DESCRIPTION OF THE PROPOSED EXPANSION

5

5.1 INTRODUCTION

This chapter describes the various phases and timing for the development of the proposed expansion. It provides a holistic overview of the expansion, before describing each of the major components: mining, processing, waste management, water supply, electricity supply, transportation, workforce and accommodation. A brief context and overview is provided for each component, followed by details of the proposed design, construction method and operation. Strategies for the progressive rehabilitation and future closure are presented in Chapter 23, Rehabilitation and Closure.

The proposed expansion is scheduled to start immediately following approval by the Australian, South Australian and Northern Territory governments and a decision by the Board of BHP Billiton Group to proceed. The proposed expansion would increase total production at Olympic Dam from the current nameplate capacity of 235,000 tonnes per annum (tpa) of copper plus associated products (i.e. uranium oxide, gold and silver) to up to 750,000 tpa of refined copper equivalent plus associated products.

5.2 EXPANSION OVERVIEW

The proposed expansion introduces a new open pit mining operation, together with an increased capacity to process minerals and additional infrastructure to support the expanded operation (see Figure 5.1).

Table 5.1 provides an overview of the indicative ore, mine rock and metal production rates for the proposed expansion. A summary of the major inputs and outputs is also provided in Figure 5.2.

About 300–350 m of overburden would be removed over a period of five to six years to reach the ore. Once ore has been reached, the mining rate would be progressively increased from an initial rate of 20 Mtpa to about 60 Mtpa of ore. The mined ore would be sent to both the existing and a new metallurgical plant for processing. An additional 350–390 Mtpa of mine rock would also be extracted. The mine rock comprises overburden and mineralised rock that is currently uneconomic to process, and this material would be directed to the rock storage facility (RSF) or low-grade stockpiles for future processing.

Table 5.1 Indicative ore, mine rock and metal production rates

Production measure	Current operation (post-optimisation)[1]	Proposed expansion	Combined operations
Ore mined (Mtpa)	12	60	72
Mine rock (Mtpa)	0	350–390	350–390
Total material movement (Mtpa)	12	410	422
Copper concentrate (ktpa)	600	1,800	2,400
Refined copper (ktpa)	235	515[2]	750[2]
Uranium oxide (tpa)	4,500	14,500[2]	19,000[2]
Gold bullion (oz/a)	100,000	700,000[2]	800,000[2]
Silver bullion (oz/a)	800,000	2,100,000[2]	2,900,000[2]

[1] Nameplate capacity.
[2] Includes on-site and overseas production.

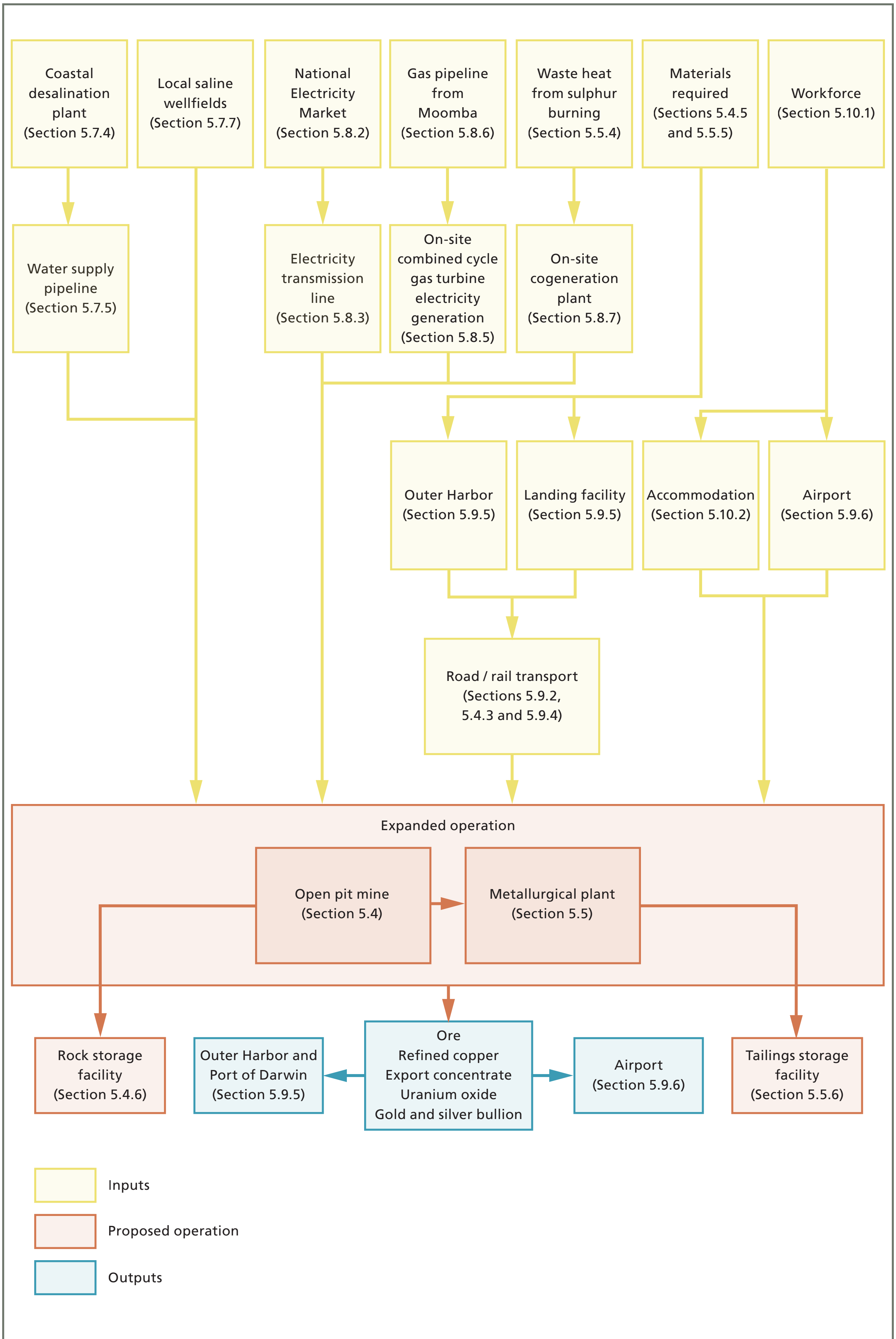
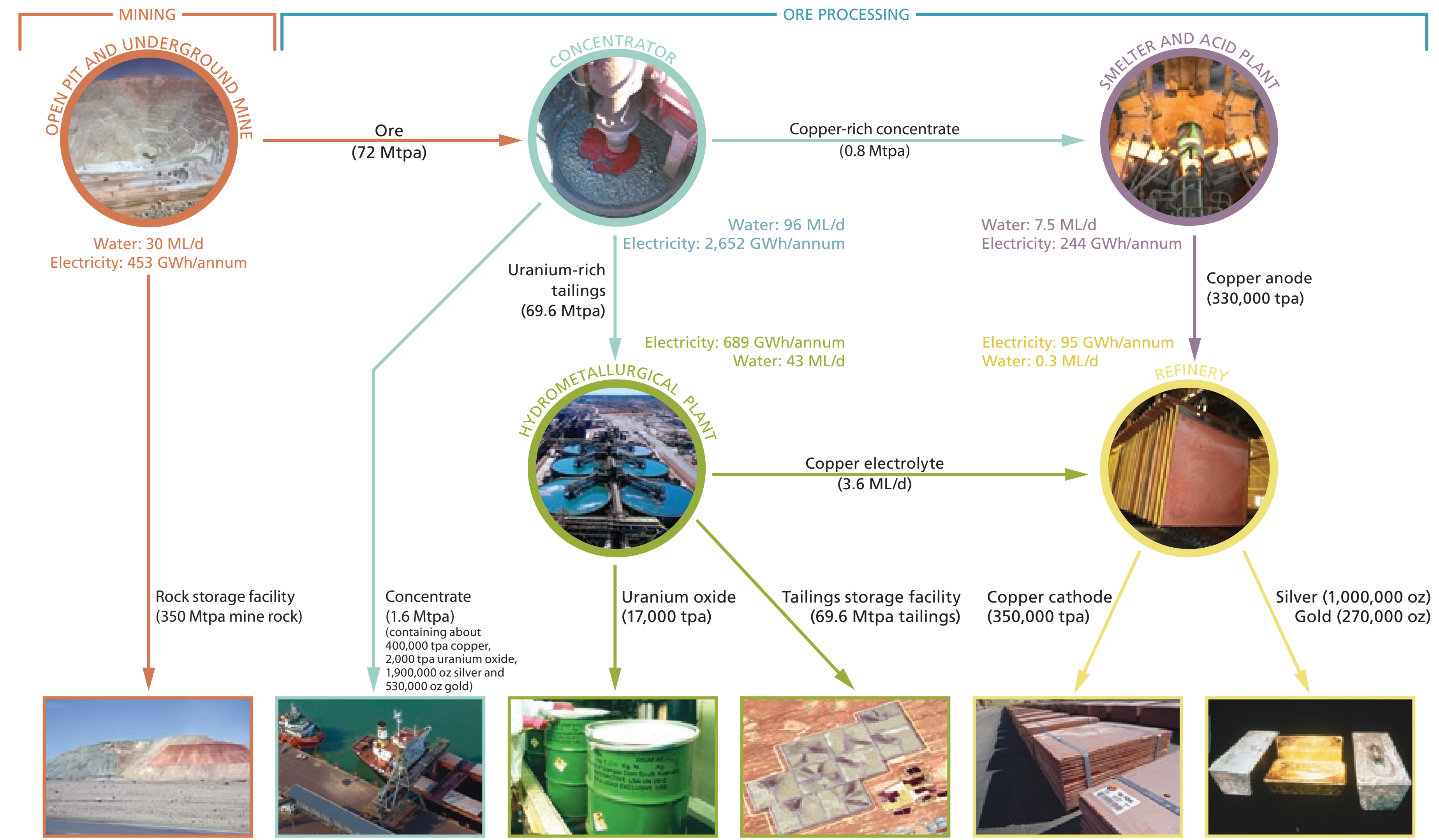


Figure 5.1 Expansion overview



Note: Water and electricity demand amounts are for the combined (existing and proposed) on site operation and exclude off-site infrastructure and some on-site demands including administration facilities and processing infrastructure.

Figure 5.2 Combined operations overview and key inputs and outputs

The metallurgical plant and tailings storage facility (TSF) would be expanded to accommodate the increased ore throughput. A new concentrator and hydrometallurgical facility would be constructed, and the existing copper solvent extraction, smelter and refinery would be modified and optimised to process approximately 800,000 tpa of copper concentrate sourced from both the existing and expanded operation (termed the combined operations). This would produce approximately 350,000 tpa of refined copper at Olympic Dam. A further 1.6 Mtpa of copper concentrate containing recoverable quantities of uranium oxide, gold and silver (hereafter called concentrate) would be produced within the new concentrator facility. This would be exported via the Port of Darwin to an overseas hydrometallurgical and smelting facility. The total on-site ore throughput would be equivalent to about 750,000 tpa of refined copper from the combined operations.

The new open pit mine and metallurgical plant would require material inputs which exceed the capacity of the current water, electricity and workforce infrastructure (see Table 5.2). As a result, new infrastructure would be required.

The main components of additional infrastructure required to support the proposed mining and metallurgical expansion are:

- a desalination plant located at Point Lowly, and a 320 km water supply pipeline between the proposed desalination plant and Olympic Dam
- the option of a 270 km, 275 kV transmission line from Port Augusta to Olympic Dam, or an on-site 600 MW capacity combined cycle gas turbine (CCGT) power station to be fed from a gas pipeline from Moomba, or a hybrid solution involving both options
- a new 105 km rail spur between Pimba and Olympic Dam
- a landing facility located about 10 km south of Port Augusta to offload pre-assembled and prefabricated infrastructure
- a new access corridor from the landing facility to the Port Augusta pre-assembly yard and on to the Stuart Highway
- a new rail/road intermodal freight terminal to be constructed at Pimba
- a new workers' accommodation village (Hiltaba Village) to be located between Roxby Downs and Andamooka to replace the existing Olympic Village
- a new airport to be located adjacent to the proposed Hiltaba Village to replace the existing airport at Olympic Dam Village
- the expansion of Roxby Downs township, including residential, commercial and retail areas
- a new heavy industrial area to replace the existing Olympic Dam Village heavy industrial area in Charlton Road
- the development of a saline groundwater supply principally for dust suppression
- the development of port facilities at Outer Harbor to import sulphur and other mining and metallurgical reagents and export additional refined copper and uranium oxide
- the development of port facilities at the Port of Darwin, East Arm, for the export of concentrate and additional uranium oxide
- the relocation and expansion of the existing on-site desalination plant
- the relocation of Borefield Road.

Figures 5.3 and 5.4 show the proposed major infrastructure elements in the regional context, and Figure 5.5 illustrates the elements in the local context of Olympic Dam. The development of the proposed mining and processing operation at Years 5, 10, 20 and 40 are shown in Figure 5.6a and b.

Table 5.2 Indicative major infrastructure demands

Expansion requirement	Current operation	Proposed expansion	Combined operations
Water demand (average GL per annum/ML per day)	13/37[1]	70/183[1]	83/220[1]
Electricity consumption (MWh per annum)	870,000	4,400,000	5,270,000
Diesel usage (ML per annum)	26	403	429
Peak construction/shutdown workforce	1,400	6,000	1,400
Ongoing operational workforce	4,150	4,000	8,000
Sulphur usage (tpa)	80,000	1,720,000	1,800,000

[1] Excludes additional water demand from off-site infrastructure.

Figure 5.3 Major infrastructure elements of the proposed expansion within the gas pipeline corridor options

Figure 5.4 Components of the proposed expansion in the southern corridor

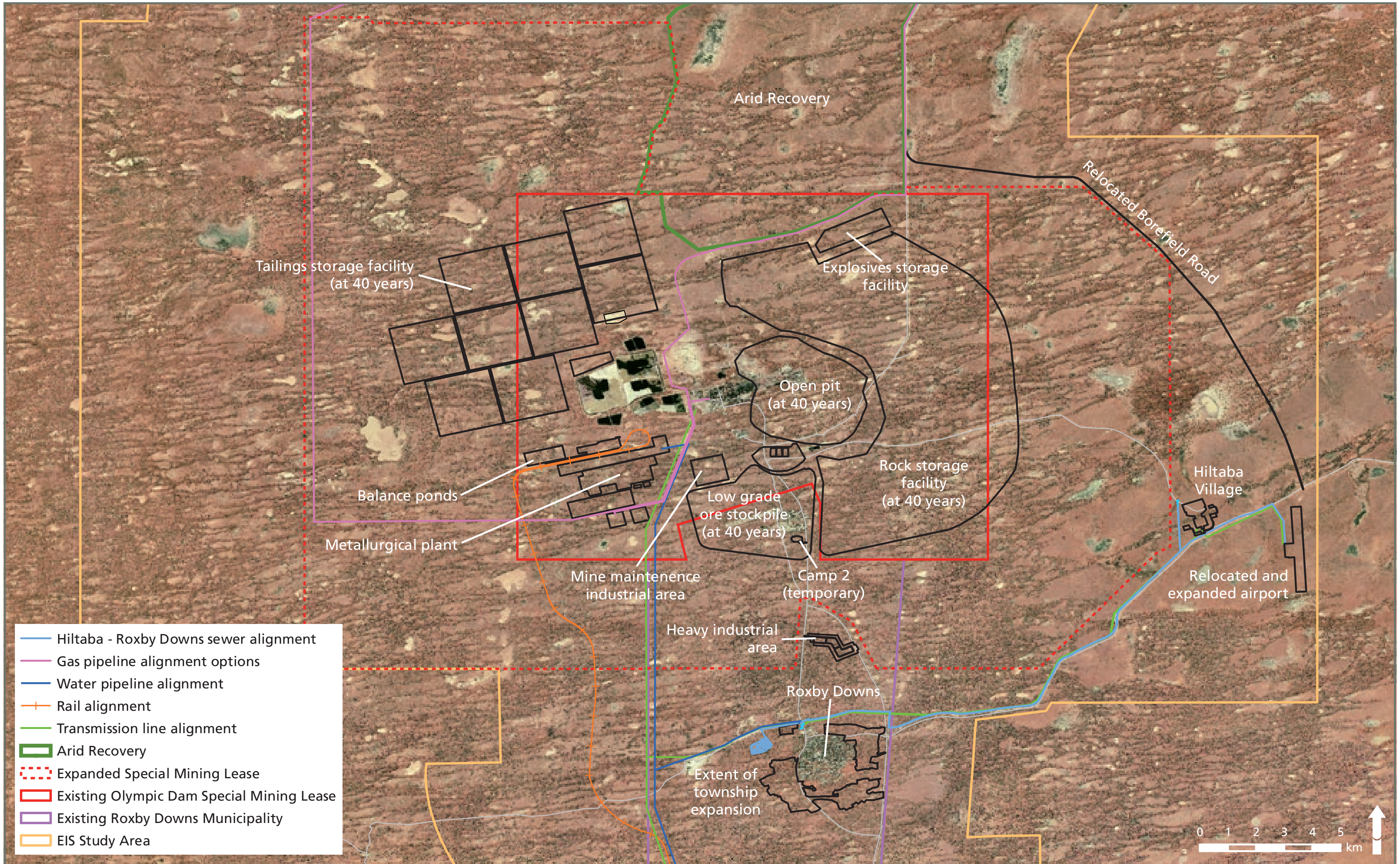
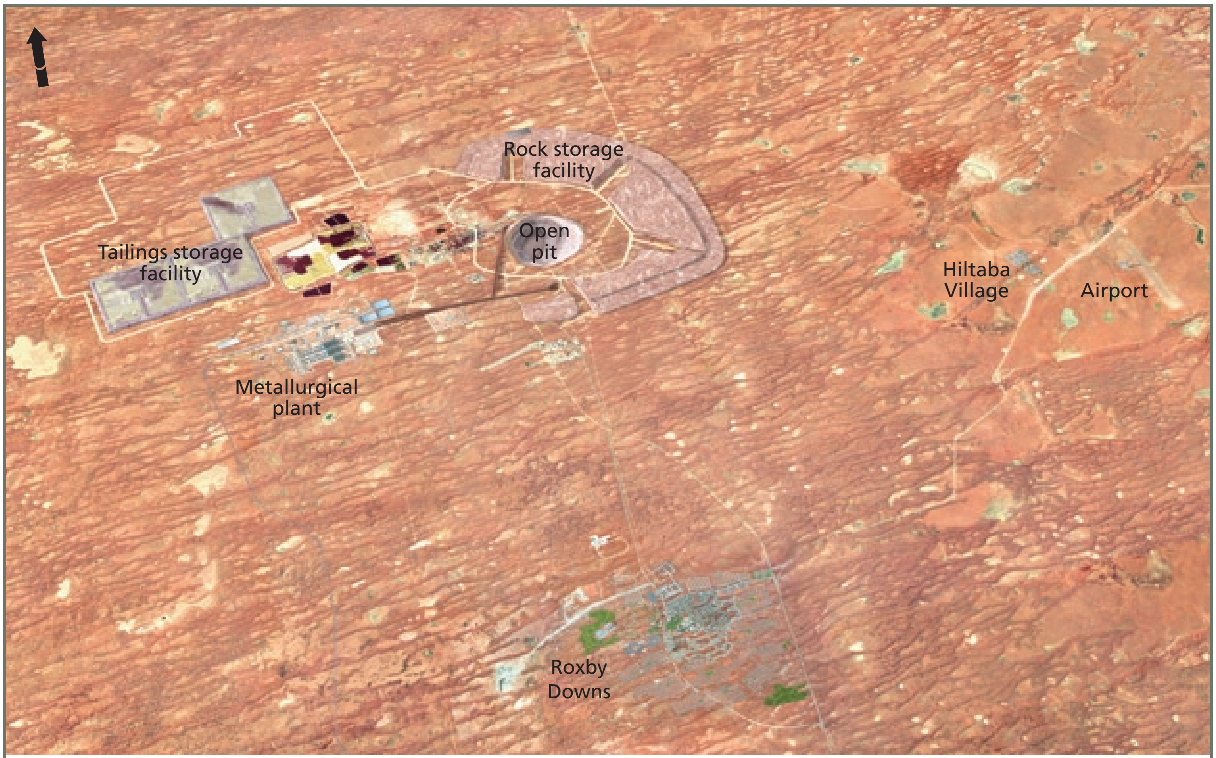


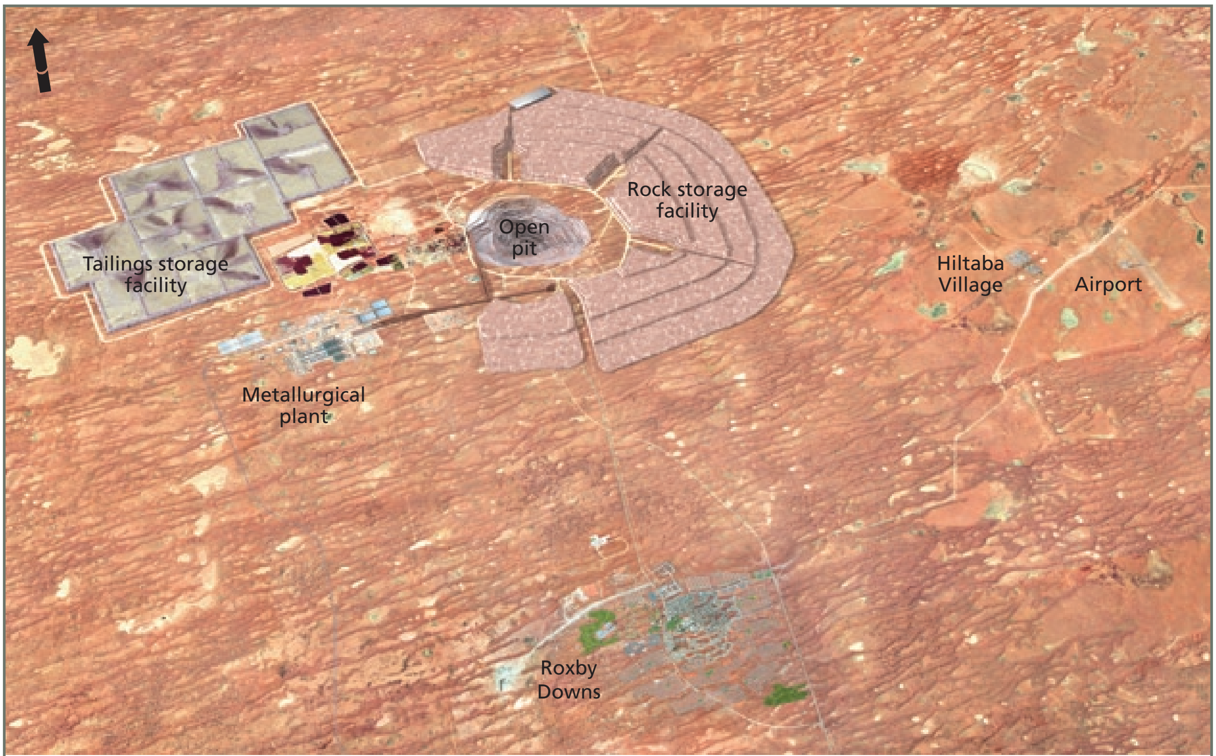
Figure 5.5 Major components of the proposed expansion around Olympic Dam



AT 5 YEARS

AT 10 YEARS

Figure 5.6a Conceptual development of the proposed expansion



AT 20 YEARS

AT 40 YEARS

Figure 5.6b Conceptual development of the proposed expansion

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5.3 EXPANSION STAGING AND TIMING

The proposed expansion would proceed in stages, designed to minimise the risks associated with the delivery of major infrastructure projects, and would progressively increase production rates for refined metal and concentrate during ongoing construction. These stages would overlap to some degree, resulting in virtually constant on-site construction for about 11 years. Off-site infrastructure would be timed to deliver the necessary inputs to the expanded operation as necessary (see Figure 5.7). A brief description of the indicative stages is presented in Table 5.3. When dates are mentioned in the context of the project activities it has been assumed that all neccessary approvals would be obtained in 2010 and work commenced soon afterwards. The project configuration is based on an 11-year construction period, however, the project schedule ultimately will depend on the timing and nature of government approvals and the final investment decision of the BHP Billiton Board.

Except where impacts are associated specifically with the initial or intermediate development stages (for example, in the assessment of road traffic, which will decrease following the construction of the rail line), the impact assessment chapters within the Draft EIS consider the impacts associated with the project at full operating capacity.

The assessment within the EIS is based on operation at full capacity (60 Mtpa for the expanded operation) until Year 40 at which time the operation would be decommissioned and rehabilitated. Infrastructure associated with the operation at Year 40, and the potential strategies for decommissioning and rehabilitation of the project components is described in Chapter 23, Rehabilitation and Closure.

The following sections provide detailed explanations about how each of the major infrastructure elements would be constructed and operated. Appendix F2 provides concept design drawings for many of these infrastructure components.

5.4 MINING

5.4.1 OVERVIEW

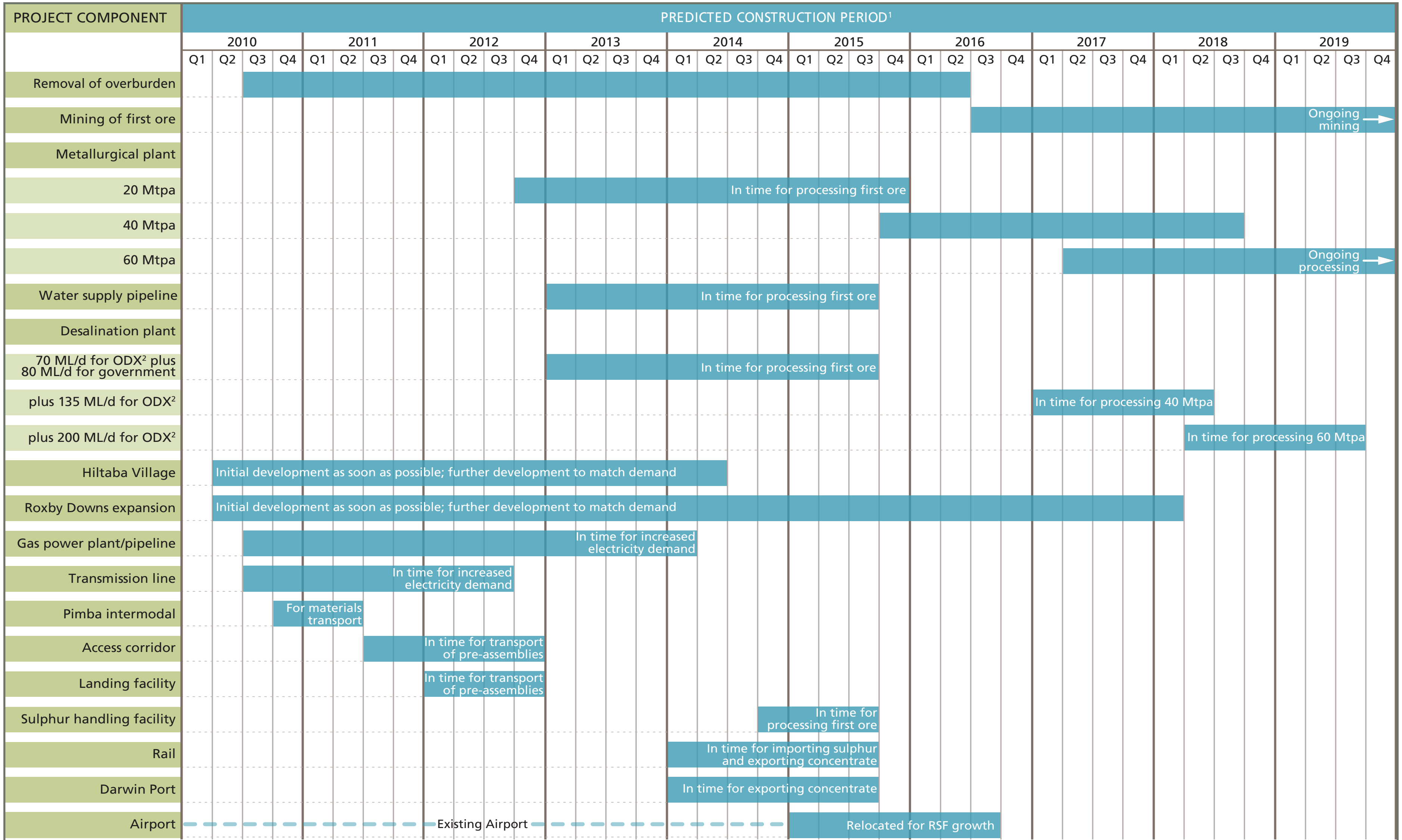
A new open pit mine would be developed to extract ore from the southern part of the Olympic Dam ore body. The open pit mine would involve drilling and blasting mine rock and ore, and loading the blasted material by electric rope shovels, hydraulic shovels and front end loaders into haul trucks which would haul the ore to primary crushers and the mine rock to the RSF. The open pit mine would commence as soon as possible after all necessary approvals had been received and first ore would be reached in about Year 5 or 6 (i.e. about 2016). From first ore it would take approximately five to six years to reach full capacity of mining (about 60 Mtpa of ore).

The major features of the open pit mine are detailed in Table 5.4. As the volumes of ore and mine rock can vary from year to year, the data are indicative. Figure 5.8 illustrates the proposed location and size of the main expansion components at Olympic Dam at Year 40.

The open pit mine development would increase the current demand for energy, water, workforce and explosives. Indicative major materials requirements for the proposed mining operation are provided in Table 5.5.

Table 5.3 Indicative staging and timing for the key components of the proposed expansion

Stage	Timing	Description
Initial development (0–20 Mtpa ore)	Year 0 to Year 6	(a) Initial development of the pre-mine infrastructure and establishing the new open pit mine to deliver 20 Mtpa of ore to a new concentrator plant, specifically: • establish the open pit groundwater depressurisation infrastructure • provision of pre-mine infrastructure • extracting 390 Mtpa mine rock and 20 Mtpa of ore following pre-mine completion • construction of a new concentrator plant to produce concentrate for export • construction of a new hydrometallurgical plant to extract additional uranium
		(b) Development of off-site infrastructure associated with the initial mining development and concentrator plant (see Figure 5.7)
Intermediate development (20–40 Mtpa ore)	Year 6 to Year 9	(a) Expansion of the open pit mine, concentrator plant and hydrometallurgical plant to extract and process up to 40 Mtpa of ore
		(b) Expansion of the existing smelter to allow smelting of up to 800,000 tpa of copper concentrate
		(c) Development of new or expanded infrastructure to support the increased capacity of the expanded mining and metallurgical plants (see Figure 5.7)
Full capacity of expansion (40–60 Mtpa ore)	Year 7 to Year 11	(a) Expansion of the open pit mine, concentrator plant and hydrometallurgical plant to extract and process to achieve full operating capacity of up to 60 Mtpa of ore
		(b) Expansion of the coastal desalination plant, construction of additional housing within Roxby Downs and decommissioning of some Hiltaba Village accommodation as dictated by demand
		(c) Development of new or expanded infrastructure to support the increased capacity of the expanded mining and metallurgical plants (see Figure 5.7)



[1] Based on government and BHP Billiton Board approval in 2010
[2] ODX - Olympic Dam Expansion

Figure 5.7 Predicted timing of construction for major project components

Figure 5.8 Location and size of major expansion components at Year 40

Table 5.4 Indicative features of the open pit mine development

Features	Proposed expansion
Mining method	Open pit
Number of years to reach first ore	5–6
Ore mining rate (Mtpa)	60
Total material movement (Mtpa)	410
Length of the open pit at Year 40 (km)	4.1
Width of the open pit at Year 40 (km)	3.5
Depth of the open pit at Year 40 (m)	1,000
Area of open pit at Year 40 (ha)	1,010
Number of rope shovels	14
Number of haul trucks[1]	160
Number of ancillary heavy vehicles[2]	150

[1] Haul fleet numbers increase with increased haul distance over time.
[2] Includes graders, rollers, front end loaders, water carts, drill rigs, dozers, compactors, scrapers and fuel and lube vehicles.

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Table 5.5 Indicative major demands for the proposed open pit mine development

Expansion requirement	Proposed expansion
Water demand (average GL per annum/ML per day)	6/32
Electricity consumption (MWh per annum)	283,000
Diesel usage (ML per annum)	350
Peak construction/shutdown workforce	3,000
Ongoing operational workforce	2,500
Ammonium nitrate (tpa)	110,000
Total land disturbance – open pit and RSF (ha)	7,730

5.4.2 CONTEXT

The most notable mineral and energy resources in South Australia are at Olympic Dam (copper, uranium, gold and silver), Leigh Creek (coal), Prominent Hill (copper and gold), Beverley (uranium), Honeymoon (uranium), the Eucla Basin (mineral sands), the Gawler Craton (iron ore) and the Cooper Basin (oil and gas) (see Figure 5.9).

Copper is mined in all Australian states and around the world. To illustrate the scale of the proposed expansion, Table 5.6 and Figure 5.10 show the 2006 production rates at a selection of the major Australian and overseas mines.

Half of the world's uranium is currently mined in Canada and Australia. Table 5.7 and Figure 5.11 show the 2007 production rates from individual mines and highlight the significance of the proposed Olympic Dam expansion.

Chapter 2, Existing Operation, of the Draft EIS details the current Olympic Dam mineral resource and ore reserve estimates.

5.4.3 CONSTRUCTION PHASE

For the purpose of the Draft EIS, the construction phase is defined as the period required to clear the vegetation, remove the topsoil and the overburden (i.e. to reach the ore), plus the initial ore extraction activities required to commission the materials handling systems and metallurgical facilities.

Examples of activities that would typically be undertaken during this phase include establishing the mine infrastructure and facilities, the mine materials handling systems (i.e. the primary crushers and conveyors), the RSF, mine maintenance facilities, surface and groundwater management systems (including depressurisation wells), and sand stockpiles. Mine rock and ore material would be drilled, blasted, loaded and hauled during this phase. Monitoring would be undertaken to confirm that air quality, noise and vibration levels and equipment productivity parameters were within predictions.

Depressurisation

The area in the vicinity of the new open pit would be depressurised before mining commenced to control potential inflows of groundwater to the pit and to reduce residual pore pressures behind the pit walls. This activity would be essential to create drier and safer mining conditions. Depressurisation would continue for the life of the open pit mine at a rate of abstraction of about 5 ML/d, but dewatering would be at its greatest (up to about 15 ML/d) up to Year 6. Water abstracted from the open pit depressurisation would be used for dust suppression and construction activities.

Table 5.6 Copper mine production figures (2006) compared with the current Olympic Dam and proposed expansion

Mine	Company	Mining method	Country	Copper mine production capacity[1] (ktpa Cu)
Escondida	BHP Billiton Group, Rio Tinto, Japan Escondida	Open pit	Chile	1,311
Codelco Norte	Codelco	Open pit	Chile	957
Olympic Dam (expanded)	BHP Billiton	Open pit and underground	Australia	750
Grasberg	P.T. Freeport Indonesia, Rio Tinto	Open pit and underground	Indonesia	750
Collahuasi	Anglo American, Xstrata plc, Mitsui, Nippon	Open pit	Chile	450
Morenci	Freeport McMoran Copper & Gold, Sumitomo	Open pit	United States	430
Taimyr Peninsula	Norilsk Nickel	Open pit and underground	Russian Federation	430
El Teniente	Codelco	Underground	Chile	418
Antamina	BHP Billiton Group, Teck, Xstrata plc, Mitsubishi	Open pit	Peru	400
Los Pelambres	Antofagasta Holdings, Nippon Mining, Mitsubishi Materials	Open pit	Chile	335
Batu Hijau	P.T Pukuafu Indah, Newmont, Sumitomo Corp., Sumitomo Metal Mining	Open pit	Indonesia	300
Bingham Canyon	Kennecott	Open pit	United States	280
Andina	Codelco	Open pit and underground	Chile	236
Olympic Dam	BHP Billiton	Underground	Australia	235
Zhezkazgan Complex	Kazakhmys	Open pit and underground	Kazakhstan	230
Los Bronces	Anglo American	Open pit	Chile	226
Rudna	KGHM Polska Miedz S.A.	Underground	Poland	220
El Abra	Codelco, Freeport McMoran Copper & Gold	Open pit	Chile	219
Mount Isa	Xstrata plc	Open pit and underground	Australia	212
Toquepala	Southern Copper Corp.	Open pit	Peru	210
Cananea	Grupo Mexico	Open pit	Mexico	210

[1] Sourced from International Copper Study Group 2007.

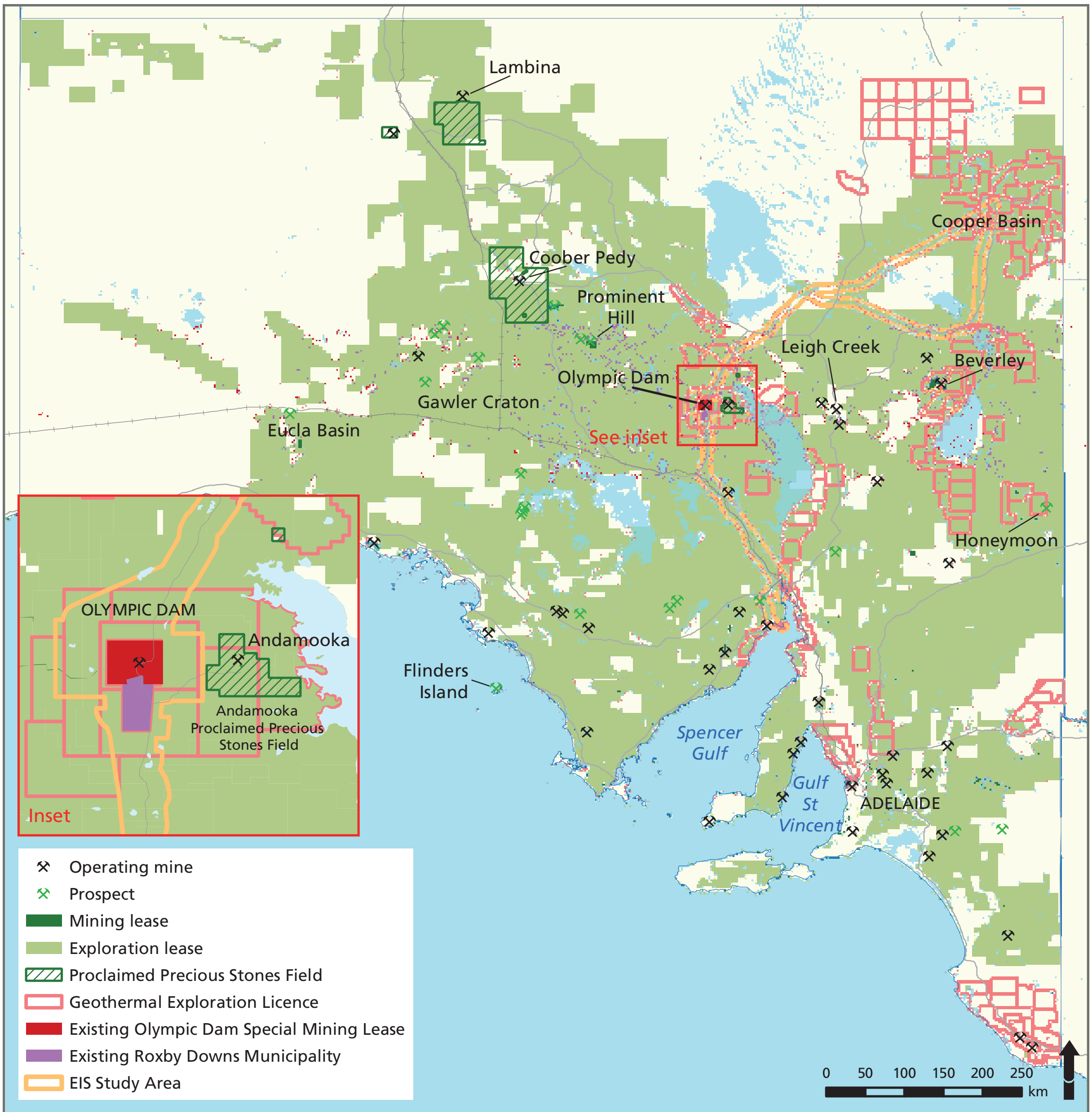
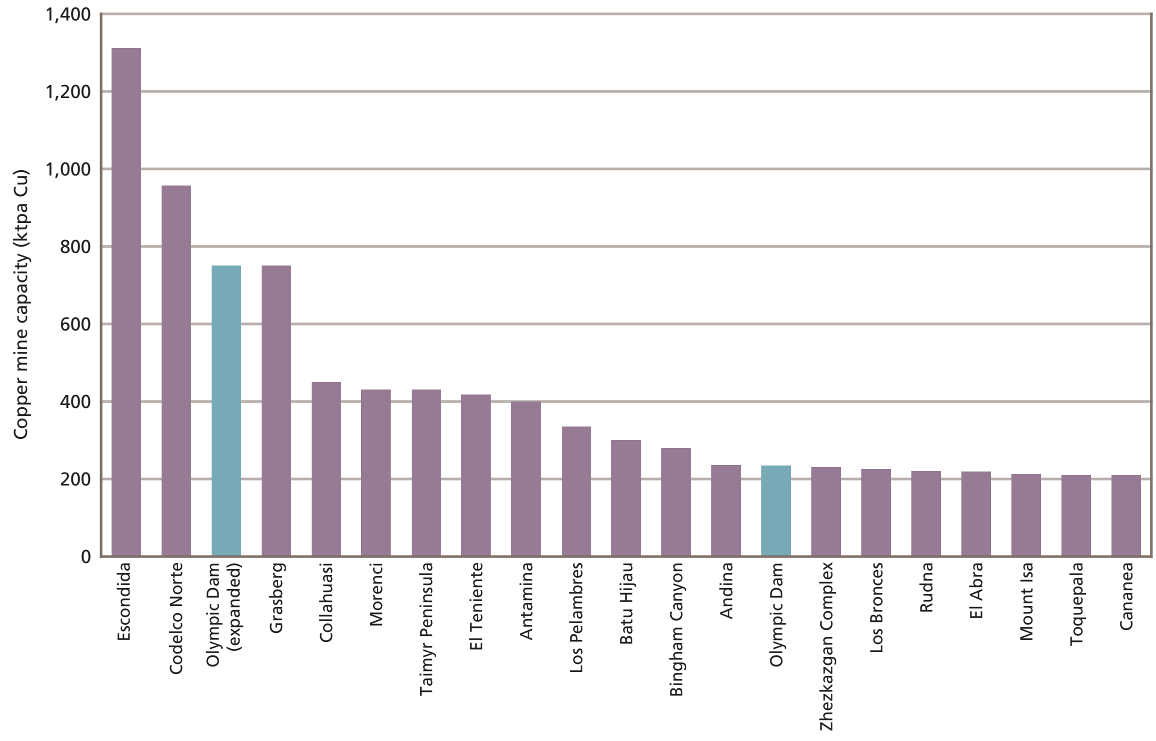


Figure 5.9 Mining and energy resource development in South Australia

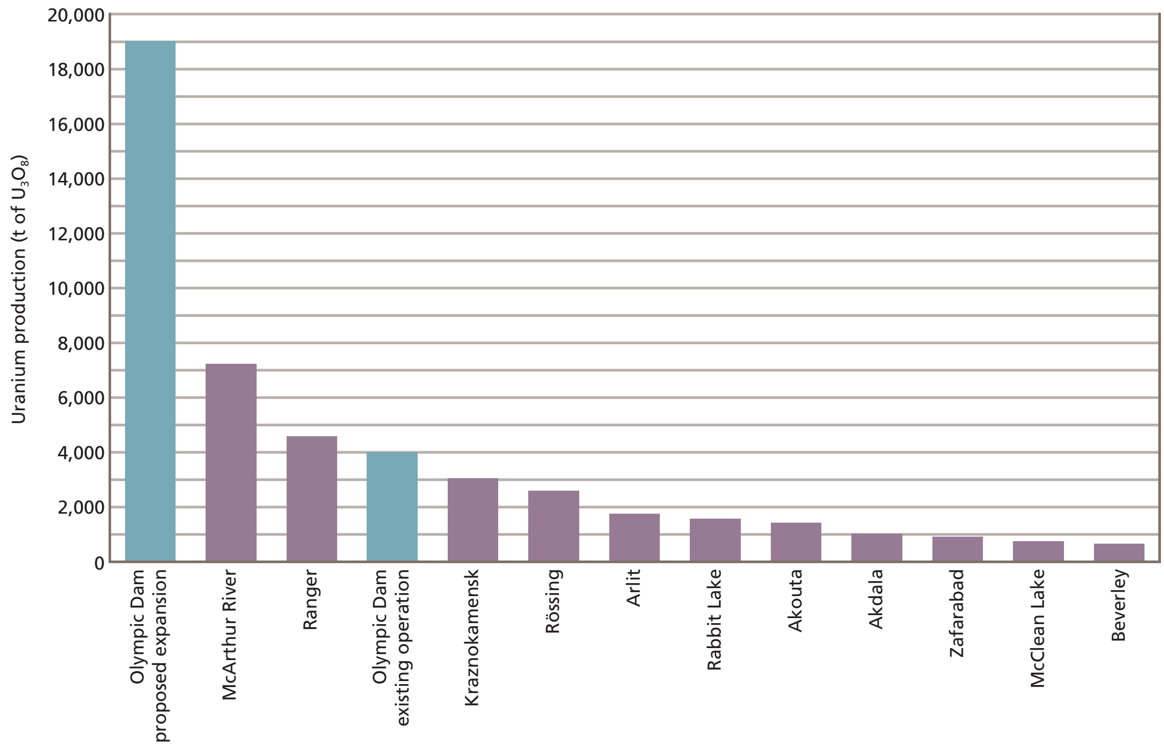
The proposed design for depressurisation would include some or all of the following components:

- The cover sequence is likely to be depressurised using about 20–35 wells located in the Corraberra Sandstone and Arcoona Quartzite (see Chapter 12, Groundwater). Temporary wells would be located inside the area of the pit void prior to pre-stripping to remove groundwater, and permanent wells would be located around the perimeter of the open pit to intercept groundwater that flows toward the pit walls (see Figure 5.12). Some water would enter the pit and this would be managed with in-pit horizontal drains, in-pit wells and pumping from sumps in the pit floor.
- The low permeability cover sequence and basement rocks would be depressurised using in-pit horizontal drain holes and (potentially) by drain holes drilled from an underground access tunnel.
- Additional wells may be located away from the immediate pit edge, and away from the fractured basement rock to intercept and manage areas of higher inflow.
- Grading of the landscape and building of a pit perimeter bund would prevent significant stormwater run-off entering the pit.
- Sumps and a series of mobile and primary transfer pumping stations would manage rainfall that falls directly into the pit. Water that accumulated in the pit during significant rainfall events would either be pumped out and discharged into natural depressions or used in the pit for dust suppression.



Source: International Copper Study Group 2007

Figure 5.10 World copper mining production in 2006



Source: World Nuclear Association 2008

Figure 5.11 World uranium mining production in 2007 relative to the proposed expansion

Table 5.7 Selected uranium mine production figures (2007) compared to the current Olympic Dam and proposed expansion[1]

Mine	Country	Company	Mining method	Estimated production capacity per annum (tonnes of U_3O_8)
Olympic Dam – proposed expanded operation	Australia	BHP Billiton	Open pit and underground	19,000
McArthur River	Canada	Cameco	Underground	7,199
Ranger	Australia	ERA (Rio Tinto 68%)	Open pit	4,589
Olympic Dam – existing operation	Australia	BHP Billiton	Underground	4,500[2]
Kraznokamensk	Russia	TVEL	Underground	3,037
Rössing	Namibia	Rio Tinto (69%)	Open pit	2,583
Arlit	Niger	Areva/Onarem	Open pit	1,750
Rabbit Lake	Canada	Cameco	Underground	1,544
Akouta	Niger	Areva/Onarem	Underground	1,403
Akdala	Kazakhstan	Uranium One	*In situ* leach	1,000
Zafarabad	Uzbekistan	Navoi	*In situ* leach	900
McClean Lake	Canada	Cogema	Open pit	734
Beverley	Australia	Heathgate	*In situ* leach	634

[1] Sourced from World Nuclear Association 2008.
[2] Olympic Dam nameplate capacity, actual production in 2007/08 was 4,144 tonnes of uranium oxide.

The quality of groundwater pumped during depressurisation activities would be very low (with total dissolved solids of around 40,000 to 200,000 mg/L). It would be used primarily for dust suppression, although some may be desalinated at the on-site desalination plant for use within the metallurgical plant. A monitoring program using piezometer monitoring wells would be established to review the depressurisation system and optimise its performance.

Pre-mine infrastructure

Infrastructure would need to be established prior to the surface mining operations commencing. This includes truck and shovel assembly facilities, relocation of roads and services, a mine maintenance industrial area (i.e. workshop), a power supply to electric rope shovels and electric drills, refuelling and explosive facilities and offices for mining contractors.

The mine maintenance industrial area would be located to the west of the proposed open pit and comprise a suitably sized enclosure for servicing ultra-class haul trucks, plus hardstand areas, bunded areas for hydrocarbon storage and equipment warehousing (see Figure 5.13).

The existing desalination plant would be decommissioned after a new desalination plant had been commissioned (see Figure 5.12 for locations). Infrastructure from the existing desalination plant would be relocated and reused in the new desalination plant to provide additional on-site desalination capacity as appropriate.

The mining contractor pre-strip facility, assembly area for mining (which includes offices), the laydown facility and the civil crusher are shown on Figure 5.12. All but the laydown facility would ultimately be covered by the expanding RSF.

The pre-strip facility would be the maintenance and operational area for the pre-strip contractor. The pre-strip assembly area would be used to assemble the mining haul trucks and shovels. The civil crusher would be used to crush rock for use as aggregate in construction of building pads, concrete aggregates, roads and other construction activities.

The operation of the proposed open pit mine, combined with existing usage in the underground mining operation, would require a significant quantity of explosives. A dedicated explosives facility would be constructed (see Figure 5.5 for location) to produce and store the explosive products used in the mine. This facility would consist of the following infrastructure:

- an ammonium nitrate storage area
- emulsion storage tanks
- gasser storage, manufacture and delivery facilities
- detonator magazine
- high explosives magazine
- diesel storage facility
- workshop and offices.

The facility would be managed in accordance with relevant acts, regulations and standards which dictate certain storage, handling and use requirements, together with stringent security and clearance requirements.

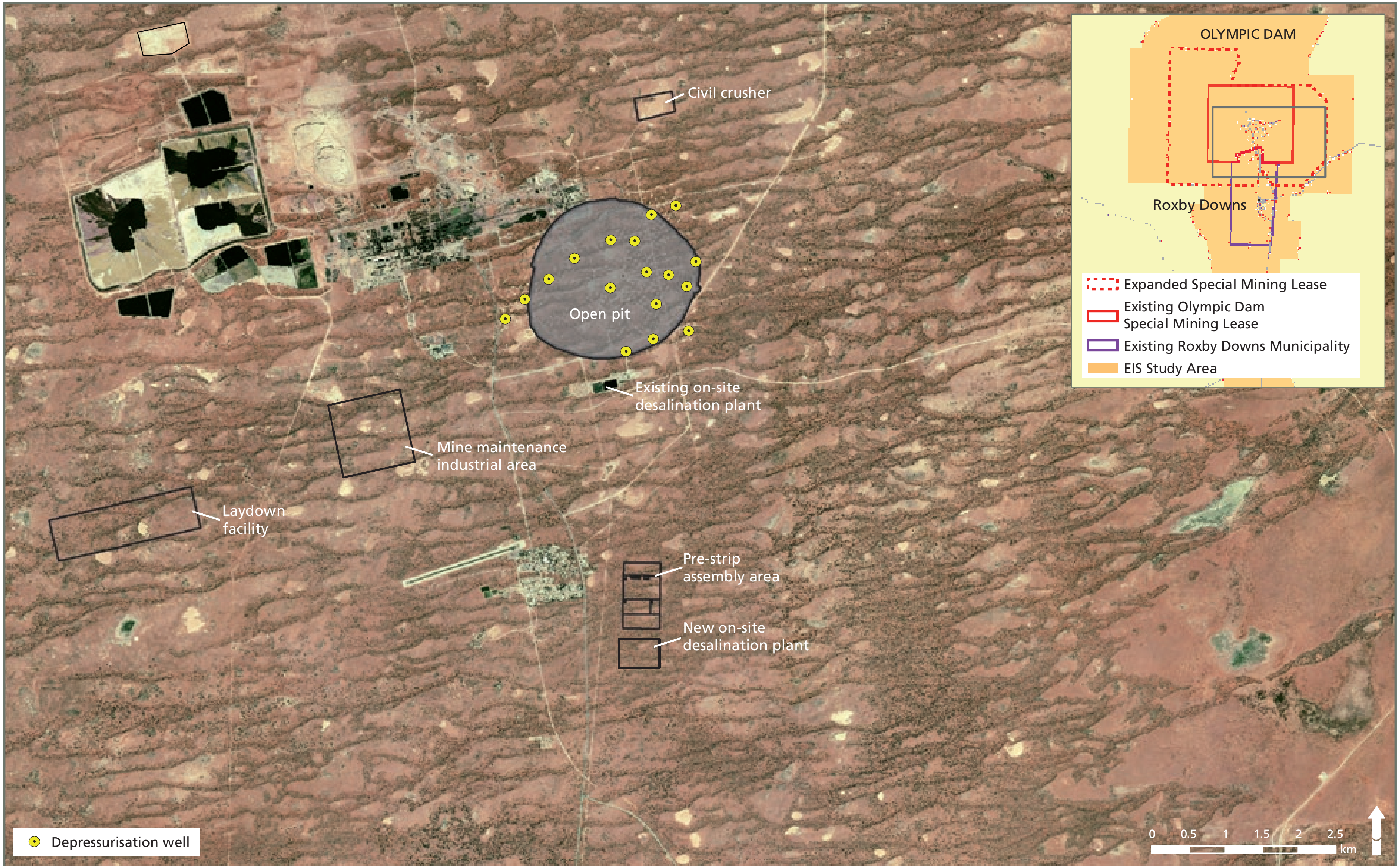


Figure 5.12 Indicative location of open pit mine depressurisation wells and initial infrastructure

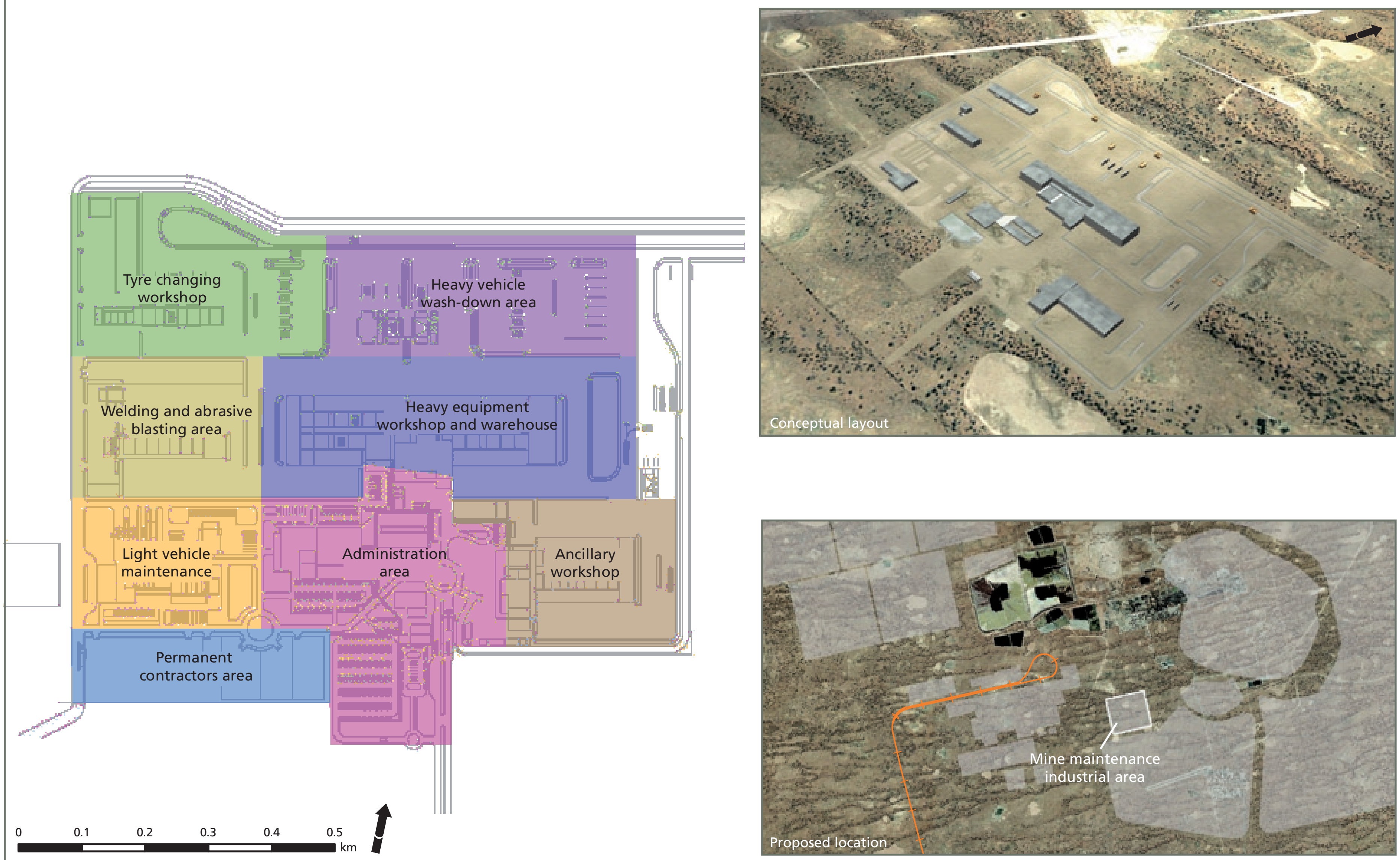


Figure 5.13 Indicative configuration of the proposed mine maintenance industrial area

Pre-strip

The next step in constructing the open pit mine involves progressively removing vegetation, sand dunes and topsoil from the open pit footprint. These works, known as the pre-strip phase, would excavate material using general earth moving equipment.

During the pre-strip phase, a portion of the sand would be stockpiled in designated locations for use in backfilling the underground mine, smelter flux and as a material for use in constructing the infrastructure. Where appropriate, topsoil would be stockpiled for use in future rehabilitation activities.

Pre-mine

At an estimated depth of 10–40 m below the surface, the mobile equipment would be unable to dig the material *in situ* and hard rock mining would commence. Hard rock mining involves standard drilling, blasting, loading and haulage activities and would commence in the first 12 months and continue for the life-of-mine.

Pre-mine at BHP Billiton's Spence mine in Chile

Open pit benches at BHP Billiton's Escondida mine in Chile

It is envisaged that the mining equipment fleet would reach near full operational capacity to deliver 20 Mtpa of ore in Year 6. As the operation developed, the average haulage distance and associated vertical lift of material would increase, and additional haul trucks and associated equipment would be added to maintain the anticipated rate of material movement.

The rock generated at depths of greater than approximately 40 m would be used to construct ramps for access to the RSF tip-heads, for constructing the base layer of the RSF, and for the initial TSF walls (see following section for details).

5.4.4 OPERATION PHASE

The operation of the proposed open pit would use traditional large-scale open pit metalliferous bulk mining techniques as described in Figure 5.14 and illustrated in Figure 5.15. It is envisaged that a combination of large electric rope shovels and various sized diesel hydraulic shovels, excavators and front-end loaders would be used to load overburden and ore into large dump trucks. Typically, electric rope shovels would load ultra-class trucks (i.e. trucks with a payload capacity of greater than 300 t) while the hydraulic machines would load ultra-class or smaller sized trucks based on the size of the loading unit and the specific application.

During the operation phase, the open pit would be expanded through a series of push-backs or circumferential strips that would expose additional ore sequentially (see Figure 5.8). These push-backs would be 150–400 m wide, and multiple push-backs would be undertaken simultaneously to provide sufficient working room to operate the required equipment and facilitate the regular exposure of ore.

Each push-back would be developed by removing a series of production benches. For operations using large electric rope shovels, the height of the production benches would be in the range of 14–20 m. Hydraulic excavators would typically operate on benches 3–10 m high (see Figure 5.15).

As the mine pit deepens, a network of in-pit haulage roads and ramps would be developed to allow the mine rock and ore to be transferred to the surface. These haulage ramps would spiral around the outer wall of the pit and vary in width between 40 and 100 m (i.e. wide enough to permit two-way traffic for the mine haul trucks).

The bench face batter angle excavated by a rope shovel is typically between 60 and 90 degrees, depending on the structure of the rock mass encountered. Narrow benches (or berms) would generally be developed at regular vertical intervals to catch any loose material that rills down the pit wall. These catch berms, together with the network of mine haulage ramps and benches, would effectively reduce the overall pit wall angle to a range of between 35 and 53 degrees, depending on the specific local stability and structure of the rock mass (see Figure 5.15).

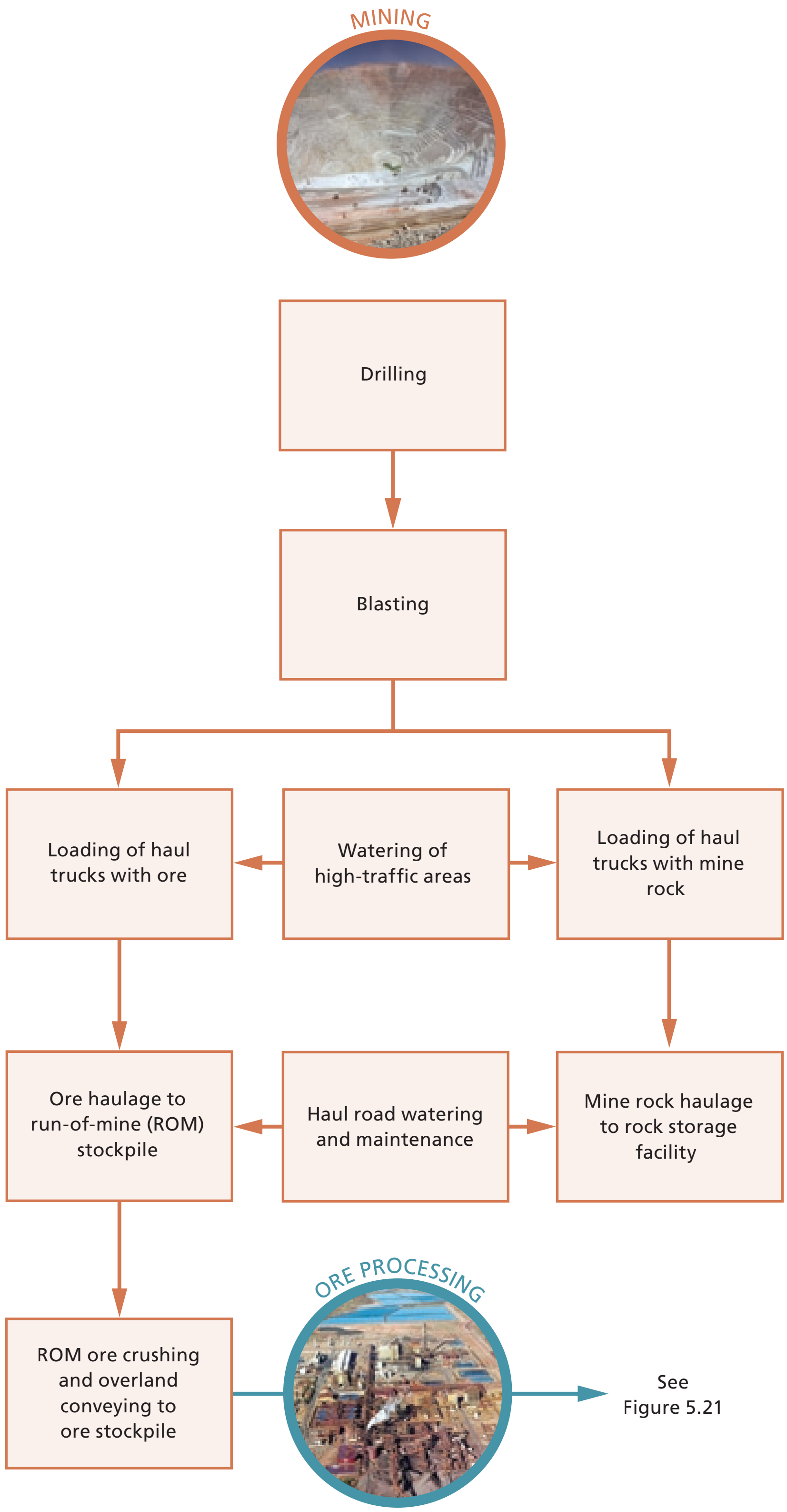
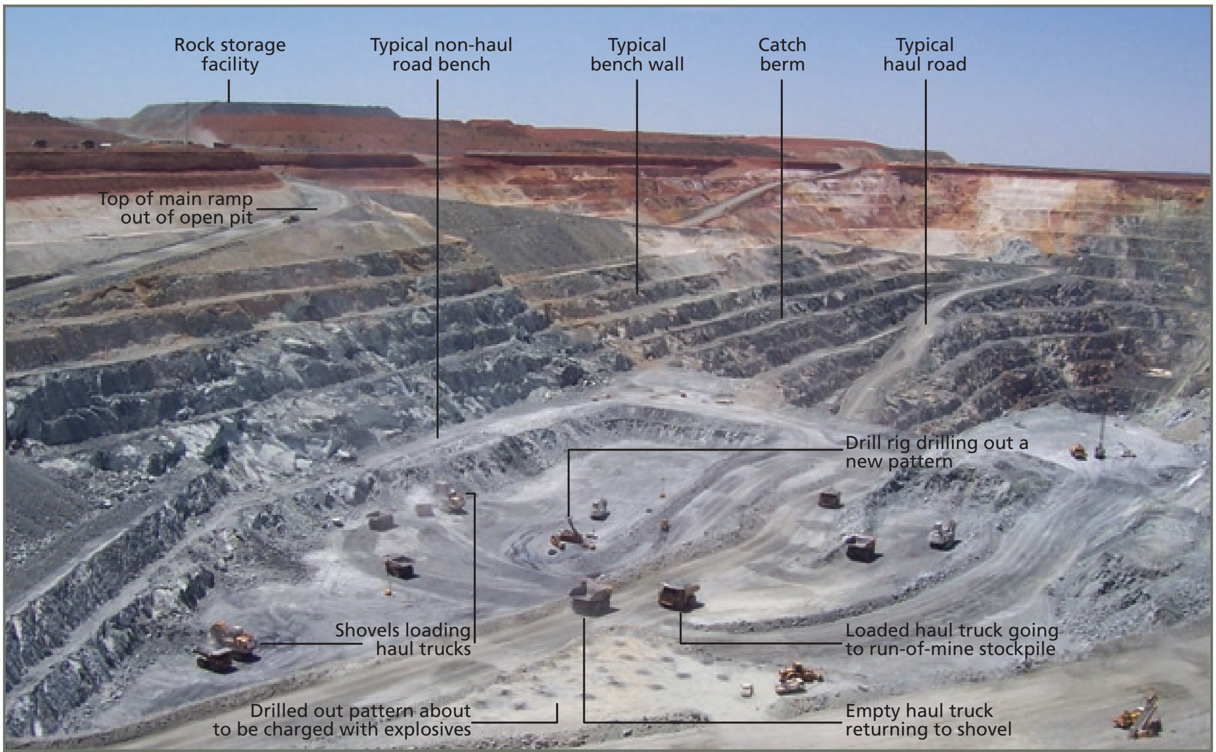
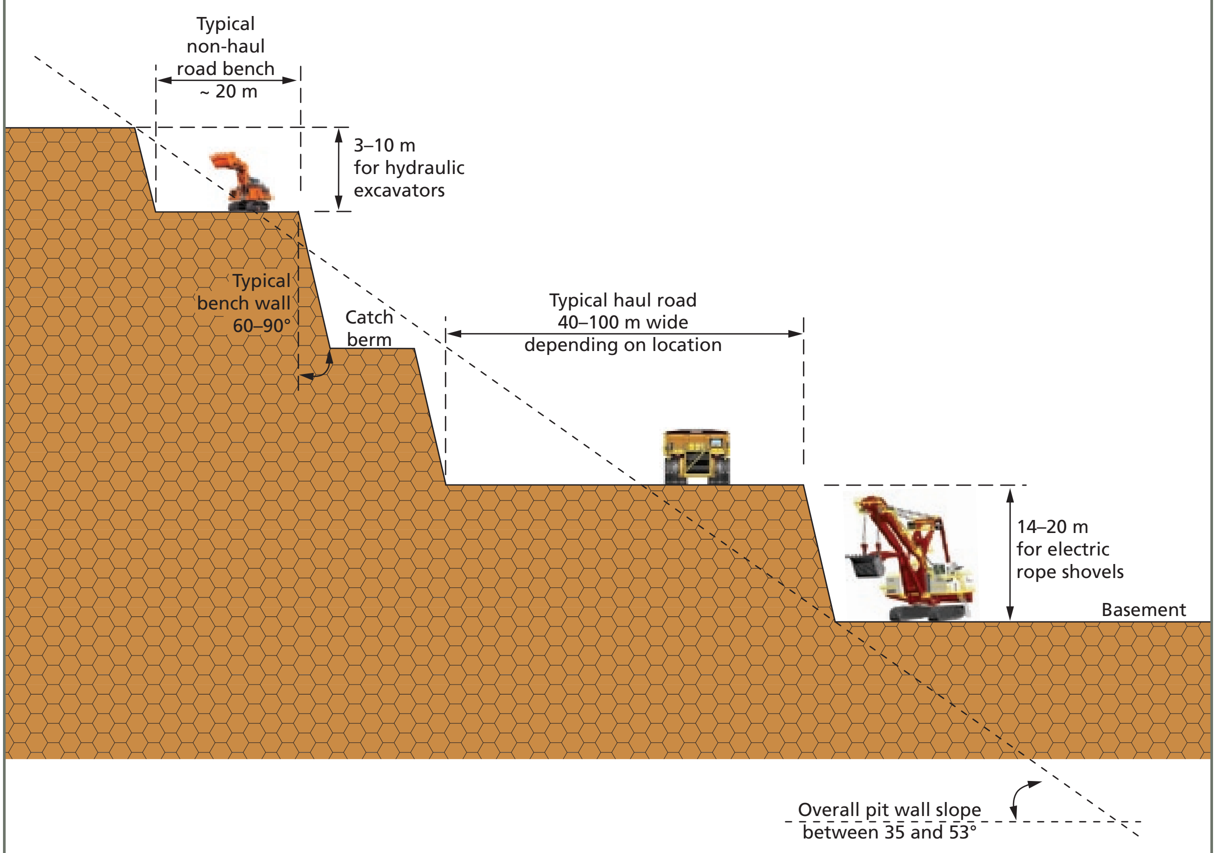


Figure 5.14 Proposed mining method



TYPICAL OPEN PIT



TYPICAL SECTION OF THE PIT WALL

Figure 5.15 Indicative cross-section of the proposed open pit

Drilling

Specially designed rigs drill large diameter vertical holes into the initial bench level. Drill patterns are designed on a case-by-case basis to yield the optimal fragmentation. Due to the hardness variability of the rock to be mined, production blast holes would be sized to optimise cost and fragmentation results, with larger holes used in the overburden. Smaller diameter holes may be used for controlled blasting adjacent to pit walls and other specialist applications. Drilled holes would then be charged with explosives.

Charging and blasting

Blasting to achieve the desired fragmentation would use industry standard ammonium nitrate-based bulk blasting products and initiation systems. A new explosives facility would be constructed to store the explosives prior to use. This would be located to the north of the RSF (see Figure 5.8).

When complete, the drill holes would be charged (i.e. the holes are loaded with detonators, boosters, high explosive products and stemming). Stemming (i.e. the placing of aggregate material or drill cuttings in the top of each blast hole) is typically used to maximise blast efficiency by ensuring the energy from blasting goes into the surrounding rock and not out the top of the hole. This also reduces dust generation.

Once charging was complete, the down-hole detonators would be linked together at the surface. Detonation of the blast would occur at a pre-arranged time known as firing time. During these times the surrounding area would be cleared of personnel and equipment to a safe distance and the blast would be detonated remotely using non-electronic and/or electronic initiation techniques. The detonation of the charges would be sequenced over a short period in order to maximise blast efficiency and minimise the generation of dust, vibration and flyrock. Typically, a number of blasts would be detonated separately within a single firing time. The objective of the blasting process would be to present well-fragmented rock that could be efficiently excavated and removed from the pit.

Blast sizes would range from around 100 to 500 kt, with the total material blasted ranging between 1.5 and 3 Mt. Blasting would generally occur every second day.

Loading and hauling

Following blasting, the fragmented mine rock and ore would be loaded into haul trucks by a rope shovel and removed from the pit via a system of pit ramps. Ore would be tipped onto the run-of-mine (ROM) ore stockpile or directly into the primary ore crusher. Mine rock would be hauled to tip-heads at the RSF. Haul roads would be constructed of materials excavated from the pit, and would be watered regularly by water carts using chemical suppressants to provide a compacted all-weather surface with minimal potential for dusting.

This cycle of loading and hauling would be continuous, with an empty truck arriving at the shovel just as the previous truck completed loading. Typically, a rope shovel would require four passes or buckets (dippers) to load an ultra-class haul truck, and this would normally take two to three minutes. Hydraulic excavators and front-end loaders would be used where digging space was restricted, or in situations where more precision was required during the excavations.

A bulldozer and water truck would operate in the general area of loading operations to tidy up spilt rock in the loading zone, level the loading zone and reduce dust.

Dumping

Dumping is the process of discharging rock from the tray of the haul truck after it arrives at a tip-head, either on the ROM stockpile or the RSF (see Section 5.4.6 for details of the proposed RSF). Once at the stockpile or RSF the truck would reverse to a tip-head and raise its tray to discharge the load. The dumping cycle would take approximately 90 seconds per load. Once the load was discharged, the tray would be lowered and the truck would return to the shovel to be loaded again. Typically, dumping would be arranged so that as one truck finished dumping, it would be replaced by another loaded truck. Given the size of the haul truck fleet, however, it is very likely that multiple tipping would occur at each tip-head. A bulldozer would operate at the ore stockpiles and RSF to maintain the haul road surface and the windrow at the tip-head.

Crushing

The ore would be crushed by gyratory pit-rim crushers (primary crushers) to reduce the average particle size distribution to that required to suit the metallurgical plant design. After crushing, the ore is transferred to the metallurgical plant ore stockpile by overland conveyor.

Truck loading in Chile

The dump pocket for the primary crushers would be designed so that when operational conditions allow, the large haul trucks would be able to deliver ore directly to the crusher. However, when not available, the large haul trucks coming from the bottom of the pit would place their loads on large ore stockpiles (termed ROM stockpiles) immediately adjacent to the crusher dump pocket. Front-end loaders would then take ore from these stockpiles and load smaller trucks that would deliver the ore to the crusher bowl. The ROM stockpile, primary crushers and overland conveyor locations are shown in Figure 5.8.

5.4.5 CHEMICAL STORAGE AND USE

The quantities of each reagent required for the proposed mining operation are listed in Table 5.8.

5.4.6 ROCK STORAGE FACILITY

This section provides a context to the proposed Olympic Dam RSF by comparing it with similar facilities at other mines. It also describes how the RSF would be designed to maximise short- and long-term stability and manage the potential for mineral leaching and acid generation.

Starter pit at BHP Billiton's Spence mine in Chile

Overview

The open pit mine would also extract non-mineralised and low-grade or non-economic rock (collectively termed 'mine rock'). Haul trucks would place this material in a dedicated RSF, with the low-grade material (i.e. the material that was below the current economic cut-off grade) being located in a separate area or stockpile so that it could be recovered from the RSF later if the value of the material increased.

During the pre-strip and pre-mine phases of the open pit mine development, almost all material mined would be transported to the RSF, except for those materials set aside for use as construction materials. Up to 390 Mtpa of mine rock is expected to be extracted when the open pit first intersects ore, decreasing to about 350 Mtpa of mine rock when the ore production rate stabilises at 60 Mtpa of ore. As the mine rock consists of material of different geochemical and geotechnical properties, the RSF would be designed to achieve particular performance outcomes, which are outlined in the following sections.

Context

RSFs are used by all open pit mining operations to store the non-economic material encountered while extracting the economic ore from the pit. The mine rock production rates for some of these facilities are presented in Table 5.9.

Design

The key design features of the proposed RSF at Olympic Dam are listed in Table 5.10.

By Year 40, a total of approximately 12,700 Mt of mine rock (non-mineralised) and low-grade material would have been generated. Some of the mine rock material would be used in the construction of other infrastructure for the expanded project within the expanded SML (such as the construction of tailings cell walls and haul roads), and some material would be stockpiled for use during the operation phase of the project (such as sand used for flux within the existing smelter). The remaining mine rock would be managed in the RSF.

Table 5.8 Indicative mining reagent usage per annum and storage methods

Description	Proposed expansion	Storage method
Ammonium nitrate (t)	110,000	A dedicated explosives yard similar in design and operation to the existing site explosives yard, built to relevant specifications
Emulsion (t)	4,500	
Pentaerythritol tetranitrate (PETN) (t)	129	
Oil – hydraulic (L)	2,189,000	Stored in bunded compounds within the mine maintenance industrial area
Oil – engine (L)	2,085,000	
Degreaser (L)	51,000	
Brake fluid (L)	400	
Detergent (L)	400,000	
Diesel (ML)	350	Bunded above ground storage tanks complying with AS 1940
Dust suppression chemical (ML)	5	Bunded above ground storage tanks

Trucks building a rock storage facility in Chile

5

Table 5.9 Selected indicative mine rock production figures compared to the proposed open pit operations

Mine	Company	Country/Australian state	Indicative mine rock production capacity, excluding ore (Mtpa)
Olympic Dam – proposed expansion	BHP Billiton	South Australia	350–390
Escondida	BHP Billiton Group (57.5%) Rio Tinto (30%) Mitsubishi (12.5%)	Chile	274[1]
Grasberg	Freeport-McMoRan C&G, Rio Tinto	Indonesia	183.5[2]
Bingham Canyon	Kennecott Utah Copper	North America	97.5[1]
Fimiston	Kalgoorlie Consolidated Gold Mines	Western Australia	69.5[3]
Prominent Hill	OZ Minerals	South Australia	44.6[4]
Cadia Hill	Newcrest Mining Limited	New South Wales	36.2[5]
Telfer	Newcrest Mining Limited	Western Australia	29.4[5]

[1] Minera Escondida 2008; [2] Freeport-McMoRan Annual Report 2006; [3] Newmont Sustainability Report 2005; [4] Oxiana Limited Sustainability Report 2007;
[5] Newcrest Mining Concise Annual Report 2006.

Table 5.10 Indicative features of proposed RSF

Features	Proposed expansion
Estimated stored mass at Year 40 (Mt)	12,700
Bench height (m)	10–50
Maximum dump face height (m)	20–75
Maximum RSF slope angle (degrees)	37
Maximum overall RSF slope angle (degrees)	30
Method of construction	Truck dumped
Proportion of reactive[1] versus total mine rock (% by mass)	29
Selective placement of reactive mine rock	Yes
Benign base layer to be constructed	Yes
Estimated final footprint (ha)	6,720
Estimated final height (m)	Approximately 150 m above ground level

[1] Reactive material is defined later in this section.

The key design principles that influenced the design of the RSF were:

- maintaining suitable buffer distances to key infrastructure and Arid Recovery
- the stability of the RSF structure
- the size and location of the footprint
- the economic aspects of the RSF to minimise double handling and to optimise horizontal versus vertical haulage distances
- the geochemical and physical properties of the mine rock in order to minimise the potential for releasing metal-rich and acidic leachate from the base of the structure
- the potential to emit dust and radon.

RSF layout

While the final RSF layout would be determined during detailed design, the indicative location and size of the facility assessed for the Draft EIS is shown on Figure 5.8.

The design principles for the RSF footprint aimed to achieve a balance between the following:

- creating a 500 m buffer between the RSF and the Arid Recovery area to the north of the operation
- allowing an area for the construction of the expanded metallurgical plant and mine maintenance industrial area
- providing a separate area for the stockpiling of low-grade ore
- minimising haulage costs
- creating access corridors to allow haul trucks to travel to the edges of the RSF
- maximising the distance between the RSF and Roxby Downs township and the proposed Hiltaba Village in order to minimise potential dust and noise impacts
- minimising the footprint of the RSF while maximising constructability, safety, operability and long-term stability.

Geotechnical stability

The RSF would be constructed by haul truck end-dumping to generate slopes with a natural angle of repose (about 37 degrees). A series of batters would be added throughout the RSF construction, limiting the overall average RSF outerface slope to a maximum of 30 degrees.

For the purpose of optimising the construction sequence, the facility has been modelled with an average bench height of 25 to 50 m. Mine rock characteristics and construction method may create operational constraints on dumping lift heights that would be studied and defined prior to operations commencing.

The RSF would be constructed on a base layer of end-dumped and levelled benign mine rock placed over the top of a sand dune/clay pan foundation, except in locations where the sand had been stripped for use in construction and/or smelter flux, in which case a base layer would be constructed on the sub-soil. This would provide a stable base upon which to develop the RSF and aid in managing potential leachate by disrupting preferential flow pathways within the base layer of the RSF (see Figure 5.16 and Chapter 12, Groundwater, for details).

There is no specific geotechnical limit to the height of the RSF, and the final height would be determined through an economic assessment of the costs associated with hauling mine rock material either vertically or horizontally. For the purposes of the Draft EIS the final height of the RSF would be 150 m above ground level. The separation distance between the lower edge of the RSF and the outer edge of the open pit would be determined after considering the geotechnical stability of the pit and RSF, and the requirements for infrastructure (e.g. haul roads) between the two.

Geochemical and physical properties

A variety of rock types would be selectively placed within the RSF, with their differing geochemical and physical properties influencing the design and construction of the facility. The rock types have been divided into four classes based on their potential reactivity (i.e. a measure of the likelihood that a rock type will react in the presence of water and/or oxygen and generate a leachate containing metals or acid):

- class A – low grade ore (potentially reactive)
- class B – basement (potentially reactive)
- class C – overburden rock (benign)
- class D – overburden rock (acid neutralising).

More than 2.5 million geochemical assays were undertaken to understand the mineralisation of the ore body and categorise the Olympic Dam rock types into their respective classes. Descriptions of the mine rock classes are provided in Table 5.11 and the results presented in Figure 5.17.

In addition to selective placement in the RSF, the class C mine rock would also be used in other areas of the operation. For example, the Tregolona Shale and Arcoona Quartzite Red are suited to providing cover material for decommissioned tailings cells, while the Arcoona Quartzite White and Arcoona Quartzite Transition, and the Corraberra Sandstone, are blocky materials suited to tailings embankment and other structural uses.

The mine rock would be selectively placed within the RSF so that class A and B materials would be enclosed by class C or D materials, thereby limiting the exposure of class A and B materials to rainfall and oxygen, and minimising the potential for the mobilisation of metals in leachate.

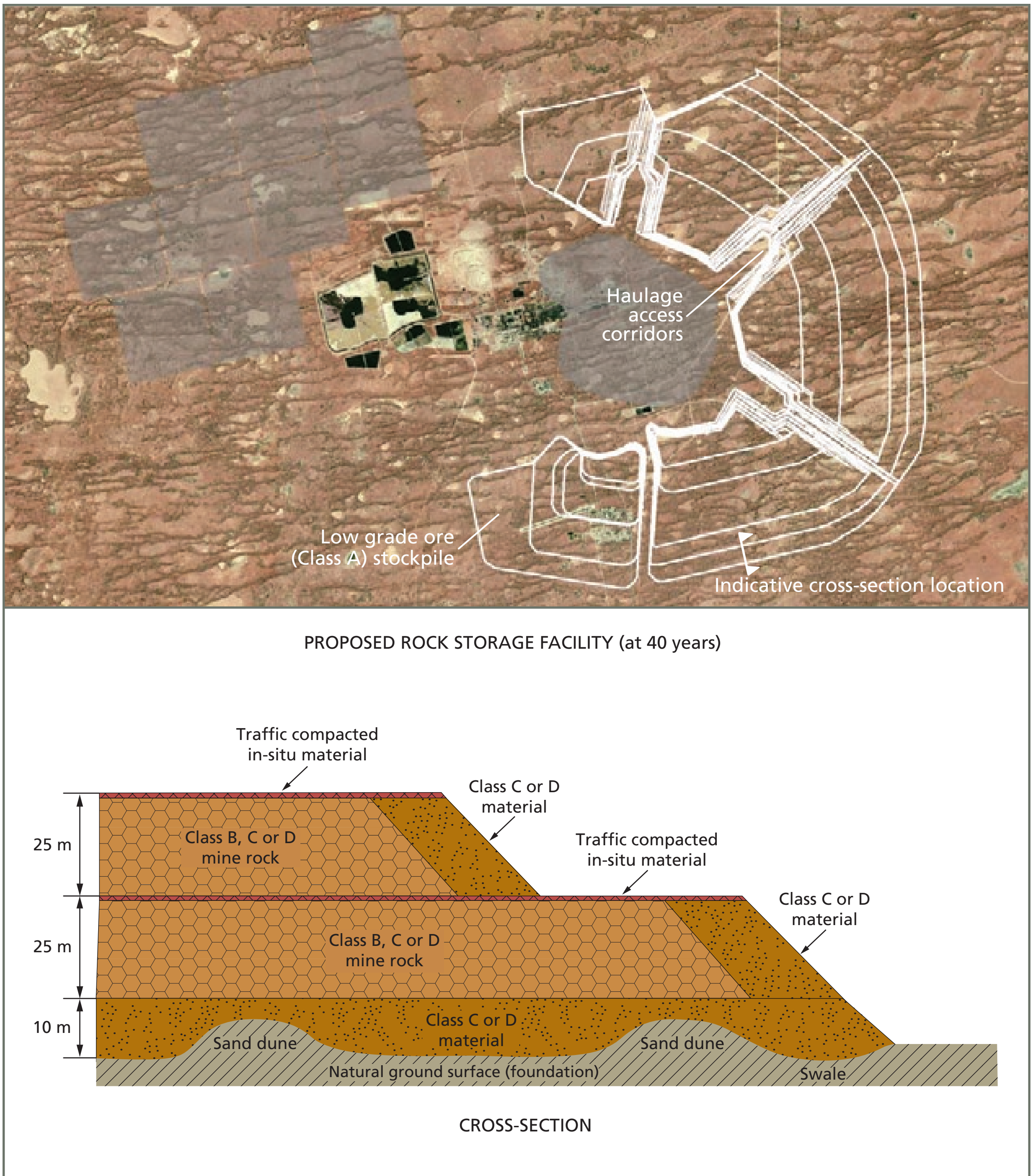
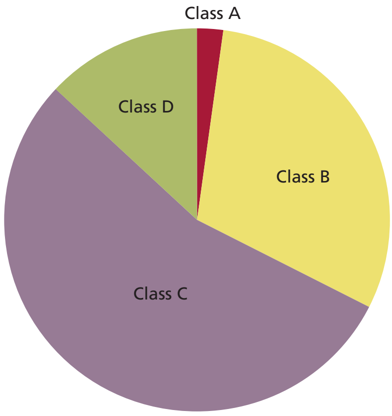


Figure 5.16 Indicative cross-section of the rock storage facility

Table 5.11 Geochemical classifications of mine rock types arising from the open pit mine

Class	Geological unit	Geochemistry
A	Low-grade ore (ODBC)	Material with moderate metals mobilisation potential and some acid neutralising capacity and some acid generating capacity. May become valuable enough to process in future
B	Basement (ODBC)	Material with low-to-moderate metals mobilisation potential and some acid neutralising capacity and some acid generating capacity
C	Overburden (Tregolona Shale, Arcoona Quartzite Red, Arcoona Quartzite White, Arcoona Quartzite Transition, Corraberra Sandstone)	Material with low metals mobilisation potential
D	Overburden (Andamooka Limestone, dolomite, calcareous clays)	Material for which the neutralising potential greatly exceeds metals mobilisation potential



Class	Volume (%)	Weight (Mt)	Mine rock classification
A	2	242	Low grade ore
B	30	3,483	Basement mine rock
C	55	6,275	Benign overburden material
D	13	1,494	Acid neutralising overburden material

Figure 5.17 Classification of mine rock to be stored in the rock storage facility to Year 40

The extraction of the various classes of material over time indicates that there are sufficient class C and D materials to enclose all class A and B materials, even assuming that all class B material is reactive, with about 41% of the enclosure capacity used (see Figure 5.18).

Layers compacted by traffic would be generated through the natural construction and operation of the RSF, reducing infiltration and further limiting the potential for metals to mobilise from class A and B materials (see Figure 5.16).

The external batters of the final RSF would be constructed of class C or D materials (see Figure 5.16) as these areas are generally subject to higher rainfall infiltration because it is not possible to establish a traffic-compacted layer above them. Internal benches would also be constructed of class C and D materials where operationally possible. Class A material (i.e. low-grade ore) would generally be stored in a separate section of the RSF (see Figure 5.8) and would not be covered by benign material during operation as this material may prove economic to process as some point in the future. Class A material that remained after operations ceased would be covered with benign material at mine closure.

Construction phase

In the initial RSF construction phase, haul truck ramps and tip-heads would be developed to enable end-dumping of mine rock and the placement of a base layer of class C or D material to form the foundation of the RSF. The benign base layer would be extended progressively, as required, in front of the advancing RSF benches.

A portion of the sand mined initially would be placed in stockpiles outside of the immediate RSF footprint. As these stockpiles were depleted they would be replenished with material sourced from the active mining area and relocated as required to meet the ongoing needs of the expanded and existing operation. Some limestone excavated from the open pit would also be stockpiled for use as aggregate for concrete or structural fill.

Operation phase

The RSF would be developed simultaneously at a number of heights, expanding outwards over time to the maximum RSF footprint as shown in Figure 5.16.

During operation, multiple simultaneous tip-heads would be established, with trucks moving to the tip-heads via haulage access corridors, which are valleys in the RSF that allow haul trucks to maintain access to the outer tip-heads (see Figure 5.16).

Each tip-head would consist of a number of tipping faces, with a windrow of approximately two metres in height, designed to provide a safety barrier to the reversing haul truck. A bulldozer, grader and water cart would operate as required at each tip-head to maintain it in good condition.

Based on the geological model and economic cut-off criteria, each haul truck load would be categorised into one of the classes of rock outlined earlier, and would be tracked to the tip-head using the Fleet Management System, enabling the material to be selectively placed.

5.4.7 INTEGRATION WITH THE EXISTING OPERATION

Ore would continue to be extracted from the existing underground mine simultaneously with the development of the open pit mine, and would continue to be delivered to the existing metallurgical plant for processing. As the open pit expanded, it would intersect some of the southern sections of the existing underground mine, resulting in decreasing output of ore from the underground operations over time. Underground mining may occur until at least Year 40.

Ore from the proposed open pit mine would typically be delivered to the new metallurgical plant (see Section 5.5). However, provision would be made for the cross feeding of the ore streams to provide operational flexibility.

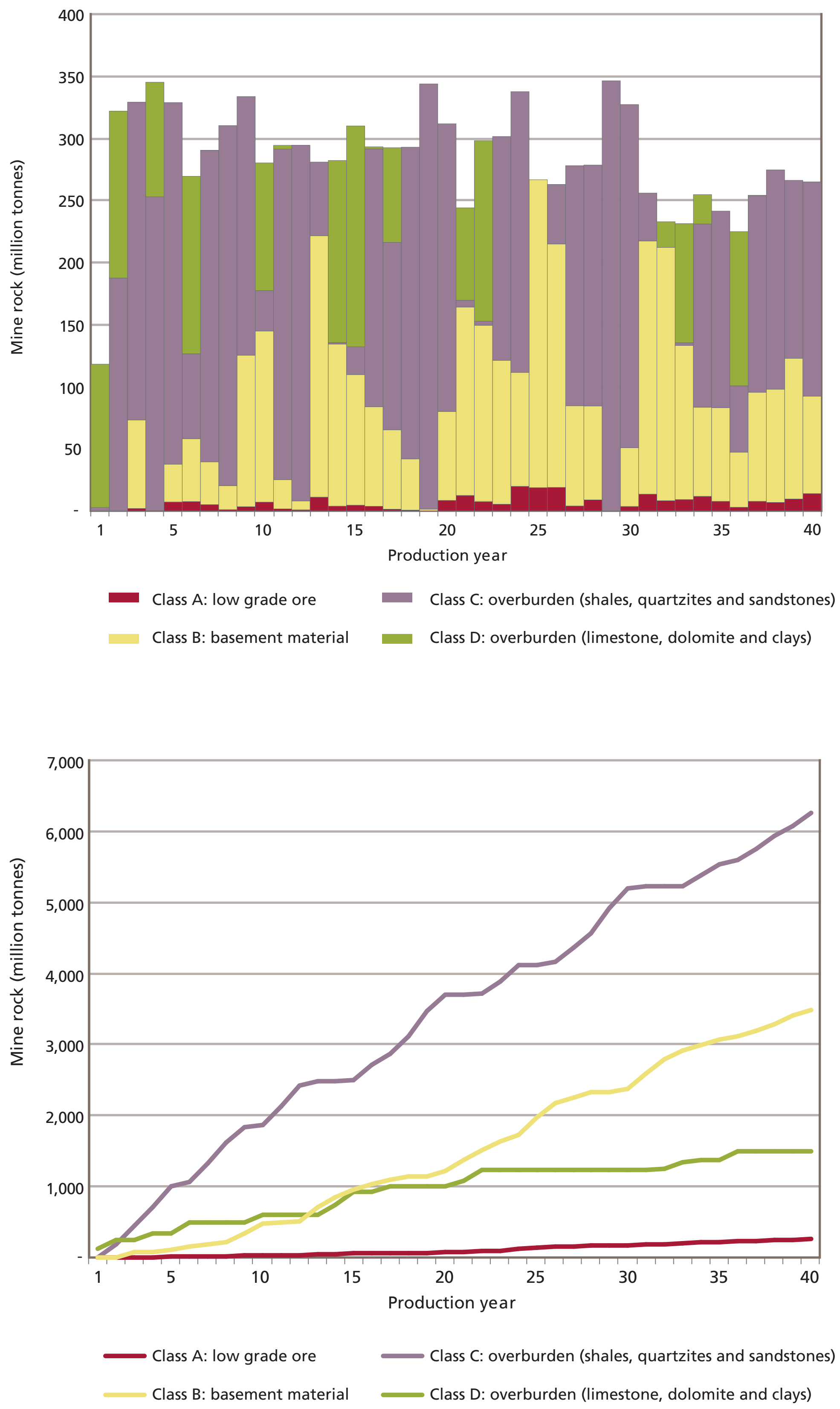


Figure 5.18 Mine rock extraction by class over time

There are several potential uses for the mine rock generated during the open pit mining operation within the existing underground mining operation:

- limestone could be used to generate cemented aggregate fill (CAF) for backfilling primary stopes in underground workings, and the existing limestone quarry would be decommissioned
- sand could be used as smelter flux
- cover sequence material (class C and D) could be used for the progressive decommissioning and rehabilitation of the existing TSF cells
- cover sequence material could be used to construct the embankments of TSF cells.

These uses would be investigated in greater detail during the definition phase of the project, with the aim of minimising disturbance and maximising beneficial reuse while ensuring adequate material was available throughout the life-of-mine to enclose the class A and B materials within the RSF.

5.5 PROCESSING

5.5.1 OVERVIEW

A new metallurgical plant would be constructed to process the ore mined in the open pit mine. The plant would consist of a new concentrator and a new hydrometallurgical plant to extract uranium from the tailings generated in the new concentrator. The new metallurgical plant would be constructed over a number of stages, each of about 20 Mtpa ore throughput and designed to coincide with the ramp-up in the rate of mining in the open pit. Ultimately, the new metallurgical plant would process about 60 Mtpa of ore.

This plant would supplement the existing metallurgical plant, which would continue processing ore from the either the underground operation, or the open pit mine, at a rate of around 12 Mtpa. Some connections between the existing and the new metallurgical plant would be established in order to maximise the combined production from both metallurgical plants. The existing metallurgical plant would also be enhanced by an expansion of the existing electrorefinery and the optimisation of the existing smelter.

Tailings from both the existing and new metallurgical plants would be combined in a new tailings disposal facility and then pumped to a new TSF. The new TSF cells would be a refinement of the existing TSF cell design, taking into account the 20 years of operating experience with the existing cells and the additional construction materials that will be available as a result of the open pit mine.

Table 5.12 provides an indicative summary of the major features associated with the expansion of the existing metallurgical plant and the new metallurgical plant and Figure 5.19 illustrates the location and footprint of the major metallurgical components. A conceptual layout of the proposed new metallurgical plant is shown as Figure 5.20.

The new metallurgical plant, combined with the optimisation of the existing metallurgical plant, would increase the demand for energy, water and sulphur. Indicative requirements for major materials to support the proposed mining operation are shown in Table 5.13.

5.5.2 CONTEXT

The new metallurgical plant would include the construction of the following facilities:

- a new concentrator plant, including nine new grinding mills and new flotation circuits. The grinding mills would be slightly larger than the current mills, and the flotation circuit would be significantly larger, although it would operate in a manner similar to the existing flotation circuit. The new concentrator plant would also incorporate a more efficient thickening stage, which would follow the flotation stage. This would be designed to reduce the use of fresh water and enhance the recycling of acidic liquor from the TSF
- a concentrate filter plant to produce concentrate for export and load-out facilities to transfer the concentrate to the rail terminal

Table 5.12 Indicative features of the expanded metallurgical facilities

Features	Proposed expansion
Ore grinding rate (Mtpa)	60
Copper concentrate (ktpa)	1,800[1]
Refined copper (ktpa)	515[2]
Uranium oxide (tpa)	14,500[2]
Gold bullion (oz/a)	700,000[2]
Silver bullion (oz/a)	2,100,000[2]
Number of new grinding mills	9
Number of new acid plants	4 + 1[3]
Number of new TSF cells	8 + 1[4]

[1] Of the 1,800 ktpa of copper concentrate produced, 1,600 ktpa would be prepared for export to off-site smelting facilities, and 200 ktpa would be directed to the expanded on-site smelter.
[2] Production numbers include copper, gold and silver production derived from off-site facilities processing Olympic Dam-generated copper concentrates, and represent production equivalents given typical metal recoveries at Olympic Dam.
[3] Four acid plants would be constructed in the new metallurgical plant, and one associated with the expansion of the existing smelter.
[4] An additional TSF cell has been allocated for construction as contingency against changes in the site water balance over time.

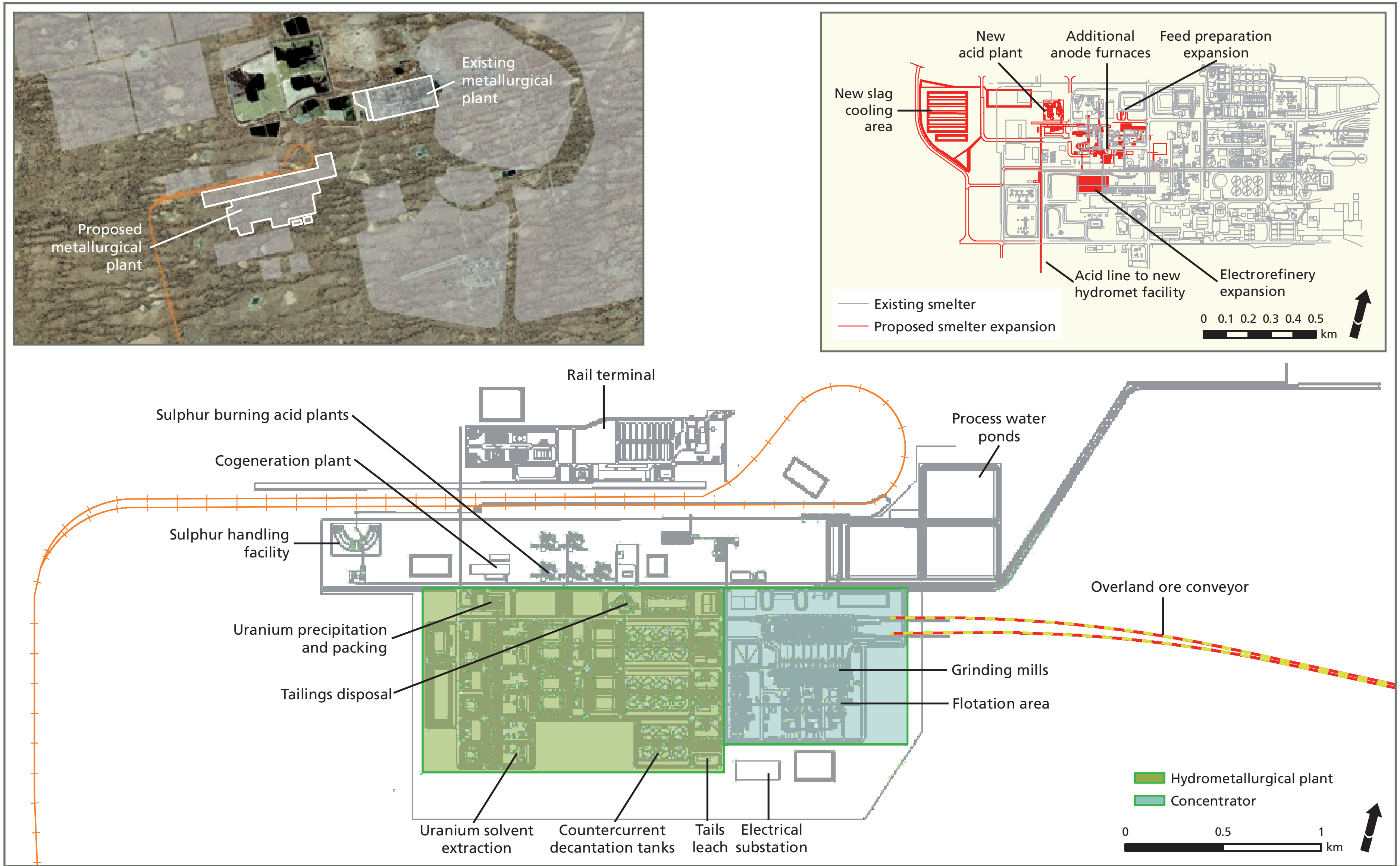


Figure 5.19 Indicative configuration of major metallurgical plant at Year 40

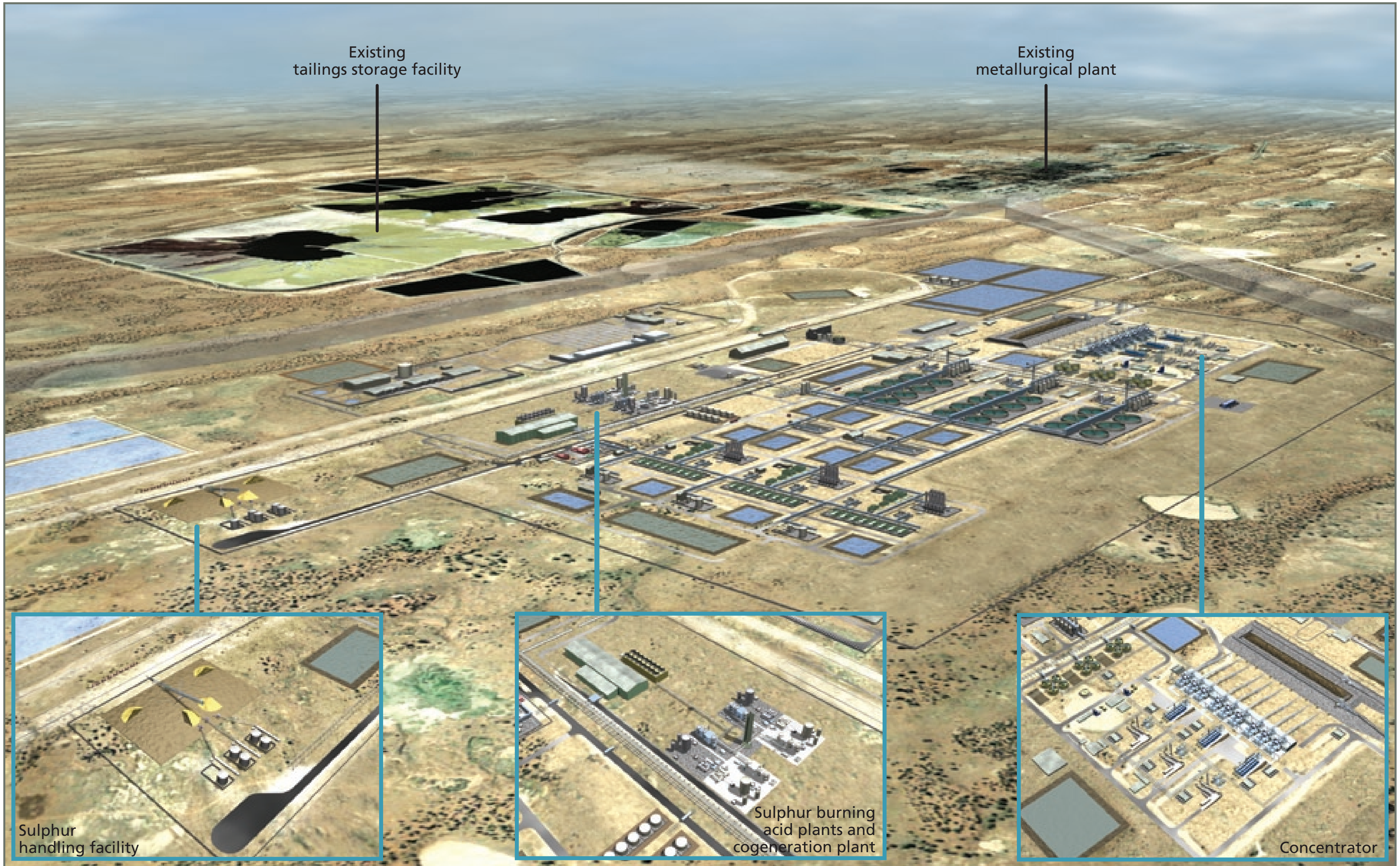


Figure 5.20 Conceptual layout of the proposed metallurgical plant at Year 40

Table 5.13 Indicative major demands for the proposed new metallurgical plant

Expansion requirement	Proposed expansion
Water demand (average GL per annum/ML per day)	63.5[1]/175
Electricity consumption (MWh per annum)	3,310,000
Sulphur (tpa)	1,720,000
Peak construction workforce	3,000
Ongoing operational workforce	1,000
Total land disturbance (including TSF) (ha)	4,690

[1] Water demand for the new metallurgical plant would be met through a combination of process water generated at the desalination plant (about 75%) and liquor recovered from the TSF cells (about 25%) – see Section 5.7 for further information.

- a new hydrometallurgical plant, including new tails leach tanks, new countercurrent decantation tanks and new clarifier tanks. These would be larger than the existing hydrometallurgical plant, but would operate in a similar manner
- a new uranium solvent extraction plant, including new raffinate ponds, new pulse columns and a new uranium precipitation and calcination circuit. These would generally be enlarged versions of the present solvent extraction operation
- a new tailings disposal plant that would handle both existing and new metallurgical plant tailings. This would be larger than the existing facility and would be designed to transfer tailings to the TSF at 52–55% solids, compared to the existing facility which operates at around 47% solids
- eight to nine new TSF cells. These would be a refined version of the existing TSF cell 4 design incorporating a new centreline raise design instead of the current upstream raise design. This change is possible because the more competent mine rock extracted from the open pit would be used instead of consolidated tailings for TSF wall construction. The existing TSF seepage controls would be improved, using the experience gained in operating the current TSF cells over more than 20 years
- four additional balance ponds to assist in the management of liquor decanted from the TSF
- four additional acid plants, which would be similar, but larger, than the existing acid plant, and would be designed to burn elemental sulphur to generate sulphur dioxide for conversion to sulphuric acid, rather than using off-gas from a furnace as occurs in the existing acid plant
- an electricity cogeneration plant, in which steam-driven electrical turbines and generators use the heat produced from burning sulphur in the new sulphur burning acid plant. Currently, heat from sulphur burning within the existing acid plant is directed to a heat exchanger and lost.

The existing metallurgical plant would be expanded and optimised to provide synergies with the new metallurgical plant and open pit mine. The significant aspects of the proposed expansion of the existing metallurgical plant are:

- modifications to optimise the existing smelter and associated infrastructure. This includes upgrades to the existing concentrate leach, feed preparation and concentrate feed system, modifications to the flash, electric and anode furnaces, upgrades to the gas cleaning systems (if necessary), and upgrades to the metal casting facilities
- construction of a second acid plant adjacent to the existing acid plant, which would be similar in design and operation to the existing acid plant
- optimisation of the existing copper solvent extraction circuit and the existing electrowinning plant
- expansion of the electrorefining tank house
- expansion of the existing precious metals recovery plant
- construction of additional infrastructure necessary to run the existing or proposed operation, including:
  - pipelines to transfer copper concentrate from the new metallurgical plant to the expanded concentrate leach area of the existing metallurgical plant prior to feeding into the existing smelter
  - pipelines to transfer tailings from the existing metallurgical plant to the new tailings disposal plant.

5.5.3 CONSTRUCTION PHASE

Construction of the new metallurgical plant, and modification of the existing metallurgical plant, would occur as necessary in time to process the first 20 Mtpa of ore from the open pit. Initially, three TSF cells and two balance ponds (see Section 5.5.6) would be required.

The intermediate development would expand the new metallurgical plant to process about 40 Mtpa of ore through the new concentrator and hydrometallurgical plant. Additional grinding mills, flotation cells and an additional tails leach circuit would be added. The existing smelter and associated infrastructure would be modified to increase its capacity to around 800,000 tpa. Two additional TSF cells and two balance ponds would also be constructed during this time.

The final development would increase ore throughput to the full operating capacity of around 60 Mtpa through additional grinding mills, flotation cells and an expansion to the hydrometallurgical plant. Two to three additional TSF cells would be constructed but no additional balance ponds would be required.

Additional electricity, water infrastructure and workforce would also be required during development to 60 Mtpa, and these are detailed in their respective sections in this chapter.

Construction of the plant

Access and deliveries to the construction area would be via road and/or the proposed new rail line. Materials would be imported through Outer Harbor and the landing facility and transported to pre-assembly yards at Port Augusta and Olympic Dam.

Construction would begin with ground preparation for foundations. Vegetation on the site would be cleared and topsoil would be removed and stockpiled for reuse in rehabilitation or landscaping. Graders, front end loaders and bulldozers would level the ground to the required gradient. The selection of appropriate foundations for the metallurgical plant is not usually made until the detailed design stage, but, normally, massive concrete foundations would be installed over a compacted rock base. The fabrication and erection of the buildings would follow, including erection of the mechanical, piping, electrical and instrumentation components of the plant.

Containment bunding would be constructed around all material storage areas in accordance with legislative requirements.

Testing and commissioning

Once the various process components have been constructed and made ready for energising, the functional testing of each component, system and separable portion would commence. To minimise the risks associated with plant and equipment failure, this pre-commissioning is typically executed using air or water, rather than with process materials such as ore and chemicals.

Once pre-commissioning has been concluded, the various processing areas would be mechanically complete and ready for process commissioning with ore. The plant, equipment and systems would then be tested for performance while operating with ore, reagents and other process materials. When the pre-determined level of output and quality is achieved, the areas would be handed over to operations personnel for optimisation and routine operation.

5.5.4 OPERATION PHASE

The proposed new metallurgical plant, together with the modified existing metallurgical plant, would operate as shown in Figure 5.21 and as described in the previous sections. The following sections describe the operation phase for each of the metallurgical areas in greater detail.

Concentrator plant

The new concentrator plant would grind ore from the open pit mine to a size that permits the liberation of the copper-bearing mineral from the remainder of the ore in the flotation section of the concentrator. In addition, infrastructure for the handling of off-site concentrates may be established to permit the metallurgical processing of concentrate produced from other operations. This would be added to the flotation feed tank prior to the flotation circuit. The output of the concentrator would consist of two streams: a copper-rich slurry, and a uranium-rich slurry.

The following sections describe the concentrator process in more detail, and a conceptual layout is presented in Figure 5.20.

Ore storage and handling

Two overland conveyors would feed grinding mill feed stockpiles of around 120,000 t total capacity, obtaining ore from the open pit primary crushers (described previously). The ore would be distributed to the stockpiles according to certain ore characteristics (e.g. the copper-to-sulphur ratio) either by two or three travelling and luffing stackers or by tripper conveyors. Feeders underneath the stockpiles would direct ore onto conveyors to the mills.

Grinding

The ore from the stockpiles would be mixed with process water to form a slurry which would then be milled to the appropriate product size to allow the copper-bearing minerals to be separated from the remaining minerals during flotation. Nine grinding mills would be necessary to grind the 60 Mtpa of ore. These would be installed in stages, with three grinding mills installed initially, and the subsequent installation of a further three grinding mills in each of the intermediate and development to full operating capacity phases. After grinding the slurry would be stored in an agitated tank before being directed to the flotation circuit.

Flotation

A conventional flotation process similar to that presently used at Olympic Dam would separate the copper-bearing minerals from the other minerals in the ore (including uranium). Dosing the flotation cells with chemical reagents enables the copper-bearing minerals to float to the surface when air is blown through the cells. The copper-bearing minerals are then skimmed off to form a copper-rich slurry which would be thickened and transferred to new concentrate storage tanks. The remaining materials in the ore, including the unrecovered uranium-bearing minerals, sink to the bottom of the flotation cells where they are collected and sent for tailings thickening.

Tailings thickening

The concentrator tailings thickening design is proposed to reduce the amount of fresh water demand using recycled acidic liquor collected from the TSF. This stage would consist of about 12 deep-cone thickeners for the flotation tailings stream, thickening the slurry to about 65–70% solids. The thickened slurry would subsequently be mixed with recycled acidic liquor from the TSF before further treatment in the hydrometallurgical section of the facility.

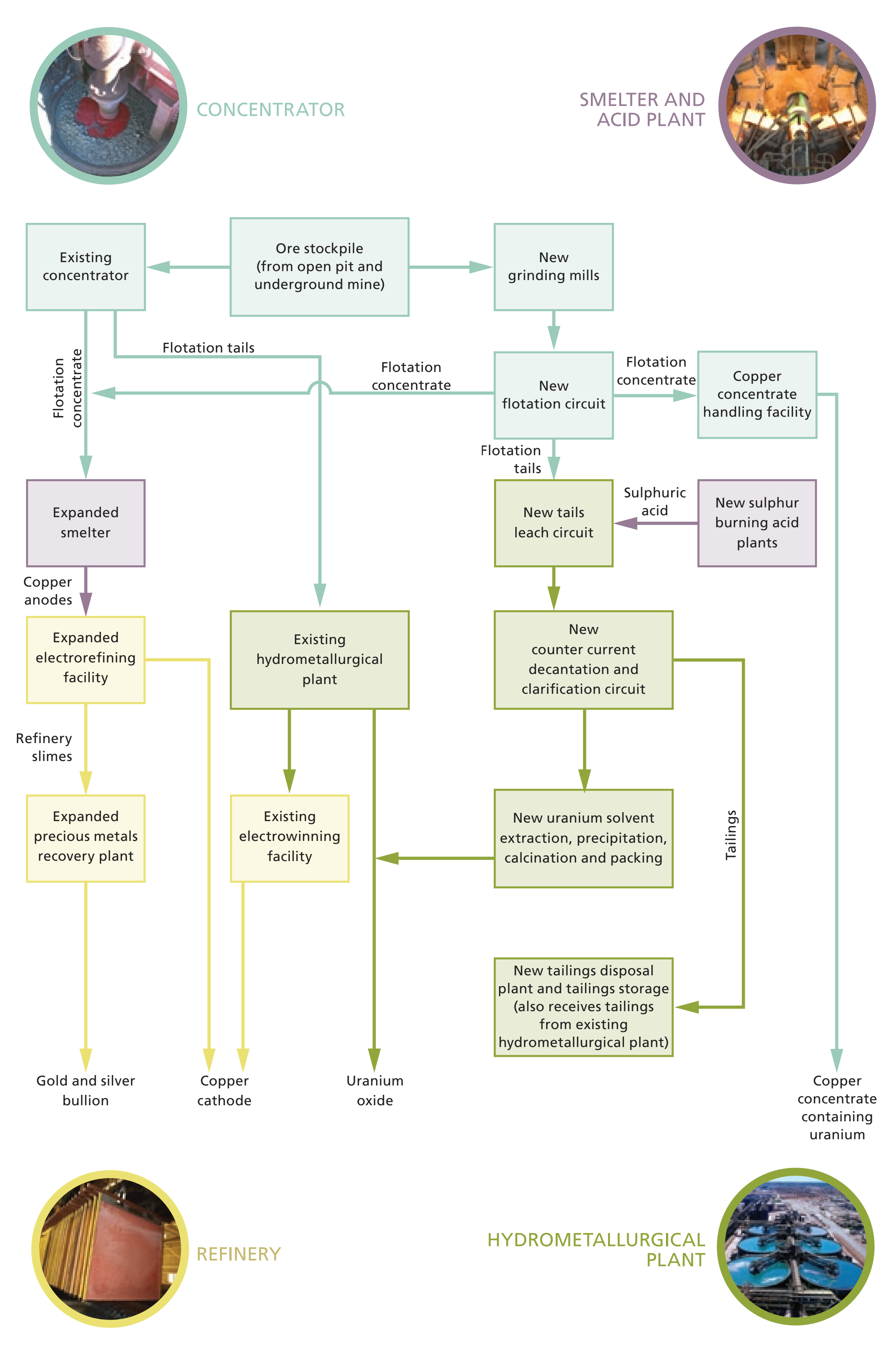


Figure 5.21 Proposed metallurgical processes (ore processing)

Concentrate handling

During the initial development copper-rich concentrate derived from the new flotation circuit would be thickened and directed to a new concentrate filter plant. Here it would be filtered through six to ten filter presses to form a copper concentrate solid containing about 10% moisture. This would be stockpiled inside an enclosed shed (which can store around 100,000 t), before it is loaded onto a train for export via the Port of Darwin (see Section 5.9 for details). Ultimately, about 1.6 Mtpa of concentrate would be exported.

Following an upgrade of the existing smelter (to increase its capacity from 600,000 tpa of concentrate to 800,000 tpa), the additional 200,000 tpa of copper concentrate would be directed to the expanded concentrate leach plant from the flotation concentrate storage tanks. Extra leach tanks would be added to process the greater throughput.

Hydrometallurgical plant

The hydrometallurgical plant recovers the uranium from the flotation tailings generated within the concentrator plant. A new hydrometallurgical plant would be built essentially duplicating the existing hydrometallurgical process but without the components to extract the copper.

The following sections describe the hydrometallurgical process in more detail.

Tails leach

Tails leach is the process used to recover uranium from the uranium-rich flotation tailings using sulphuric acid and oxidising agents. The new hydrometallurgical plant would install up to three trains of tails leach tanks with each train consisting of 8–10 covered and lined tanks. These would operate in a similar manner to the existing tails leach circuit, however each train would be able to leach around 20 Mtpa of flotation tailings, ramping up to match ore production from the open pit mine. The leached material would be discharged as a slurry and passed to the countercurrent decantation circuit (see following section).

A bypass system comprising pumps and pipelines would be installed to bypass the tails leach process should the tails leach plant be unavailable. This would allow copper concentrate to be generated for the smelter and export while maintenance to the tails leach plant was undertaken. When the tails leach bypass system was operating flotation tailings would be disposed of at the TSF.

Countercurrent decantation

The countercurrent decantation (CCD) circuit allows uranium-bearing liquor to be recovered and separated from the leach residue. Slurry from the new tails leach circuit would be pumped to the CCD circuit which would have three trains consisting of six thickeners operating in series, each of around 20 Mtpa throughput capacity. Flocculant would be mixed with the feed material in each thickener to enhance the settling characteristics of the solids.

The thickened residue from the last tank in the new CCD circuit would be pumped to the tailings disposal area before being discharged to the TSF. Uranium raffinate liquor (the low-uranium bearing solution) from the new uranium solvent extraction circuit would be added to this final thickener as a wash solution with thickener overflow advancing in a countercurrent manner to the solids. The overflow solution from the first CCD thickener in each train would be pumped to the pregnant liquor solution clarification circuit where entrained solids would be removed.

Pregnant liquor solution clarification

Clarification units, consisting of large tanks operating in a manner similar to thickeners, would be used to remove entrained solids from the pregnant liquor solution. Flocculant and coagulant would be added to aid the clarification process. The solids separated out during this process would be returned to the CCD circuit and the clarified liquor solution would be pumped to the pregnant liquor solution ponds. Additionally, a series of PLS filters would be installed to remove any remaining solid material.

These ponds would provide a buffer capacity between the tails leach/CCD/clarification sections and the solvent extraction circuit, enabling more consistent operation. Up to four pregnant liquor solution ponds would be constructed to allow maximum operational flexibility and each pond would be lined and have an appropriate leak-detection system.

Uranium solvent extraction

A new uranium solvent extraction (USX) plant would be constructed. This plant would be similar in design and operation to the existing USX plant, differing only in scale. It would have three trains to cater for the ramp-up in the rate of mining over time, each of which would be capable of operating independently of the others. The two outputs from the new USX plant would be uranium raffinate liquor (containing little uranium) which would be directed back to the new CCD circuit, and uranium-rich liquor which would be directed to the new uranium precipitation circuit.

Uranium precipitation, calcination and packaging

The uranium precipitation circuit would remove uranium from the uranium-rich stream produced by the new USX plant and be similar in design and operation to the existing uranium processing and handling infrastructure. Ammonia, stored in a dedicated storage facility about 1 km to the west of the proposed new metallurgical plant, would be used to produce a uranium precipitate, ammonium diuranate (ADU) $[(NH_4)_2U_2O_7]$, commonly called yellowcake. The precipitate would be washed and thickened and then pumped to the calcination area. Once the uranium had been removed the remaining barren strip solution would be recycled to the new uranium solvent extraction circuit.

The new calcination plant would use two calcining furnaces to oxidise the ADU and create uranium oxide (U_3O_8), which would then be packed into 200-litre drums that would be automatically

Uranium packing

filled and weighed in a sealed enclosure prior to transport off-site as per the existing process.

Tailings thickening and disposal

Tailings from the existing operation would be pumped from the tailings disposal area of the existing metallurgical plant to a new common tailings disposal area to be combined with tailings from the new hydrometallurgical plant. The combined slurry would have a solids concentration of about 52–55%. The slurry would be pumped and deposited to the new TSF cells (see Section 5.5.6).

Smelter

The existing smelter converts copper concentrate produced in the concentrator plant, containing around 40% copper, to cast copper anodes of about 99% copper. Slag, containing largely iron and silica with small amounts of residual copper, is also produced in the smelter. In order to meet the needs of the expanded operation, the throughput of the existing on-site smelter would be increased to receive about 800,000 tpa of copper concentrate.

This would be achieved by expanding the existing smelting infrastructure, the most significant of which would be the installation of additional anode furnaces in the smelter, and an additional acid plant for the treatment of the sulphur dioxide-rich off-gas from the flash smelting furnace. The details of the modifications necessary within the existing smelter are provided in the following sections.

Concentrate leach

The concentrate leach circuit uses sulphuric acid to remove uranium from the copper concentrate prior to smelting. The discharged concentrate leach slurry would be thickened and the solids would be filtered, washed and re-pulped with process water and a caustic solution to neutralise the residual acid. The leach liquor would be directed to the existing hydrometallurgical plant for the recovery of uranium. The filtered solids would be pumped to the existing feed preparation plant for further filtration, stockpile blending and drying, before being conveyed to an enclosed concentrate-blending stockpile for smelting. One or two additional filter presses and an extra steam dryer would be added to the existing feed preparation plant to increase its capacity.

Feed preparation

The operation of the feed preparation plant has been described above. The existing feed preparation plant would require an additional steam dryer to meet the throughput requirements, plus some minor infrastructure, such as additional conveyors.

Flash smelting furnace

The dried copper concentrate from the feed preparation plant reacts with oxygen and silica in the flash smelting furnace to separate metallic copper from other minerals within the concentrate.

Additional blister copper tapholes would be installed on the eastern end of the existing flash furnace to meet the additional throughput of copper concentrate. These tapholes would discharge to a modified launder system so that the flash furnace copper could be directed to the new anode furnaces. An upgrade of the flash smelting furnace feed system would also be required to ensure the furnace received sufficient copper concentrate feed with the correct proportions of oxygen and silica.

Additional ventilation would be installed in the smelter to manage the gases generated through tapping the new blister tapholes on the eastern end of the furnace. This system would be similar to the existing taphole hood ventilation installed on the existing tapholes, and would collect fugitive gases and direct them to a dedicated stack to be located to the north-east of the existing smelter building. The stack height would be determined during detailed design (a height of 35 m has been used for the purpose of the Draft EIS assessments), but it would be sufficiently tall to ensure ground level concentrations of emitted substances were acceptable and to avoid the potential for ventilation gases to re-enter the smelter building.

Electric slag reduction furnace

The existing electric slag reduction furnace treats the slag from the flash smelting furnace, removing residual copper and directing it to the anode furnaces. Modifications may be required to the slag handling area of the electric slag reduction furnace to meet the increased slag generation rates. This may include additional slag tapholes and replacement of the existing 40 t slag tapping pots with 100 t slag pots. An upgrade to the electric slag reduction furnace off-gas handling system may also be required. This would include the installation of a larger off-gas fan and minor modifications to associated infrastructure.

Anode production
Blister copper produced by the flash smelting furnace and the electric slag reduction furnace would be delivered to both the existing anode furnaces and new anode furnaces, which would be constructed on the north-eastern side of the existing smelter building. Anode furnaces are used to further refine the molten copper, which is cast into moulds in preparation for final refining in the electrorefinery. The new anode furnaces would be the same as those currently installed and would feed a casting wheel, similar in design and operation to that already used.

Off-gas from the new anode furnaces would be treated in a new off-gas handling system. This would be a quench-venturi style scrubbing system similar to those currently installed for the existing anode furnaces. The scrubbed off-gas would be directed to the main smelter stack most of the time, or to one of the two acid plants during oxidation cycles.

Waste-heat-boiler
The existing waste-heat boiler would be modified with additional steam tubes to increase its capacity to cool the off-gas and generate steam for use in other sections of the existing metallurgical plant.

Oxygen plants
An additional oxygen plant would be constructed to supply extra oxygen for use in the furnaces within the smelter. The additional plant would be similar in design and operation to the four plants already used in the existing operation.

Ancillaries
A number of other, smaller, components would need to be upgraded to meet the demands of the expanded smelter. These include additional compressed air capacity, additional storage and handling capacity for reagents, additional infrastructure to manage anodes (i.e. laydown areas and anode hauling capacity), and expanded slag cooling areas.

Acid plants

New acid plants would need to be constructed and operated in order to meet the sulphuric acid needs of the on-site consumers in the metallurgical plant, and to treat the high-sulphur dioxide off-gas from the expanded smelter. Construction of this infrastructure would be timed to coincide with the expansion of the smelter and the construction of the new hydrometallurgical plant.

Metallurgical gas acid plant
One additional acid plant would be constructed adjacent to the existing acid plant to treat additional off-gas generated by the modified smelter. This acid plant would be similar in scale to the existing acid plant, with a capacity to generate around 1,500 t of sulphuric acid per day, compared to the existing 1,800 tpd acid plant. This new acid plant would be similar in design and operation to the existing acid plant.

Sulphur dioxide-rich off-gas from the flash smelting furnace and the anode furnaces (when in oxidation) would be treated through the existing waste-heat boiler and electrostatic precipitator to reduce the temperature of the gas and remove most of the particulate matter. Following treatment in the existing electrostatic precipitator, the off-gas stream would be split between the existing acid plant and the new acid plant. The off-gas in both acid plants would be cleaned (i.e. the fluorides, chlorides and any residual particulate matter would be removed) before entering the gas converter, where the sulphur dioxide is converted to sulphur trioxide. This process uses a vanadium-based or caesium-based catalyst. The sulphur trioxide gas is then brought into contact with sulphuric acid, which absorbs the sulphur trioxide and generates more sulphuric acid. Unconverted sulphur dioxide and sulphur trioxide are recycled around the acid plant in order to reduce emissions to the atmosphere. This type of acid plant, termed a double contact, double absorption acid plant, would typically capture around 99% of the sulphur.

As with the existing plant, some elemental sulphur would be burned in the new acid plant to increase the volume of sulphuric acid produced and to maintain gas converter temperatures during maintenance to the flash smelting furnace or associated infrastructure.

Sulphur burning acid plants
Four additional acid plants would be constructed within the new metallurgical plant to provide sulphuric acid. These acid plants would be similar to the new smelter acid plant previously described but would be larger. Each would have a capacity of about 3,500 tpd of sulphuric acid, but this would only be generated from burning elemental sulphur (i.e. these acid plants would not treat off-gas from the smelter).

Waste heat generated from these new sulphur burning acid plants would be recovered as steam by waste-heat boilers. The steam would be directed to the cogeneration plant (see Section 5.8.6 for a description of the proposed cogeneration plant) to produce electricity, partially off-setting the scheduled demand for electricity.

Elemental sulphur is necessary to ensure sufficient sulphuric acid can be made to supply the hydrometallurgical plant. About 1.7 Mtpa of sulphur would be delivered by rail and conveyed to a storage facility with a capacity of around 300,000 t (see Figure 5.20). This facility would be enclosed within concrete barriers and wind-disruptive fencing, similar to the existing sulphur storage area.

Refinery

The refinery area of the proposed plant is broadly divided into three processes: electrorefining, electrowinning and precious metals recovery. A new electrorefinery tank house would be constructed within the existing metallurgical plant. The existing electrowinning operations would require minor optimisation.

Electrorefining

The existing electrorefinery would be expanded through the addition of an extra tank house located near the existing metallurgical plant. The additional tank house would operate in the same manner as the existing refinery, containing a number of cells into which cast copper anodes were inserted. An electrical current would be applied, plating the copper onto stainless steel mother plates, and dropping the impurities, including gold and silver, to the bottom of the cells. These plates would then be removed from the cells, and the copper stripped and bundled for sale to customers. The new electrorefinery tank house would be fitted with new equipment to prepare the anodes, strip the cathodes and bundle the copper.

Electrowinning

The electrowinning operations would require only minor optimisation to cater for the additional copper electrolyte throughput from the existing copper solvent extraction plant, such as refining the plating cycle times and optimising crane use.

Precious metals recovery

The precious metals recovery plant takes the gold and silver slimes collected from the bottom of the electrorefinery cells and processes them (by removing impurities such as lead and selenium) to form gold and silver bullion.

The existing precious metals recovery plant would be retained and with minor metallurgical optimisation, the capacity would be sufficient to handle the additional slimes throughput.

5.5.5 CHEMICAL STORAGE AND USE

No changes are proposed to the types of reagents used throughout the metallurgical operation given the similarities between the existing and new metallurgical plants. The volumes of reagents used, however, would increase. Table 5.14 identifies the indicative volumes of reagents and methods of storage that would be required for the expanded operation. This table does not include reagents generated on-site (e.g. sulphuric acid, oxygen and nitrogen).

Table 5.14 Indicative annual metallurgical plant reagent requirements and storage methods

Description	Proposed expansion	Storage method
Ammonia (t)	11,000	Above ground bullet tanks
Boiler and cooler feedwater chemicals (t)	320	Self-bunded bulk containers
Caustic soda (t)	25,000	Dedicated, bunded reagents yard as per existing practice
Coagulant (m^3)	31,700	Bunded tank
Coke (t)	18,300	Covered storage shed
Copper extractant (Oxime) (t)	880	Stored in bulk containers within a dedicated bunded area
Diesel (m^3)[1]	16,000	Bunded tank conforming to the requirements of AS 1940
Diluent (m^3)	14,500	Bunded tank conforming to the requirements of AS 1940
Ethanol (m^3)	17,300	Bunded tank conforming to the requirements of AS 1940
Ferrous sulphate (t)	120	Dedicated, bunded reagents yard as per existing practice
Flocculant (t)	8,800	Bunded tank
Flotation modifier (t)	1,000	Dedicated, bunded reagents yard as per existing practice
Frother (t)	1,950	Dedicated, bunded reagents yard as per existing practice
Fuel oil (kL)[1]	14,000	Bunded tank conforming to the requirements of AS 1940
Liquid oxygen (t)	5,000	Above ground bullet tanks
Liquid petroleum gas (kL)[1]	32,000	Above ground bullet tanks
Natural gas (t)[1]	45,000	Above ground bullet tanks
Nitric acid (t)	150	Bulk containers stored in a dedicated bunded and undercover area
Promoter (t)	2,000	Dedicated, bunded reagents yard as per existing practice
Silica (Flux) (t)	56,000	Storage of pre-strip sand to be determined, but likely to be within the existing quarry, with intermediate storage in a stockpile
Soda ash (t)	6,700	Dedicated, bunded reagents yard as per existing practice
Sodaberg electrode paste (t)	410	Dedicated, bunded reagents yard as per existing practice
Sodium chlorate (t)	63,900	Dedicated, bunded reagents yard as per existing practice
Sodium cyanide pellets (t)	410	Bulk containers stored in a dedicated bunded and undercover area
Solvent extraction modifier (m^3)	680	Stored in bulk containers within a dedicated bunded area
Sulphur (t)	1,720,000	Bunded and wind disruptive stockpile enclosure
Uranium extractant (Amine) (t)	270	Stored in bulk containers within a dedicated bunded area
Xanthate (t)	2,000	Dedicated, bunded reagents yard as per existing practice
Zinc (t)	115	Bulk containers stored in a dedicated bunded and undercover area

[1] The expanded smelter may use natural gas in preference to diesel, LPG and fuel oil. Natural gas, LPG, diesel and fuel oil figures are 'worst case' maximum values.

5.5.6 TAILINGS STORAGE FACILITY

The design of the TSF is described below and in Appendix F1. General waste management is discussed in Section 5.6.

Overview

Tailings generated after the uranium and copper have been extracted in the new hydrometallurgical plant would be disposed of in a new TSF. Material from the countercurrent decantation process within the new hydrometallurgical plant would be directed to a new tailings disposal facility at a solids concentration of around 55%. Tailings from the existing metallurgical plant would also be directed to the new tailings disposal facility, the combined tailings having a solids concentration of around 52–55% solids.

The new TSF cells would be a refinement of the existing TSF design which has been operating for 20 years, modified to make use of both the experience gained in the operation of the existing cells and the different types and volumes of construction materials available.

Each of the proposed TSF cells would be approximately 400 ha in tailings surface area, and eight cells would be required to manage the additional tailings and water throughput. Area for an additional cell would be allocated as a contingency in the event of unforseen issues such as a positive water balance, plant failures or extreme rainfall events. The area and design of the TSF cells proposed would avoid the need to construct new evaporation ponds to manage such events. An additional area would also be disturbed to construct tailings walls, roadways and infrastructure corridors.

The design of the TSF walls and the existing 'upstream raise' methodology would change. Using mine rock generated from the open pit mine (which would otherwise be stockpiled in the RSF), would allow the TSF cells to be designed with greater stability in a 'centreline raise' arrangement, and to greater heights than currently permissible. This method is detailed further in the following sections.

Other design features have been proposed to improve the management of acidic liquor. These include the use of a rock ring wall within each cell, together with additional liquor seepage control measures. These measures, together with the additional cell area and the thickening of flotation tailings within the new concentrator plant, would negate the need for additional evaporation ponds and may allow the existing evaporation ponds to be removed over time (see Chapter 15, Terrestrial Ecology, for further information regarding fauna interaction with the TSF). Covered balance ponds would also be constructed to facilitate the transfer of acidic liquor from the TSF cells back to the metallurgical plant, and to provide additional surge liquor capacity to manage seasonal variation in the water balance and high rainfall events.

TSF cells would be constructed throughout the development phases, commencing with three TSF cells and two balance ponds and finishing with eight or nine cells and four balance ponds around Year 11.

Context

Tailings storage facilities are used by mining and minerals processing operations throughout the world. The annual deposition rates of some of the world's TSFs are presented in Table 5.15.

Design

The main design features of the proposed TSF at Olympic Dam are listed in Table 5.16 (the values provided are indicative and may change as required during detailed design). Design information is presented in Appendix F1, and summarised in the following sections. Appendix F1 also discusses the key design criteria and the various alternatives that were investigated (see also Chapter 4, Project Alternatives).

TSF layout, geometry and key infrastructure

The number of TSF cells proposed and the rate of expansion are described in the overview to this section, and shown in Figure 5.6a and 5.6b. The major components of TSF cells are shown in Figure 5.22 and further detailed in Figure 5.23.

A cross-section of the proposed TSF wall is shown in Figure 5.22, detailing both the indicative construction sequence and the components of the wall design.

The proposed TSF cells introduce a small central decant pond (approximately 300 m x 300 m) within a flow-through rock filter wall (see Figure 5.22) to maximise operational control of the free liquor. The central decant facility also provides the opportunity to restrict access (e.g. netting or similar) to the free liquor and reduce fauna interaction with the TSF (see Chapter 15, Terrestrial Ecology). The flow-through wall also allows the decant pond to be maintained centrally over the TSF seepage control features, which are described below and illustrated in Figures 5.22 and 5.23.

- A 1.5 mm HDPE liner would extend over an area approximately 400 m x 400 m. The central pond would be positioned above this area, allowing an additional 100 m of liner outside of the decant pond.
- The design ensures that all water inputs can be contained within the TSF with no potential for overtopping. At any point in time, there is more than 4 m freeboard above the water level that would occur after the Probable Maximum Flood (PMF) event. The balance ponds would also be designed with sufficient freeboard to accommodate the PMF and ANCOLD (1999) guidelines without overtopping.
- Seepage control measures would be implemented during each cell start-up process to minimise the ponding of liquor on bare ground until such time as the tailings consolidated to form an effective liner or barrier. These seepage control measures would include constructing temporary divider walls to enable rapid covering of the TSF floor, and infrastructure to remove decant liquor from the edges of the temporary area to the lined central decant area, where it would be evaporated. These measures successfully limited seepage when the existing TSF cell 4 was commissioned.

Table 5.15 Proposed Olympic Dam TSF annual deposition rate compared to rates at other metallurgical facilities[1]

Mine	Company	Country/Australian state	Type of TSF facility	Contains radioactive material	Annual deposition rate (Mtpa)
Escondida	BHP Billiton Group (57.5%) Rio Tinto (30%) Mitsubishi (10%) IFC (2.5%)	Chile	Contained in a natural depression with a dam wall at one end	No	82
Olympic Dam – combined operations	BHP Billiton	South Australia	Paddock, centreline raise with central decant	Yes	69.6
Collahuasi	Xstrata	Chile	Contained in a natural depression with a dam wall at one end	No	41
Rössing	Rio Tinto	Namibia	Paddock, upstream raise	Yes	14
Ernest Henry	Xstrata	Queensland	'Turkeys nest' style with upstream mine rock walls	No	9.9
Olympic Dam – existing operation	BHP Billiton	South Australia	Paddock, upstream raise	Yes	9.8
Prominent Hill	OZ Minerals	South Australia	Integrated waste landform with central decant	No	7.9
Century Zinc	Zinifex	Queensland	Contained in valley with dam wall at one end	No	4.2
ERA Ranger	Rio Tinto	Northern Territory	Initially to paddock tailings cells, now returned to Pit 1 depression	Yes	2
Langer-Heinrich	Paladin Resources	Namibia	In-pit disposal	Yes	0.9
Narbalek	Queensland Minerals	Northern Territory	Tailings returned to old pit using sub-aqueous deposition	Yes	0.6
McClean Lake	Areva	Canada	In-pit disposal	Yes	0.2

[1] Sourced from Uranium Equities 2008.

Table 5.16 Indicative features of the proposed TSF

Features	Proposed expansion
Additional solids disposal rate (Mtpa)	58
Facility operating life (years)	40+
Number of TSF cells[1]	8 + 1
Design type	Paddock style with centreline raise using mine rock walls and central decants
Deposition solids concentration (%)	52–55
Maximum rate of rise for tailings (m/annum)	2
Dry density of stored tailings (t/m^3)	1.7
Final height (m)	65
Embankment slope angle (degrees)	25
Estimated height of starter embankment (average) (m)	10
Estimated TSF wall raise height (m)	10
Crest width of external walls (m)	10
Area of central decant pond (ha/cell)	9
Rate of acidic liquor return to the metallurgical plant at 72 Mtpa ore (ML/d)	24
Area of balance ponds (ha)	60
Depth of balance ponds (m)	10
Estimated final footprint – including contingency cell (ha)	4,400

[1] The indicative number of TSF cells required for the management of the tailings and acidic liquor is eight. However, an additional cell has been allowed as a contingency in the event of unforseen issues such as plant failures or extreme rainfall events.

5

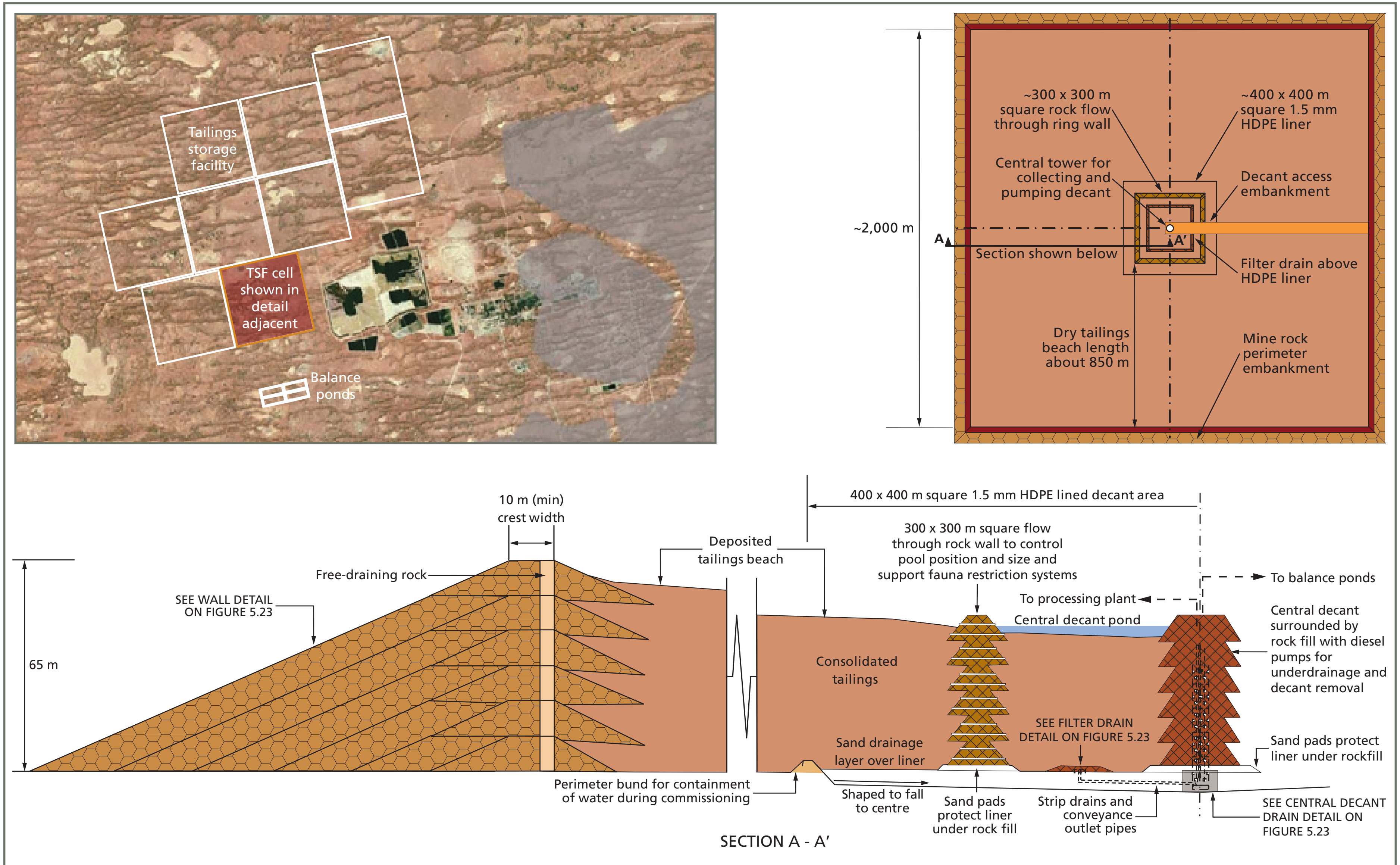
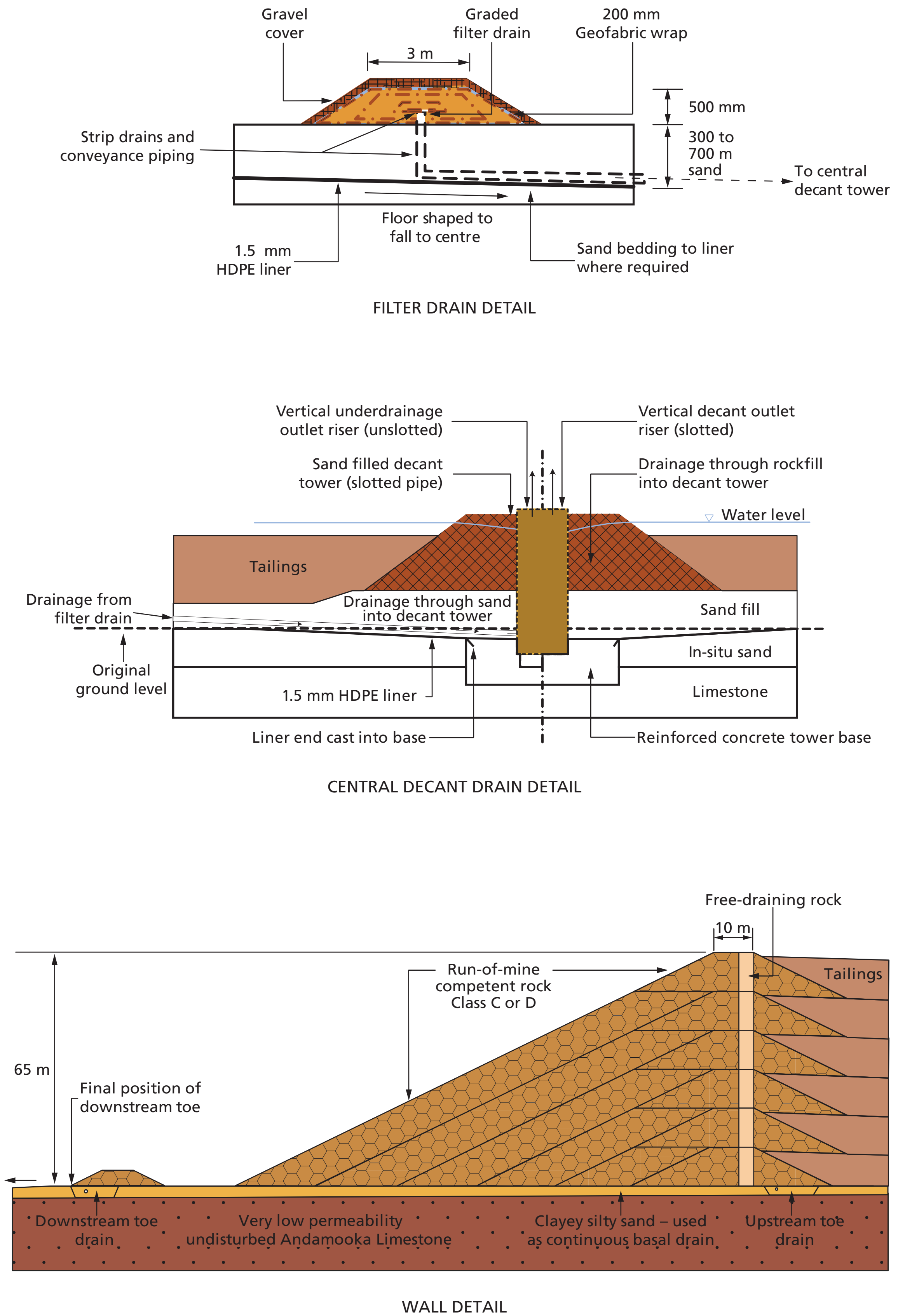


Figure 5.22 Plan view and cross-section of a cell within the proposed tailings storage facility



Detail locations are shown on Figure 5.22

Figure 5.23 Seepage control and design details for the proposed tailings storage facility at Year 40

- A layer of dune sand on top of the HDPE liner would form a base drain. The sand layer may eventually become clogged by fine tailings, but it would assist with consolidation of the fine tailings and provide an effective low permeability layer above the liner. The sand layer would also act as a protective cover to the liner.
- A filter drain would be installed above the liner to act as a permanent drain to recover liquor back to the decant ponds prior to transfer to the balance ponds (see below).

A number of balance ponds would be constructed, allowing liquor to be decanted from the TSF cells and either returned to the metallurgical process or directed to the tailings disposal circuit to be returned to the TSF. The balance ponds would be about 60 ha in total area, and would be covered to restrict fauna access and lined to minimise seepage.

Geotechnical stability

The stability of the proposed TSF (i.e. a centre raised rock fill design, with a slope angle of 25 degrees and assessed at a height of 40 m and 80 m) was assessed using methods described in the ANCOLD standards (ANCOLD 1999), taking into account the necessary safety factors for high pool (exceeding the minimum freeboard requirements), earthquake loading and normal operation. The factor of safety ratings of the proposed designs meets or exceeds the ANCOLD criteria as shown in Table 5.17.

Tailings geochemistry

The geochemistry and radiological properties of the new tailings are expected to be similar to the current tailings, with a pH on deposition of about 1.5 (see Table 5.18 to Table 5.21).

Further information regarding the geochemical properties of the tailings as they relate to seepage is described in Chapter 12, Groundwater.

Construction phase

During the initial development, three new TSF cells would be constructed, together with two balance ponds. The vegetation and sand dunes would be removed from the footprint of each TSF cell prior to construction. TSF walls would generally be built in 10 m lifts, with one cell taken off-line during wall raising, then recommissioned upon completion of the 10 m lift. It is expected that wall raising would take about one year to complete per cell. Initial TSF walls would be constructed to different heights to establish a sequence that would aid in scheduling subsequent cell decommissioning and wall raising activities. TSF cell walls would be constructed of class C or D mine rock (see Section 5.4.6 for details).

Subsequent development phases would involve the construction of an additional five or six TSF cells and two balance ponds. As previously discussed, the starting heights for these would be staggered.

Operation phase

During operation, tailings would be deposited to all but one of the TSF cells at any given time (the other being taken off-line to raise walls). Deposition would be via spigots mounted on the edge of the cells, as occurs with the existing TSF. The tailings would be deposited in thin layers up to a maximum of 2 m in depth per annum when fully dried.

Liquor that does not evaporate on the beaches (the decant liquor) would flow through the central flow-through rock wall into the decant pond, and be directed for further treatment by one of two alternative methods:

- to the covered TSF balance ponds, then recycled to the metallurgical plant for use as dilution liquor following flotation tailings thickening within the new concentrator plant
- recirculated, via the tailings disposal circuit, to the TSF cells to obtain additional evaporation on the TSF beach areas.

The treatment path would be determined by the volume of decant liquor available and by the demand for acidic liquor in the metallurgical plant.

5.5.7 INTEGRATION WITH THE EXISTING PROCESSING FACILITIES

The interaction of the new metallurgical plant and the existing metallurgical plant has previously been discussed throughout Section 5.5, and is summarised below:

- the existing concentrate leach circuit would be expanded
- the existing smelter and associated infrastructure would be expanded
- the existing electrorefining tank house would be expanded
- the existing precious metals recovery plant would be optimised
- a new acid plant would be added to the existing smelter
- pipelines would be installed to transport copper concentrate from the new concentrator plant to the expanded concentrate leach facility

Table 5.17 Factor of safety for the proposed TSF compared to ANCOLD criteria

Loading condition	Factor of safety	
	ANCOLD criteria	Proposed TSF
Normal operation	1.5	1.53
Steady state seepage (high pool)	1.3	1.31
Earthquake	1.1	1.20

Table 5.18 Chemical constituents of existing tailings solids

Constituent	Concentration
Aluminium	4.34%
Arsenic	30–150 ppm
Barium	0.6%
Calcium	1.5%
Copper	0.08%
Fluorine	1.0%
Iron	29.6%
Lead	40–120 ppm
Magnesium	0.22%
Manganese	80–170 ppm
Potassium	2.6%
Sodium	0.21%
Uranium	65–274 ppm

Table 5.19 Chemical properties of existing tailings liquor

Constituent	Concentration (mg/L)
Aluminium	9,100
Calcium	1,000
Chloride	5,500
Copper	2,000
Cyanide	Not detectable
Fluoride	2,000–5,000
Iron	40,000
Lead	6
Magnesium	500–5,000
Potassium	350–6,000
Silica	2,000
Sodium	5,000–24,000
Sulphate	135,000
Sulphuric acid	11,900
Thorium	17
Uranium oxide	130
Free acidity	8,000–15,000

Table 5.20 Radiological properties of existing tailings solids

Radionuclide	Activity (Bq/g)
Lead-210	5.3
Polonium-210	6.4
Radium-226	5.8
Thorium-230	4.5
Uranium-238	1.3

Table 5.21 Radiological properties of existing tailings liquor

Radionuclide	Activity (Bq/L)
Lead-210	150–250
Polonium-210	30–100
Radium-226	3–10
Thorium-230	1,200–2,400
Uranium-238	250–1,200

- a tailings pipeline would be installed to transport tailings from the existing metallurgical plant to a new tailings disposal facility within the new metallurgical plant.

The other major interaction relates to the import and export of materials and products to and from the operation. A new rail terminal would be constructed to import the reagents necessary to process the ore, and export the refined metal products, uranium oxide and concentrate. Reagents would generally be delivered by rail then distributed between the proposed and existing metallurgical plants by either loaders or trucks. Suitable road access to deliver bulk goods to the existing metallurgical plant would need to be provided. Until the rail line is constructed, reagents would continue to be imported by truck as per the existing operation.

5.6 ON-SITE INDUSTRIAL AND GENERAL WASTE MANAGEMENT

5.6.1 OVERVIEW

The management of industrial waste generated on-site from the mining and processing operations would largely follow the existing site practices, controlled through the site EM Program (see Chapter 2, Existing Operation, and Chapter 24, Environmental Management Framework, for further information). A new waste management facility complying with relevant legislation would be constructed, incorporating a new waste transfer station, a new landfill site and new areas for storing materials that are to be reused or recycled (see Figure 5.8 for location of proposed landfill zone). Off-site wastes are discussed further in Section 5.10.2.

5.6.2 GENERAL WASTES

The volumes of industrial and general wastes arising from the expanded operation are summarised in Table 5.22 and illustrated in Figure 5.24. Tyres, sewage, hazardous and low level radioactive wastes are discussed in greater detail in the following sections.

New waste management facility

An area of around 560,000 m^2 has been assigned for the future development of the waste management facility (see Figure 5.8). This would be suitable for around 60 years of operational life at the predicted waste generation rates, and assuming a 15 m maximum landfill height plus 10% additional height for a landfill cover (equating to an available volume of around 7.5 million m^3). The new waste management facility would consist of:

- a transfer station (this may continue to be the existing transfer station)
- a recyclable materials store located near the rail head
- a general waste landfill facility for industrial wastes with a small content of putrescibles (2.5% during the construction phase and 0.5% during the operation phase). Cover to the landfill would be provided on a daily basis with construction of the waste cells in accordance with EPA guidelines.

Table 5.22 Indicative annual general waste generation rates (excluding tyres, sewage, hazardous and low-level radioactive wastes)

Waste type	Expanded operation (construction phase)		Expanded operation (ongoing operation)		Indicative management practices
	Volume (m^3)	Mass (t)	Volume (m^3)	Mass (t)	
Plastic	61,000	3,000	38,000	2,000	Bulk containers and HDPE pipe would be reused and/or recycled. Miscellaneous plastic may be sorted and recycled, subject to market availability and transport cost, otherwise would be directed to landfill
Wood	16,000	3,000	10,000	1,700	Pallets would be reused where possible, with other timber wastes stockpiled and chipped for use as mulch
Paper/cardboard	29,500	1,500	18,000	900	The existing paper and cardboard recycling schemes would be expanded to increase the volume of paper and cardboard recycled
Steel	70,500	9,500	44,000	5,700	The current practice of recycling all ferrous metals would continue, subject to the materials meeting the surface radiation limit for off-site transport. Should material not meet these limits, it would remain on-site until such time as the limits were met
Aluminium	1,200	200	700	100	The current practice of recycling all non-ferrous metals would continue, subject to the materials meeting the surface radiation limit for off-site transport. Should material not meet these limits, it would remain on-site until such time as the limits were met
Putrescibles	1,200	500	700	300	Would be disposed of to the on-site landfill
Filters	1,500	200	1000	100	Air filters would continue to be cleaned and reused (up to five times) before being disposed of to landfill. Oil filters would be drained of oil and the metal casing recycled
Inert materials	10,000	200	6,000	100	Clean fill and concrete would be preferentially used as a construction material (e.g. road base) where possible, or stockpiled within the waste management centre or disposed of to landfill
Rubber	3,500	700	2,200	500	The current practice of reusing conveyor belt for fencing and sandhill stabilisation would continue. It may be possible to treat the surplus rubber as part of the tyre recycling scheme
Total	**194,400**	**18,800**	**120,600**	**11,400**	

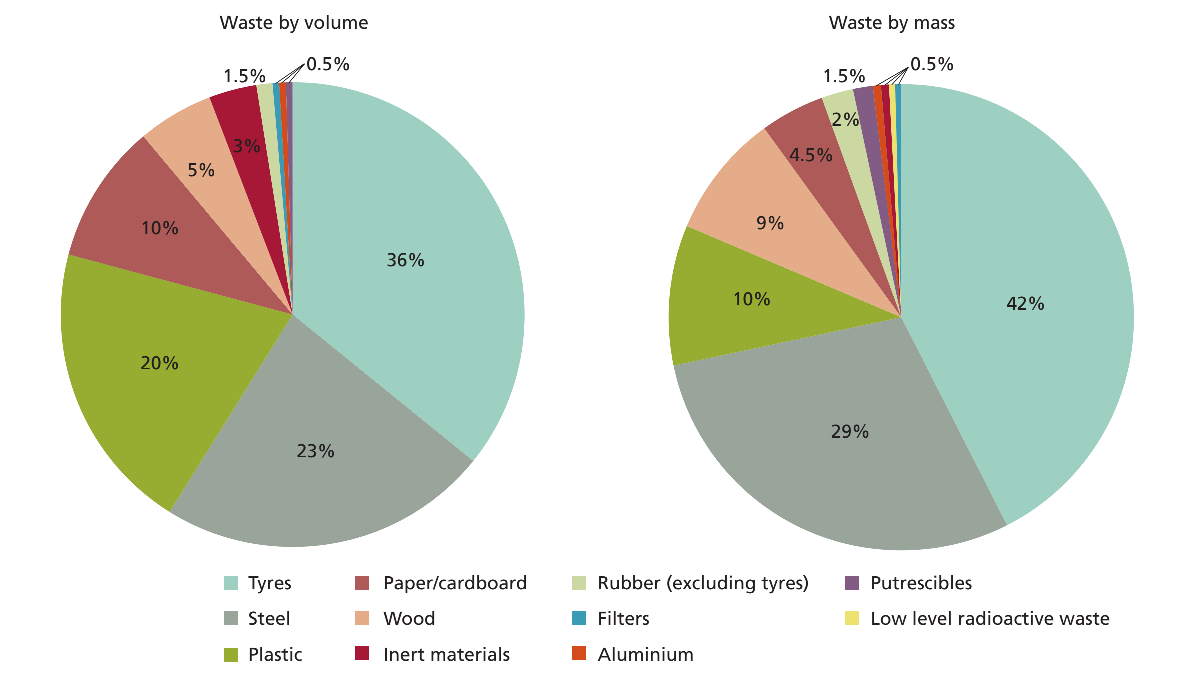


Figure 5.24 Predicted waste generation by type

5.6.3 TYRES

The most significant change to the volumes of waste generated from the proposed expansion would be the considerable increase in rubber tyres, from the existing rate of around 25 tpa to about 8,090 tpa. This is associated principally with the tyres used on haul trucks required for the open pit operation (see Table 5.23).

Several options for managing used tyres are currently being investigated. The hierarchy of preferred practice adopted for the expanded operation is to:

- reduce the volumes of tyres requiring management by implementing programs to increase the life of tyres
- retread or repair, where possible
- use waste tyres for industrial purposes such as berms, road demarcation and fencing
- treat waste tyres using energy recovery technologies such as incineration, co-combustion, tyre-derived fuel, pyrolysis, gasification, shredding and granulation
- disposal in RSF in a documented location.

While the disposal of waste tyres in the RSF is accepted practice within the mining industry, if not properly managed it may lead to stability issues in the RSF if the tyres are stacked too high, metal leaching if the tyres are shredded before disposal, or it may create a potential fire hazard if the tyres are not covered with inert material. Investigations facilitated by BHP Billiton into the recycling of tyres, including a trial for recycling a haul truck tyre, are showing promising results with the tyre steel being successfully separated and the production of rebonded rubber that has physical characteristics practically identical to the vulcanised rubber that made up the original tyre.

In the event that the investigations do not provide a recycling solution for the volume of Olympic Dam used tyres, and disposal in the RSF is required, appropriate management practices to mitigate the above-mentioned risks would be applied.

5.6.4 SEWAGE MANAGEMENT

The sewage treatment plant handles the collection and pumping of raw sewage, treatment of raw sewage and the disposal of effluent from the treatment plant. The proposed sewage treatment plant, to provide for 2,500 people, would be a proprietary packaged plant located to the north of the concentrator. Class B treated water is expected to be produced in accordance with water recycling guidelines, and would be recycled into appropriate process uses.

5.6.5 LOW-LEVEL RADIOACTIVE WASTE (INCLUDING LABORATORY WASTE)

Low-level radioactive waste would continue to be produced at the expanded operation. This waste would generally comprise laboratory waste (about 8 m^3 per annum) and used personnal protective equipment from workers within the uranium packing compound (about 40 m^3 per annum).

Low-level radioactive waste is currently disposed of in the TSF and this practice would continue for the expanded operation. Disposal of low-level radioactive waste during the operation of the expanded facility would be consistent with relevant codes and legislation, including the provisions of the Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing 2005. Chapter 22, Health and Safety, provides further information on the management of radiation at Olympic Dam.

5.6.6 HAZARDOUS WASTES

The existing metallurgical process produces some hazardous materials, and these would continue to be produced for the expanded metallurgical plant. In general, any hazardous materials produced would be recycled wherever possible, as occurs with the existing operation. The hazardous wastes that would be recycled are:

- Slag, which would be forwarded to a slag re-milling circuit within the metallurgical plant where it would be ground to a fine slurry before passing through a flotation circuit and either passing through the hydrometallurgical plant to be deposited to the TSF, or through the feed preparation plant where it would be blended with other copper concentrates and fed into the smelter.
- Smelter acidic effluent, which would be directed to the hydrometallurgical plant (where the acid would supplement the leaching process), or to the TSF.
- Waste hydrocarbons, which would be collected in a dedicated area of the waste management centre. The waste oils could be used in explosives produced on-site, or could be either used directly in the smelter furnaces, following the implementation of suitable modifications to furnace burners, or be transferred to Adelaide to be converted into fuel oils for use in the existing unmodified furnaces. Should the on-site furnaces be converted to natural gas, the oil or converted fuel oils could be used within other furnaces and kilns in South Australia.

Table 5.23 Indicative tyre generation rates for the proposed expansion

Type of tyre	Tyres per annum	Tonnes per tyre type	Tonnes per annum
Haul trucks – large	1,300	5.3	6,890
Haul trucks – medium/small	200	2.8	560
Ancillary heavy equipment	320	1.5	480
Light vehicles	1,600	0.1	160
Rounded total	**3,420**	**–**	**8,090**

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- Paints, thinners and solvents, of which about 30,000 litres per annum would be expected to be generated. These are currently recycled where possible, or transported to Adelaide for disposal in a registered landfill. Future solvent waste could be used as a heat source for on-site furnaces, or may continue to be disposed of in a registered landfill.

Hazardous wastes for which there is no favourable recycling option would be collected and disposed of in accordance with applicable regulations and legislation.

Acid plant catalyst, used within the acid plant gas converters, is one such waste. These typically contain about 6–9% vanadium pentoxide, and the expanded operation would have an installed capacity of around 4.1 ML of catalyst. Routine maintenance is undertaken to screen the fine catalyst material from the gas converter beds, with the first bed being screened every three years, the second bed every six years and the third and fourth beds every nine to twelve years. On average, such screening is expected to generate around 225,000 litres of catalyst fines every three years, which would initially be transferred to lined steel drums and stockpiled prior to disposal or recycling. Options for recycling catalyst fines (to either the supplier or a vanadium refining operation) will continue to be investigated up until the fines are generated. Historically, however, recycling has not proved to be viable in Australia. If a suitable recycling option is not found, the catalyst fines would be disposed of in trenches excavated into the TSF and their location documented.

5.7 WATER SUPPLY

5.7.1 OVERVIEW

The demand for water of various qualities would increase during construction and operation of the proposed expansion. The most significant areas of increased demand are associated with the need for low-quality water for dust suppression within the new open pit mine, increased process and demineralised water use associated with the new metallurgical plant, and increased potable water demand required from the expansion of Roxby Downs and the operation of Hiltaba Village.

The construction of infrastructure associated with the proposed expansion would also require water, specifically for use in compaction activities, concrete manufacture, dust suppression and hydro-testing of the water supply and gas supply pipelines.

Saline water would be used where practicable to reduce the volume of process and potable water required.

Water for the proposed expansion would be obtained from a number of sources, depending on the quality of water required and where the water would be used. During construction of off-site infrastructure such as the rail line and the water and gas supply pipelines, low-quality water would be sourced from existing or new groundwater wells along the infrastructure corridors. Higher-quality water, for use in construction camps or for hydro-testing pipelines, would be sourced from either the existing on-site desalination plant, the proposed new coastal desalination plant or from the existing state water supply network, depending on timing and where the water would be used. The demand for on-site construction water would be met through a combination of process or potable water from the existing GAB supply source if high-quality water is desired, or from wellfields should low-quality water be required.

The demand for operational water would be met through the construction and operation of a coastal desalination plant located at Point Lowly (see Figure 5.4) and an associated water supply pipeline (see Figure 5.4) combined with abstraction from a number of saline aquifers in the SML and the broader Stuart Shelf (see Figure 5.25). The desalination plant would produce potable quality water, which would either be used on-site as is, or desalinated on-site to produce demineralised water. Water required for dust suppression during the operation of the open pit mine would be sourced from a combination of saline water extracted from the mine depressurisation activities or from saline wellfields.

The existing underground mine and metallurgical plant would continue to source process, potable and demineralised water from the GAB, via the on-site desalination plant.

5.7.2 SUMMARY OF WATER DEMAND

A summary of the water demand and supply source for the construction and operation of the proposed expansion is presented in Tables 5.24 to 5.27. Demand fluctuates with seasonal and operational variations (e.g. maintenance shutdowns) and, as a consequence, the volumes presented may vary in any given year.

Table 5.24 Indicative water source and demand during construction (Olympic Dam site development)

Source	Demand (ML/d)	Description
Potable		
Great Artesian Basin (GAB) and local saline wellfields	up to 7	The current demand from the existing GAB Wellfields A and B averages 37 ML/d. The current licence limit is based on drawdown, extrapolated to an extraction rate of about 42 ML/d. Further extraction from Wellfield B, under South Australian Government approvals, would be used to supply potable water during the construction phase, with any additional needs being met through on-site desalination of water extracted from local saline wellfields
Saline		
Mine depressurisation and saline aquifer extraction	25	This water would be obtained from depressurising the open pit (about 20%) and extraction from production wells associated with the fractured rock aquifers in the vicinity of the mine area (about 80%)

Table 5.25 Indicative water source and demand during construction (off-site infrastructure development)

Infrastructure development	Approximate total demand (ML)	Source and description
Water supply pipeline	485–590	This is required for hydrostatic testing of the pipeline (about 85–90 ML), first flush testing (about 400–500 ML), and small volumes used for dust suppression and concrete manufacture. The water for hydrostatic testing and concrete would be supplied either through water generated during commissioning of the Point Lowly desalination plant, through the existing on-site desalination plant, through the state potable water supply network, or a combination of these. Water used for dust suppression would be sourced from saline aquifers
Desalination plant	100	This is required for earthworks, dust suppression and concrete manufacture. With the exception of concrete manufacture, water would be sourced from saline aquifers. Water for concrete manufacture would come from either the existing on-site desalination plant or the state potable water supply network
Transmission line	50	
Gas supply pipeline	20	
Rail line	500	
Pimba intermodal facility	20	
Roadworks	200	
Port – Darwin	20	
Port – Outer Harbor	20	
Port – Landing facility	5	
Airport	20	
Roxby Downs	200	
Hiltaba Village	300	
Total	**1,940–2,045**	

Table 5.26 Indicative water demand and source during operation of the combined operation

Area of demand	Average daily demand (ML)	Source and description
Existing metallurgical plant	36	GAB wellfield
Existing underground mine	1	GAB wellfield
New metallurgical plant	151	Water would be sourced from the proposed coastal desalination plant and used directly within the plant. Further treatment of some water would be undertaken at the on-site desalination plant to meet the new metallurgical plant demineralised water demand
Open pit mine and associated facilities	7	
Roxby Downs residential growth	5	Potable water for the expanded operation would be sourced from the proposed coastal desalination plant and piped directly to the townships for distribution. Off-site infrastructure operational water demand, including the water needs for the airport, pumping stations, transmission lines, gas pipeline and the landing facility, would be expected to total less than 1 ML/d
Hiltaba Village	2	
Regional users including Andamooka	1	
Dust suppression and other engineering needs	25	Sourced from the coastal desalination plant. Alternatively, saline water would be used, originating from either the open pit mine depressurisation wells, or from saline wellfields within the Stuart Shelf groundwater system
Total	**228**	

Table 5.27 Indicative water supply during operation of the combined operation

Supply	Average daily demand (ML)
Existing GAB Wellfields A and B	42
Coastal desalination plant	186[1]
Total	**228**

[1] 25 ML/d may be sourced from saline groundwater and mine depressurisation.

5.7.3 PROPOSED EXPANSION WATER BALANCE

An indicative water balance for the proposed expansion, following the final development phase, has been developed, and is illustrated in Figure 5.26.

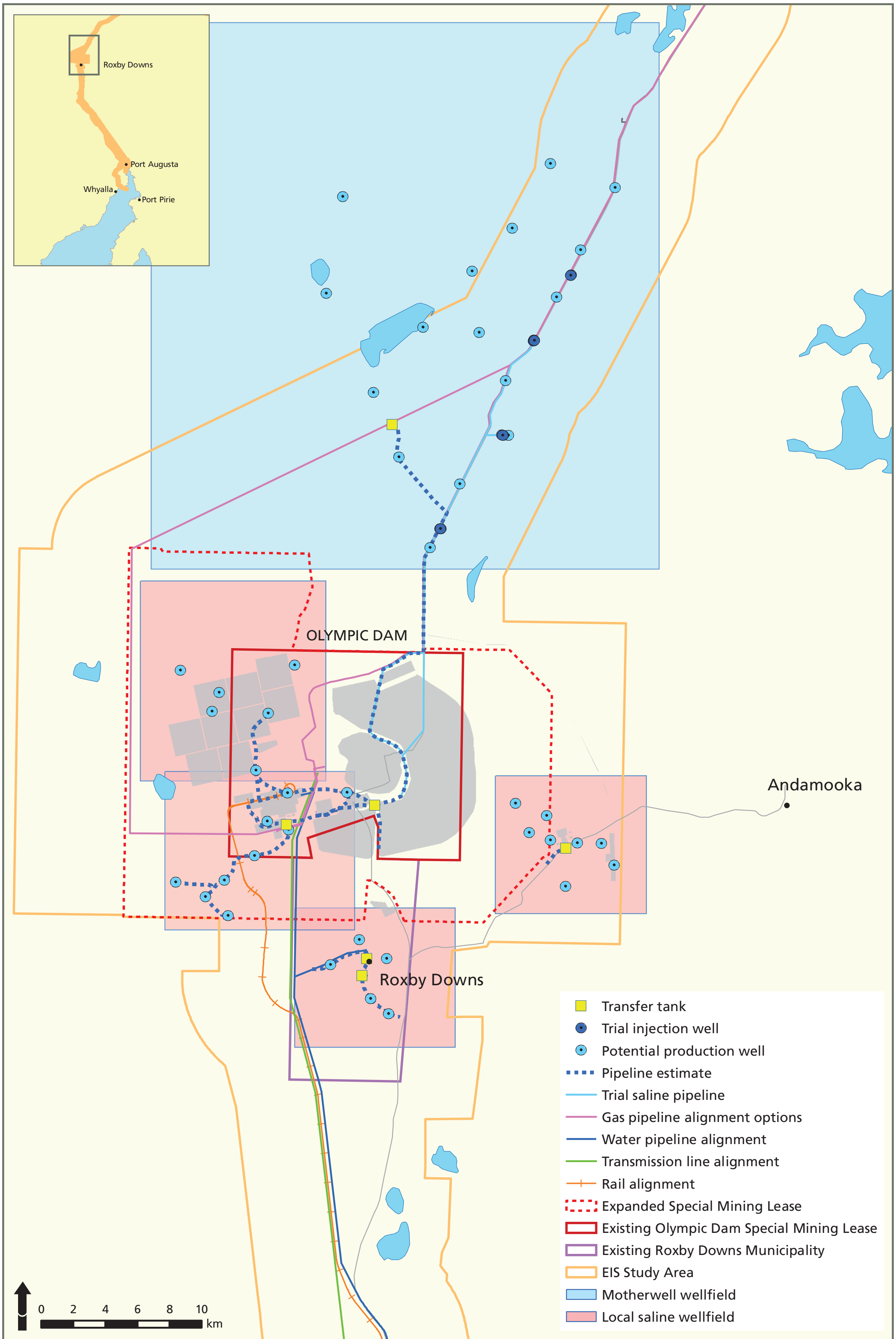
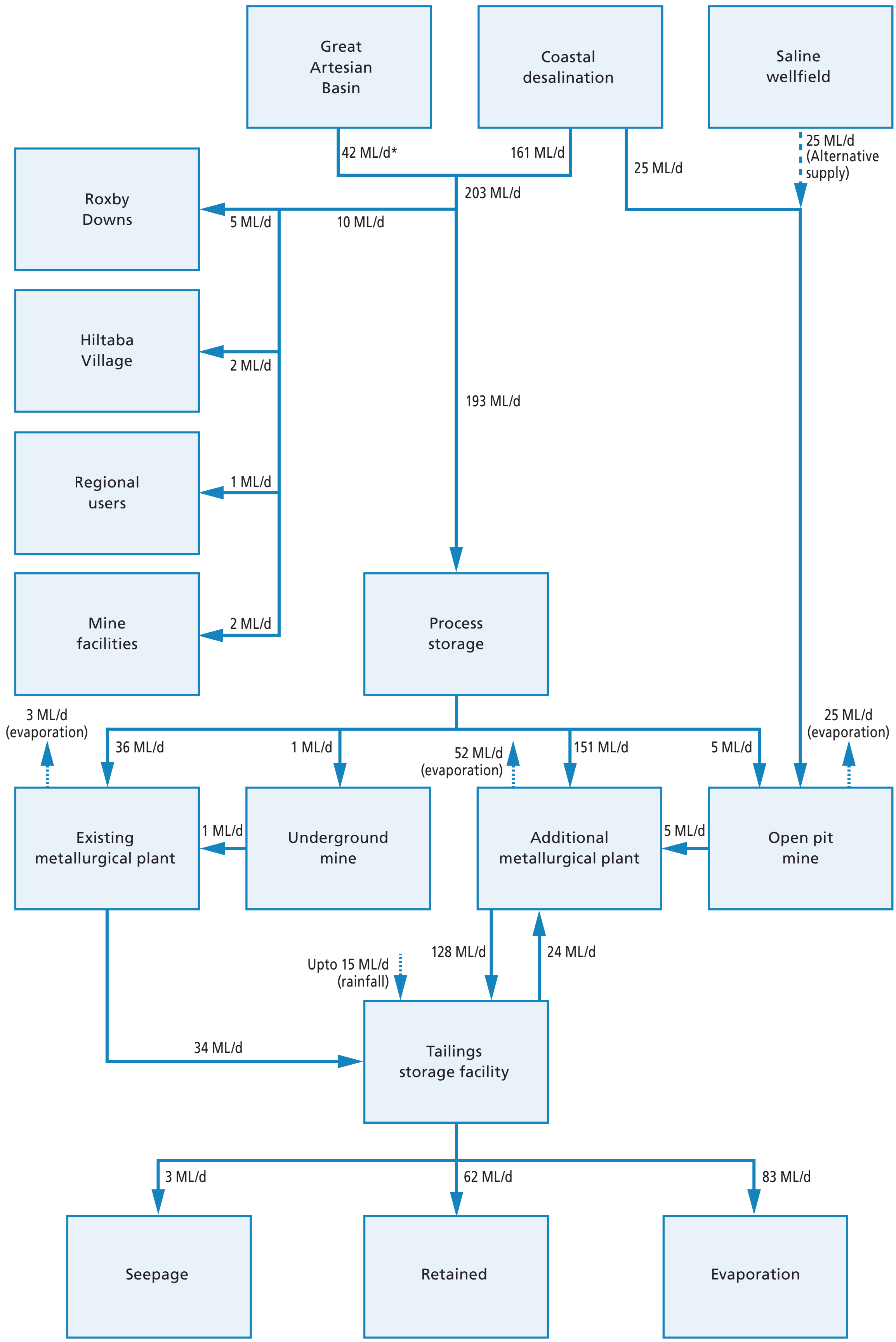


Figure 5.25 Indicative locations of local and regional saline wells



* Subject to drawdown limit approvals

Figure 5.26 Indicative water balance for the combined operation

5.7.4 DESALINATION PLANT

Overview

A coastal desalination plant would be constructed to supply potable water to the new open pit mine, metallurgical plant and associated infrastructure. The proposed plant would use reverse osmosis to produce water from seawater extracted from the Spencer Gulf. Seawater would be pumped through fine membranes to produce low-salinity product water and high-salinity return water. The return water would be a combination of brine (which is about twice as salty as seawater) and small quantities of anti-scalant chemical used to prevent scale accumulating on the membranes of the plant (see Chapter 16, Marine Environment, for further discussions regarding the potential environmental impacts associated with the discharge of return water into the gulf). A conceptual layout of the proposed coastal desalination plant is provided in Figure 5.27.

The proposed desalination plant would be constructed in modules to allow a ramp-up in potable water production to meet the increased demand of the proposed expansion as it develops to 60 Mtpa of ore mined. Indicative features of the plant are provided in Table 5.28.

The construction and operation of the desalination plant would create additional demand for electricity, water and labour (see Table 5.29).

South Australian Government water supply

The development of a desalination plant at Point Lowly would provide an opportunity for the South Australian Government to deliver a new water supply to the Upper Spencer Gulf and the Eyre Peninsula areas, replacing about 80 ML/d of water currently pumped from the River Murray. Water produced for the government's needs would meet the Australian Drinking Water Quality Guidelines 2004. This would require additional water treatment modules within the proposed desalination plant, with the desalinated water passing through additional reverse osmosis membranes to achieve the required water quality standard.

The assessment of the potential impacts of constructing and operating the desalination plant on the marine environment has been based on the total desalination plant throughput (i.e. BHP Billiton's peak requirement plus the government's peak requirement, see Table 5.30). The potential impacts of constructing the government-managed water supply pipeline to the existing state potable water network were also assessed. Some additional infrastructure such as pump stations and water storages may also be required to supplement the existing government water supply network. An assessment of this additional infrastructure has been undertaken and is presented for completeness in Appendix F3. However, approval for these ancillary facilities is not sought in the Draft EIS.

Table 5.28 Indicative features of the proposed desalination plant

Features	Proposed expansion
Method	Reverse osmosis
Distance off-shore for intake pipe (m)	>250
Diameter of the intake pipe (m)	3.0
Volume of seawater intake (ML/d)	650[1]
Salinity of seawater intake (nominal – g/L)	38–42
Peak volume of potable water produced for the proposed expansion (ML/d)	200[1]
Peak volume of potable water produced to replace River Murray supply (ML/d)	80[1]
Distance off-shore for outfall pipe (m)	>600
Diameter of outfall pipe (m)	2.1
Length of the return water dispersion structure (m)	200
Volume of return water (ML/d)	370[1]
Salinity of return water (g/L)	78

[1] The data includes South Australian Government requirements and represents peak daily demand.

Table 5.29 Indicative major demands for the proposed desalination plant

Expansion requirement	Proposed expansion
Water demand during construction (ML)	100
Electricity consumption during operation (MWh per annum)	245,000
Percentage of electricity consumption to be met from renewable sources (%)	100
Peak construction/shutdown workforce	400
Ongoing operational workforce	30
Total land disturbance (ha)	29 + 12[1]

[1] 12 ha is allocated for a temporary construction laydown area. This would be rehabilitated as necessary following completion of construction works.

Figure 5.27 Conceptual layout of the proposed coastal desalination plant

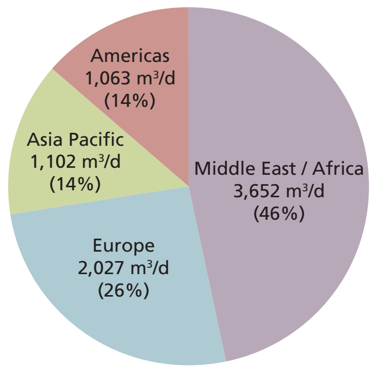
Table 5.30 Combined coastal desalination plant volumes

Supply	Average daily demand (ML)	Design capacity (ML/d)
Olympic Dam desalination plant	186	200
SA Government desalination plant	65	80
Total	**251**	**280**

Context

Water bodies such as Lake Eyre South and Lake Torrens are within 200 km of Olympic Dam, but these are salt lakes that rarely fill and only after heavy and prolonged rainfall. Olympic Dam receives on average about 167 mm of rainfall per annum and has a pan evaporation rate of approximately 3,000 mm per annum.

The preferred option to supply fresh water for the proposed expansion is a reverse osmosis desalination plant, located at Point Lowly near Whyalla, about 320 km from Olympic Dam. There were about 4,600 desalination plants operating worldwide in 1985 (Al-Mutaz 1991), more than 7,500 in 1993 (California Coastal Commission 1993) and about 12,300 desalination plants in 147 countries in 2006 (Global Water Intelligence 2006). Of the 12,300 desalination plants, about 1,460 are coastal desalination plants using reverse osmosis technology and they are installed in around 96 countries, divided into regions as shown in Figure 5.28. In comparison, Australia currently produces relatively little desalinated water (around one per cent of the world's capacity); however, a number of large-scale desalination plants are proposed or under construction (see Figure 5.29).



Source: Global Water Intelligence 2008

Figure 5.28 Seawater reverse osmosis desalination capacity by region

Figure 5.29 Australian desalination plants

Examples of reverse osmosis desalination plants of comparable size are listed in Table 5.31.

Design

The major design features of the proposed desalination plant are listed in Table 5.29. Figures 5.30 and 5.31 provide conceptual drawings of the proposed plant design and the locations of the associated intake and outfall pipes. The major design features and a summary of the proposed desalination process are discussed in the following sections and shown in Figure 5.32.

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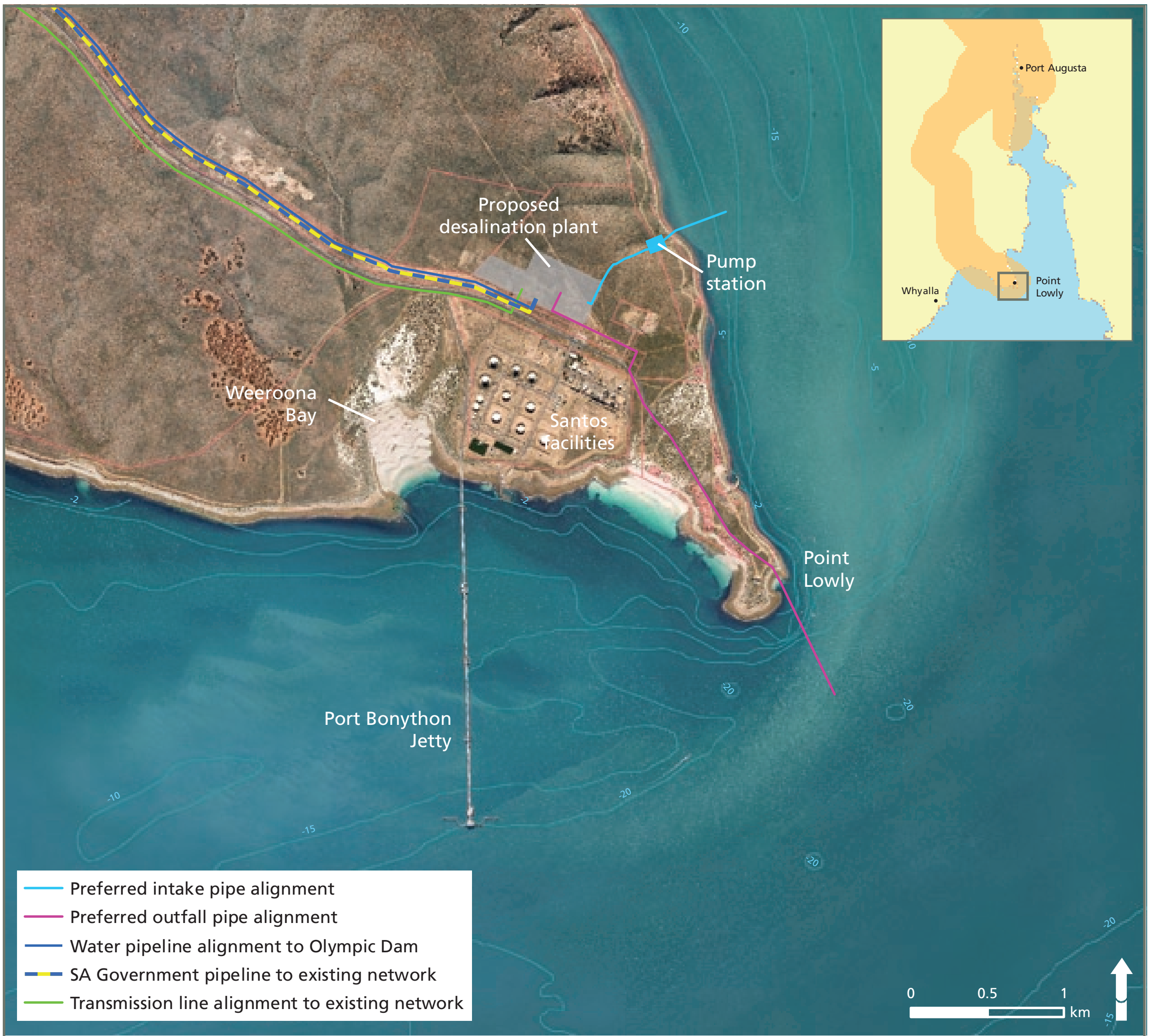
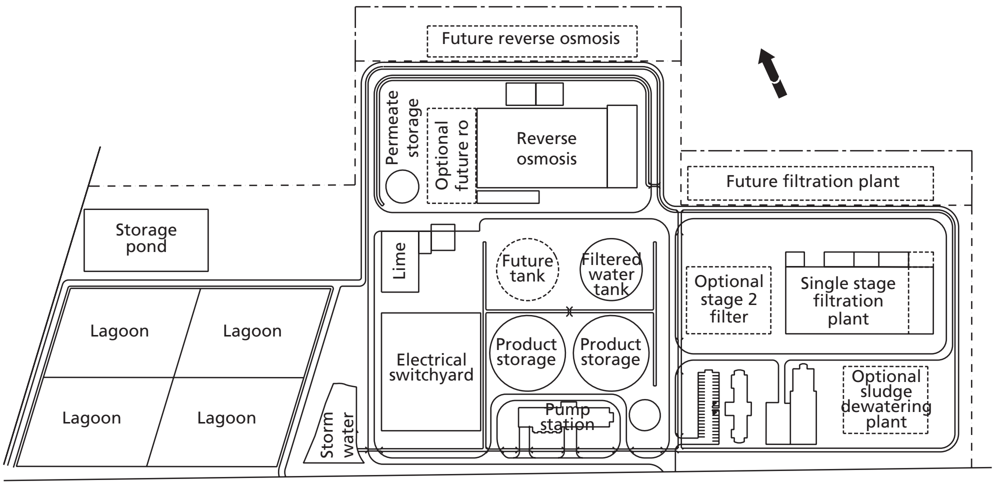
Table 5.31 Examples of reverse osmosis desalination plants[1]

Name	Country/State	Potable water produced (ML/d)	Stage of development
Mactaa	Algeria	500	Proposed
Wonthaggi (Melbourne)	Victoria	411	Under construction (completion expected 2010)
Hamriyah	United Arab Emirates	364	Proposed
Istanbul	Turkey	300–350	Proposed
Ashkelon	Israel	330	Operational (2005)
Point Lowly	South Australia	280 (includes 80 for SA Government)	Proposed
Ashdod, Soreq, Hadera	Israel	274 each	Under construction (completion expected 2012)
San Francisco Bay	United States of America	270	Proposed
Sydney	New South Wales	250 (expandable to 500)	Under construction (completion expected 2009)
Port Qasim	Pakistan	227	Proposed
Taweelah	United Arab Emirates	225	Under construction (completion date unknown)
Jeddah	Saudi Arabia	225 (expanding to 465)	Operational (1984), expansion proposed
Ténès	Algeria	200	Proposed
El Hamma	Algeria	200	Operational (2005)
Rabigh	Saudi Arabia	200	Under construction (completion date unknown)
Brisbane River (Brisbane)	Queensland	200	Proposed
Calsbad, Huntington Beach, San Onofre (California)	United States of America	190 each	Proposed
Jebel Ali N	United Arab Emirates	182	Operational (unknown)
Qidfa	United Arab Emirates	170	Operational (2004)
Lima	Peru	2 x 150	Proposed
Sino Iron Project (Pilbara)	Western Australia	140	Under construction (completion expected 2009)
Binningup (Perth)	Western Australia	140	Under construction (completion expected 2011)
Port Stanvac (Adelaide)	South Australia	140	Proposed
Tuas	Singapore	136	Operational (2005)
Shuwaikh	Kuwait	136	Proposed
Kwinana (Perth)	Western Australia	130–143.7	Operational (2006)
Tugun (Gold Coast)	Queensland	125	Under construction (completion expected 2009)
Tampa Bay	United States of America	95 (proposed expansion to 132)	Operational (2003)
Escondida	Chile	45	Operational
Olympic Dam – current	South Australia	14	Operational (1988)
Penneshaw	South Australia	0.3	Operational (1999)

[1] Sourced from Global Water Intelligence, 2008.





Indicative layout

Figure 5.30 Indicative configuration and infrastructure alignments for the proposed desalination plant

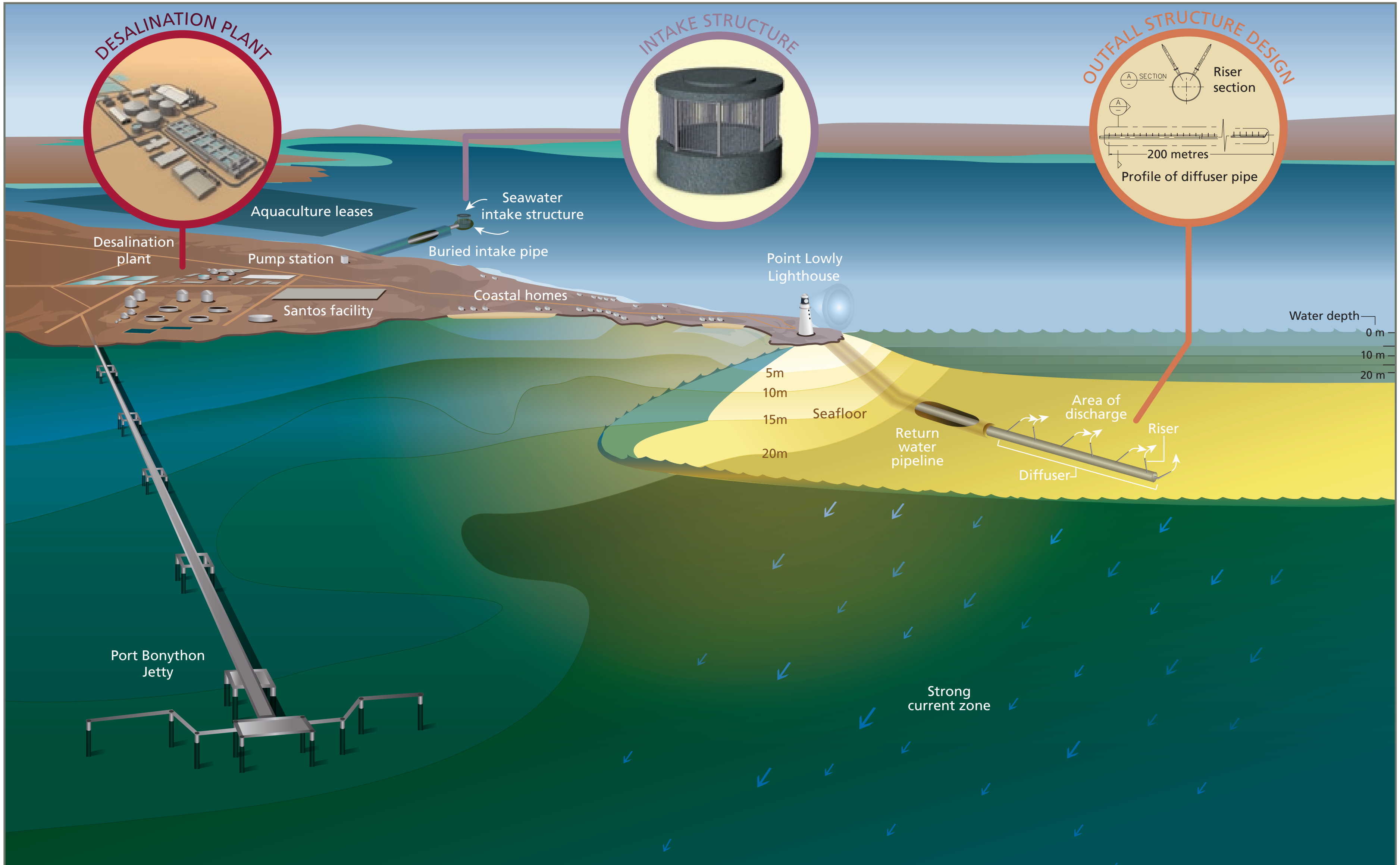


Figure 5.31 Conceptual layout of the proposed desalination plant and intake/outfall infrastructure at Point Lowly

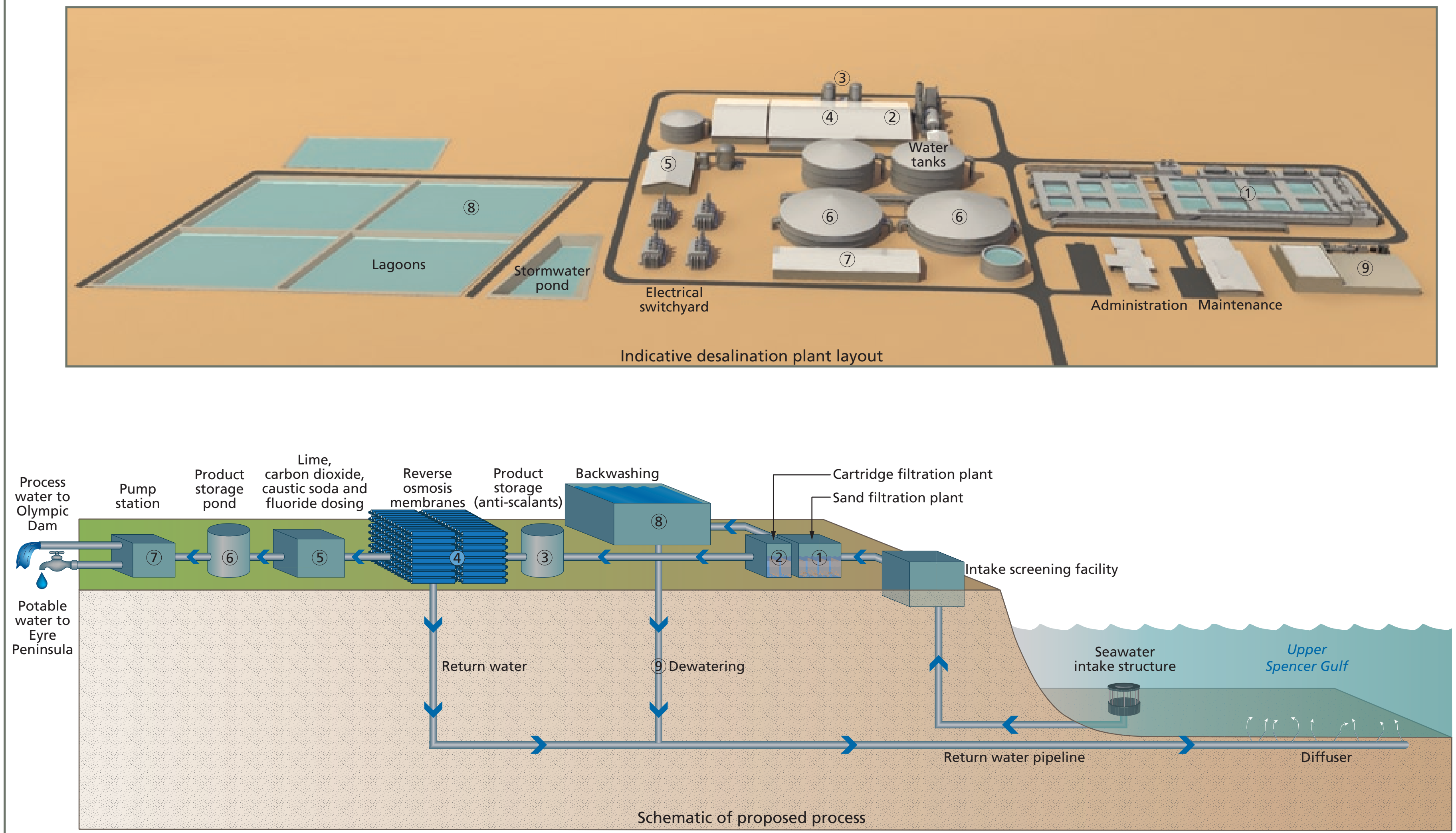


Figure 5.32 Proposed desalination process

Intake sump and pipe

A reinforced concrete sump of about 15 m x 15 m would be constructed near the shore to a depth of about 10 m so that intake seawater can gravitate to the sump. A contingency of around 0.9 m was added to the wave elevation calculations, fundamental to the seawater intake design, to account for potential sea level rise associated with climate change. A small, enclosed building would be constructed over the sump and seawater would be pumped in a buried water pipeline to the desalination plant. The sump would include secondary intake screening, flow stabilisers and either a submersible pumping well or a dry pumping well. Chlorine dosing systems (to inhibit fouling of the intake pipe) would be placed as close to the intake as possible. These systems would be installed at the same time as the intake structure. Chlorine dosing would occur intermittently to prevent marine growths and the residual chlorine would be removed by chemical scavenging using sodium metabisulphite or neutralisation before the seawater is desalinated.

The end of the intake pipe would be fitted with a bar screen and intake structure (see Figure 5.31). The intake structure would be designed to limit flow velocities to about 0.2 m/s.

The inflow rate from the structure would average about 560 ML/d, with 650 ML/d at peak demand. The average salinity of the intake water is expected to be between 38–42 g/L (seasonally dependent).

Desalination plant

Seawater dosed with acid, coagulant and/or a polymer would be directed through mixing tanks and a deep-bed sand filter, which operate just like a domestic pool filter. Fine particles would be captured in the filter and removed during periodic backwashing, which would occur once per day. Solids from the backwash water would be removed and disposed of on land.

Product from the media filters would be directed to cartridge filters. The filters contain disposable cylindrical elements, not unlike those used in household water filters. Anti-scalants (phosphates, organophosphonates or polymers) are then added to control the scaling potential of the water and these are discharged to Upper Spencer Gulf with the concentrated seawater (collectively termed return water).

High-pressure feed pumps are used to create a sufficiently high water pressure to drive the reverse osmosis process. Seawater would be pumped to a number of membrane elements, with around 45% of the water passing through the membrane to produce low-salinity product water. The remaining water, and the salt rejected by the membranes, forms a concentrate stream with a salinity of around double that of the seawater.

Low-salinity (about 300 mg/L salt) product water would be dosed with lime, carbon dioxide, caustic soda, chlorine and possibly fluoride, and held in storage ready to be pumped to Olympic Dam. The return water would be discharged via a diffuser into Upper Spencer Gulf.

Outfall pipe

The outfall pipe would be a 2.1 m diameter glass-reinforced plastic pipe with the end of the pipe in at least 20 m of water. A series of risers (about 50) would be constructed in the last 200 m of the outfall pipe to enable the return water to be discharged under pressure (called a diffuser).

The diffuser would be located on the seafloor, orientated at right angles to the prevailing current direction. After initially rising 2–5 m above the diffuser ports, the return water would be entrained by the prevailing currents and, being denser than the ambient seawater, fall towards the seabed. The currents, and to a lesser degree wave action, would cause turbulent mixing of the return water with the ambient seawater, which would disperse the plume (see Chapter 16, Marine Environment, for details).

Construction phase

The major steps to construct the proposed desalination plant, including the intake and outfall structures, are described below.

Construction method

The design for the plant's foundations would be based on the geotechnical investigations of the site. The options include bored piles, driven piles or strip footings, and the steps involved in constructing the foundations include setting out, excavation/boring, pile driving, placing reinforcing steel/concrete and backfilling the excavated foundations.

The desalination plant would require reinforced concrete tanks cast *in situ*, lined earth storages, and mechanical components such as pumps, pressure vessels, filter elements and chemical dosing systems. Specialised components would be imported and assembled on-site or pre-assembled overseas and erected on-site.

Wastes arising from construction activities would be disposed of to local licensed landfills.

Transmission line

A new 132 kV transmission line would be installed from the Cultana substation to the proposed desalination plant (see Figure 5.30). This would be a double circuit transmission line of about 25 km in length, requiring the installation of around 60 transmission towers. This is further detailed in Section 5.8.4.

Intake and outfall structures

The method for installing the intake and outfall pipelines would be determined during detailed design and after geotechnical studies have determined the ease with which the pipes may be buried along their full length. There are two main options. The first would see the intake and outfall pipelines buried for their full length. Alternatively, the pipelines would be buried in the land-based sections and coastal margin and laid on the seabed in the deeper waters.

The method to excavate the buried sections would also be determined following detailed geotechnical studies, the two options being:

- a wheel trencher or large excavator on land and a clamshell bucket or cutter suction dredge operated on a temporary jetty or flat-top barge
- a combination of the above and blasting to fracture rock prior to removal.

Should blasting be required, it would be likely to involve approximately 15 land-based blasts every two to three days over a period of 40–60 days and approximately 25 underwater blasts every two days for a period of approximately 50 days. A maximum charge size of 10 kg would be used, and would involve sequential detonations to minimise potential airblast, overpressure and vibration impacts. Blasting would only occur during daylight hours.

Testing and commissioning

There would be a commissioning period before the plant becomes operational, during which time the plant systems would be tested thoroughly and water quality targets would be confirmed. During this period, the potable water produced from the plant would not be sent to Olympic Dam; instead, it would be combined with the return water before being discharged through the outlet pipe into Upper Spencer Gulf.

Water supply during construction

The coastal desalination plant would require about 100 ML of water during the construction and commissioning phase. This water would be sourced from the sea, if low-quality water is required, and from the state potable water network should higher quality water be required (for concrete manufacture, for example).

Workforce accommodation

About 400 people would be required during the desalination plant construction period. Lunch rooms and basic sanitation facilities would be established on-site for the 33 month construction period. The workforce would stay at existing accommodation facilities within Whyalla, and would be transported by bus to and from the work site.

Operation phase

The general operation of the desalination plant was discussed in previous sections. Plant maintenance activities would be undertaken during operations and would include assessing the performance of the monitoring system, replenishing chemical storages and visual inspections for signs of unusual wear, corrosion or damage. The membranes used in reverse osmosis age over time, and they become less efficient in removing salt and impurities. These would be cleaned every few months using agents such as acids, bases and surfactants, and the wastewater collected would be disposed of on land in a managed pond, where the water would evaporate and the solids would be collected and disposed of to a licensed landfill. Membranes typically need to be replaced after three to seven years of operation.

Chemical storage and use

Table 5.32 indicates the rate at which reagents would be used and the storage method for the proposed desalination plant.

5.7.5 WATER SUPPLY PIPELINE

Overview

One water supply pipeline would be constructed to transport potable water from the new desalination plant about 15 km to the existing state potable water network (see following section) and a second pipeline of about 320 km to supply water to Olympic Dam. The South Australian government pipeline would be buried for its entire length. The BHP Billiton pipeline would generally be buried except where it intersects water courses, when the pipeline would be raised above ground on concrete plinths. In addition to the pumping stations located at the coastal desalination plant, a further three pumping stations would be required to transport the water to Olympic Dam. No further pumping stations, other than the one installed within the desalination plant, would be required for the South Australian government pipeline to transport the water to the existing network.

Table 5.33 presents the indicative major features of the proposed water supply pipelines for the proposed expansion and the South Australian government.

Figure 5.33 shows the pipeline alignment is located within or adjacent to existing infrastructure corridors with the exception of some areas between Point Lowly and Port Augusta. The location and conceptual layout of proposed pumping stations along the alignment is also shown on Figure 5.33. Figure 5.34 provides cross-sections at three indicative locations along the corridor to show separation distances between infrastructure. The proximity of the water supply pipeline and other linear infrastructure to the townships of Port Augusta, Woomera and Roxby Downs is shown in Figure 5.35.

The construction and operation of the water supply pipeline would necessitate additional demands for water, electricity and workforce (see Table 5.34).

South Australian Government water supply pipeline

New infrastructure would be required to distribute desalinated seawater to the existing South Australian potable water network. A new pumping station adjacent to the desalination plant site and new pipeline approximately 15 km in length would be required to connect the supply to the existing Morgan–Whyalla No. 2 pipeline. A new mild steel pipeline nominally 900 mm in diameter would be buried in a trench within a 20 m wide easement running parallel to the new BHP Billiton pipeline easement. The pipeline would be constructed independently of the BHP Billiton pipeline.

In addition, a number of system alterations would be required to allow the flow to be reversed within sections of the existing network. Alterations to the existing South Australian potable water supply network are subject to approvals outside of this EIS.

Table 5.32 Indicative reagent usage per annum and storage

Description	Usage rate (tpa)	Stored volume (t)	Chemical details[1]	Storage method
Organophosphonate	100–150	20	Liquid 100% w/w	Antiscalant would be stored within a bunded on-site chemical storage facility
Lime	3,500–4,600	500	Powder	Lime would be stored in silos adjacent to the lime clarifier and batching tanks. Milk of lime liquid is produced and would be stored in a tank within a bunded area
Sodium hypochlorite	25	2	Liquid 10% w/w	Located in bunded tanks adjacent to the intake pumping station
Hydrofluosilicic acid	200	15	Liquid 20% w/w	This fluoridation agent would be stored within a bunded on-site chemical storage facility
Ammonia	25	2	Gas	Ammonia gas would be stored as a liquid in pressure vessels housed within a purpose-designed building
Carbon dioxide	1,800–2,500	275	Gas	Carbon dioxide gas would be stored as a liquid in pressure vessels housed within a purpose-designed building
Sulphuric acid	10,000–13,000	500	Liquid 98% w/w	Acid would be stored within a bunded on-site chemical storage facility
Chlorine	200–300	40	Gas	Chlorine gas would be stored in liquid form within a purpose-designed building
Sodium metabisulphite	400–500	10	Liquid 37% w/w	This dechlorination agent would be stored within a bunded on-site chemical storage facility
Polyelectrolyte	90–120	15	Powder	This would be stored as a powder, and batched into liquid form prior to use. It would be stored within a bunded on-site chemical storage facility
Ferric chloride	5,400–6,300	300	Liquid 42% w/w or powder	This would be stored as a powder, and batched into liquid form prior to use. It would be stored within a bunded on-site chemical storage facility. In liquid form it would be stored within a bunded tank

[1] w/w = weight percent.

Table 5.33 Indicative major features of the proposed water supply pipelines

Features	Proposed expansion	SA Government
Predominantly buried or above ground pipe	Buried	Buried
Length (km)	320	15
Diameter of pipeline (m)	1.4	0.9
Average width of corridor/easement (m)	40	20
Typical width of disturbance within the easement (m)	20–35	20
Approximate total length of sections above ground (km)	1.5	Nil
Depth of the excavated trench (m)	2.0–3.0	1.7–2.0
Average width of the excavated trench (m)	2.0	1.2–2.0
Total length of the trench open at any given time during construction (km)	up to 5	up to 5
Depth to top of pipeline at road crossings (m)	1	1
Maximum operating pressure (kPa)	4,000	2,500
Number of pumping stations (excluding desalination pumping station)	3	Nil
Number of pipe stacking sites	50	Nil

Table 5.34 Indicative major demands for the proposed water supply pipelines

Expansion requirement	Proposed expansion	SA Government
Water demand during construction (ML)	485–590	n.a.
Water demand during operation (GL per annum)	Negligible	Negligible
Electricity consumption during operation (MWh per annum)	154,000	25,000
Peak construction/shutdown workforce	100	n.a.
Ongoing operational workforce	2	n.a.
Total land disturbance (ha)	993	30

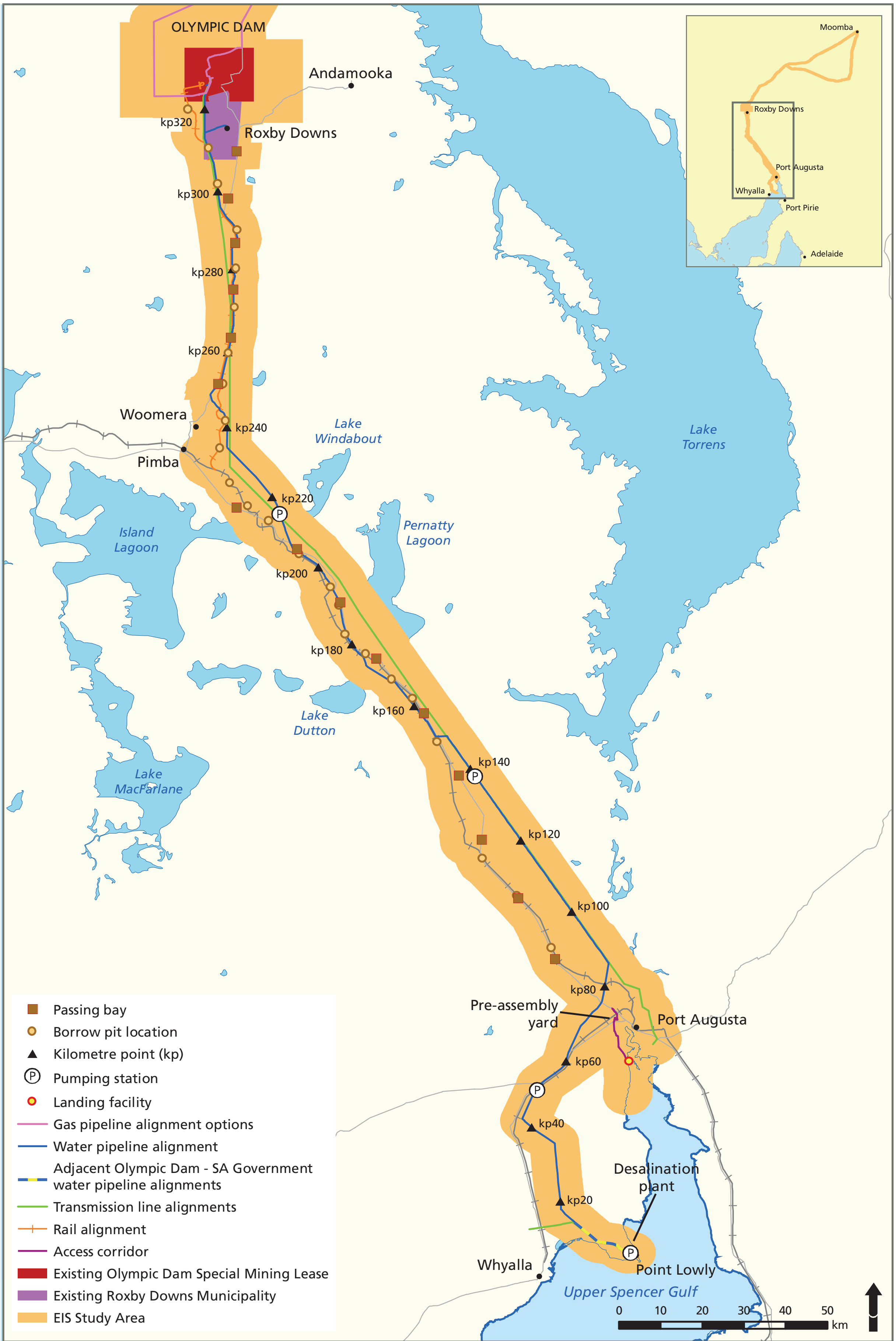


Figure 5.33 Proposed infrastructure in the southern corridor

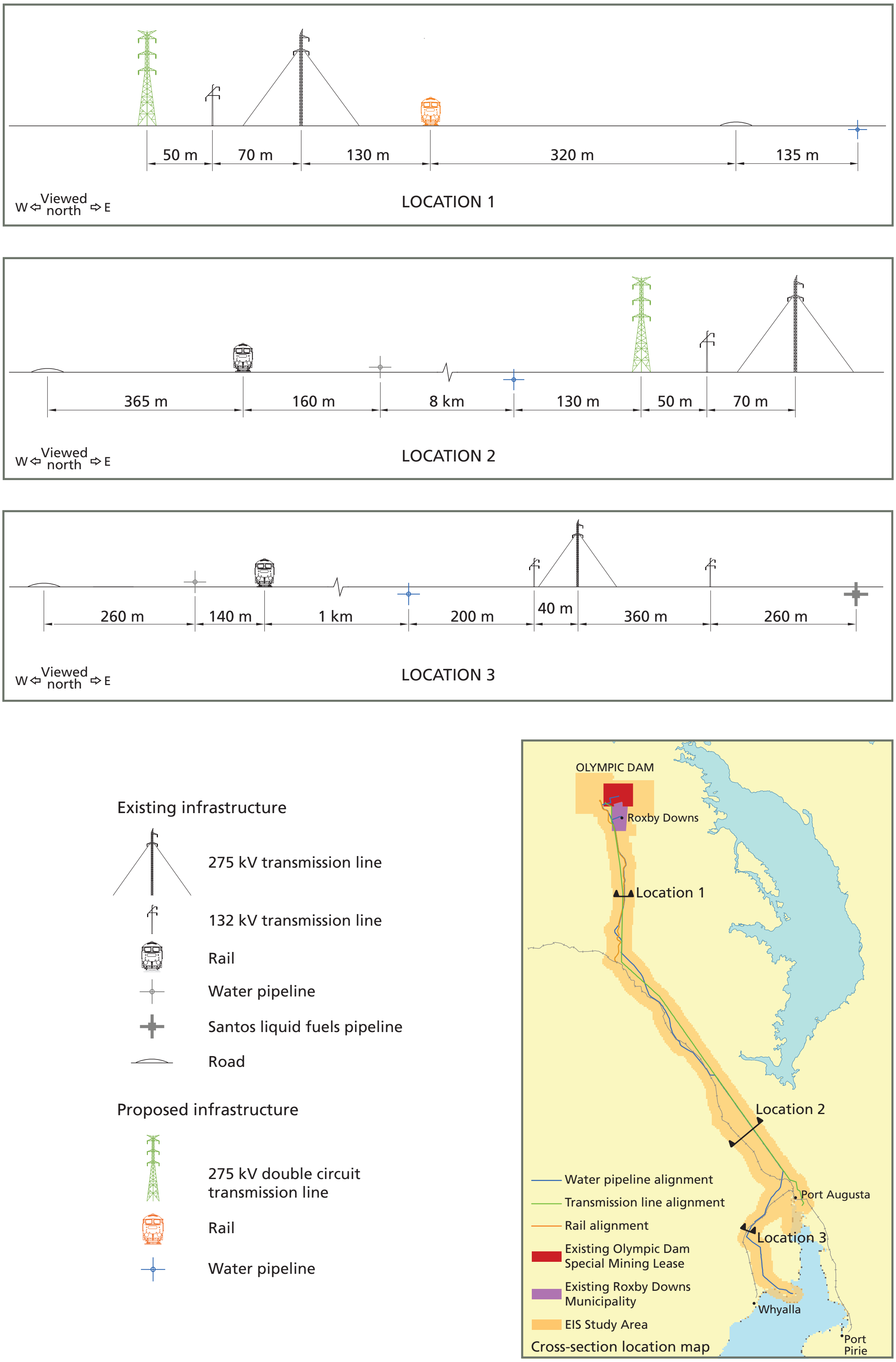


Figure 5.34 Indicative separation distances of proposed linear infrastructure

Figure 5.35 Insets of major towns related to infrastructure within the southern corridor

Construction phase

Construction method

Vegetation along the BHP Billiton pipeline easement would be cleared and access tracks would be constructed along the pipeline easement to provide access for pipeline installation equipment. Deep-rooted vegetation would be removed within a distance of three metres either side of the mid-line of buried pipeline sections, so as not to damage the pipe. Grass and other shallow-rooted vegetation would be left to establish over the easement following construction. Steel pipe sections of around 12–13.5 m long would be delivered directly to the pipeline easement for stringing along the easement to avoid storage and double handling. However, in some cases pipe would need to be stored temporarily in laydown areas, termed pipe stacking sites. These sites may occur every 5–10 km along the pipeline corridor and would occupy an area of about 200 m x 200 m. Each site would be cleared, grubbed and prepared with a 200 mm compacted quarry rubble or similar base to ensure flat, all-weather access.

The pipe would either be transported to site as a finished product, complete with internal lining and coating, or transported as a coated steel pipe to storage and marshalling areas for on-site lining.

The proposed water supply pipeline would be buried about 0.5 m underground for the majority of its length. A wheel trencher or large excavator would probably be used to dig a 2 m wide trench within the easement for the buried sections of pipeline. The material excavated from the trench would be stockpiled adjacent to the trench for use as backfill, with excess material spread back over the easement. Generally around 1 km of trench would be open at any one time for each work site, depending on the soil types and the amount of rock through which the trench is to be excavated. Four to five work sites may operate at any one time and a variety of excavation methods may be used for areas crossing watercourses, roads and major infrastructure corridors. These would be determined by the construction contractor and include open trenching, boring or directional drilling.

The pipeline lengths would be lifted into the trench for jointing using rubber ring slip joints (or similar) before being backfilled and compacted.

Small sections of the pipeline, particularly those sections of the line that intersect watercourses, such as the inlets to Lake Windabout and Pernatty Lagoon, would remain above ground (about 1.5 km in total). These above-ground sections of pipeline would be supported on pre-cast concrete plinths or culverts to keep the pipeline above flood levels. Above-ground pipeline joints would be welded and the pipeline attached to the support plinths.

Disturbed areas would be cleaned up and rehabilitated. Measures would include removing foreign material (i.e. construction material and waste), respreading excess material from the excavated trench, contouring if required, and respreading topsoil and cleared vegetation to retain the seed bank and promote regeneration. Marker posts with visible covers would be installed adjacent to pipeline isolation valves and air valves to enable easy location during maintenance works. The temporary pipe stacking sites would be rehabilitated.

Testing and commissioning

The pipeline would be hydrostatically tested for strength and potential leaks. Once a section had been constructed it would be filled with approximately 12–30 ML of water and the pressure increased to exceed the anticipated operating pressure. Generally 10–50 km long sections would be tested at a time to 125% of operating pressure, depending on the spacing of isolation valves. Water for each new section would usually be drawn from the adjacent section that had been previously tested, with make-up water added to replace the small amount of water lost through leakage. It is anticipated that 85–90 ML of water would be required to complete the hydrostatic testing for the full 320 km of pipeline.

Following hydrostatic testing, the pipe would be filled completely. This would require 400–500 ML of water sourced from either the state potable water network or from commissioning the desalination plant. The first flush of water through the pipe would be of reduced quality as a result of debris contained within the line, and so would be screened before being sent to the process water storage dams at Olympic Dam.

Pumping stations, substations and surge tanks

It is likely that three pumping stations would be required along the pipeline route in addition to the main pumping station located at the coastal desalination plant (see Figure 5.33). These would be constructed at intervals of 50–100 km along the pipeline and would each require an area of about 50 m x 50 m, located adjacent to the pipeline easement and within a fenced compound of about 1.2 ha. Concrete slab foundations would be poured at each site and a building of about 35 m x 20 m would be erected to house pumps and related equipment. Plant and equipment for the pumping station are likely to be pre-assembled in modular form and installed on-site.

An electrical substation would be constructed adjacent to each pumping station, within the fenced compound. The electrical substation requires an area of about 90 m x 65 m, which would also have concrete footings for towers, pylons, disconnectors, transformers and switch room buildings. Pads of compacted crushed rock would be prepared for temporary buildings (e.g. crib rooms and toilets) to be used during construction. The plant and equipment would be manufactured off-site and erected on-site.

The pipeline would require surge protection measures in the form of surge tanks to release water into the pipeline during emergency shutdown events involving the desalination plant or any of the pumping stations. Around four surge tanks, each with a capacity of about 200 kL, and a gravity flow tank of up to 3.5 ML would be required along the length of the pipeline. An area of up to 90 m x 70 m would be required for these tanks. A concrete ring beam footing would be poured to support the tank's concrete or steel walls. A concrete slab floor may also be constructed for the tank floor. The tank is likely to be covered with a lightweight steel roof to reduce evaporation and restrict vermin and native fauna access. Permanent fencing and gates would be erected around the tank site boundary.

Water supply during construction

Construction of the water supply pipeline and associated infrastructure would require about 485–590 ML of water, principally for the full first flush testing of the pipe following the hydrostatic testing of sections, with small quantities also used for dust suppression. The majority of the water would be sourced from the commissioned Point Lowly desalination plant or the state potable water network. Additional dust suppression water could be drawn from purpose-drilled wells located in local saline aquifers. All wells would be drilled and decommissioned in accordance with applicable state legislation and the requirements of the Department of Water, Land and Biodiversity Conservation (DWLBC).

Workforce accommodation

Approximately 100 people would be required for the construction of the water supply pipeline. Temporary facilities, including lunch rooms and sanitary facilities would be constructed at each pumping station site, and mobile facilities would be provided at the pipeline construction sites. The workforce would be accommodated at Whyalla, Port Augusta, Woomera and Roxby Downs. No on-site accommodation camps would be necessary.

Operation phase

Water supply pipeline

The pipeline would be operated so that pressure does not exceed around 4,000 kPa (or PN40) at any point along the pipeline. In general operating pressures would be 2,500 kPa (or PN25).

Access tracks established during construction would be maintained to allow vehicle access to the pipeline and pump-ing stations for inspection and maintenance activities. Maintenance and testing programs would include leak detection surveys, ground patrols, repairing or replacing faulty pipe or other equipment, scouring and cleaning of the pipeline and shock chlorination.

Pumping stations

The pumping stations would be equipped with off-site monitoring capabilities and all water flows would be metered and checked for accuracy. However, routine trips would occur to undertake maintenance, including cleaning air filters for ventilation systems, changing bearing oil, cleaning within electrical cubicles, replacing air filters, and overhauling equipment. Waste generated during maintenance activities would be disposed of to a licensed landfill.

Electrical substations

The electrical substations would be equipped with telemetry and instrumentation to enable off-site monitoring. Maintenance visits to the substations are likely to occur at least monthly. During these visits, maintenance would normally be limited to inspecting auxiliary plant such as batteries, chargers, transformer oil levels and general housekeeping. Annual maintenance could include functional checks of transformers, circuit breakers and disconnectors and checks of auxiliary plant.

Surge tanks

The surge tanks would be equipped with level-measuring equipment and telemetry to enable off-site monitoring of water levels. The tanks would be visually inspected for leaks during maintenance visits, which would be concurrent with visits to the pumping station. Monthly checks may include confirming the performance and accuracy of the level-measuring equipment and telemetry. Annual inspections may include inspection of the tank floor to check for build-up of sediments, and the tanks would be drained and cleaned to remove built-up sediments if required. The sediments would be contained and disposed of in a licensed landfill.

5.7.6 GREAT ARTESIAN BASIN SUPPLY

The existing approvals for Olympic Dam include special water licences to extract groundwater from the GAB, subject to meeting groundwater level drawdown criteria around the wellfield.

Potable water demand during the construction phase of on-site or near-site infrastructure (including infrastructure within the SML, plus potable water for the expansion of Roxby Downs, the construction of the airport and Hiltaba Village) would be met through the desalination of GAB water at the existing on-site desalination plant providing the additional extraction can maintain drawdown within approval limits.

Additional potable water, if required, would be sourced from local saline wellfields, to be desalinated in the existing on-site desalination plant (see Section 5.7.7). Potable water demand for the new open pit mine and metallurgical plant, plus the expanded Roxby Downs, new airport and Hiltaba Village would be met from the coastal desalination plant following construction and commissioning in around Year 4.

The existing mining and metallurgical operation would continue to use water sourced from the GAB.

5.7.7 SALINE AQUIFER SUPPLY

Overview

A demand for around 50 ML/d of saline water would be generated during the construction phase of the proposed expansion. This demand would be met through the development of the mine depressurisation wells and abstraction from saline aquifers. Geological studies and drilling campaigns have been undertaken around and within the Olympic Dam SML to identify potential sources of saline groundwater. These investigations have indicated several potential sources of groundwater of various qualities, which could be developed into saline wellfields for use during the construction and operation of the proposed expansion.

Indicative wellfield abstraction rates are shown in Table 5.35 and are further detailed in the following sections.

Table 5.35 Indicative saline wellfield abstraction rates

Saline wellfield	Abstraction rate (ML/d)
Open pit depressurisation wells	5–15
Motherwell Wellfield	25
Local saline wellfields	10

Depressurisation wellfield

A maximum of around 15 ML/d of saline water would be extracted from the proposed area of the open pit during the initial development phase, later stabilising at around 5 ML/d for the life of the open pit mine. Details regarding this wellfield are presented in Section 5.4.3.

Motherwell Wellfield

The primary saline water supply for the construction phase of the proposed expansion would be the so-called Motherwell Wellfield, located about 30 km north of Olympic Dam. This wellfield intersects the upper levels of the Andamooka limestone aquifer, and has a salinity of around 50,000 mg/L total dissolved solids, which would be suitable for desalination via a new on-site desalination plant.

Production from the Motherwell Wellfield would ramp-up over time to meet the increasing saline demand during the construction phase. This would be achieved with the installation of additional wells. The number of wells would increase from an initial single well, producing about 1.8 ML/d, up to 14 wells producing around 25 ML/d within four to five years. This capacity would be maintained for the duration of the construction phase. Investigations of aquifer response to the abstraction would be used to determine whether the Motherwell Wellfield could continue operation beyond the construction phase and become a source of low-quality water for the operation phase.

Additional infrastructure would be required to support the wellfield. Pipelines would be buried and would range from 0.2 m in diameter at the most distant well, up to 0.75 m when the production of all wells is combined. The pipelines would run from the Motherwell Wellfield to the existing Borefield pipeline, and then run adjacent to the existing pipeline to the existing on-site desalination plant.

The location and a conceptual layout of the Motherwell Wellfield and associated pipeline is presented in Figure 5.25.

Local saline wellfields

The local saline wellfields would consist of a range of wellfields within 20 km of the existing Olympic Dam SML. These wells would abstract water from the aquifers within the Tent Hill geological formation (Corraberra Sandstone, Arcoona Quartzite and Tregolana Shale – see Chapter 12, Groundwater, for further information).

The wellfields would abstract saline-to-hypersaline water at locations adjacent to significant infrastructure during the construction phase, for use in civil works such as earth compaction and dust suppression. Wellfields are proposed next to the new TSF cells, the new metallurgical plant, the proposed mine maintenance industrial area, Roxby Downs, Hiltaba Village and the proposed airport (see Figure 5.25). The individual wells would have the capacity to deliver about 0.4 ML/d each, and total local saline wellfield abstraction would be about 16 ML/d during the construction period. The wellfields would be decommissioned at the end of construction activities.

5.7.8 WATER RECYCLING, REUSE AND CONSERVATION

The existing Olympic Dam operation reuses water through the following activities:

- water from depressurising the underground mine, extracted to prevent flooding of the workings, is used in the manufacture of CAF backfill and for dust suppression on roadways
- groundwater beneath the TSF is reclaimed for use within the metallurgical process
- supernatant liquor from the TSF is reused within the metallurgical process.

The proposed mining and processing operation would increase the reuse of water across the site by constructing infrastructure such as the flotation tailings thickening circuit that would create a greater demand for acidic liquor within the new metallurgical plant. Other areas of potential water reuse and recycling would include:

- using open pit mine depressurisation water as a saline water source during construction of the proposed expansion
- potentially using treated domestic sewage water for landscaping and other low-quality water uses
- capturing stormwater run-off from the RSF and the open pit and storing it in the clay pans located between sand dunes. Subject to the quality of the water, it would be used in dust suppression activities or within the metallurgical plant
- reducing the requirements for demineralised water in the proposed expanded smelter through the use of water/steam and air/steam condensers to condense and collect excess steam as pure water for reuse in the boilers
- recycling water used for the hydrostatic testing of the water and gas supply pipelines as process water within the new and existing metallurgical plants.