced by the Project (approximately 11.4 Mt) in the existing South Waste Rock Dump;
- raising of the existing NTSF and STSF embankments to accommodate approximately 450 Mt of Cadia East tailings to be produced over the life of the Project;
- augmentation and upgrade of the existing Cadia Valley Operations water management/supply system including development of additional pipeline/pumping systems and raising of the Rodds Creek Water Holding Dam;
- obtaining additional mining leases to facilitate the Project extensions of the STSF, NTSF, subsidence zone and Rodds Creek Water Holding Dam;
- re-alignment of a 1.1 km section of Cadia Road;
- construction of a new dewatering facility to the east of Blayney (to be known as the CVO Dewatering Facility);
- maintaining the existing Blayney Dewatering Facility to provide standby additional processing capacity during the peak production period from Year 3 to Year 7 and the decommissioning of this facility if it is deemed redundant after this time;
- installation of a new concentrate pipeline and return water pipeline between the Cadia Valley Operations and the CVO Dewatering Facility;
- increased rail transportation of dewatered mineral concentrate from Blayney to the eastern seaboard;
- augmentation, relocation and upgrade of supplementary surface facilities including workshops, administration and site access roads; and
- other associated modifications to existing infrastructure, plant, equipment and activities to allow mining of the Cadia East deposit and integration with the approved Cadia Valley Operations.

Over the life of the Project, the mining sequence may vary from that shown on Figures 2-4a to 2-4d to take account of localised geological features, continued exploration activities, detailed mine design, mine economics, market conditions or relevant Project Approval conditions that are imposed by the NSW Minister for Planning.

The mining sequence over any given period would be documented in the relevant Mining Operations Plan (MOP) as required by the DPI-MR. Should the mining sequence vary, the development schedule (Figure 2-3) would be adjusted accordingly to reflect any such changes. The general arrangements may also vary to take into consideration detailed engineering and feasibility design during the life of the Project.

2.4 PROJECT CONSTRUCTION/ DEVELOPMENT ACTIVITIES

Infrastructure that is required to support the Project would be progressively developed in parallel with ongoing mining operations at the Cadia Valley Operations. The key components that would be constructed during Project development include:

- construction/development of Cadia East mining infrastructure;
- upgrade of the ore processing facilities;
- progressive raising of the NTSF and STSF embankments to expand their storage capacity;
- augmentation of the existing water management/supply system (including raising of Rodds Creek Water Holding Dam, and installation of new pipelines and pumps);
- re-alignment of Cadia Road;
- relocation of the Cadia Hill access road;
- installation of a new concentrate pipeline and return water pipeline to the CVO Dewatering Facility; and
- construction of the CVO Dewatering Facility.

The above activities are described in more detail in the sub-sections below.

2.4.1 Cadia East Mining Infrastructure

Key underground and surface mining infrastructure construction activities required for the Cadia East underground mine include:

- continued extension of the existing Cadia East and Cadia Hill Deeps exploration declines (Section 2.1.3);
- installation of eight underground crushing stations;
- installation of nine additional ventilation raises and associated underground centrifugal fans (Figure 2-5);
- installation of underground ore conveyors;
- installation of mine water pump stations, electricity reticulation/substations, underground workshops, surface heavy vehicle workshop, refuelling station, office, crib and ablution facilities;
- construction of administration buildings (Figures 2-4a and 2-6);
- construction of a concrete batch plant (Figure 2-4a);
- construction of surface ore handling infrastructure (e.g. surface conveyors, stockpiles and transfer points) (Figure 2-6); and
- construction of underground undercut and extraction levels and associated drawpoints.

A description of the operation of the Cadia East underground mine and further details of the underground and surface infrastructure are provided in Section 2.5.

2.4.2 Ore Processing Facilities Upgrade

Increased Processing Capacity

The Cadia East ore is harder and has more copper and molybdenum than the Cadia Hill and Ridgeway deposits. As a result, the processing capacity of the existing low grade processing plant would reduce from 18 Mtpa to 11 Mtpa. The capacity of the existing high grade processing plant would remain at approximately 6 Mtpa.

In order to bring the capacity of the ore processing facilities up to 27 Mtpa, CHPL would undertake one of the following:

Option 1. Upgrade of the existing ore processing facilities by adding the following components:

- a new secondary crushing circuit and fine ore stockpile;
- high pressure grinding roll/ball mill comminution circuit (HPGR circuit) and/or additional ball mill;
- an additional regrind circuit; and
- upgrades/additions to the existing flotation circuit, concentrate handling facilities, reagent delivery/storage areas.

Option 2. Construction of a new processing plant to the south-east of the existing ore processing facilities, where the existing administration buildings and warehouse are located, including:

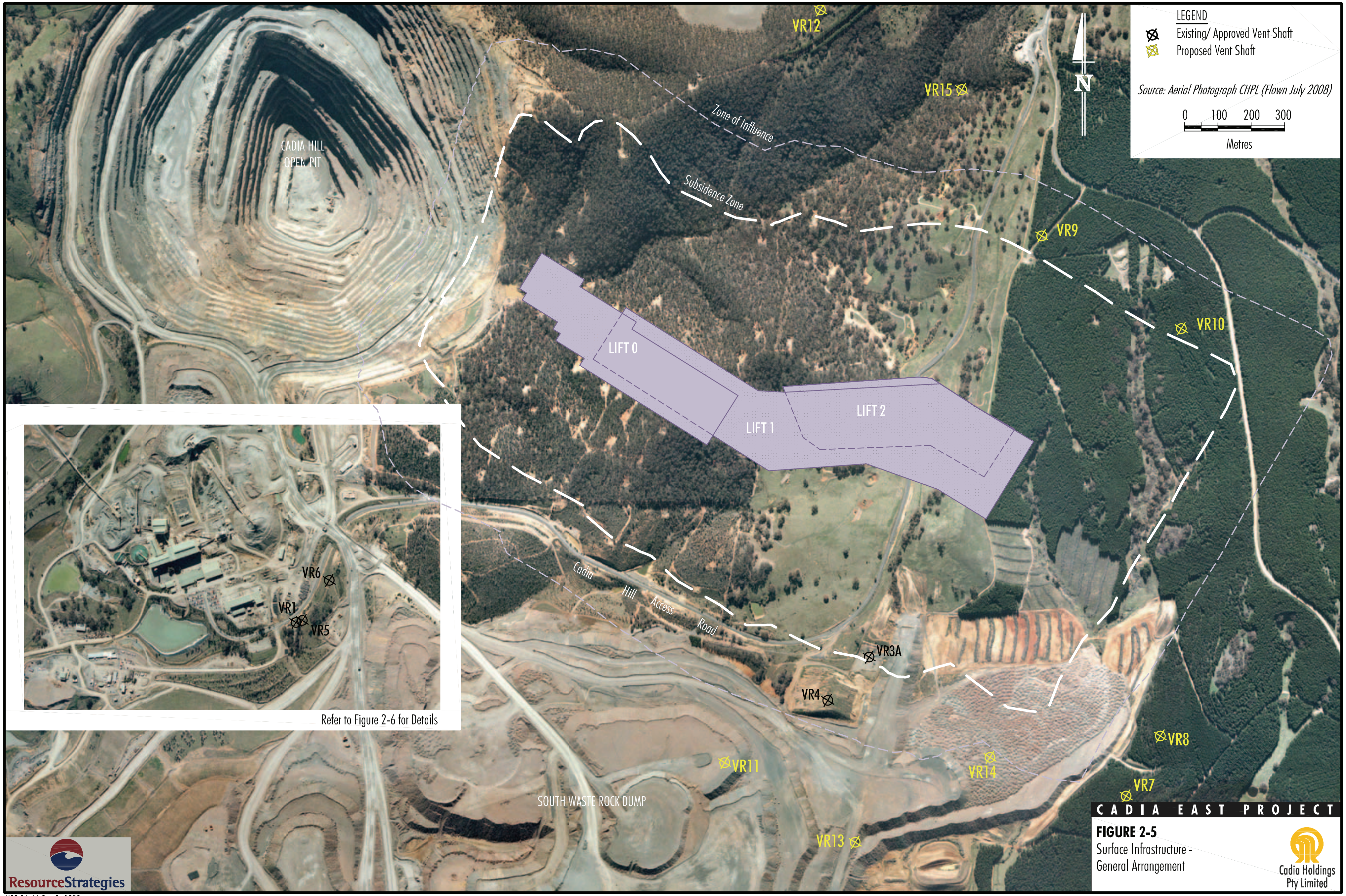
- new coarse ore stockpile;
- ore reclaim;
- secondary crusher;
- HPGR circuit;
- regrind circuit;
- flotation circuit;
- concentrate thickener;
- tailings thickener; and
- minor upgrades to the existing low grade processing plant.

As indicated in Figure 2-3, the upgrades to the ore processing facilities would be undertaken during Years 1 to 3 of the Project. All upgrades would be undertaken in the vicinity of the existing ore processing facilities (i.e. the upgrades would not involve any additional vegetation disturbance). The operation of the upgraded ore processing facilities is described in Section 2.7.

Molybdenum Recovery Plant

The Project would include the construction and operation of a molybdenum recovery plant with a concentrate feed design capacity of up to 460,000 tpa. The molybdenum recovery plant would be located south of the existing low grade processing plant (Figure 2-6) and would be constructed during Years 1 to 3 (Figure 2-3).

The operation of the molybdenum recovery plant is described in Section 2.7.3.



CADIA EAST PROJECT

FIGURE 2-5
Surface Infrastructure - General Arrangement

Cadia Holdings Pty Limited

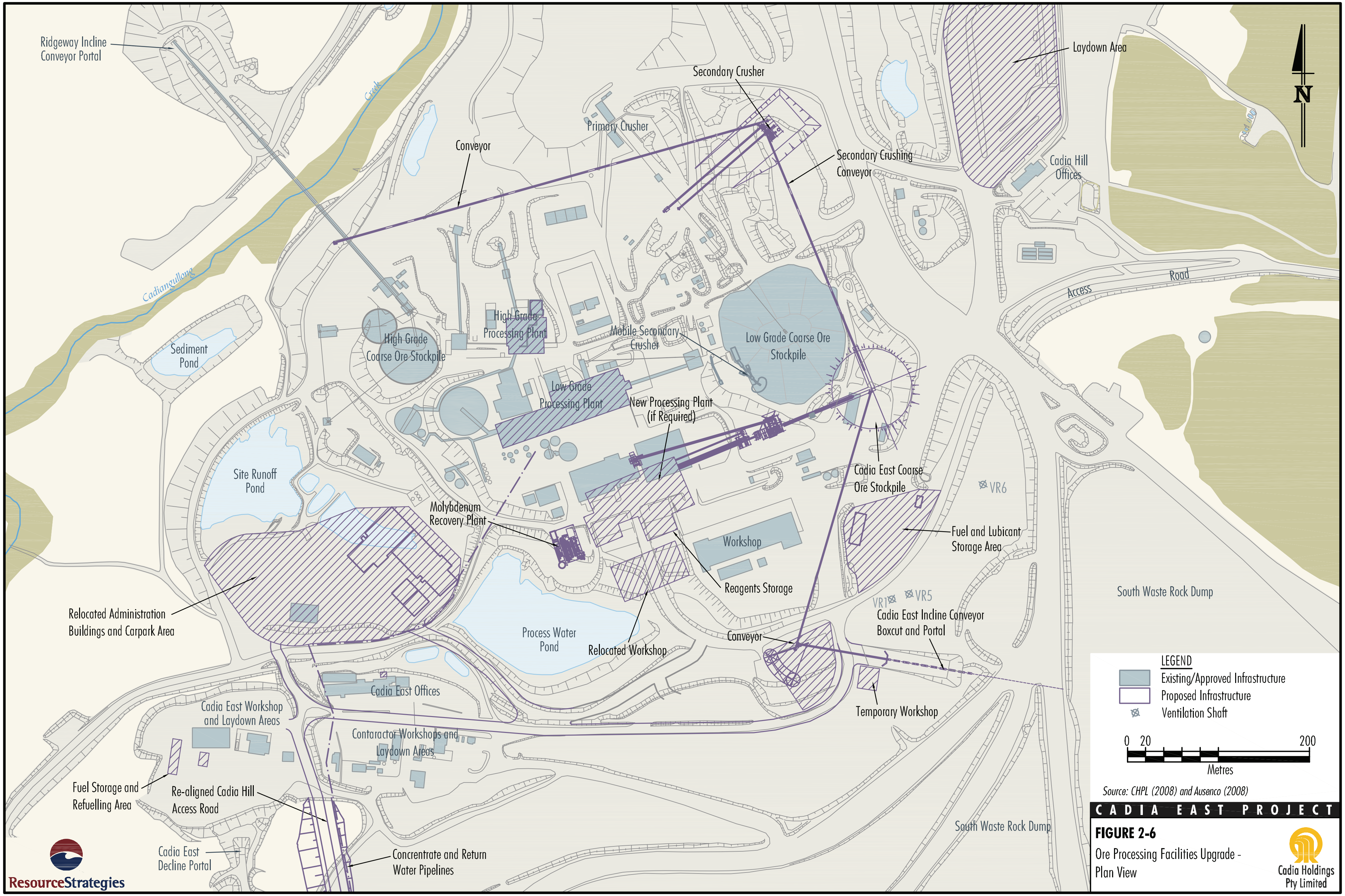


FIGURE 2-6
Ore Processing Facilities Upgrade - Plan View

NEC-06-66 Sect 2_129F

2.4.3 Tailings Storage Facility Embankment Construction

The capacity of the existing NTSF and STSF would be progressively increased over the life of the Project by raising the height of the embankments in a series of approximately 4 m high lifts to maximum embankment heights of 779 m AHD and 702 m AHD, respectively. A description of the development of the tailings storage facilities is provided in Section 2.8, with further detail provided in Appendix O.

2.4.4 Water Management/Supply System Augmentation

The main components of the existing Cadia Valley Operations water management/supply system are listed in Section 2.1.9.

The current average daily make-up water demand for the Cadia Valley Operations would increase by approximately 5.9 ML/day (or approximately 12%) as a result of the Project. In order to increase the reliability of supply and accommodate the increased make-up water demand, CHPL would augment the existing Cadia Valley Operations water supply system by:

- installing a new pipeline to transfer water from Cadiangullong Dam to Rodds Creek Water Holding Dam;
- raising Rodds Creek Water Holding Dam embankment by 15 m;
- installing additional pipe and pumping infrastructure with a 30 ML/day capacity to extract water from the Belubula River in accordance with existing annual extraction limits; and
- installing an additional return water pipeline from the CVO Dewatering Facility.

The operation of the augmented water management and supply system is described in Section 2.10.

2.4.5 Cadia Road Re-alignment

A 1.1 km section of Cadia Road, located to the east of the existing Cadia Valley Operations, would be re-aligned around the Cadia East zone of influence (Figure 2-7). The conceptual design of the proposed re-alignment of Cadia Road is shown on Figure 2-7.

2.4.6 Cadia Hill Site Access Road Relocation

The existing Cadia Hill site access road would need to be relocated as it traverses the future Cadia East subsidence zone. Therefore, a new site access road would be constructed to the south of the existing alignment, using an existing haul road over the South Waste Rock Dump. The proposed alignment of the site access road is shown on Figure 2-4c.

2.4.7 CVO Dewatering Facility

The design mineral concentrate production rate for the Project (460,000 tpa) would exceed the current capacity of the existing Blayney Dewatering Facility (180,000 tpa). To accommodate the increased production rates, the CVO Dewatering Facility would be constructed adjacent to an existing industrial complex approximately 1.7 km east of Blayney township (Figure 1-3). The CVO Dewatering Facility would comprise a filter press to dewater concentrate similar to the existing Blayney Dewatering Facility.

The Project would include the construction of a 1.7 km rail spur from the Great Western Railway (Figure 1-3). The design and construction of the rail spur would be undertaken in accordance with the requirements of the Australian Rail Track Corporation (ARTC) and RailCorp. The rail spur would be jointly used by the adjacent existing industrial facility (the Blayney Cold Storage and Distribution warehouses). CHPL has entered into commercial agreements with Metziya Pty Ltd (owners of the Blayney Cold Storage and Distribution warehouses) regarding the shared use of the rail spur.

In addition, a new concentrate pipeline and associated return water pipeline would be constructed during Years 2 and 3 of the Project from the CVO Dewatering Facility to the Cadia Valley Operations. The new concentrate pipeline would be positioned within the existing pipeline easement. The take-off from the new concentrate pipeline from the existing Blayney Dewatering Facility to the CVO Dewatering Facility would be located within the railway line easement, which runs between the two sites (Figure 1-3). The new return water pipeline would be connected to the Blayney effluent pipeline as per the existing return water pipeline.

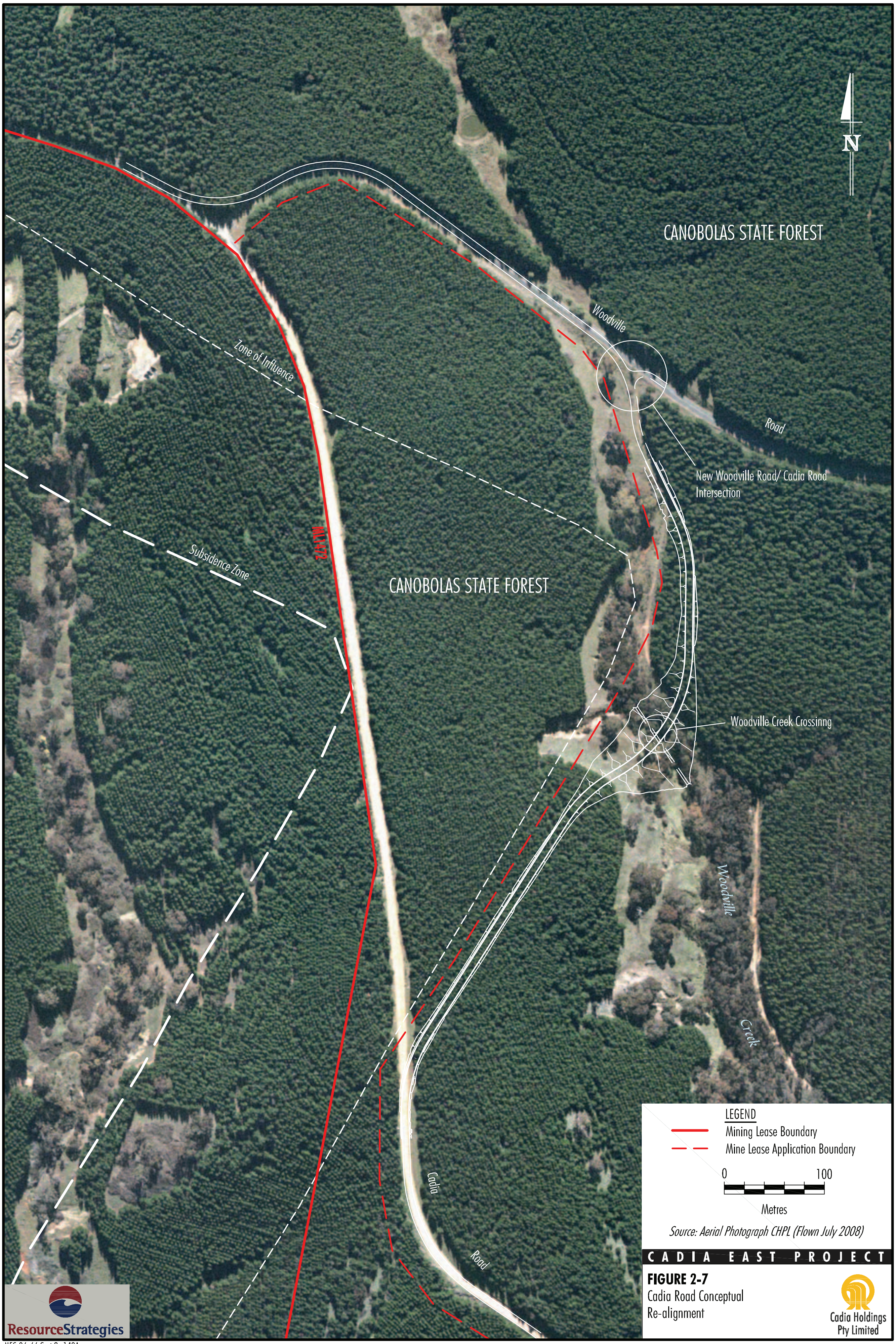


FIGURE 2-7
Cadia Road Conceptual
Re-alignment

NEC-06-66 Sect 2_140A

The existing Blayney Dewatering Facility would be maintained to provide standby additional processing capacity during the peak production period from Year 3 to Year 7. After this time, if this facility is deemed redundant, it would be decommissioned by CHPL.

2.5 UNDERGROUND MINE OPERATIONS

2.5.1 Mining Method

CHPL proposes to use the panel caving mining method to extract up to 450 Mt of Cadia East ore over the 21 year mine life at a nominal rate of up to 27 Mtpa. Panel caving is an underground mining method used to mine large, low grade ore bodies like the Cadia East deposit.

The Cadia East panel caving operation would be conducted in three lifts (i.e. Lifts 0, 1 and 2). The relative elevation of these lifts and all underground infrastructure is expressed in mine height datum which is 5,000 m above AHD (i.e. 5,900 m mine Relative Level [RL] is equivalent to 900 m AHD). Lifts 0, 1 and 2 would be approximately 400 m high with their bases located at approximately 5,050 m RL, 4,650 m RL and 4,250 m RL, respectively.

The mining method involves inducing caving of the rock mass by undercutting a block of ore. Mining proceeds by progressively advancing an "undercut" level beneath the block of ore. Above the undercut level, the overlying host rocks are pre-conditioned using blasting and/or hydraulic fracturing (Section 2.5.7), resulting in controlled fracturing of the ore block. Figure 2-8 provides a schematic diagram of the panel caving ore extraction method during the mine life.

Following pre-conditioning of the overlying host rocks, broken ore is removed through an extraction level developed below the undercut level. The extraction level is connected to the undercut level by drawbells, through which the ore gravitates to drawpoints on the extraction level (Figure 2-8). The ore would then be removed by a load-haul-dump (LHD) fleet to underground crushing stations.

Panel caving mining operations can commence production before the development and undercutting of the full orebody has been completed. At Cadia East, extraction of ore would occur while development of the undercut and production levels takes place in different parts of the orebody.

2.5.2 Subsidence Assessment

Panel caving is a bulk mining method, which requires ore and host rock to fracture under controlled conditions and results in caving and subsidence of the overlying host rock. A subsidence assessment of the Cadia East underground mine has been conducted by CHPL (2008c). A summary of the findings of the subsidence assessment is provided below.

Methodology

Due to the current conceptual stage of engineering design for the Cadia East underground mine the design chart method was used in the Cadia East underground mine subsidence assessment (CHPL, 2008c).

Design Chart Methodology

The design chart methodology for assessing subsidence in caving operations was developed by Flores and Karzulovic (2004) and is based on analytical and numerical methods. Design charts are used to estimate the angle of break of the subsidence zone and the extent of the zone of influence[1]. Design chart inputs include the geometry of the panel caving operation (e.g. depth from surface to the first lift) and the geotechnical properties of surrounding rock.

Assessment

The average break angle for the Ordovican volcaniclastic rock and the Silurian sediments at Cadia East are 70 degrees (°) and 55°, respectively. These break angles and the depth of the panel caving operations would result in an average extent of the zone of influence at the ground surface of approximately 200 m. Figures 2-5 and 2-8 show the future subsidence zone in plan view and cross-section, respectively. Figures 2-4a to 2-4d show a plan view of the progression of the subsidence zone and zone of influence over the life of the Project.

[1] Zone of influence – the area within which subsidence is not expected, but surface cracks may develop.

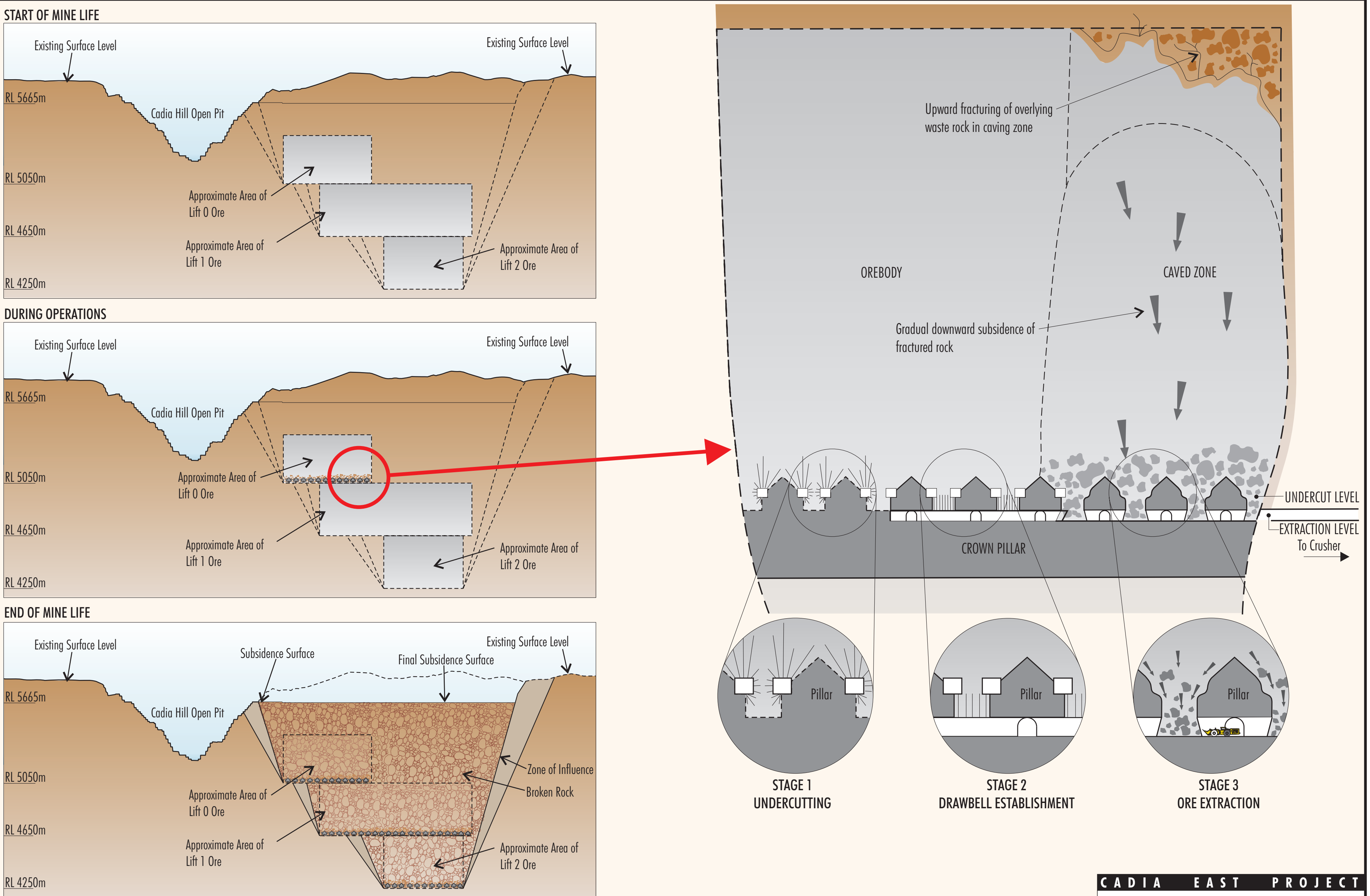


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FIGURE 2-8
Panel Caving Mining Method Schematic

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NEC-06-66 Sect 2_024H

Sensitivity Analysis

The subsidence assessment described above used the geometry of the panel caving operation (e.g. depth from surface) and the geotechnical properties of surrounding rock to determine the angle of break and therefore the subsidence zone area. The proposed geometry (i.e. layout) of the panel caving workings was determined by CHPL using conceptual engineering designs and therefore the only parameter considered to be variable was the geotechnical properties of the surrounding rock.

It was considered by CHPL that the geotechnical properties of rock surrounding the Cadia East underground mine were sufficiently understood to conclude that the angles of break upon which the subsidence assessment is based on was conservative (CHPL, 2008c). Therefore it was considered that the subsidence zone shown in Figure 2-4d is a conservative representation of the maximum predicted Cadia East subsidence zone.

Conclusion

At the end of the Project life, the surface subsidence area would be approximately 255 ha and would resemble a dish-shaped depression surrounded by steep slopes on the margin. The ultimate extent of the Cadia East subsidence zone and zone of influence is shown on Figure 2-4d.

Within the subsidence zone, aspects of the natural and built environment would be lost. Within the zone of influence, access to aspects of the built and natural environment would be restricted through bunding and fencing of the area. Some surface cracking is also expected to occur in the zone of influence.

2.5.3 Provisional Mine Schedule

The proposed Cadia East underground mine schedule, based on the planned maximum production rate, is provided in Table 2-5. Underground mining operations would be conducted 24 hours per day, seven days per week.

A combined Cadia Valley Operations mine schedule (i.e. includes the approved Cadia Hill, Ridgeway, Ridgeway Deeps and proposed Cadia East production) is provided in Table 2-6.

The provisional mine schedules in Tables 2-5 and 2-6 are based on the planned Project maximum production. However, production may vary to take account of localised geological features, detailed mine design, mine economics, market conditions or relevant Project Approval conditions that are imposed by the NSW Minister for Planning.

2.5.4 Mine Fleet

A provisional Cadia East underground mine equipment fleet is provided in Table 2-7.

2.5.5 Underground Access

Cadia East Decline and Portal

The existing decline and portal developed as part of the Cadia East exploration programme (Section 2.1.3 and Figure 2-1) would be used as the main access to the Cadia East orebody. The decline would be extended to the base of the underground mine workings. It would slope downwards at a gradient of 1:7 with approximate dimensions of 6 m high and 5.5 m wide.

The decline would contain electrical cabling, communications, potable water, service water and compressed air. These services would be attached to the walls and roof with allowance for clearance above and beside mobile equipment. Stockpile areas and passing bays would be constructed at regular intervals to allow for the passing and turning of mobile equipment. Ventilation drives would be developed off the decline to connect with the ventilation shafts.

The location of the Cadia East decline portal is shown on Figure 2-6.

Conveyor Incline and Portal

The exploration decline and portal developed as part of the Upper Cadia East and Cadia Hill Deeps Exploration and Decline Development Programme (Section 2.1.3) would be used to house a conveyor, which would transfer ore and waste rock from the Cadia East underground mine to the surface. The conveyor would be extended to the base of the underground mine workings.

Table 2-5
Provisional Cadia East Underground Mine Schedule

Year	Cadia East Waste Rock (Mt)	Cadia East Ore (Mt)	Cadia East Products (includes metals in concentrate)		
			Gold ('000 ounces)	Copper (kt)	Molybdenum (kt)
1 (2010)	1.0	0.2	3.1	0.7	0.0
2	1.0	0.2	4.6	0.8	0.0
3	1.0	4.0	97.7	15.7	0.0
4	1.0	13.8	306.7	38.0	0.2
5	1.0	18.9	378.7	50.2	0.3
6	0.2	19.0	410.4	52.6	0.5
7	0.2	19.0	454.6	54.4	0.6
8	0.2	23.4	590.7	71.0	0.8
9	0.2	27.0	630.0	83.4	1.1
10	0.2	27.0	639.9	85.8	1.2
11	0.2	27.0	634.7	87.1	1.3
12	0.2	27.0	625.1	81.7	1.1
13	0.2	27.0	629.8	79.4	1.2
14	1.0	27.0	623.4	79.8	1.3
15	1.0	27.0	625.2	81.9	1.4
16	1.0	27.0	630.7	86.6	1.4
17	1.0	27.0	633.9	88.2	1.5
18	0.2	27.0	630.4	91.6	1.5
19	0.2	27.0	626.9	93.2	1.5
20	0.2	27.0	620.0	95.8	1.5
21 (2030)	0.2	27.0	593.0	96.0	1.4
Total	**11.4**	**449.5**	**10,389.5**	**1,413.9**	**19.8**

Source: CHPL (2008).
kt = kilotonnes.

Table 2-6
Provisional Cadia Valley Operations Mine Schedule[1]

Year	Cadia Valley Operations		Cadia Valley Operations Total Products (includes metals in concentrate)		
	Total Waste (Mt)	Total Ore (Mt)	Gold ('000 ounces)	Copper (kt)	Molybdenum (kt)
1 (2010)	2.8	24.0	547.3	56.0	0.0
2	1.0	24.0	650.7	49.9	0.0
3	1.0	27.0	619.6	59.7	0.0
4	1.0	27.0	634.6	76.7	0.2
5	1.0	27.0	645.1	84.5	0.3
6	0.2	27.0	632.6	82.3	0.5
7	0.2	27.0	603.4	76.5	0.6
8	0.2	27.0	633.8	78.5	0.8
9	0.2	27.0	630.0	83.4	1.1
10	0.2	27.0	639.9	85.8	1.2
11	0.2	27.0	634.7	87.1	1.3
12	0.2	27.0	625.1	81.7	1.1
13	0.2	27.0	629.8	79.4	1.2
14	1.0	27.0	623.4	79.8	1.3
15	1.0	27.0	625.2	81.9	1.4
16	1.0	27.0	630.7	86.6	1.4
17	1.0	27.0	633.9	88.2	1.5
18	0.2	27.0	630.4	91.6	1.5
19	0.2	27.0	626.9	93.2	1.5
20	0.2	27.0	620.0	95.8	1.5
21 (2030)	0.2	27.0	593.0	96.0	1.4
Total	**13.2**	**561**	**13,110.1**	**1,694.6**	**19.8**

Source: CHPL (2008).

1 Includes production from Cadia Hill, Ridgeway, Ridgeway Deeps and Cadia East.

Table 2-7
Provisional Cadia East Underground Mine Equipment Fleet

Mobile Plant	Project Years		
	Years 1 to 4	Years 5 to 10	Years 11 to 21
Development Jumbo Drilling	5	4	3
Development Jumbo Drill and Bolt	3	3	2
Rock Bolting Machine	3	3	2
Production Drill – Undercut	4	4	4
Production Drill – Drawbells	4	4	4
Cable Bolting Machine	3	3	2
Scaling Machine	4	4	3
Secondary Breaking Machine	4	4	4
Charging Vehicle	4	4	3
Shotcrete Rig	4	4	4
Concrete Agitator Truck	8	8	6
Development LHD	7	5	5
Production LHD	4	3	3
Production LHD	6	18	18
Development Haul Truck	12	8	8
Production Haul Truck	6	12	12
Integrated Tool Carrier	8	8	6
Manitou	4	4	4
Grader	3	3	2
Roller	1	1	1
Water Truck	1	1	1
Flat Bed Truck	1	1	1
Light Vehicles (Four-Wheel Drive)	30	20	20
Scissor Lift Truck	3	3	2
12 t Crane	1	1	1
50 t Crane	1	1	1
Diamond Drill	4	4	2
Raiseborer Vent Shafts	2	2	2
Raiseborer Drawbells	2	3	2

Source: CHPL (2008).

The conveyor incline would have approximate dimensions of 6.5 m high and 6.5 m wide. As well as incorporating the suspended ore conveyor and service infrastructure, the incline would include a clearway sufficiently wide for light vehicles to exit and enter the mine. The use of this access point would generally be restricted to maintenance of the conveyor equipment.

Emergency Egress

In the event of an emergency, mine workers would exit the mine via the decline or the conveyor incline. These exits would be fresh air intakes and would be accessible from the underground working areas. Refuge chambers would also be positioned throughout the underground mine at strategic locations.

2.5.6 Mine Development

Mine development refers to works associated with the installation of underground mining infrastructure and tunnelling prior to full-scale mining of ore taking place. Mine development works would involve extending the two existing declines, access drives, installing ventilation raises, developing crushing stations, underground ore conveyors and other associated infrastructure.

2.5.7 Mine Preconditioning

Hydraulic fracturing and/or blasting would be used to precondition the ore at Cadia East, where necessary. Both methods may be used at Cadia East and are described below.

Hydraulic Fracturing Technique

Pre-conditioning using hydraulic fracturing may be conducted to improve the fragmentation and caving characteristics of the overlying host rocks, prior to panel caving mining being initiated.

Hydraulic fracturing would involve isolating sections of ore via drilling and creating a pressurised zone by pumping water into the system until the tensile strength of the rock is reached and a fracture is created. The fracture would be extended by pumping water at a rate of up to approximately 300 litres per minute (L/min).

Once the planned fracture extension is achieved, the pressure would be released and up to 60% of the total water injected would be recovered via the mine dewatering system. Estimated water consumption for hydraulic fracturing would be approximately 0.2 litres per tonne (L/t) of preconditioned ore or up to approximately 5 ML of water per annum. It is estimated that around 3 ML of water per annum would be recovered.

Blasting Technique

Preconditioning using drilling and blasting may be used instead of, or as well as, hydraulic fracturing.

The blasting technique would involve developing long, vertical drillholes from the undercut or extraction levels and controlled and precise detonation of explosives. Estimated consumption of bulk emulsion explosive would be approximately 0.003 kilograms per tonne (kg/t) of preconditioned ore using up to a Maximum Instantaneous Charge (MIC) of 1,500 kilograms (kg) of explosives per delay. Preconditioning of the Cadia East underground mine orebody using this technique would involve use of up to approximately 110 tpa of emulsion explosive.

2.5.8 Development Blasting Activities

Blasting activities during development of the Cadia East underground mine would be limited to blasting associated with the decline and drive development, pre-sink excavations for ventilation shafts and a number of small blasts associated with civil construction.

Once full-scale production commences, blasting would take place at depth and would involve development blasting, and production blasting to precondition the ore (unless hydraulic fracturing is used – refer to Section 2.5.7).

Emulsion explosives would be used for development blasting. The quantity of emulsion explosive used for underground development (i.e. construction of drives and the decline, etc.) would be up to approximately 1,700 tpa. The number of holes, quantity and type of explosives used would be adjusted according to the rock conditions and design objectives of the blasts. Blasting would take place several times a day, 24 hours a day and seven days per week.

Ammonium nitrate fuel oil (ANFO) may be used on occasions if emulsion charging is not available.

2.5.9 Ore Extraction

Extraction of ore from the drawpoints on the two production levels would be via an electric LHD fleet. The electric LHD fleet would transport the ore from the active drawpoints to one of the crushing stations. LHDs would be able to place ore into two or three sides of a crushing station.

2.5.10 Primary Crushing

A schematic diagram showing the crushing stations and the other main underground ore handling system components is provided on Figure 2-9.

At each ore crushing station, ore would be tipped by the LHDs through a static grizzly (stationary bar screen) equipped with a rock breaker (Figure 2-9) and would then pass into a 1,000 tonnes per hour (tph) jaw crusher (Figure 2-9). The crushed material would then fall into a 250 t surge bin below the jaw crusher.

An apron feeder would be used to regulate the feed from the crushing station surge bin onto the collection conveyors (Figure 2-9). The collection conveyors would allow for the automated removal of tramp metals (e.g. drill steels, rock bolts, etc.). Tramp metal removed would be directed by a chute to a tramp metal collection bin.

2.5.11 Ore Transfer and Surface Stockpiling

Ore conveyors would be used to transport ore from the underground primary crushing stations to the surface (Figure 2-9). The ore conveyors would consist of two sections (i.e. trunk conveyors and incline conveyor).

The two trunk conveyors (i.e. one trunk conveyor for each lift) would transport the ore from the collection conveyors to the incline conveyor. The trunk conveyors would be approximately 1.5 m wide.

The incline conveyor would transport ore to the surface (Figure 2-9) at a rate of approximately 4,400 tph. The incline conveyor would commence at 4,250 m RL (i.e. the base of Lift 2) and would extend approximately 6,000 m to the surface at approximately 5,750 m RL.

The majority of the length of the incline conveyor would be located in the conveyor incline (Section 2.5.5). The conveyor would consist of three or four sections and would be suspended from the roof of the incline. Clearance provided below and beside the conveyor would allow vehicular access for removal of spillage, maintenance, and emergency egress requirements.

The conveyor would reach the ground surface and exit the incline at the incline conveyor portal (Figure 2-9). The surface conveying system would transfer the ore to the ore stockpiles adjacent to the ore processing facilities (Figure 2-9).

2.5.12 Waste Rock Handling

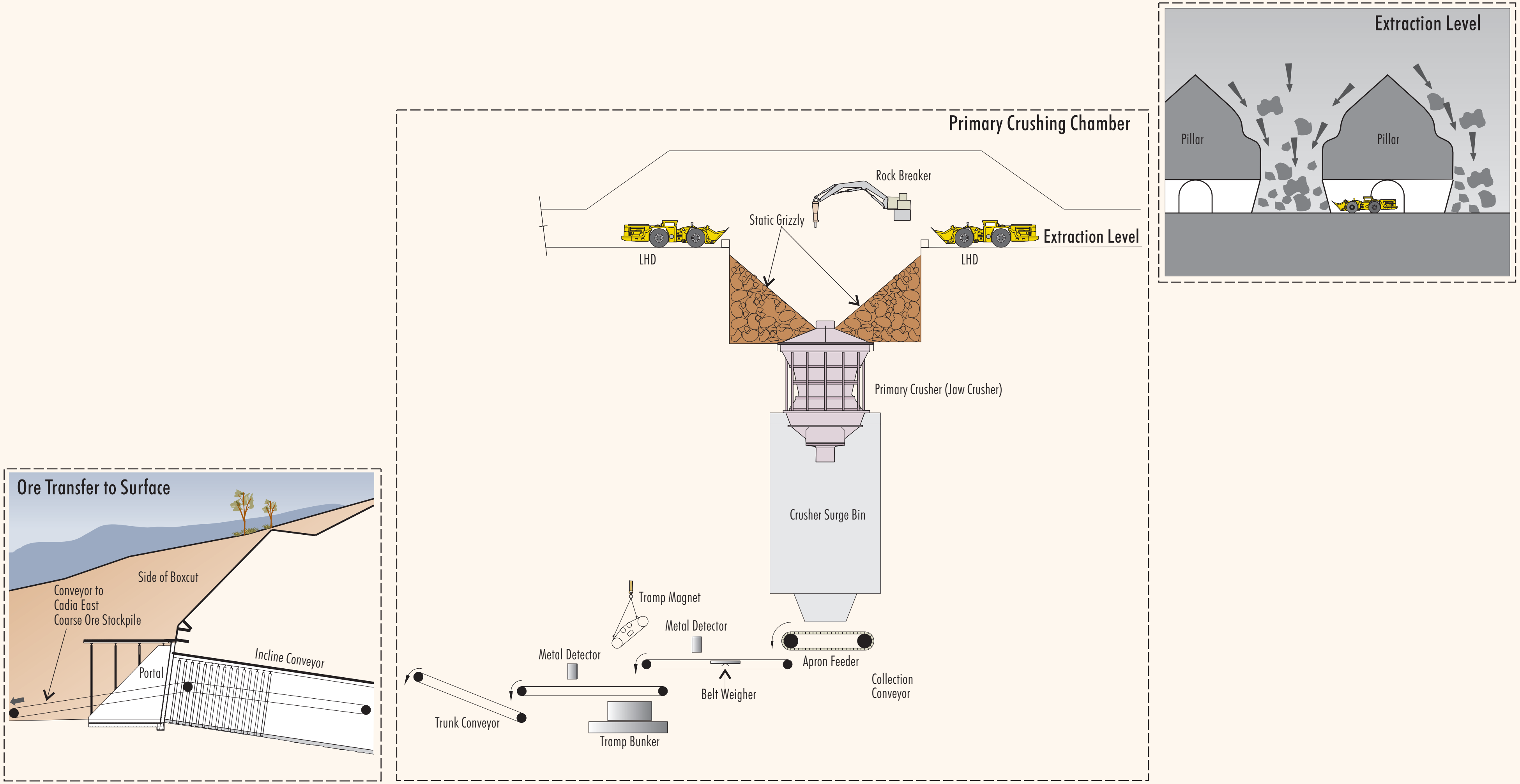
A relatively small quantity of waste rock (approximately 11.4 Mt – Table 2-5) would be removed from the Cadia East underground mine during the life of the Project. A large proportion of this waste rock would be generated during the development of the decline and incline. Waste would also be generated through the development of the primary crushing station chambers and other mine development works (e.g. production levels) during the mine life.

Waste rock would be removed from the underground workings on a campaign basis via the decline and the conveyor incline (once constructed). Waste rock transferred to the surface via the decline would be hauled to the South Waste Rock Dump. Waste rock transferred to the surface via the conveyor incline would be conveyed and stacked on a temporary stockpile adjacent the ore stockpile before being loaded and hauled to the South Waste Rock Dump as required.

2.5.13 Ventilation Systems

Fresh air would enter the underground workings via the decline, conveyor incline and six ventilation intake shafts (VR4, VR6, VR9, VR11, VR13 and VR15) (Figure 2-5). A total flow intake of up to approximately 2,200 cubic metres per second (m^3/s) of fresh air would be required to maintain underground air quality.

Air would be expelled from the workings via eight 4.5 to 6 m diameter vertical shafts and exhaust fan installations (VR1, VR3A, VR5, VR7, VR8, VR10, VR12 and VR14) (Figure 2-5). The fans would be centrifugal fans and would be located underground. Initial ventilation would be provided by underground axial fans, with these fans being replaced by centrifugal fans as required.



Not to Scale

Source: SKM (2008)

CADIA EAST PROJECT

FIGURE 2-9
Conceptual Overview of
Ore/Waste Rock Extraction,
Primary Crushing and Conveyor

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2.5.14 Raw Water and Fire Fighting Supply

The underground raw water supply system would provide water for mining activities, washdown, dust suppression and fire fighting. Raw water would be gravity fed via pipeline from the surface down the decline.

2.5.15 Underground Mine Dewatering

Estimates of groundwater inflows were based on results of numerical groundwater flow modelling, which are described in detail in Appendix G. The maximum predicted groundwater inflow during the Project mine life is 5.46 ML/day.

Groundwater that accumulates in the underground mine workings would be collected and then pumped to the surface at a maximum rate of up to 160 litres per second (L/s).

Water recovered from the active underground mine workings has the potential to contain sediments and/or contaminants resulting from the operation of underground mining plant (i.e. fuels and lubricants). In addition, the geochemical characterisation of Cadia East mine rock and tailings by MESH (Appendix J) has classified the Cadia East orebody as a relatively high sulphide mineralisation system when compared to Cadia Hill and Ridgeway. In particular, a high proportion of the Ordovician age waste rock and material in the subsidence/caving zone is predicted to be acid generating (Appendix J).

Water recovered from the Cadia East underground mine would be pumped to the surface for use in the Cadia Valley Operations water management system. This water would be directed to a sump and pumping station located at the base of the mine workings where it would be pumped to the surface for treatment (if necessary) and then used in the ore processing facilities.

2.5.16 Electricity Reticulation

Electricity for the underground workings would be reticulated via an 11 kV or 33 kV ring main system. The ring design of the underground distribution system would supply electricity from two sources providing security of supply to the underground substations (Section 2.12.4).

2.5.17 Underground Maintenance and Support Facilities

Table 2-8 summarises the main underground maintenance and support facilities at Cadia East.

Table 2-8
Cadia East Underground Maintenance and Support Facilities

Component	Description
Maintenance Workshop Facilities	Maintenance workshop facilities and stores would be located on the main production levels of each lift. The maintenance facilities would accommodate vehicles for planned minor services and minor repairs. A fire suppression system would be provided.
Refuelling Station	A refuelling station would be located adjacent the maintenance workshops. An automated refuelling system would be used for refuelling of underground light and heavy vehicles. A fire suppression system would be provided.
Crib Rooms, Offices and Toilets	Crib rooms and offices would be located adjacent the maintenance workshops. The crib room would include all necessary facilities to accommodate and service shift personnel during normal mine operation. The crib room would also serve as a refuge area and would be fire rated for two hours. It would be equipped with emergency battery lighting and fail safe closing dampers on the ventilation system and a limited emergency air supply. Toilets would be a fully self-contained system and would be located adjacent to the crib room area.

Source: CHPL (2008c).

2.6 WASTE ROCK MANAGEMENT

2.6.1 Waste Rock Production

Relatively small volumes of waste rock material (e.g. approximately 11.4 Mt during the mine life) would be generated by the Cadia East underground mine. The maximum quantity of waste rock to be mined in any one year of the Cadia East underground mine would be approximately 1 Mt (Table 2-5). As described in Section 2.1.1, only minor amounts of waste rock would be extracted from Cadia Hill for the remainder of its mine life.

By comparison, approximately 430 Mt of waste rock has been produced by Cadia Hill over its life of mine, therefore the existing South Waste Rock Dump would undergo only a minor expansion as a result of the Project.

2.6.2 Waste Rock Geochemistry

An assessment of the acid generation potential and metal leaching behaviour associated with the development of the Project is provided in Appendix J.

The geochemistry assessment included testing of samples of host rock within the subsidence zone, zone of influence and the mine waste rock (Appendix J).

Geochemical testing of the Silurian and underlying Ordovician host rock units, indicate a distinct difference in the geochemistry (Appendix J). In summary, it is expected that the Silurian cover would have low total sulphur and variable acid neutralising capacity (ANC) but would be predominantly NAF. The geochemical characteristics of the Ordovician units show greater variability of total sulphur and PAF characteristics (Appendix J).

2.6.3 Waste Rock Management

General Waste Rock Management

The existing Cadia Valley Operations waste rock categories and management strategies would be used for the Project (Section 2.1.5).

PAF waste rock generated by the Project would be selectively handled and placed on the South Waste Rock Dump consistent with the current methodology employed for the existing mining operations (Section 2.1.5).

NAF waste rock material generated over the life of the Project would be either:

- used as construction fill materials for development of the other Project-related infrastructure (e.g. tailings storage facility embankments); or
- placed in the South Waste Rock Dump.

The existing South Waste Rock Dump would be marginally extended to accommodate the waste rock generated by the Project. However, the maximum final dump surface level (880 m AHD) would remain unchanged.

Relocation of Waste Rock Material within the Cadia East Zone of Influence and Subsidence Zone

A small portion of the north-east corner of the South Waste Rock Dump would be affected by the predicted Cadia East zone of influence and subsidence zone (Figure 2-5).

If left in its current location some of this material would fall into the subsidence zone once it reaches the surface. If this were to occur it would present a safety and rehabilitation issue along the edge where the dump and subsidence zone meet (i.e. rehabilitation equipment would not be able to safely operate in this area to stabilise and revegetate the dump batter).

In order to manage this issue, CHPL would:

- reclaim some of the waste rock that occurs in the predicted subsidence zone and/or zone of influence; and
- reclaim some of the adjoining material so that the residual north-east batter of the dump is at its final overall slope of 1:4.

Geochemical testing of 180 samples taken from this area was conducted by CHPL in December 2008. Of the 180 samples, one was classified as PAF, 11 yielded inconclusive results, and the remaining 168 were classified as NAF. Although the results indicate that the majority of the material would be benign, CHPL would monitor for evidence of PAF material (i.e. visible fresh or oxidised sulphide mineralisation) during the reclaiming of the waste rock. If pockets of PAF waste rock are identified in the area they would be selectively removed and placed in the active encapsulation cell within the South Waste Rock Dump.

Notwithstanding the safety/rehabilitation issues described above, in order to reduce haulage costs, some NAF waste rock may be left within the subsidence zone itself (where it would be allowed to fall into the void).

The majority of the reclaimed NAF waste rock would either be used for construction of the NTSF and STSF embankments (if it has suitable geotechnical characteristics), or it would be placed in the central part of the South Waste Rock Dump. Some of the NAF waste rock may be used to construct a bund around the zone of influence to restrict access to this area.

2.7 ORE PROCESSING

2.7.1 Materials Handling

A description of materials handling at the Project is provided in the following sections.

Cadia Hill and Ridgeway

The existing Cadia Hill and Ridgeway materials handling system is described in Section 2.1.

Cadia East Underground Mine

Cadia East ore would be primary crushed underground (Section 2.5.10 and Figure 2-9). Surface conveyors would transfer the primary crushed ore from the Cadia East incline conveyor to a new Cadia East coarse ore stockpile adjacent to the existing low grade coarse ore stockpile.

The primary crushed ore would then be reclaimed, transported via conveyor to the secondary crusher (Figure 2-6) and crushed. The secondary crushed ore would then be transported via conveyor to either the new processing plant or the existing high or low grade processing plants.

2.7.2 Ore Processing Facilities Operations

As described in Section 2.4.2, the proposed increase in the ore processing rate would be accommodated by either upgrading the existing ore processing facilities or constructing a new processing plant. The sub-sections below provide an operational description of each option.

Option 1 Upgrade of the Existing Ore Processing Facilities

Upgrades to the existing ore processing facilities would be undertaken to increase the ore processing rate to 27 Mtpa. These upgrades would be undertaken to the existing low and/or high grade processing plants and would include the following:

- **Secondary crushing circuit** – a secondary crushing circuit would be constructed to crush ore from the Cadia East underground mine.
- **Fine ore stockpile** – a fine ore stockpile would also be installed for the Project.
- **Installation of additional milling capacity** – additional milling capacity (e.g. an additional ball mill and/or HPGR circuit) would be installed for the Project.
- **Regrind circuit** – a new Vertimill® and an associated cyclone pack would be added to increase the capacity of the regrind circuit.
- **Flotation circuit** – an expansion of existing circuit would be required and would include the reconfiguration of some existing flotation cells and addition of flotation cells.
- **Concentrate handling** – a new concentrate storage tank and a concentrate thickener would be constructed.
- **Reagent Delivery/Storage** – new lime and flocculant plants would be constructed to replace the existing lime and flocculant plants.

The above upgrades would allow ore processing at a rate of 27 Mtpa. The low and high grade processing plants would generally operate as described in the Cadia Hill EIS and *Ridgeway Project Environmental Impact Statement* (Ridgeway EIS), respectively.

Option 2 New Processing Plant

If constructed, the new processing plant would have a processing capacity of up to approximately 10 Mtpa. The new processing plant would maximise the use of existing infrastructure. As per the existing ore processing facilities, the new processing plant would not use cyanide.

A new coarse ore stockpile would be developed as part of the construction of the new processing plant. From the coarse ore stockpiles, the following eight stages would be involved in ore handling and processing:

- ore reclaim;
- secondary crushing;
- HPGR circuit (including ball milling and flash flotation);
- regrind circuit;
- flotation circuits;
- concentrate thickening;
- tailings thickening and disposal; and
- concentrate dewatering (occurs at the dewatering facilities).

Figure 2-10 presents a simplified flow diagram of the ore processing to be undertaken at the new processing plant.

Table 2-9 provides a summary description of each of the above listed stages. Figure 2-6 illustrates the location of the new processing plant relative to the existing ore processing facilities.

Ore Handling

Ore from Cadia Hill and Ridgeway would be processed in either the low or high grade processing plants. Ore from the Cadia East underground mine would be processed in both the upgraded low and high grade processing plants for Option 1 and the low grade, high grade and new processing plants for Option 2.

Ore processing operations would continue to operate up to 24 hours per day, seven days per week.

2.7.3 Molybdenum Recovery Plant

The 460,000 tpa molybdenum recovery plant would be located south of the existing low grade processing plant (Figure 2-6). Mineral concentrate from the high grade, low grade and the new processing plants' flotation circuits would feed to the molybdenum recovery plant. Figure 2-11 presents a simplified process flow diagram of the molybdenum recovery plant.

The general stages involve:

- a flotation circuit;
- an optional regrind circuit (i.e. would be included to increase molybdenum recovery if required);
- a molybdenum conditioning and thickening circuit; and
- a concentrate filtering, drying and bagging facility.

The molybdenum concentrate from the final flotation columns would report to a concentrate storage tank prior to being pumped to the molybdenum filtration and drying plant (Ausenco, 2007).

The molybdenum concentrate would be filter pressed to approximately 8% by weight (w/w) and the filter cake dried to approximately 3% w/w (Ausenco, 2007). The dried molybdenum concentrate would be stored in a hopper prior to bagging and sealing. The bagged molybdenum concentrate would be stored on pallets for subsequent transport via road to market.

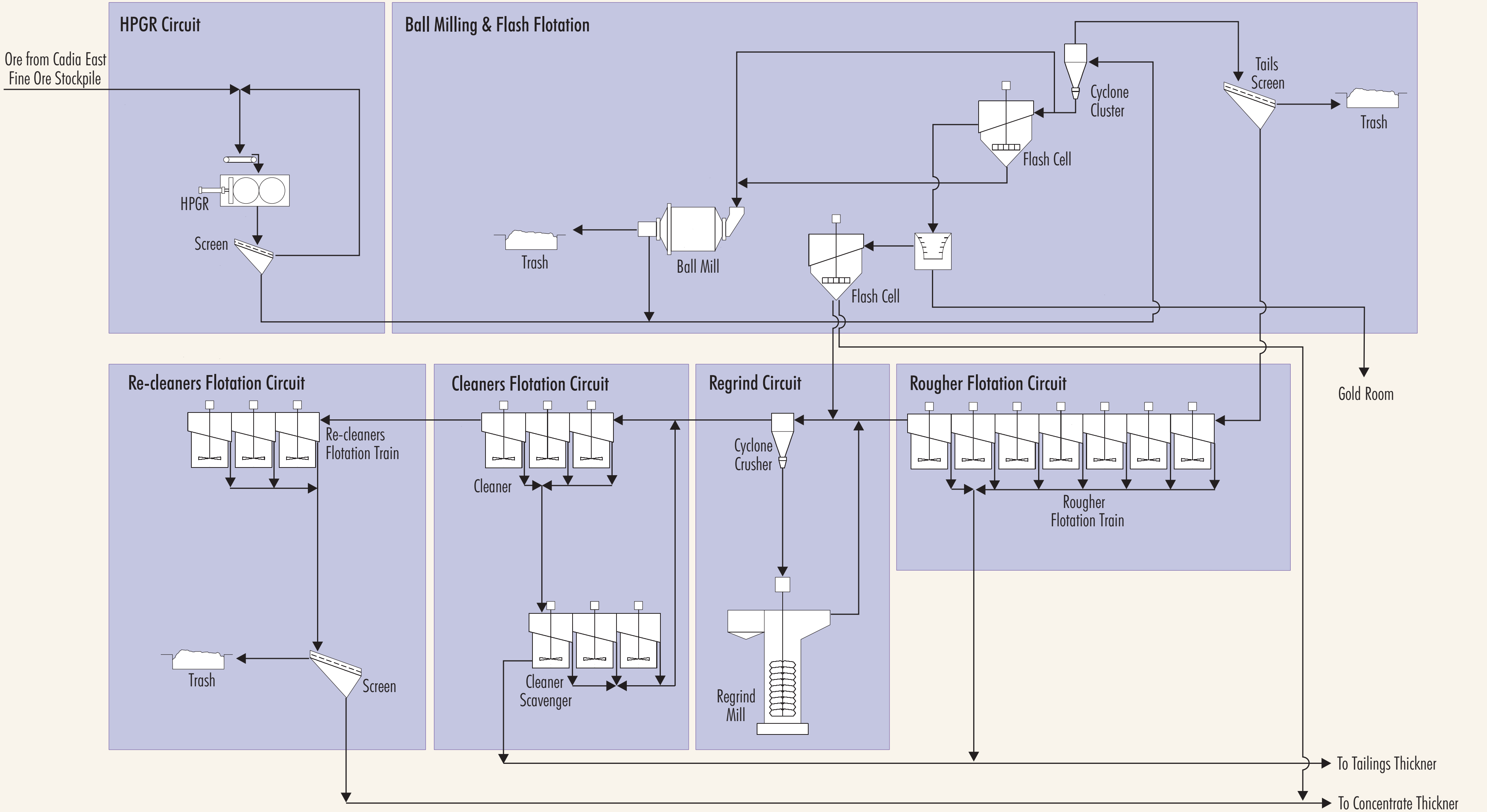
Molybdenum Concentrate Transport

Molybdenum concentrate product would be transported on trucks (nominally to Sydney, subject to market requirements) at a rate of up to 1,500 tpa (or approximately 6 trucks per week).

2.7.4 Concentrate Thickening

The gold/copper concentrate produced at the ore processing facilities would be pumped to the concentrate thickeners (including an additional thickener and storage tank) where it would be thickened to approximately 60% solids w/w. The mineral concentrate slurry would be withdrawn from the stock tanks and pumped to the CVO Dewatering Facility and/or Blayney Dewatering Facility.

Further details of the mineral concentrate transport, dewatering and product transport is provided in Section 2.9.



Source: Ausenco (2008)

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FIGURE 2-10
New Processing Plant -
Process Flow Diagram

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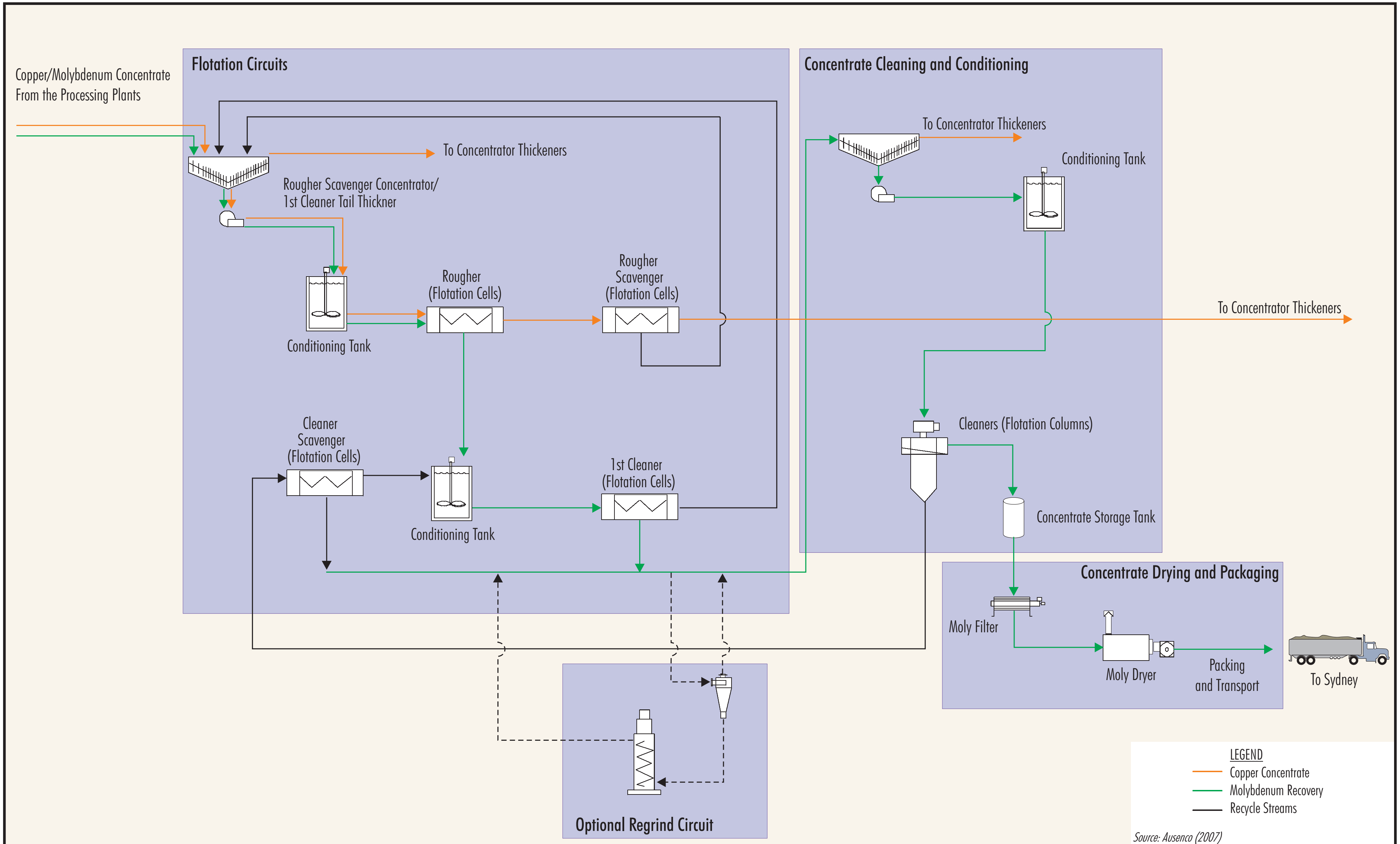
Table 2-9
Summary of the Main Components of the New Processing Plant and Associated Ore Handling Infrastructure

Processing Stage	Component	Function/Description
Ore Reclaim	Reclaim Tunnel	Steel reinforced tunnel located below the new coarse ore stockpile and housing the reclaim feeder and conveyor.
	Reclaim Conveyor	Conveyor which transfers primary crushed ore from the reclaim tunnel to the secondary crushing circuit.
Secondary Crushing	Vibrating Screen	Vibrating screen which separates oversize material from the coarse ore stockpile (i.e. greater than 50 millimetres [mm]).
	Secondary Crusher	Cone crushers which crushes ore to less than 50 mm. Two 600 kilowatt (kW) cone crushers would be used.
	Transfer Conveyor	Conveyor which transfers crushed ore from the secondary crusher to the HPGR circuit.
HPGR circuit	HPGR	HPGR that crushes ore by passing the ore through a pair of counter rotating rolls, one fixed and the other floating.
	Wet Screens	Vibrating screen which separates oversize material from the ore slurry produced in the HPGR.
	Hydrocyclone	Separator producing two streams according to particle size (larger particles as underflow and smaller particles as overflow).
	Ball Mill	Large rotating drum containing steel balls used to break ore down into smaller particles. Two 10 megawatt (MW) twin pinion ball mills would be used in the new processing plant.
	Gravity Concentrator	Removes free gold particles from the ore slurry by gravity extraction methods.
	Flash Flotation Circuit	Flotation cell and small cleaner cell located in the gravity circuit, designed to rapidly extract readily separated gold and copper particles from the ore slurry (overflow from the circuit reports to the concentrate thickener and underflow is returned to the grinding circuit).
Regrind Circuit	Vertimill®	Vertimill® which grinds ore slurry to a P80 (80% of material) of 38 micrometres (μm).
Flotation Circuit	Rougher Flotation Cells	Cells where minerals are separated from the ore slurry by flotation with reagents to produce overflow or concentrate (reports to cleaner cells) and underflow (reports to scavenger cells).
	Scavenger Flotation Cells	A secondary flotation unit following the rougher cells to separate additional minerals from the slurry (overflow reports to cleaner cells, underflow to tailings thickener).
	Cleaner Cells	Flotation cells designed to refine concentrates produced by the rougher and scavenger cells to the required concentrate quality (underflow reports to scavenger cleaner cells and overflow reports to the concentrate thickener).
	Scavenger Cleaner Cells	Provides a secondary refinement of the cleaner cell underflow (underflow reports to the tailings thickener and overflow reports back to the cleaner cells).
Concentrate Thickening	Concentrate Thickener	Thickens gold/copper concentrates produced by the flotation circuit by removing water (for recycle within the plant).
	Agitated Concentrate Storage Tank	Storage tank with 24 hours storage capacity with an agitator to maintain concentrate consistency.
Concentrate Dewatering	Concentrate Pipeline (existing and proposed)	Pipeline and associated pump stations from the Project to the CVO Dewatering Facility.
Tailings Thickening and Disposal	Tailings Thickener (existing)	Thickener, which recovers water from flotation barren residues (tailings) – thickens tailings to approximately 55% solids w/w.
	Tailings Delivery Pipeline	Tailings pipeline running in the existing pipeline corridor from the tailings thickener to the NTSF and STSF.

Source: Ausenco (2007).



Source: Ausenco (2007)

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FIGURE 2-11
Molybdenum Recovery Plant - Process Flow Diagram

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2.7.5 Tailings Thickening

Tailings from the ore processing facilities would flow by gravity to a new tailings thickener. Flocculant would be added to the tailings slurry to coagulate the fine particles and increase settling rates and terminal densities.

Thickener underflow, at 55% solids w/w would be withdrawn by a pump and delivered to the tailings disposal line sump. Thickener overflow would be pumped back to the ore processing facilities for water re-use.

Thickened tailings would be pumped to the tailings storage facilities by pipeline and discharged via spigots located peripherally around the tailings storage facilities.

2.7.6 Process Consumables

Table 2-10 lists typical quantities of chemicals and reagents that would be used at the Project (including those that are currently approved for use at the Cadia Valley Operations).

The existing flocculant and lime storage facilities would be demolished to enable the upgrade to the low grade processing plant and would be replaced by a new reagents storage facility (Figure 2-6).

Other process consumables for the new processing plant would be stored in existing storages (with the exception of flocculant and lime).

The proposed molybdenum recovery plant would require the use of additional reagents, namely: molybdenum collector (XD103); copper depressant (Aero 7260); and sodium hydrosulphide. The approximate rate of consumption, transport volumes and storage capacity of these additional reagents are provided in Table 2-10.

Table 2-10
Reagent Consumption, Transport and Storage Quantities

Reagent	Consumption (t/month)	Storage Volume (t)	Transport Volume (t)
Hydrated lime	1,184	300	25
Quicklime	725	150	25
Collector - S701	12	43	16
Promoter - S8761	24	48	16
Collector - aerophine 3418A	12	48	16
Frother – MIBC	62	41	27
Flocculant	59	32	20
Antiscalent	11	10	10
Collector - XD103	1	48	16
Copper depressant - Aero 7260	2	48	16
Sodium hydrosulphide	276	78	25
Sulphuric acid	11	110	24

Source: CHPL (2008).
t/month = tonnes per month.
MIBC = Methyl Isobutyl Carbinol.

2.7.7 Process Control

The low and high grade processing plants would continue to be controlled by a control room using a Process Control System (PCS). If constructed, the new processing plant would also use the existing control room and PCS. The PCS would be augmented as required for the upgrade to the ore processing facilities to provide continuous and sequence controls.

2.8 TAILINGS MANAGEMENT

The sub-sections below describe the tailings management concepts for the Project with further detail provided in Appendix O.

2.8.1 Tailings Quantities, Storage Requirements and Geochemistry

The Project would result in the production of approximately 450 Mt of Cadia East tailings (dry weight) at a rate of up to approximately 27 Mtpa. Tailings would be deposited in the NTSF and STSF (Section 2.1.7 and Figures 2-4a to 2-4d).

Geochemical characterisation testwork conducted by MESH (Appendix J) indicates that tailings from the processing of ore from the Cadia East deposit are likely to be NAF and similar to the tailings produced from the processing of Cadia Hill and Ridgeway ore (i.e. most of the sulphides contained in the ore report to the mineral concentrate rather than the tailings).

2.8.2 Tailings Management Strategy

Tailings would continue to be peripherally discharged in the NTSF and STSF using the existing sub-aerial tailings deposition techniques. The NTSF and STSF would continue to be progressively raised in nominal 4 m stages using upstream construction methods (Figure 2-12).

Table 2-11 shows the provisional tailings development schedule for the NTSF and STSF. A description of the augmented NTSF and STSF is provided in Sections 2.8.3 and 2.8.4, respectively.

Table 2-11
Provisional Tailings Storage Development Schedule

Year	Project Year[1]	Main Embankment Crest Level (m AHD)	
		NTSF	STSF
2010	1	728	678
2011	2	732	678
2012	3	732	678
2013	4	736	682
2014	5	740	682
2015	6	740	686
2016	7	744	686
2017	8	748	686
2018	9	752	690
2019	10	752	690
2020	11	756	690
2021	12	756	694
2022	13	760	694
2023	14	764	694
2024	15	764	698
2025	16	768	698
2026	17	768	698
2027	18	772	702
2028	19	776	702
2029	20	776	702
2030	21	779	702

Source: after Appendix O.

1 Construction of each raise is undertaken during the previous year and the additional storage is available at the start of each calendar year.

2.8.3 Northern Tailings Storage Facility

Tailings Storage Design

The currently approved embankment crest level for the NTSF is 741 m AHD. As a component of the Project the NTSF embankment would be raised in a series of stages up to a final embankment crest level of 779 m AHD as shown on Figure 2-12.

The NTSF would be raised using upstream lifts. Each new 4 m embankment would comprise an earth and rockfill embankment with an upstream clay face (Figure 2-12) (Appendix O). The toe of each new embankment would be keyed into the previous stage's embankment. The remainder of each embankment would be founded on the tailings beach (Figure 2-12).

Rockfill would be used to form a platform on the tailings surface onto which the clay fill materials would be placed (Figure 2-12).

On the eastern side of the NTSF, the ridge along which Cadia Road runs has a low point which would require the construction of a perimeter embankment as shown on Figure 2-4c. Construction of the perimeter embankment would generally be undertaken similar to the previous construction of starter embankments for the main tailings storage facility embankments and would comprise:

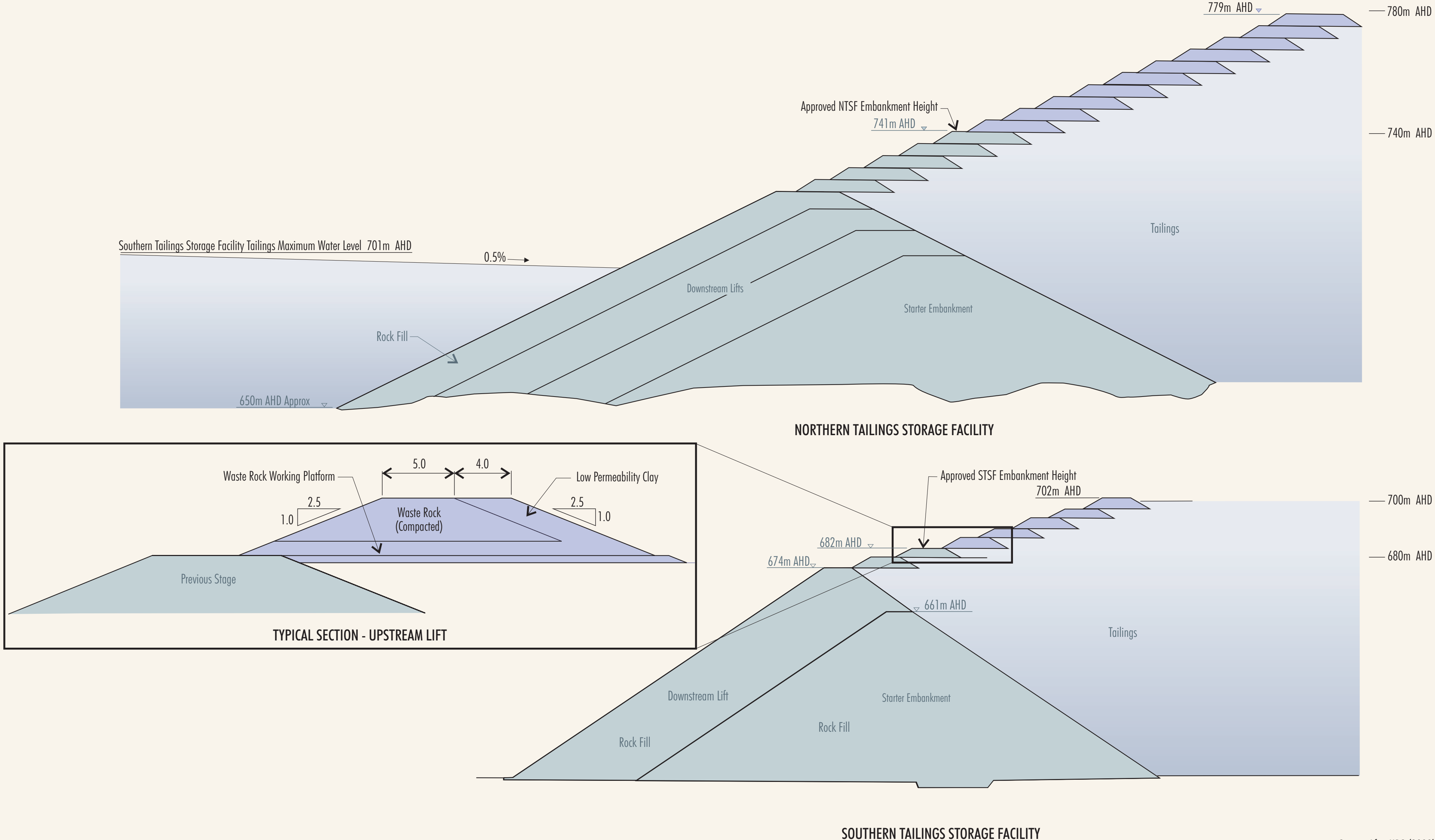
- an upstream benign waste rock shell;
- a sloping clay core;
- a transition zone of selected finer rockfill; and
- a downstream shell of mine benign waste rockfill.

The NTSF perimeter embankment (to the east) would be up to 15 m above the natural surface.

Construction Materials

Rock for the construction of the working platform and embankments would be sourced from NAF material from the South Waste Rock Dump. Approximately 3 million cubic metres (Mm^3) of rock would be required over the life the NTSF.

Clay for the construction of low permeability zones of the embankments would be sourced from borrow areas within the future NTSF or STSF inundation areas. Approximately 2.22 Mm^3 of clay would be required over the life the NTSF.



Not to Scale *Source: After URS (2008)*

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FIGURE 2-12

Northern and Southern Tailings Storage Facilities - Embankment Section

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Interaction with the South Waste Rock Dump

The NTSF would encroach into the footprint of the South Waste Rock Dump (Figures 2-4a to 2-4d). The NTSF embankment would intersect the toe of the South Waste Rock Dump at approximately 772 m AHD. Up to this level, the embankment of the NTSF would continue to be keyed into the natural ground surface.

A clay capping layer on the southern face of the South Waste Rock Dump would be keyed into the *in-situ* ground surface. The low permeability clay zones of the last two lifts (i.e. Stages 17 and 18 NTSF embankments) would then be keyed into this clay capping layer (Appendix O).

Interaction with the Rodds Creek Water Holding Dam

The Rodds Creek Water Holding Dam would be raised by 15 m to a final spillway level of 780 m AHD (Section 2.4.4).

The tailings within the NTSF would extend to the embankment of the Rodds Creek Water Holding Dam and progressively partly submerge its downstream face. This interaction is not anticipated to detrimentally affect the performance of either storage (Appendix O).

2.8.4 Southern Tailings Storage Facility

Tailings Storage Design

The currently approved embankment crest level for the STSF is 682 m AHD. As a component of the Project, the STSF embankment would be raised in a series of stages up to a final embankment crest level of 702 m AHD as shown on Figure 2-12.

The STSF would be raised using upstream lifts as described in Section 2.8.3 for the NTSF.

Construction Materials

Rock for the construction of the working platform and embankments would be sourced from NAF material from the South Waste Rock Dump. Approximately 1.47 Mm^3 of rock would be required for embankment lifts over the life the STSF.

Clay for the construction of low permeability zones of the embankments would be sourced from borrow areas within the future NTSF or STSF inundation areas. Approximately 1.09 Mm^3 of clay would be required over the life the STSF.

2.8.5 Seepage Management

The existing tailings storage facility seepage control methods and water management strategies would be implemented for the Project. These seepage control methods include:

- General sub-excavation within storage areas to remove topsoil and, if required, any loose or weak soils which may allow shallow, lateral migration of tailings water beneath the storage embankment.
- Construction of a low permeability clay core embankment and foundation cut-off key beneath the embankment.
- Placement of reworked *in-situ* clay blanketing in selective areas of the storage floor, where and if required.
- Discharge of the tailings into the storages in a manner that maximises storage densities and reduced tailings permeability.

Seepage from the NTSF would continue to report to the STSF and decant pool. Seepage from the STSF would continue to report to the seepage collection pond below the STSF. A float controlled electric pump located at the seepage collection pond returns collected seepage water to the STSF. The seepage collection pond and pump would remain during the life of the Project (Appendix O).

Water flow has been observed downstream of the STSF embankment in a gully reporting to Rodds Creek to the east of the existing seepage collection pond (Appendix O). Appendices F and G provide further discussion of recent surface water and groundwater investigations in the area downstream of the STSF embankment. As part of seepage management for the existing operations, water in this gully is intercepted and transferred to the existing seepage collection pond or the STSF. It is anticipated that the operation of this pond would continue for the life of the Project as part of the seepage management regime.

2.8.6 Tailings Storage Water Management

Water recycling from the NTSF and STSF would be maximised through the use of floating decant structures, a runoff/drainage collection pond and return water system.

Tailings Delivery

Tailings would be delivered via existing tailings pipelines (Figure 2-4a to 2-4d). Tailings would continue to be concurrently peripherally discharged in the NTSF and STSF using the existing sub-aerial tailings deposition techniques.

Decant Pool

Supernatant tailings water and stormwater would flow towards the decant pools. The NTSF and STSF would be operated to keep the decant pool as small as practicable in order to maximise water recovery and drying of the tailings beaches.

Return Water Systems

The return water system would continue to be used to pump water (including stormwater) collected in the decant pools of the NTSF and STSF to the Rodds Creek Water Holding Dam or the process water pond for re-use.

2.9 MINERAL CONCENTRATE PUMPING, DEWATERING AND PRODUCT TRANSPORT

2.9.1 Concentrate Pipeline

To accommodate the planned concentrate production rates for the Project, a new concentrate pipeline (124 mm internal diameter [ID]) would be installed with a design capacity of up to approximately 60 tph at a slurry density of 60% solids w/w. The new pipeline would be installed parallel to the existing concentrate pipeline to the Blayney Dewatering Facility, with a take-off to the CVO Dewatering Facility (Figure 1-3 and Figure 2-13). The new pipeline would be designed to handle the full duty from the Project, with the existing pipeline available as a partial standby. The new concentrate pipeline would also require the installation of supporting infrastructure (e.g. pumps). A new return water pipeline would also be constructed alongside the new concentrate pipeline.

The new concentrate pipeline would be positioned entirely within the existing concentrate pipeline easement. The section of the new concentrate pipeline from the existing Blayney Dewatering Facility to the CVO Dewatering Facility would be located within the railway line easement, which runs between the two sites (Figure 1-3 and Figure 2-13).

Leak detection and shutdown systems would be installed in the pipeline to identify and respond to variations in flow rates (used to detect leaks in the pipeline or other malfunctions). At larger creek crossings (e.g. Cowriga Creek), the pipeline would be encased in steel structures, equivalent to those on the existing pipeline, with the capacity to contain leakage if the pipeline was to fracture before automatic cut-off valves were activated.

The existing return water pipeline, which is located immediately adjacent to the concentrate pipeline would remain in use for the life of the Project.

2.9.2 Blayney Dewatering Facility

The existing Blayney Dewatering Facility (Figure 1-3) would be maintained to provide standby additional processing capacity between Year 3 to Year 7. After this time, if the facility is deemed redundant, it would be decommissioned.

The continued operation of the existing Blayney Dewatering Facility would be undertaken in accordance with the conditions of the existing Development Consent (DA 133-04-00).

2.9.3 CVO Dewatering Facility

Location and Layout

The CVO Dewatering Facility would be located adjacent to an existing industrial facility (the Blayney Cold Storage and Distribution warehouses) approximately 1.7 km east of Blayney township. The layout of the proposed CVO Dewatering Facility is shown in Figure 2-14.

Concentrate Dewatering

The concentrate treatment process at the CVO Dewatering Facility would be as per the process employed at the existing Blayney Dewatering Facility.

The concentrate would be discharged from the pipeline into a concentrate distribution box from where the slurry would be charged to one of two agitated storage tanks or to a clarifier feed box if required. The storage tanks would provide sufficient storage capacity to provide approximately 48 hours residence time prior to filtration.

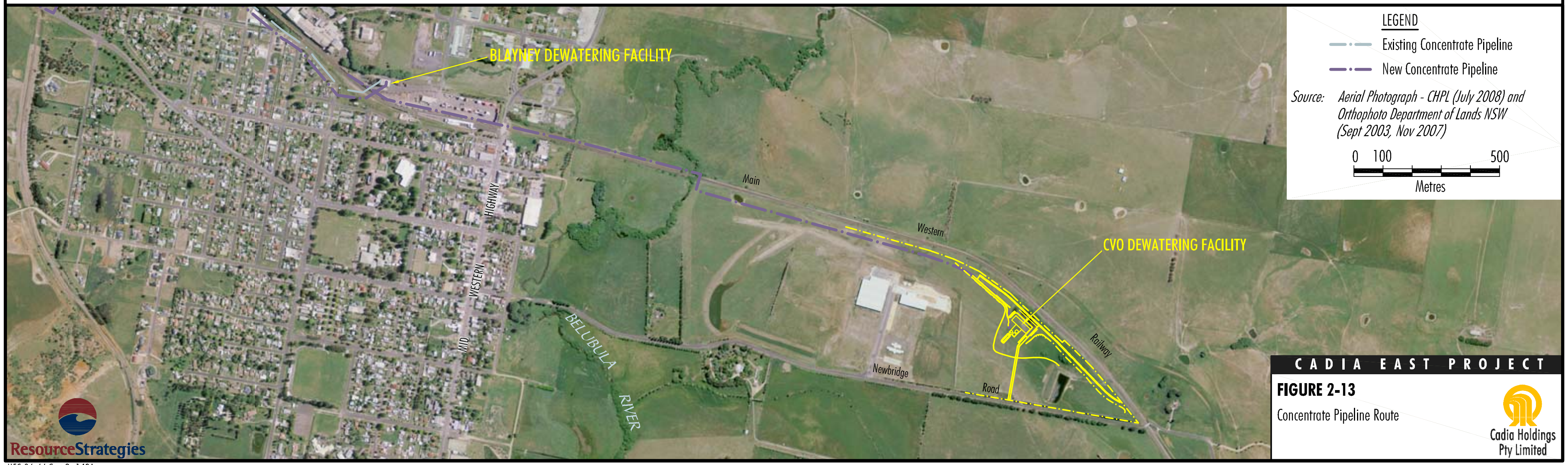

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FIGURE 2-13

Concentrate Pipeline Route

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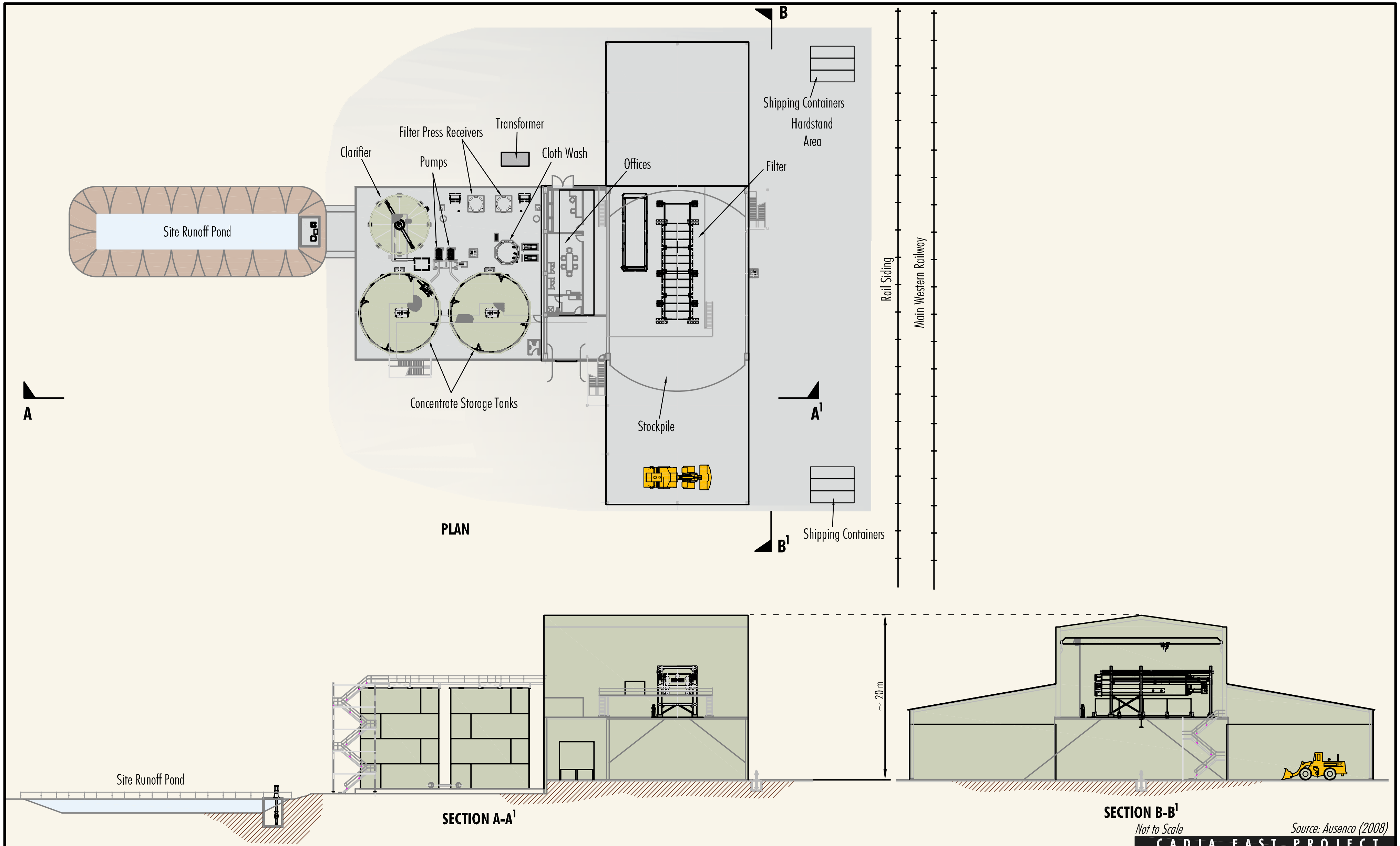
NEC-06-66 Sect 2_143A



Source: Ausenco (2008)

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FIGURE 2-14

CVO Dewatering Facility Conceptual Layout

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From the storage tanks, the concentrate slurry would be pumped to a vertical plate pressure filter press housed in a purpose built, metal clad shed. The filter press would produce dewatered concentrate with a residual moisture content of approximately 11%. Dewatered concentrate would be discharged onto a conveyor and transferred onto a stockpile (located wholly within the shed).

Water extracted from the concentrate slurry would be pumped to the return water pond at the existing Blayney Dewatering Facility and the return water pumps would pump all return water to the Cadia Valley Operations. If the existing Blayney Dewatering Facility is decommissioned after Year 7, new return water pumps and a tie-in to the return water pipelines would be installed at the CVO Dewatering Facility.

Concentrate Load-out

The concentrate load-out process would be as per the current process employed at the Blayney Dewatering Facility. A front-end loader would be used to load dewatered concentrate from the stockpile into containers for rail transport. The containers to be used would be approximately 6.5 m long, 2.6 m wide and 1.8 m high and have a carrying capacity of approximately 26 t of mineral concentrate.

A container forklift would transfer the filled containers from the load-out area to hardstand areas in readiness for loading onto a train. The filled containers would be loaded onto train wagons via the container forklift with two containers per wagon.

Hours of Operation

The CVO Dewatering Facility would operate 24 hours per day over two 12 hour shifts, seven days per week.

2.9.4 Mineral Concentrate Product Transport

It is anticipated that approximately six trains per week would be required to transport the concentrate from the CVO Dewatering Facility to the eastern seaboard for export. Each train would be capable of carrying up to approximately 68 containers.

2.10 WATER SUPPLY

2.10.1 Water Demand

The main water demand for the Project would be associated with ore processing. Other water supply requirements include underground mining water, dust suppression on roads, potable and non-potable uses around the mine site.

The majority of water used during ore processing would be recycled, either in the plants, from the tailings decant system or via the return water pipeline from the dewatering facilities. Water losses from the system would include tailings pore water and evaporative losses.

Make-up water demand for the Project is anticipated to be approximately 56 ML/day. This is approximately a 5.9 ML/day increase from existing operational water demand (i.e. approximately 12%).

The water supply scheme proposal has been designed to provide an additional 5.9 ML/day of water from various sources. A schematic of the water supply scheme is shown on Figure 2-15 and is described below.

Where practicable, the Project water supply would be prioritised as follows:

1. Recycling of water from the tailings thickeners.
2. Recovery of supernatant water from the tailings decant system. Return water from the CVO Dewatering Facility. Capture of incident rainfall and runoff across mine operational areas (i.e. ore processing facilities and stockpile areas).
3. Dewatering of active/inactive Cadia Hill open pit including groundwater inflows and incident rainfall, plus dewatering of Ridgeway/Cadia East underground mine workings/development in accordance with existing water licence conditions.
4. Treated effluent from the Orange and Blayney Sewage Treatment Plants.
5. Licensed surface water extractions from Cadiangullong Dam (including Cadia Creek Weir) and Rodds Creek Water Holding Dam.
6. Licensed surface water extractions from the Belubula River and Flyers Creek Weir, plus licensed groundwater extractions from existing bores.

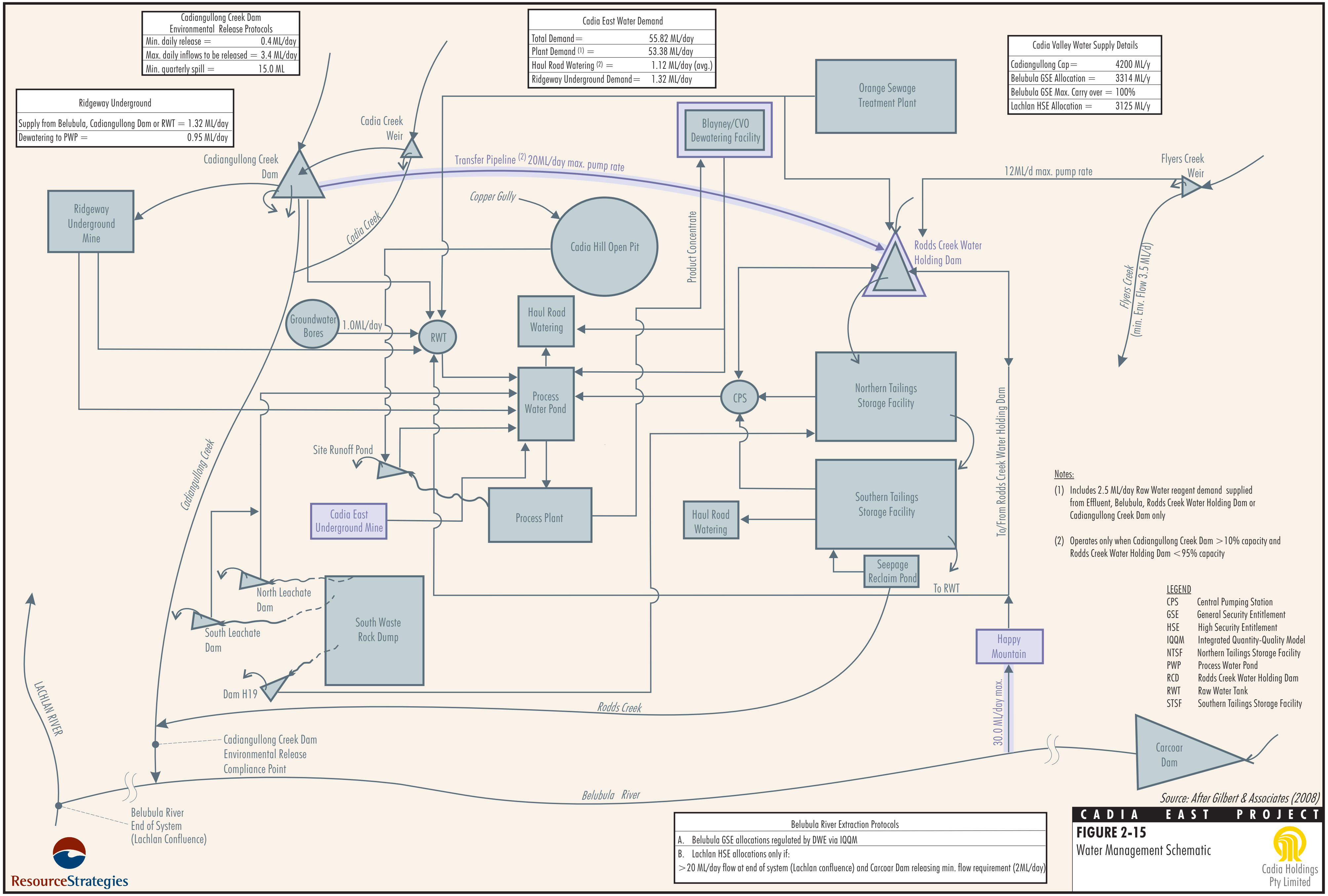


FIGURE 2-15
Water Management Schematic

NEC-06-66 Sect 2_018I

2.10.2 Project Water Supply Scheme

The modelled performance of the Project water supply system is described in Appendix F. The sub-sections below describe the Project water supply augmentations.

Cadiangullong Dam

In accordance with the Cadia Hill Development Consent (DA 44/95), Cadiangullong Dam has a release protocol to maintain low flows downstream of the dam for riparian water access for downstream users and environmental flows.

A new transfer pipeline would be installed between Cadiangullong Dam and Rodds Creek Water Holding Dam. This pipeline would be located within existing disturbance areas and would be aligned adjacent to existing roads or pipelines where practicable. The pipeline would enable water to be transferred from Cadiangullong Dam to Rodds Creek Water Holding Dam. The amount of water extracted per year would not exceed the licensed cap of 4,200 ML.

Transfer of water would occur until the volume in Cadiangullong Dam drops to 10% of its capacity, at which point transfers would cease until the volume equals or exceeds 10%. During these periods where the level of Cadiangullong Dam is at or less than 10% CHPL would continue to release water from the Cadiangullong Dam in accordance with the existing environmental release protocol. These releases would continue up to the point when the storage level falls below the lowest release point on the multi-level off-take in Cadiangullong Dam (set at 764.9 m AHD). This protocol is targeted at maintaining a storage “reserve” within Cadiangullong Dam for environmental and riparian releases to Cadiangullong Creek.

Belubula River Water Supply Extractions

CHPL is currently licensed to extract water from the Belubula River up to a daily maximum of 20 ML/day. To augment the Project water supply, CHPL would upgrade the existing pipeline and pumping infrastructure to allow a maximum extraction of 30 ML/day from the Belubula River. CHPL’s current licensed allocation on the Belubula River would remain unchanged[2]. The upgrade to the pipeline would allow CHPL to extract more of the current licensed allocation (Section 2.1.10).

The new Belubula River pipeline would be located immediately adjacent to the existing pipeline (Figure 2-16). The existing pumping station located near to the Belubula River would also be upgraded. The layout of the upgraded pumping station is shown on Figure 2-17.

Rodds Creek Water Holding Dam

The capacity of the Rodds Creek Water Holding Dam would be increased from approximately 3,700 ML to approximately 14,500 ML by raising the spillway by 15 m to 780 m AHD (URS, 2009).

These augmentations would allow CHPL to store more water that is currently licensed to be extracted on an annual basis on-site and from the Belubula River.

Rodds Creek Water Holding Dam has a soil and rock embankment with an upstream clay core keyed into the foundation. Construction of the raise would be conducted by downstream placement of waste rock and extension the clay core. The crest level would be extended to 782 m AHD, with the spillway being reconstructed at 780 m AHD. The revised dam inundation area and a conceptual cross-section of the embankment extension is shown on Figure 2-18. The dam crest width has been designed to accommodate the new Cadia Hill site access road (Section 2.4.6).

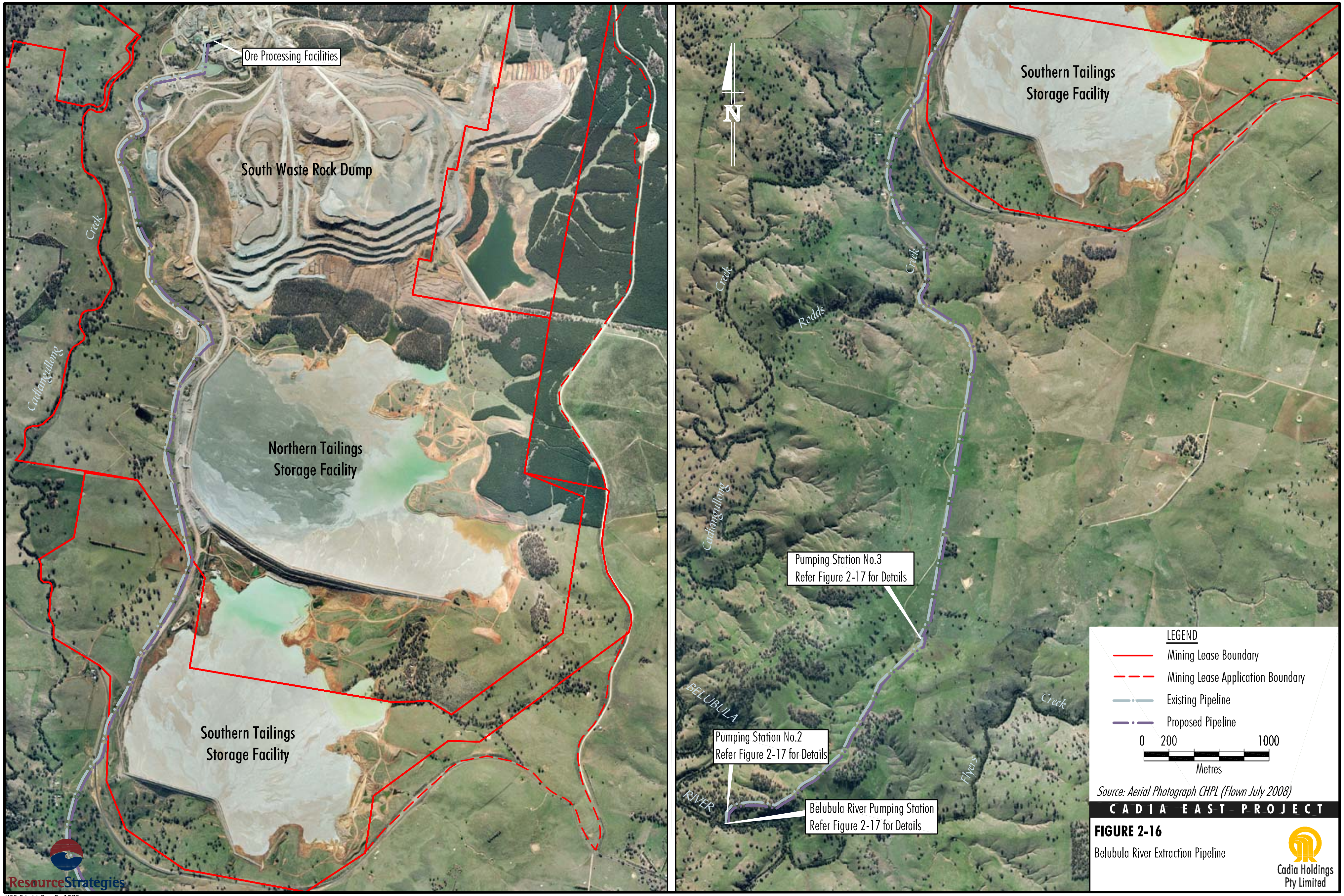
The inundation area would not extend to the Cadia East subsidence zone or zone of influence (Figure 2-4d). Notwithstanding, monitoring and surveillance of the subsidence zone would be undertaken to determine the extent of mine subsidence progression (URS, 2009), and its proximity to Rodds Creek Water Holding Dam.

It is possible that the inundation area would interact with the toe of the South Waste Rock Dump. In order to manage this potential interaction, a clay capping layer may be used on the dump, where required.

The Rodds Creek Water Holding Dam would be used to store water from the following sources:

- licensed water extractions from the Belubula River;
- water transferred from Cadiangullong Dam;
- excess water in the site water management system, including but not limited to excess water in the tailings storage facilities, water from on-site sediment dams, and water from underground dewatering activities; and
- treated effluent from Orange and Blayney.

[2] CHPL may consider purchasing permanent or temporary transfers on the Belubula River if opportunities arise on the open water market in the future, and subject to DWE requirements.



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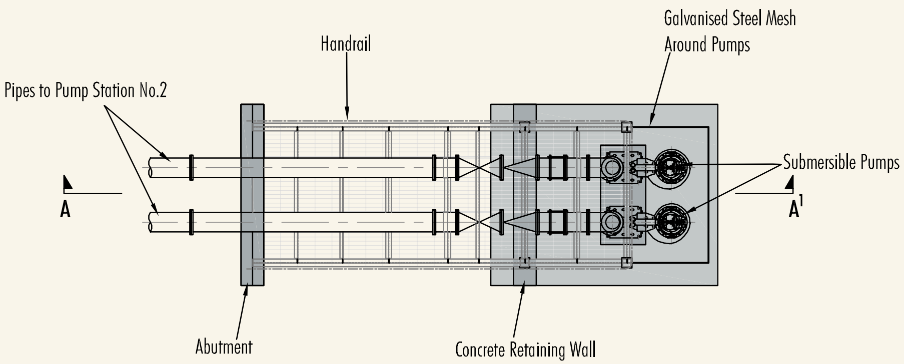
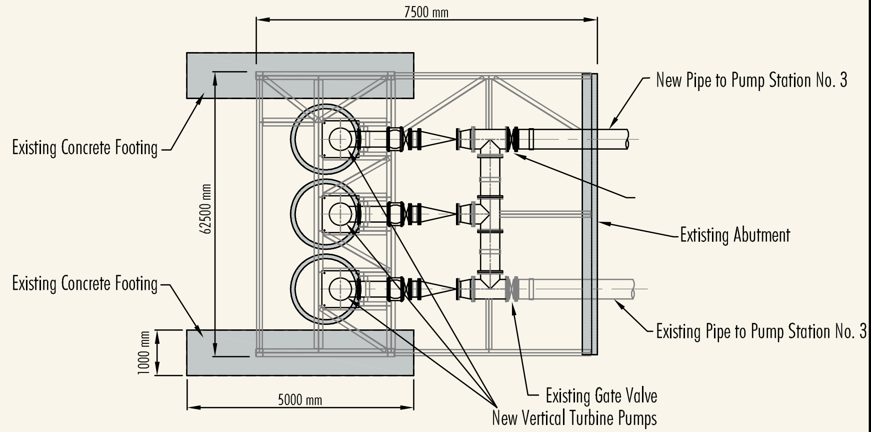
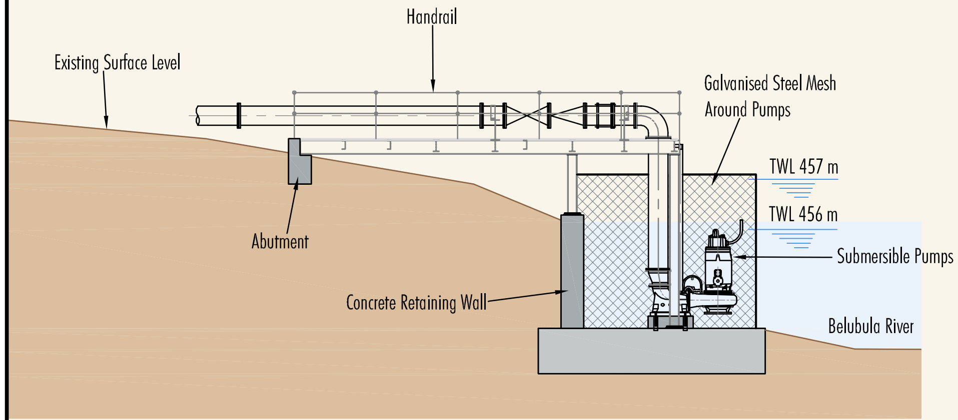


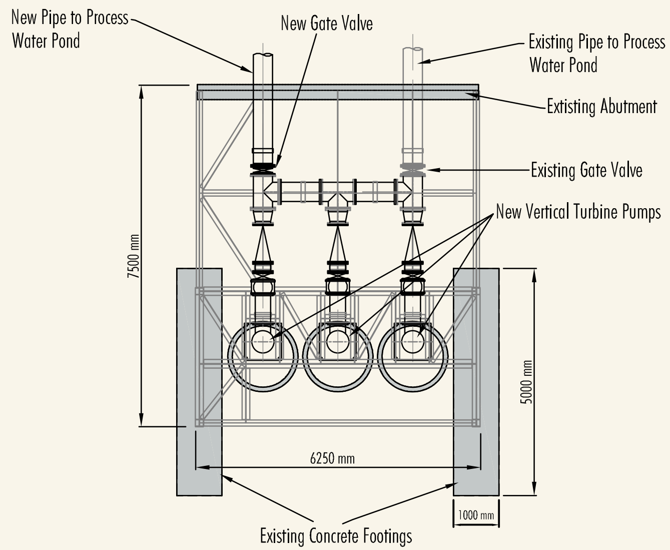
PLAN OF BELUBULA RIVER PUMPING STATION



PLAN OF PUMPING STATION No. 2



SECTION A-A[1]



PLAN OF PUMPING STATION No. 3

0 1000 5000
Millimeters

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FIGURE 2-17

Belubula River Pump Station Upgrade-
Conceptual Design

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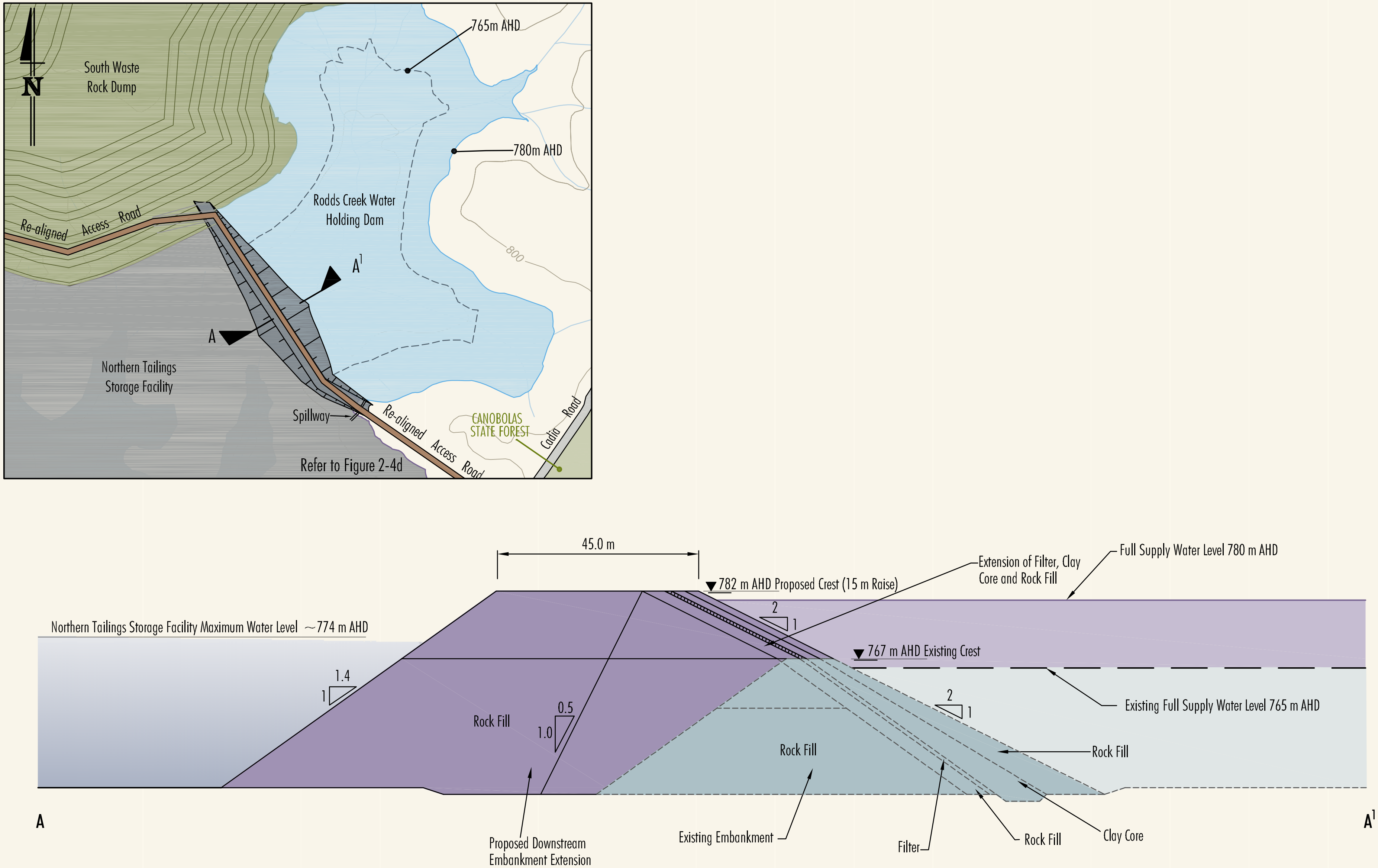

Not to Scale *Source: URS (2009)*

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FIGURE 2-18

Rodds Creek Water Holding Dam Extension

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Whilst inflows from the relatively small catchment (4.7 square kilometres [km^2]) of the extended Rodds Creek Water Holding Dam are likely to be small relative to the capacity of the storage, overflow from the bypass spillway may occur during prolonged periods of intense rainfall if these conditions were coincident with near full conditions in the storage. Overflows would report to the decant pond of the NTSF which is designed to contain inflows from the entire contributing Rodds Creek catchment.

Internal Runoff Collection

Project area runoff would be collected by a series of bunds and collection ponds, the majority of which are existing and approved. Runoff from the administration/laydown areas and other disturbed areas would be collected during rainfall events and transferred to the process water pond or Rodds Creek Water Holding Dam for inclusion in the water supply system.

Mine Dewatering

Appendix G presents a groundwater assessment for the Project including estimates of groundwater inflows into the Cadia East underground mine, Ridgeway underground mine and Cadia Hill open pit.

Groundwater inflows into the Cadia East underground mine are expected to be up to 5.46 ML/day. As described in Section 2.5.15, this water would be pumped to the surface for treatment (if necessary) and then used in the ore processing facilities.

On-site Groundwater Extraction Bores

CHPL has installed a borefield comprising ten bores (Figure 2-1). The borefield is generally used for potable water requirements. In accordance with Cadia Hill Development Consent (DA 44/95) Condition 38A, the maximum approved extraction from the borefield is 2 ML/day on average over a year. As noted in Section 2.1.10, the borefield is currently permitted for use as potable water, and for use as process make-up water only under exceptional circumstances (e.g. periods of prolonged drought), as determined by the Director-General of the DoP, in accordance with the Cadia Hill Development Consent (DA 44/95).

Under the Project, it is proposed that the borefield would be used for process make-up water on an ongoing basis (i.e. not just during exceptional circumstances). Some of the bores would need to be relocated as a result of the development of the Cadia East subsidence zone. Relocation would be undertaken in consultation with the DWE.

2.11 WATER MANAGEMENT

The water management strategy for the Project is summarised below and described in more detail in Appendix F. A description of the surface water and groundwater monitoring programmes to be undertaken for the Project are provided in Sections 4.2 and 4.3.

2.11.1 Integrated Erosion and Sediment Control System

The objectives of the existing Cadia Valley Operations erosion and sediment control system are:

- to control soil erosion and sediment generation from areas disturbed by construction activities; and
- to maintain water quality (particularly in terms of suspended solids content) in local watercourses to acceptable standards for downstream use.

The water management strategy during construction/development and operational areas for the Project would meet these objectives by incorporating the following components:

- construction sequencing to reduce to minimum practicable levels the potential for sediment generation;
- upslope clean water diversions to limit run-on to disturbed areas;
- construction of sediment retention storages sized in accordance with the existing Cadia Valley Operations design criteria;
- use of small scale runoff controls comprising silt fences and rockfill filter bunds; and
- rapid stabilisation and/or revegetation of disturbed areas.

The existing IESCP (CHPL, 2007a) would be reviewed and revised for the Project.

2.11.2 Water Management System

As described in Section 2.4.4, the existing Cadia Valley Operations water management system would be used for the Project with some augmentation. The water management system is shown in schematic form on Figure 2-15 and would be progressively developed as water management requirements change over time.

The water management strategy for key areas is provided in Appendix F and summarised below:

- *Processing Plant and Ore Stockpile Areas*. Runoff from the ore processing facilities site would be intercepted and conveyed to the existing process water pond (Figure 2-6) via a system of bunded collection drains constructed around the perimeter of the plant area. The existing site runoff pond would be enlarged if necessary to provide containment of all runoff from a 1 in 100 year Average Recurrence Interval (ARI), 48 hour rainfall event.
- *Mining Operations* - A system of sediment dams, clean water diversions, internal runoff drains and culverts have been constructed for the existing Cadia Hill and Ridgeway operations. These structures are described in the IESCP. The storage capacity of these structures would be reviewed under the IESCP and increased where necessary to accommodate the proposed additional hardstand areas and modifications to the layout of buildings/workshops.
- *Tailings Storage Facilities* – Refer to Section 2.8.
- *Rodds Creek Water Holding Dam* – Refer to Section 2.10.2.
- *Mine Dewatering System* – Water collected from Ridgeway, Cadia Hill and Cadia East would be pumped to the process water pond or the Rodds Creek Water Holding Dam.

2.12 INFRASTRUCTURE AND SERVICES

2.12.1 Administration Offices, Buildings and Workshops

The existing general infrastructure (i.e. service workshops, laydown areas, explosive, consumable and general storage areas) at the Cadia Valley Operations would generally remain unchanged during the life of the Project. However, the following key modifications would be required:

- relocation of the Cadia Hill administration building, warehouse and fixed plant workshop to the south of the ore processing facilities (to accommodate the new processing plant, if required) (Figure 2-6);
- construction of new administration buildings (Figure 2-4a);
- construction of a new five bay heavy vehicle workshop (Figure 2-6); and
- construction of a new concrete batch plant (Figure 2-4a).

2.12.2 Site Access Roads and Internal Roads

Site Access Roads

The existing Cadia Hill access road (Figures 2-1 and 2-4a) would be the main access road for the Project and provides access to the administration buildings, workshops, stores, ore processing facilities and the Cadia East underground mine.

As discussed in Section 2.4.6, the existing Cadia Hill access road would be relocated around the Cadia East subsidence zone. The relocated Cadia Hill access road would be constructed to a similar standard to the existing Cadia Hill site access road. The revised alignment of the site access road is shown on Figure 2-4c. Barriers would be installed as necessary where the road traverses the raised Rodds Creek Water Holding Dam wall.

The existing Ridgeway access road would be retained for use during the operation of Ridgeway and Ridgeway Deeps and thereafter for access to the northern portion of the Cadia Valley Operations mining leases.

Internal Roads

Wherever possible, existing internal gravel roads would be used to service the Project facilities. New internal roads would be constructed as required (e.g. for access to ventilation raises [Figure 2-5]). The use of these internal access roads would be restricted to mine personnel only.

Existing haul roads (e.g. ore processing facilities area to the STSF, NTSF and South Waste Rock Dump) would be used, where practicable. Haul roads would continue to be regularly watered to minimise dust generation potential.

2.12.3 Cadia Road Re-alignment

A 1.1 km section of Cadia Road would be re-aligned to avoid the Cadia East zone of influence (Figure 2-7).

The road re-alignment would be constructed in consultation with BSC and CSC with consideration of the requirements of the *Road Design Guide* (NSW Roads and Traffic Authority [RTA], 1999) and would be similar to the existing sealed section of Cadia Road.

2.12.4 Electricity Supply and Distribution

The total maximum power supply requirement for the Project when the ore processing facilities are fully operational would be approximately 160 MW. It is expected that up to approximately 50 MW would be required for underground mining and approximately 100 MW for the upgraded ore processing facilities. Minor infrastructure, buildings and administration offices would require approximately 10 MW.

The electrical supply could be delivered by the existing Cadia Valley Operations 132 kV ETL. However, CHPL is currently undertaking concept and pre-feasibility studies of potential power supply upgrade options to increase the power supply reliability for the Project. These include:

- augmentations to the existing 132 kV ETL from Orange; and/or
- construction of a new ETL.

Approval for any augmentation to the Cadia Valley Operations power supply would be sought separately to the Project, and therefore is not assessed in this EA.

A number of substations would be installed for the Project including surface sites adjacent to the ventilation fans and surface conveyors, at the ore processing facilities, and underground substations for the crushing stations, loading conveyors, dewatering system, crib room/workshops and other mining purposes.

Power reticulation for the underground workings is discussed in Section 2.5.16. Power would be transferred either by overhead cable or underground cable where necessary. Standard electrical safety laws and practices (including vehicle clearance considerations) would apply.

2.12.5 Potable Water

The potable water supply for the Project would continue to be sourced from existing groundwater bores.

2.12.6 Security and Public Safety

Security and public safety at the Cadia Valley Operations would continue to be maintained by restricting access to authorised personnel.

Gatehouses would continue to be operated 24 hours per day and would be linked to the administration office to control all vehicle movements and visitors to the Cadia Valley Operations. Existing warning signs posted around mining lease boundaries would be retained and extended to new mining lease boundaries where necessary.

The existing Cadia Hill gatehouse would be relocated to the new intersection between the new access road and Cadia Road.

2.12.7 Communications

The following communication systems would be required for the Project:

- mobile phones using existing networks;
- existing telephones providing outside call capability and intercom facilities through the existing systems;
- the existing Very High Frequency radio system for above ground communications (with connection to the underground radio system);
- an underground communication system, consisting of telephone lines and an underground mine radio system; and
- existing computer local area and wide area networks for provision of email communication.

2.13 MANAGEMENT OF CHEMICALS AND WASTES

2.13.1 Wastes

The Project would generate waste streams that would be similar in nature to the existing Cadia Valley Operations. The key waste streams would continue to comprise:

- waste rock (estimated waste rock production rates, management measures and characteristics are described in Section 2.6);
- tailings (estimated tailings production rates and management measures are described in Section 2.8);
- general domestic waste and recyclables associated with the Project workforce and administration and workshop facilities; and
- waste oils, scrap metal, used tyres and other wastes from the workshops and mining activities that are periodically removed for recycling or disposal by appropriately licensed contractors.

All domestic waste and general recyclable products would continue to be collected by an appropriately licensed contractor.

Scrap metals would continue to be segregated at source into bins and recycled by a scrap metal contractor. Waste oil and grease would continue to be collected by a licensed contractor for off-site disposal or recycling.

Used tyres produced by light fleet vehicles would continue to be periodically collected by a contractor, for recycling or disposal. Additional tyres produced by heavy vehicles (approximately 510 tyres per year) would continue be disposed of in the waste rock dumps.

Where licensed waste contractors handle waste, those contractors would be required to comply with their own licence agreements with the NSW Department of Environment and Climate Change (DECC). Waste would be disposed of at a DECC approved waste facility that is licensed under the *Protection of the Environment Operations Act, 1997* (PoEO Act).

Estimated annual waste volumes removed from site over the life of the Project area provided in Table 2-12.

CHPL would continue to apply general waste minimisation principles (i.e. re-use and recycling where practicable) to reduce the quantities of waste that require off-site disposal. For example, comingle recycling bins would continue to be provided around site to encourage personnel to recycle applicable waste to reduce the amount of waste going to off-site landfills. In addition, larger quantities of recyclable materials such as paper, cardboard and scrap metals would continue to be segregated at source and recycled.

Table 2-12
Predicted Annual Waste Volumes Removed from Site

Example of Waste	Indicative Waste Type[1]	Estimated Annual Quantity to be Removed from Site	Management Measure
General Waste	General Solid Waste (putrescible)	1,420 t	Removed from site by appropriately licensed contractor for disposal
Paper and Cardboard	General Solid Waste (non-putrescible)	72 t	Removed from site by appropriately licensed contractor for recycling
Scrap Steel	General Solid Waste (non-putrescible)	1,613 t	Removed from site by appropriately licensed contractor for recycling
Empty Drums	General Solid Waste (non-putrescible)	50 t	Removed from site by appropriately licensed contractor for disposal
Mercury	Liquid Waste	299 kg	Removed from site by appropriately licensed contractor for disposal
Waste Oil	Liquid Waste	714 kL	Removed from site by appropriately licensed contractor for recycling
Oil Filters	General Solid Waste (non-putrescible)	30 t	Removed from site by appropriately licensed contractor for disposal
Oily Water	Liquid Waste	168 kL	Removed from site by appropriately licensed contractor for recycling
Oily Rags	General Solid Waste (non-putrescible)	33 t	Removed from site by appropriately licensed contractor for disposal or re-use
Light Vehicle Tyres	Special Waste	30 t	Removed from site by appropriately licensed contractor for recycling
Batteries	Hazardous	20 t	Removed from site by appropriately licensed contractor for disposal
Sewage Treatment Sludge	General Solid Waste (putrescible)	148 t	Removed from site by appropriately licensed contractor for treatment and disposal

Source: CHPL (2008).
[1] Indicative only – described or pre-classified wastes in *Waste Classification Guidelines Part 1: Classifying Waste*(Waste Guidelines) (DECC, 2008a).
kL = kilolitre.

2.13.2 Sewage Treatment and Effluent Disposal

Sewage and wastewater from ablution facilities on-site would continue to be collected and transferred via a sewerage system to the existing on-site sewage treatment plant, located adjacent the ore processing facilities, which consists of anaerobic and aerobic treatment and final sterilisation. Sludge from the sewage treatment plants is removed annually by a licensed contractor.

Treated effluent would continue to be pumped via the existing raw water supply line to the process water pond.

2.13.3 Management of Dangerous Goods

Transportation

Consistent with the existing Cadia Valley Operations procedures, hazardous reagents and explosives required for the Project would be transported in accordance with the appropriate regulations under the *Dangerous Goods (Road and Rail Transport) Act, 2008*. These regulations apply versions of the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (ADG Code) (National Transport Commission, 2007).

Handling and Storage

Hydrocarbon Storages

Hydrocarbons used on-site for the Project would include fuels (diesel and petrol), oils, greases, degreaser and kerosene. Diesel usage would range between approximately 6 ML/annum and 45 ML/annum with an average use of approximately 12 ML/annum.

Diesel would continue to be stored at the Cadia Valley Operations in the existing 55,000 litres (L) and 20,000 L above-ground tanks with fuel dispensing facilities. A new fuel storage facility would be constructed to the north of the Cadia East decline (Figure 2-6). All hydrocarbon storage facilities would be operated in accordance with Australian Standard (AS) 1940:2004 *The Storage and Handing of Flammable and Combustible Liquids.* All new hydrocarbon storage tanks for the Project (above-ground and underground) would be located in facilities designed to comply with Australian Standards.

Procedures have been developed at the existing Cadia Valley Operations for the handling, storage and disposal of workshop hydrocarbons (i.e. oils, greases, degreaser and kerosene). Waste hydrocarbons are collected, stored and removed by licensed waste contractors on a periodic basis. Workshop hydrocarbon spills and leaks are contained by a purpose built oil/water separator system which is inspected and maintained on a regular basis.

Explosives Storage

Emulsion and ANFO is currently stored above-ground at the existing explosive magazine (Figure 2-1). Storage of high explosives (e.g. accessories and primers) and detonators would continue to be stored in purpose-built above-ground and underground magazines.

Explosives for the open pit and underground mining operations would continue to be used in accordance with the existing safety and operational procedures at the Cadia Valley Operations and AS 2187.2:2006 *Explosives – Storage and use – Use of explosives*. AS 2187.2:2006 details the requirements for the safe storage and handling of explosives as well as safe storage distances from other activities and bunding requirements.

Gas Storage Tanks

Liquid Petroleum Gas (LPG) and compressed oxygen (O_2) tanks would both be stored separately, and in isolation, near the ore processing facilities. The tank facilities would be installed and operated in accordance with relevant Australian Standards (e.g. Australian Standard/New Zealand Standard [AS/NZS] 1596:2008 *The storage and handling of LP Gas*) and NSW safety regulations.

Material Safety Data Sheets and Chemical Storages

No chemical or hazardous material is permitted on-site at the Cadia Valley Operations unless a copy of the appropriate Material Safety Data Sheet (MSDS) has been received and the product assessed for suitability.

All chemicals on-site would continue to be recorded in the existing inventory register which identifies the type of product, dangerous goods class, liquid class, hazchem class and the quantity held on-site. The register also identifies the emergency response procedures in the event of a spill.

Chemical storages would be provided within existing workshop and storage buildings and would be segregated according to chemical type and storage requirements.

2.14 WORKFORCE

The total operational workforce at the Cadia Valley Operations (including mining contractor's personnel and employees at the Blayney Dewatering Facility) currently averages approximately 950. The current workforce is approximately 1,100, which includes Ridgeway Deeps construction. It is anticipated that an average of 880 employees and a maximum of approximately 1,300 employees would be required for the Project. Maximum employment occurs in year two of the Project, during peak construction/development activity.

A summary of the initial development and operational workforce is provided in Table 2-13.

Table 2-13
Initial Development and Operational Workforce

Development Activity	Average	Peak
Cadia Hill Open Pit	35	260
Ridgeway/Ridgeway Deeps	55	140
Cadia East Underground Mine	550	490
Ore Processing Facilities	150	310
Administration/Support Services	90	100
Total	**880**	**1,300**

Source: CHPL (2008).

Nominal shift times for construction staff would be between 7.00 am to 7.00 pm and 7.00 pm to 7.00 am and up to seven days per week.

The Project would operate 24 hours per day, seven days per week. Nominal shift start and finish times for mining operations would generally remain unchanged as follows:

- Administration – 7.00 am to 4.00 pm weekdays.
- Open pit/underground (day) personnel – 7.00 am to 7.00 pm.
- Open pit/underground (night) personnel – 7.00 pm to 7.00 am.
- Ore processing facilities (day) personnel – 6.30 am to 4.30 pm.
- Ore processing facilities (day shift) personnel – 6.30 am to 6.30 pm.
- Ore processing facilities (night shift) personnel – 6.30 pm to 6.30 am.

Nominal shift start and finish times for personnel at the CVO Dewatering Facility would be 7.00 am to 7.00 pm and 7.00 pm to 7.00 am.

2.15 SURFACE EXPLORATION

As discussed in Section 2.1.4, numerous surface exploration campaigns have been undertaken in the Cadia Valley.

Surface exploration activities at Cadia Valley Operations would continue. It is proposed that future exploration activities within the Project mining leases be managed via an Exploration Environmental Management Plan to be developed in consultation with the DPI-MR.